SEVENTH FRAMEWORK PROGRAMME
THEME 9
Space Call 2, FP7-SPACE-2009-1

Grant agreement for: **Collaborative Project**

Annex I - "Description of Work"

Project acronym: FIELD_AC
Project full title: **F**LUXES, **I**NTERACTIONS AND **E**NVIRONMENT AT THE **L**AND-OCEAN BOUNDARY. **D**OWNSCALING, **A**SSIMILATION AND **C**OUPLING
Grant agreement no.: 242284

Date of preparation of Annex I (latest version): 10-11-2009
Date of approval of Annex I by Commission: *(to be completed by Commission)*

List of Beneficiaries

Beneficiary Number *	Beneficiary name	Beneficiary short name	Country	Date enter project**	Date exit project**
1 (Coordinator)	Universitat Politècnica de Catalunya	UPC	Spain	Month 1	Month 36
2	Katholieke Universiteit Leuven	KUL	Belgium	Month 1	Month 36
3	Service Hydrografique et Oceanographique de la Marine	SHOM	France	Month 1	Month 36
4	Forschungszentrum Geesthacht GmbH	GKSS	Germany	Month 1	Month 36
5	Institute of Hydro-Engineering of the Polish Academy of Sciences	IBW-PAN	Poland	Month 1	Month 36
6	Natural Environment Research Council - Proudman Oceanographic Laboratory	NERC - POL	UK	Month 1	Month 36
7	Istituto di Scienze Marine, Consiglio Nazionale delle Ricerche	ISMAR - CNR	Italy	Month 1	Month 36
8	DHI Water ● Environment ● Health	DHI	Denmark	Month 1	Month 36
9	Barcelona Supercomputing Center	BSC	Spain	Month 1	Month 36

* Please use the same beneficiary numbering as that used in the Grant Agreement Preparation Forms

** Normally insert "month 1 (start of project)" and "month n (end of project)"

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PART A

A1. Budget breakdown and project summary

A.1 Overall budget breakdown for the project

A3.2:
What it costs

Project Number [1]	242284	Project Acronym [2]	FIELD_AC

One Form per Project

Participant number in this project [9]	Participant short name	Estimated eligible costs (whole duration of the project)					Total receipts	Requested EC contribution
		RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D		
1	UPC	898,310.00	0.00	109,991.00	62,410.00	1,070,711.00	0.00	846,133.50
2	K.U.Leuven	489,840.00	0.00	12,960.00	18,640.00	521,440.00	0.00	398,980.00
3	SHOM	248,656.00	0.00	9,728.00	0.00	258,384.00	0.00	196,220.00
4	GKSS	493,000.00	0.00	11,597.00	36,918.00	541,515.00	0.00	418,265.00
5	IBW PAN	125,600.00	0.00	5,600.00	0.00	131,200.00	0.00	99,800.00
6	NERC - POL	476,232.00	0.00	11,286.00	36,198.00	523,716.00	0.00	404,658.00
7	ISMAR-CNR	454,775.00	0.00	21,418.00	37,274.00	513,467.00	0.00	399,773.00
8	DHI	239,400.00	0.00	22,000.00	144,000.00	405,400.00	0.00	345,550.00
9	BSC	254,750.00	0.00	8,975.00	0.00	263,725.00	0.00	200,037.00
TOTAL		3,680,563.00	0.00	213,555.00	335,440.00	4,229,558.00	0.00	3,309,416.50

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and associated Third Parties.

A.2 Project summary

A1:
Our project

Project Number [1]	242284	Project Acronym [2]	FIELD_AC
One form per project			
General information			
Project title [3]	Fluxes, Interactions and Environment at the Land-Ocean Boundary. Downscaling, Assimilation and Coupling		
Starting date [4]	Start date to be notified; must lie within 0 months of grant agreement signature		
Duration in months [5]	36		
Call (part) identifier [6]	FP7-SPACE-2009-1		
Activity code(s) most relevant to your topic [7]	SPA.2009.1.1.01: Stimulating the development of downstream GMES services		
Free keywords [8]		GMES added value, Downstreaming, Downscaled Coupling, Coastal Domains	
Abstract [9] (max. 2000 char.)			

Coastal-zone oceanographic predictions seldom appraise the land discharge as a boundary condition. River fluxes are sometimes considered, but neglecting their 3D character, while the "distributed" continental run-off is not taken into consideration. Moreover, many coastal scale processes, particularly those relevant in geographically restricted domains (coasts with harbours or river mouth areas), are not well parameterized in present simulations. Because of this situation, local predictions still present significant errors and are not robust enough, even being locally wrong for sharp gradient events, such as flash flood discharges into the Mediterranean sea. This hampers decision-making in coastal zones. The FIELD_AC project aims at providing an improved operational service for coastal areas and to generate added value for shelf and regional scale predictions from GMES Marine Core Services. Local assimilation will be analysed together with advanced error metrics to provide a reliable service that can be transferred to public and private parties, using the spin-off company that will result from the project. This will be achieved by the introduction of more comprehensive "land" boundary conditions, improved local parameterizations and new coupling terms/strategies for the studied field cases. They cover a representative range of meteo-oceanographic drivers for four "geometrically" restricted domains (Catalan coast, Venice Gulf, Liverpool Bay and the Wadden Sea). FIELD_AC will bridge the gap from shelf predictions to local (river mouth or harbour/beach scales) simulations required at the coastal zone. This will result in a wider demand for operational services and an enhanced use of in-situ and remote observations. Such improvements (services and expertise) will require the advancement of the present state of the art.

A.3 List of beneficiaries

Beneficiary Number *	**Beneficiary name**	**Beneficiary short name**	**Country**	**Date enter project****	**Date exit project****
1 (Coordinator)	Universitat Politècnica de Catalunya	UPC	Spain	Month 1	Month 36
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9	Barcelona Supercomputing Center	BSC	Spain	Month 1	Month 36

PART B

B1. Concept and objectives, progress beyond state-of-the-art, S/T methodology and work plan

B.1.1 Concept and project objective(s)

Some of the main coastal "conflicts" and management problems occur within a few kilometres of the land-ocean boundary. The demands from marine transport and safety (harbours and navigation), marine "resources" (renewable energy, aggregates, aquaculture and fisheries, leisure and marine reserves) and coastal land planning (coastal cities with their beaches and outfalls) require a level of resolution and accuracy from meteo-oceanographic predictions not currently available. The unique contribution of the FIELD_AC project is both scientific and operational, backed by a team which has contributed significantly to the present state-of-art in operational oceanography and the models and knowledge behind it (see e.g. (Cavaleri et al., 2007); (Guenther et al., 1992); (Komen et al., 1994)). FIELD_AC will provide coupled wind-wave-current fields considering also part of the effects associated to land freshwater and sediment/nutrient discharges for geographically "restricted" domains (with sharp gradients and comparatively large prediction errors). This will provide a new GMES "downstream" service at harbour/river-mouth scales complementing the current simulations from Marine Core Services – MCS – and will support the development of space imagery (new sensors and recovery algorithms) for the always difficult land-ocean boundary.

Within this context the FIELD_AC project has two types of objectives:

1) OPERATIONAL

- → Coupling land discharges, both point-wise (river type) and distributed (urban run-off type), already available, into operational oceanography predictions at a resolution (grid size of order 100m as required by e.g. our end-users from harbour and coastal authorities), which is a smaller scale than that currently available. This discharge plays a key role in coastal, suspended sediment transport and water quality as requested by our end-users.
- → Adding free-surface wave effects to GMES marine core services, in terms of coupled wave fields (wave-current 3D interactions) and considering wave effects in the resulting near-shore circulation and mixing. Wind-waves constitute the main driver in the coastal zone and their coupled inclusion will provide a more realistic prediction of meteo-oceanographic conditions at local scales, enhancing the value of marine core services for coastal users (as demanded by e.g. coastal authorities).
- → Including local assimilation (inside the computational domain or as boundary conditions) of meteo-oceanographic variables, particularly rainfall for the land discharge boundary condition. This will prevent (as requested by our end users) local water quality simulations being "wrong", as it often happens for flash flood situations in e.g. the Mediterranean coast. The assimilation will consider the "memory" of each variable/process and the variable gradients (essential in restricted domains).

2) SCIENTIFIC

- → Formulating processes at the land-ocean boundary and incorporating them into the local scale simulations. These processes, not normally considered in the available predictions (from MCS or meteo services), include the 3D dynamics associated to the fresh water land discharges (e.g. the near permanent salt wedge in Mediterranean river mouths) into the coastal sea, essential for bathing water quality and aquaculture exploitation, as pointed out by our end-users. These processes also include the near-shore and wind-induced circulations (both 3D in restricted areas), also requested by our coastal end users, since they play a key role in sediment and pollutant transport and swimmers safety (search and rescue).
- → Coupling wind-wave-current fields, considering explicitly some new interaction terms proposed in the state of art (among others by some of the FIELD_AC partners) but not yet used operationally. This coupling will also consider the effects of resolution (in the models' discretizations) and in-homogeneities in the geometrically restricted field sites studied in the project. It is for these restricted domains that the operational predictions show larger errors and where the local end users have requested such an effort to improve the operational services provided.
- → Diagnosing Lagrangian transport in coastal zones from i) MCS remote sensing data, ii) in-situ data and iii) local scale simulations produced within FIELD_AC. The critical comparison of surface winds, ocean colour and sea surface temperature (from MCS scatterometer, altimeter and optical data) with wind-wave-current in-situ data and simulations can provide a new level of understanding for transport in coastal areas (demanded by some of our end users), particularly if wave effects (mass transport and radiation stresses) are introduced in local circulation patterns.

The obtained improvements in local scale predictions will advance the state of the art which now "misses" significant elements of the physics and does not normally include continental discharges nor the full range of wave effects. They will also "connect" the GMES marine core service results to the coastal (local) anthropogenic forcing (causing morphodynamic evolution and ecosystem degradation) and will support a knowledge-based assessment of decisions in the coastal zone. This will contribute to the implementation of EU directives (e.g. the Water Framework Directive for water quality at beaches near harbour entrances or the Risk or Flood Directives for waves and sea-level at beach /river-mouth scales).

The project strategy will be based on the following building blocks (figures 1a and 1b) which describe more specifically the research and operational objectives:

1. Improving the capability to model meteo-hydrodynamics and sediment/nutrient fluxes from harbour/river-mouth scales to shelf/offshore areas. This includes local parameterizations consistent with the model down-scaling (reduction of grid sizes) and the connection with continental run-off at the coastal zone. This will enable accounting for the riverine liquid and solid discharges, the distributed transport and dispersion of particulate matter from continental run-off and the reproduction of "local" phenomena such as sea breezes or rip currents, which play an essential role in coastal dynamics.

2. Providing a practical coupling strategy which, after testing the existing formulations with a set of bench-mark cases (e.g. for 3D wave effects on currents), will lead to a "preferred" approach in terms of coupling protocols and formulations. This will benefit both the efficiency and the accuracy of the downscaling.

3. Advancing the "level" of boundary conditions by i) looking at the quality of MCS results (e.g. wind fields from MyOcean) in terms of the "off-shore" boundary and the simulated wave-current fields plus in-situ data and ii) introducing into predictions existing formulations not yet considered (e.g. effect of bed forms on near bed stresses and velocities and the resulting transport rates, critical for re-suspension processes near harbour or river mouth areas).

4. Reducing prediction errors at local scales so as to facilitate the actual use of such predictions. This will be achieved from the gain in knowledge derived as discussed above and will be supported by the multi-variable (meteo-hydrodynamics, suspended sediment and nutrient fluxes) observations available to the partnership (from existing networks in the studied field sites) and from the intensive field campaign in the project. It will also include local assimilation and advanced techniques (e.g. neural networks) to control the difference between simulations and observations.

5. Consolidating the existing networks of in-situ (harbour, beach and river mouth) observations as a component of the in situ global earth observing system. This will serve to integrate these local scale observations with larger scale remote data from satellite and radar images. It will also contribute to other international efforts such as GOOS (Global Ocean Observing System) and its associated COOP (Coastal Ocean Observing Panel) and will, thus, serve to preserve and more fully exploit the irreplaceable set of local observations nowadays available (extending for more than 100 years for some rivers and often to a period of more than 20 years for beaches or harbours) and which are neither integrated nor homogenized in the core service products.

6. Commissioning a newly created spin-off, conceived following the FIELD_AC framework, to work under the guidance of the partnership to achieve an efficient transfer of the project results. The spin-off, together with the partners and other SMEs in the participating countries will assess the feasibility of exploiting an innovative local-scale operational service with a new level of predictions for restricted domains. This will serve public bodies such as the meteo-services or harbour/coastal authorities participating in FIELD_AC. The project downscaling services will also be transferred to private stake-holders and users in the coastal zone such as fishermen's associations, aquaculture, navigation and dredging companies, insurance firms and others. They have all shown their interest in more robust local-scale predictions.

The spin-off will establish agreements with the project partners or their selected SMEs and/or technology transfer offices to ensure the sustainable transfer of project results. In this manner the spin-off, linked initially to the project coordinator UPC in Spain, will subsequently build alliances with other companies in this field and will act as a "catalyst" for similar developments in other EU countries. Aditionally the spin-off will support the partnership in establishing Service Level Agreements with the different users to facilitate the transfer of project results.

7. Raising social awareness and acceptance of local oceanographic predictions for the studied field cases which presently remains limited. This is because the set of studied

cases consists of geographically restricted domains (in bathymetric and orographic terms) where present prediction errors may be large and where the linkage to the core GMES services presents particular difficulties in terms of processes, boundary conditions and overall compatibility (sub-grid parameterizations, treatment of transients, etc). As an illustration, small variations in the atmospheric field may produce important changes in e.g. the predicted waves (NW Mediterranean case) or small changes in mean water depth may lead to quite different flow patterns (Wadden Sea case).

Figure 1 A. Convergence scheme representing the FIELD_AC project building blocks: from data to models

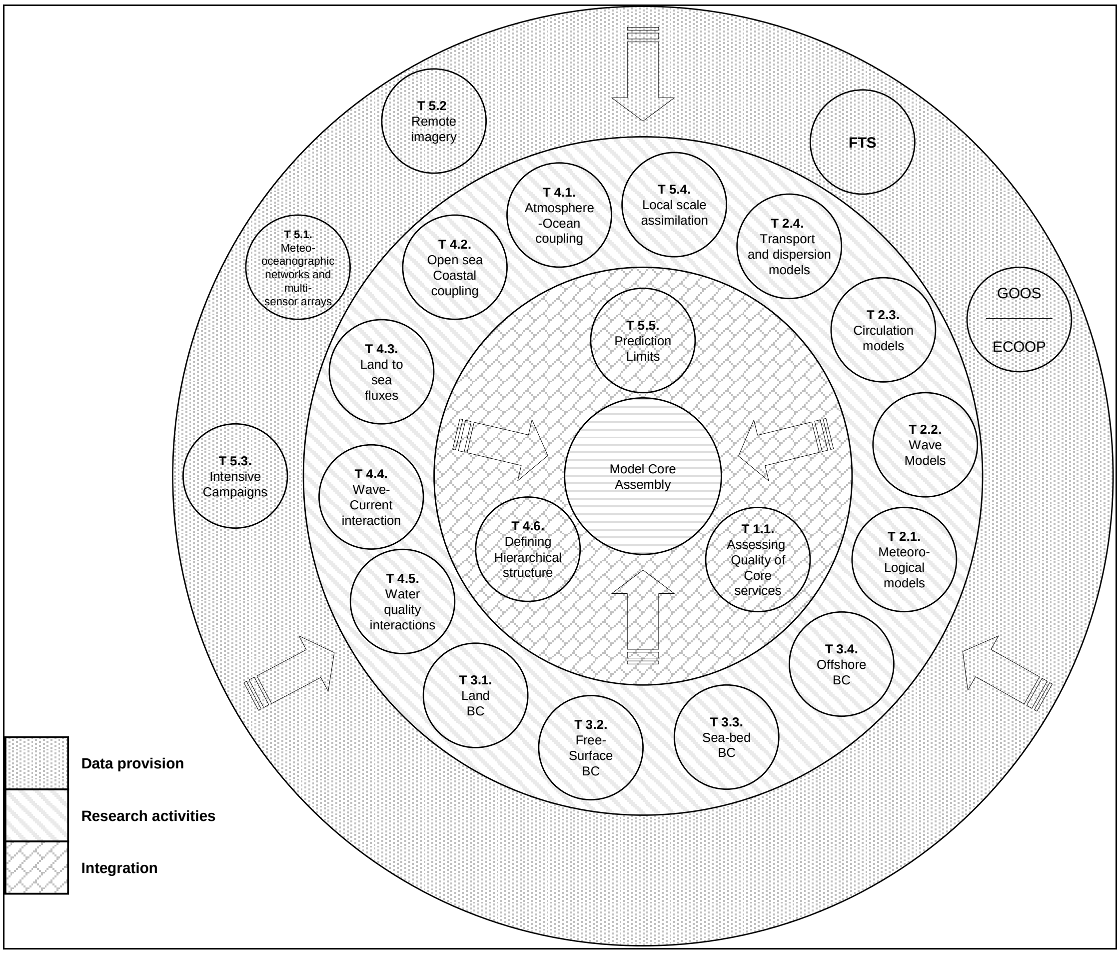
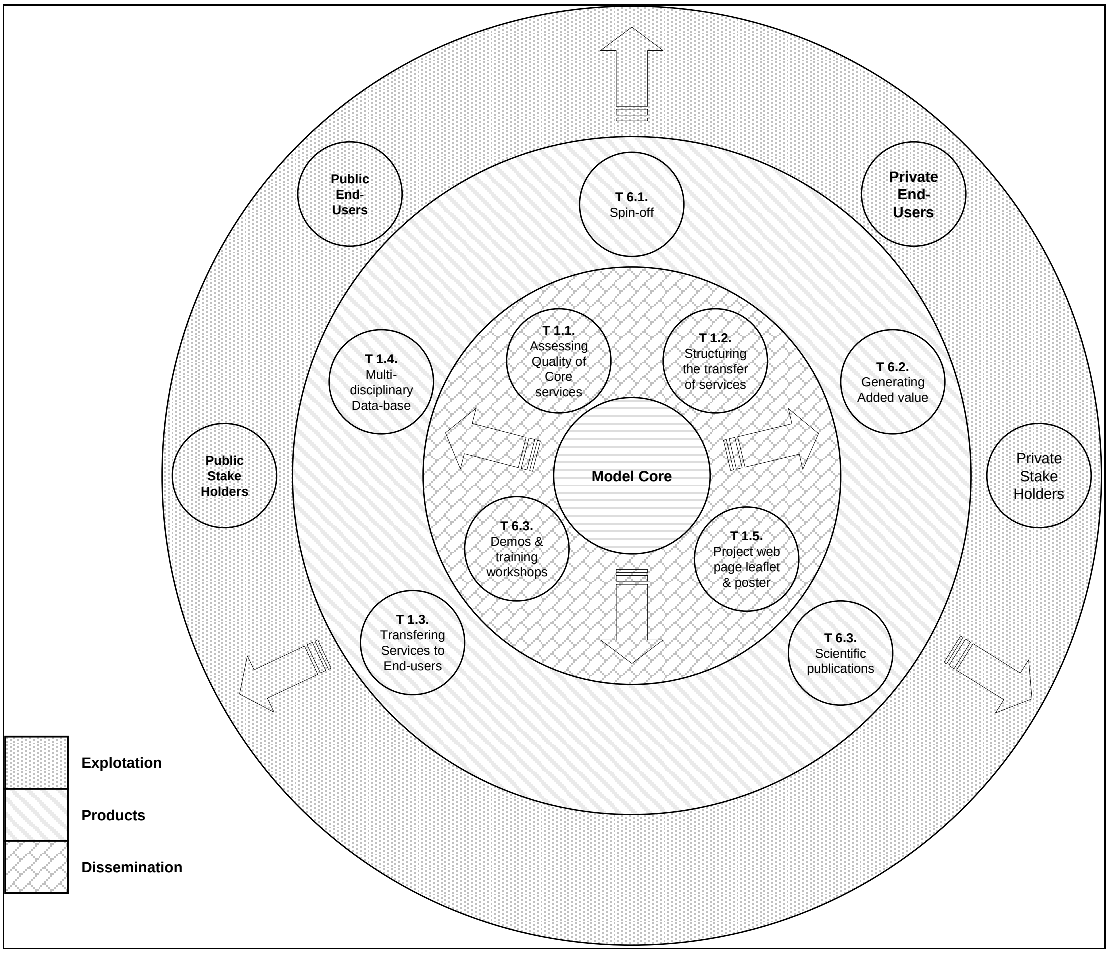


Figure 1 B. Divergence scheme representing FIELD_AC project development: form simulations to new operational services and sensor support



B.1.2 Progress beyond the state of the art

<u>General problem setting</u>

In recent decades there has been considerable development in the field of operational oceanography, advancing our understanding of atmospheric and oceanographic processes and providing numerical models which are robust and efficient enough to realistically simulate meteo-oceanographic dynamics at various time scales.

For the ocean, the application of operational scientific concepts has been carried out under the auspices of various inter-governmental organizations such as the IOC (International Oceanographic Commission of Unesco) which established in 1997 GOOS (Global Ocean Observing System), and its associated COOP (Coastal Ocean Observing Panel), see e.g. (Pinardi and Woods 2002). In Europe there have been similar developments such as Euro-GOOS (European component of GOOS) and more local applications such as for instance Med-GOOS.

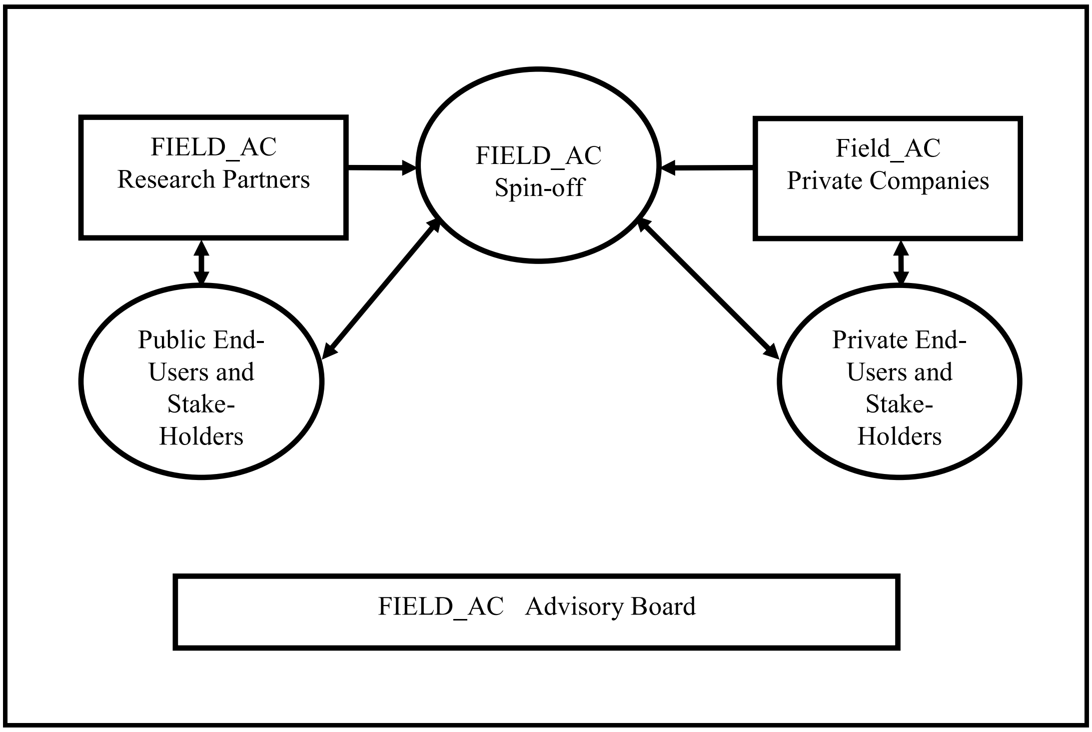
Recent research projects in this field have combined numerical simulations and field experiments, extending from large to regional scales, to address the complexity of processes, simulations and observations. The European Commission, for instance, has recently financed a cluster of operational oceanography projects that has been and continues developing several marine prototype operational systems (TOPAZ for the Arctic and North Atlantic, MFS for the Mediterranean and so on). Recently there has been a new category of projects for assessing on the smaller scale observations and forecasting (such as ECOOP European Coastal Shelf Sea Operational Observing and Forecasting System) or which have considered the global monitoring and environmental safety of the earth seas at a variety of scales (Lancelot et al., 2002, MacCracken et al., 2008). As an illustration the recently-funded European Union, FP7 MyOcean project (2008-2011) addresses the development of GMES/MCS on a pan-European level and basin scales, bringing together 61 partners including operational agencies and a set of prototype core systems. It aims at further bringing current R&D into the operational domain and strengthening links with the US, Japan, Australia, Canada, China and emerging systems in Africa. As such it has a large-scale view of marine forecasting.

Within this context, the FIELD_AC unique contribution is to provide "parameters" at sufficient resolution and accuracy in terms of temporal and spatial discretization but also, more fundamentally, in terms of local processes and coupling not normally considered. This contribution will be of real value for coastal managers, river authorities, harbour authorities and, in general, most coastal zone end-users. The inclusion of land-discharge boundary conditions, the consideration of wave and storm surge fields (coupled to the local circulation field) and the combination of satellite, radar and in situ data offer a promising path to add value to GMES marine core services in an efficient manner, since the models and most formulations are available but not yet coupled or used in an operational context.

Some of the main difficulties in local predictions (e.g. harbour or river-mouth scales) stem from the limited predictability of highly non linear "coastal" systems. Such systems are characterised by a geometrically limited domain (e.g. the coastal boundary) in which the wind-wave signal dominates (e.g. the surf zone) and where inhomogeneous and transient situations are the norm (see e.g. (Ardhuin et al., 2007); (Lee et al., 2005); (Stanev et al., 2009b)). This requires different parameterizations and unstructured grids, which implies introducing advanced (fragmented but available) knowledge into operational oceanography.

The FIELD_AC partnership, schematized in figure 2, is in a unique situation to add such a local value to MCS (simulations and remote measurements in the land-ocean boundary) since the partners have contributed decisively to the present state-of-art (WAM model, ROMS model, turbulence or drag formulations – e.g. GOTM – wave-current coupling, sediment fluxes and associated morphodynamics, nutrient fluxes and water quality and even the development of advanced mesh generators), as justified in the enclosed descriptions of institutions and main participant researchers. Moreover, the partnership manages a powerful network of in-situ coastal field equipment and radar systems (see e.g. (Cavaleri, 2000); (Howarth et al., 2006); (Bolaños et al., 2009); (Stanev and Colijn, 2009)). They have also a proven background in using satellite images (see e.g. (Bignami et al., 2007); (Doerffer and Schiller, 2007)) and in transferring results/services to private and public coastal "users" and stake-holders.

Figure 2. The FIELD_AC partnership



Specific advances

BOUNDARY CONDITIONS AND COMPUTATIONAL DOMAIN

In coastal (limited) domains and at local scales all boundary conditions become important since the simulated field may be well controlled by boundary information. The zone of boundary influence is dynamic and process-dependent and has received relatively limited research attention in oceanography (with some exceptions such as e.g. (Sanchez-Arcilla and Simpson, 2002)).
The simultaneous consideration of land point-wise and distributed discharges is a new topic in operational oceanography (Staneva et al., 2009) which demands 3D high resolution (e.g. the salt wedge discharge of Mediterranean rivers, see e.g. (Sierra et al., 2004)) and a careful sensitivity assessment in terms of "redundant" field data. This is because of the many uncertainties still present in our knowledge of the land-ocean boundary condition (discharges of subterranean estuaries and ground-water flow are, in general, poorly known, local rainfall e.g. as in flash floods is sometimes "missed" or operationally predicted at the "wrong" time, which requires local assimilation for this variable). The merging of modelling and observations (Mestres et al., 2003; Mestres et al., 2007a; Schulz-Stellenfleth and Stanev, 2009) – using advanced techniques such as neural networks (Wahle et al., 2009) – will be used in FIELD_AC to advance in the specification of such unknown fluxes. The use of remote imagery (both satellite and radar) is particularly suited for assessing the region of influence of river and urban run-off.

The sea-bed boundary condition also requires improvement with respect to standard models, since the presence of bed forms increases bed shear stresses (from an equivalent sand roughness of sediment-diameter scale to one scaled with ripple or water orbital-excursion dimensions) and affects all near-bed fluxes significantly (Precht and Huettel, 2004, Stanev et al., 2009a). Moreover the correct description of bed generated turbulence for water with high sediment concentrations requires new low Reynolds closure models (Toorman, 2008). Finally, we shall also consider the performance of (some pilot applications) 3-layer and multi-layer sediment transport models (available in two partner institutions) and the implications of turbulence/diffusion on the resulting fluxes (see e.g. (Carniel et al., 2008), (Toorman, 2007), (Stanev et al., 2007a)). This is the approach that will be used in FIELD_AC, using inter-ferometric side-scan sonar images to obtain bed-form coverage at some pilot sites.

The free-surface air-sea coupling is particularly important for inhomogeneous and transient situations typical of limited domains (Janssen et al, 2002). The air-sea drag coefficient for coexisting waves-surges-currents has been recently examined (Brown and Wolf, 2009) but this has not yet reached operational predictions. FIELD_AC will examine the consistency of advanced formulations and the various data sources (modelled fields from MCS projects such as MyOcean – scatterometer level2 and blended NWP+scatterometer – or the best available fields in the co-participating meteo services and satellite data from SAR/ENVISAT) in terms of the resulting wave fields (Horstman and Koch, 2005; Schulz-Stellenfleth at al., 2005, 2006) and the in situ observations of sediment and nutrient fluxes (with time memories longer than the meteo fields). The obtained conclusions will provide useful feedback to MCS.

The offshore boundary condition will play also an essential role since it will connect the regional-scale MCS products to the local scale service to be provided from the FIELD_AC project. The quality of this boundary condition will be assessed in terms of in situ and remote data and from the fields simulated in the FIELD_AC project. The use of multiple variables (water levels and velocities, suspended particulate matter and water properties) and data sources will allow improved error metrics and a valuable feedback to GMES MCS. The derived results will also serve to support the development of sensors and algorithms for remote data and will be also transferred to the ESA.

Finally, another important operational advance is to bring together all these conditions in a domain discretized with an unstructured grid (which affects the coupling and parameterizations and for which there is already expertise in the partnership, see e.g. (German at al., 2008), (Hall and Davies, 2005)) and incorporating, for some selected areas, a mass conservative dry/wet point treatment module. The sensitivity and validation performed will provide useful practical conclusions that generalise partial work carried out previously (also within the partnership see e.g. (Cavaleri and Bertotti, 2006)) on assessing the effects of downscaling and increasing resolution. This work will be compared to similar efforts elsewhere through the international Advisory Board, which will support the project development from their experience also in other countries.

LOCAL SCALE PARAMETERIZATIONS

Coastal meteorology has traditionally claimed the lack of a suitable parameterization of boundary layer atmospheric phenomena (see e.g. (Berg and Zhong, 2005)) as one of the causative factors that hamper quality weather forecasts (for weekly scale horizons).

The FIELD_AC project aims at exploiting the most advanced (available) physical knowledge on processes (from small to micro scale, including turbulence) to develop/improve downstream services. It will be based on models such as the WRF code for high resolution simulations down to 1 km grids, run operationally at the Barcelona Supercomputing Centre BSC-CNS (see e.g. (Michalakes et al., 2005); (Skamarok and Klemp, 2007); (Perez et al., 2006)). As the vertical and horizontal resolutions are increased, the micro physics and other boundary layer parameterizations must be adjusted to correctly describe these very local new phenomena (e.g. (Hervella, 2004)). Moreover, small scale instabilities grow faster than larger ones (e.g.(Kalnay, 2003)), which degrades the result. This needs a massively parallel computing environment such as that of the BSC partner, one of the most powerful computer facilities in the EU.

The aim of FIELD_AC will be to improve local meteorological forecasts and extend the temporal prediction horizon by using spatial-temporal deformation fields and ETKF (Ensemble Transform Kalman Filter) techniques to improve the spread and increase the spatial resolution (see e.g. (Eckel, 2005)). Some effort will be also dedicated to modify local parameterizations taking into account the effects of higher resolution and the two way interaction with coupled oceanographic models. The resulting fields will be then used to create a high resolution ensemble forecast that could be used as input conditions for the corresponding oceanographic models in order to obtain a multi dimensional ensemble, particularly important for situations such as the ones that we shall be faced with in restricted domains (e.g. local wind channelling through river mouths bisecting a coastal mountain chain in the Catalan coast case or sea breezes).

Coastal hydrodynamic fields i.e. waves and circulation without interactions, are commonly modelled and predicted nowadays for basin scales and time scales up to 10 days (Pinardi et al., 2003), (Sanchez-Arcilla et al., 2003), (Dobrynin et al., 2009). The regional subsystems downscale the basin nowcast/forecast outputs to 1-3 kilometres resolution and provide short term forecasts from 3 to 7 days depending on external forcing considerations (Sørensen et al., 2008); (Staneva et al., 2009). Near-shore circulation models must be introduced in this “loop” to account for shore-line “features” and the surf zone. The FIELD_AC partnership will start with an advanced off-the-shelf near-shore code within which we shall improve the rip current part, mainly for reflective beaches (although also considering the reproduction of “residual” rips for dissipative beaches).

Wave fields are propagated towards the shore by means of propagation/generation models running from the “deep water” area to the beach or harbour of interest, often without taking into account local air-sea interactions or even some of the wave-wave interactions (see e.g. (Jorda et al., 2006), (Gonzalez-Marco et al., 2004)). The atmospheric forcing is used in an asynchronous way and some air-sea interaction corrections have been developed for this purpose as a function of the physics and the numerical resolution (see e.g. (Cavaleri and Bertotti, 2003)). Local assimilation may be required to compensate for local processes not considered physically or numerically (see e.g. (Siddons et al., 2009)).

River catchment models do not normally incorporate the effects of air-sea transfers nor the “boundary” interaction at the river mouth (e.g. salt wedge effects, surged sea levels or river mouth sand bars), despite the existence of conventional 1D, 2D or even 3D models for river discharges (Mestres et al., 2007b, 2007c) and run off. These models will very likely have to be "accelerated" so that they provide competitive results (at a reasonable CPU-time cost) when compared to, for instance, a "calibrated" reservoir type model combined with "simple" wind/wave/current codes.

Many of these circulation models incorporate transport and dispersion routines (Mestres et al., 2009a, 2009b) which do not include local assimilation or the two-way coupling effects. Most assimilations efforts have been carried out at basin scales (e.g. (Pinardi and Woods, 2002)) using optimal interpolation schemes with a time-varying error covariance matrix (to assimilate variables such as sea level anomaly, sea surface temperature or temperature and salinity profiles). Little effort has been dedicated to the metrics of errors, particularly when considering simultaneously the coupled wind, wave and current fields.

Because of these reasons the corresponding predictions at river-mouth or harbour scales "miss" part of the physics at sub-grid scales and degrade the obtained forecasting. Such local resolution require also a suitable knowledge of conditions at larger scales (boundary conditions) which, as discussed in previous paragraphs, allow the coupling between all considered domains. FIELD_AC aims at improving some of these parameterizations and coupling strategies based on local knowledge/features and recent advances which, as described in previous points, have not yet been implemented operationally.

COUPLING AND INTERACTIONS

The FIELD_AC team is in a unique position to improve the coupled meteo-oceanographic modelling sequence. The team is developing new generation/dissipation parameterizations for wave modelling particularly for European coasts and for coupled wave-current simulations (Ardhuin et al., 2003), (Ardhuin and Magne, 2007). Moreover, the coupling 3D "terms" are not exact, with errors up to leading order of the solution (Ardhuin et al., 2008) and the obtained results may also be dependent on the coupling strategy (use will be made of existing methods such as the PALM-OASIS coupler from the PRISM project) and discretizations and on the particulars of the meteo-oceanographic conditions (see e.g. (Bolaños et al., 2007); (Osuna and Wolf, 2005)).

The FIELD_AC partnership will devise a set of bench-mark cases based on observed patterns – such as e.g. current profiles (Groeneweg and Klopman, 1998, Stanev et al., 2007b) – which, together with the event-scale field campaign and the satellite/radar images plus in-situ data, will provide a validation control well above the present state-of-art. The computed fields will be diagnosed for each variable, considering also the resulting Eulerian and Lagrangian transport velocities (essential in a context with circulation, wave-induced mass fluxes and fresh-water discharges) and building upon previous experience within the partnership, (see e.g. (Taillandier et al., 2008)). They will be also used to assess the transfer functions from meteo fields to waves-currents-surges (even to the surface mixing parameterizations, critical for transport simulations), expanding preliminary (partial) work done within the partnership (see e.g. (Signell et al., 2005)) and providing feedback to MCS providers.

