European ERA4CS Joint Call for Transnational Collaborative Research Projects 2016

Topic B - Researching and Advancing Climate Service Development by Institutional integration

PROPOSAL APPLICATION FORM 2016

1. Project title
Integrated approach for the **d**evelopment across **E**urope of user oriented **c**limate **i**ndicators for GFCS high-priority **s**ectors: agriculture, disaster risk reduction, energy, health, water and tourism.

2. Project acronym (max. 30 characters)
INDECIS

3. Sub-topic(s)
B1, B3

4. Duration
36 Months

5. Publishable abstract (Maximum 2000 characters; includes spaces)
Climate, climate variability and change strongly impact Europe. For example, drought severely affects agriculture; precipitation extremes are associated with flooding, severe damage to properties and lives; temperature extremes can increase mortality; the seasonality and availability of snow affects water resources and winter tourism and wind speed or sunshine hours affect the production of renewable energy. These relations can be studied through the computation of climate indices, defined as tailored combinations of climate variables. To be useful, they need to be based on long and reliable climate datasets and be formulated to express relevant and comparable information. INDECIS will provide an integrated approach to produce a set of relevant climate indices targeting the high priority sectors of the World Meteorological Organization's Global Framework for Climate Services (agriculture, disaster risk reduction, energy, health, water) plus tourism. To accomplish this, INDECIS will inventory and catalog existing datasets of precipitation, temperature, wind

speed and sunshine duration, search new data holdings and develop new methods and tools to operationally assure their quality and homogeneity. In parallel, we will gather information on climate indicators routinely computed by the participating institutions and third parties across Europe and work to improve them in consultation with sectorial experts. It is also intended to use sectorial statistics and teleconnection indices to explore predictive relations and responses to climate variability and change. This will be accompanied by the development of tools for indices near-real time calculation, spatial interpolation, visualization and communication of climate monitors. INDECIS will compare its products with those derived from reanalysis to assess their validity as alternate datasets to produce sectorial indices in the absence of observed datasets and with climate model output for validation and interpretation.

6. Key words (at least 3 and up to 10)

Climate; Indices; Homogeneity; Extremes; Agriculture; DRR; Health; Tourism; Water; Energy.

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(*Details for section 8, 9, 10, 11, 12, 13 and 14 will need to be uploaded in the form of a pdf document*)

8. Executive Summary (Maximum 2 pages)

Details should be articulated clearly, particularly with regard to the following points related to the "Excellence" criteria:

- *Fit to objectives and chosen topic of the call text*
- *(Scientific) quality and innovativeness, contribution to knowledge, originality, cutting-edge way of performing research*
- *Added value of European trans-national co-operation*

Climate services are defined as the provision of climate information in a way that assists decision making by individuals and organizations. The proposal **In**tegrated approach for the **d**evelopment across **E**urope of user oriented **c**limate **i**ndicators for GFCS high-priority **s**ectors: agriculture, disaster risk reduction, energy, health, water and tourism (INDECIS) constitutes a pan-European effort for the routine production of climate indices and specifically targeting the priority sectors of the GFCS plus tourism and their conversion into climate services by engaging the stakeholders in their definition and communication. The INDECIS consortium is integrated by 15 Research Performing Organizations (RPOs) from 12 countries and intends to maximize the benefits achievable from the use of observational data across Europe to develop climate indicators and climate services useful to assess the effects of climate variability, including extreme events, and climate change over socioeconomic systems. Climate indices are useful synthetic measures that are easily comprehensible for the stakeholders, managers, end-users and the public in general. These indices have wide applications, e.g. to determine the severity and spatial extent of a drought; to know the severity of extreme precipitation events with the purpose of improving the damage assessment and insurance management; to develop weather derived products based on cooling and heating degree day indices which are subject to a commercial exchange; to develop crop models to improve early yield predictions, etc. The development of these indices requires real time climate information and the availability of long-term historical datasets with proven quality and free of inhomogeneities. These indices become climate services when they are tailored and packaged in a way that can be adopted and used by third parties, such as other scientists, public administrations, the private sector and other stakeholders. INDECIS has two main objectives: i) to develop historical high quality, dense climate networks across Europe based on long-perspective time series of different meteorological variables (e.g. precipitation, temperature, atmospheric humidity, solar radiation, wind speed and evaporation) based on in situ measurements from which accurate and robust climate indices can be calculated and ii) generate a set of sector oriented indices and sector oriented climate services which help to understand the effects of climate change and variability over societies and cope with their impacts.

To achieve its objectives, INDECIS is structured in seven Working Packages (WPs). **WP1 Coordination,** will be in charge of ensuring that the activities of INDECIS are carried out effectively and efficiently and the work flow of the project is fully integrated for the delivery of climate services to the users. **WP2, Identification and Catalog of Climate Data Sets and**

Portal, will identify and catalog European datasets of different Essential Climate Variables (ECVs) at monthly and daily resolution and identify spatial and temporal gaps to prepare data rescue missions. WP1 will offer access to open data through a dedicated portal which will also host the climate products and services developed. **WP3. Data Quality and Homogeneity,** will produce quality controlled and homogenized datasets of the target ECVs at daily and monthly resolution using automated procedures, integrating existing approaches and developing new ones. This will include both station data and gridded datasets. **WP4. Indices Catalog, Definition and Implementation,** will involve collecting and systematizing climate indices datasets and derived products. These indices will be refined and new indices will be defined in consultation with stakeholders from the priority sectors of the GFCS plus tourism. The sectors will also be involved in defining and providing key statistics from their fields (e.g. mortality, energy production, number of tourists, crop yields, etc.) for their comparison with the climate indices. **WP5. Indices Time Evolution and Relations with the Atmosphere,** will explore data and indices developed in WPs 2 and 3 and 4 to quantify the variability and change over time, including analysis of extremes, and their link to atmospheric circulation patterns, which modulate and exacerbate climate impacts over sectors. **WP6. Evaluation of Gridded Datasets, Reanalyses and Model Output,** will examine the limits and strengths of selected gridded, reanalyzed and modeled datasets as alternative data sources to compute the indices in the absence of observations and will highlight the added-value of the newly developed indices. **WP7. Generation and Communication of Climate Services,** will transform INDECIS' climate datasets and indices into climate services, targeting a wide range of stakeholders. It will coordinate their delivery and effective communication.

INDECIS aligns with topics B1 and B3. It targets the creation of new methods and tools for climate data quality control and homogenization, indices calculation, visualization and communication to produce integrated sector oriented climate indices and services across Europe and their communication to stakeholders. The project will provide tools to evaluate the impacts of climate variability and change over key regions (e.g. Mediterranean, Arctic).and key areas (e.g. rural areas and agriculture; urban areas and health; coastal and mountain zones and tourism). The project will also integrate climatic and non-climatic data and help to better understand the relation between key priority sectors and climate extremes in the context of climate change. INDECIS aims to integrate the chain of processes, from compiling observations and the creation of climatic datasets to the production of sectorial indices and climate services – tailored to specific sectors – and the evaluation and comparison with alternative dataset like reanalysis and model data activities. INDECIS will offer to European countries a start-to-end approach for climate services provision as well as an evaluation of the added value of other sources of information. INDECIS is enabled by the trans-national cooperation between partners from western (Portugal, Spain, France, Italy, Ireland, UK), northern (Sweden, Finland) and central and eastern (The Netherlands, Belgium, Czech Republic, Romania) Europe and a mixture of academic institutions and National Meteorological and Hydrological Services ensure both access to data and knowledge.

(*Details for section 8, 9, 10, 11, 12, 13 and 14 will need to be uploaded in the form of a pdf document*)

9. Project description (Maximum 11 pages)

Graphics can be included in this section.

Details should be articulated clearly, particularly with regard to the following points related to the "Excellence" criteria:

- *Fit to objectives and chosen topic of the call text*
- *(Scientific) quality and innovativeness, contribution to knowledge, originality, cutting-edge way of performing research*
- *Added value of European trans-national co-operation*

The World Climate Conference – III (Geneva, 2009) established the Global Framework for Climate Services (GFCS). Climate Services are defined as "*the transformation of climate-related data – together with other relevant information – into customized products such as projections, forecasts, information, trends, economic analyses, assessments (including technology assessments), counselling on best practices, development and evaluation of solutions and any other service in relation to climate that may be of use for the society at large*" (Street et al., 2015). The proposal, **In**tegrated approach for the **d**evelopment across **E**urope of user oriented **c**limate **i**ndicators for GFCS high-priority **s**ectors: agriculture, disaster risk reduction, energy, health, water and tourism (INDECIS), constitutes an European effort for the routine production of climate indices based on reliable climate datasets, specifically targeting the priority sectors of the GFCS plus tourism and their conversion into climate services by engaging the stakeholders in their definition and communication.

High quality climate services must be based on reliable data with an adequate geographical and spatial coverage and free of errors and biases. Most European National Meteorological and Hydrological Services (NMHSs) have enough infrastructural capacity to maintain national datasets of terrestrial surface Essential Climate Variables (ECVs). Additionally, some of these institutions maintain regional or global datasets. Perhaps the most comprehensive pan-European dataset at the daily resolution is the European Climate Dataset and Assessment (ECA&D, Klein Tank et al., 2002; Klok et al, 2009). It is hosted by the Royal Netherlands Meteorological Institute (KNMI), and acts the Climate Data node for the WMO Regional Climate Center for Europe. Data is contributed mostly by NMHSs and other data holding institutions. It contains series for 62 countries across Europe and the Mediterranean Basin. The highest data density belongs to air temperature and precipitation. Additionally, ECA&D makes also available a gridded dataset, E-OBS for temperature, precipitation and sea level pressure (Haylock et al., 2008; van den Besselaar et al., 2011) based on ECA&D data holdings, complemented through the ENSEMBLES and EURO4M EU-FP7 projects and currently maintained as part of the EU-FP7 project UERRA.

A climate dataset needs to be quality controlled and homogenized for the production of climate services. Homogenization is defined (see Aguilar et al., 2003) as the process of removing artificial biases from a climate time series. In the last few years, the exponentially increased computer power has made possible the application of benchmarking approaches to evaluate the quality of homogenization algorithms and assess the associated uncertainty. They put the stress in reproducing real-world cross correlations, variability and frequency and characteristics of the inhomogeneities introduced. In this line, Venema et al. (2012) describes the benchmark dataset of the COST-HOME

action. It uses surrogate data (Venema et al., 2006) to produce realistic small networks of temperature and precipitation, and evaluates several algorithms at the monthly resolution. Some other ongoing efforts, mostly targeting temperature or temperature and precipitation are developing now, such as the ISTI Benchmark dataset (mean temperature, monthly resolution, see Willet et al., 2014), the MULTITEST project (temperature and precipitation at the monthly and daily resolutions, Guijarro et al. 2016) and Killick (2016), for daily temperature.

Indices derived from climate data are an attempt to objectively extract information from observations that tackles situations affecting many human and natural systems (Zhang et al., 2011). As indices are not the original data itself, but derived synthetic quantities, their exchange is easier, as demonstrated by the WMO Commission for Climatology (CCl) Expert Team on Climate Change Detection and Indices, ETCCDI (Peterson and Manton, 2008). Their set of indices are computed both over observations and models and can be coupled with simple trend analysis techniques, and standard detection and attribution methods in addition to complementing the analysis of rarer extremes using Extreme Value Theory (EVT). To further adapt the indicators to sectorial needs, another CCl team, Expert Team on Sector Indices (ETSCI, see Alexander and Herold, 2016), in consultation with technical experts from different sectors, defined or adopted 34 additional indices intended to be compared with sector specific data. Examples of those added indices are the Heating and Cooling Degree Days, key quantities to monitor energy consumption (see Oliver, J.E., 2005 for a formal definition), Growing Degree Days (Gilmore and Rogers, 1958), widely applied to agriculture, different formulations of heat wave and cold wave indices (see Perkins and Alexander, 2013), with obvious implications in the health sector and the Standardized Precipitation Index (McKee, et al., 1993) and the Standardized Precipitation and Evapotranspiration Index (Vicente-Serrano et al., 2010), cross cutting most of the previous sectors, with special importance on water management and agriculture. ETSCI Indices do not target the tourism sector, although its relevance in many European countries, justifies

Users demand true climate services: optimized climate information adapted to the specific needs of the sector of interest. For this reason, different specific – and then not comprehensive - initiatives have been developed to satisfy these demands. As a representative example, we mention the case of the regional irrigation offices located in some countries of the Mediterranean region. These offices provide information of the water needs for cultivations according to the measured atmospheric evaporative demand (AED). This information is re-elaborated from the available data of different meteorological variables (temperature, wind speed, vapor pressure deficit, net solar radiation, etc.) measured in agrometeorological networks and used to determine the water needs for cultivations. Therefore, the final user receives simple information for the real time irrigation management, which allows an optimization of the water inputs in the cultivations. This shows how synthetic information adapted to specific user needs is very helpful for operational management purposes. Other sectors that also demand information do not receive these operative inputs since the complexity of climate processes and variables involved is much higher. For example, dry-land agriculture is highly dependent on climate variability and water availability conditions, yet the variety of cultivation types (with different resistances to water stress and drought (Chaves et al., 2003), varied phenology's, cultivation practices, etc.) make it difficult to establish single climate indicators useful for the assessment of crop

conditions over large areas, and also to know the possible impact of climate conditions on crop failure or crop yield reductions. This complex pattern is also valid for other sectors. This is the case for electricity production and consumption, with complementary relationships between different climate variables for power production (Jerez et al., 2013) and the high dependence on climate variability for power consumption (e.g., power consumption for heating and cooling as a function of temperature magnitude). The wind power industry is accustomed to deal with indices such as the Wind Power Density and the Capacity Factor, which need high quality wind, temperature and pressure data. The tourism sector also shows a strong complexity and has extensively used climate information since the definition of Tourism Climatic Index (Mieczkowski, 1985). Dubois et al. (2016) review the existing indices for the touristic sector and their application in modeling the economic impact of climate change. In the same line, (re-)insurance companies, which are impacted by a range of weather hazards, need tailored indices to manage their risk exposure.

It is necessary to test the usefulness of different climate indicators for particular operative applications over a range of sectors and offer them in a solid and easy to interpret way (e.g. Papathoma-Koehle et al., 2016). This approach should consider the variety of conditions that characterize the European continent and should be an essential and preliminary analysis before any multi-sectorial real-time monitoring and early warning system. The flagship Copernicus climate change service program by the European Community (http://climate.copernicus.eu/) will produce a range of climate information and derived climate products at the European scale based on the monitoring of different atmospheric variables (http://www.copernicus.eu/main/atmosphere-monitoring). This program provides the core information that serves to feed different climate tools useful for an end-user perspective. Nevertheless, there are very few studies that have determined the usefulness of the climate information for different sectors (Freitas et al., 2008; Bachmair et al., 2015; Stagge et al., 2015), but the few existing results stress the need for a local to regional assessment of the information and the development of synthetic climate indices easy to interpret and to use by the relevant stakeholders and end-users. This would allow linking climate indices, which are easy to calculate with the currently available and future climate information, with sectorial climate impacts, which are very difficult to determine across a variety of sectors and regions.

Climate indices derived from high quality and homogeneous data can fulfill a double mission: as they become climate services if their definition and communication is aligned with sectorial demands and they are also suitable for basic research, helping to understand the mechanisms through which local and regional climate impacts those same sectors and their non-stationarities. Caloiero et al. (2011b) and Brunetti et al. (2012) use a quality controlled and homogenized dataset to describe trends in precipitation. The tendencies of the temporal rainfall concentration in Southern Italy are investigated, suggesting a trend towards a more uniform distribution of rainfall throughout the year (Coscarelli & Caloiero, 2012). This analysis has been expanded to investigate the consequences of these changes. In particular, the meteorological drought phenomena in Southern Italy is analyzed on a monthly scale by means of well-known drought indices, such as SPI or DSI (Buttafuoco et al., 2015; Caloiero et al., 2015; Caloiero et al., 2016). Drought is also investigated on a daily scale, leading to the definition of a stochastic model of monthly rainfall to analyze long dry-spells (Sirangelo et al., 2015 a, b).

Furthermore, the teleconnections between Atmospheric Circulation Indices (such as the North Atlantic Oscillation, the Mediterranean Oscillation, etc.) and rainfall in Southern Italy are investigated (Caloiero et al., 2011a; Coscarelli et al., 2013; Ferrari et al., 2013). Other authors, e.g. Dascalu et al. (2016), study drought indices computed over modeled data. Other ongoing studies on the societal impact of droughts are those conducted by the DESEMON project which is focused on the scientific study of drought in Spain, and the development of innovative tools for researchers to connect with managers and society. The research will take into account the participation of several public and private end-users at various stages and it will ensure a focused development towards the real needs of the stakeholders.