The selected set of models includes some of the internationally accepted “references” (WAM or WAVEWATCH III, SWAN, MM5, WRF, POLCOMS, GETM, NEMO, MIKE 21/3, ROMS and FVCOM), which the partnership staff has contributed to develop – either from the beginning or as recent recruits – and over which the FIELD_AC team has enough control (see e.g. Chen et al., 2003). The partners have also a solid track in one and two way coupling among these models, both in i) hydrodynamic-only terms (see e.g. (Wolf 2008, 2009), (Osuna and Monbaliu, 2004), (Ozer et al., 2000) for wave-tide-surge coupling or (Bolaños et al, 2009) for the sensitivity to the employed formulation and ii) in a multidisciplinary sense (see e.g. (Carniel et al., 2007) for physical-biological coupling or (Sherwood et al., 2004), (Caceres et al., 2005), (Rosales et al., 2008) for the hydro-morphodynamic coupling at two different scales).

These hydrodynamic fields will be used in a 3-D sediment module based on a “Community Sediment Transport” model featuring suspended sediment and bed-load transports, layered bed dynamics (Gayer et al., 2006), flux-limit solution of sediment settling, unlimited number of sediment classes and bed layers and even cohesive sediment erosion/deposition algorithms (see FVCOM at fvcom.smast.umassd.edu). The results will be contrasted with 3-layer model results looking for robustness and compatibility. This will bring the previous expertise in FIELD_AC (see e.g. (Giardino et al., 2008), (Van den Eynde et al., 2008)) to a new accuracy and robustness level. Likewise, these “hydrodynamic” results will be used as input for further environmental modelling. This can be illustrated by a generalized lower-trophic level food-web biological module that allows users to build their own biological model (within the FVCOM package), or various water quality or turbulence – related applications (Carniel et al., 2007; Radwan et al., 2004; Toorman et al., 2008).

Moreover, the FIELD_AC team has also developed and commercialized one of the most competitive set (see http://www.mike-by-dhi.com/) of codes for coastal scale and “land” input simulations (waves inside harbours with multiple reflections, urban and river discharges and near-shore circulation, see e.g. (Madsen and Sørensen, 1992), (Sørensen et al., 1998)). Additionally, the FIELD_AC partnership has proven expertise in coupling water quality and biological models (Tian et al., 2009) to the previously described set of codes (e.g. water quality and food web dynamics modules in the FVCOM model).

DATA INTEGRATION & HARMONISATION

The wealth of coastal scale meteo-oceanographic data available to the FIELD_AC partnership plus the above mentioned numerical tools should allow a “merge” of information from multiple sources and with different accuracies and resolutions. The advance here refers to the homogenization of in-situ coastal data – from harbour, coastal and river authorities and from the municipalities of the coastal cities in the studied field cases – with MCS meteo-oceanographic data sets. FIELD_AC will build upon the data bases from the participating institutions such as CoastLab or CoastDat, COBS or XIOM (see e.g. (Howarth et al., 2006, 2008), (Bolaños et al., 2009)) and the expertise of the partnership in handling large data sets (see e.g. (Signell et al., 2008)) from satellite or radar (see e.g. (Bell, 1999), (Wolf, 2005)). This will allow standardising the format of fields from observations and simulations (e.g. using NetCDF) to improve the handling efficiency.

The main progress in this thematic area will come from the critical inter-comparison, using optimal interpolation techniques, of in situ and remote images against the results from numerical simulations (see e.g. (Gommenginger et al., 2003); (Stanev et al., 2003, 2007b)). The in situ data will, for the first time, combine coastal meteo-oceanographic networks – such as XIOM in the Catalan coast, the Liverpool Bay Coastal Observatory, the German Bight Coastal Observatory (COSYNA) or the Gulf of Venice oceanographic Tower "Acqua Alta", providing some of the longest open sea time-series in the world and satellite sea-truth (altimeter and SeaWIFS) – with river, urban and harbour data. This will facilitate the inter-comparison with optic remote images, particularly important for the coastal fringe.

The magnitude and spectral variation of in situ Inherent Optical Properties (IOPs) are determined by the concentration and chemical composition of dissolved and suspended materials present in seawater (Kirk, 1994). In addition to water itself, coastal seas are generally considered to contain three classes of optically significant constituents: phytoplankton (measured as chlorophyll a, CHL), mineral suspended solids (MSS) and coloured dissolved organic matter (CDOM). Information on water composition should allow the identification, quantification and mapping of various physical and biological processes both spatially and temporally. For example, CHL concentration is often used as a proxy for phytoplankton abundance and MSS concentration may be used to indicate sediment re-suspension and transport.

Measurements of optically significant constituent concentrations are currently obtained through sample collection and laboratory analyses which are time consuming and provide poor spatial and temporal coverage compared to that of other physical variables such as salinity and temperature. Operationally algorithms exist which detemine constituent concentrations from satellite ocean colour data (Doerffer and Schiller 2007). Still, there is a need for development of supplementary methods of determining water composition to provide comparable coverage to that of other physical variables. The high sampling rate and relative ease of deployment suggest that in situ optics would provide a suitable basis for such procedures. As in situ absorption and attenuation coefficient measurements (from which scattering is derived) are routinely made using WETLabs AC-S dual-beam spectrophotometers, and the magnitude and spectral variation of these inherent optical properties (IOPs) are determined by the concentration and composition of seawater constituents, IOP inversion is a prime candidate. Such inversion techniques, applied to in situ optical data obtained from sample campaigns, may provide useful insights into the variability of water composition and underlying coastal sea processes.

For all considered variables the deviations between simulations and observations (for these multi-dimensional fields) will be minimised, while preserving the underlying system dynamics (Schulz-Stellenfleth and Stanev, 2009). We shall start with single variable analysis, leaving for a later stage the use of multi-variate versions of the Kalman filter (co-kriging). Additional information from data/simulations can be added sequentially by considering gradients as extra variables (Chauvet et al, 1976) and non-stationary covariance structures (Van Der Boogaart and Brenning, 2001). Such a procedure has not been considered before.

This approach, particularly suited for limited domains with in-homogeneous and transient situations – typical of the field cases studied – will provide scientific support to GMES, particularly for its space component in the coastal fringe where wave action plays an energetically (and otherwise) dominant role. However, without the coupling, some predictions can be significantly off their "true" values. For instance, the significant wave height – Hs – can vary by a factor 2 at the English coast between low and high tide (Wolf et al., 2007), while the effect of veering winds in the NW Mediterranean can lead to Hs errors in excess of 50%, see e.g. (Sanchez-Arcilla et al., 2008a). Likewise, small mean-water level variations can drastically affect circulation patterns in the Wadden Sea (Stanev et al., 2007b) while the presence of surges in the Venice Gulf may heavily impact the overall hydrodynamics (Umgiesser et al, 2004).

The "integrated" in situ harbour/river data will be, thus, tested for pre- operational meteo-oceanographic predictions (Stanev et al., 2009b). This will be done for the four field sites considered in the project, including in particular the pilot intensive campaign to be carried out in the Catalan coast case where the impulsive (flash) flood events, co-existing with low-pressures off the coast and energetic (short duration) storm waves pose a tough test case for our predictions. We shall also consider the challenge imposed by larger volumes of information (spatial images) while looking for consistency at the European level (end-users from various EU countries and areas, public and private sectors and different meteo services also involved) and in agreement with the criteria of the EU Environment Agency.

TRANSFER OF IMPROVED OPERATIONAL SERVICE

The main progress here will be the expertise to quantify uncertainty in the coupled predictions and the error propagation through the modelling sequence, particularly for systems with limited predictability (see e.g. (Bertotti and Cavaleri, 2008)). The team expertise to establish the role of remote versus local processes and the resulting errors will be "transferred" by the partners, supported by the newly created spin-off via the service Level Agreements (SLA) established with the users. These SLA will include the relevant partners and selected SMEs or Technology Transfers Offices (on a country by country basis). Such agreements will establish the free exchange of results for scientific purposes and a commercial agreement for marketable applications.. The partnership has proven experience in deterministic forecasts but also in the probabilistic ones and the implications for statistical characterizations (see e.g. (Hawkes et al., 2008), (Sanchez-Arcilla et al., 2008b)) and likewise regarding the uncertainty in modelling sequences (see e.g. (Radwan et al., 2004), (Rubarenzya et al., 2007), (Willems, 2008)).

Thanks to this it will be possible, based on a careful testing and diagnostic plan, to assess the "local" scale performance of the coupled modelling suite. This will be achieved in FIELD_AC with the participation of a well recognised private institute specialized in developing and commercialising software for the land component of the project and for local scale coastal (civil engineering) applications such as 2D or 3D unsteady flow models or Boussinesq type models (see e.g. (Madsen and Skotner, 2005), (Sorensen et al., 1998), (Schäffer et al., 1993)). The SME spin-off from FIELD_AC will structure, under the partnership guidance, the transfer of research expertise, homogenised data sets and simulations from scientific partners to interested users. The FIELD SME will, thus, support the commercial side of the project scientific results, in accordance with the agreements established among the SME, the partners and their associated or selected national companies.

The combination of EU research institutions/Universities plus a private research institute and a newly generated SME spin-off will offer a wide fan of transfer options (see e.g. (Wolf, 2003)) for the developed expertise and the "Coastal Operational Framework" that will be the main tangible product distributed by the spin-off. This software frame, with flexible plug-in/off capabilities to accommodate the requirements from users in the field sites (in terms of accuracy, resolution or even processes or preferred models) will allow an efficient assessment of MCS products as a function of local predictions (e.g. through the offshore boundary condition). This will directly lead to a feedback to MCS providers and a scientific support to agencies dealing with remote (ESA) or in-situ (EEA) data. The improved operational service at local scales is also expected to contribute to EU directives such as the Flood and Risk directives (waves and surge conditions at the coast or the associated statistics) or the Water Framework Directive (sediment, nutrient and pollutant fluxes near harbours or river mouths) and associated contingency plans. It will also contribute to local scale climate studies (see initial work in e.g. (Hargreaves et al., 2002); (Tsimplis et al., 2005); (Wolf and Flather, 2005); Stanev et al., 2006)). In this manner FIELD_AC will also support the UN Millenium Development Goals and the societal benefit areas of the GEO initiative.

List of References

Ardhuin, F. and Magne, R. 2007. Current effects on scattering of surface gravity waves by bottom topography, J. Fluid Mech., 576, 235–264.

Ardhuin, F., Bertotti, L., Bidlot, J.-R., Cavaleri, L., Filipetto, V., Lefevre, J.-M. and Wittmann, P. 2007. Comparison of wind and wave measurements and models in the Western Mediterranean Sea. Ocean Engineering, 34, 526-541.

Ardhuin, F., Herbers, T.H.C., Jessen, P.F. and O'Reilly, W.C. 2003. Swell transformation across the continental shelf. Part II: Validation of a spectral energy balance equation. J. Phys. Oceanogr., 33, 1940–1953.

Ardhuin, F., Chapron, B. and Collard, F. 2008. Strong dissipation of steep swells observed across oceans. Geophysical Research Letters (in press).

Ardhuin, F., Marié, L., Rascle, N., Forget, P. and Roland, A. 2008. Observation and estimation of Lagrangian, Stokes and Eulerian currents induced by wind and waves at the sea surface. Jornal of Physical Oceanography (in press).

Bell, P.S. 1999. Shallow water bathymetry derived from an analysis of X-band marine radar images of waves, Coastal Engineering, 37, 513-527.

Berg, L.K. and Zhong, S. 2005. Sensitivity of MM5-simulated boundary layer characteristics to turbulence parameterizations. J. Appl. Meteorol., 44, 1467–1483.

Bertotti, L. and Cavaleri, L. 2008. Analysis of the Voyager storm. Ocean Engineering, 35, 1-5.

Bignami, F., Sciarra, R., Carniel, S. and Santoleri, R. 2007. The variability of the Adriatic sea coastal turbid waters from SeaWiFS imagery. Journal of Geophysical Research – Oceans, 112, C03S10. DOI: 10.1029/2006JC003518.
Bolaños, R., Jorda, G., Cateura, J., Lopez, J., Puigdefabregas, J., Gomez, J. and Espino, M. 2009. The XIOM: 20 years of a regional coastal observatory in the Spanish Catalan coast. Journal of Marine Systems 77, 237-260.
Bolaños, R., Sanchez-Arcilla, A. and Cateura, J. 2007. Evaluation of two atmospheric models for wind–wave modelling in the NW Mediterranean. Journal of Marine Systems, 65, 336-353.
Brown, J. and Wolf, J. 2009 Coupled wave and surge modelling for the eastern Irish Sea and implications for model wind-stress. Continental Shelf Research 29 (10), 1329–1342.
Caceres, I., Sanchez-Arcilla, A., Zanuttigh, B., Lamberti, A. and Franco, L. 2005. Wave overtopping and induced currents at emergent low crested structures. Coastal Engineering, 52, 931-947.
Carniel, S., Vichi, M. and Sclavo, M. 2007. Sensitivity of a coupled physical-biological model to turbulence: high frequency simulations in a northern Adriatic station. Chemistry and Ecology, 23, 157-175.
Carniel, S., Sclavo, M., Kantha, L.H. and Prandke, H. 2008. Double-diffusive layers in the Adriatic Sea. Geophysical Research Letters, 35, L02605, DOI: 10.1029/2007GL032389.
Cavaleri, L. and Bertotti, L. 2003. The characteristics of wind and wave fields modelled with different resolutions. Q.J.R. Meteorolog. Soc., 129, 1647-1662.
Cavaleri, L., and Bertotti, L. 2006. The improvement of modelled wind and wave fields with increasing resolution. Ocean Engineering, 33, 553-565.
Cavaleri. L., Alves, J.-H.G.M., Ardhuin, F., Babanin, A., Banner, M., Belibassakis, K, Benoit, M., Donelan, M., Groeweg, J., Herbers, T.H.C., Hwang, P., Janssen, P.A.E.M., Janssen, T., Lavrenov, I.V., Magne, R., Monbaliu, J., Onorato, M. Polnikov, V., Resio, D., Rogers, W.E., Sheremet, A., McKee Smith, J., Tolman, H.L., van Vledder, G., Wolf, J. and Young, I. 2007. Wave modelling – the state of the art. Progress in Oceanography, 75, 603-674.
Cavaleri, L., 2000, The oceanographic tower Acqua Alta - activity and prediction of sea states at Venice, Coastal Engineering, 39, 29-70.
Chauvet, P., Pailleux, J. and Chiles, J.P. 1976. Analyse objective des champs météorologiques par cokrigeage. La Météorologie, Sciences et Techniques 6(4), 37-54.
Chen, C., Liu, H. and Beardsley, R.C. 2003. An Unstructured Grid, Finite-Volume, Three-Dimensional, Primitive Equations Ocean Model: Application to Coastal Ocean and Estuaries. Journal of Atmospheric and Oceanic Technology. 20, 159-196.
Dobrynin, M., H. Gunther, and G. Gayer,2009: Assimilation of satellite data in a Suspended Particulate Matter transport model (under review).
Doerffer, R. and H. Schiller, 2007: The MERIS case 2 water algorithm. International Journal of Remote Sensing. 28, 3-4. 517-535.
Eckel, F.A. 2005. Aspects of Effective Mesoscale, Short-Range Ensemble Forecasting. Weather and Forecasting, 20, 328-350.
Gayer G, S. Dick, A. Pleskachevsky, and W. Rosenthal, 2006: Numericl modeling of suspended matter transport in the North Sea. Ocean Dynamics 56, 62-77.
German, A.L., Espino, M., Blasco, J., Maidana, M., Escolano, E. and Pasenau, M. 2008. Application of GID to generate the 3D element mesh for the study of marine

circulation in the Bay of Biscay. 4th Conference on Advances and Applications of GiD, Ibiza, Spain.
Giardino, A., Ibrahim, E., Adam, S., Toorman, E.A. and Monbaliu, J. 2008 Hydrodynamics and cohesive sediment transport in the IJzer estuary (Belgium): a case study. Journal of Waterway, Port, Coastal, and Ocean Engineering. (accepted).
Gommenginger, C.P., Srokosz, M.A., Wolf, J. and Janssen, P.A.E.M. 2003. An investigation of altimeter sea state bias theories Journal of Geophysical Research, 108, C1, 3011, DOI:10.1029/2001JC001174.
Guenther H., S. Hasselmann, and P.A.E.M. Janssen, 1992: The WAM Model User Manual., Deutsches Klimarechenzentrum, Technical Report.
González-Marco, D., Sánchez-Arcilla, A., Bolaños, R., Sospedra, J., Sierra, J.P. and Uzcanga, J. 2004. Forecasting wave conditions in beaches. From nested simulations to field observations. Proc 29th International Conference on Coastal Engineering, ASCE, Lisbon, pp. 791-803.
Groeneweg, J. and Klopman, G., 1998. Changes of the mean velocity profiles in the combined wave-current motion in a GLM formulation. Journal of Fluid Mechanics, 370, 271-296.
Hall, P. and Davies A.M,. 2005. Effect of coastal boundary resolution and mixing upon internal wave generation and propagation in coastal regions. Ocean Dynamics, 55, 248-271.
Hargreaves, J.C., Carter, D.J.T., Cotton, P.D. and Wolf, J. 2002. Using the SWAN wave model and satellite altimeter data to study the influence of climate change at the coast. The Global Atmosphere and Ocean System, 8, 41-66.
Hawkes, P., González-Marco, D., Sanchez-Arcilla, A., Prinos, P. and Samuels, P. 2008. Best practice for the estimation of extremes. A review. Journal of Hydraulic Research, 46 Extra Issue 2, 324-332.
Hervella B. 2004. How to improve heavy rainfall events simulations with increasing resolution? An answer from a convective parameterization scheme perspective. Proceedings 6th Plinius Conference on Mediterranean Storms. European Geophysical Society.
Horstmann J., and W. Koch, 2005:Comparison of SAR Wind Field Retrieval Algorithms to a Numerical Model utilizing ENVISAT ASAR Data, IEEE Journal of Oceanic Engineering, Vol. 30, Iss.3, doi 10.1109/JOE.2005.857514, pp. 508-515.
Howarth, M.J., Proctor, R., Knight, P.J., Smithson, M.J. and Mills, D.K. 2006. The POL Liverpool Bay Coastal Observatory. Proceedings of the World Maritime Technology Conference, London, pp 5.
Howarth M.J., Proctor, R., Balfour, C.A., Greenwood, N., Knight, P.J., Palmer, M.R. and Player, R.J. 2008. The Liverpool Bay Coastal Observatory. EuroGOOS, Exeter, UK. Submitted.
Janssen, P., Doyle, L., Bidlot, J., Hansen, B., Isaksen, I. and Viterbo, P. 2002. Impact and feedback of ocean waves on the atmosphere. Advances in Fluid Mechanics, 33, Atmosphere-Ocean Interactions, Vol. I, Ed. W. Pierre.
Jorda, G., Bolaños, R., Espino, M. and Sánchez-Arcilla, A. 2006. Assessment of the importance of the current-wave coupling in the shelf ocean forecasts. Ocean Science Discussions (online), 3, 1825-1870.
Kalnay, E. 2003. Atmospheric Modeling, Data Assimilation and Predictability. Cambridge University Press, UK.

Kirk, J.T.O. 1994. Light and Photosynthesis in Aquatic Ecosystems (second ed.), Cambridge University Press, UK.

Komen, G.J., Cavaleri, L., Donelan, M., Hasselmann, K., Hasselmann, S. and Janssen, P.A.E.M. 1994. Dynamics and Modelling of Ocean Waves, Cambridge University Press, 532 pp.

Lancelot, C. L., J. V. Staneva, D. Van Eeckhout, J.-M. Beckers, and E. V. Stanev (2002) Modelling the Danube-influenced North-western continental shelf of the Black Sea. II: Ecosystem response to changes in nutrient delivery by the Danube River after its damming in 1972. *Estua. Coast and Shelf Sci.*, 54, 473-499.

Lee C., Askari, F., Book, J., Carniel, S., Cushman-Roisin, B. and Dorman C. 2005. Northern Adriatic response to a wintertime Bora wind event. EOS, Transactions, American Geophysical Union, 86(16), 157-165.

Madsen, H. and Skotner, C. 2005, Adaptive state updating in realtime river flow forecasting - A combined filtering and error fore casting procedure, J. Hydrology, 308, 302-312.

MacCracken, M.; Escobar-Briones, E.; Gilbert, D.; Korotaev, G.; Naqvi, W.; Perillo, G.M.E.; Rixen, T.; Stanev, E.; Sundby, B.; Thomas, H.; Unger, D.; Urban Jr., E.R. (2008). Vulnerability of semi-enclosed marine systems to environmental disturbances, *in*: Urban Jr., E.R. *et al.* (Ed.) (2008). *Watersheds, bays, and bounded seas: The science and management of semi-enclosed marine systems. Scientific Committee on Problems of the Environment (SCOPE) Series,* 70: pp. 9-29 , ISBN-13: 9781597265034, ISBN-10: 1597265039.

Madsen, P. A. and Sørensen, O. R. 1992. A new form of the Boussinesq equations with improved linear dispersion characteristics. Part 2: A slowly-varying bathymetry. Coastal Eng., 18, 183-204.

Mestres, M., J.P. Sierra, A. Sánchez-Arcilla, J. González del Río, T. Wolf, A. Rodríguez and S. Ouillon (2003). Modelling of the Ebro river plume. Validation with field observations. Scientia Marina, 67, 379-391.

Mestres, M., J.P. Sierra and A. Sánchez-Arcilla (2007a). Baroclinic and wind-induced circulation in Tarragona harbour (northeastern Spain). Scientia Marina, 71, 223-238.

Mestres, M., A. Sánchez-Arcilla and J.P. Sierra (2007b). Modeled dynamics of a small-scale river plume under different forcing conditions. Journal of Coastal Research, SI 47, 84-96.

Mestres, M., J.P. Sierra and A. Sánchez-Arcilla (2007c). Factors influencing the spreading of a low-discharge river plume. Continental Shelf Research, 27, 2116-2134.

Mestres, M., J.P. Sierra, A. Pascual, C. Mösso, J. González del Río and M. Rodilla (2009a). Bacterial pollution in Cullera Bay (Spanish Mediterranean Coast). Journal of Coastal Research, SI 56, 861-865.

Mestres, M., J.P. Sierra, C. Mösso and A. Sánchez-Arcilla (2009b). Modelling the sensitivity to various factors of shipborne pollutant discharges. Environmental Modelling & Software (in press).

Michalakes, J., Dudhia, J., Gill, D., Henderson, T., Klemp, J., Skamarock, W. and Wang, W. 2005. The weather research and forecasting model: software architecture and performance. Proceedings of the 11th ECMWF Workshop on the use of High Performance Computing in Meteorology, pp 156-168.

Osuna, P. and Monbaliu, J. 2004. Wave–current interaction in the Southern North Sea. J. of Marine Systems, 52, 65-87.

Osuna, P. and Wolf, J. 2005. A numerical study on the effect of wave-current interaction processes in the hydrodynamics of the Irish Sea. in, Proceedings of the 5th. International Conference on Ocean Wave Measurement and Analysis: WAVES2005, Madrid, Spain.

Ozer, J., Padilla-Hernandez, R., Monbaliu, J., Alvarez Fanjul, E., Carretero-Albiach, J.C., Osuna, P., Yu, C.S. and Wolf, J., 2000. A coupling module for tides, surges and waves. Coastal Engineering, 41, 95-124.

Pérez, C., Jiménez, P., Jorba, O., Sicard, M. and Baldasano, J.M. 2006. Influence of the PBL scheme on high-resolution photochemical simulations in an urban coastal area over the Western Mediterranean. Atmospheric Environment, 40, 5274–5297.

Pinardi, N. and Woods, J.D. 2002. Ocean Forecasting: conceptual basis and applications. Springer-Verlag, 472 pp.

Pinardi, N., Allen, I., Demirov, E., de Mey, P., Korres, G., Lascaratos, A., Le Traen, P-Y., Maillard, C., Manzella, G. and Tziavos, C. 2003. The Mediterranean ocean Forecasting System: first phase of implementation (1998-2001). Annales Geophysicae, 21, 3-20.

Precht, E. and Huettel, M. 2004. Rapid wave-driven advective pore water exchange in a permeable coastal sediment, Journal of Sea Research, 51, 93–107.

Radwan, M., Willems, P. and Berlamont, J. 2004. Sensitivity and uncertainty analysis for river water quality modelling, Journal of Hydroinformatics, 06.2, 83-99.

Rosales, P., Ocampo-Torres, F.J., Osuna, P., Monbaliu, J. and Padilla-Hernandez, R. 2008. Wave-current interaction in coastal waters: Effects on the bottom-shear stress, Journal of Marine Systems, 71, 131-148.

Rubarenzya, M-H., Graham, D., Feyen, J., Willems, P. and Berlamont, J. 2007. A site-specific land and water management model in MIKE SHE. Nordic Hydrology, 38(4-5), 333-350.

Sánchez-Arcilla, A., Espino, M., Bolaños, R., Gómez, J., Jorda, G., Ponce de Leon, S. and Sairouni, A. 2003. Wave and current forecasting along the Spanish Catalan coast, Proceeding of the 3rd Eurogoos Conference, Athens, Greece.

Sánchez-Arcilla, A. and Simpson, J.H. 2002. The narrow shelf concept: coupling and fluxes. Continental Shelf Research, 22, 153-172.

Sánchez-Arcilla, A., González-Marco, D. and Bolaños, R. 2008a. A review of wave climate and prediction along the Spanish Mediterranean Coast. Nat. Hazards Earth Syst. Sci., 8, 1-12.

Sanchez-Arcilla, A., Gomez, J., Egozcue, J.J., Ortego, M.I., Galiatsatou and P., Prinos, P. 2008b. Extremes from Scarce Data: The Role of Bayesian and Scaling Techniques in Reducing Uncertainty. J. Hydraul. Res. 46(Extra Issue 2), 224–234.

Schäffer, H.A., Madsen, P.A. and Sørensen, O.R. 1993. A Boussinesq model for waves breaking in shallow water. Coastal Engineering, 20, 185-202.

Schulz-Stellenfleth, J.; Lehner, S.; Hoja, D., 2005, A Parametric Scheme for the Retrieval of 2-D Ocean Wave Spectra from Synthetic Aperture Radar Look Cross Spectra. Journal of Geophysical Research, 110:C05004, DOI 10.1029/2004JC002822.

Schulz-Stellenfleth, J., I.. Hajnsek, and S. Lehner, 2006 : Retrieval of 2-D Current and Ocean Wave Information Using TanDEM-X in a Squinted Split Antenna Mode Configuration. In *Proceedings of EUSAR*, pp. 1-4.

Schulz-Stellenfleth, J., and E. Stanev (2009). Assessment of ocean observing networks - A study of water level measurements in the German Bight. Ocean Modelling (submitted to Ocean Modelling)

Sherwood, C.R., Carniel, S., Cavaleri, L., Chiggiato, J., Das, H., Doyle, J.D., Harris, C.K., Niedoroda, A.W., Pullen, J., Reed, C.W., Russo, A., Sclavo, M., Signell, R.P., Traykovski, P. and Warner, J.C. 2004. Sediment Dynamics in the Adriatic Sea investigated with coupled models. Oceanography, 17, 46-57.

Siddons, L.A., Wyatt, L.R. and Wolf, J. 2009. Assimilation of HF radar data into the SWAN wave model. Journal of Marine Systems, 77 (3), 312-324.

Sierra, J.P., Sánchez-Arcilla, A., Figueras, P.A., González del Río, J., Rassmussen, E.K. and Mösso, C. 2004. Effects of discharge reductions on salt wedge dynamics of the Ebro river. River Research and Applications, 20, 61-77.

Signell, R.P., Carniel, S., Cavaleri, L., Chiggiato, J., Doyle, J., Pullen, J. and Sclavo, M. 2005. Assessment of wind quality for oceanographic modeling in semi-enclosed basins. Journal of Marine Systems, 53 217-233.

Signell, R.P., Carniel, S., Chiggiato, J., Janecovic, I., Pullen, J. and Sherwood, C. 2008. Collaboration tools and techniques for large model datasets. Journal of Marine Systems, 65, 154-161.

Skamarok, W. and Klemp, J. 2007. A time-split nonhydrostatic atmospheric model for research and NWP application. Journal of Computational Physics, SI on Environmental Modeling.

Sørensen, O.R., Schäffer, H.A. and Madsen, P.A. 1998. Surf zone dynamics simulated by a Boussinesq type model III. Wave-induced horizontal nearshore circulations. Coastal Engineering, 33, 155-176.

Sørensen, J., Erichsen, A., Hansen, I. and Mohlenberg, F., 2008. Water Forecasts and Data Assimilation. US/EU-Baltic International Symposium, Estonia.

Stanev, E. V., G. Brink-Spalink, and J.-O. Wolff (2007a), Sediment dynamics in tidally dominated environments controlled by transport and turbulence: A case study for the East Frisian Wadden Sea, *J. Geophys. Res.*, *112*, C04018, doi:10.1029/2005JC003045.

Stanev, E. V. and F. Colijn (2009) Coastal Observing and Forecasting System for the German Bight, JAOT (submitted).

Stanev, E. V., M. Dobrynin, A. Pleskachevsky, S Grayek, H. Günther (2009a) Bed shear stress in the Southern North Sea as an important driver for sediment dynamics. Ocean Dynamics 59, 2: 183-194.

Stanev, E. V., B. Flemming, A. Bartholomae, J. Staneva, and J.-O. Wolff (2007b) Vertical circulation in shallow tidal inlets and back barrier basins. Continental Shelf Research, v. 27, iss. 6, p. 798-831.

Stanev, E. V., S Grayek, and J. Staneva (2009b) Temporal and Spatial Circulation Patterns in the East Frisian Wadden Sea, OD, 59, 2 167 – 181

Stanev, E. V., J. O. Wolff, and G. Brink-Spalink (2006) On the sensitivity of sedimentary system in the East Frisian Wadden Sea to sea level rise and magnitude of wind waves. Ocean Dynamics 56(3-4): 266-283 ISSN 1616-7341

Stanev, E. V., J. –O. Wolff, H. Burchard, K. Bolding, and G. Floeser (2003) On the Circulation in the East Frisian Wadden Sea: Numerical modeling and data analysis. *Ocean Dynamics*, 53, 27-51.

Staneva, J., Stanev, E. V., Wolff, J.-O., Badewien, T. H., Reuter, R., Flemming, B., Bartholom¨a, A., and K. Bolding (2009) Hydroynamics and Sediment Dynamics in the German Bight. A Focus on Observations and Numerical Modelling in the East Frisian, Wadden Sea, Cont. Sh. Res. 29, 1, 302-319.

Taillandier, V., Griffa, A., Poulain, P.M., Signell, R.P., Chiggiato, J. and Carniel, S. 2008. Variational analysis of drifter positions and model outputs for the

reconstruction of surface currents in the Central Adriatic during fall 2002. Journal of Geophysical Research – Oceans, 113, C04004, DOI: 10.1029/2007JC004148.
Tian, T., A. Merico, J. Su, J. Staneva, K. Wiltshire, and Kai Wirtz (2009): Importance of resuspended sediment dynamics for the phytoplankton spring bloom in a coastal marine ecosystem, J. Sea Res. (accepted)
Toorman, E.A. 2007. Vertical mixing in the fully-developed turbulent layer of sediment-laden open channel flow. J. Hydraulic Engineering (ASCE) (in press).
Toorman, E.A. 2008. New low-Reynolds mixing-length and k-ε turbulence models for shear flow along smooth walls. Submitted to Journal of Turbulence.
Tsimplis, M.N., Woolf, D.K., Osborn, T.J., Wakelin, S., Wolf, J., Flather, R., Shaw, A.G.P., Woodworth, P., Challenor. P.G., Blackman, D., Pert, F., Yan, Z. and Jevrejeva, J. 2005. Towards a vulnerability assessment of the UK and northern European coasts: the role of regional climate variability, Phil. Trans. R. Soc. A, 363, 1329–1358.
Umgiesser, G., Sclavo, M., Carniel, S. and Bergamasco, A. 2004. Exploring the bottom stress variability in the Venice lagoon environment. Journal of Marine Systems, 51, 161-178.
Van der Boogaart, K.G. and Brenning, A. 2001. Why is universal kriging better than IRFk-kriging: estimation of variograms in the presence of trend, Proceedings of 2001 Annual Conference of the International Association for Mathematical Geology, Cancun, Mexico.
Wahle, K., H. Günther, H. Schiller, (2009): Neural Network parameterisation of the mapping of wave-spectra onto nonlinear four-wave interaction. Ocean Modeling 30, 48-55
Van den Eynde, D., Giardino, A., Portilla, J., Fettweis, M., Francken, F. and Monbaliu, J. 2008. Modelling the effects of sand extraction, on sediment transport, due to tides on the Kwinte Bank. Journal of Coastal Research (in press).
Willems, P. 2008. A time series tool to support the multi-criteria performance evaluation of rainfall-runoff models. Environmental Modelling & Software (in press).
Wolf, J. 2003. Application of oceanographic observations to sports and recreation. GOOS Products & Services Bulletin. http://ioc.unesco.org/gpsbulletin/
Wolf, J. 2005. Intercomparison of S4DW and DWR, p. 281-290 in, COST Action 714: Measuring and analysing the directional spectra of ocean waves, Working Group 3. Hauser, D., Kahma, K., Krogstad, H.E., Lehner, S., Monbaliu, J. and Wyatt, L.R. Eds. Luxembourg: Office for Official Publications of the European Communities, EUR 21367.
Wolf, J. 2008. Coupled wave and surge modeling and implications for coastal flooding. Advances in Geosciences, 17, 1-4.
Wolf, J. 2009. Coastal Flooding – Impacts of coupled wave-surge-tide models. Natural Hazards, 9 (2), 241-260.
Wolf, J. and Flather, R.A. 2005. Modelling waves and surges during the 1953 storm. Phil. Trans. R. Soc. A 363, 1359–1375.
Wolf, J., Osuna, P., Howarth, M.J. and Souza, A.J. 2007. Modelling and measuring waves in coastal waters, Proceedings of ICCE 2006, 539-551, San Diego, USA.

NOTE: out of this state of the art list of references only seven are not co-authored by partnership staff.

B.1.3 S/T methodology and associated work plan

B.1.3.1 Overall strategy and general description

The FIELD_AC project approach is based on a synergetic combination of numerical and observational expertise applied to coastal, and thus geometrically limited, domains, aiming at fulfilling the practical requirements of the end users from our case studies.

The rationale behind the project is the development of a "Coastal Operational Framework" which should enable the coupling of already existing meteo-oceanographic models to land discharges and harbour/river/beach hydrodynamic models (also available). The hierarchical structure of such a framework will be carefully devised from the results of a comprehensive sensitivity analysis to boundary conditions, new interaction terms (also available from recent advances in the state-of-art) and data (remote and in situ) from multiple sources for the four considered field cases. The associated methodology is built from the following five blocks

1.-Coupling and Processes

This block refers to the proposal of new terms in the governing equations and the consideration of coupling between various fields. It also refers to the coupling with other components e.g. sediment fluxes or the coupling among models available in the partnership.

2.-Domain and Boundaries

This block deals with the domain "size" (in geometric and dynamic terms) and discretizations and the boundary conditions for waves, currents, surges and suspended transport at the land, sea-bed, free-surface and offshore boundaries. The latter will "connect" the MCS fields to the project simulations, allowing an indirect assessment of the quality of basin scale services.

3.-Field Evidence

This block combines in-situ data from existing coastal and river networks with satellite (altimeter, scatterometer, infra-red and optical) and radar (HF and X-band) images. This will be supplemented by a pilot intensive (event-scale) field campaign at one of the field sites (Catalan coast) to support a comprehensive validation and an assessment of "local" and "remote" errors. The data will be also "homogenized" using the EEA criteria.

4.-Improved Local Service

This block involves a feasibility analysis of the project results to be carried out by the newly created spin-off, under the guidance of the partnership. The analysis will consider the existing (country by country) companies and technology transfer offices and the explicit needs of the identified users. The project spin-off will, thus underpin the scientific work of the partners looking for new market niches and the overall sustainable transfer of project results. This will enhance the transfer of the partnership scientific expertise in the downscaling, coupling and local scale calibration, including the improved access to coastal data sets. The jointly "validated" predictions will also consider advanced error metrics in the modelling sequence and explicit prediction limits for each variable, field case or "event" type. The marketing of project results will be carried out via the Service Level Agreements established with the identified users, based on the initial MoU among partners and the agreement of these partners with the newly created SME.

5.-Transfer and Feedback

This block is related to the transfer of project results such as the Coastal Operational Framework, the simulated local fields for the four field sites (during the Target Operational Periods), the multi-variable data base and the training for our users to maximize the benefit of this new wealth of information.