Modeling extremes and assessing their temporal changes in frequency, duration and magnitude becomes an important aspect in managing climate related risk. In a changing climate, trends in extremes are better modeled using non-stationary extreme value distributions (see Coles, 2001). Analogously, the non-stationarity can be approached by introducing a parameter linked to modes of variability such as the NAO (Van de Vyver, 2012). The variability and trends of impact-related indices is linked to weather typing configurations and teleconnection indices (Capotondi et al. 2014). Baker et al. (2016), relate extreme seasonal rainfall indices in the UK and NW Europe to the North Atlantic Oscillation (NAO) and the East Atlantic Pattern. The characteristics and metrics of precipitation extremes can be associated with thermodynamic variables (Allan and Soden, 2008; Chan et al., 2016) and large scale atmospheric circulation precursors (Brands et al, 2016) which are linked to sectorial impacts and offer potential for predictive skill (Lavers et al., 2014). A key element is the transport of moisture (Gimeno et al., 2012), including “atmospheric rivers” of enhanced humidity and wind and remote sources of moisture (e.g. Gimeno et al., 2014; Lavers et al., 2012; Ramos et al., 2015). Evolving SST patterns can influence the probability of extreme moisture/energy transports and associated impacts over Europe and the links between atmospheric circulation indices and intense moisture transport episodes can be characterized (e.g. Brands et al. 2016). In an insurable context, extreme events impact on property and people the most and are thus the priority for that sector. One of the main sources of financial losses in Europe is from flooding with additional losses caused by wind storms, hail, droughts and wildfires. Climate oscillations have been linked to variations in the frequency/intensity of these catastrophes. It is not well understood is how the risk exposure changes are linked with global climate oscillations. If these links were better understood, it would be possible to diversify risk exposure not only geographically and temporally, but also across hazards. Using climate indices used by the insurance sector and those developed in the previous section, we will investigate the change in risk exposure across regions and impact-types due to ENSO, whose impact on climate is relatively well understood.

The use of modeled data, e.g. land surface models such as, JULES (Best et al., 2011; Clark et al., 2011) can provide further details on the impacts of the situations associated to extreme indices and the human-induced changes in their relation to atmospheric circulation indices (Betts et al, 2007). Reanalyses can help broaden results and conclusions obtained with near-real time observations up to wider spatial domains. For instance, one can assess the wind resource in areas without direct observations, or obtain aggregated values per region. The use of energy and moisture transport

diagnostics (e.g. Liu et al. 2015) are fundamental in determining regional hydrological change (Muller and O'Gorman 2011), heatwaves (Miralles et al. 2014) and droughts (Trigo et al., 2013). Validating models with observations is the first step to verify its quality and understand if the model reproduces the relevant weather phenomena. The analysis should be carried out at different timescales and there is the unique possibility to identify emerging signals of climate change in a particular country relative to weather variability based on impact-relevant observations.

As described, there are many options for non-climatologists to find climate information which has the potential to contribute in the management of different societal problems. Nevertheless, too often the offered datasets lack of the adequate spatial and/or temporal coverage, are not assessed for quality and homogeneity and are complex and difficult to interpret and to apply by sectorial managers and end-users. INDECIS intends to integrate all these efforts and funnel this information to society. Thus, integrity, quality and usability are key words in the layout of this proposal.

9.2 Research plan.

The objective of INDECIS is to maximize the benefits achievable by exploiting observational data across Europe to develop climate indicators and climate services useful to assess the effects of climate variability, including extreme events, and climate change over socioeconomic systems. INDECIS will be articulated into seven Working Packages (WPs), described below. Figure 1 presents a GANTT diagram of the deliverables of the scientific WPs and Table 1 indicates the work load for each package.

WP1. Coordination. Responsible: URV-C3. WP Leader: Enric Aguilar. Duration: Months 1-36.

WP1, further described in section 10, is part of the core management of INDECIS and will be in charge of ensuring that the activities of INDECIS are carried out effectively and efficiently and the work flow of the project is fully integrated for the delivery of climate services to the users.

Tasks:

Day to day management of the Project; Coordination of meetings; Coordination of project reports and publications; Coordination of WPs work flow; Risk management of the project

Deliverables:

D1.1 Kick-off meeting report

D1.2 Mid-term report

D1.3 End of project report

WP2. Identification and Catalog of Climate Data Sets and Portal. Responsible: KNMI. WP Leader: Gerard van der Schrier. Duration: Months 1-24.

WP2 will define metadata items for the targeted ECVs (initially, temperature, precipitation, wind, humidity and radiation) in compliance with the standards of the World Meteorological Organization Information System, WIS to catalog the existing datasets. The catalog shall include non-standard variables intended for specific usage for specific sectors. For example, an effort will be made to identify and collect wind data from tall towers and oil-drilling installations at sea. Another example is the combination of sunshine duration data in ECA&D with radiation data which will be sourced from NMHS, the BSRN (Baseline Surface Radiation Network) and WMO's WRDC (World Radiation Data Center) to service the solar energy sector. The spatial and temporal coverage of the different variables

will be assessed. WP1 will make an evaluation of critical gaps to prepare and conduct both Data Rescue (DARE) missions and missions to the relevant NMHSs to engage these institutes to collaborate more actively with ECA&D and INDECIS. The stronger commitment of European NMHSs to sharing data through ECA&D may mean that in INDECIS a data policy is developed which restricts use of data to identified users. Within INDECIS, targeted services, like the calculation of climate indices of specific use for NMHSs in their national Climate Services, may need to be made available in exchange for daily station data. This Work Package will put forward ECA&D as the core of the INDECIS Data, Indices and Services Portal **(**IDISP) integrating pre-existing approaches. IDISP will link with or provide open or restricted access to data, products and services, according to the permissions negotiated with dataset owners and the providers of each product and service, including a protocol for periodical updates. In WP2, the frequency of updating station data is aimed to increase from monthly to daily, making it possible to monitor developing climatic extremes as they unfold. WP2 will also deliver the raw version of the INDECIS dataset INDECIS-RDS, including the datasets catalogued and the rescued data.

Tasks (indicating months of development):

Definition of metadata items in compliance with WIS standards (M1-M3); Inventory and catalog of climate datasets. Catalog release (M1-M6); Further establishment of terms of update, use and dissemination of climate datasets with data providers, building upon existing contacts and agreements (M1-M6); Persuading selected NMHS to participate more intensely, possibly introducing access control and/or a more strict data policy to ECA&D (M1-M6); Report on potential Data Rescue Missions (M1-M6); Data Rescue Missions (M1-M12); Operationalize daily updates of ECA&D (M12-M18); Establishing ECA&D as the core of IDISP, with the INDECIS- Raw Data Set, INDECIS-RDS (M12-M18)

Deliverables

D2.1 Inventory and Catalog of Climate Datasets

D2.2 Report on Data Rescue Missions

D2.3 INDECIS Raw-Data Set and IDISP Portal

D2.4 First update of the INDECIS Raw Data-set, including additional rescued data.

WP 3. Data Quality and Homogeneity. Responsible: URV-C3. WP Leader: Enric Aguilar.

Duration: months 1-24

WP3 will ensure the adequacy of the data used through the rest of the project. It will start with the definition of sets of quality control rules (QCR) tailored for each variable. After the definition of the QCR, WP3 will evaluate and integrate existing free open software and code new routines in a free open language (e.g. R) into a beta version of the Quality Control Software Suite (QCSS). The beta version will be tested using a benchmarking approach, in connection with the homogenization tools. INDECIS will integrate the knowledge and results from previous experiences and prepare a new benchmarking experiment, in particular targeting those variables (e.g. precipitation, wind, radiation, humidity) and resolutions (daily) for which current initiatives are not comprehensive. After the design of the benchmark datasets, based on the datasets identified by WP2, WP3 will conduct a benchmarking experiment applying the QCSS and the homogenization software previously identified and *ad-hoc*

designed software. The validation of the benchmarking experiment will help to consolidate the QCSS into a final version and identify the capabilities, strengths and weaknesses of the different homogenization approaches as well as the uncertainty associated. This will allow to develop a final procedure for the homogenization of the data included in INDECIS, the INDECIS Homogenization Suite (IHS), which will include a protocol for semi-automated re-runs, in connection with the updates of the INDECIS Portal. A first version of quality controlled and homogenized data set, INDECIS-QCHDS, will be launched to the portal and made available according to granted permission and/or made available to the data-owner for use in their own climate services. Data will be gridded using the E-OBS approach and machinery developed in the EU-FP7 UERRRA project and aggregated for each variable and the whole product will be forwarded for the exploitation of other WPs in INDECIS. This WP will interact with the H2020 EUSTACE project which aims to provide a homogenized daily temperature data set for Europe based on available ECA&D data.