For that we shall address the public bodies and Agencies and the private "users" described elsewhere. The transfer will also include the meteo services and MSC providers involved in the project and the ESA and EEA.

Significant risks and associated contingency plans

The main identified project risks are related to the limitations in EO data, the difficulties in model couplings and the spurious competition with existing products. If the project objectives are developed according to plan, none of these risks will materialize. Because of this the contingency plans in the following list refers first to the project performance and any deviations produced with respect to the FIELD_AC expected developments. Below there are the main specific contingencies identified. The risks listed below will be a key input for preparing the management plan for the project kick-off meeting and subsequent development. This risk analysis will be regularly updated to ensure optimal performance.

Identified risks	Contingency plan
Difficulties in managing the project due to the size of the project, the number of partners, the different nationalities, the "weight" of the fast track services.	• Skilled Steering Committee. • Experience from other large European projects • Partners working together in Euro-GOOS regional alliances and in other projects with MCS institutions • Steering Committee is in charge of ensuring a good coordination between WP's
Underestimation of work to be done or over-ambitious plan in relation to available funding	Specific review by FIELD_AC Steering Committee and Advisory Board to establish priorities and adjust work plans.
Delay in WP performance, partner failure etc.	• Addressed by the Steering Committee. • Reconfiguration, exclusion of partner and/or possible involvement of new partner.
Each WP may be tempted to go its own way.	• Clear commitment of partners with a long tradition of joint work.

	• Steering Committee advice and ruling • Advisory Board criteria
Delays or limitations in Myocean products.	• Look for a similar "product" from original providers with whom there is an agreement via the MOON platform or via the support letters for this project. More specifically: - Fields from the Mediterranean to be obtained from INGV directly - Fields from the Atlantic to be obtained from Puertos del Estado directly
Lack of robustness in the simulated fields.	• Cross-check with alternative models (all available within the partnership) • Fall-back onto more conventional coupling formulations
Overall planning divergence and / or changes of priorities during the course of the project.	• Use key milestones, deliverables and scheduled or extra meetings and events where progress is assessed. • Flexibility to reconfigure • 6-monthly review process, to adjust work plan

B.1.3.2 Timing of work packages and their components

		YEAR 1				YEAR 2				YEAR 3				
WP	**TASK**	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	
	1.1					M1.1	D1.3	M1.2						
	1.2												D1.6	
1	1.3							M1.3a		M1.3b		D1.4	M1.4	
	1.4												D1.5	
	1.5	D1.1	D1.2											
	2.1		D2.1											
	2.2				D2.2									
2	2.3						D2.3							
	2.4						M2.1		M2.2					
	3.1						D3.1 M3.2		D3.2					
3	3.2						M3.1	M3.3						
	3.3												D3.3	
	3.4								M3.4					
	4.1						M4.1a							
	4.2						M4.1b							
	4.3							M4.2	D4.1					
4	4.4										D4.2			
	4.5								M4.3		D4.3			
	4.6								M4.4			D4.4		
	5.1	D5.1			M5.2a				M5.2b				M5.2c	
	5.2		M5.1		D5.2									
	5.3				D5.3		M5.4							
5	5.4						M5.3a TOP		M5.3b TOP	M5.5 D5.4				
	5.5										M5.6			
	5.6												D5.5	
	6.1		M6.2	D6.1	M6.3									
	6.2				M6.4a	D6.3a			M6.4b	D6.3b			M6.4c	D6.3c
6	6.3	M6.1a	M6.1b		M6.1c D6.2a	M6.5a	M6.1d		M6.1e D6.2b	M6.5b	M6.1f		M6.1g D 6.2c	D6.4 M6.5c

B.1.3.3 Work package list /overview

Work package No[1]	Work package title	Type of activity[2]	Lead participant No[3]	Lead participant short name	Person-months[4]	Start month[5]	End month
WP1	Down - streaming GMES services to coastal-zone end-users	OTHER	1	UPC	30	M 1	M 36
WP2	Meteo-oceanographic modelling tools	RTD	6	NERC-POL	69	M 1	M 24
WP3	Boundary Fluxes	RTD	2	KUL	74	M 1	M 36
WP4	Interactions and coupling in restricted domains	RTD	7	ISMAR-CNR	119	M 6	M 30
WP5	Field Evidence and Prediction Limits	RTD	4	GKSS	79	M 3	M 36
WP6	Management of the FIELD_AC project and its results	MGT	1	UPC	20	M 1	M 38
				TOTAL	391		

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1 Work package number: WP 1 – WP n.

2 Please indicate <u>one</u> activity per work package:

RTD = Research and technological development (; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable in this call including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities) According to the description of the funding scheme given previously.

3 Number of the participant leading the work in this work package.

4 The total number of person-months allocated to each work package.

5 Measured in months from the project start date (month 1).

B.1.3.4 Deliverables list

Del. no. [6]	Deliverable name	WP no.	Lead beneficiary	Estimated indicative person-months	Nature[7]	Dissemination level8	Delivery date9
D1.1	Project web page **(UPC)**	WP1	1	2	P	PU	Month 3
D1.2	Project leaflet and poster **(UPC)**	WP1	1	0.5	P	PU	Month 4
D1.3	Report on end-user parameters and requirements. Implications for the operational framework	WP1	8	2	R	PP	Month 18
D1.4	Demo packages developed for end users at each of the field sites **(UPC)**	WP1	1	15.5	D	PU	Month 30
D1.5	Multidisciplinary FIELD_AC database **(DHI)**	WP1	8	10	O	RE	Month 36
D1.6	Collection of project publications **(UPC)**	WP1	1	0.2	R	PU	Month 36
D2.1	Review (critical analysis and suggestions for selecting high resolution configurations) of the models' parameters (building a practical user-oriented list) and implementation plan (for the met codes) for the 4 studied field sites **(BSC)**	WP2	9	13	R	PU	Month 6
D2.2	Review (critical analysis and suggestions for selecting the codes and carrying out the implementation) of model/set-up for	WP2	7	26	R	PU	Month 12

6 Deliverable numbers in order of delivery dates. Please use the numbering convention <WP number>.<number of deliverable within that WP>. For example, deliverable 4.2 would be the second deliverable from work package 4.

7 Please indicate the nature of the deliverable using one of the following codes:
R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

8 Please indicate the dissemination level using one of the following codes:
PU = Public
PP = Restricted to other programme participants (including the Commission Services).
RE = Restricted to a group specified by the consortium (including the Commission Services).
CO = Confidential, only for members of the consortium (including the Commission Services).

9 Measured in months from the project start date (month 1).

	coastal wave modelling **(ISMAR)**						
D2.3	Practical criteria assessing the performance of structured versus un-structured grids and the various nesting configurations **(POL)**	WP2	6	30	R	PU	Month 18
D3.1	Methodology (including best practice guidelines) on how to identify and incorporate 'concentrated' and 'distributed' run-off in pre-operational forecasts, based on the input and requirements from our users **(KUL)**	WP3	2	14	R	PU	Month 18
D3.2	Methodology to introduce the 3D boundary condition for river discharges (including practical recommendations) for the 4 studied sites as a function of their prevailing conditions and users needs **(KUL)**	WP3	2	14	R	PU	Month 24
D3.3	Impact assessment for the improved four boundary conditions (at bed, free-surface, land-boundary and offshore-boundary) on coastal hydrodynamics and particulate transport **(KUL)**	WP3	2	46	R	PU	Month 36
D4.1	Assessment of the land inflow in coastal zone processes and models **(KUL)**	WP4	2	17	R	PU	Month 24
D4.2	Coupling framework to fully reproduce 3-D wind-wave-current interactions **(SHOM)**	WP4	3	77	P	PU	Month 28
D4.3	Methodology to carry out local applications in different coastal environments **(UPC)**	WP4	1	10	R	PU	Month 28
D4.4	Guidelines for a nested cascade of coupled models derived from applications to the selected field cases **(ISMAR)**	WP4	7	15	R	PU	Month 30

D5.1	SLA among FIELD_AC partners and MyOcean	WP5	1	2	P	RE	Month 2
D5.2	Common quality control and observational protocol for multi-sensor arrays **(POL)**	WP5	6	13	R	PU	Month 12
D5.3	Spatially distributed database of quality controlled remote sensed images and in-situ multi-sensor observations **(GKSS)**	WP5	4	20	O	RE	Month 12
D5.4	Report on intensive pilot field campaign **(UPC)**	WP5	1	19	R	PU	Month 26
D5.5	Protocols and approach to enhance the operability of existing operational systems at local scales and limited domains (by optimal use of data and assimilation techniques) **(ISMAR)**	WP5	7	25	R	PU	Month 36
D6.1	MoU among partners including the ad-hoc spin-off **(UPC)**.	WP6	1	4.5	P	RE	Month 6
D6.2	Collection of three annual progress reports **(UPC)**	WP6	1	7.5	R	RE	Months 12, 24 and 36
D6.3	Collection of the 3 Advisory Board reports **(UPC)**	WP6	1	2	R	RE	Months 14, 26 and 38
D6.4	Final Project Report **(UPC)**	WP6	1	6	R	PU	Month 38
			Total	391			

B.1.3.5 Work package descriptions

Work package number	1	**Start date or starting event:**			M 1
Work package title	Down-streaming GMES services to coastal-zone end-users				
Activity Type[10]	OTHER				
Participant number	**1**	2	4	6	7	8
Participant short name	**UPC**	KUL	GKSS	POL	ISMAR	DHI
Person-months per participant:	**7**	2	4	4	4	9

Leader of Work Package: UPC

Objectives

Since the FIELD_AC research project is "strongly" user-driven (with aims based on user needs concerning GMES information and services), the main objective of WP1 is providing dedicated *downstream service portfolios*. This means "tailoring" a Coastal Operational Framework and the underlying expertise for the specified users' needs (harbour, coastal and river authorities, coastal municipalities and a wide spread of private companies and users). This will be achieved by using the resources (science and engineering but also "contacts" and press services) of all research partners and the commercial "push" of the participating private research institute, plus the ad-hoc spin-off created following the project rationale to reach this aim in a coordinated and efficient manner.

Description of work (possibly broken down into tasks), and role of participants

Task 1.1. Assessing the local (coastal) quality of GMES services in restricted domains.

Leader of Task: DHI

Participants of Task: Ad-hoc Spin-off, KUL, GKSS, POL, ISMAR, DHI

There is a wide list of potential end-users for the FIELD_AC operational services, including both private companies and public administrations. The first include consultancy and building firms, aquaculture companies, fishermen associations, navigation and dredging companies, harbour terminal operators and others. Among the second, there are harbour and coastal authorities, river authorities, municipalities, meteorological services, etc. Their needs for local (coastal) services widely differ depending on their activities and legal/social settings. Among the "first" measures of quality required for an improved service is the spatial resolution together with the accuracy and error tolerance levels acceptable by each user. The robustness of predictions and the explicit definition of thresholds for each user/activity must be also considered from the beginning to ensure an efficient promotion of the project production. Starting from here and with the interaction among all partners/users (**POL, KUL, GKSS, ISMAR)** in FIELD_AC (enhanced by the training seminars) it is expected to build a protocol

[10] Please indicate <u>one</u> activity per work package:
RTD = Research and technological development; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable (including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities).

(DHI, Ad-hoc Spin-off) to assess the quality of the *downstream* service *portfolios* provided for coastal (restricted) domains. This will include specific dissemination sessions with end-users and ad-hoc workshops to generate input for the critical assessment. The partners will utilise existing stakeholder groups in the four areas. For example **POL** will use the North West and North Wales Coastal Group for the Liverpool Bay area, which includes all relevant local authorities and the UK Environment Agency, who are responsible for drawing up Shoreline Management Plans. ISMAR will utilise the Italian end-users expertise to set up a Service Level Agreement for the subjects they are interested in. Consorzio Venezia Nuova and Istituzione Centro Previsioni e Segnalazioni Maree will be involved in dissemination activities from the very beginning of the project (M8), promoting devoted seminars/technical meetings. From the beginning of the Project ISMAR will organize dissemination seminars with other potential end users (Port Authorities, Regional Governments, etc.). Spanish and Portuguese end users will be involved by UPC from the startof the project, organizing technical meetings and dissemination seminars (M8).

Expected results:

i) Development of a questionnaire for end-users and input from ad-hoc workshops

ii) Interviews with each end-user (before and after the training seminars/workshops)

iii) Assessment of the quality of downstream service portfolios in coastal restricted domains

Task 1.2. Structuring the dissemination of services and expertise

Leader of Task: UPC

Participants of Task: UPC, KUL, ISMAR, BSC

This task deals with the promotion and transfer of service/prediction activities addressed to users not specifically included in other tasks (**UPC, KUL, ISMAR, BSC**). It will, thus, refer to users considered as secondary in this first attempt at local predictions (surfer communities, schools organizing beach-based classes, etc). The same applies to additional scientific users as e.g. the marine biological community for which the improved local predictions can be useful to study implications for the coastal environment or to suggest periods for intensive campaigns. This same approach will be used for interested users from countries participating in FIELD_AC but which are not involved in any field site (e.g. Poland).

Finally, the social awareness part refers to coastal societies in general, but also to emergency or other similar services in coastal cities which can benefit from the new level of predictions and should be made aware of these developments (**UPC, ISMAR**).

Expected results:

i) Dissemination to users not specifically addressed in Task 1.3
ii) Dissemination of services and expertise to the scientific community (as end-users for further research), with emphasis on those related to MCS providers and data agencies such as ESA.
iii) Raising societal awareness to local predictions and their error intervals through mass communication media (TV, newspapers, radios…).

Task 1.3. Transferring services to coastal-zone end-users (in restricted domains).
Leader of Task: UPC
Participants of Task: Ad-hoc Spin-off, UPC, KUL, GKSS, POL, ISMAR, DHI

The aim of this task is to disseminate and transfer the FIELD_AC down streaming GMES operational services to the project public and private end-users in the four (restricted domains) studied field sites **(UPC, POL, GKSS, ISMAR)**. For this we shall up-date the knowledge of users on the present state of coastal meteo-oceanography. We shall also establish a network to familiarise all interested users with the new GMES local services, making explicit the associated errors so as to avoid creating "false" expectations. This will involve specific workshops for targeted users and more general seminars in the frame of the national and international (e.g. the Erasmus Mundus COMEM program, http://www.comem.tudelft.nl) Master Courses of the FIELD_AC Universities **(UPC)**.

The planned capacity building will also involve the project Ad-hoc spin-off, which will produce interactive and demo packages to promote the transfer of knowledge. The demo packages will be built from the predictions at the four field sites during the Target Operational Periods (TOPs), including a simple colour-coding to indicate the level of each variable compared to the users' requirements (e.g. green is acceptable, yellow is doubtful and red indicates some decision must be taken).

These packages will also benefit the participating Universities, since they will be used for dissemination within their regular teaching activities. The proposed activities at each of the four field sites will also enhance social awareness of the new local-scale services which, through dialogue and feedback, will help to steer the project development according to users' needs. This last point will be discussed in-depth by the project end, within the open forum on Coastal Operational Oceanography that will be organised within a regular conference **(UPC, KUL, POL, GKSS, ISMAR, DHI)** with large participation of potential end users (e.g. the IAHR or the Int. Conf. Coastal Eng. would provide such opportunities). The Forum conclusions will serve to steer the Ad-hoc spin-off future activities (particularly related to the partnership and its associated SMEs) and to identify the need for further research or development in this field.

Expected results:

i) Identify / Quantify specific services and requirements for each field site

ii) Coastal scale forecasting and demos for the TOPs

iii) Training workshops and University Seminars for public and privates end-users in each field site

iv) Open Forum

Task 1.4. Multi-disciplinary data-base.
Leader of Task: DHI
Participants of Task: Ad-hoc Spin-off, UPC, KUL, GKSS, POL, ISMAR, DHI

In this task, a multidisciplinary database with key performed simulations and observations (existing coastal networks plus pilot intensive campaign) will be built **(DHI,** Ad-hoc **Spin-off)**, maintained and announced to all relevant parties **(UPC, POL, KUL, GKSS, ISMAR)**. This database will be available also to end-users by the signature of a single Service Legal Agreement between the FIELD_AC consortium and the users for all required products. This key element for disseminating the project results will support the interoperability and interconnection of the data processing and delivery systems, taking into account harmonisation policies, directives such as INSPIRE, and standardisation initiatives, in order to facilitate an efficient acquisition and exploitation by both service providers and end users. Particular attention will be paid to the EEA requirements and to the compatibility with MCS data sets and the existing oceanographic data bases e.g. POL Coastal Observatory (http://cobs.pol.ac.uk) and ISMAR oceanographic tower "Aqua Alta".

Expected results:

i) Compiling local-scale (e.g. harbour and beach parameters, river-mouth discharges and similar) observations

ii) Compiling local-scale meteo-oceanographic simulations

iii) Compiling satellite images and other remote images (HF-radar and X-band radar will be specifically addressed but we may also consider LIDAR images where available)

iv) Combining in-situ and remote data plus simulations with objective quality assessment criteria and protocols

Task 1.5. Dissemination of project results

Leader of Task: UPC

Participants of Task: all partners

This task comprises all the subjects related with the generic dissemination of project results at different levels. It includes the building and maintaining of a web page (**UPC**) to diffuse project activities as well as operational forecasts and multi-sensor observations. On the other hand, a leaflet and a poster summarizing the project as well as the expected results, products and services will be generated (**UPC**) and distributed among scientific institutions, public administrations and potential (private sector) interested end-users. Another aspect contemplated in this task is the publication of project results in i) scientific journals or conferences, ii) popularizing magazines or newspapers, iii) Master classes and iv) TV, radio and web forums (important e.g. for surfing communities or children schools, as additional beneficiaries of our local-scale predictions) (**all partners**). In this task the demo packages developed for the studied sites will also be shown (via international meetings or well established conference series) to potential end-users from other field sites, identified by the ad-hoc spin-off and the partnership as part of the project development. Particular attention will also be paid to "additional" dissemination addressed to MCS or data agencies (MyOcean, EEA or ESA).

At any appropriate stage of the implementation, the consortium will endeavour to make best use of the project exploitable results, in particular those with a commercial potential, based on the partnership's own resources, CORDIS or other external services. This may include (**all partners**) proofs of "concept" outside the academic/research environment; the identification of market potential and opportunities; the evaluation of competing modelling tools and technologies; the assessment of the cost for up-scaling from pre-operational level to industrial application; the protection of intellectual property rights; annual (local) demonstration of model progress and products to local stakeholders groups (separate demonstrations for the study areas including generic results common to the project as a whole as well as site-specific products); etc.

Expected results

i) An operational webpage permanently actualized (during the project duration)
ii) A leaflet and a poster describing the project and its expected results, products and services.
iii) Collection of project publications
iv) Collection of project demos (one per field case)
v) Collection of Master level class notes, including selected project results

Deliverables (brief description and month of delivery)

D1.1 Project web page (UPC - M3)

D1.2 Project leaflet and poster (UPC – M4)

D1.3. Report on end-user parameters and requirements. Implications for the operational framework (DHI – M18)

D1.4 Demo packages developed for end users at each of the field sites (UPC - M 30)

D1.5 Multi-disciplinary FIELD_AC database (DHI - M36)

D1.6 Collection of project publications (UPC - M36)

note: M** gives month of deliverable

Work package number	2		Start date or starting event:			M 1	
Work package title	Meteo-oceanographic modelling tools						
Activity Type[11]	RTD						
Participant number	1	2	3	4	5	**6**	7
Participant short name	UPC	KUL	SHOM	GKSS	IBW	**POL**	ISMAR
Person-months per participant:	14	1	4	10	6	**11**	9
Participant number	8	9					
Participant short name	DHI	BSC					
Person-months per participant:	4	10					

Leader of Work Package: NERC-POL

Objectives

This WP will set up the basic model infrastructure on which the other work packages will be constructed. We require the implementation of state-of-the-art models for coastal meteorology, waves, currents and water quality on a sufficiently high resolution O(100m) to provide products of use to coastal managers and other potential clients. The outputs will include surge, tide and wave forecasts for warnings of coastal flooding; temperature, salinity, dissolved oxygen and other water quality parameters for application to public health, bathing water standards, aquaculture and fisheries; as well as improved coastal wind, precipitation and visibility forecasts for coastal navigation.

This general aim can be split into the following specific objectives:

i) Investigate what processes must be included to provide useful predictions of parameters required by coastal managers
ii) Identify the appropriate spatial and temporal scales required for modelling the coastal zone
iii) Select appropriate models
iv) Set up a modelling system for each of the areas studied in the field cases
v) Work with results from other work packages to optimise the model system
vi) Provide model predictions and assess their accuracy
vii) Demonstrate the added value of coastal enhancement for downstream services

Description of work (possibly broken down into tasks), and role of participants

Task 2.1. High-resolution coastal meteorological models

[11] Please indicate one activity per work package:
RTD = Research and technological development; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable (including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities).

Leader of Task: BSC

Participants of Task: BSC, POL

For the various field study sites there are already some operational met model outputs in place, with resolution O(1-10km). As an illustration the Catalan Meteo Service runs MM5 at grid sizes (locally) down to 4 km and the Italian Meteo Service has recently made operational a high resolution (4 km mesh size) model for the Mediterranean providing probably one of the best wind fields in the area (Services linked to the project).

Starting from here **BSC** will run the Weather Research and Forecasting (WRF) meso-scale atmospheric model for the Catalan coast as a pilot application, considering mesh refinements and parameterizations (see also Task 3.2). We will review the appropriate resolution required for meteo forcing in order to obtain the pattern of the coastal flow circulation and mean boundary layer structure in all field sites (Catalan coast, Venice Gulf, Liverpool Bay and Wadden Sea coast). **BSC** will identify the effort required and the potential benefit to use the high resolution nested grid WRF operated by **BSC**. This will be done in close collaboration with local partners. For example, **BSC** and **POL** will cooperate to quantify the effort required to set up the WRF met model for Liverpool Bay. The UK Met Office forcing is already available at 12km resolution and **POL** will investigate obtaining the new 4km resolution model output now available, through our collaboration with the Met Office via the National Centre for Ocean Forecasting (NCOF). A similar approach will be applied to the rest of considered field sites.

Expected results:

i) A review of available met models and appropriate scales required for improved coastal forecasts
ii) Implementation of models for field sites

Task 2.2. Wave generation/propagation models

Leader of Task: ISMAR

Participants of task: UPC, KUL, SHOM, GKSS, IBW-PAN, POL, ISMAR, DHI

Generally, regional scale models are spectral, phase-averaged models such as WAM, SWAN and Wavewatch III (WWIII), whereas for engineering purposes (e.g. for beaches, breakwaters and harbours) phase-resolving models such as e.g. Boussinesq models, are required. It is possible to bring the phase-averaged models down to scales of order 100m and use this information as directional input for the local area models (**ISMAR, SHOM, IBW-PAN, DHI, UPC**).

POL, **UPC** and **KUL** have experience of running and validation of both WAM and SWAN for various areas and developing coupling with circulation models. POL implemented current refraction in WAM. **UPC** also has developed Boussinesq wave propagation models like LIMPORT to apply in harbours and beaches. **GKSS** has an extensive experience with wave modelling (development of WAM), observations (Waverider buoys) and data assimilation. The modelling has been extended to improve forcing of sediment transport models. **ISMAR** has an extensive experience with wave modelling. It was part of the team that developed WAM, the first third-generation model, later extensively used at both the global (e.g. Atlantic ocean) and local scale (Mediterranean and Adriatic sea). **ISMAR** has also a long-term experience with SWAN, and it has contributed developing and testing a fully coupled version of the wave-hydrodynamical SWAN-ROMS code (see Task 2.3). The latter is suitable for evaluating wave and current conditions in the coastal areas, and close to the shore. This model can also account for sediment resuspension and transport, through its sediment transport module that can handle an unlimited number of sediment classes. **SHOM** is now developing a new set of wave generation and dissipation parameterizations, that already outperforms all previous parameterizations especially for the European coasts. These should be very well adapted to wave-current interactions since the wave dissipation is now explicitly a function of the local steepness of the waves. They will also include a wave-dependent bottom roughness. These parameterisations will be included in WAVEWATCH III with both structured and unstructured grids and may be implemented in the other models and validated for the field sites.

Both structured and unstructured grid codes will be implemented and a new unstructured-grid version of MIKE 21 and SWAN will be tested (**POL, KUL, DHI**). In some local applications, e.g. harbours, the use of a nested Boussinesq model, available and well tested in one of the partner institutions (**DHI**) may be required.

These local scale wave models will be driven by local winds and also by open boundary forcing from regional scale wave models (**GKSS, IBW-PAN, DHI**). They will be part of the coupled suite of models (see also WP 2.3 and 4.4) and will be coupled with the near-shore circulation models (**POL, KUL, GKSS, IBW-PAN, DHI**).

Expected results:

i) Wave models implemented at each field site.

ii) A review of the optimum model setup for generic coastal wave modelling.

Task 2.3. Near-shore circulation models

Leader of Task: POL

Participants of Task: UPC, GKSS, IBW-PAN, POL, ISMAR, DHI

The heart of the model system will be a 3D baroclinic hydrodynamic model. Various models are presently used in the partnership including structured grid models such as ROMS, GETM and POLCOMS (**GKSS, ISMAR, IBW-PAN, UPC**) and the unstructured-grid finite volume models MIKE 3 and FVCOM (**DHI**, **POL**). It is anticipated that unstructured grids may be beneficial in order to properly model detailed bathymetry and coastlines.

POL has been developing an in-house model, POLCOMS, for several years. It is based on a 3D baroclinic structured grid and has modules for turbulence modelling (including GOTM), advection-dispersion and sediment transport, including wetting and drying which are important in the macro-tidal area of Liverpool Bay. **POL** also has experience in running several unstructured grid models, including TELEMAC, ADCIRC and ICOM and will also run FVCOM. **UPC** is one of the first research institutions to implement and test the ROMS models in restricted domains like Harbour and Estuaries. **GKSS** uses BSH-mod and GETM which are free-surface models, with rich physical parameterizations, accounting for wetting and drying. BSH-mod is a two-way coupled model. **ISMAR** is part of the community that is developing and testing the ROMS model: a primitive equation, free-surface, fully 3-D, finite-difference circulation model able to account for wetting/drying. Recently, a two-way coupled SWAN-ROMS model (see Task 2.2) has been developed and released, being capable to take into account wave-current interactions (i.e. reproducing near-shore currents). Moreover, via a sediment transport module, the code is capable of modelling sediment transport processes in the coastal zone and beyond the breaker limit. Particular attention is posed to the mixing and sub-grid scale parameterization processes, which are incorporated into SWAN-ROMS model following state-of-the-art techniques, and to the standardization of input/output fields (NetCDF file, close link to the CF convention). **IBW-PAN** will contribute by developing a rip current model applicable to reflective beaches, where rips are commonly observed as well as to predominantly dissipative systems, where they appear only residually. The Catalan site and application sites will be a source of data for this action. From these various model codes an optimum suite of models will be selected for each field site, considering the important physical processes in each case.

In this respect is important to consider 3D codes in order to model the vertical density stratification due to freshwater run-off. Also wind-driven flow in restricted areas has a vertical structure. The models will be driven by tides, winds and density fields and forced by open boundary conditions taken from regional circulation models e.g. the products of the FP7 'MyOcean' project (**POL**). Output will be surface elevation (including tides and storm surges) and velocity fields, which will be passed to the transport and dispersion models (see WP 2.4). Coupling with other models will take place through the surface and bottom stress (**GKSS, ISMAR, IBW-PAN**) and the latest theory developed in WP4.4 to allow interaction between waves and mean circulation. This comprehensive modelling application will, thus, include coastal flood and erosion forecasting through prediction of tides, surges and waves (**UPC, POL, GKSS, ISMAR, IBW-PAN**), for which much experience has already been obtained with well-validated models. The near-shore 3D circulation will be validated against the extensive dataset of existing in-situ data as well as ground-based and satellite remotely sensed data.

Expected results:

i) Circulation models for the field study sites.

ii) An inter-comparison of the unstructured-grid versus structured grid approach.

Task 2.4. Transport and dispersion models

Leader of Task: UPC

Participants of Task: UPC, POL, GKSS, IBW-PAN

Water quality modelling is very important as it is one of the most challenging areas for coastal managers to deal with. The circulation models described above all have modules built in to model the advection-dispersion equation. The modelling of sediment transport (**IBW-PAN**) will be essential to model suspended particulate matter (SPM) which is a key variable controlling absorption of pollutants and light penetration. Bedload transport and coastal morphodynamics will not be considered as this is beyond the time-scale of the forecasts (up to 7 days) considered here.

UPC has extensive experience with the implementation of transport and dispersion models such as ROMS for quality water studies in restricted domains (beaches, estuaries and harbours). It has also developed Lagrangian transport and dispersion models (eg. LIMMIX) to apply in harbours and beaches in order to estimates residence and renewal times. At **GKSS** transport and circulation models (BSH-mod and GETM) have been largely validated with respect to their performance to predict sediment transport. Work is underway to couple these models with ecosystem models for the German Bight. Various water quality parameters are generated from POLCOMS (**POL**), which includes recently implemented Lagrangian and

Eulerian SPM modules. POLCOMS, has been coupled with the European Regional Seas Ecosystem Model (ERSEM) in collaboration with scientists at the Plymouth Marine Laboratory. This work will continue, with validation against remote sensing and in-situ data. **IBW-PAN** have developed a 3-layer sediment transport model, capable of dealing with graded/ungraded sediments, driven by a fully phase resolving wave component and phase-averaged current component. This will be tested and improved using the data from the project study sites, with differing beach systems.

Again, the experience of the various partners will be pooled in order to identify the best model for application in each study area.

The parameters to be predicted (**UPC, POL, GKSS**) will include a range of contaminants after an initial review of the requirements from coastal managers. The models should be able to model the seasonal phytoplankton blooms. The possibility of prediction of harmful algal blooms (HABs) and eutrophication in coastal seas is a challenging goal, for which a key issue is to assess the reliability of the new service to be provided.

Expected results:

(i) A review of required parameters for coastal managers

(ii) Implementation of models for field sites

(iii) Assessment of the present ability of near-shore water quality models

Deliverables (brief description and month of delivery)

D2.1 Review (critical analysis and suggestions for selecting high resolution configurations) of the models' parameters (building a practical user-oriented list) and implementation plan (for the met codes) for the 4 studied field sites. (BSC - M 6)

D2.2 Review (critical analysis and suggestions for selecting the codes and carrying out the implementation) of model/set-up for coastal wave modelling (ISMAR - M12)

D2.3 Practical criteria assessing the performance of structured versus un-structured grids and the various nesting configurations (POL - M 18)

note: M** gives month of deliverable

Work package number	3	**Start date or starting event:**				M 1	
Work package title	Boundary Fluxes						
Activity Type[12]	RTD						
Participant number	1	**2**	4	6	7	9	
Participant short name	UPC	**KUL**	GKSS	POL	ISMAR	BSC	
Person-months per participant:	15	**26**	5	11	7	10	

Leader of Work Package: KUL

Objectives

The main objective of WP 3 is establishing and using the best possible boundary conditions for coastal water quality modelling. On this scale all boundaries become important. For the land boundary side the needed products are distributed and point wise run-off both quantitatively and qualitatively. For the offshore boundary condition 3D current and water quality fields and wave spectra will be used (from MCS ocean and shelf scale products). For the atmospheric boundary, products from local scale meteorological models (wind, atmospheric pressure and rainfall) are needed. For the seabed, boundary information on sediment composition, bedforms and bathymetry and bio-geo-chemical parameters is essential.

Description of work (possibly broken down into tasks), and role of participants

Task 3.1. Boundary fluxes from land

Leader of Task: KUL

Participants of Task: KUL, UPC, ISMAR, GKSS, POL

The aim here is to incorporate the continental run-off, including both the distributed and point wise (rivers / creeks) run-off for the selected case studies (**KUL**). Numerically these lateral boundary conditions will be prescribed to one or multiple model grid points. All available data will be interpolated at the exact time step of the model to provide a synchronous continuous source. The main breakthrough will be the explicit identification / quantification / qualification of distributed and point-wise run-off in order to quantify the input and budget of sediment and nutrients into coastal waters. Distributed continental/urban run–off is rarely considered in circulation models but can play a crucial role for water quality assessment and prediction on the local scale.

For river outflow particular attention will be paid to the 3D structure of the discharge (essential e.g. for Mediterranean estuaries which show a nearly permanent stratification). Existing data from previous EU research projects (e.g. FANS, PIONEER and ECOSUD) and sensitivity analyses from 3D circulation/dispersion/turbulence models in academic case studies will be used (**UPC, ISMAR, GKSS, KUL**) together with data from the intensive field campaign (**UPC**).

[12] Please indicate <u>one</u> activity per work package:
RTD = Research and technological development; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable (including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities).

We shall not cover exhaustively (see the different subtasks below) all the scientific or practical aspects related to land fluxes for each of the study sites. Such a comprehensive approach (e.g. including ground-water flow exchanges) would not be feasible within a limited duration project.

We shall, therefore, start by identifying which processes are expected to be dominant for each of the study sites **(KUL)**. On this basis, a choice will be made from the field cases in WP5 to demonstrate the impact of the different boundary fluxes. As an illustration, for the Catalan coast site the combination of local topography with torrential rain fall can produce considerable local run-off on a very short time interval which might have a large impact on short term local coastal water quality. However, the local rainfall and river run-off are not the only fresh water sources for the Wadden Sea case where the discharge from subterranean estuaries can become significant (distributed run-off). The coupling between modelling and observations will advance the robust specification of these unknown fluxes. For all the study sites the local partners (**GKSS, ISMAR, POL, and UPC**) can have access to outflow data from the major rivers.

Expected results:

i) Identify and assess distributed and point-wise (river, outfall and similar) continental run-off both quantitatively and qualitatively for the selected study sites **(KUL)**. We shall start by gathering, analysing and "homogenising" local information: river and urban drainage discharges (measuring stations), data on water quality, existence of (operational) rainfall-runoff river hydrodynamic and sediment/nutrient water quality models and similarly for sewer systems. We shall also collect topographic data (topography, data on permeable and impermeable surface areas), data on rain-fall (rain gauges, rainfall radar) plus information on flow control infrastructure (**GKSS, ISMAR, POL, and UPC**). Where needed and possible local information will be supplemented by earth observation data from satellite or airborne imagery. Use will be made, also, of the information available at the EEA (European Environment Agency).

ii) For river outflow particular attention will be paid to incorporating the 3D structure of the discharge (in terms of water / sediment / nutrients) **(KUL)**. This 3D structure is essential boundary information for a realistic simulation of river plume dynamics and its effect on the "receiving" coastal sea (**GKSS, ISMAR, POL, and UPC**).

iii) We shall also examine critically whether it is "realistic" or necessary to use on an operational basis a detailed (deterministic and process based) urban discharge model since a "conceptual" rainfall/run-off model can be well suited for this purpose when properly calibrated **(KUL)**. The set-up of such a conceptual model for predicting run-off including rain-input data from a local meteo-model (see also task 3.2) will at least be done for the Catalan coast site where local (torrential) rainfall is considered to have a high impact on the quality of coastal waters. This set-up includes validation and fine-tuning using local knowledge (e.g. comparison with detailed urban-runoff models, discharge stations in rivers, rainfall measurements …) **(KUL, UPC)**.

Task 3.2. The free-surface boundary condition.

Leader of Task: BSC

Participants of Task: BSC, POL, ISMAR, GKSS, KUL

This task will bring in detailed meteorological information - in terms both of wind/pressure fields and rainfall estimates - into the (pre-) operational predictions. Accurate local winds are needed to drive coastal circulation and wave/surge models. For some field cases (e.g. NW Mediterranean) local winds can be particularly important when they come from the land side (imposing a tough challenge for wave predictions under short fetches). For the different study sites atmospheric forcing is available either from operational services (like the UK Met Office, Italian Meteorological Service, Catalan Meteorological Service...) or from pre-operational high resolution research models (e.g., WRF model run by **BSC**), see also Task 2.1.

Rainfall predictions/now-casts are needed to drive the rainfall-run-off model pre-operational forecasts/now-casts. This will be analysed for cases where it is considered (by partners and end users alike) to be important, i.e. situations where the response time of coastal circulation associated to rainfall events is short, as is the case for narrow coastal fringes (e.g. the Catalan coast study site).

For the Catalan coast study site, the pattern of the coastal flow circulation and "mean" boundary layer structure will be simulated using the high resolution nested grid meso-scale model Weather Research and Forecasting (WRF) operated by **BSC**. These results, supplemented by available meteorological information from operational services, will allow the analysis and impact of current treatment of atmospheric boundary layer parameterizations (PBL) over coupled coastal circulation models (**KUL)**.

The atmospheric boundary layer treatment and evolution is a critical issue to correctly simulate the heat and moisture exchanges between soil and sea with the surface atmospheric layer. It controls the development of strong convection conditions and vertical stratification. The PBL parameterization is important in the simulation of lower atmospheric winds, temperature and humidity, all critical variables for the associated oceanographic simulations (**BSC, POL, KUL)**.

The pre-operational high resolution research model at BSC can be configured with two different PBL parameterizations: the first order non-local Yonsei University (YSU) scheme and the more complex TKE based Mellor–Yamada–Janjic (MYJ) scheme. Sensitivity studies will permit to quantify the skills of the different parameterizations applied to the considered field cases (**BSC, POL, ISMAR, GKSS**).

Rainfall periods in some of the analysed field cases (e.g. the Mediterranean area) are mainly due to a combination of synoptic and meso-scale forcing. That produces a large variability in the rainfall distribution, both spatially and temporally. The in-homogeneous topography and geomorphology typical of these coastal areas, with large variations in land physical properties, vegetation and distribution of urban and rural land uses, result in complex meso-scale and micro-scale flows over these regions. Typically, synoptic situations that affect weather patterns over the Catalan Coast in conjunction with its unique geography and topography makes numerical weather prediction a multi-scale problem that involves synoptic scale features along with complex meso-scale interactions accounting for a variety of physical interaction parameterizations. It is due to these complexities that the use of an advanced meso-scale model in a nested configuration is a major requirement for simulating and forecasting rainfall occurrences over the studied regions (**BSC**).

The WRF modelling system will provide a high resolution meteorological description of the boundary layer evolution and the development of high-impact rainfall (**BSC, POL**). The performance of the WRF model for simulating these rainfall events will be improved through variational assimilation of available meteorological observations. Assimilation techniques will permit the improvement of the model skills, especially for short-term forecast and now-cast of rainfall events.

Expected results:

i) Surface flow patterns for the field zone: Surface winds (10 m level), sea level pressure pattern, sea breeze circulation and its influence on the inland flow pattern (adjacent to the coast) and evolution of surface temperature (see also WP 2.1)

ii) Accurate atmospheric boundary layer evolution to provide detailed surface boundary layer features for wave and current models in coastal zones

iii) Assimilation of observational datasets through variational techniques to improve short-term forecasts.

iv) Pre-operational forecast for short-term and now-cast.

Task 3.3. The seabed boundary condition.
Leader of Task: KUL
Participants of Task: KUL, UPC, ISMAR, POL, GKSS

This task aims at incorporating into pre-operational products the detailed knowledge nowadays available about sediment deposition / suspension near the sea-bed. These mechanisms also apply to pollutants deposited inside and near the entrance of harbours in the studied field cases. This is an essential component to, for instance, assess water quality after a storm or during dredging operations, as well as being an added value from operational oceanography not often exploited and that shall be offered in the project at our users request (**KUL**).

For bed-flow interactions both the bed composition and its associated bed-forms are important. They play a critical role in flow/sediment coupling and therefore in the resulting fluxes of sediments and pollutants. There is considerable information available for the different project sites, both in terms of bathymetry and bed composition as well as in terms of measurements of SPM fluxes under different forcing conditions. For instance **ISMAR** will provide the detailed bathymetry and sediment composition for the most northern area of the Adriatic Sea (gulf of Venice), where the coupled SWAN-ROMS (see Tasks 2.2 and 2.3) model will be set up for the evaluation of the wave, current and sea level conditions. Similar detailed information is available for the other study sites (**UPC, POL, GKSS**).

The work here is, thus, strongly linked to tasks in other work packages: multi-disciplinary database in WP1, sediment transport model in WP2, detailed modelling of interactions between hydrodynamics (waves, currents, turbulence) and sea-bed sediments in WP4 and its application to particular project sites in WP5.

Expected results in this task are, therefore, limited to

i) Identification, collection and storage of available (meta) data on bathymetry and bottom sediment characteristics for the selected study cases in the multi disciplinary data base (see also Task 1.4)

The resulting fluxes and comparison between modelled and observed bottom and near bed fluxes and interactions are dealt with in other work packages.

Task 3.4. Open boundary fluxes.

Leader of Task: POL
Participants of Task: POL, UPC, ISMAR, GKSS, KUL

The FIELD_AC project has its main focus is on the coastal zone, where waves, currents and related processes are modelled with an increasing resolution towards the coast (**POL, UPC, ISMAR, GKSS, KUL**). However to account for "fluxes" from the sea side and to bring this information close to the shore, offshore boundary conditions are required to nest the local model into a coarser resolution one implemented for a larger domain (basin).

This boundary condition information will be derived from existing MCS providers (the MyOcean project, recently funded within FP7 GMES is an illustrative case) and from operational centres and project partners (**POL, UPC, ISMAR, GKSS**). All study sites have access to, or receive, sea boundary data from operational centers, e.g. waves and fluxes from the POLCOMS-WAM Irish Sea model and MyOcean NEMO model, waves from MeteoCat for the Catalan coast …

The link with and use of output from other ongoing projects like ECOOP will also be considered and incorporated (**GKSS, UPC**) since several partners are involved in this project (including the ECOOP coordinator). The accuracy of these boundary conditions (waves, sea level, currents, thermo-haline field etc.) will be assessed using in-situ and remote data available from the different project sites.

Expected results:

i) Identification and validation of sea/ocean side pre-operational boundary conditions for each study site
ii) Assessing the quality of shelf operational predictions and satellite images in terms of the resulting local (coastal) fields

Deliverables (brief description and month of delivery)

D3.1 Methodology (including best practice guidelines) on how to identify and incorporate 'concentrated' and 'distributed' run-off in pre-operational forecasts, based on the input and requirements from our users (KUL - M 18)

D3.2 Methodology to introduce the 3D boundary condition for river discharges (including practical recommendations) for the 4 studied sites as a function of their prevailing conditions and users needs (KUL - M 24)

D3.3 Impact assessment for the improved four boundary conditions (at bed, free-surface, land-boundary and offshore- boundary) on coastal hydrodynamics and particulate transport (KUL - M 36)

note: M** gives month of deliverable

Work package number	4		**Start date or starting event:**			M 6
Work package title	Interactions and coupling in restricted domains					
Activity Type[13]	RTD					
Participant number	1	2	3	4	5	6	**7**
Participant short name	UPC	KUL	SHOM	GKSS	IBW	POL	**ISMAR**
Person-months per participant:	13	14	20	13	3	11	**21**
Participant number	8	9					
Participant short name	DHI	BSC					
Person-months per participant:	8	16					

Leader of Work Package: ISMAR

Objectives

WP 4 deals with the interactions and coupling between meteorological and oceanographic (circulation-waves-tide/surge) numerical models, covering the various spatial scales present in coastal zones.

More specifically, the problem of the coupling in the coastal zone between the lower atmosphere and the upper ocean will be addressed, with focus on the heat and momentum exchanges between the two systems.

The issue of the different spatial scales present when analysing a coastal transect from the shelf outer edge to the shore-line will be addressed paying particular attention to the boundary conditions, both offshore and on the land-ocean border.

Wave-current interactions will be examined adopting different state-of-the-art approaches, with a special focus on understanding how the improved "interaction" physics affects the results in the coastal and near-shore area.

Some effort will be also dedicated to the spatial/temporal scales necessary for successfully integrating and coupling sediment transport and water quality models. The working group will consider the dispersion modelling of different types of particulate matter with emphasis on the determination of residence times in restricted domains (e.g. harbours, semi-enclosed basins, bays, estuaries,…).

For each application area (see Task 5.1) a model interaction matrix will be defined to assess the mutual relevance of coupling among different models and input information. This will define the flow chart of the Coastal Operational Framework for each field site application.

Description of work (possibly broken down into tasks), and role of participants

Task 4.1. Atmosphere-ocean coupling

Leader of Task: BSC

[13] Please indicate one activity per work package:
RTD = Research and technological development; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable (including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities).

Participants of Task: BSC, POL, SHOM, ISMAR

This task will focus on the implementation and configuration of a state-of-the-art limited area atmospheric model and its coupling to the set of oceanographic models (waves, currents and surge). We shall build upon our expertise with the numerical weather prediction model "Weather Research and Forecasting Model" (WRF) run daily on the Mare-nostrum parallel supercomputer operated by one of the partners (**BSC**) in Barcelona. These meteo fields will be compared with results from the Limited Area Model Italy (LAMI) provided by **ISMAR.** Both will be checked with operational predictions from the participating meteo services (e.g. the UK Met Office, or the Servei Meteorologic de Catalunya) and will be used as surface forcing for the hydrodynamic models (see Task 2.1).

The coupling of meteorological models and oceanographic codes will allow the study of feedbacks between the lower atmosphere and the upper ocean boundary layer at coastal scales (**POL**) i.e. the effect of wave-modified roughness of the sea surface. The interface between the WRF and the oceanographic models will be designed following a modular approach, and will be based on widely used Earth System Modelling couplers such as ESMF or OASIS4 (**SHOM**).

The Task aims also at improving the parallelism, efficiency and portability of the resulting codes. This approach will allow coupling different oceanographic and atmospheric models (e.g. WRF with ROMS) to be later introduced in the Coastal Operational Framework, possibly as plug in/out sub-modules (**BSC**). Moreover, the design of a set of sensitivity experiments focusing on "processes" (specific physical parameterization of both atmospheric and oceanographic models), relevant for our end users, will advance the current knowledge on air-sea interactions in coastal areas. In particular we shall investigate the feedback of roughness due to fetch-limited waves into the atmospheric model (**POL**).

The coupling interface will be controlled through scripting files (**BSC**) where the configuration of the model and the interactions of the parameterizations will be defined. The relevance that different grid resolutions of the atmospheric model may have on the oceanic 3D structures evolution in terms of currents and SST fields will be investigated (**ISMAR**). A set of testing and verification activities will define the final implementation of the system as an operational atmospheric-ocean model for short-term forecasts (72 h). The system will be applied for the FIELD-AC field (intensive) campaigns (**BSC**).

The optimal resolution of the limited-area-models adopted both in space and time, will be investigated (**BSC, ISMAR**) for the considered field sites. This will provide practical indications on the best spatial-temporal scales to be used when forcing hydrodynamic models at limited domains. The accuracy of final products with respect to these issues will be critically assessed against the requirements from our end users.

Expected results:

i) Exploration of different formulations for sink-source terms in wave, current and turbulence models as a function of wind/wave/current parameters.

ii) Definition of the surface roughness felt by meteorological models in coastal areas as a function of local wave conditions.

iii) Start assessment of "interaction" effects on remote sensing data (e.g. scatterometer winds) for coastal areas.

Task 4.2. Open sea to coastal zone coupling
Leader of Task: ISMAR
Participants of Task: ISMAR, UPC,POL, GKSS, DHI

The main target of this task is to establish the optimal coupling conditions between offshore fields and coastal models in relation to site-specific characteristics (geometric or meteo-oceanographic) and the optimization and efficiency of the related routine applications. To obtain sound guidelines toward a fully coupled wave-current-surge-transport model in the coastal zone we will discuss the input boundary conditions and focus on single "elements" or processes (**ISMAR, UPC, POL, GKSS, DHI**).

The spatial, hence temporal, scale of processes relevant in near-shore circulation is much shorter than the dominant scales in offshore (shelf or basin) circulation models. The coupling between the offshore and coastal models (**POL, ISMAR**) will be explored to highlight the progressive transition of dominant circulation characteristics towards the coastal geometrical features and to account for the appearance of new processes such as those associated to harbour breakwater tips which affect both waves and currents locally (**DHI**).

The project will assess the optimal one - or two - way coupling (**GKSS**), specifying the number of nesting sub-grids, if finite differences are used (**ISMAR**), or the progressive increasing density of the net if finite elements are used (**DHI**). The optimal strategy is location-dependent due to the different geometrical and meteo-oceanographic characteristics (e.g., shelf dimensions, bottom topography, and coastal geometry plus the dominant drivers) of the area of interest. A crucial point will be assessing the vertical resolution (**ISMAR**) required by the local coastal model in relation to 3D freshwater discharges or bathymetric features. This should allow the proper representation, as required by our users, of processes forced by the local topo-bathymetry and the associated continental discharge (**UPC**, **KUL**).

A related problem is the evaluation of the storm surge. Storm surges are strictly related to the general conditions (meteorology, circulation, surface elevation) of the overall basin where the area of interest is located. However, the spatial gradients of local sea level may increase tremendously in shallow coastal areas. The project will explore the optimal coupling between large scales and (local) coastal ones (**POL**, **ISMAR, DHI**), analyzing the necessary resolution and extension of the local model with respect to the required accuracy.

A similar, but physically different, problem exists with waves. The domain coupling, i.e. the boundary conditions, must be imposed at a distance from coast sufficient to ensure that the large scale resolution is not missing sub-grid characteristics relevant for the accuracy demanded by our users close to the coast. The project will explore (**POL**, **ISMAR**) how to determine the optimal set-up for a coupling, and provide a general methodology (suitable for any location) to approach this problem.

Expected results:

i) Assessment of the necessary boundary conditions for local applications of wave, circulation/surge and atmospheric models.
ii) Estimate of the influence of large scale dynamics on small scale coastal processes.
iii) Optimization of coastal and near-shore numerical models in a sequential loop.

Task 4.3. Land to sea fluxes, interactions and coupling
Leader of Task: KUL

Participants of Task: KUL, UPC, POL, GKSS, ISMAR, IBW-PAN

When modelling circulation in coastal areas it is essential to take into account the inflow of water and suspended particulate matter from land. This corresponds to point-wise (river) and distributed (continental run-off e.g. in urban areas) discharges particularly important for intensive precipitation events. The focus will be on the simulation of discharges associated to flash-floods (**UPC**) so characteristic of the Mediterranean in autumn. The project will explore (**POL**, **ISMAR**, **KUL**, **GKSS**) the resolution required to take properly into account these inflows to be able to represent the associated local processes with sufficient detail. This will consider both the hydrodynamic problem (**POL**, **ISMAR**, **GKSS**, **IBW**) and the flow and distribution of sediments and other particulate substances discharged under heavy rain events. We shall address issues such as the optimal coastal resolution (**ISMAR**, **KUL**) to be able to represent local processes with the necessary detail, also in relation to the resolution available for urban run-off and river discharges.

The methodology will be applied in the considered field cases (**POL, ISMAR, KUL, GKSS, IBW, DHI**) to explore its applicability in different environments. Particular attention will be paid to the Catalan area (**UPC**) where the devoted campaigns and the occurrence of frequent intense land discharges (flash-floods) will allow a full verification both of the methodology and its results.

Expected results:

i) Assessing the relevance of (small scale) “lateral” boundary conditions on coastal modelling.
ii) Assessing the relevance of urban run-off on coastal water quality modelling.

Task 4.4. Wave-current interactions and coupling

Leader of Task: SHOM

Participants of Task: SHOM, UPC, POL, GKSS, IBW-PAN, DHI, ISMAR

All existing robust 3D wave-current coupled models are based on theoretical approaches that still represent an open issue in the scientific community. This Task, thus, proposes to test the influence of the design-strategies generally adopted in the state-of-the-art numerical models, by defining a set of benchmark tests for 3D wave effects on currents. All the participants will contribute by setting up ad-hoc test cases for the different numerical models adopted, and eventually to the final synthesis of results (**SHOM, UPC, POL, GKSS, IBW-PAN, DHI**).

This activity will develop starting from simple situations (e.g. waves shoaling without breaking) up to idealized rip current configurations for which there is data available and observed wave-current profiles. Results will then be diagnosed both in terms of Eulerian and Lagrangian velocities.

Concerning the coupling methodology, after testing several options (e.g.OASIS3, MCT, ESMF, etc.), an evaluation of different strategies that control the information transfer in such coupled models will be carried out (**SHOM**, **ISMAR**). Again, particular efforts will be devoted to define benchmark test cases that can be carried out by single project partners, aiming at verifying and improving the coupling methodology (**UPC, POL, GKSS, IBW-PAN, DHI**).

The performance of wave-current-surge coupled models for different geographic regions will be also assessed (e.g., **ISMAR** in the northern Adriatic Sea; with specific topo-bathymetric “controls”; **GKSS** in the German Bight/Wadden Sea outside the surf zone, focusing on the wave effects on currents and turbulence; **UPC** off the Catalan coast with emphasis on bi-modal spectra; **POL** in Liverpool Bay with a strong tidal signature). Expected results will outline the relative importance of wave-current interaction terms in coastal regions, with emphasis on small-scale applications for shallow water (e.g. harbours, semi-enclosed bays). The obtained results will be used to define the “performance envelope” of the introduced new terms and of the devised coupling strategies.

Moreover, pilot applications under different meteo-oceanographic scenarios will focus on near-shore interactions between bottom friction and wave/currents, with the aim of testing and improving sediment transport and re-suspension modules (**ISMAR**, **POL**). For this purpose both phase-resolving (**DHI**) and phase-averaged (**IBW**) wave models combined with current models will be used. These suites of experiments will be planned in strict cooperation with end users. They will include:

- wave-current-tide interactions outside the surf-zone
- wave driven processes in the surf-zone (near-shore wave-driven currents)
- wave-current coupling strategy in nested numerical models

Expected results:

i) Assessment of the relative importance of wave-current terms in coastal regions.

ii) Definition of an efficient wave-current coupling strategy.

Task 4.5. Water quality interactions and coupling

Leader of Task: UPC

Participants of Task: UPC, KUL, POL

In this task water quality models and their interactions with previous models will be assessed. We shall start with suspended sediment and nutrient fluxes and the distribution of water properties (**UPC, KUL**). The final step will be the food web dynamics modules in FVCOM (**POL**). The emphasis will be on the coupling strategy for already existing models. The foreseen results are of direct application to satisfy a number of end-user needs.

The simulation of transport and dispersion processes, such as e.g. faecal bacteria (**UPC**), will be of interest for coastal authorities, aquaculture and tourism companies. The simulation of suspended sediment dispersion is important for harbours and dredging companies (**UPC, KUL**). Trace metal dispersion is also interesting for harbours and coastal authorities and the computation of residence times can support the environmental management of harbours and adjacent beaches, as pointed out by our users (**UPC**). The food web dynamics simulations (**POL**) will provide a more “integrated” field to be compared against satellite (optic) images and the associated in situ optic data (**POL, KUL**).

This task will also address bed/sediment/flow interactions. **KUL** will contribute by refining the turbulence description based on improved parameterizations for sediment/turbulence interaction in 3D-flow models. This aspect, very important for flows with high sediment concentration (mud / fluid mud), will constitute an important step towards a better prediction of nutrient/pollutant fluxes (considering their attachment to sediment particles).

Expected results:

i) Assessment of methods to estimate residence times.

ii) Assessment of decay and re-suspension terms.

iii) Definition of an efficient strategy for assessing hydrodynamic-water quality interactions.

Task 4.6. Defining the hierarchical structure of the mainframe

Leader of Task: ISMAR

Participants of Task: ISMAR, SHOM, POL, UPC, DHI

Despite the advances experienced by models in coastal areas, their formulations are sometimes difficult to compare and it is hard to evaluate the effective role played by the different modelling approximations. Likewise regarding the level of complexity and resolution which makes it difficult to decide on the optimal level of sophistication. This has clear practical implications to solve the users' needs or to assess whether the complexity is justified by the obtained results.

For these reasons the main objective of the Task is to formulate a general framework (**ISMAR, SHOM**) from which the models proposed in previous WPs can be hierarchically framed and then critically compared (**POL, UPC, DHI**) according to their level of detail in describing the involved physical processes (**ISMAR, SHOM**).

The final aim is to evaluate the relative importance of the degree of refinement in each model and of the level of information exchanged between models (**ISMAR, SHOM, POL, UPC, DHI**). This will allow assessing the relevance of boundary conditions (including bathymetry) in terms of the accuracy of coastal (local) predictions.

Finally, the considered case studies (Task 5.1) will allow highlighting the role of the different models/closures/hypotheses within a sensitivity matrix (see also WP 5, Task 5.5 (**ISMAR, SHOM**)).

Expected results:

i) Definition of the Coastal Operational Framework for coastal (field sites) applications
ii) Definition of a general methodology to export the FIELD_AC approach to other coastal (limited) sites

Deliverables (brief description and month of delivery)

D4.1 Assessment of the land inflow in coastal zone processes and models (KUL - M24)

D4.2 Coupling framework to fully reproduce 3-D wind-wave-current interactions (not normally considered in present meteo-oceanographic models and which are essential in restricted domains) (SHOM - M 28)

D4.3 Methodology to carry out local applications in different coastal environments (UPC - M 28)

D4.4 Guidelines for a nested cascade of coupled models derived from applications at selected field cases (ISMAR - M30)

note: M** gives month of deliverable

Work package number	5		Start date or starting event:			M 3	
Work package title	Field Evidence and Prediction Limits						
Activity Type[14]	RTD						
Participant number	1	2	**4**	5	6	7	8
Participant short name	UPC	KUL	**GKSS**	IBW	POL	ISMAR	DHI
Person-months per participant:	21	7	**24**	6	12	5	4

Leader of Work Package: GKSS

Objectives

This WP aims at enhancing practical exploitation of the existing coastal observatories in the four field sites and making a step toward (1) networking multi-disciplinary integrated observational systems and (2) establishing their predictive capabilities. The major focus is on coastal ocean predictions. Prediction limits will be quantified for the considered field case applications. Activities in this WP include data assimilation at local scales and for multi-dimensional observations and the feedback to MCS providers (MyOcean project) and agencies with data responsibilities such as EEA and ESA. The emphasis here will be on generating and making explicit the added value for such basin scale predictions or the satellite data used for their validation or assimilation. Overall consistency will be assessed through selected field applications.

This general aim can be split into the following specific objectives:

i) Advance the scientific understanding needed in coastal prediction practice
ii) Quantify the role and need of individual observations and complementarities between them
iii) Reach optimal synergy between observations and prognostic models
iv) Trace the route towards operational use of developed methods
v) Network available similar coastal systems and increase the consistency (at EU level) of their products
vi) Demonstrate the enhancement of downstream services at coastal scales by optimal synergy between remote sensing, in situ observations and modelling.

Description of work (possibly broken down into tasks), and role of participants

Task 5.1. Link to the MyOcean project
Leader of Task: UPC
Participants of Task: POL, ISMAR, GKSS, KUL

The objectives of GMES Marine Core Services is to deliver a range of fully validated core operational oceanographic products and services which can be used by intermediate service providers, like the FIELD_AC consortium, to meet information needs of the European Union, Member States, European industry and European Citizens. MyOcean is the first MCS project implemented by the European Commission under FP7 to face this challenge.

14 Please indicate one activity per work package:
RTD = Research and technological development; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable (including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities).

The MyOcean core information on the ocean state is generated through a network of 12 production units: 5 TACs (Thematic Assembly Centres) dealing with observations of sea level, SST, ocean colour, sea ice, surface wind and in situ temperature/salinity, and 7 MFCs (Monitoring and Forecasting Centres) dealing with numerical modelling and data assimilation in the Global Ocean, the Arctic Ocean, the Baltic Sea, the Atlantic North West Shelf seas, the Atlantic Iberian-Biscay-Irish seas, the Mediterranean Sea and the Black Sea. The list of products accessible through the MyOcean service is detailed in the on-line catalogue (http://www.myocean.eu.org/index.php/products-services). There are currently 45 different MyOcean products available to users. The MyOcean catalogue also contains a brief overview of the key technical elements characterizing each production sub-system in place today.

These MCS ocean state fields will be used as drivers (via boundary conditions for instance) and conditioners for the coastal scale predictions foreseen in FIELD_AC. Our project will also provide feedback to the MCS in terms of the local scale fit obtained. For this reason, a Service Level Agreement (SLA) between FIELD_AC and MyOCEAN will be signed in place M2 of the project. This SLA will contain four parts:
:

- The service level description and associated commitments
- The MyOcean License
- The detailed list of products selected by FIELD_AC
- And the user data registration form

Regarding the persons of contact between projects, Agustín Sánchez-Arcilla from UPC (coordinator of FIELD_AC) has become a member of the MyOcean Core User Group and Pierre Bahurel (director of Mercator Ocean, which is the institution coordinating MyOcean) has accepted to become a member of the FIELD_AC Advisory Board (see Task 6.2).

Finally, and in case the requested products are not available from MyOcean, other SLAs or other types of agreements are foreseen with the ESA and EEA in the case of Earth Observation Data and with the original providers (like Mercator Ocean or Puertos del Estado or INGV) in the case of numerically forecast results in the European Seas. This will be achieved through the MOON platform, where all the above mentioned institutions, including UPC, are registered members. For the case of ESA data a separate agreement will be established for the project duration.

Expected results:

i) Signature of a Service Level Agreement among FIELD_AC partners and MyOcean.
ii) Periodic updating of FIELD_AC developments through the MOON platform and request for exchanges if required

Task 5.2. Meteo-oceanographic networks and multi-sensors arrays

Leader of Task: POL

Participants of Task: UPC, POL, ISMAR, GKSS

The observational backbone of this WP includes some of the most developed European coastal observatories: the POL Coastal Observatory in Liverpool Bay (COBS, http://cobs.pol.ac.uk), Coastal Observation System for Northern and Arctic Seas (COSYNA, http://www.cosyna.de), Catalan network including the Badalona coastal pier (hydro-dynamically “transparent” structure to achieve a full "transect" coverage) (XIOM, http://www.boiescat.org) and the oceanographic tower "Acqua Alta" in the Gulf of Venice at a depth of 16 m. (http://www.ismar.cnr.it/centraline-meteo/venezia/). These are observation facilities with distributed in space sensors, supported by remote sensing and Ferry-box data. Observed variables include meteorology, wave heights, currents, sea level, water temperature, salinity, turbidity and chlorophyll (eventual addition of extra sensors such as e.g. optic ones for intensive campaigns). Model supported outputs include mapped data of forecast meteorological and oceanographic states. In most of cases the use of data via data assimilation is not optimal.

The FIELD_AC partners are involved in these observation activities at each of the field sites and have access to the data (**UPC** for instance is responsible for managing the XIOM network at the Catalan coast). The cooperation, including making data available to FIELD-AC, as well as the data processing according to the project stringent specifications will be formalized in the Consortium Agreement to be signed before three months of project development.

Near-shore "augmentation" of some systems/observatories (COBS, XIOM and COSYNA) aims at improving the understanding and prediction of SPM exchanges between estuary plumes and the "receiving" coastal sea, including light penetration in shallow waters (**UPC, POL, GKSS**). New measurements will support the development/improvement of SPM/ water quality /ecological models. This will be based on the ROMS, GETM and FVCOM simulations (all codes are available and "controlled" by the partnership since the researchers have participated in their development and adjustment to local field sites). The enhanced observations will continue at least one year and include ADCP, wind, wave and a range of optical sensors (including OBS, AC-S, BB9, LISST).

Deployment of wind/wave buoys and/or ADCP is planned to enhance the locals scale resolution of near-shore waves and 3D currents, which will be combined with X-band measurements (**POL**). Spatial survey of SPM and light penetration will be carried out for a number of pilot sites such as e.g. from Point of Air (mouth of the Dee) to Southport, out to 20 km, encompassing the outflow from the Dee and Mersey plumes with contrasting suspended sediment signatures (**POL**).

The coordinated work effort of all partners will result in developing:

i) High resolution and integrated network of "homogenised" observations getting close (e.g. in the Badalona pier the most in-shore wave gauge is at 2.5m depth) to the shore-line.
ii) Quality control for such observations based on the feedbacks between different variables, the expertise available within the partnership and the users requirements.
iii) A new quality control and observational protocol for multi-sensor arrays, applicable to similar coastal environments throughout Europe.
iv) A meteorological and oceanographic data set (multi–sensor observations), subject to quality control procedures never before achieved in European waters, which will be proposed as a component of the in-situ global earth observing system.
v) Useful stream of data feeding forecasting models at local scales.

Task 5.3. Remote Sensing Observations

Leader of Task: GKSS

Participants of Task: POL, KUL, GKSS

The aim of this activity is to provide remote sensing data for the analysis of coastal sea states, local data assimilation and pre-operational activities. Participants in this task, who are among the world leaders in the processing and use of remote sensing data in coastal areas (including satellite SAR data, http://www.coastlab.org/wind.html, MERIS data, http://www.coastlab.org/rs.html, SST data , http://cobs.pol.ac.uk/cobs/sat/) will commit to link their institutional and national activities to FIELD-AC. Remote sensing imagery can include satellite airbone and ground-based data.

Remote sensing products such as colour or SST images with a horizontal resolution of 1 km, which is much higher than that in conventional applications (e.g. in the OSTIA system) will be reconstructed for the FIELD-AC targeted areas (**POL, GKSS**). Wind fields provided by the QUICKSCAT scatterometer (25 km) and the high-resolution synthetic aperture radar (SAR) sensors onboard the European satellites ERS-2 and ENVISAT (SOPRANO products) will be analysed and included in the model forcing data base (**POL, GKSS**) . Sea level anomalies from altimeters will be validated against tidal gauges to infer circulation, together with SAR – derived currents (SOPRANO) to be used for wave-current coupling.

The emphasis at the 4 areas (limited domains) studied in FIELD_AC will be on local (“beach”) to regional (shelf to open ocean) scales and on the wave fields – variables such as the significant wave height - provided by the ESA – funded Globwave and related projects with images from JASON, TOPEX, ENVISAT and ERS satellites (**POL, KUL**). We shall also use surface ocean colour products and chlorophyll-a concentrations (**POL, GKSS**) from MERIS (300m) and MODIS-AQUA and MODIS-TERRA (250m).

The simultaneous analysis of SAR images and simulated wave/current fields will provide the means to recover underwater bathymetry and basin geometry. This should allow assessing, in some pilot cases, the “error“ introduced in the predicted fields by the (inevitable) uncertainties of the bathymetry (**POL, GKSS**).

HF radar waves and currents and X-band radar data for very local-scales will also be analyzed (**POL**). The accuracy of HF radar wave data will be assessed from a comparison with wave buoys and ADCPs (**POL**). The usefulness of remote sensing imagery on the influence region of river and urban run-off will be also quantified (**KUL**). These activities will lead to a protocol for the “optimal” use of satellite and land-based remote sensing techniques, which will support improved data analyses and data sets for preoperational purposes. All products will be quality controlled following the requirements of international efforts and agencies such as the EEA (**POL, KUL, GKSS)**. In all studied cases a wide coverage will be required, to have a general meteo-oceanographic pattern for the open sea boundary conditions. This means the full Mediterranean and Irish Sea, although the coupled high-resolution tests will be run at a local scale.

Expected results:

i) Spatially distributed database of quality controlled remote sensed images
ii) Improved (local scales) retrieval algorithms enhancing the added value of satellite images based on an optimal use of radar images and in-situ multi-sensors data.

Task 5.4. Pilot intensive campaign

Leader of Task: UPC

Participants of Task: UPC, POL, GKSS, KUL

The aim of this activity is to carry out two intensive field campaigns (one month duration scale) during two Target Operational Periods (TOPs) at the Catalan Coast regarded as common “pilot site” for this purpose (**UPC**). The other 3 FIELD-AC areas are considered in this context (as “application” sites. This activity will serve to gather detailed observations on the interactions between wind-wave-current fields and the resulting water quality fluxes at event scales (e.g. for a typical Mediterranean low pressure centre with torrential rain – flash flood – and co-existing waves and storm surge. The intensive campaigns, supported by existing in-situ (wave plus wind buoys and ADCPs plus current-meters at various depths (**UPC**) ranging from 2.5m up to 600m) and remote observations, will cover and allow analysing the studied area at local (Barcelona beaches, LLobregat and Besos river-mouths and Barcelona harbour) to regional (shelf to open ocean) scales (**UPC, POL, GKSS, KUL**).

The campaigns will characterize typical winter/intermediate seasons for the Catalan coast climate. The field deployment will be designed (**UPC, POL, GKSS, KUL**) to achieve "enough" spatial coverage (considering the specific gradients of the prevailing Catalan coastal environment) and making full use of the unique collection of field equipment available at the partnership and supporting institutions. Consistency between preoperational activities in all "Application Sites" (the remaining 3) and the one carried out in this pilot intensive campaign will be critically analysed (**GKSS**) and further enhancements for future similar efforts in the application sites will be considered.

Expected results:

i) Unique temporal and spatial coverage of targeted site representative of "restricted" European coastal zones (water domain) with sharp gradients
ii) Practical protocols from the campaign as a contribution to down-streaming services.

Task 5.5. Coastal Data Assimilation

Leader of Task: GKSS

Participants of Task: SHOM ,UPC, POL, GKSS, IBW, DHI

The aim of this activity is to maximise the use of regional observations on the "route" of down-streaming services for coastal regions.

In most operational systems, products for near-coastal areas are just an extension of open ocean products, the use of available data is perhaps not optimal and the benefit of using local observations is not clearly quantified. Here we intend to introduce sub-regional to local (coastal) scale observations into the predicted wind-wave-current fields and to quantify the improvement in modelling skills (**IBW, GKSS**).

The same enhancement for "used" data is proposed for sediment transport and nutrient fluxes (**UPC, IBW**) models. Two-way nested (**SHOM**) prediction models will be employed, as well as up-to-date data assimilation techniques (**GKSS, UPC**).

For instance, data assimilation will be included in a pre-operational German Bight-Wadden Sea model with maximum horizontal resolution of 100 m (**GKSS**). The initial approach will be based on reduced-order (typically stationary-covariance) Kalman filter as it was employed for regional-scale assimilation. The skill of models will be analysed with respect to the individual data sources, which will help identifying the optimal set of variables needed to be assimilated.

Analysis of prediction skills will also provide a first step towards best-practice guidelines about "optimal" assimilation techniques (**DHI**). Additional information will be added sequentially, by considering gradients as extra variables and non-stationary covariance structures (**UPC**). Such a physically-consistent sequential approach has not yet been proposed nor implemented. Neural network concepts will also be tested and their contribution for improving skills of coastal predictions in the study sites will be evaluated (**IBW**).

Furthermore, rainfall data assimilation is considered to be an important parameter for rainfall-runoff models under sharp gradient conditions (e.g. NW Mediterranean). Therefore we shall also address (**UPC, SHOM**) this issue to assess whether it is best done inside the rainfall prediction from the meteo model or in a semi-separate manner within the rainfall-runoff estimates. This will support the methodology development part in other WPs.

Expected results:

i) Enhancement of the "operability" for existing systems by an optimal use of data and assimilation techniques

Task 5.6. Prediction Limits

Leader of Task: ISMAR

Participants of Task: UPC, KUL, ISMAR, GKSS

This activity aims at providing an objective answer to the question of prediction limits for coastal processes in limited domains. The targeted periods will be addressed in accordance with the requirements of our users.

Forecast skills in coastal area depend strongly on (1) open ocean, meteorological and hydrological *forcing*, and (2) on local *processes*. Forcing is usually provided by an "outer model" or outer part of a nested system. We shall be using the products of MCS and those from meteo and similar (e.g. Puertos del Estado in Spain) services, with whom there will be a close cooperation and feedback (they are already supporting by written commitment the project).

Since local processes are simulated by the "inner" (coastal) set of models supported by data assimilated into the model, data assimilation can help in achieving an improved consistency between (1) and (2), advancing the present state-of-art. However, in some cases, the errors (**ISMAR, GKSS**) from models and observations may pose non-trivial problems, in particular because waves and currents so close to the shore are highly sensitive to the accuracy of data/processes involved.

In this activity we will also evaluate the sensitivity of the simulated results to the accuracy of boundary information and to uncertainties in the various models used (**UPC, KUL**). Likewise, the accuracy of the input information, not necessarily available at a specific site, will be also assessed (**ISMAR, GKSS**). This will require extensive tests of the offshore values for wind, waves and currents, versus the available measured data. The uncertainties in the predictions of land fluxes will be integrated in the overall uncertainty analysis (**KUL**).

Expected results:

i) Overall objective assessment and "performance" limits for the forecast periods
ii) Accuracy limits and error bounds (objectively estimated) for a characteristic set of individual state variables.

Deliverables (brief description and month of delivery)

D5.1 SLA among FIELD_AC partners and MyOcean (UPC – M2)

D5.2 Common quality control and observational protocol for multi-sensor arrays (POL – M12).

D5.3 Spatially distributed database of quality controlled remote sensed images and in-situ multi-sensor observations(GKSS - M12)

D5.4 Report on intensive pilot field campaign (UPC – M26)

D5.5 Guidelines to enhance the operability of existing operational systems at local scales and limited domains (ISMAR - M36)

note: M** gives month of deliverable

Work package number	6		**Start date or starting event:**		M 1	
Work package title	Management of the FIELD_AC project and its results					
Activity Type[15]	MGT					
Participant number	**1**	2	3	4	5	
Participant short name	**UPC**	KUL	SHOM	GKSS	IBW	
Person-months per participant:	**12**	1	1	1	1	
Participant number	6	7	8	9		
Participant short name	POL	ISMAR	DHI	BSC		
Person-months per participant:	1	1	1	1		

Leader of Work Package: UPC

Objectives

This WP includes the project management and coordination, the communications among participants (including end-users and Advisory Board).