Tasks

Definition of Quality Control Rules (QCRs) for the target ECVs (M1-M3); Inventory and evaluation of existing Quality Control software (M1-M3); Implementation and release of the INDECIS Quality Control; Software Suite (QCSS), including update protocols (M3-M6); Inventory of existing homogenization benchmarking projects (M1-M3); Inventory of existing free and open source software for automatic or semi-automatic homogenization (M1-M3); Definition and implementation of the INDECIS benchmarking process (M1-M9); Evaluation of benchmark results (M10-M12); Development of algorithms to improve homogenization results (M6-M12); Development of the INDECIS Homogenization Homogenization Suite (IHS), including the best performing algorithms, including update protocols (M12-M15) ; Quality control and homogenization of the INDECIS-RDS, generation of the INDECIS Quality Controlled and Homogenized Data Set, INDECIS-QCHDS (M15-M18); Release of the INDECIS-QCHDS for incorporation into the IDISP, according to granted permissions and including update protocols. (M15-M18); Analysis of the uncertainty introduced by the homogenization process (M19-M24)

Deliverables

D3.1 INDECIS Quality Control Software and Manual

D3.2 Report on Recommended Homogenization Technics based on Benchmarking Results

D3.3 Release of the INDECIS Homogenization Suite and Manual

D3.4 Release of INDECIS-QCHDS (Station data and gridded versions)

D3.5 Report on the uncertainty of the homogenization process

WP4, Indices Catalog, Definition and Implementation. Responsible: IPE/CSIC. WP Leader: Sergio Vicente-Serrano. Duration: 1-24

WP4 will deal with the inventory and catalog of existing climate indices prior to the definition of a new set of sectorial relevant indices and their calculation using the INDECIS-QCHDS. INDECIS will combine standard climate indices and adapt them to the target sectors. Also, more advanced diagnostics relating to characteristics of rainfall, impact-relevant fingerprints of multiple indices (temperature/rainfall/radiation) and the use of horizontal moisture and energy transports to complement standard metrics will be considered. The catalog will be followed by the reformulation of

the indices and definition of new metrics, in consultation with representatives from the key GFCS sectors plus tourism. WP4 will make a statistical analysis of these indices to determine their advantages and shortcomings from a theoretical point of view in terms of spatial comparability, temporal coherence, and the reliability of their implementation. Again in consultation with the sectors, WP4 will define a list of non-climatic statistics (e.g. mortality/morbidity data, energy production/consumption, road accidents, crop yields and phenological indicators, economic and human losses, water availability, tourism nights, etc.) and gather datasets of these variables for comparison to the indices. It will also analyze a wide array of information sources such official reports and satellite information for different regions of Europe: crop yields, phenology, hydropower production, wind and solar production, power consumption, streamflow, forest fires, reservoir storages, groundwater, etc. Using this information, WP4 will analyze relations between sectorial data and different climate indices to determine the response and sensitivity of sectorial variables to the different climate indices. WP4 will also analyze the thresholds of the different indices that cause an impact in the different sectorial variables, which may be useful as early warning indicators. The purpose is to determine the most suitable climate index to monitor impacts in a variety of sectors. The indices and sectorial dataset (INDECIS-ISD) will be integrated – according to granted permissions – into the IDISP, including update protocols.

Tasks

Inventory and catalog of existing climate indices datasets, according to WIS standards (M1-M6); Communication and coordination with sectorial experts in the Agriculture, Health, Water management, Disaster Risk Reduction, Energy, Tourism and the cross-cutting sector of Insurance for the definition of specific-purpose sectorial indices (M1-M12); Communication and coordination with sectorial experts for the identification of a set of sector-specific statistics (M1-M12); Creation and application of a software suite for indices calculation and comparison with sectorial data. (M12-M18) ; Integration of Indices and Sectorial Dataset (INDECIS-ISD) into de IDISP, according to granted permissions (M18-M21); Analysis of the statistical relations between climate indices and sectorial statistics (descriptive statistics and lagged relations) (M21-M24)

Deliverables

D4.1 Report on the Inventory and Catalog of Indices Datasets

D4.2 Report on Indices of INDECIS-ISD, including definitions, and accompanying sectorial data.

D4.3 Release of the Software Suite for indices Calculation

D4.4 INDECIS-ISD released and integrated into de IDISP.

D4.5 Report on comparison of the ISD with sectorial data.

WP5. Indices Time Evolution and Relations with the Atmosphere. Responsible: UREAD. WP Leader: Richard Allan. Duration: M10-M33

WP5 will explore data developed in WPs 2 and 3 and indices developed through WP4 to quantify the variability and change over time, including analysis of extremes, and their link to atmospheric circulation patterns which modulate and exacerbate climate impacts over sectors. This will be assessed by exploring and describing the statistical relationships between the indices integrated into IDISP and evaluating the predictability skills of lagged interconnections. The statistical analyses will be

supplemented with investigation of the physical processes that govern the links between atmospheric variability, extremes and sector-relevant indices. The unique set of diagnostics will also enable analysis of the emergence of climate change signals relative to weather variability to be investigated for the first time from an impact-relevant observationally-based perspective. This work will also feed into WP4 to influence the way climate indices are presented and communicated and will link to WP5 in identifying remote sources and magnitudes of moisture and energy transports and associated modes of atmospheric variability relating to extreme events across Europe using reanalysis and climate modeling capabilities to advance process understanding.

Tasks:

Compilation of teleconnective indices, weather types, blocking patterns, Atmospheric Rivers and other indicators of atmospheric variability (M10-M13); Analysis of temporal evolution of the INDECIS-QCHDS and preliminary/additional datasets, including derived extremes (M14-M21); Analysis of temporal evolution of the INDECIS-ISD. (M22-M28); Investigation of the physical links between atmospheric variability, extremes and sectorial indices, with special emphasis on drought, heatwaves and agriculture. (M24-M33); Investigation of time-emergence of observed climate change signal relative to variability (M24-M33)

Deliverables:

D5.1 Inventory and Catalog of Indicators for comparison with the INDECIS-ISD

D5.2 Report on temporal evolution of the INDECIS-QCHDS and INDECIS-ISD, including the time-emergence of climate-change signals and relation with atmospheric patterns.

D5.3 Report on the relation between INDECIS-QCHDS and INDECIS-ISD and atmospheric patterns.

WP6. Evaluation of Gridded Datasets, Reanalyses and Model Output. Responsible: MeteoRom. WP Leader: Liliana Velea. Duration: M16-M33

WP6 will examine the limits and strengths of the available gridded, reanalyzed and modeled datasets as alternative data sources to compute the indices, in the absence of observations and will highlight the added-value of the newly developed indices. The first task of this group will be to inventory and catalog selected hindcasts of climate simulations (e.g. FP6-CECILIA, CMPI5, ENSEMBLE or EuroCORDEX), reanalysis products (e.g. ERAI, MERRA, JRA55, ERA-20C, 20CR; REAN6 and MESCAN at the regional level) as well as gridded observational datasets. Next, WP6 will define a set of statistical measures, including the widely used Taylor diagram, for the inter-comparison of selected datasets. A software suite will be designed/adapted for this purpose, focusing on the comparison of newly developed, sectorial indices (defined in WP4). In order to investigate the added values of the INDECIS-ISD, a series of pilot sectorial applications will be developed. The first type of applications will focus on the applicability of INDECIS-ISD in terms of seasonal forecasting; the skills of seasonal forecast systems and the applicability of seasonal forecast outputs for 3 sectors (agriculture, energy and tourism) will be evaluated through a series of selected indices from INDECIS-ISD. 5 pilot studies, focusing on areas with different environmental conditions (North Sea for the wind energy pilot study, Spain and France for agriculture, Finland for agriculture and tourism) will evaluate the performance of seasonal forecast hindcast simulations provided by the UC-IH group through their ECOMS User Data Gateway (http://www.meteo.unican.es/ecoms-udg), in predicting the selected

sector-oriented indices. The newly developed indices calculated from the past seasonal forecasts will be verified against those calculated from reanalysis. Reliability and uncertainties will be estimated using standard verification methodology. The comparison will help to assess the quality and usability of newly developed sectorial indices at seasonal scale, for monitoring and/or early-warning purposes; it will also contribute to the design of basic semi-automated free climate services (e.g. monitors and watches) prepared to meet general sectorial needs (WP7). The second type of application of the INDECIS-ISD will focus on the assessment of sectorial climate change impact based on INDECIS derived indices in the context of the latest climate change scenarios (EUROCORDEX), in the near-future (2021-2050) and on long term (2070-2100).

Tasks.

Inventory, catalog and selection of observation-based gridded datasets, reanalysis products and climate models outputs to be used. (M16-M18); Definition of a set of statistical measures for the inter-comparison of selected datasets with the INDECIS-QCHDS and the INDECIS-ISD. (M19-M24); Creation of a software suite to implement the dataset comparisons. (M19-M24); Demonstration of the applicability of INDECIS-ISD in terms of seasonal forecasting. (M25-M30); Assessment of sectorial climate change impact based on INDECIS-ISD in the context of climate change scenarios. (M28-M33)

Deliverables.

D6.1 Release of the Datasets comparison software suite, including the description of statistical measures used for the datasets inter-comparison

D6.2 Report on the datasets inter-comparisons with regard to selected ECVs and INDECIS-ISD.

D6.3 Report on the reliability and uncertainties associated with the (hindcast-type) seasonal forecasts of selected sectorial INDECIS indices.