WP 6 also deals with the handling of contractual and financial matters, particularly those related to the establishment of a sustainable relationship among partners and the ad-hoc spin-off (MoU among partners and business plan for the SME).

The WP work also covers the organisation of regular and ad-hoc meetings as required, both "in person" and using tele-communication means (video or web conference basically). It will also deal with the preparation of workshops and the final Open Forum. It will include the University Seminars transferring the expertise generated during the project and the organisation of an Advisory Board to steer the project development and to receive and disseminate the project results. This Board, composed by representatives from an official service with similar responsibilities – United States Geological Survey – and two private companies active in this field (one participating in a similar spin-off cooperating with related public services) plus representatives from the considered field sites will be particularly useful to ensure the efficient transfer of project results, building upon previous similar experiences.

The WP will also cover the assessment of project development (in terms of milestones and deliverables) and the dissemination of project results at scientific, commercial and general-society level.

Description of work (possibly broken down into tasks), and role of participants

Task 6.1. Linking the ad-hoc spin-off to the partnership

Leader of Task: UPC

Participants of Task: UPC, KUL, GKSS, POL, ISMAR, DHI

[15] Please indicate <u>one</u> activity per work package:
RTD = Research and technological development; DEM = Demonstration; MGT = Management of the consortium; OTHER = Other specific activities, if applicable (including any activities to prepare for the dissemination and/or exploitation of project results, and coordination activities).

The objective of this task is to establish the legal and administrative pathways to ensure an efficient transfer of project results based on the scientific and engineering expertise of the partnership plus the marketing push of the ad-hoc spin off created following the FIELD_AC rationale. This will allow transferring in a commercially sustainable manner the downstream services required by the project end-users **(UPC)**. It will imply establishing Memorandums-of-Understanding among all project participants, partners and end-users. It will also require drafting Service Legal Agreements (SLA) among the partners, the ad-hoc spin off and the local (country level) end users and SMEs selected by the partners. Since the aim of the consortium is to transfer the group expertise based on the Coastal Operational Framework, in close cooperation with the participating public end-users and meteo services, the SLAs will be prepared at 3 levels:

i) Related to the transfer of general information about the new FIELD_AC products, indicating their commercial and scientific uses.
ii) Related to the actual transfer of FIELD_AC results for commercial use, established by the corresponding monetary counterparts.
iii) Related to the actual transfer of FIELD_AC results for scientific use, which will be free of charge but looking for complementarities in datasets, applications and similar aspects.

The combination of FIELD_AC research partners **(KUL, GKSS, ISMAR, POL)**, which are among the best in the EU in this field, together with the partner private research institute **(DHI)** (one of the more recognised firms in the EU in the field of local-scale commercial software models) plus the targeted public/private end users will facilitate the future commercialization of the new local-scale service and, based on this tangible product, the transfer of the group know-how.

This is the approach taken by similar initiatives elsewhere, where such cooperation has facilitated the self-sustainability of the transfer of project results and larger returns -of all types- for all involved parties (a member of the International Advisory Board represents this type of initiative). The new service and expertise will, naturally, lead to an improvement of European competitiveness and sustainable development in this area.

All the FIELD_AC partners will participate in the writing and discussion of the memorandum of understanding among the consortium together with the SME spin-off. This MOU shall cover all the complexities of getting public data from various sources, depending on the country, adding value to them as a genuine downstreaming service should do, and transferring that information to the more final end users and stakeholders from the coastal zone. Among the various issues to be discussed when preparing the MOU are the Service Level Agreements that partners shall have to sign with end users and with data and image (off-shore fields, boundary conditions…) providers. This will vary from site to site since the organizations responsible for providing shelf and open sea fields are different. The same applies to end users and the particular administrative arrangements that there are in the various countries. Because of that, the amount of work required to deal with these issues, is not small and justifies the requiered management effort of partners.

Expected results:

i) Signature of a Memorandum of Understanding (M-o-U) among partners.

ii) Structured format for the Service Level Agreements at 3 levels
    a. General

b. Commercial
c. Scientific

to be used during the project development.

Task 6.2. Organisation of an International Advisory Board
Leader of Task: UPC
Participants of Task: UPC

This task consists in organizing and maintaining an Advisory Board (AB), formed by a maximum of five (5) people selected among scientists, personnel from private companies and end-user or stakeholder representatives from the studied field cases (**UPC**).

The representatives contacted so far (see samples of enclosed letters) come from the project field sites and from the U.S. where related initiatives are also under way. The two-way interaction of the partnership with this AB will, thus, avoid the lack of efficiency inevitable for a “first-time” service down-streaming while, at the same time, ensuring that all project developments are in line with actual users’ needs. The AB members represent a similar private initiative (Eoin Hoelett, CEO from the US firm ASA), a well known European company as Mercator (Dr. Pierre Bahurel, Director), a public institution (Dr. John C. Warner, from USGS) and one end-user (Antonio Marzoa, Director of a Spanish aquaculture exploitation) –all working in this field and with complementary expertise– plus some selected public/private representatives from the field sites (see enclosed letters in Annex A).

The role of the AB will be the following:

- To provide advice to the FIELD consortium on a regular basis in areas related with the project science, transfer of results or feedback to users.
- To advise the coordinator and the Steering Committee in their decision-making based on the abilities, experience and knowledge of its members.
- To guide FIELD partners to develop useful products and services, taking into account stakeholders and end-user necessities, and looking at complementary initiatives in the EU or elsewhere.
- To answer questions related to the project and posed by the coordinator, the Steering Committee, the EC or other projects.
- To review the project development, identifying deviations and possible corrective measures.

More specifically the AB will follow, in yearly 1-day sessions simultaneous with general FIELD_AC meetings, the project development with emphasis on the transfer of expertise and the role of the ad-hoc spin-off. In these meetings the AB will discuss and propose corrective measures (if required) to optimise the use of resources during the work development so as to be able to meet on time all the project objectives. The AB will transmit its conclusions to the project coordinator (**UPC**) and will check the adequacy of FIELD_AC results to the private and public users’ needs (see also section 2 on Management Structure and Procedures).

Expected results:

i) Improved control of the project quality
ii) Steering of project development (according to experiences in other countries/contexts)
iii) Enhanced suitability of the project results to end-user needs

Task 6.3 Project Management
Leader of Task: UPC
Participants of Task: all partners

This task includes the organization of regular meetings among participants: one overall meeting every 6 months, as well as regular contacts among partners via additional meetings or video/web-conference when necessary. It also comprises the organization of scheduled meetings with end-users, to assess their needs and the services they want to receive (**all partners**). Besides this, he coordinator and some work package leaders on a case by case basis, will have to travel to Brussels for the review meetings.

Moreover, this task involves all the management aspects of the project, in particular the coordination of the work and the control of the project development and quality, checking the achievement of milestones, the production of deliverables and the budget evolution (**UPC**).

Expected results:
i) A meeting every 6 months.
ii) Scheduled meetings with end-users.
iii) Assessment of the project evolution

Deliverables (brief description and month of delivery)

D6.1 MoU among partners, including the ad-hoc Spin-off (UPC-M6).
D6.2 Collection of three annual progress reports (UPC - M12, M24 and M36)
D6.3 Collection of the 3 AB reports (UPC - M14, M26 and M38)
D6.4 Final Project Report (UPC - M38)

note: M** gives month of deliverable

B.1.3.6 Efforts for the full duration of the project

Project Effort Form 1 - Indicative efforts per beneficiary per WP
Project number (FIELD_AC) : 242284

	WORKPAKAGES						
Participant no./short name	**WP1**	**WP2**	**WP3**	**WP4**	**WP5**	**WP6**	**Total person months**
1.- UPC (Coordinator)	**7**	14	15	13	21	**12**	82
2.- KUL	2	1	**26**	14	7	1	51
3.- SHOM	0	4	0	20	0	1	25
4.- GKSS	4	10	5	13	**24**	1	57
5.- IBW-PAN	0	6	0	3	6	1	16
6.- NERC-POL	4	**11**	11	11	12	1	50
7.- ISMAR-CNR	4	9	7	**21**	5	1	47
8.- DHI	9	4	0	8	4	1	26
9.- BSC	0	10	10	16	0	1	37
Total	30	69	74	119	79	20	391

Project Effort Form 2 - indicative efforts per activity type per beneficiary[16]
Project number (FIELD_AC) : 242284

Activity Type	UPC	KUL	SHOM	GKSS	IBW-PAN	NERC-POL	ISMAR-CNR	DHI	BSC	TOTAL ACTIVITIES
RTD/Innovation activities										
WP 2 Meteo-oceanographic modelling tools	14	1	4	10	6	11	9	4	10	69
WP 3 Boundary fluxes	15	26	0	5	0	11	7	0	10	74
WP 4 Interactions and coupling in restricted domains	13	14	20	13	3	11	21	8	16	119
WP 5Field Evidence and Prediction Limits	21	7	0	24	6	12	5	4	0	79
Total 'research'	63	48	24	52	15	45	42	16	36	341
Demonstration activities										
Total 'demonstration'	0	0	0	0	0	0	0	0	0	0
Consortium management activities										
WP 6 Management of the FIELD_AC project and its results	12	1	1	1	1	1	1	1	1	20
Total ' management'	12	1	1	1	1	1	1	1	1	20
Other activities										
WP 1 Down - streaming GMES services to costal-zone end-users	7	2	0	4	0	4	4	9	0	30
Total 'other'	7	2	0	4	0	4	4	9	0	30

TOTAL BENEFICIARIES	82	51	25	57	16	50	47	26	37	391

[16] Please indicate in the table the number of person months over the whole duration for the planned work , for each work package, for each activity type by each beneficiary

B.1.3.7 List of milestones and planning of reviews

Milestone no.	Milestone name	WP's no's	Lead beneficiary	Delivery date from Annex I [1]	Means of verification[2] (*Comments*)
M1.1	Questionnaire and interviews with end-users **(DHI)**	1	8	Month 12	List of interviews and completed questionnaires. It will also include an integrative report proposing how to incorporate the end-users via SLAs or otherwise
M1.2	Assessment of downstream services quality **(DHI)**	1	8	Month 18	Acceptance letters from end-users, with assessment input and, if relevant, signature of the corresponding SLA
M1.3	Training Workshops and Seminars **(UPC)**	1, 2, 3, 4, 5	1	Months 20 and 26	Agenda and list of participants plus summary of presented material
M1.4	Open Forum **(UPC)**	1, 2, 3, 4, 5	1	Month 33	Agenda and list of participants plus a report with the main conclusions in 3 blocks: i) relative to scientific issues, ii) relative to the transfer of project results, iii) relative to new possible project products
M2.1	Set-up meteo, wave, circulation and transport				Software validation presented in the 18th month

[1] Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

[2] Show how you will confirm that the milestone has been attained. Refer to indicators if appropriate. For example: a laboratory prototype completed and running flawlessly; software released and validated by a user group; field survey complete and data quality validated.

	models at coastal scales for the studied field sites **(UPC)**	2	1	Month 18	meeting. It will be accompanied by a summarized report illustrating the strong and weak points of the site-specific code applications for commercial and scientific applications
M2.2	Proposal of model hierarchy for the Coastal Operational Framework **(UPC)**	2	1	Month 24	Proposal completed and tested (including Advisory Board input)
M3.1	Validation of pre-operational wind fields (for the study sites) from the standpoint of our modelling needs and the users requirements **(BSC)**	3, 2	9	Month 18	Software validation presented in the 18th month meeting. It will include an assessment of error bounds and how the robustness / resolution / accuracy issues affect the user's requirements
M3.2	Calibration of rain-fall / run-off model for the selected study sites **(KUL)**	3	2	Month 18	Software validation presented in the 18th month meeting. It will include an assessment of error bounds and how the robustness / resolution / accuracy issues affect the user's requirements
M3.3	Validation of preoperational rainfall fields (rates) for the study sites and from the	3, 2	9	Month 21	Software validation presented in the 2nd year meeting. It will be accompanied by

	standpoint of our modelling needs and the users requirements **(BSC)**				a report suggesting improvements to better answer the user needs and a feasibility analysis of the on-line transfer of results
M3.4	Validation of “offshore” wave and circulation fields (in terms of local values and impacts) as boundary conditions for the pre-operational simulations **(POL)**	3, 1	6	Month 24	Software validation presented in the 2nd year meeting. It will be accompanied by a report suggesting improvements to better answer the user needs and a feasibility analysis of the on-line transfer of results
M4.1	New coupling formulations and implications for remote sensing imagery **(BSC)**	4, 5	9, 7	Month 18	New formulations presented in the 18th month meeting. The explicit advances with respect to present state-of-art will be made explicit
M4.2	Assessment of land boundary condition **(KUL)**	4, 3	2	Month 20	Land BC tested and running flawlessly
M4.3	Assessment of residence times **(UPC)**	4, 2	1	Month 22	Assessment of residence times completed and presented in the 2nd year meeting. It will also decide how the residence time concept should be employed by our users for environmental management of the

					corresponding water bodies
M4.4	Optimized sequence of models from shelf to near-shore **(ISMAR)**	4, 3, 2	7	Month 24	Model sequence run flawlessly
M5.1	Integrated network of high resolution observations **(POL)**	5	6	Month 6	Definition of integrated network completed and prepared for its marketing at each of the field sites and its exportation to other places
M5.2	Periodic updating of the relationship between FIELD_AC and MyOcean **(UPC)**	5	1	Months 12, 24 and 36	Updating completed and reviewed during the 3 yearly general meetings
M5.3	Intensive pilot campaign at the Catalan Coast **(UPC)**	5	1	Months 18 and 24	Field measurements completed and data quality validated with emphasis on its suitability for model validation and end-user exploitation
M5.4	Assessment of the accuracy of satellite images based on an optimal use of radar images and in-situ multi-sensors data **(GKSS)**	5	4	Month 18	Assessment completed and presented in the 18th month meeting. It will include a set of recommendations for the combined use of remote and in-situ data, making reference to present ESA products and to the European-level coordination effort of in-situ

					observations by the EEA
M5.5	Assessment of the consistency between preoperational activities in Pilot Site and Application Sites and the lessons derived from the TOPs **(UPC)**	5, 4, 3, 2	1	Month 27	Assessment completed and presented in the 30th month meeting. It will tackle the transition from pre-operational to fully operational predictions in terms of computational requirements
M5.6	Estimates on the forecasting periods for the selected individual state variables in each of the field sites considered in FIELD-AC **(GKSS)**	5, 4, 3, 2	4	Month 30	Estimates completed and presented in the 30th month meeting. They will deal with the prediction limits for each considered variable as a function of local geometry (topography, bathymetry,…) and drivers (precipitation, wind,…)
M6.1	Organisation of General Project Meetings including the kick-off and final meetings **(UPC)**	6	1	Months 1, 6, 12, 18, 24, 30 and 36	Minutes of General Project meetings, with a list of action points including responsible partners, people and the expected data for completion
M6.2	Service Legal Agreements at 3 levels **(UPC)**	1	1	Month 6	Structure of Service Legal Agreements (SLAs) at general, scientific and commercial levels according to the partnership constraints and

					satisfying the end users requirements. These SLAs will also tackle the relation between the ad-hoc spin off and the partnership, laying the basis for a symbiotic combination of scientific expertise (partners) and marketing push (SME).
M6.3	Final Business plan for the spin-off **(UPC)**	1	1	Month 9	Final version of the SME business plan, including the updated version of Service Level Agreement at 3 levels (general, commercial and scientific)
M6.4	Organisation of three Advisory Board Meetings **(UPC)**	6	1	Months 12, 24 and 36	Minutes of AB meetings in which the emphasis will be on the expert advice transferred and possible ideas to export project results to other field sites, inside or outside the EU
M6.5	Review meetings at Brussels	6	1	Months 15, 27 and 38	Minutes of the meeting.

Tentative schedule of project general meetings			
Meeting no.	**Tentative timing, i.e. after month X = end of a reporting period [1]**	***planned venue of review***	***Comments , if any***
1	After project month: 12	**Venice**	The partners and reviewers will be able to follow the initial project developments, including a possible visit to one of the oldest time-series available in the EU of collocated wind and wave observations. The revue will also serve to discuss the application of project results to a particularly vulnerable area such as Venice
2	After project month: 24	**Liverpool**	The partners and reviewers will keep on tracking the project development while getting in touch with one of the leading centres in the EU for maritime observations (BODC). The venue will also serve to discuss the application of project results to a complex environment such as the Liverpool bay, with an important tidal signal and an extensive coverage of field observations
3	After project month: 36	**Barcelona**	The partners and reviewers will discuss the full project development and its suitability for a complex coastal zone (the Spanish Mediterranean) subject to a torrential type of climate (in both meteo and oceanographic terms) and a high level of uses (tourism, navigation, environmental values,…). The meeting will also serve to review the value of the intensive campaign and the suitability of future editions based in the instrumented Badalona pier and the existing network of coastal (XIOM) and deep-water (Puertos del Estado) buoys

[1] Month after which the review will take place. Month 1 marking the start date of the project, and all dates being relative to this start date.

Tentative schedule of project review meetings			
Review no.	**Tentative timing, i.e. after month X = end of a reporting period [1]**	***planned venue of review***	***Comments , if any***
1	After project month: 15	**Brussels**	**To be determined by the Project Officer and Project Coordinator**
2	After project month: 27	**Brussels**	**To be determined by the Project Officer and Project Coordinator**
3	After project month: 38	**Brussels**	**To be determined by the Project Officer and Project Coordinator**

[1] Month after which the review will take place. Month 1 marking the start date of the project, and all dates being relative to this start date.

B2. Implementation

B.2.1 Management structure and procedures

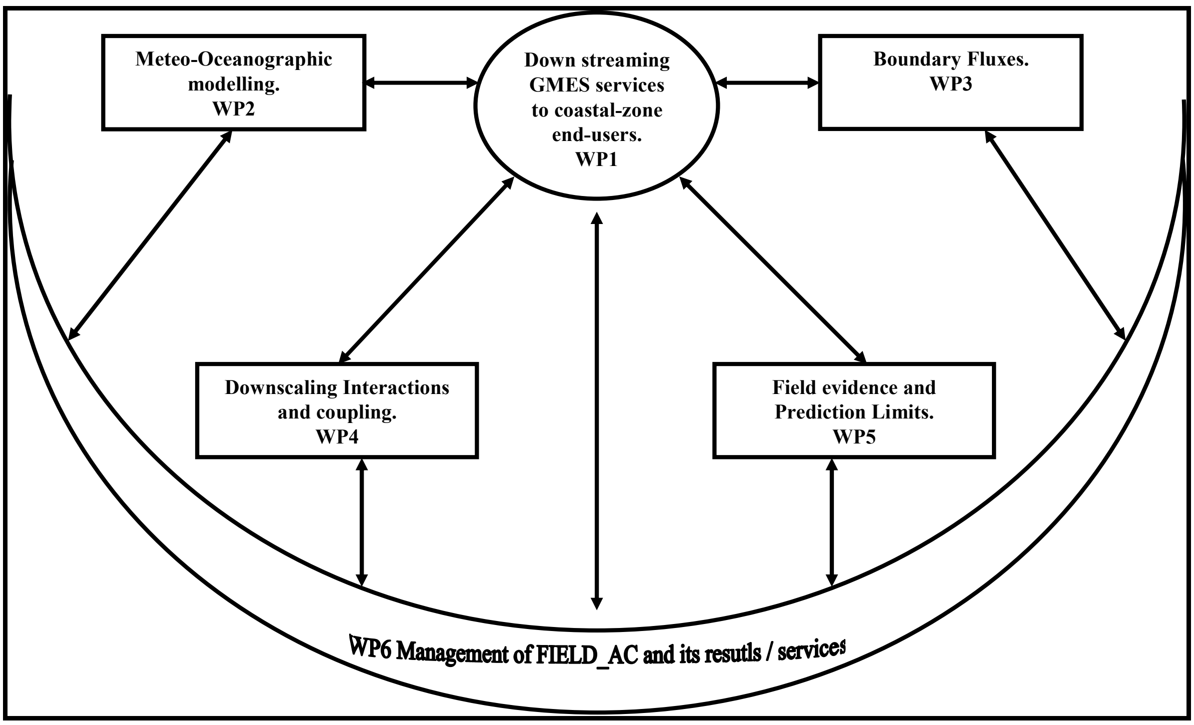
A project involving so many different components requires a well-established management structure, considering all the stages and specific aspects of the project. In order to secure a well-running project, the management tasks have been clearly defined and will be distributed among the partners taking into account their interests, resources and expertise.

Organisation of the project work

It is planned to enforce cooperation between all partners with regards to their specific expertise. The partners will complement each other to develop the project (meteo, wave and circulation experts, coupling and assimilation, mesh generation and error metrics, in-situ, satellite and radar data), making full use of the capabilities within the institutions in the FIELD_AC partnership.

The project work has been divided into rational tasks, which are combined into 6 work packages (figure 3). For every single task one *task leader* is assigned with regards to its expertise, means and the work to be carried out. The task leaders are responsible for the coordination of the distribution and execution of the work, with the contribution of the participating partners. These partners are responsible for different parts of these tasks and are obligated to carry out their work with regard to the state of the art and the project's objectives. They will plan the work together with the task leader and other participants of special tasks, execute the planned work, evaluate the results, organise distribution of deliverables, and report the outcome of the work to the task leader, who will be obliged to supervise the work and, when necessary, compile the reports of the participants into one document.

Figure 3. The FIELD_AC work-package relationship



Project management (scientific and administrative management)

The administrative management of the project will deal with financial issues, guarantee timing and adherence to the schedule, achieving the work packages' objectives and providing quality assurance for all deliverables and milestones. The project management has to ensure a regular reporting to, and a smooth interface with, the EC's Project Officer. To carry out these important tasks the *coordinator*, Prof. Agustin Sanchez-Arcilla, will be helped by a project manager, Dr. Daniel Gonzalez-Marco, who will assist him to control scheduled times, deliverables, responsibilities, milestones, duration of tasks, orders, payments and costs with a special regard to the objectives and the cost effectiveness of the project.

The coordination and the progress control of the project work will be the responsibility of the coordinator scientist as well as the overall project and financial management. The coordinator has more than 25 years of experience in project management and coordination of European and National research projects and will take over the responsibilities of the *scientific and administrative management*. He will be responsible for the scientific coordination of all partners and the administrative management, including reporting, financial statements, planning of meetings etc. All reports compiled by the task and work-package leaders will be collected by the coordinator and the partners will be informed with regards to the communication procedure described below.

The main responsibilities of the coordinator are the following:

Organisation and chairing of project management meetings.
Monitoring the progress of the whole project against the work programme.
Gathering information from partners about the project status in the scheduled periods.
Submission of progress reports and review documentation to the EC.
Leadership in decision making activities.
Main point of contact for the EC project officer.
Compilation of progress reports and preparation of official reports for the EC.

The coordinator will be supported by a well recognised University Laboratory (more than 40 high level research staff and 5 management/administration personnel) and an adjacent (sharing the same means and offices) public research centre with additional research and management capabilities. He will also be supported by the FIELD_AC Steering Committee, essential for the scientific coordination in such a multi-component project.

The *Steering Committee* (SC) will be formed by a representative from all the partners leading a WP and will be established from the project initial meeting. The main tasks of the scientific SC are to monitor the technical progress of the project, to update the work-plan and to decide on any changes in the partner tasks and obligations. The SC members will promote the close cooperation between partners and fulfil (beside others) the following responsibilities:

Organisation and chairing of specific work meetings
Monitoring the progress and "coupling" (among components or disciplines)of the performed research against the work programme
Exploitation and transfer of project results in each specific research area.

Decision making structures

The project coordinator will be, together with the *Steering Committee* responsible to ensure that correct state-of-art procedures are carried out according to the topics and deliverables of each work package. They will also ensure that all deadlines and obligations are met in due time. It will be the responsibility of the coordinator to seek consensus on project steering issues. In the case of dispute, decisions will be taken by majority voting.

Further arrangements such as representation, rights, licences, and delegation (even quorum and access rights) will be defined in the MoU to be signed by all partners and the ad-hoc spin-off within the first six months of project development. This will also include the up-dating of the initial spin-off business plan, the working relationship among the SME and the partnership and other possible agreements with SMEs and Technology Transfer Offices suggested by the partners on a country by country basis. The MoU will regulate the transfer, exploitation and property rights of the expertise, data (observed or simulated), codes and framework resulting from the joint work. Particular attention will be paid to the relationship among public research institutions and the private companies in FIELD_AC, looking for an "efficient" relationship – mutually agreed upon – between the private and public elements in FIELD_AC. Likewise regarding the "open" or restricted character of the produced new sub-modules, including specific routines, new programmed formulations and similar. We shall also consider here the public character of many of the involved data sets.

Another responsibility of the coordinator and the *Steering Committee* will be the execution of the work programme, communication with the Commission, technical and commercial reporting, delegation of work packages and tasks, motivation of the team, encouragement of creativity, problem solving procedures and any necessary "corrective" action.

Communication structures

Informal communication between all partners will be encouraged at all times, with a responsibility to report via the work-package and task leaders to the project coordinator on significant actions/conclusions and immediately upon experiencing any type of problems. A communication network between the project partners will be set up, for this purpose, within the planning and execution of the different tasks mentioned in the work packages.

Use of e-mail will be encouraged, especially where interactive amendment to documents is required. By way of preparation, concise written text by e-mail or fax will be required in advance of meetings or in-depth discussions. All participating partners, and in particular task leaders, are obliged to prepare task reports after completion of their tasks or when a milestone is reached. They should also inform the WP leader and the coordinator about the achievement of project deliverables.

In all project meetings there will be some time dedicated to on-going tasks meetings. Partners will be able to communicate directly among each other and with the coordinator and SC regarding special problems or deviations from the work plan. They will also be asked to organise their tasks against the latest information from other projects, with emphasis on MCS providers and ESA activities.

The representatives of all partners will attend all scheduled general meetings (every 6 months and yearly). Results obtained will be compared to the initial objectives, successful tasks and problem areas or delays will be analysed and discussed. This will allow the partners to redefine more precisely the future work and the transfer of services and exploitation of results. In case of technically insufficient results or poor outlooks for their future exploitation, the partners or the European Commission can decide to terminate the project. The Advisory Board members will be invited to participate in all project general gatherings, with emphasis on the training workshops and the final Open Forum. Likewise, a representative of the Commission shall be invited to all scheduled yearly project meetings.

Additional work reunions will be held when necessary, against the planned tasks, deliverables and/or experienced problems to ensure the scheduled time of delivery and the quality of the deliverables. This strategy will also facilitate the solution of problems at an early stage.

Project management task and preparatory measures for the exploitation of results

A special project management task is included in the work programme (WP 6) for the management procedures described above. This task covers all the manpower needed for the overall coordination of the project. The measures required to assure the transfer and exploitation of results are included in WP 1 and WP 6.

Quality assurance mechanisms and the screening of final deliverables will be established at the signing of the *Consortium Agreement*. This is critical in a project dealing with "improved" local scale forecasting since otherwise the local users (direct observers of many of the predicted variables) will rapidly loose confidence in the "promised" capabilities.

The assessment of progress against objectives will be carried out against the deliverables and milestones mentioned in the work packages, always checking the satisfaction of end user requirements. The final review at month 36 will assess, with the support of the Advisory Board and the contributions from the final Open Forum, the main results of the project against the expected achievements, with emphasis on the practical value of the improved local-scale predictions.

Once the quality is assured, the project will transfer and disseminate its results to the public and private users from the four considered sites. It will also feedback to MCS providers and to agencies such as ESA or EEA. Likewise, there will be a transfer of results to users in countries not included in the partnership via existing contacts from other projects, publications and using a number of regular international meetings and networks in this field (e.g. the various GOOS and COOP assemblies). The Open Forum by the project end will also serve this purpose.

In each case particular effort will be paid to using the most suitable "tool" (e.g. executive summaries for high level public officers or demos for construction companies working at sea). The social awareness on the obtained advances at local scales will be raised by communication media and leisure associations (conservation associations to anticipate flooding or erosion of valuable coastal assets, surfing groups, etc).

Based on previous EU studies, key end-users and stakeholders are already known to the partnership and will be targeted from the project beginning. They include EU and national decision-makers in coastal and maritime areas (climate, economy, environment, industry, energy, water, waste, fisheries); teachers and researchers, public and private companies in the climate, economic, environmental, geography, aquaculture, transport, engineering, planning and other coastal zone services and the media. Representatives from the involved countries and the EC dealing with the new Directives for which the project work is deemed relevant (Risk, Flooding or Water Quality) will also be approached. These contacts will be expanded as the project develops and will continuously help to disseminate and evaluate the results.

International Advisory Board

The project also foresees the establishment of an international Advisory Board. The Board will be composed by a maximum of five experts (see WP 6) in areas relevant to FIELD. They will be selected among representatives of the scientific community, commercial companies or potential end-users from the field sites.

The role of the AB will be the following:

- To provide advice to the FIELD consortium on a regular basis in areas related with the project science, transfer of results or feedback to users.
- To advise the coordinator and the Steering Committee in their decision-making based on the abilities, experience and knowledge of its members.
- To guide FIELD partners to develop useful products and services, taking into account stakeholders and end-user necessities, and looking at complementary initiatives in the EU or elsewhere.
- To answer questions related to the project and posed by the coordinator, the Steering Committee, the EC or other projects.
- To review the project development, identifying deviations and possible corrective measures.

B.2.2 Beneficiaries

Participant No. 1: Universitat Politecnica de Catalunya, Barcelona, Spain, UPC

The Maritime Engineering Laboratory (LIM) is a public research centre from the Catalonia University of Technology (UPC). It is located within the Department of Hydraulic, Maritime and Environmental Engineering (Technical High School of Civil Engineering in Barcelona). The main aim of LIM/UPC is to generate and transfer basic and applied technology in the field of Maritime Eng. and Marine Sciences.

Main tasks attributed and previous experience relevant to those tasks

Main tasks attributed to UPC

UPC will lead WP1 (down-streaming GMES services to coastal-zone end-users) and WP6 (management of the project and its results) and also will contribute to WP2 (meteo-oceanographic modelling tools), WP3 (boundary fluxes), WP4 (interactions and coupling in restricted domains) and WP5 (field evidence and prediction limits).

Previous experience relevant to these tasks

UPC conducts research actively in the fields of coastal and estuarine hydrodynamics and water quality, oceanographic engineering, coastal morphodynamics and morphology, harbour engineering and operational oceanography. This is achieved by means of numerical (original and adapted) models, field permanent networks (e.g. the wave-wind-current system XIOM) and intensive campaigns and an internationally recognised hydraulic lab (featuring the third wave flume CIEM in the EU in this field). UPC has been involved in a large number of both National and International projects, including the national projects PREVIMED (led by UPC), RIMA (led by UPC), RISTE and EU projects MEDDELT (led by UPC), FANS (led by UPC), WAVELAB, HYDRIV, HYDRALAB-II, DELOS, ECOSUD (led by UPC), WAVELABII, FLOODsite, AQUAS (led by UPC) and MARIE (led by UPC). Most of these projects have strong environmental components and some of them, coordinated by the UPC group, deal directly with the sustainable development of fisheries and other similar “hot” topics in environmental sciences and engineering.

Staff members

Prof. Agustin Sanchez-Arcilla is Full Professor, Head of the LIM and Vice-president of the International Centre for Coastal Resources Research of the UPC. He is Civil Engineer (UPM, 1977) and PhD in Civil Engineering (UPC, 1979). He has participated in numerous National and EU funded projects such as: PREVIMED (led by UPC), RIMA (Led bay UPC), RISTE and EU projects; MEDDELT (led by UPC), FANS (led by UPC)WAVELAB, HYDRIV, HYDRALAB-II, DELOS, ECOSUD (led by UPC), WAVELABII, FLOODsite, MARIE (led by UPC), AQUAS (led by UPC), CIRCE and HYDRALAB-III. His publication record in this field includes: 15 books, more than 7 chapters of book, more than 60 articles in peer reviewed journals, more than 120 communications in international conferences and workshops and more than 200 technical reports.

Prof. Joan Pau Sierra is Associate Professor and Head of the Hydraulic, Maritime and Environmental Engineering Department of the UPC. Civil Engineer (UPC, 1984). PhD in Civil Engineering (UPC, 1990). He has participated in several EU funded research projects: FANS, COAST3D, PIONEER, DELOS, ECOSUD, MARIE, AQUAS, CIRCE, BAWAPLA and HYDRALAB-III. His publication record in this field includes: 32 papers in journals, more than 110 communications in conferences and workshops and 90 technical and research reports.

Prof. Manuel Espino is Associate Professor and Head of the Coastal Oceanography area of LIM. Civil Engineering (UPC, 1990), PhD in Marine Science (UPC, 1994). He has participated in several EU funded research projects: FANS, PACOS, MMARIE, MFSPP, MFSTEP and ECOOP. His

publication record in this field includes: 25 papers in journals, more than 100 communications in conferences and workshops and 60 technical and research reports.
Dr. Daniel Gonzalez-Marco: Graduated in Marine Sciences (ULPGC, 2000), PhD in Marine Sciences (UPC, 2005). He has participated in several EU funded research projects: DELOS, ECOSUD, FLOODsite. He is Vice-Director of the LIM and is in charge of the management tasks in this group, formed by a staff of about 40 persons, including researchers and technicians.

Participant No. 2: Katholieke Universiteit Leuven, Leuven, Belgium, KUL

The Katholieke Universiteit Leuven was established in 1425 and forms with its 13-member association the largest group for higher education in Flanders. The Hydraulics Laboratory is a research unit of the Civil Engineering Department of the Faculty of Engineering. The main aim of the KUL Hydraulics Laboratory is to generate and transfer fundamental and applied research into the field of urban and river hydrology, and coastal and estuarine engineering.

Main tasks attributed and previous experience relevant to those tasks
Main tasks attributed to KUL
The main contributions of KUL will be in WP 2 (boundary fluxes), WP4 (coupling and interaction) and WP5 (prediction limits).

Previous experience relevant to these tasks
The research activities of the KUL Hydraulics Laboratory are situated in two main fields: i) Urban and River Hydrology and Hydraulics and ii) Hydrodynamics, Sediment Mechanics and Remote Sensing of the Coastal and Estuarine Zone.
KUL was and is involved in many national research related to the above field (Marebasse, QUEST4D, Exwaco, KISS, Algased, Simulation model for two-phase flow on geophysical scale, Modelling and in situ measurement of flocullation,CCI-HYDR) and EU projects (NOWESP, COSINUS, PROMISE, MaxWave, MARIE, SEAMOCS, FRIEND/Nile, FAME, WISE (Water Information System for Europe),..). It was and is also involved in very applied projects: the development of an operational current and wave model for the Belgian coast, setting up a numerical flood model and working out composite hydrograms for river basin and urban drainage applications, Real Time Flood Forecasting.

Staff members
Prof. Jean Berlamont is full professor in hydraulic engineering, and coordinates the Belgian network on Coastal Research (http://www.bencore.be/) within the EC funded ENCORA (www.encora.org) and is an expert on river engineering, (cohesive) sediment mechanics and urban and river hydrology.
Prof. Jaak Monbaliu is professor in coastal engineering. He has published more than 50 articles in international journals and conferences on topics mainly dealing with spectral wave modelling, extreme waves, wave-current interaction, hydrodynamic modelling and remote sensing of the coastal and estuarine zone. Jaak Monbaliu will be responsible for the overall coordination and integration of K.U.Leuven contributions.
Prof. Erik Toorman is associate research professor specialised in sediment mechanics. He is author of more than 40 articles in internal journals and conferences. As an international leading scientist in the field of cohesive sediment mechanics, he is member of the international steering committee of the INTERCOH conference series (www.intercoh.com), and Editor of the Cohesive Sediment Research mailinglist (CSRList). Erik Toorman will be leading the sediment turbulence interaction contribution in WP.4
Patrick Willems is associate professor in urban and river hydraulics. He is author of more than 100 articles in international journals and conferences. His main areas of research are in mathematical

modelling of surface water runoff (both water quantity and physico-chemical water quality), analysis of hydrological extremes (both high flows and low flows), statistical analysis and stochastic modelling of the processes involved including model uncertainty. Patrick Willems will be leading the land fluxes in WP.3 and the uncertainty analysis of the border fluxes for the prediction limits estimation in WP.5.

Participant No. 3: Service Hydrografique et Oceanographique de la Marine, Brest, France, SHOM

The Naval Hydrographic and Oceanographic Office (SHOM) is a public institute related to the French Department of Defense. SHOM provides information describing the physical maritime, coastal and ocean environment, for navigation safety, military applications and the support of national maritime policies.

Main tasks attributed and previous experience relevant to those tasks:

Main tasks attributed to SHOM:

SHOM will provide an extensively validated version of the WAVEWATCH III code with both upgraded parameterizations and solvers for unstructured grids, and help set-up configurations for the different demonstrations (as part of WP1). SHOM will coordinate task 4.4. This will include the coordination of wave-current coupled modelling tests, the definition of series of benchmark tests for 3D wave-current coupling, and the definition of practical and efficient wave-current coupling methods.

Previous experience relevant to these tasks:

SHOM conducts research in the field of coastal physical oceanography, and provides services to both civilian and military users. SHOM develops theoretical and numerical models for ocean currents and waves, including their interactions, and manages operational observation systems for sea level (French Tide Gauge network "RONIM"), currents (HF-radar systems) and waves (as part of the French national network managed by CETMEF). SHOM is involved in a variety of projects, generally funded at a national level.

Staff members:

Dr. Hab. Fabrice Ardhuin is a researcher in SHOM's Military Hydrography, Oceanography and Meteorology division. He is an Engineer (Ecole Polytechnique, Palaiseau, France, 1997) and has PhD in Physical Oceanography (NPS, Monterey, USA, 2001). He is responsible for wave and nearshore research at SHOM since 2001, which included the management of the ECORS-Truc Vert 2008 experiment. He has published 28 articles in peer reviewed journals (H-index of 8), on topics ranging from coastal ocean currents, to global wave modelling and wave-current interaction theory. He received the 2008 Fofonoff Award from the American Meteorological Society.

Dr. Rudy Magne is a researcher in SHOM's Military Hydrography, Oceanography and Meteorology division, in charge of field experiments and numerical model validation. He graduated in Ocean Engineering (ISITV, Toulon, France, 2002), and obtained his PhD in Oceanography at the University of Toulon (2005). He has published 5 articles in peer reviewed journals.

Participant No. 4: GKSS – Forschungszentrum Geesthacht GmbH, Geesthacht, Germany, GKSS

The Forschungszentrum Geesthacht GmbH (GKSS) is one of 16 national research centres belonging to the Hermann von Helmholtz Association (HGF). One of the main GKSS research areas covers environmental research focusing on weather and climate in the coastal zone. GKSS has co-ordinated and participated in different EU research projects. In GKSS new instruments and automatic monitoring systems have been developed and numerical models have been used for the development of new monitoring strategies. There are well equipped computational facilities and scientific laboratories, high sophisticated analytical instruments and other facilities such as research vessels, stations and buoys for testing new sensors under operational conditions.

Main tasks attributed and previous experience relevant to those tasks

Main tasks attributed to GKSS

In this Project the major activity of GKSS is in WP 5, where the partner is leading Task 5.2 "Remote Sensing Observations" and Task 5.4 "Coastal Data Assimilation". In WP2 GKSS will contribute to Task 2.2. Wave generation/propagation models and Task 2.3. Nearshore circulation models. The contribution in WP4 is focussed on Wave-current interactions.

Previous experience relevant to these tasks

GKSS has a proven experience in the following fields: nested models for coastal areas, data assimilation, coupled hydrodynamics and sediment transport models, wave forecasting systems. Operational activities are exemplified by the implementation of a particulate matter transport model at the Federal Maritime and Hydrographic Agency of Germany (BSH). Routine wave predictions at the German Weather Center (DWD) and the BSH are based on GKSS developments. GKSS has strong collaborative links with various organizations involved in environmental monitoring and modeling, such as the *Federal Waterways* Engineering and Research Institute (BAW) and Hamburg Port *Authority* (*HPA*). GKSS has implemented several national and international measurement stations. The Department for Data Analysis and Data Assimilation at GKSS has developed numerous methods for retrieval of geophysical parameters from radar remote sensing data. GKSS possesses also world-renowned expertise in the field of bio-optical remote sensing, determining the dispersion of light, transparency, concentration of phytoplankton or suspended matter. This experience has been of particular use to the ESA in the analysis and assessment of satellite images and found promising applications in assimilating remote sensing data into numerical models. The preoperational forecasting in the frame of German COSYNA activity is carried out by the GKSS, who coordinates the contribution of partners from the German Marine Research *Consortium (KDM)*.

Staff members

Prof. Dr. Emil Stanev is heading the Department for Data Analysis and Data Assimilation at GKSS. Emil Stanev is professor at the University of Oldenburg. In the frame of IP ECOOP he leads the WP on "Synergy between coastal forecasting and newly available data and methodologies (a step towards next generation forecasting systems)". He is author of more than 90 papers in refereed journals and Editor of the journal "Ocean Modeling" (Elsevier). He was PI in EU and NATO projects dealing with different aspects of modelling hydro-eco-and-sediment dynamics.

Heinz Günther is research scientist at the GKSS. PhD in Geophysics (University of Hamburg, 1981). He has long term experience in the development, application and operational implementation of numerical wave prediction models (e.g. WAM), as well as wave modelling and data assimilation. He was co-ordinator and WP-leader in numerous national and international projects, dealing with wave modelling, wave measurement and remote sensing (ground, ship and satellite based).

Joanna Staneva is research scientist at the GKSS. Her scientific interests are in numerical physical oceanography, dynamics of shelf and semi-enclosed seas, data assimilation, regional oceanography, marine chemistry and modelling of the marine environment. She developed a nested modelling system for North Sea-German Bight-Wadden Sea. Recently, she is involved in operational applications of data assimilation with a focus on remote sensing data from radars and satellites.

Johannes Schulz-Stellenfleth is research scientist at the GKSS. In the framework of different national (FEME, SARPAK, TIDE, KORIOLIS) and European projects (MAXWAVE, COST 714, MERSEA) he worked on the derivation of ocean wave and wind parameters from synthetic aperture radar data. He presently works on the assimilation of ocean circulation models with a focus on the North Sea. In this context he is strongly involved in the COSYNA project.

Participant No. 5: Institute of Hydro-Engineering of the Polish Academy of Sciences, Gdansk, Poland, IBW-PAN

IBW PAN, employs 60 people, covers fundamental and applied research in marine and inland water engineering, coastal engineering, soil mechanics and foundation, geotechnics, geomechanics and environmental engineering. The activities of the Institute are based on the methods of applied mechanics and mathematics, both analytical and numerical. Theoretical studies are supplemented with extensive laboratory and field investigations.

Main tasks attributed and previous experience relevant to those tasks

Main tasks attributed to IBW-PAN

The contribution to the Field project will encompass the following actions: (1) contribution to WP2, task 2.3 Shelf and near-shore circulation models by developing a rip current model applicable to reflective beaches, (2) contribution to WP3, task 3.1 Land Boundary Conditions and WP4, task 4.3 Hydrodynamic interactions and coupling by application/improvement of IBW PAN 3-layer sediment transport model, component (3) contribution to WP5, task 5.4 Local assimilation by application of the neural network concept for the predictions of circulation patterns in project study sites.

Previous experience relevant to these tasks

Current and recent international projects:

FP6 ENCORA (2006-2009); FP6 FLOODsite (2004-2009); FP5 HUMOR (2001-2004); Enrich RTD Action SURVAS (1999-2001); MAST III INDIA (1997-2000); MAST III BASYS (1996-1999); MAST III PACE (1996-1999); VALIDATION (1996-1997), Polish-Dutch project; Vietnam Vulnerability Assessment (1994-1996), Polish-Dutch-Vietnamese project.

Staff members

PRUSZAK Zbigniew: PhD (1977), DSc (1990), Professor (2000). Author or co-author of about 150 publications, including 5 books on coastal engineering, sediment transport and coast dynamics, physical oceanography, climatic changes and vulnerability assessment. Key Projects: Effectiveness of Coastal Defence Measures, Polish-Dutch Project (1990-1992); Vietnam Vulnerability Assessment Study, Dutch-Polish-Vietnamese Project (1995-1996); Erosion in wave-dominated coastal zones. Consequences of climate change, NATO Research Grant: USA-Canada-Poland (1996-1997); Validation of Shore Evolution Models, Polish-Dutch Project (1996-1998); BASYS (BAltic Sea SYstem Studies), and PACE (Prediction of Aggregated Scale Coastal Evolution), MAST-III projects (1996-1999); SURVAS **(**Synthesis and Upscaling of Sea-Level Rise Vulnerability Assessment Studies-European and Global Dimensions), ENRICH RTD action (1999-2001).

OSTROWSKI Rafał: PhD (1994), DSc (2006). Author and co-author of about 50 publications and a book, as well as a number of reports on coastal engineering. Expertise on coastal dynamics and protection, applied research on hydrodynamics and sediment transport in the coastal zone. Key Projects: Vietnam Vulnerability Assessment – joint Dutch-Polish-Vietnamese project, 1994-1996 (Assistant Project Manager); MAST III – INDIA 1997-2000 (key IBW researcher), 5th FP – HUMOR 2001-2004 (team leader), INTERREG IIIC – InterMareC – ASTIR c/17/k 2005-2007 (team leader).

RÓŻYŃSKI Grzegorz: PhD (1993), DSc (2004). Author or co-author of over 20 publications in peer review journals and top international conferences on coastal engineering. Key projects: EU MAST III project Prediction of Aggregate Scale Coastal Evolution (PACE) (1997 – 99) as key IBW researcher, FP6 FLOODsite (2004-2009) – team leader, FP6 ENCORA Coordination Action (2006-2009) – co-ordinator of the Polish Network on Coastal Research.

SZMYTKIEWICZ Marek: PhD (1986), DSc (2003). Author or co-author of about 40 publications, participation and/or leadership in about 50 expert opinions on coastal engineering. Expertise on coastal engineering, coastal dynamics and protection, applied research on hydrodynamic and sediment transport in coastal zones. Key projects: project leader of two Polish-Dutch Projects 1992-1993 and 1996-1998.

Participant No. 6: Natural Environment Research Council - Proudman Oceanographic Laboratory, Liverpool, United Kingdom, NERC-POL

The Proudman Oceanographic Laboratory (POL) is a fully-owned research laboratory of the Natural Environment Research Council. Its research areas include the physics of estuarine, coastal and shelf sea circulation, wind wave dynamics and sediment transport processes, global sea level science and geodetic oceanography, marine technology and operational oceanography. POL hosts the British Oceanographic Data Centre, and the UK National Tidal and Sea Level Facility & Tide Gauge Network.

Main tasks attributed and previous experience relevant to those tasks

Main tasks atributed to NERC-POL

POL will manage WP2 concerning the setting up of the various modelling tools and will contribute to the other work packages.

Previous experience relevant to these tasks

POL has expertise in interdisciplinary modelling of estuaries and shelf-seas, nearshore coastal processes, operational measurement of sea-level, near-bed turbulence and acoustic measurement of currents and suspended matter. The POL research programme related to this proposal is *Shelf and Coastal Processes* within which are themes on Shelf Sea Processes and Sediment Dynamics, Advanced Numerical Modelling and Sustained Observations. POL has been involved in many EU projects most recently including MERSEA, ECOOP, MICORE and MyOcean. POL has developed operational models including the 3D MRCS POLCOMS model and the 2D tide-surge model, presently run at the UK Met Office. POL has strong collaborative links with various organizations involved in environmental monitoring and modeling including the Plymouth Marine Laboratory (PML) which developed the ERSEM model and the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), which operates a Smart Buoy in Liverpool Bay as part of the Coastal Observatory. As part of NERC we have access to ships and equipment and the NERC Earth Observation, Data Qcquisition and Analysis Service (NEODAAS) based at PML and the University of Dundee.

Staff members

Dr. Judith Wolf: (Band 4 scientist). Physical oceanographer, author of more than 50 refereed publications as well as numerous reports and conference proceedings. Expertise in shallow water modeling of waves, tides and surges, wave observation and analysis. She leads the Shelf Sea Processes theme at POL. She has led POL's participation in various projects including the EU FP6 MARIE project, the EPSRC-funded LEACOAST2, the Tyndall Coastal Simulator and the Joule Centre project on Tidal Power in the Eastern Irish Sea and is co-PI on several NERC-funded projects.

Dr. Alex Souza (Band 5 scientist). Over 18 years experience in shelf sea oceanography. Leader of POL Coastal and Sediment Processes theme. Specific research interest include turbulence and mixing, sediment transport dynamics, marine optics, density driven currents, internal waves and tides and marine ecosystem dynamics. PI on several NERC-funded projects and FP7 MICORE.

Dr Jason Holt: (Band 4 scientist) Leads Oceans 2025 theme on advanced numerical modelling at POL. 16 years experience of modelling, observational and laboratory based aspects of physical oceanography, specialising in the synthesis of model and observations to develop understanding of shelf-sea physical and coupled physics-biological systems. PI on several NERC and European projects.

Mr John Howarth: Has studied the dynamics of tidally dominated continental shelf seas, including their response to meteorological and density forcing, since 1969. The studies have been on all scales from turbulence upwards. He coordinated the EU MASTIII project PROVESS. Since 2001 he has led the initiation and operation of the Liverpool Bay Coastal Observatory.

Dr. Hedong Liu (Band-5 scientist). During the past 10 years, he has worked on the development and applications of 3-D unstructured and structured grid ocean models (ICOM, FVCOM, POM, ECOM_si, NEMO) at universities and national laboratories in the USA and the UK. He specialises in shelf/coastal ocean and estuary modelling and numerical methods for CFD and ocean models.

Participant No. 7: Istituto di Scienze Marine, Consiglio Nazionale delle Ricerche, ISMAR-CNR, Venice, Italy, ISMAR-CNR

The Institute of Marine Sciences of the National Research Council (ISMAR-CNR) is a 360 person Institute focused on all aspects of Oceanography. The Institute, located in Venice, has 6 other sections in Italy. ISMAR is the leading Institute on wave and current modelling of the Italian National Research Council (CNR). ISMAR has been partner and coordinator of several EC funded projects.

Main tasks attributed and previous experience relevant to those tasks

Main tasks attributed to ISMAR-CNR

For what the Project is concerned, the activity of ISMAR will be mainly dedicated to WP4: Interactions and coupling in restricted domains.

Previous experience relevant to these tasks

The working group (WG) has a long lasting experience in wind and wave modelling, including the handling and interpretation of the ERA 40 (from 1957) reanalysis wind fields. In the frame of MEDATLAS and the EC EUROWAVES and EQUIMAR projects, the WG carried out studies on distribution and analysis of extreme events. The WG has quite a good experience in data analysis and assembling wave and tidal databases, wave power estimation (EC WERATLAS Project, EQUIMAR), long term wave spectra statistics and in defining spectral shape and moments to assess down time for marine structures with respect to efficiency and operability. The WG has worked on the comparison of off-shore wave model data and satellite data, assessing the capability of the WAM and SWAN models, with which ISMAR has a more than decadal expertise on a regional and sub-regional scale.

A substantial background is also present in the field of hydrodynamic numerical modeling, from the shelf to the coastal region, of semi-enclosed basins. A variety of 3D numerical tools have been implemented by the WG in the last decades, with particular focus on the vertical mixing parameterization and on the coupling with high-resolution meteorological models that provide the surface boundary conditions. Recently, the WG helped developing an advanced fully coupled wave-current model (where nesting techniques are used to focus on areas of particular interest) to reproduce the wave field and assess the wave-3D current interactions at specific locations. The coupling to a sediment transport module describing resuspension and bedload transport allows to investigate storm effects on sediment mobilization and to describe morphodynamic variations at high resolution (from coastal to harbour-regions scale), also including river outflows in terms of water and sediment load.

Staff members

Dr. Mauro Sclavo. Scientist, author of more than 20 papers in JCR journals. Expertise in shallow water modelling, coastal protection, statistics of extremes, vulnerability and risk assessment. Formerly head of the Venice branch of CNR-ISMAR, is presently Head of the CNR research group

on “Coast vulnerability related to wave climate variations”. Co-P.I. in EC Projects (EUROWAVES, EQUIMAR) and P.I. of a Natl. Project on the impact of climate changes on the coasts (VECTOR).
Dr. Andrea Bergamasco Senior scientist, physical oceanographer. Expertise in dense water formation, dispersion and mixing processes, general circulation modelling and polar oceanography. Head of the Physical Oceanography dept. 1986-96, since 1995 is P.I. of CNR Polar Oceanography collaborations within the Italian National Antarctic Research Program (PRNA). Author of more than 40 papers in JCR journals.
Dr. Luciana Bertotti, Scientist. She has long term experience in data analysis and numerical wave modeling, and has taken part to the development of the WAM wave model and to long term calibration of wind fields, that resulted in an atlas for wind and waves in the Mediterranean Sea. Author or more than 30 papers in JCR journals.
Dr. Sandro Carniel. Scientist, physical oceanographer, author of more than 30 papers in JCR journals. Expertise in coupled hydrodynamic and wave models, turbulence measurements and modelling, sediment transport models. P.I. of a Office of Naval Research projects, co-P.I. in EC Projects (BEACHMED-e) and National Projects (VECTOR).
Dr. Luigi Cavaleri. Since 1969 researcher at ISMAR. Director of Research since 1991. Director of ISMAR from Jan 2006 till March 2007. Since 2001 member of the Scientific Advisory Committee of the European Centre for Medium-Range Weather Forecasts, Reading, U.K. Over 90 published papers on JCR journals. Main subject of research: wave measurements and modelling with application throughout the world.

Participant No. 8: DHI Water ● Environment ● Health, Horsholm, Denmark

DHI is a private research and consultancy organization established as a foundation in 1964. DHI has more 800 staff working over a broad range of disciplines ranging from marine, coastal and river hydrodynamics over environmental sciences for aquatic systems to toxicology and related health and safety issues. DHI is approved by the Danish Ministry of Science and Technology and receives a public grant for its core research. Since 1970 DHI has developed one of the most widely used numerical modeling systems for hydrodynamics and environmental use. DHI’s consulting services is based on numerical modeling, physical model tests and field studies. The services are provided from the main office in Denmark and a number of subsidiaries established around the world.

Main tasks attributed and previous experience relevant to those tasks:
Main tasks atributed to DHI: DHI will contribute with a strong operational market experience to the FIELD_AC team (WP1.1, WP1.2 and WP1.4), bringing in a highly qualified commercial software package, MIKE by DHI with more than 5000 installations worldwide (WP2.2 and WP2.3) and solid research competencies in wave and flow modelling (WP4.2, WP4.4 and WP4.6) and data assimilation (WP5.4).

Previous experience relevant to these tasks: DHI has a long list of previous experience in international research projects. Of particular relevance is NAME, Marcoast, HYDRALAB, GANES, DYNOCS and DAONEM. In additional DHI has a consolidated business in both modelling software (MIKE by DHI) and downscaling forecasting systems (www.waterforecast.com)

Staff members:
Dr. Jacob Tornfeldt Sørensen:
Dr. Jacob Tornfeldt Sørensen is currently senior researcher in the Coastal and Estuarine Dynamics Depertment at DHI. Since 1999, Dr. Tornfeldt Sørensen has been at DHI where he has been involved in several national and international research projects on data assimilation, earth observation and downscaling in oceanographic modelling. He was project leader for DHI activities

related to the ESA GMES Marcoast project and is responsible for the development of marine data assimilation and oceanographic research at DHI. Dr. Tornfeldt Sørensen holds a growing publication record in international journals and has contributed to a large number of international conferences with invited presentations and as convenor.

Dr. Erik Damgaard Christensen:

Dr Christensen has experience from many projects involving the application of advanced mathematical modelling tools to coastal and marine problems. He has been involved in several research programmes funded by Danish and European agencies. The main subjects of the research and projects have been analyses of breaking waves, flow around offshore and coastal structures, sediment transport, shoreline development, and analyses of moored ships in harbours and in the open sea.

Dr. Ole René Sørensen:

Dr Sørensen has 20 years experience developing numerical model for coastal and marine problems. He has been working as senior research Engineer from 1993 to 1999 at the International Research Centre for Computational Hydrodynamics (ICCH). The main subject of research has been wave modelling and numerical solution techniques. Dr. Sørensen has been part of the core team behind the development of a hydrodynamic modelling system based on flexible mesh approach.

Mr. Janus Larsen:

Through his employment in 1999-2005 in the International Council for the Exploration of the Sea (ICES) and subsequent employment at DHI, Janus has been responsible for Oceanographic EC projects, (ESOP, VEINS and TRACTOR) and the commercial Water Forecast. The main task has been to plan the data management for the projects, participate in the steering committee meetings, collect, convert and quality control data, create and maintain online data overviews and produce final presentation of the project results on CD-ROM. Janus has been project leader or technical lead on a number of DHI modelling or forecasting projects.

Participant No. 9: Barcelona Supercomputing Center, Barcelona, Spain, BSC

BSC (Barcelona Supercomputing Center) is the National Supercomputing Facility in Spain. BSC manages MareNostrum, one of the most powerful supercomputers in Europe (10.240 processors with a final calculation capacity of 94.21 Teraflops). BSC works in areas such as Computational Sciences, Life Sciences and Earth Sciences. The organization of BSC has a main scientific structure divided into 3 Departments. Research in Earth Sciences Department of BSC (ES-BSC) is devoted to modelling and understanding the behaviour of the Earth System, mainly focusing on climate and atmospheric processes.

Main tasks atributed to BSC

The activity of BSC will be mainly dedicated to WP2, WP3 and WP4

Previous experience relevant to these tasks

The Earth Sciences Department of the BSC has as main topics of research: high-resolution air quality and meteorological modelling; global and regional mineral dust modelling; and global and regional climate modelling. Currently, the group maintains daily high-resolution operational air quality forecasts for Europe and the Iberian Peninsula (Caliope project funded by the Spanish Ministry of the Environment) and mineral dust forecasts for the Euro-Mediterranean region and East Asia (project DREAM). The group also collaborates with the World Meteorological Organisation and the Spanish Meteorological Institute for the creation of the Regional Center for Sand and Dust Warning System (SDS-WAS) covering Europe, northern Africa and Middle-East.

Staff members

Prof. José Mª Baldasano-Recio is Chairman of the Earth Sciences Department at BSC**.** He is also full Professor of Environmental Engineering at UPC. Counsellor of the United Nations Environment Programme (UNEP), of the World Bank (WB) and expert of the Intergovernmental Panel on Climate Change (IPCC) on emission inventories. He has a considerable number of peer review international publications, proceedings of international conferences and books and chapters in books. He is member of the Editorial Board of ENVIRONews, The Series Advances in Air Pollution, Dechets, Waste Management, and Int. Journal of Sustainable Planning & Development.
Dr. Santiago Gassó-Domingo is Air quality Group Manager at BSC**.** He is also Professor in the Project Engineering Area (UPC). He has about 20 years of R&D experience, and he has been involved as coordinator in several national and international projects. He has numerous technical reports, and communications in international congresses, as well as a significant number of articles published in JCR indexed journals. His R&D activities are orientated to: Air emissions, air quality, environmental management systems and environmental decision-making.
Dr. Oriol Jorba-Casellas is Head of Research on Meteorological Modelling at BSC. Full-time research at BSC since 2005. His main topics of research cover high-resolution meteorological modelling and forecasting and their applications on air quality modelling; numerical methods applied to numerical weather prediction models, interactions between meteorology and chemistry. His work has been published in over 45 international journals and conferences. He is and has been involved in several national and international research projects (IMMPACTE, CALIOPE, EARLINET, Is-ENES).
Dr. Carlos Pérez-García-Pando is Head of Research on Mineral Dust at BSC. He has participated in 27 national and international research projects related to atmospheric sciences. His research (leading to over 25 publications in peer-review journals and more than 80 international meetings) is related mainly to the development of global and regional mineral dust models; direct and indirect dust radiative effects; air quality forecasting, lidar and sun-photometer characterization of aerosols. He also collaborates with other research communities such as ocean and health in order to assess impacts of mineral dust.
Dr. Pedro Jiménez-Guerrero is Senior Researcher at BSC. Ph.D. in Environmental Engineering (UPC, Spain, 2005). His research activities and interests have included high resolution air quality and climate modeling, development of emission inventories, boundary layer studies, chemical mechanisms and environmental impact assessment. He has co-authored over 25 papers in international scientific journals, 25 books/chapters in books and over 75 communications to international conferences. He has participated in several national (e.g. IMMPACTE, CONMED, CALIOPE, CONSOLIDER) and European Projects (e.g., EARLINET, ACCENT, ENES, PROMOTE, GLORIA).

B.2.3 Consortium as a whole

The present consortium is composed of 9 partners, from which 6 are public research institutes (SHOM, GKSS, IBW-PAN, NERC-POL, ISMAR and BSC), 2 are universities (UPC and KUL) and 1 is a research institute and commercial company, with a dual role and recognised as such (DHI). Table 2.1 indicates the work packages and tasks were the different partners contribute.

Complementarities between participants

The participants complement each other at various levels, and therefore constitute a consortium with European added value, capable of achieving the project objectives. This statement is substantiated by the following points

1. The partners complement each other across the disciplines they represent. The project covers the following three major disciplines: (a) Meteorology (b) Oceanography and (c) Coastal engineering. Each of these disciplines is actually a major area of research in the field of geosciences, each with its own literature (i.e., with its own text books and scientific journals) and undergraduate or postgraduate courses. Representation of each discipline listed above in the consortium is crucial to achieve the project objectives and there are partners specialised in all of them.

2. The second level where the project participants complement each other is through the tools and techniques employed in the project. These are: numerical modelling, in situ field observations, remote sensing and data assimilation and the consortium covers all these fields.

3. The third level where the project participants complement each other is across the participants' background. All of them present a long record of participation in research projects both at national and European levels. Some of them have coordinated large-scale research programs and projects. In particular, the scientific coordinator has coordinated several EU-funded projects (MEDDELT, FANS, SPANWAVE, ECOSUD, AQUAS and MARIE).

4. The fourth level where the project participants complement each other is across the individual work-package tasks. Each partner works in the tasks related to its expertise area (e.g. BSC in meteorological subjects, SHOM in wave-current interaction and coupling, etc.), allowing the optimization of the work and enhancing the success probabilities of the project.

5. Finally the partners also complement each other geographically (covering Mediterranean, Atlantic/North Sea and Baltic) and in terms of public/private character.

Balance between consortium composition and project objectives

As it was indicated in section 1, there are two types of objectives in this proposal: operational and scientific. Operational objectives will be achieved through WP 1, WP 3, WP 4 and WP 5. Scientific objectives will be attained through WP 2, WP 3, WP 4 and WP 5. Participants that will undertake the different tasks are shown in table 2.1. From the analysis of this table, a coherent and rather well distributed assignation of tasks can be observed, so it can be concluded that the composition of the consortium is well balanced in relation to the project objectives.

Suitability of participants

All the participants involved in the work packages have vast experience in Meteorology, Oceanography and/or Coastal Engineering. As an illustration all the references (but seven) describing the state-of-the-art have at least one (or more) co-author(s) from the partnership.

With this experience, the members of the consortium are all well suited to the work contemplated in the present project, where they can extend their knowledge/expertise and generate mutual benefit (added value) regarding the specific problems to be addressed under the proposed work packages.

In particular, all the partners have a wide experience in developing and applying meteo-oceanographic numerical models, so they are highly qualified to carry out WP 2 (meteo-oceanographic modelling tools), where the implementation of state-of-art models for coastal meteorology, waves, currents/surges and water quality will be carried out at a sufficiently high resolution. This same experience in numerical modelling together with the knowledge on meteo-oceanographic and coastal processes can be employed in WP 3 (boundary fluxes), where the best possible boundary conditions for coastal water quality modelling will be established and used.

In the same way, WP 4, which deals on the interactions and coupling between meteorological and oceanographic numerical models, can be afforded using this wide expertise on numerical modelling where the partners have been involved in the most recent coupling exercises both in the EU and in cooperation with US agencies. This ensures an efficient development of WP 4.

Finally, most participants have also a long track record on coastal observations. This experience includes some of the most developed European coastal observatories: COBS at Liverpool Bay (run by the partner NERC-POL), COSYNA at Northern Sea (from the partner GKSS), “Aqua Alta” oceanographic tower in the Gulf of Venice (from the partner ISMAR) and Badalona coastal pier and XIOM network (run by the partner UPC). These observation facilities and their spatial distributed sensors plus remote sensing data, will supply the necessary data to cover the objectives of WP 5 (field evidence and prediction limits).

Participant	WP 1					WP 2				WP 3				WP 4						WP 5						WP 6		
	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	4.5	4.6	5.1	5.2	5.3	5.4	5.5	5.6	6.1	6.2	6.3
UPC		**L**	**L**	X	**L**		X	X	**L**	X		X	X		X	X	X	**L**	X	L	X		**L**	X	X	**L**	**L**	**L**
KUL	X	X	X	X	X		X			**L**	X	**L**	X			**L**		X		X		X			X	X		X
SHOM					X		X							X			**L**		X					X				X
GKSS	X		X	X	X		X	X	X	X	X	X	X		X	X	X			X	X	**L**	X	**L**	X	X		X
IBW-PAN					X		X	X	X							X	X							X				X
POL	X		X	X	X	X	X	**L**	X	X	X	X	**L**	X	X	X	X	X	X	**X**	**L**	X	X	X		X		X
ISMAR	X	X	X	X	X		**L**	X		X	X	X	X	X	**L**	X	X		**L**	X	X				**L**	X		X
DHI	**L**		X	**L**	X		X	X							X		X		X					X		X		X
BSC		X			X	**L**					**L**			**L**														X

Table 2.1. Participants active in the various work-packages and tasks

Suitability of the coordinator
The project will be coordinated by UPC (1). UPC and, in particular, Prof A. Sanchez-Arcilla, has coordinated and participated in many national and international projects/research programs. UPC has been involved in EU MAST projects during MAST I and MAST II, MAST III, FP5 and FP6 programs. UPC (Prof A. Sanchez-Arcilla) has coordinated successfully the EU research projects MEDDELT, FANS, SPANWAVE, ECOSUD, AQUAS and MARIE. UPC has technical, financial and administrative means to undertake the coordination task, and, due to the available experience at coordinating research projects, both UPC and the coordinating scientist are considered to be well suited to this task.

Industrial involvement and end-users
End users and stakeholders are one of the most important components of the project, as emphasized in previous sections, to ensure the user-driven character of the project and the subsequent exploitation of project results. Therefore, establishing and maintaining contacts with the end users and stakeholders is one of the project mainstreams. The details of the plan of action to this end are summarized in section B2.1 and WPs 1 and 6. Table 2.2 gives a partial list of end users and stakeholders with an already signed commitment. We have also contacted a larger number of potentially interested groups / institutions which will form the starting base to disseminate the FIELD_AC expertise and results.

The partnership, supported by the ad-hoc spin-off in commercial matters, will address the transfer of FIELD_AC products and expertise according to the users' requests. The FIELD_AC output will, in this manner, make use of the partnership scientific capabilities to provide the "best" possible answer to various stakeholders with users' interests in the coastal zone.

The target groups which will benefit, directly or indirectly, from the project results are: (a) Oceanographic/Coastal Engineering groups in the form of improved knowledge; (b) European higher education institutions in the form of improved research-based education of engineers and scientists; (c) European consultant and construction firms, furnished by new local scale services, based on new (improved) resolution and accuracy levels.

The developed Coastal Operational Framework will also serve the needs of Met services and Institutions with operational (e.g. Puertos del Estado) or search and rescue responsibilities (associated by many projects to FIELD_AC participants).

Name	Address	Country	Contact Person	e-mail / Tel.
Ministerio de Medio Ambiente, Medio Rural y Marino	Plaza San Juan de la Cruz s/n 28071 Madrid	Spain	Carlos Peña Martínez	+34 915 975 852
Tarragona Harbour Authority	Passeig de l'Escullera s/n 43004 Tarragona	Spain	Francesc Sánchez	porttgna@porttarragoba.cat

Puertos del Estado	Av. Partenón 10, 28042 Madrid	Spain	Enrique Alvarez Fanjul	enrique@puertos.es
Catalan Meteorological Service	C/ Berlin 38-46, 08029 Barcelona	Spain	Sergi Paricio I Ferreró	+34 935 676 090
Cultivos Marinos del Maresme	Edificio de Cooperatiavas, Puerto s/n 08350 Arenys de Mar	Spain	Antonio Marzoa Notlevsen	+34 937 958 321
The University of Manchester	PO Box 88 Sackville St, Manchester M60 1QD	U.K.	Peter Stransby	peter.k.stransby@ manchester.ac.uk
The Port of Liverpool and Manchester Ship Canal	Maritime Centre, Port of Liverpool, L21 1LA	U.K.	Ian Holden	ian.holden@merseydocks.co.uk
Sefton Council	Ainsdale Discovery Centre,Ainsdale-on-Sea, Southport, PR8 2QB	U.K.	Graham Lymbery	graham.limbery@ technical.sefton.gov.uk
The University of Liverpool	Civil Eng. Tower, Brownlow St. Liverpool L69 3GQ	U.K.	Richard Burrows	r.burrows@liv.ac.uk
Environment Agency	Lutra House, Dodd Way, Preston, PR1 8BX	U.K.	Andrew Wither	+44 151 795 4801
Etermar	Estrada da Graça 38, 2910-520 Setúbal	Portugal	Director	+351 265 700 800
Istituzione Centro Previsioni e Segnalazioni Maree	Palazzo Cavalli, San Marco 4090, 30124 Venezia	Italy	Luigi Alberotanza	maree@comune.venezia.it
Consorzio Venezia Nuova	Palazzo Morosini, San Marco 2803, 30124 Venezia	Italy	Director	segreteria.generale@ consorziovenezianuova.com
Stato Maggiore dell'Aeronautica	Viale dell' Università 4, 00185 Roma	Italy	Massimo Capaldo	+39 649 864 872
Forschungsinstitut Senckenberg Abteilung für Meeresforschung	Südstrand 40 26382 Wilhelmshaven	Germany	Prof. Dr. B. W. Flemming	bflemming@senckenberg.de
Bundesamt fuer Seeschifffahrt und	Bernhard-Nocht-Str. 78	Germany	Stephan Dick	stephan.dick@bsh.de

Hydrographie (BSH)	20359 Hamburg			
Brockmann Consult	Max-Planck-Str. 2 21502 Geesthacht	Germany	Dr. Carsten Brockmann	carsten.brockmann@brockmann-consult.de
Applied Science Solutions, Inc.	55 Village Square Drive South Kingstown, RI 02879	USA	Eoin Howlett	+1 401 789-6224

Table 2.2. Partial list of end-users and stakeholders

Subcontracting

NERC-POL operates a Coastal Observatory (COBS) in Liverpool Bay and the data from this institution will be provided to the project. The moorings are serviced by a regular cruise several times per year. In order to extend the dataset into the nearshore zone and include further instrumentation, especially a shallow water ADCP and optical measurements with AC-S, NERC-POL will require a few extra days of ship time. In addition to the use of the Prince Madog which serves the COBS needs, this institute will make use of a coastal waters vessel for shallow water work. Ship time on RV Prince Madog (5 days @ ~£6,000 per day) and use of the Environment Agency vessel Coastal Guardian or new Liverpool University boat (15 days @ ~£1,500 per day) amount to a total £50,000 ~ 60,000 Euros.

Finally, some of the participants have expressed their plan for auditing. Auditing certificates are a cost under Management Activity and it is to be considered as a subcontract. The interested participants - UPC (1), KUL (2), GKSS (4), NERC-POL(6) and ISMAR (7) - will organize the corresponding auditing accordingly. The estimation of the cost for the above mentioned subcontracting is 3,000 € for UPC, 2,000 for KUL, 2,500 € for GKSS, 2,250€ for NERC-POL and 8,100 € for ISMAR.

Third Parties

Firstly, as it was aforementioned, some of the project tasks deal with the combined effort by the partnership and the newly created spin-off to transfer the FIELD_AC expertise and products to the already identified users. This will be supplemented by the same effort towards newly appointed users in the course of the project development.

The scientific expertise will come from the partnership while the commercial drive will be provided by the ad-hoc spin-off, under the guidance of the partners and in cooperation with selected SMEs and transfer offices at the participating countries.

The spin-off SME, participated by the Universitat Politècnica de Catalunya (UPC), which is the project coordinator, will act as Third Party, based in the existing agreement between UPC and SIMO.

The SME SIMO will develop its allocated tasks with a strong linkage to the partnership and other relevant public/private parties in participating countries. The amount foreseen to undertake the SME initial activities for FIELD_AC is 150,000 €.

The transfer of the partnership joint expertise and the developed Coastal Operational Framework requires this type of private company structure and flexibility, to ensure that the Research Institutions generate knowledge and the "prototype", while the ad-hoc spin-off will organize activities related to the transfer process to interested parties. This splitting of tasks will improve the overall efficiency and ensure the long-term sustainability of the joint venture.

More specifically, the ad-hoc SME SIMO will start from a member country (Spain) and from the initially allocated funds from the FIELD_AC budget. It will evolve from a SME supported by the UPC INNOVA program (http://pinnova.upc.edu) for University spin-offs to a self-sustainable status after the project. This approach will provide the initial "momentum" to carry out all the tasks commissioned by the project Steering Committee. These tasks will build upon the initial Business Plan here enclosed (Annex A) and the ideas included in the MoU to be signed among the partners and the ad-hoc SME. This will provide the framework to legally establish relations with the end-users from all field sites, following the expert advice of the other private research institute partner (DHI). Particular effort will be dedicated to gathering and structuring users' needs and translating them into operational or scientific requirements for the partners. Similarly regarding the issue of the public or proprietary character of many data sets included in the project activities.