D6.4 Report on the assessment of sectorial climate change impact based on INDECIS-ISD in the context of climate change scenarios

WP7. Generation and Communication of Climate Services. Responsible: AEMET. WP Leader: Yolanda Luna. Duration: M7-M36

WP7 will be in charge of transforming the climate products computed across the project into climate services, targeting a wide range of stakeholders. It will coordinate its delivery and effective communication, linking the outputs of WPs 3, 4, 5 and 6 to turn them into user-friendly products. Firstly, WP7 will identify, in communication with the sectors, a strategy for the communication of climate services. This will include the identification of potential customers in the different sectors and at different levels (public, private, national, international) and the definition of their exact needs. WP7 will extend this work by developing, as a case study, a business model for the exploitation of climate service in the touristic sector. The work package will have a second branch consisting in the delivery of climate services in IDISP, in linkage with WP2. This includes effective creation and delivery of graphic output, GIS-based visualization functionalities and semi-automated free basic climate services, regularly updated, such as monitors and watches. This will be both packaged into a software suite based in free open source language (e.g. R for calculations and graphics and SAGA for GIS) and front-ended with IDISP. It will also include into IDISP a system for the request of advanced climate services, to link potential users with the specialists in the consortium.

Tasks:

Discussion with the sectors and discussion for the definition of climate services and needs in terms of their communication. (M7-M15); Identification of potential customers of the climate services. (M15-M18); Development of a communication strategy for climate services considering the needs of and the language of the sectors.(M7-M18); Development of a business model for de delivery of climate services in the tourism sector (M13-M24); Definition of graphic and GIS-Based functionalities and automated reporting for visualization/interpretation of the data to be included in the INDECIS datasets and the INDECIS-IDS (M7-M12); Implementation into a software package of the functionalities for visualization/reporting functionalities (M13-M24); Communication with IDISP for the integration and updates of the visualization/reporting functionalities (M25-M30); Definition of semi-automated basic climate services (M25-M30) ; Creation of semi-automated basic climate services, including an update protocol, to be launched in IDISP (M31-M36); Creation of a system to request advanced climate services in IDISP. (M31-M36)

Deliverables

D7.1 Document Communication Strategy for Delivering Effective Climate Services

D7.2 Document Business Cases Study for the Delivery of Climate Services in the Tourism Sector

D7.3 Release of the software suite and integration into IDSIP

D7.4 Basic semi-automated Climate Services and protocol for requesting advanced climate services launched at IDISP.

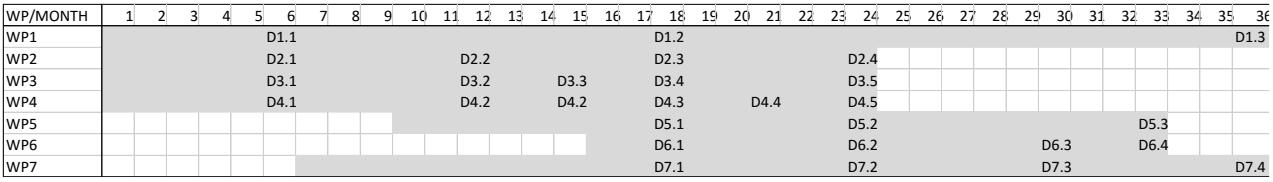

Figure 1. GANTT Diagram of Deliverables.

Table 1. Summary of contributions to each Work Package by members of the consortium. Values expressed in persons/month

WP	URV-C3	UREAD	FMI	BRGM/D3E	IRPI(CNR-DTA)	UC/IHC	SMHI	MÉT EIREANN	AEMET	BSC	FFCUL	CZECHGLOBE	KNMI	RMI	METEORO	IPE/CSIC
1	36						1								1	
2	12				17		6	4	6	18			6		1	2
3	66				17			4	24	12	13	20	6		0	
4	60	3	25	1	17	32			3	37		24			2	105
5		40			17	75			3	39	16			10	2	
6		10	52	24		41		4		48		10			15	
7	78		25	1	10				54		11				2	8

(*Details for section 8, 9, 10, 11, 12, 13 and 14 will need to be uploaded in the form of a pdf document*)

10. Management Plan (Maximum 5 pages)

Graphics can be included in this section.

Details should be articulated clearly, particularlywith regard to the following points related to the "Implementation" criteria:

• *Competence and expertise of team and complementarities of consortium (e.g. inter-disciplinary / inclusion of all necessary expertise /expertise in managing inter- and transdisciplinary research collaborations, gender balance)*

• *Appropriateness of the conceptual approach, feasibility of aims and objectives of project, feasibility and suitability of project design and methods*

10.1 MANAGEMENT STRUCTURE AND PROCEDURES

In this section we describe the management structure of INDECIS. Project management will be carried out through **WP1, Coordination**, under the direct responsibility of the Project Coordinator (Universitat Rovira i Virgili). Its primary objective will be to ensure that the tasks of the WPs are carried effectively and efficiently and are fully integrated towards a common purpose of delivering innovative research and products and climate services to users. WP1 will pursue the timely release of deliverables and expected output. Furthermore, the PC will be assisted by a Secretariat, supported by Scientific Steering Committee, and advised by an external Advisory Board. We present the Consortium plans for managing financial matters, risks, technical and scientific, quality and other legal aspects. INDECIS management structure aims at facilitating the cooperation between partners while maintaining a strict control of gradual achievements of the project objectives. This structure is depicted in Figure 2

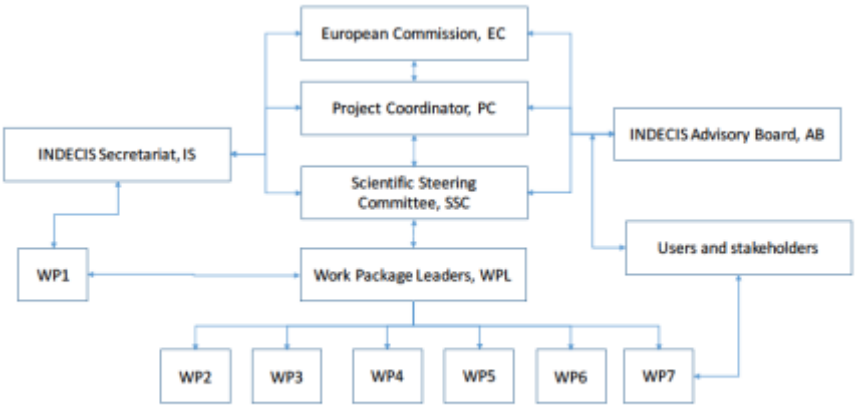

Figure 2. INDECIS. Management Structure.

10.1.1. Project coordinator (PC)

The project will be coordinated by a scientist with high experience and top level scientific background. This is necessary given the complexity of INDECIS and the volume of administrative and scientific coordination activities required. The PC has a strong experience with the participation in different EC projects of the 5th, 6th and 7th Framework Programs of the EC (EMULATE, UERRA, EURO4M, COST-HOME and is or has been the principal investigator of

several National projects related to climate variability and change, climate data processing and homogenization (CAFIDEXPI, DAAMEC, IMPACTRON). The PC will chair the INDECIS Scientific Steering Committee and they will be assisted by the INDECIS Secretariat. The PC will be in charge of the day-to-day management of the entire project including responsibilities over: the administration and coordination of the project resources, communication within the consortium (dissemination of deliverables, reviews, etc.), setting up and management of the project Web site, interface with the European Commission, monitoring and control of the Work Plan, arrangement of meetings and minutes-related activities, issuing of periodical reports, billing of efforts and budget, and leading the financial management activities. The PC will summarize the progress report from the WP leaders and submit the summary report to the Scientific Steering Committee. This is particularly important in a project where late deliverables or no deliveries will have negative effects for the fulfillment of other activities. The PC will be responsible for ensuring that all the reports will be available on time to the Commission and to the INDECIS project partners, including: progress reports, mid-term assessment report and final report. Once a year the PC, based on WP reports from the WP leaders and cost-statements from all partners, will prepare a consolidated review of the project budgetary situation, i.e. Periodic Report, according to EU-standard contracts.

10.1.2. INDECIS Secretariat

The INDECIS Secretariat is integrated by a hired project manager and other administrative personnel from the coordinating institution. The INDECIS Secretariat will assist the PC in monitoring the progress of the work packages, facilitate communication between the different groups, organize the scheduled meetings of the project (particularly the Annual General Assemblies and the Management Board meetings), as well as small working sessions between groups as appropriate. The INDECIS Secretariat will also communicate regularly with the EC in Brussels and help the Coordinators in preparing recommendations for future collaboration on the issues that are addressed by the INDECIS project. The secretariat will be deal with the setup and maintenance of the project's internal website. It will be a restricted access site to link INDECIS members and guarantee availability of resources and fluent communication. The project's web site will also have a public access area including an overview of the project, all the public deliverables and an open forum throughout a two-way communication tool between the general public and the INDECIS Consortium.

10.1.3. The Scientific Steering Committee (SSC)

The SSC is chaired by the PC and will include the WP leaders and the INDECIS Secretariat. The SSC is the forum for scientific discussions, coordination and optimization between WPs, risk analysis and reorganization when necessary. The SSC will make decisions on all administrative and financial project issues including exploitation. The SSC aims for consensus. In case of voting, each of the SSC members has one vote, but the PC have the final decision in cases of split opinions. The SSC will be the decision body of INDECIS, reviewing the scientific aspects of INDECIS and will: monitor the project progress, achievements and costs; undertake risk analysis, react to problems that have a potential impact on project by defining the necessary contingency plans; review the policy and strategy for dissemination and publicity for the project; review the

declaration of know-how and/or knowledge; assess the impact of any changes to the contract suggested by the European Commission and respond accordingly; solve any conflict that may arise on issues that have an impact on the project; prepare any contract change (budget, resources, plans, etc.); review the project development and expansion strategy; oversee and review the administration arrangements for the project Coordinators.