This will be followed by a search for added value activities, based on the partnership expertise and advances and looking to provide "local" services in all participating countries, guided by the advice of the FIELD_AC home institutions. In all cases the ad-hoc spin-off will be closely coordinated with the other public and private parties in FIELD_AC, avoiding spurious and undesired effects. This "added value" dissemination will also include MCS providers and data related agencies such as the ESA or the EEA (for remote and in situ information, respectively). It will equally include the establishment and maintenance of the corresponding web page. Finally, the ad-hoc SME will contribute to providing a flexible and user-friendly software environment to implement the Coastal Operational Framework developed in the project.

As a final issue the newly created SME plan will present, by the end of the project, an assessment for the sustainability of the added value services and transfer of knowledge initiated in FIELD_AC, looking for long-term alliances with the partners and the public and private users contacted during the project life. This will serve to consolidate the market "niche" (downscaling and coupling at local scales with multi-variable mapping) identified by the project and will enhance the mid-term competitiveness of all partners (including now the spin-off SIMO).

Based on these considerations the Third Party founds allocated to SIMO (150.000€) will be dedicated to finance (partly) the contract of some staff and legal assessment for the spin-off support of FIELD_AC during the 3 years of project duration.

On the other hand, the International Advisory Board (IAB) will be initially composed by 4 members with expertise in organising and transferring the scientific and technological product of FIELD_AC. These members are: Eoin Howlett, Chief Executive Officer of Applied Science Associates Inc (USA); John C. Warner from the USGS (USA); Pierre Bahurel, Director of Mercator (France); Antonio Marzoa, Director of the auqaculture company Cultivos Marinos del Maresme (Spain).

The IAB budget, within the UPC –project coordinator- part is related mainly to travel and subsistance (T&S) to participate in the 3 scheduled meetings of the IAB during the project duration.

Since the meetings have been scheduled to take place in Venice, Liverpool and Barcelona, at months 12, 24 and 36 it has been possible to estimate the corresponding T&S costs. They are as follows (assuming the final number of members of the IAB will be 5, with 2 from outside the UPC):

- Total Number of trips within the EU: 3 × 3 = 9
- T&S per trip: 1,400 €
- Subotal1: 1,500 × 9 = 13,500 €

- Total Number of trips outside the EU: 2 × 3 = 6
- T&S per trip: 2,500 €
- Subotal2: 2,500 × 6 = 15,000 €

- Total = 13,500 + 15,000 = 28,500 €

Therefore, the funding for the trips of the IAB has been estimated in 28,500 €. The rest up to 90,000 correspond to T&S for the enduser and stakeholder activities included in the project.

B.2.4 Resources to be committed

Resources may be broken down in the following three categories:

- Resources indicated in Part A, related to the Requested EC Contribution.
- Resources indicated in Part A, related to the contribution to be provided by the participant’s organization (which is equal to the Total Budget minus the Requested EC Contribution).
- Resources related to any other major costs.

Each type of activity in Part A (namely, RTD, Management, and Other) is broken down into the following cost categories:

a. Personnel costs.
b. Sub-contracting costs (if any).
c. Other direct costs, which may be broken down into
    1. Travel/subsistence.
    2. Durable equipment.
    3. Consumables.

4. Other (if any)

d. Indirect costs.

<u>Resources related to Requested EC contribution</u>
Each participant has identified the method of calculating the indirect cost (item d) for their organization. With this, the total budget is calculated by A = a + b + c + d for each type of activity. Subsequently, the requested EC contribution is determined by applying the upper funding limits indicated below for each activity and for each participant:

- RTD activities with $75\% \times A$ (the latter figure, 75%, is for participants that are non profit public bodies, secondary and higher education establishments, research organizations and SMEs).
- Management activities with $100\% \times A$.
- Other activities with $100\% \times A$.

The coordinator will be responsible for the immediate transfer of the EC contribution to the participants upon its arrival, in four instalments, namely the advance payment, two in-term payments (after the approval of the first two annual reports), and the final payment after the approval of the final report.

<u>Resources related to the contribution from the participants' organizations</u> will be at the project's disposal, as committed by individual participants. These include scientific and technical personnel, observational facilities including meteo-oceanographic equipment, computing facilities and other equipment like scanners, printers, etc.

With the resources related to the EC contribution, and those related to the contribution to be provided by the participants' organizations, and stated in A3 forms, the financial plan for the project is considered to be adequate and efficient (from a value-for-money standpoint). Table 2.3 shows the institution-based budget breakdown, including both the total costs and the amount requested to the EC.

	Partners									Third Parties	
	1	2	3	4	5	6	7	8	9	SME spin-off	
	UPC	KUL	SHOM	GKSS	IBW-PAN	NERC-POL	ISMAR-CNR	DHI	BSC		
Personnel Costs											
RTD	273338	261150	144160	287717	52500	201600	209336	100246.30	125000	84375	
MNG	52064	6850	6080	5535	3500	3978	4984	9953	3500	0	
OTHER	30370	11650	0	22252	0	17920	19937	59716	0	0	
Subcontracting											
Auditing	3000	2000	0	2500	0	2250	8100	0	0	0	
Ship time	0	0	0	0	0	60000	0	0	0	0	
Other Direct Costs											
Travel	86600	35000	16000	9500	26000	10000	30500	30000	10000	7500	
Consumables	10000	10000	2000	4000	0	0	8900	0	16000	1875	
Durable Equipment	0	0	0	0	0	0	28000	0	0	0	
Third Parties											
IAB and End Users T & S	90000	0	0	0	0	0	0	0	0	0	
Indirect Costs	375339	194790	90144	210011	49200	227968	203710	197484.7	109225	56250	
TOTAL	1070711	521440	258384	541515	131200	523716	513467	405400	263725	150000	4229208
REQUESTED EC	846133.5	398980	196220	418265	99800	404658	399773	345550	200037	112500	3309416.5

Table 2.3. Institution-based budget breakdown

Specification of other major costs

The contribution required by ISMAR for "durable equipment" will cover part of the cost for a workstation cluster, inclusive of system massive storage. The cluster will be a facility fully dedicated to running the models employed in the Project. The use of a dedicated cluster is required by the computational effort involved, and blade-type architecture will ensure an exchange rate between nodes adequate to the level of parallelization in the codes.

B3. Potential impact

B.3.1 Strategic impact

How our project will contribute towards the expected impacts listed in the work programme

Coastal seas are, ecologically and economically, among the most productive areas of the world ocean and have been the subject of many international agreements and conventions looking to preserve and exploit them in a sustainable manner. Additionally, more than 120 million people live and "impact" on Europe's coastal regions and their quality of life is affected by the environmental status of its regional seas. Within this interactive loop, the discharge from the continent to the coastal sea is changing rapidly due to human activity.

As a consequence, conflicts between commerce/transport, recreation, development, environmental protection, and the management of living and non-living resources are becoming increasingly contentious and politically "charged". The social and economic costs of uninformed decisions are increasing accordingly. Without an adequate, knowledge-based, support of the interactions between coastal dynamics and human action the effective management and sustainable use of coastal areas and resources will become progressively more difficult.

In this context, the FIELD_AC project will bridge the gap between available operational (basin scale) predictions and the local scale information required for actual conflicts and decisions in the coastal area. Moreover, FIELD-AC covers the full range of variables critical in the near-shore area, namely waves, currents, surges and the fluxes of particulate matter. This holistic coverage has been deemed essential for ICZM (see e.g. McFadden, L., Nicholls, R.J. & Penning-Rowsell, E. 2007. Managing Coastal Vulnerability, Elsevier, 262 pp.) or the ICZM Protocol for the Mediterranean signed in Madrid in 2008.

FIELD_AC will have a multi-faceted impact based on the capitalization and integration of knowledge and know-how, the enhanced capability of operational services and the improved identification, in cooperation with key stakeholders, of end-users needs in restricted coastal domains.

Because of this it is expected that FIELD_AC will have a tangible "impact" on many coastal zone "decisions". The local scale meteorological predictions have been requested by harbour terminal operators but they also affect the air pollution of coastal cities (that is one of the environmental problems in e.g. the Barcelona harbour for planning the discharge of bulk ore).

The local predictions of waves near the coast will have a more critical impact since wave action is the main driving term for coastal dynamics (erosion, flooding, navigation, etc). Such wave detailed (local scale) characterization has been demanded by coastal municipalities to improve their beach management or to better maintain their coastal infrastructures (including "first line" buildings). Operational forecasting of near-shore circulation (essentially wave-induced) is fundamental for coastal sediment and pollutant transports (needed by Coastal and Water authorities). It has also a critical impact on the safety of swimmers and conditions coastal flooding. This latter aspect requires the joint (coupled in the case of FIELD_AC) prediction of waves and mean sea level at beach scales, such as it will be provided by the project.

The transport of particulate matter and the dynamics of sea water properties (such as temperature or salinity) play a key role in primary production and, thus, on the sustainable exploitation of fisheries and on the management of aquaculture farms, as indicated by our end users. These transport and dispersion results will also be important for dredging and construction companies in order to satisfy the stringent environmental criteria they have to face whenever they work on the coastal zone (an important point also highlighted by our users).

The local predictions and expertise from FIELD_AC will, therefore, benefit the sustainable "integrated" management of coastal areas, providing information useful for diagnosing eutrophication events, forecasting impulsive erosion at a given beach profile or controlling the trans-boundary fluxes of nutrients (important for fisheries) or pollutants (important for ecosystem status). Such a wealth of coastal applications will contribute to steer the project development according to actual users' needs in coastal meteo-oceanography.

More specifically, FIELD_AC will expand new GMES service capacities towards specific end users (see WP1, WP5 and WP6), opening new business lines and adding value to existing ones. This includes the development of new sensors and/or algorithms for the land-ocean border. It also refers to the gathering of coastal data, homogenizing and structuring them according to oceanographic criteria and EEA requirements, which will generate added value and help to preserve this valuable source of information (now dispersed in a number of public authorities or departments of the environment).

Because of these reasons (that will be commercially "demonstrated" through the partnership and, particularly, via the ad-hoc spin-off) FIELD_AC results will contribute to the competitiveness of European operational science and to the sustainable management of a number of pilot coastal areas, requiring urgently such an approach. This can be illustrated by the flooding events in the Venice Lagoon, the acute erosion and impulsive flooding (flash flood events in autumn) in the Catalan (Barcelona) coast or the water quality (now acute) problems in Liverpool bay.

End users and decision makers from the public and private sectors will be regularly consulted to establish a feedback loop delivering assessments of the project outputs in terms of accuracy, reliability, and adequacy to their needs. The design of the down streaming FIELD_AC services and, in particular, of the Coastal Operational Framework will be formulated taking account of their specifications, and providing enough flexibility to accommodate present and future (e.g. related to climatic variability) needs.

Why this contribution requires a European (rather than a national or local) approach.

Building such an integrated "Coastal Operational Framework" (with observing and forecasting components) requires that FIELD_AC operates at an European (rather than a national or local) level. The principal idea of carrying out the proposed research as a consortium at the European level is to achieve synergies by coordination of the participating European institutes whose expertise areas are rather diverse, but thoroughly complementary, building on existing i) numerical and "physical" expertise ii) observations from in situ networks, iii) satellite imagery from ESA (plus additional sources) and iv) local radar images. The complexity of simulations and observations preclude any advancement in a 3 year period unless a formidable combination of models, data and expertise is already available.

The above mentioned expertise is available only Europe-wide in different organizations. The project is organized in such a way that the expertise areas of the participating institutes at the European level are utilized to the greatest extent possible. This enables the project to lower the total cost of the planned work while enhancing the European added value for the consortium. On the other hand, it may be mentioned that the individual participants do not have the critical mass to undertake the research efforts contemplated in the present proposal. With the realization of the proposed joint work, the critical-mass problem will be overcome, with an immediate benefit for the EU science / technology in this field.

That is indeed the case of the FIELD_AC partnership, which has contributed to the present state of art and which offers unique expertise in coupling and local-scale knowledge and observations (see WP descriptions, previous references and institutions/research staff presentations). This ensures a clear impact aiming at providing added value for on-going larger scale projects and for coastal zone users and stake-holders. The links that the project will foster among the European operational oceanographic community and its local end users will ensure a uniform high level of expertise for European coastal zones that would be unattainable without this pan-European cooperation that covers North Sea, Mediterranean and Baltic coasts.

The foreseen developments will also contribute to maintain the competitiveness and scientific pre-eminence of the FIELD_AC partnership, in particular, and the European meteo-oceanographic "science" in general. In this sense FIELD_AC, in spite of being mainly user-driven (WP 1 and 6) aims at developing an innovative technological approach containing highly advanced research into development of better boundary conditions for the models (WP 2 and 3), model coupling (WP 4) and data analysis (WP 5).

How account is taken of other national or international research activities.

FIELD_AC will maintain a close linkage with GMES marine core services, illustrated here by the MyOcean project where one of our partners is a member and with whom we have written cooperation agreement (see e.g. the Puertos del Estado case for Spain). The simulated current fields and satellite images will be used as boundary conditions for the local circulation predictions that will also incorporate the coupled wave and surge fields. This should allow a "local" quality assessment and fruitful two-way interactions, so as to improve both the far and local fields (from a coastal perspective). To advise this cooperation the FIELD_AC coordinator has become a member – since the initial positive assessment of the project – of the MyOcean "Core User Group", where he will make the most to ensure the two-way interaction and to further define the exchanges between the MCS and our project.

The FIELD_AC partners will also make use of ESA products, notably the wave data from the Globwave project and the full range of SOPRANO products (eg. Wind fields from ERS and ENVISAT's SAR). The partnership will also use, for wave-current coupling processes, the SAR – derived currents also included in SOPRANO and the circulation fields inferred from SST or Colour images.

FIELD_AC will also coordinate with on-going national marine research activities, via partners from European operational agencies and regional cooperation of the partnership with BOOS, NOOS, IBIROOS, and MOON, where the partnership is already represented. FIELD_AC partners are also involved in other European-scale projects and initiatives, including GMES services and projects. This, together with the wave-oriented character of the research to be performed in the project development, will avoid any undesired overlap in research content between FIELD_AC and those projects and proposals.

Assumptions and external factors that may control the extent of the impacts.

The impact of FIELD_AC will cover a variety of temporal and spatial scales. It will serve the short time scale end by improved coupled predictions of storm conditions which in limited domains such as the Mediterranean may last 24 hours or less. These sharp gradients can introduce errors compared to the predicted magnitudes. The increase in prediction robustness will benefit public (Ministry of Environment, coastal municipalities) and private (small craft harbours, fishing fleets) users alike.

The FIELD_AC methodology will be tested for a wide range of meteo-oceanographic conditions which go from micro-tidal to significant tidal currents. This implies a challenge for the suite of models and their validation but it also means an enlarged set of users benefiting from it (those of the participating countries and by extension from similar coastal environments in the EU, plus those of the Advisory Board members and even from "third" countries via the final Open Forum).

Our local scale predictions will benefit a comprehensive set of safety and environmental issues. They include beach and shelf water quality in terms of the predicted fresh-water, sediment (suspended) and nutrient fluxes. This will impact coastal municipalities and fishing and aquaculture exploitations since e.g. poor water quality after a flash-flood requires closing the surrounding beaches for bathing during periods of order one week. Likewise the sea-bed accumulation of nourishment and excreted particles below fish cages needs a careful monitoring to prevent eco-system degradation and the local scale simulations will contribute to an improved management of this problem typical of sheltered environments.

The calculated velocity fields will also contribute to the safety and environmental management of the studied coastal areas. The prediction of near-shore circulation in domains with multiple groins, breakwaters and inlets – as it happens in our case studies – will reduce the number of drowning people during e.g. the September storms (a hazard common in some of our considered beaches).

To maximize the impact of project results we have included explicitly rip currents in FIELD_AC, since these currents have been claimed to be one of the causative factors for the reported drowning. Like this we have combined a scientifically difficult subject (since we shall not address directly in the project the presence of IG waves related to near-shore in-homogeneities) with an end-user request that needs a “robust” answer from the safety standpoint.

The environmental implications can be illustrated by the predicted velocities which need to consider explicitly the “irregularities” introduced by breakwaters and other coastal engineering structures. This includes harbour entrances where the predicted (coupled) wave-current fields will have a positive impact (indicated by our users) on navigation and the exchanges between harbour waters and the coastal sea. This becomes a particularly challenging task for micro-tidal environments where the measured velocities are often below 10 cm/sec (e.g. for the water renovation in Barcelona harbour) which implies predictions close to the accuracy level of our numerical codes and also comparable to the resolution of many conventional field equipment. The required research and operational work on this topic, will benefit alike harbour and coastal users but also the predictive capabilities of meteo services and consultancy firms.

The local (beach scale) predictions of wave-current-surge parameters will allow calculating run-up and flooding at a level not available before. For the first time we shall be offering the means to “calculate” using local values (e.g. common run-up formulations are based on off-shore wave values). This will have a beneficial impact on the management of coastal areas by the municipalities (e.g. beach plans) or by the corresponding local or central Ministries.

In summary FIELD_AC is expected to have a beneficial impact on mid to long-term scales (e.g. coastal management) but also on episodic event scales (e.g. hazard and rescue associated to an “impulsive” storm with a decadal return period). Likewise it will contribute positively to coastal public (e.g. fisheries departments) and private (e.g. civil engineering consultancy and construction firms) users or stake-holders. Finally it will also have a societal positive effect since the obtained local predictions and expertise can be used by schools and Universities (at different levels of depth and detail) and also raise the awareness of our coastal societies on the level of information that our technology can nowadays offer.

B.3.2 Plan for the use and dissemination of foreground

Management of knowledge and intellectual property

FIELD_AC is a user-driven project, performing problem-solving research. It therefore takes explicitly into account user needs concerning GMES information and services. This will be achieved by a core of 2 commercial companies, one of the best recognised private research institutes in the EU in the field of local scale commercial software models and a newly created spin-off.

The commercial company will combine its local scale river/urban discharges, near-shore circulation and wave (Boussinesq) models with the operational meteo-oceanographic codes available within the FIELD_AC group of Universities and Research Institutions (among the best in the EU in this field). The ad-hoc spin-off will support the transfer of the group expertise and the “Coastal Operational Frame-work” starting from the pilot experience for the selected field sites (and the studied operational TOP intervals).

This will suppose providing a locally improved operational service, tailored according to the needs of our end-users (starting from their initial list of requirements). The contribution of the newly created spin-off will ensure the practical value of the downstream service provided, while the private research institute will get an added value for its local (civil engineering) scale software codes. The overall combination will facilitate the transfer to public and private parties and the follow-up of future users’ needs or new sensor developments for the land-ocean border.

The successful completion of this project will deliver a final product that will mean a significant progress beyond the state of the art. For the partners involved, this will derive in a significant improvement in their competitiveness. The potential market in Europe for operational services is immense, so with their participation in this project, the partners are practically assuring a great demand of their services in the coming future. All this will be based in the cooperation plan and agreement included in the Memorandum of Understanding to be signed by all partners at the beginning of the project.

The new Coastal Operational Framework and coupling strategy will be the joint (intellectual) property of the partnership. The various new interaction terms and sub-modules will remain the property of their authors. The plug-in/off codes will retain their original property rights. Thanks to the flexible plug-in/off design of the Coastal Operational Framework (COF) and a clear assignment of intellectual property right from the first draft of the Memorandum of Understanding among partners, FIELD_AC will have a sound legal basis to exploit and disseminate its “production”. This will allow the use of partial modules or the full COF by the various partners as required. For instance the participating Universities will use the COF within their Master projects, after the students have signed a suitable agreement (terms) of use. The prediction results will be the joint property of the FIELD_AC team.

The innovative services that will be offered for coastal environments will lead, naturally, to an improvement of European competitiveness in this field, and a more sustainable management of our coastal societies and their activities. This will benefit public bodies, as e.g. the meteo-services or harbour, river and coastal authorities participating in FIELD_AC. The project products will also be transferred to private users/stake-holders in the coastal zone, such as fishermen associations, aquaculture, navigation and dredging companies, insurances firms and others.

One of the objectives of this project is to transfer in a commercially sustainable manner the downstream services required by the project end-users. This will imply establishing a Memorandum-of-Understanding among all project participants, partners, ad-hoc spin-off, associates and end-users. This latter point is particularly important since the aim of the spin-off is to support the sustainable transfer of the group expertise based on the

Coastal Operational Framework, in close cooperation with the participating public end-users and meteo services. The objective is to complement their activities so as to facilitate the viability of such a transfer, within the identified market opportunity.

The combination of FIELD_AC research partners, which are among the best in the EU in this field, together with the partner private research institute (one of the more recognised firms in the EU in the field of local-scale commercial software models) plus the targeted public/private end users will facilitate the commercialization of the new local-scale service and, based on this tangible product, the transfer of the group know-how.

This is the approach taken by similar initiatives elsewhere, where such cooperation has facilitated the self-sustainability of SMEs and larger returns -of all types- for all involved parties (a member of the International Advisory Board represents this type of initiative). The new service and expertise will, naturally, lead to an improvement of European competitiveness and sustainable development in this area.

Dissemination and/or exploitation of project results

By dissemination of the project results (which represent a significative technological advancement in the field of operational services) at international and national platforms, consortium partners will be able to commercially exploit the results and develop European systems which could be marketed at the international maritime and coastal sectors.

Experiences gained will be passed on to other technological and scientific centres within and outside the EU. Key organisations with the capacity of identification and promotion of good practice like CIEM (The Mediterranean Marine Research Network), IMO, EMSA (European Maritime Safety Agency) and EEA (European Environmental Agency) will be contacted for a most effective dissemination of results.

The aim in here is to better position the FIELD-AC Team in the international operational oceanography society, together with all scientific and technological users of such a product. This specifically includes the MOON, GOOS, MERSEA and MFS communities with which there are written agreements with some of the FIELD-AC partners. It also covers international programmes and organizations such as UNEP, MAP and LOICZ with which there are also long-standing and written agreements.

For the longer term applications (data base) use will be made of ICZM programmes and EU research projects (FLOODSITE, AQUAS…) and even the IPCC with which there are also links and participation from various partners of the FIELD_AC team. The establishment and maintenance of these links will be the responsibility of all the partners with long-standing experience in the international domain.

A further objective of this project is to distribute and disseminate the generic project results to an audience which include all the sectors related to coastal and maritime areas. Adequate dissemination tools (described below) will be established. The project results will also be disseminated to related projects in this area. The awareness about project results will also be enhanced within the target group via presentations at work shops, symposiums and forums.

A policy of wide dissemination of project results will be pursued and will be strongly supported by the end-users involved in this project. The methodology of the dissemination process will focus on electronic (www, FTP, mailing lists, etc.) as well as on paper (flyer, conference papers, direct mailings, press clippings and press conferences etc.) distribution and promotion to reach a large number of target organisations.

The overall dissemination plan, progressively refined with the project development, will be based on the following (see also WP 6) elements:

• Building and maintaining (during the project development) a web page to "disseminate" project activities as well as operational forecasts and multi-sensor observations. Before the end of the project an agreement with the ad-hoc spin-off will be established so that the web page is maintained within the public research institutions in FIELD_AC with the support of the SME.

• Producing a leaflet and a poster summarizing the project, its approach and a sample of the innovation and expected results. Additional single-page up-datings (to be kept inside the leaflet) will be provided during the project development to illustrate the local scale products and services. This leaflet/poster will be distributed among scientific institutions, public administrations and potential end-users not yet included in the project. Particular attention will be paid to users in EU countries not included in the partnership, to further promote the dissemination of FIELD_AC results.

• Producing a number of high-quality (peer-reviewed) scientific papers in the main journals/conferences for this field (covering the "operational" and meteo-oceanographic communities as well as the engineering, management or inter-disciplinary groups interested in the Coastal Zone). The emphasis here will be on the innovative aspects (from a scientific point of view) and on the new applications (from an operational point of view) of the project results to coastal zone management and "diagnosis" of conflicts, proactive decisions based on the advanced forecasting at local scales, etc.

• Transmitting the project achievements in a non-scientific "wrapping" to the coastal communities in the four considered field cases, using the press, TV and the corresponding services of the participant universities/institutions.

• Supporting the transfer (by the ad-hoc spin-off) of the combined expertise of the partnership in coupling, downscaling and local-scale calibration with improved access to coastal data sets. The jointly "validated" predictions will include advanced error metrics in the modelling sequence and explicit prediction limits for each variable, field case or "event" type. The SME will commercialize this know-how in cooperation with the private research institute (DHI) that will generate added value for its freshwater discharge and coastal scale packages and with the full scientific support of the partnership.

• Transferring the project results such as the Coastal Operational Framework, the simulated local fields for the four field sites (during the Target Operational Periods), the multi-variable data base and the training for our users to maximize the benefit of this new wealth of information. For that we shall address the public bodies and Agencies with coastal zone responsibilities (coastal, harbour and river authorities, coastal cities municipalities and environment departments) and the private "users" of the new level of information produced (dredging or aquaculture companies, navigation and insurance companies, construction firms, etc), including the MCS providers. The transfer will also include the meteo services (with permanent operational responsibilities) involved in the project and the ESA and EEA for the remote and in situ data respectively. Finally, we shall also feedback to climate centres and projects (e.g. the EU project CIRCE where some of the partners are involved) since the radar, simulated and in situ time series may provide useful information for climate assessments.

B4. Ethical issues

Not applicable

B5. Consideration of gender aspects

Some of the partners in FIELD_AC have gender action plans at the institutional level as part of their commitment to gender equality. These include programmes to raise awareness of the issues involved in gender equality, commitments to family friendly work practices and career breaks, and provision of child-care facilities. Organizational initiatives to encourage gender equality enjoy high level backing within partner institutes.

The FIELD_AC project intends to provide a balanced approach to the work development from the very beginning. In relation to gender aspects we shall encourage specific activities such as:

- Training and dissemination aspects of the project being female-friendly when required.
- Raising parity in the rates of female participation at all levels of the project.
- Promoting recruitment of young, talented female researchers when the gender balance may demand it.
- Encouraging participation of young female researchers in workshops, symposiums and academic meetings, particularly in partner countries where such a balanced participation is not assured.
- Adopting a positive discrimination in favour of women when the un-balanced situation requires it. This may lead to giving priority to the appointment of women in the event of a choice of equally qualified and suitable male and female candidates presenting for a given post.

- Enhancing the fruitful co-existence of the “male” (analytical) and “female” (relational) dimensions in all project activities such as in publications and on the web-site. This may affect, for example, the choice of illustrations and language.

Whenever new staff are to be recruited to work on the project all appointments will be made using equal opportunities procedures of comparable standards as those adopted by the coordinating institution (UPC) which has been recognised as one of the EU leading Universities in its commitment to equality and diversity.

In this respect, UPC aims to create conditions whereby students and staff are selected and treated solely on the basis of their merits, abilities and potential - regardless of gender, colour, ethnic or national origin, race, disability, age, socio-economic background, religious belief, trades union membership, family circumstances, sexual orientation or other irrelevant distinction. The equal opportunities policy seeks to eradicate unfair and discriminatory practices wherever they occur in the University, and to encourage a diverse community in which individuals may contribute as fully as possible. The equal opportunities monitoring form included with all application packs is not made available to any selector, but the data collected is a confidential statistical record of the monitoring and effectiveness of the policy. The application forms considered by selectors, during the short-listing process, do not contain gender information unless specifically contributed by the applicant. Short-listing is done on the basis of a list of essential and desirable skills identified by the selection panel prior to the job being advertised – at the time that the further particulars are written.

The Coordinator and project management team will strive to ensure that these (or equivalent) high standards are adopted by all beneficiaries in the selection of new staff appointed to the project. We note that these procedures are in line with those outlined by the European Platform of Women Scientists (EPWS) Position Paper on the Regulation of the European Parliament and of the Council, laying down the rules for the participation of undertakings, research centres and universities in actions under the Seventh Framework Programme and for the dissemination of research results (2007-2013)

ANNEX A: Ad-hoc Spin-off Initial Business Plan

SIMO Initial Business Plan 2010-2012
(For the FIELD_AC project)

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1. Framework

In recent decades there has been considerable development in the field of operational oceanography, advancing our understanding of atmospheric and oceanographic processes and providing numerical models which are robust and efficient enough to realistically simulate meteo-oceanographic dynamics at various time scales.

For the ocean, the application of operational scientific concepts has been carried out under the auspices of various inter-governmental organizations such as the IOC (International Oceanographic Commission of Unesco) which established in 1997 GOOS (Global Ocean Observing System), and its associated COOP (Coastal Ocean Observing Panel). In Europe there have been similar developments such as Euro-GOOS (European component of GOOS) and more local applications such as for instance Med-GOOS.

Recent research projects in this field have combined numerical simulations and field experiments, extending from large to regional scales, to address the complexity of processes, simulations and observations. The European Commission, for instance, has recently financed a cluster of operational oceanography projects that has been and continues developing several marine prototype operational systems (TOPAZ for the Arctic and North Atlantic, MFS for the Mediterranean and so on). Recently there has been a new category of projects for assessing the quality of the smaller scale observations and forecasting (such as ECOOP European Coastal Shelf Sea Operational Observing and Forecasting System) or which have considered the global monitoring and environmental safety of the earth seas at a variety of scales.

As an illustration, the recently-funded European Union, FP7 MyOcean project (2008-2011) addresses the development of GMES/MCS on a pan-European level and basin scales, bringing together 61 partners including operational agencies and a set of prototype core systems. It aims at further bringing current R&D into the operational domain and strengthening links with the US, Japan, Australia, Canada, China and emerging systems in Africa. As such it has a large-scale view of marine forecasting.

However, some of the main difficulties in local predictions (e.g. harbour or river-mouth scales) stem from the limited predictability of highly non linear "coastal" systems. Such systems are characterised by a geometrically limited domain (e.g. the coastal boundary) in which the wind-wave signal dominates (e.g. the surf zone) and where inhomogeneous and transient situations are common. This requires different parameterizations and unstructured grids, which implies introducing advanced (fragmented but available) knowledge into operational oceanography.

In this context, the FIELD_AC project (Grant agreement no. 242284, Space Call 2, FP7-SPACE-2009-1) contribution is to provide "parameters" at sufficient resolution and accuracy in terms of temporal and spatial discretizations but also, more fundamentally, in terms of local processes and coupling not normally considered. This contribution will be of real value for coastal managers, river authorities, harbour authorities and, in general, most coastal zone stakeholders and users. The inclusion of land-discharge boundary conditions, the consideration of wave and storm surge fields (coupled to the local circulation field) and the combination of satellite, radar and in situ data offer a promising path to add value to GMES marine core services in an efficient manner, since the models and most formulations are available but not yet coupled or used in an operational context.

The main progress in the project will be the expertise to harness uncertainty and error propagation through the coupled modelling sequence, particularly for systems with limited predictability. The team expertise to establish the role of remote versus local processes and the resulting errors will be "transferred" by the partners, supported by SIMO (www.simo.cat) via the corresponding Service Level Agreements (SLA) established with the users. These SLAs will include the relevant partners and selected SMEs or Technology Transfers Offices (on a country by country basis). Such agreements will establish the free exchange of results for scientific purposes and a commercial agreement for marketable applications. This combination of scientific expertise – from the FIELD_AC partnership – and commercial drive – from the UPC spin-off SIMO – will provide a symbiotic approach to the sustainable transfer of project results which requires the two types of know-how.

Thanks to this it will be possible, based on a careful testing and diagnostic plan, to assess the "local" scale performance of the coupled modelling suite. This will be achieved in FIELD_AC with the participation of a well recognised private institute (DHI) specialized in developing and commercialising software for the land component of the project and for local scale coastal (civil engineering) applications and the ad-hoc spin off SIMO.

SIMO will structure, under the partnership guidance, the transfer of research expertise, homogenised data sets and simulations from scientific partners to interested users. SIMO will, thus, support the commercial side of the project, in accordance with the agreements established among SIMO, the partners and their associated or selected national companies. This includes issues such as the web page creation and maintenance, the drafting and signing of SLAs at general, scientific and commercial levels, the look for market opportunities at local (coastal) scales, the early identification of spurious competition with national centres and companies marketing similar products but with different built-in processes and resolution and, in particular, the software environment for the "Coastal Operational Framework" that will weld together the various FIELD_AC products as required by the partnership. This commercially-oriented set of non-trivial tasks, hard to achieve from a scientific standpoint, will be the core of the spin-off activities for FIELD_AC.

The combination of EU research institutions/Universities plus a private research institute and the SIMO spin-off will offer a wide fan of transfer options for the developed expertise and the "Coastal Operational Framework" that will be the main tangible product distributed by SIMO. This software frame, with flexible plug-in/off capabilities to accommodate the requirements from users in the field sites (in terms of accuracy, resolution or even processes or preferred models) will allow an efficient assessment of MCS products as a function of local predictions (e.g. through the offshore boundary condition). This will directly lead to a feedback to MCS providers and a scientific support to agencies dealing with remote (ESA) or in-situ (EEA) data.

2. Objetives

In the framework of the FIELD_AC project, the SIMO main objective will be to work under the guidance of the partnership to contribute towards an efficient transfer of project results (see figure A). For this reason, SIMO, together with the partners and other SMEs in the participating countries, will assess the feasibility of exploiting an innovative local-scale operational service with a new level of predictions for restricted domains.

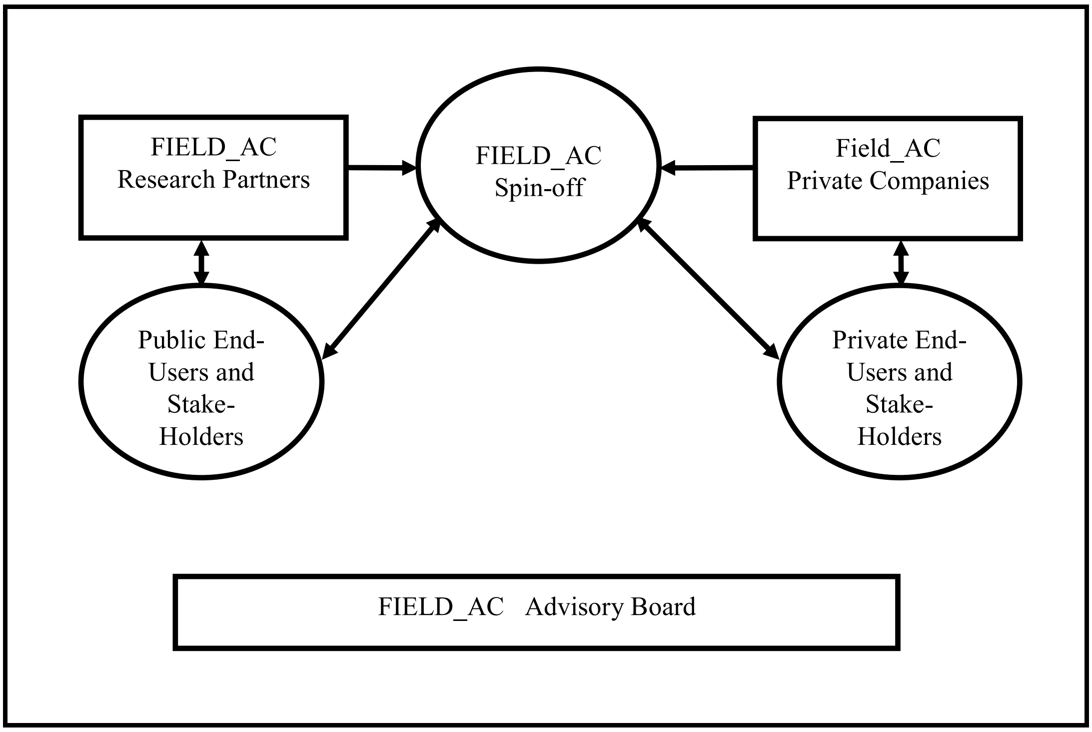

Figure A. The FIELD_AC partnership

This will serve public bodies such as the meteo-services or harbour/coastal authorities participating in FIELD_AC. The project downscaling services will also be transferred to private stake-holders and users in the coastal zone such as fishermen's associations, aquaculture, navigation and dredging companies, insurance firms and others. They have all shown their interest in more robust local-scale predictions.

SIMO will establish agreements with the project partners or their selected SMEs and/or technology transfer offices to ensure the sustainable transfer of project results. In this manner SIMO, linked initially to the project coordinator UPC in Spain, will subsequently build alliances with other companies in this field and will act as a "catalyst" for similar developments in other EU countries. Additionally SIMO will support the partnership in establishing service level agreements with the different users to facilitate the transfer of project results.