The SSC shall meet physically at least every 6 months, and monthly by teleconference. However extraordinary meetings could be requested by any of the members of the Committee. The Work Package leaders will be responsible to convey the decisions of the SSC to their WPs.

10.1.4. INDECIS Advisory Board

The Advisory Board will consist of representatives of International Organizations, External experts, European Commission Representative and End-users.

The Advisory Board will physically meet three times during the duration of the project (kick-off, midterm and at the end). It consists of representatives of global and regional organizations and international networks that address climate variability and climate services on different levels – global, continental, national and sub-national. The Advisory Board will communicate regularly with the project consortium through the project web site, email lists, as well as by participation in technical conferences, workshops and demonstrations that are planned to be organized within the project. As each of the international organizations on the project Advisory Board includes their own extensive network of climate service experts and authorities, the project will use these networks to promote end-user participation and valorization of the scientific results.

10.1.5. Consortium agreement

A consortium agreement will be established in order to address aspects relative to intellectual property, pre-existing information, material transfer agreements and confidentiality of results. The consortium agreement will specifically regulate the internal organization of the consortium, the distribution of the Community financial contribution, additional rules on dissemination and use including intellectual property rights arrangements, as appropriate, the settlement of internal disputes, an outline of the exploitation plan and patent policy. The PC will coordinate the elaboration of this document in consultation with the SSC and the rest of the project partners. The agreement will be signed prior to the start of the project and in agreement with the European Commission. The members of the Consortium have considerable experience in these issues from the participation in previous EC projects, and both the PC and the other Partners have experienced advisors that will help in preparing this document. Due to the nature of the project, the consortium agreement will provide a flexible procedure for making changes to the initial specifications if needed. This will involve the termination of certain tasks, the reassignment of others, etc. To avoid possible disputes, the conditions and procedure will be clearly set. However, INDECIS will promote unanimous decision making whenever possible.

10.1.6. Cooperation Procedures

The partners of the INDECIS Consortium will cooperate in order to achieve the common goal. Each partner will produce research and development activities that will be beneficial to their organization; however, the consortium is aware that the synergies developed within the

consortium will provide an outcome of a greater value than the addition of each individual result.
As detailed within the description of the work all Work Packages are related, with strong dependencies among them. This is also the case of the tasks within each Work Package. The management structure discussed in the previous section ensures communication from a Work Package level to a higher, more strategic, point of view so that these dependencies can successfully be met and take place in an efficient communication manner.

10.1.7. Competence of the team and complementarities of consortium

The INDECIS consortium is composed by a multidisciplinary team of scientists with strong experience in climate data management and in the study of the climate variability and change, atmospheric mechanisms, meteorological forecasting, hydrological processes, hydrological modeling, extreme events and related impacts, vegetation monitoring, remote sensing data processing and analysis, and the development of climate-related systems. The consortium is very well balanced in relation to the objectives of the project. INDECIS draws upon the collective expertise of scientists representing top-level research institutions at national and international levels and a private company with strong experience in the use and development of climate information for practical applications. KNMI is one of the most advanced world institutions in climate data management. URV-C3 has DARE, quality control, homogenization and climate indices analysis as primary expertise. AEMET, SMHI, Met Éireann and GCRI/CAS are also experts in those fields. IPE/CSIC has expertise in developing climate indices, specially related to drought, and in the statistical analysis of climate variability and change. This expertise is shared with UREAD and FFCUL. RMI has a strong background in statistical analysis. MeteoRo, FMI, UC/IHC, BMRG, BSC and CNR/IRPI have expertise in the production and analysis of predictive climate data The consortium includes 6 NMHSs, ensuring good connection with data providers. Most of the partners (e.g. URV-C3 with tourism) include sectorial and communication experts to facilitate the contact with the stakeholders. Therefore, the composition of the consortium is very well-balanced in relation to the objectives indicated in the project since the INDECIS project draws upon the collective expertise of scientists representing top-level research institutions, and working on the complementary topics, necessary to achieve the different objectives of the project.

10.1.9 Gender issues

INDECIS will follow EC's policy on Gender Issues. The European Commission already has an instrument to deal with discrimination based on gender in the form of Article 141 (ex Article 119) of the EC Treaty and has adopted a whole series of measures to implement this article in practice.
The gender issues will be addressed within the INDECIS consortium with different approaches. First, by observing the gender policies already established at the participating institutions. Within WPs, priority will be given to ensure that the final team will have an adequate presence of women with the right position and competencies. And the representation towards externals will be well balanced between men and women to act as successful ante type to young women. Recruitment of young, talented female researchers will be encouraged in INDECIS. Job advertisements will state the project's commitment to gender equality and will explicitly encourage women to apply.
An annual report will be submitted to the Management Board detailing the level of progress made

in the gender aspects of the project and suggesting ways and means to improve these aspects as the project progresses in time. INDECIS will support the Article 141(3) of the EC Treaty giving importance to protect male and female members of this Consortium exercising the rights inherent in fatherhood, motherhood or the combination of professional and family lives. We shall ensure participation of women during the course of the project by providing equal access and opportunities

10.3 CLIMATE-FRIENDLY RESEARCH

Many of the institutions participating in INDECIS have developed or are developing environmental policies to ensure and environmental friendly research. This is the case, for example, of the coordinating institution, Universitat Rovira i Virgili. Also, University of Reading has the “Clean and Green” programme, both, with the clear goal of reducing the energy consumption and the CO2 footprint of their employees. BRGM complies with the international ISO 9001 standard (version 2008), with certification awarded by AFAQ AFNOR in 2004 and renewed in December 2010. It also obtained ISO 14001 (version 2004) certification in December 2012 for its environmental management system in recognition of its environmental practice by effectively managing the impacts of its sites and activities in compliance with environmental regulations BRGM, assisted by A2DM, has drawn up mandatory Greenhouse Gas Emissions Reports (BEGES), the last one published in 2014. Between 2011 and 2014, the BRGM's greenhouse gas emissions have decreased by 45%, which is beyond the objective of 34% set in the 2011 report. RMI defined its environmental policy, which achieved the ECO-label with three stars.

Climate friendliness of INDECIS will be improved by following the JPI Climate Friendly Research Recommendations. Several actions are foreseen:

- Reducing the CO2 footprint of routine mobility by suggesting to the consortium employees public transportation alternatives, reducing internal mobility in the institutions and fostering homework when the role of the employee permits.
- Avoiding flying when other alternatives are available.
- Reducing the impact of meetings and other events by replacing face-to-face intermediate meetings by the use of teleconferencing facilities; linking the Consortium meetings to other events attended by the participants (e.g. international conferences, see section 14); when the Consortium meets in a stand-alone event, select from the possible venues the one that, being cost-effective, implies less overall travel; foster the use of public transportation, (preferably bus, metro, tram) in internal displacements during the meeting; fostering the provision of regional, fresh, seasonal food during the meetings; suggesting the use of compensation mechanisms to the participants.

Reducing the amount of printed documents and relying on an e-document policy as much as possible.

(*Details for section 8, 9, 10, 11, 12, 13 and 14 will need to be uploaded in the form of a pdf document*)

11. Impact, Engagement and dissemination plan (Maximum 5 pages)

Details should be articulated clearly, particularly with regard to the following points related to the "Impact" criteria:

- *Envisaged societal impacts (e.g., capacity and community building, networking effects, contributions to societal welfare and well-being, policy related or economic impact)*
- *Value and transferability for the user community*
- *Complementarity to other initiatives*
- *Institutional integration*

11. Expected impacts listed in the work programme

11.1. Strategic impact

The project will address scientific and technical challenges by means of further developing methodologies and improving the current knowledge for the application of climate indices to different sectors with the purpose of improving the multisectorial management. As such, the outcomes of this project will not only be basic research, but also aim at putting this knowledge into work contributing to develop information tools based on server-side technologies that are needed for the sound management of climate issues from a multi-sectorial perspective.

This will be attained in close collaboration with stakeholders and end-users to ensure an adequate uptake of the new products developed, and the use of these products for a better management and in the case of the extreme events to improve early warning and mitigation of the risk (droughts, floods, heat waves, frost, etc.). The close collaboration with relevant end-users and managers from the start of the project will ensure that the research outputs are useful in operational practice in the different catchments chosen as case-studies of the project, but also that the methods and the results can be exported to other catchments. Additionally, advances in the knowledge of climate variability, especially with respect to extreme events and climatic hazards, is at present a high priority in the physical sciences. Besides, the projects aims at putting this knowledge into work and will develop information tools that are basic for a sound management of climate risks in a specially vulnerable context such as varied European regions. Capacity building activities are also foreseen by INDECIS, and will include a preliminary assessment of the institutional and capacity context in order to adequately understand the current needs at this respect.

The collaboration between partners of different countries adds a transnational value to the project since it puts together multidisciplinary knowledge on the research topic and it also enables working in regions with very different environmental and management characteristics, which will allow methods to be adapted to a broad range of conditions. Once the project has finished, the methodologies and systems may be transferred to the management authorities to be operative for the long-term. In addition, the core of the systems and the general design will be publically available, with the ability to be implemented and adapted in other basins with varied characteristics.

INDECIS will contribute to strengthen the practical use of the EU research infrastructures, since

the information indices and systems developed by the project will be able to provide relevant information at the UE decision levels, complementing the Copernicus Emergency Management Service. INDECIS will also contribute to the 'EU Climate Change Adaptation Strategy'. The strategy calls for an enhancement of preparedness and capacity to respond to the impacts of climate change at local, regional, national and EU levels. INDECIS will help reduce these impacts by establishing means for understanding social costs through better monitoring and forecasting of climate extreme events in vulnerable areas. INDECIS will also be fully involved in the priority areas of the 'European Innovation Partnership on Water' (EU EIP 2014) that include flood and drought risk management and decision support systems and monitoring. INDECIS is also aligned with the objectives of the World Meteorological Global Framework for Climate Services, GFCS, which specifically targets the sectors of water, disaster risk reduction, agriculture and food security and health

11.2. Dissemination and exploitation of the results: expected outputs

Responsibility for the dissemination and exploitation of results lies with the whole partnership in their capacity as the repository/owner of those results. All project partners should therefore take an active part in bringing into effect the measures set out in the exploitation plan. The plan will involve specific tasks falling to each partner during the course of the project and in line with their particular interests and expertise.

The purpose of the Research Theme is to provide an efficient means of disseminating the results emerging from the INDECIS research community at different levels (general public to advanced researchers), the exchange of data within the consortium and also with other researchers not directly involved with INDECIS. A further aim is to open up initiatives of education and training on methodologies, models, and novel concepts developed within the INDECIS framework; this will provide state-of-the-art material for graduate students and advanced researchers alike, and stimulate exchanges of students and researchers between the various partner institutions.

Participation of leading European research centers and universities will ensure a high level and efficient area of dissemination. Thus, an effort to gain presence of INDECIS´s participants in different scientific or educational discussions, as well as in climate services related decision making processes. There will also be provision for scientists from other countries not involved in the project who could then adapt and apply the knowledge developed within INDECIS to the particular conditions of their regions.

It is planned to coordinate a special issue in a peer-reviewed journal with the main scientific findings of the project. In addition, the team members will be encouraged to publish scientific articles in top-level international journals. It is expected that at the end of the project the team will publish around 10 scientific articles per year in journals included in the Journal Citation Report and with a strategic importance for the scientific disciplines included in INDECIS. The objective is to publish at least one article in a top-rank multidisciplinary journal during the duration of the project. Project partners will also participate in sessions at international conferences such as the EGU, AGU or IAHS and will showcase the scientific visibility of the project results in the international arena. Moreover, a periodic newsletter will be available from the project´s website.

Newsletters and social media will inform the scientific community, stakeholders and the general public about the evolution INDECIS and its main outcomes. Another important output of the project will be the development of indices and methodologies for monitoring and early warning systems. All the data generated (climate indices, meteorological forecasting, vulnerability maps, etc.) will be also available to the general public, end-users and scientists. Most of the dissemination actions will start at the beginning of the project and will be continuously developed during the project duration. Progress on this will be given in the annual reports of the project to the Commission and on request if more frequent reporting is needed.

11.3. Exploitation and communication activities (measures to maximize impact)

Dissemination and knowledge transfer are one of the main goals of INDECIS. Participation of leading research teams will ensure a high level and efficient area of dissemination, and also guarantees the visibility across networks and communities. Different partners have indicated a budget to pay for open-access availability of articles published in peer-reviewed journals, in agreement with section 10.2. In any case, all the scientific publications from the project will be available in open institutional repositories.

Different management organizations and end-users have been consulted during the development of the project and expressed their interest in participating as stakeholders. INDECIS will develop a dialogue and foster linkages between the scientific community, policy makers, NGOs, managers and end-users in order to ensure effective development and uptake of the project outcomes. Work Package 7 (WP7), **Generation and Communication of Climate Services**, will be devoted to these issues, developing a strategy for the communication of climate services. WP7 will provide a channel for discussion and communication as to the appropriateness of tools to meet local and regional requirements and will assess the current development of operative climate information, from an institutional perspective. This will help in the development of appropriate plans of measures monitoring and risk mitigation in several areas (agriculture, environment, urban supply, etc.).

The knowledge generated in the project will be translated into layperson language so as to be accessible to the public. A newsletter will be available from the project´s website to inform about relevant news concerning INDECIS, the evolution of the project and its main outcomes. WP7 will also provide a forum, or support the existing platforms, to ensure effective uptake of the project outcomes by the end-users. This includes facilitating interfaces and fostering linkages between the scientific team and the end-users in the domains of the work packages, and guarantees a larger diffusion of the project results by means of the common scientific and management channels. On-line tutorials accessible through the project website, ensuring the visibility of the project and provide the most essential general information to the public at large.

11.4. Cross-thematic research

INDECIS will promote cross-thematic research by assessing possible synergies with other EC research projects. As part of the core program, it will support development of inputs to the work packages from other research projects and promote collaboration with the objective of creating opportunities for expanding the issues addressed by INDECIS to different climate issues in

Europe addressed by the ERANET calls. To this end, all data, as well as the possible open source software generated, will be provided for incorporation into European data information systems, e.g. the Shared Environmental Information System (SEIS, http://ec.europa.eu/environment/seis/) or the INSPIRE infrastructure for spatial information in Europe (http://inspire.ec.europa.eu). To promote exchange of information between European countries, institutions, stakeholders and the interested public, and to support the working process under the WFD Implementation Strategy, INDECIS will provide expert knowledge, methodology and project results for implementation into the Communication Information Resource Centre Administrator (CIRCA) system.

11.5. Market knowledge and economic advantages/return of investment

Using open source approach, the knowledge and tools generated in the project could be further packed and/or developed as local/regional services in Europe and worldwide encouraging the development of SMEs dealing with environmental issues. This should also allow water resource managers, agricultural bodies, hydroelectric power companies, among others, to improve the efficiency of their coping strategies and allow them to introduce more effective work practices which should have cost and resource benefits and hence economic advantages.

11.6. Impact on the efficiency of the overall EU research system and EU research infrastructures

INDECIS will help strengthening Europe's position as one of the major providers of climate information and derived products and methodologies with a clear direct applicability and interaction with society. The project's scope and its ambition to deliver spatial products ready to be used by policy makers and stakeholders to promote the social and economic development of different European regions further allow increasing the practical efficiency of the EU research system. INDECIS will also contribute to strength the practical use of the EU research infrastructures, since the information systems and real-time web-platforms developed by the project will be able to provide relevant information at different EUEU decision levels.

11.7. Steps needed to bring about these impacts

Because of the complexity of the issues that will be undertaken in the different work packages and the interdisciplinary nature of the topics considered, only a large consortium of scientists will be in a position to achieve these goals. The EU-wide consortium is necessary because complex implications of climate variability and change. The broad range of disciplines that are included in the consortium allows for an appropriate coverage of the widely varying temporal and spatial scales of the topics addressed by the project. The project's scope and its ambition to deliver products that can be used by scientists, policy makers, managers and end-users further justify the constitution of a Europe-wide consortium to fulfil with the necessary steps to apply. Finally, by bringing together some leading scientists in the various domains covered by INDECIS, the project has added value in that the collective efforts will be more productive than the sum of individual contributions if the consortium would not exist.

11.8 Input to the implementation of global policies and agreements

Through the processes of collective interdisciplinary learning, INDECIS will develop tools and obtain outcomes to face with the challenges contained in the EU Strategy on Sustainable

Development (Gothenburg, June 2001 and reviewed in July 2009), the Johannesburg Summit on Sustainable Development (2002) and the UN Millennium Development and the WMO Global Framework for Climate Services (2009). INDECIS has obvious links with the objectives of the COPERNICUS programme, especially in the thematic areas of atmosphere, climate change and in their application to different priority areas, e.g. health, agriculture or tourism.