3. Company Overview

SIMO activities will deal with the transfer of numerical predictions and observational or hybrid data sets of winds, waves and currents at local (down to harbour or beach applications) scales. SIMO will thus support the FIELD_AC partnership in providing a service to coastal zone users and responsible authorities avoiding explicitly from the beginning any undesired overlaps with MCS providers and with the various national companies working in this field. The range of possible applications include aspects such as spill and waste management, fisheries and aquaculture, construction activities, and the various coastal operations related to tourism.

Based on a proposal following these ideas, in May 2009, the governing body of UPC acknowledged SIMO as a technology-based spin-off company and allowed its formal establishment with a participation of the Catalonia University of Technology UPC.

a. Product or services

SIMO products will include legal agreements, web pages, data sets (numerically simulated or from observations) and the organization support of any other added value related activities requested by possible end users. It will also address the linkage of users needs in terms of horizons, resolution, reliability and similar with the advanced expertise available in the FIELD_AC partnership. A sample list of activities where the combination of FIELD_AC products plus the marketing push of SIMO may prove symbiotic appears below

- Wave predictions: Applications to **maritime works construction companies** (interested in the proper management of their construction activities), and to **digital communication sectors** (interested in broadening their range of meteorological information with marine prediction products).
- Current Predictions: Applications to the transport of various substances (nutrients, pollutants) and to navigation routes. This will be used to predict the evolution of e.g. contaminant spills and to optimize sea routes.

b. Marketing

There is a wide list of potential customers for the combined FIELD_AC and SIMO services, including both private companies and public administrations. The first include consultancy and building firms, aquaculture companies, fishermen associations, navigation and dredging companies, harbour terminal operators and others. Among the second, there are harbour and coastal authorities, river authorities, municipalities, meteorological services, etc. Their needs for local (coastal) services widely differ depending on their activities and legal/social settings.

c. Human Resources

Initially the SIMO spin-off team will be formed by Mr. **Fernando Hermosilla**, a M. Sc. Civil Engineer with 15 years of solid professional experience dedicated to the maritime field. And Mr. **Oriol Garcés**, an MBA from ESADE, and also working as an assistant to the director of the company Tombow-Esatom.

4. Work plan

The FIELD_AC project requires an analysis of the viability and suitability of many of the project results prior to their distribution. This will also include an overview of existing similar products to maximise the added value of the scientific expertise of the FIELD_AC team and it will be carried out by SIMO, under the guidance of the partnership. The analysis will consider the existing (country by country) companies and technology transfer offices and the explicit needs of the identified users. SIMO will, thus, underpin the scientific work of the partners looking for new market niches and the overall sustainable transfer of project results, with emphasis on the commercial agreements to be established among the various parties and ,in particular, the Service Level Agreements established with the identified users, based on the initial MoU among partners and the agreement of these partners with the newly created SME.

The SIMO work plan has been structured into tasks and its overall aim will be to enhance the transfer of the partnership scientific expertise in the downscaling, coupling and local scale calibration, including the improved access to coastal data sets.

Task 1. Linking SIMO to the partnership

The objective of this task is to establish the legal and administrative pathways to ensure an efficient transfer of project results based on the scientific and engineering expertise of the partnership plus the marketing push of SIMO (the ad-hoc spin off created following the FIELD_AC rationale). This will allow transferring in a commercially sustainable manner the downstream services required by the project end-users It will imply establishing agreements among all project participants, partners and end-users. It will also require drafting Service Legal Agreements (SLA) among the partners, the ad-hoc spin off and the local (country level) SMEs selected by the partners. Since the aim of the consortium is to transfer the group expertise based on the Coastal Operational Framework, in close cooperation with the participating public end-users and meteo services, the SLAs will be prepared at 3 levels:

i) Related to the transfer of general information about the new FIELD_AC products, indicating their commercial and scientific uses.
ii) Related to the actual transfer of FIELD_AC results for commercial use, establishing the corresponding monetary counterparts.
iii) Related to the actual transfer of FIELD_AC results for scientific use, which will be free of charge but looking for complementarities in datasets, applications and similar aspects.

The combination of FIELD_AC research partners (KUL, GKSS, ISMAR, POL), which are among the best in the EU in this field, together with the partner private research institute (DHI) (one of the more recognised firms in the EU in the field of local-scale commercial software models) plus the ad-hoc spin-off SIMO and the targeted public/private end users will facilitate the future commercialization of the new local-scale services and, based on this tangible product, the transfer of the group know-how.

This is the approach taken by similar initiatives elsewhere, where such cooperation has facilitated the self-sustainability of the transfer of project results and larger returns -of all types- for all involved parties (a member of the International Advisory Board of FIELD_AC represents this type of initiative). The new service and expertise will, naturally, lead to an improvement of European competitiveness and sustainable development in this area.

Expected results:

i) Signature of agreements between partners, SIMO and end-users.
ii) Structured format for the Service Level Agreements at 3 levels:

    a. General
    b. Comercial
    c. Scientific

    to be used during the project development.

Task 2. Assessing the suitabilility of local (coastal) GMES services in restricted domains.

There is a wide list of potential end-users for the FIELD_AC operational services, including both private companies and public administrations. The first include consultancy and building firms, aquaculture companies, fishermen associations, navigation and dredging companies, harbour terminal operators and others. Among the second, there are harbour and coastal authorities, river authorities, municipalities, meteorological services, etc. Their needs for local (coastal) services widely differ depending on their activities and legal/social settings and, on many instances, they have not been made explicit. Among the "first" measures of quality required for an improved service is the spatial resolution together with the accuracy and error tolerance levels acceptable by each user. The robustness of predictions and the explicit definition of thresholds for each user/activity must be also considered from the beginning. Starting from here and with the interaction among all partners/users (POL, KUL, GKSS, ISMAR) in FIELD_AC it is expected to build a protocol (DHI, SIMO) to assess the quality of the *downstream* service *portfolios* provided for coastal (restricted) domains. This will include specific sessions with end-users and ad-hoc workshops to generate input for the critical assessment.

Expected results:

i) Development of a questionnaire for end-users and input from ad-hoc workshops
ii) Interviews with each end-user (before and after the training seminars/workshops)
iii) Assessment of the quality of downstream service portfolios in coastal restricted domains

Task 3. Transferring services to coastal-zone end-users (in restricted domains).

The aim of this task is to support the transfer of the FIELD_AC down streaming GMES operational services to the project public and private end-users in the four (restricted domains) studied field sites steered by the four "local" partners (UPC, POL, GKSS, ISMAR). For this we shall up-date the knowledge of users on the present state of coastal meteo-oceanography. We shall also familiarise all interested users with the new GMES local services, making explicit the associated errors so as to avoid creating "false" expectations. This will involve specific workshops for targeted users and more general seminars in the frame of the national and international (e.g. the Erasmus Mundus COMEM program, http://www.comem.tudelft.nl) Master Courses of the FIELD_AC Universities (UPC).

The planned capacity building will also involve SIMO, which will support the partnes to produce interactive and demo packages to motivate and facilitate the transfer of knowledge. The demo packages will be built from the predictions at the four field sites during the Target Operational Periods (TOPs), including a simple colour-coding to indicate the level of each variable compared to the users' requirements (e.g. green is acceptable, yellow is doubtful and red indicates some decision must be taken).

These packages will also benefit the participating Universities for their regular teaching activities. The proposed demonstration activities at each of the four field sites will also enhance social awareness of the new local-scale services which, through dialogue and feedback, will help to steer the project development according to users' needs. This last point will be discussed in-depth by the project end, within the open forum on Coastal Operational Oceanography that will be organised with the support of SIMO, within a regular conference (UPC, KUL, POL, GKSS, ISMAR, DHI) with large participation of potential end users (e.g. the IAHR or the Int. Conf. Coastal Eng. would provide such opportunities). The Forum conclusions will serve to steer the SIMO future activities (particularly related to the partnership and its associated SMEs) and to identify the need for further research or development in this field.

Expected results:

i) Identify / Quantify specific services and requirements for each field site
ii) Coastal scale demos for the TOPs
iii) Training workshops and University Seminars for public and privates end-users in each field site
iv) Open Forum

Task 4. Multi-disciplinary data-base.

In this task, a multidisciplinary database with key performed simulations and observations (existing coastal networks plus pilot intensive campaign) will be built and maintained (DHI, SIMO), and subsequently announced to all relevant parties (UPC, POL, KUL, GKSS, ISMAR). The objective will be the interoperability and interconnection of the data processing and delivery systems, taking into account harmonisation policies, directives such as INSPIRE, and existing standardisation initiatives, in order to facilitate an efficient acquisition and exploitation by both service providers and end users. SIMO will, under the partnership guidance, support all these activities with particular attention paid to the EEA requirements and to the compatibility with MCS data sets and the existing oceanographic data bases e.g. POL Coastal Observatory, XIOM network of UPC and ISMAR oceanographic tower “Aqua Alta”.

Expected results:

i) Support to compile local-scale (e.g. harbour and beach parameters, river-mouth discharges and similar) observations
ii) Support to compile local-scale meteo-oceanographic simulations
iii) Support to compile satellite images and other remote images (HF-radar and X-band radar will be specifically addressed but we may also consider LIDAR images where available)
iv) Support to combine in-situ and remote data plus simulations with objective quality assessment criteria and protocols

5. Budget

The enclosed budget corresponds to the initially planned SIMO activities to support the scientific work done by the FIELD_AC partners. The number and volume of activities will subsequently grow following the project development and the enhancement of applications and users' needs.

The scientific expertise will come from the partnership while the commercial drive will be provided by SIMO, under the guidance of the partners and in cooperation with selected SMEs and transfer offices in the participating countries. Since SIMO did not exist at the time of submitting the FIELD_AC proposal, it was decided to allocate the necessary resources to the coordinator (UPC). The idea to establish such a spin-off has been since the time of proposal submission presented to the coordinating University (UPC) which accepted the idea and awarded a prize to it for its innovative character. Because of that SIMO (the newly created SME) will come into practical existence and start operating with a strong linkage to the FIELD_AC partnership and other relevant public/private parties in participating countries. The amount foreseen to undertake the SIMO initial activities for FIELD_AC is 150,000 €.

The transfer of the partnership joint expertise and the developed Coastal Operational Framework requires this type of private company structure and flexibility, to ensure that the Research Institutions generate knowledge and the "prototype", while SIMO will organize activities related to the transfer process to interested parties. This splitting of tasks will improve the overall efficiency and ensure the long-term sustainability of the joint venture.

More specifically, SIMO will start from a member country (Spain) and from the initially allocated funds from the FIELD_AC budget. It will evolve from a SME supported by the UPC INNOVA program (http://pinnova.upc.edu) for University spin-offs to a self-sustainable status after the project. This approach will provide the initial "momentum" to carry out all the tasks commissioned by the project Steering Committee. These tasks will build upon this initial Business Plan and the ideas included in the MoU to be signed among the partners and the ad-hoc SME SIMO. This will provide the framework to legally establish relations with the end-users from all field sites, following the expert advice of the other private research institute partner (DHI). Particular effort will be dedicated to gathering and structuring users' needs and translating them into operational or scientific requirements for the partners. Similarly regarding the issue of the public or proprietary character of many data sets included in the project activities.

This will be followed by a search for added value activities, based on the partnership expertise and advances and looking to provide "local" services in all participating countries, guided by the advice of the FIELD_AC institutions. In all cases SIMO will be closely coordinated with the other public and private parties in FIELD_AC, avoiding spurious and undesired overlaps. This "added value" dissemination will also include MCS at various EU Universities and data related agencies such as the ESA or the EEA (for remote and in situ information, respectively). It will equally include the establishment and maintenance of the corresponding web page. Finally, the ad-hoc SME SIMO will contribute to providing a flexible and user-friendly software environment to implement the Coastal Operational Framework developed in the project.

As a final issue SIMO will present, by the end of the project, an assessment for the sustainability of the added value services and transfer of knowledge initiated in FIELD_AC, looking for long-term alliances with the partners and the public and private users contacted during the project life. This will serve to consolidate the market “niche” (downscaling and coupling at local scales with multi-variable mapping) identified by the project and will enhance the mid-term competitiveness of all partners (including now SIMO).

Based on these considerations the initial 150,000€ will be dedicated to finance (partly) the contract of some staff and legal assessment for the initial spin-off development in support of FIELD_AC during the 3 years of project duration. The insurance and social part of the salaries will be covered by the UPC program for spin-offs. All this monetary information is summarized in the following table covering the 3 years of project work

	2010	**2011**	**2012**	**Total**
Personnel	45,000€	45,000€	45,000€	135,000€
Travel	4,000€	4,000€	4,000€	12,000€
Others	1,000€	1,000€	1,000€	3,000€
Total	50,000€	50,000€	50,000€	150,000€

ANNEX B: Advisory Board and End Users support letters

MINISTERIO DE MEDIO AMBIENTE
Y MEDIO RURAL Y MARINO

SECRETARIA GENERAL DEL MAR

Carlos Peña Martínez

Subdirector General Adjunto
para la Sostenibilidad

Dr. Agustín Sánchez-Arcilla
Universidad Politécnica de Cataluña
Escuela Técnica Superior de Ingenieros
de Caminos, Canales y Puertos
C/Jordi Girona, 31
08034 BARCELONA

Madrid, a 25 de Noviembre de 2008

Sr. Sánchez Arcilla:

Esta carta es para mostrar el interés de la organización de la que formo parte, Dirección General de Sostenibilidad de la Costa y del Mar (del Ministerio de Medio Ambiente y Medio Rural y Marino) en mejorar las predicciones meteo-oceanográficas a escalas locales.

Esto se debe a la importancia que tiene, para una gestión sostenible de las playas, disponer de predicciones y diagnósticos a una escala "playera". En España esto es especialmente importante para playas como las del Mediterráneo con una alta presión de uso y en las que la calidad del agua de baño, la seguridad de los bañistas o el transporte de sedimentos hacen necesario tener estas predicciones con más precisión de la que ofrece actualmente el estado del conocimiento.

La predicción operacional de la circulación cercana a la costa, las corrientes de retorno producidas por espigones o diques, o la calidad para el surf de nuestras olas hacen que estas predicciones sean una demanda de la sociedad costera.

Por todas estas razones mi Dirección General apoya el desarrollo del proyecto de investigación FIELD_AC.

Se entiende que todos los gastos asociados al desarrollo de este proyecto para mi organización serán cubiertos por el presupuesto del proyecto FIELD_AC (particularmente los gastos asociados a tarifas aéreas, y demás gastos de viaje y alojamiento).

Cordialmente.

Plaza San Juan de la Cruz s/n
28071 Madrid
TEL.: 91 5975852

THE UNIVERSITY
of LIVERPOOL

Richard Burrows
BEng, PhD, CEng, FICE, MCIWEM
Professor of Environmental Hydraulics

Department of Engineering
Civil Engineering Tower
Brownlow Street
Liverpool
L69 3GQ

Telephone: 44 (0) 151 794 5235
Facsimile: 44 (0) 151 794 5218
E-mail: r.burrows@liv.ac.uk

Our ref: RB/GM/20th November, 2008
d:/word/rb8/letters/j wolf.doc(gm)

Dr Judith Wolf
Proudman Oceanographic Laboratory
6 Brownlow Street
Liverpool
L3 5DA

Dear Judith

Re: EU FP7 FIELD AC proposal

We have a strong ongoing research interests in many applied aspects of tidal propagation and wave dynamics in the shallow waters along our coasts, mostly focused upon shoreline management, sea defence and marine renewable energy contexts.

The downscaling you propose for your oceanographic predictions combined with more complete incorporation of river and other freshwater inputs and refined shallow water bathymetrics will substantially enhance our abilities to synthesis flow dynamics and dispersal of pollutants along the coasts, and more pertinently, within estuaries for a range of engineering studies.

I am pleased to support your proposal and I look forward to follow-up interaction during the course of the work should it succeed.

Yours sincerely

Richard Burrows

Our ref: EF/AW/JW
Your ref:

Date: 15 November 2007

Dr Judith Wolf
Proudman Oceanographic Laboratory
6 Brownlow Street
Liverpool L3 5DA

Dear Dr Wolf

FIELD_AC: Fluxes, Interactions and Environment at the Land-Ocean border. Downscaling, Assimilation and Coupling

Background and need.

The Environment Agency is the competent body in England and Wales for managing coastal flood defence and in the implementation of many of the European Directives and other legislation impacting on the Coastal Marine Environment.

Understanding the near shore coastal environment is critical to the performance of our duties, and any improvement to modelling capability is welcomed and supported by us.

We are particularly pleased to see that this proposal will provide a much improved capability to model and predict light climate. Light is a critical parameter in the prediction of eutrophication, and the EA with its partners has invested over £500 000 in recent years in developing operational eutrophication models for Transitional and Coastal (TraC) Waters. Work on further developing these models continues, and your proposal will provide a valuable supporting capability greatly improving their overall utility.

On behalf of the Agency, I am please to give my unconditional support to the proposal.

Yours faithfully

ANDREW WITHER
Principal Marine Scientist
Direct dial 0151 795 4801

Environment Agency
Lutra House, Dodd Way, Preston, PR1 8BX
Tel: 01772 339882 Fax: 01772 627730

n:\jwwork\documents\proposals\fp7\field\support letter_ea.doc

MINISTERIO
DE FOMENTO

Puertos del Estado

DIRECCION DE PLANIFICACIÓN Y DESARROLLO

11/19/2008

Dear Sir/Madam:

Puertos del Estado (State Ports Authority) is an institution dependent on the Spanish Ministry of Public Works, which has the global responsibility for the state-owned port system, comprising a total of 27 port authorities. It is in charge of co-ordinate the mentioned system and implementing the governmental ports policy.

One of the roles of the organisation is the monitoring of the physical environment affecting the Ports. This work is carried out by a Puertos del Estado department named "Área de Medio Físico" (Physical environment Department), formerly "Clima Marítimo". The services developed by the "Área del Medio Físico" are being used today by a wide range of users and the public in general. The "Área del Medio Físico" develop three main areas of activities: A) measuring networks, B) forecasts systems and C) a comprehensive database.

Since our main objective is to provide services to the State Ports, I would like to express my **highest interest in the technical and scientific results that could be derived from the FIELD_AC project.**

On one hand, we consider the team involved in the project as highly balanced and qualified. On the other, we expect to take benefit of the technical developments and scientific results originated by the project in order to exploit them in our own services to the Spanish Ports.

Finally, I would like to announce our intention of collaborating with the FIELD_AC project by all possible means: data provision from our measuring networks, knowledge interchange, etc...

Best Regards,

Enrique Álvarez Fanjul
Jefe de Área de Medio Físico

- 1 -

Avda. del Partenón,10
Campo de las Naciones
28042 Madrid – España
Tel. 91 524 55 00

Port de Tarragona

AUTORITAT PORTUÀRIA DE TARRAGONA

Sortida Nº. 200800004792
25/11/2008 13:46:51

Autoritat Portuària de Tarragona

Passeig de l'Escullera s/núm. Tel. 977 259 400
43004 Tarragona Fax. 977 225 499
E-mail: porttgna@porttarragona.cat

Referència: MEDI AMBIENT JMBR/mcs

Professor Agustín Sánchez-Arcilla
Universitat Politècnica de Catalunya
Carrer Jordi Girona 1-3 Edifici D1 Campus Nord
08034 – BARCELONA

Benvolgut Agustín,

Ens complau conèixer el vostre projecte de recerca FIELD que sens dubte refinarà les prediccions i els càlculs de riscos en una zona tan versàtil com ara la Mediterrània.

L'Autoritat Portuària de Tarragona és conscient de la necessitat de disposar d'una eina que millori les prediccions del vent, de les onades, els corrents i la dispersió de substàncies particulades, objectius del projecte FIELD, i considerem que a més a més contribuiria a optimitzar la confiança social envers a aquestes prediccions i la utilitat de les mateixes a l'hora de prendre decisions a la zona costanera i als ports en cas d'incident.

En la confiança que la vostra proposta mereixerà el recolzament adient, rebeu el nostre suport i us reiterem el nostre interès en el projecte.

Atentament,

AUTORITAT PORTUÀRIA DE TARRAGONA
MEDI AMBIENT

Francesc Sánchez
Director

24 de novembre de 2008

En cas de resposta a aquest escrit, preguem facin esment de la referència consignada a l'inici.

Servei Meteorològic
de Catalunya

Berlin, 38-46 4t
08029 Barcelona
Tel. 93.567.60.90
Fax. 93.567.61.02

Generalitat de Catalunya
Departament de Medi Ambient i Habitatge
Servei Meteorològic de Catalunya
Núm. 0161 S 931
Data 20/11/2008 Hora 12:11
Registre de sortida

Prof. Agustín Sánchez-Arcilla
Laboratori d'Enginyeria Marítima
Universitat Politècnica de Catalunya
c/ Jordi Girona, 1 - 3
Edifici D1 - Campus Nord UPC
08034 BARCELONA

Barcelona, 14th November 2008

Dear Sir,

The *Servei Meteorològic de Catalunya* (SMC, Meteorological Service of Catalonia) shows its interest for the proposal of the research project named **FIELD_AC** *(Fluxes, Interactions and Environment at the Land-Ocean Border. Downscaling, Assimilation and Coupling)* for improved local scale meteo-oceanographic predictions.

These could be applied to the predictions offered by meteorological services where the high resolution predictions within a robust framework require improved coupling and nesting strategies, considering some of the coastal border processes which are not well covered by the present state of knowledge.

Moreover, the operational predictions of near shore circulation, the rips by groynes or capes are all local scale predictions required for a better coastal sustainable management.

Because of these reasons, my institution strongly gives its support to the developments foreseen within the FIELD_AC project.

Sincerely,

Sergi Paricio i Ferreró
General Coordinator
Servei Meteorològic de Catalunya

Generalitat de Catalunya
Departament de Medi Ambient
i Habitatge

CONSORZIO VENEZIA NUOVA

Venezia, 14 NOV. 2008
Prot. n. 37425 si/gce/sli

Spettabile
ISMAR
Istituto di Scienze MARine
Riva 7 Martiri, 1364
30122 Venezia (VE)

For the attention of: Dr Luigi Cavaleri

Subject: ***Interest of the Consorzio Venezia Nuova for an improved coastal wave and tidal forecast in the Northern Adriatic Sea***

The Consorzio Venezia Nuova is heavily involved in the overall plan for the design, construction and management of the barrage system planned for the protection of the Venice town from the periodical floods associate to the Sirocco storms in the Adriatic Sea. Tidal and wave forecast systems exist in the basin. Example of the former can be found at the web site *http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1644* and *http://cvnws.port.venice.it/*.

About waves the Institute of Marine Sciences (ISMAR), in cooperation with the Italian Meteorological Service, has recently installed a high resolution operational wind and wave forecasting system for the whole Mediterranean Sea. The results are available at the web site (*http://ricerca.ismar.cnr.it/MODELLI/ONDE_MED_ITALIA/page-html/nettuno/NETTUNO2.html*).

However refined, a model at the Mediterranean scale cannot have the resolution required for a detailed study close to the coasts. This requires nested applications and a better definition of all the physical processes relevant in this area. The Consorzio Venezia Nuova is much interested in an improved system for both wave and tidal forecast on the coast of Venice and, more specifically, at the three harbour entrances where the barrages are presently under construction. The need of the town and its population for an improved tidal forecast system , possibly capable to operate several days in advance, is obvious.

Best regards.

CONSORZIO VENEZIA NUOVA

Istituzione Centro Previsioni e Segnalazioni Maree

To: Prof. Prof. Agustín Sánchez-Arcilla
Director
Laboratori d'Enginyeria Marítima
C/ Jordi Girona, 1-3 Eidificio D1
Campus Nord UPC
08034 Barcelona (España)

Palazzo Cavalli
San Marco 4090
30124 Venezia

041 2748787 *tel*
041 5210378 *fax*
041 2411996 *segret. autom.*

www.comune.venezia.it/maree
maree@comune.venezia.it

Participation of Istituzione Centro Previsioni e Segnalazioni Maree in FIELD_AC

Dear Prof. Arcilla,

I am sending this letter to confirm my full support for the project "FIELD_AC" as a Public End User.

The Istituzione Centro Previsioni e Segnalazioni Maree (ICPSM - http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1) is the body of Venetian municipality with the responsability of tidal forecast and related alert to citizens in case of flood.

The constituent parts of the proposed research aiming at providing an improved operational service for coastal areas will most likely fulfil the needs of our Institution, helping in improving local prediction and providing more refined boundary condition to our area of operation (the Venice Gulf and Lagoon).

The raising of alerts in Venice in case of dangerous marine events such as storm surges or high tides are directly related to the work planned in FIELD_AC, and I would be happy to collaborate with you and your colleagues on these issues as an end user of the project.

As discussed, and according to the rules of the Seventh Framework Program, our participation in the project will be based on our own funds at Centro Previsioni Maree on related topics, and will bear no additional cost to the European Commission.

I look forward to a fruitful collaboration on this exciting project.

Best regards,

ISTITUZIONE CENTRO PREVISIONI E
SEGNALAZIONI MAREE
PG 2008 0493956 del 20/11/2008 ore 09:50:02
Dest. Sanchez
Fascicolo : 2008.VII/5/1.1

Istituzione Centro Previsioni
e Segnalazioni Maree

Il Presidente
Prof. Luigi Alberotanza

C.P.S. MAREE · ISTITUZIONE CENTRO

CITTA' DI VENEZIA

Stato Maggiore dell'Aeronautica
GENERAL OFFICE FOR AIR SPACE AND METEOROLOGY
The Permanent Representative of Italy with WMO

ROME 17 November 2008

OUR REF. N. SMA/USAM / 002/001011/SE/

Istituto di Scienze Marine Castello 1364/A 30122
Venezia

Att.n dr Luigi Cavaleri

Subject: Interest of the Servizio Meteorologico dell'Aeronautica Militare for a better coastal modelling and forecast in the frame of the "FIELD_AC" Project.

The Italian Meteorological Service has recently established a scientific and working agreement with the Institute of Marine Sciences (ISMAR) of the Italian National Research Council for the definition of an advanced meteorological and wave forecast system in the Mediterranean Sea. The system is now operational and it produces high resolution high quality daily forecast in the Mediterranean area for the following 72 hours.
The results are freely available on the web both on our site http://www.meteoam.it and on ISMAR site http://ricerca.ismar.cnr.it/MODELLI/ONDE_MED_ITALIA/page-html/nettuno/NETTUNO2.html .

However refined, a model at the Mediterranean scale cannot have the resolution needed for a detailed study close to the coasts. This requires nested applications and a better definition of all the physical processes relevant in this area. In this framework we are aiming toward a better definition of the forecast in the coastal area, and our Service is very interested in any result leading in this direction. One particular result we are very keen about is the improvement of the conditions for a better forecast of the floods that periodically affect the town of Venice.

I look forward to a positive outcome in this area of activities.

B.Gen Massimo Capaldo Head Meteorologica Department

School of Mechanical Aerospace and Civil Engineering
University of Manchester
PO Box 88
Sackville St
Manchester M60 1QD

Dr Judith Wolf
Proudman Oceanographic Laboratory
6, Brownlow St
Liverpool L3 5DA
U.K.

24.11.2008

Dear Dr. Wolf

Re: EU FP7 FIELD_AC proposal

At Manchester University we are involved in nearshore coastal modelling requiring offshore boundary conditions. These are generally downscaled from RCMs to continental shelf models without feedback from the land-sea boundary which can be significant in certain situations. The proposed project FIELD_AC will address this limitation and will enable more genuinely coupled offshore-nearshore process modelling.

We are also interested in the obtaining data on shoreline sediment fluxes due to cliff and beach erosion and river flows particularly in flood.

We thus strongly express our support for the above proposal.

Yours sincerely,

P K Stansby

Professor Peter Stansby FREng

Sefton Council

www.sefton.gov.uk

Technical Services
Coast Defence
Ainsdale Discovery Centre Complex
The Promenade
Shore Road
Ainsdale-on-Sea
Southport
PR8 2QB

Telephone : 0151 934 2960
Fax : 01704 575628
Minicom : 0151-934-4218

Please Contact: G. Lymbery
graham.lymbery@technical.sefton.gov.uk

Our Ref: GRL/SPG
20th November 2008

Dear Dr Wolf,

Re: EU FP7 FIELD_AC proposal

I am writing in my capacities as a local coastal defence practitioner, as the Chair of the Regional Coastal Group and as the coordinating authority for the Regional Monitoring programme in the North West of England in support of Flood and Coastal defence risk Management.

I would like to express our support for the above proposal. We are interested in the obtaining data on a range of parameters in the near-shore zone, particularly with reference to forcing factors such as wind, waves and tidal currents; responses such as sediment movement and long term changes such as water level.

This proposal would benefit us through provision of relevant information and the opportunity to develop closer collaborative working arrangements with Proudman Oceanographic Laboratory enabling mutual learning. I look forward to hearing more about this project and to further developing our collaborative approach to understanding our coastal systems.

Yours Sincerely,

Graham Lymbery
Project Leader Coastal Defence

Dr Judith Wolf
Proudman Oceanographic Laboratory
6, Brownlow St
Liverpool L3 5DA
U.K.

cultivos marinos del maresme, s.a.

Edificio de Cooperativas del Mar - Puerto Pesquero s/n
Aptdo 262. 08350 - Arenys de Mar (Barcelona)

☎ 93-795.83.21
fax 93-795.82.32

Galardonada 1.996 por el Departament d'Agricultura, Ramaderia i Pesca de la Generalitat de Catalunya

Prof. **Agustín Sánchez-Arcilla**
Director
International Center for Coastal Resources Research
Laboratori d'Enginyeria Marítima LIM-CIIRC
Universitat Politècnica de Catalunya
C/ Jordi Girona, 1-3 Edificio D1 Campus Nord UPC
08034 Barcelona (España)

Arenys de Mar, 17 November 2008

Dear Mr. Agustín Sánchez-Arcilla,

This is to show the interest of my company CULTIVOS MARINOS DEL MARESME, S.A. (CULTIMAR, S.A.) for improved local scale meteo-oceanographic predictions.

The environmental management of coastal water, as required for aquaculture exploitation, needs detailed predictions of waves and currents in those areas. This may even require the coupling between waves and currents since it is important to improve the efficiency of the fish cages to know in high accuracy and resolution the dispersion and mixing of nourishments and excretions from the fish.

Because of these reasons my institution supports the developments foreseen within the FIELD_AC project.

It is understood that all the project development expenses incurred by my company will be covered by the FIELD_AC budget (particularly those associated to airfares, travel and subsistence).

Sincerely,

Antonio Marzoa Notlevsen
Director General

ETERMAR

EMPRESA CERTIFICADA eiC ISO 9001 ACREDITAÇÃO IPQ

Refª 1316-08-LCB-AMP 21-Nov-08

SUBJECT: PROJECT FIELD - AC

Dears Sirs,

This is to show the interest of my institution, ETERMAR-Empresa de Obras Terrrestres e Marítimas, S.A., for improved local scale meteo-oceanographic predictions.

This particularly applies to the requirements for coastal navigation since there may be important differences in for instance wave or wind conditions near the coast which for small ships may have an influence. Therefore we would welcome an improvement of the accuracy and resolution of local scale predictions in meteorology and oceanography.

Because of these reasons my institution supports the developments foreseen within the FIELD-AC project.

It is understood that all the project development expenses incurred by my institution will be covered by the FIELD_AC budget, (particularly those associated to airfares, travel and subsistence).

Sincerely.

ETERMAR - EMPRESA DE OBRAS TERRESTRES E MARÍTIMAS S.A

GRUPO ETERGEST

ETERMAR - EMPRESA DE OBRAS TERRESTRES E MARÍTIMAS, SA
Matrículada C. R. C. Setúbal sob o n.º 621 • Capital Social 15.000.000 EUR • Contribuinte n.º 500 101 531 • Alvará de Construção n.º 99
SEDE: Estrada da Graça 38, 2910-520 Setúbal • TLF - 265 700 800 • FAX - 265 232 399 • E-mail: - correio@etermar.pt
Delegação Aveiro: Praceta de Ílhavo n.º1, Bairro de Santiago, 3810-145 Aveiro • TLF - 234 379 790 • FAX - 234 379 799 • E-mail - del.aveiro@etermar.pt
Delegação Funchal: Rua Bela Santiago n.º 20, 9050-042 Funchal • TLF - 291 228 229 • FAX - 291 227 280 • E-mail - del.funchal@etermar.pt

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Gold Coast, Australia
Perth, Australia

www.asascience.com

November 18, 2008

Prof. Agustín Sánchez-Arcilla
Director LIM-CIIRC
C/ Jordi Girona, 1-3 Edificio D1
Campus Nord - UPC
08034 Barcelona, Spain

Re: Project FIELD_AC Project

Dear Agustín,

Thank you for inviting ASA to be part of the Advisory Board of the European R&D Project FIELD_AC: *Fluxes, Interactions and Environment at the Land-Ocean border: Downscaling, Assimilation and Coupling.*

We acknowledge that the objectives and activities of the FIELD_AC project will improve the coastal scale for operational predictions in the European Project, which fit into the scope, experience and knowledge of ASA. Once approved, we will be very pleased to contribute to the development of the project by participating on the Advisory Board and assessing project activities and outputs.

We understand that the main responsibilities of the board members would be to participate in an annual 2-day evaluation meeting during the 3-year project duration; those meetings would aim to steer the ongoing project evolution. All the traveling and lodging expenses would be covered by the project.

Sincerely,

Eoin Howlett
Chief Executive Officer

THE PORT OF LIVERPOOL AND MANCHESTER SHIP CANAL
MARINE DEPARTMENT
Maritime Centre, Port of Liverpool, L21 1LA
Telephone +44(0)151 949 6000 Fax +44(0)151 6150

Dr Judith Wolf
Proudman Oceanographic Laboratory
6, Brownlow St
Liverpool
L3 5DA
U.K.

25th November 2008

Our Ref: /Proudman/081125 -EU FP7 Proposal Support
Your Ref: EU FP7 FIELD_AC proposal

Dear Dr Wolf

Re: EU FP7 FIELD_AC proposal

The Mersey Docks and Harbour Company business involves: being the CHA (Competent Harbour Authority). As such the Port is legally responsible for the *Conservancy* of Liverpool Bay within the Port Limits.

I and the Port would like to express our support for the above proposal. We are interested in the obtaining data on the following parameters in the near-shore zone: Sediment Transport Models, Tidal Models, Current Models, Wave Height, Swell Direction, Morphology and Prediction Models for all of the previous mentioned.

This proposal would benefit us in that:
Greater accuracy models will not only help the Port in assisting to predict variance in the short-term but also allow planning for the future. This will assist with current dredging and safety of navigation, but also in modelling future development such that the sustainability of the Port may be maintained.

Yours sincerely

Ian Holden

Ian Holden
Hydrographic Manager
Tel: +44 (0)151 949 6000
Direct Dial: +44 (0)151 949 6117
Fax: +44 (0)151 949 6150
Email: ian.holden@merseydocks.co.uk

senckenberg
forschungsinstitut und naturmuseum

Wilhelmshaven
Abteilung für Meeresforschung

Senckenberg Südstrand 40 D - 26382 Wilhelmshaven

Prof. Dr. B. W. Flemming
Fachgebiet Meeresgeologie
Leiter der Abteilung für
Meeresforschung

Südstrand 40
D-26382 Wilhelmshaven
Germany

Telefon +49 (0)4421-9475-200
Telefax +49 (0)4421-9475-299
bflemming@senckenberg.de
www.senckenberg.de

To whom it may concern

02.12.2008

Letter of interest/support

The Department of Marine Science at the Senckenberg Institute, Wilhelmshaven has a great interest in reconstructions of the environmental conditions in Wadden Sea, in particular the interaction between hydrodynamics, depositional process and benthic community structure. Prediction of the environmental effects of sea-level rise on coastal evolution is also of prime research and practical interest. Recently the Department has also become involved in several research activities which deal with environmental, biological and geological tasks such as the Lower Saxony Initiatives on the "Monitoring of the North Sea" and "Habitat mapping in the Eastfrisian Wadden Sea".

It is a most timely and widely appreciated initiative that, within the framework of the Topic SPA.2009.1.1.01 Stimulating the development of downstream GMES services, several key European Institutes have defined a research project on FLUXES, INTERACTIONS AND ENVIRONMENT AT THE LAND-OCEAN BOUNDARY. DOWNSCALING, ASSIMILATION AND COUPLING (FIELD-AC). We consider both the scientific and the operational aspects of the proposal very challenging. In particular, downstream GMES service at harbour/river-mouth scales is of clear practical value. We are happy to see that there is an increased interest to maximise the use of available data (also through data assimilation).
With this letter we want to testify our continued interest in using the state of the art output and methods developed in FIELD-AC, as well as to consider joint initiatives aiming at improving the quality of coastal management, predictions and management.

Sincerly

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Prof. Dr. B. W. Flemming,
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