11.9. Interaction with national and international projects

INDECIS will benefit from a number of past and ongoing projects, integrating their work into the results of the Project and contributing at the same time to expand and consolidate the results of those still in action. More specifically, there will be a close link between INDECIS WP2 and the ECA&D initiative, leaded by KNMI, a partner of INDECIS, as well as with the WMO supported MeDARE initiative, leaded by URV, the coordinators of INDECIS. WP3 will be closely linked to the International Surface Temperatures Initiative, as well as with the WMO-CCl Expert Team on Sector Specific Indices. Also, WP2 will have links with the Spanish nationally funded projects IMPACTRON and MULTITEST. In WP2, clear links with the H2020 EUSTACE project exists which aims to provide a homogenized daily dataset for temperature, based on ECA&D. Gridding methods, newly developed in the EU-FP7 project UERRA will be employed in WP3 for the gridding of selected ECVs. Furthermore, WP6 will benefit from the work developed during FP7_EURO4M project and WP4 have links with FP7-EUPORIAS and FP7-UERRA projects, where MeteoRo is also a partner. WP7 will benefit the expertise in visualization functionalities developed in EU financed SPITFIRE project. The JPI-Water ERANET IMDROFLOOD and the Spanish nationally funded project DESEMON project have links with WP3 and WP4. INDECIS relates to technological transfer projects developed for UC/IHC for the InterAmerican Development Bank like Risk Profile: Paraguay, where climate-related indices where used to study drought and flooding at the country level.

11.10. Intellectual Property Rights

As a general rule, each partner is the only proprietor of any knowledge (piece of code, scientific documentation, technical studies, etc.) developed within the project and with its sole effort. Whenever it is not possible to determine a single partner owning a specific development (for instance, when a common development has been carried out), the Intellectual Property Rights of such element will be shared among the partners participating in the development in proportion to the effort (or the associated cost, of so agreed) invested by each partner in that development.

In order to facilitate their identification by the public and the Commission, dissemination materials (e.g., publications, websites, etc.) concerning results of INDECIS will contain the following specific sentence, included in the EC Grant Agreement (Article 45 RfP – Article 11.30.4 of ECGA). “The research leading to these results has received funding from the ERA4CS project … nº …” Translation of this sentence in Community languages other than English will be used where applicable.Specific issues concerning publication, patent ownership, access rights to or exclusion of background, access rights to foreground resulting from the project, ownership, etc. will be covered in the consortium agreement.

(*Details for section 8, 9, 10, 11, 12, 13 and 14 will need to be uploaded in the form of a pdf document*)

12. Budget justification

In this section we provide a rationale for the budgetary requests of the project INDECIS and of the particular partners. Due to the nature of the call, 70% of the resources will be provided as the in-kind contribution of each Research Performing Institution, according to the allocated funding decided through the preparatory phase of ERA4CS. Each of the RPO participating in INDECIS has internally secured the in-kind contribution to this proposal, according to the regulations of this call and to the allocations made by each institution.

The total budget (in-kind + requested) is 6.847.647,29€. The distribution by institution is available at the on-line submission platform. INDECIS' coordinators, URV-C3, is requesting 1.000.000€ (this and all quantities across this section will be expressed as in-kind + requested), including 200.000 of overheads. URV-C3 provides162 months of work, worth 550.000 and requests contract of the Project Manager, plus different contracts to support its leading role in WP3, as well as contributions in WP1, WP2, WP3 and WP7. A significant amount is also requested as travel and subsistence to ensure an effective coordination, although physical travel will be reduced as much as possible as expressed in section 10. URV-C3 is requesting 10.000€ in equipment, to cover the computing necessities associated with coordination and with the development of the participated WPs. Also, a quantity of 5.000€ is included as sub-contract, for support to coordination and dissemination of INDECIS (e.g. internal and external website) and 5.000€ euros as consumables, mostly for coordination purposes.

UREAD budget is 563.415€, including 28.8 months of salaries and requesting 24 months of contracts, necessary to ensure their leading contribution to WP5 and contributions to WPs 4 and 5. UREAD includes 115.038€ of overheads and other costs. FMI has a budget of 853.750€, including 170.750€ of overheads and 61 months in salaries and the request for 41 months in contracts. These contracts will support mostly WP6, with contributions to WPs 4 and 7. The in-kind contribution of FMI shall include, but is not limited to, CLINF, CARB-ARC and PREWIN projects funded by Academy of Finland. BMRG budget is of 266.881, with a contribution of 26 months in salaries, dedicated to WP6 and small contributions to WP4 and WP7. The overheads and other costs total 53.376€.

CRN/IRPI budgets 451,429€, including 90.285€ in overheads and comprising 63 months of salaries and a request for 15 months of contracts. This requests are necessary to carry out their contributions to WPs 2,3,4,5 and 7. A small amount is requested to replace obsolete machinery. UC/ICH totals 600.588€, with 120.177€ in overheads and, containing 101 months' worth of salaries and requesting additional funding for 47 months. The associated contracts will make possible a stronger contribution to WPs 4, 5 and 6. UC/ICH is requesting 6.400€ in equipment to cover the necessities in computing. SMHI total budget is 63.250€ (7 months of salaries and 12.650€ in overheads) ensuring contributions in WP1 and WP2. Met Éireann is budgeting 114.126€, including the dedication of 12 months distributed between WPs 1 and 6 and 22.825€ in overheads.

The contribution of AEMET into INDECIS will be of 492.000€ (82.000€ in overheads), with 60

months of salaries and requesting additional funding for 30 months. AEMET's contribution will have a significant budget for travel and subsistence, to ensure their role as WP7 leaders, a WP which will include regular consultation with the sectors. Besides of WP7, AEMET will also contribute to WP2 2,3,4 and 5. The team of the BSC will budget 785.000€, including 157.000€ in overheads and 103 months in salaries. Also, BSC requests 51 months of contracts, to successfully develop their key role in WP6 and their contributions in WPs 2, 3, 4, 5. FFCUL budget is 200.000€, including 7.500€ in travel and subsistence, 40.000€ of other costs (overheads) with 24 months of salaries and requesting additional funding for 16.5 months dedicated to their contributions in WPs 3, 5 and 7. GCRI's budget totals 197.625€, with 39.525 in overheads and other costs providing 36 months in salaries as in-kind contribution and requesting 18 additional months in contracts. GCRI is also allocating 12.500 and 4.000 € in sub-contracts and consumables to ensure the viability of their contribution into WP4 and WP6. KNMI's budget totals 123.007 € (27.002 of overheads and other costs), with 12 months of salaries dedicated to the effective coordination of WP2. RMI budget is of 105.207€, including a request of 5000€ in equipment, to be dedicated to statistical analysis inside INDECIS, contributing with 8 months of salaries and requesting two additional months, to fulfill their role in WP 5. RMI's budget includes 21.041 of overheads. The work of MeteoRom is going to be concentrated in WP6, with contributions to WPs 2, 4, 5, and 7. Its total budget is 70625€, including 14.125€ of overheads and with 23 months of salaries. MeteoRom is requesting 3.800€ in consumables and 1.200 in equipment, related to their leading role in WP6 and the computational needs of the work associated to this WP.

IPE/CSIC, coordinating WP4, budgets 599.995€, requesting 28.000€ in travel and subsistence, for an effective coordination of WP6, contributing with 97 months in salaries and requesting 18 additional months. IPE/CSIC will concentrate on WP4, but also will contribute to WPs 2 and 7. The overheads of IPE/CSIC total 119.749€ and 1.000€ are requested for consumables dedicated to coordination and 1.000€ to replace obsolete equipment.

All partners are dedicating a portion of the budget to ensure the dissemination of INDECIS's results.

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Details for section 8, 9, 10, 11, 12, 13 and 14 will need to be uploaded in the form of a pdf document)

14. Suggested International Conferences Provide suggestions of **major** international conferences alongside which it would be appropriate to hold mid-term and end-of-term meetings
Due to the nature of the consortium, the most appropriated conferences for the mid-term and end-of-term meetings are the Annual Assembly of the European Geosciences Society (EGU), held in annually in Spring in Vienna and the Annual Assembly of the European Meteorological Society, held in changing venues each September.

15. Budget plan (in K€)[1]

Total budget of the proposal:	6.487,65€

Leading Principal Investigator. URV-C3		
		Totals
Permanent Position	Time dedicated to this project (# months)	162 months
	Salaries	550.000€
Non permanent position with funding requested	Time dedicated to this project (# months)	90 months
	Salaries	195.500€
Travel and subsistence		35.000€
Overheads		200.000€
Consumables		5.000€
Equipment		10.000€
Sub-contract		5.000€
Total		1.000.000€

Principal Investigator 1. UREAD		
		Totals
Permanent Position	Time dedicated to this project (# months)	28.8 months
	Salaries	298.138 €
Non permanent position with funding requested	Time dedicated to this project (# months)	24 months
	Salaries	141.593 €
Travel and subsistence		4000 €
Overheads		115.883 €
Consumables		4.600 €
Equipment		€
Sub-contract		€
Total		564.164 €

Principal Investigator 2. FMI		
Permanent Position	Time dedicated to this project (# months)	61 months
	Salaries	397.800 €
Non permanent position with funding requested	Time dedicated to this project (# months)	41 months
	Salaries	265.200 €
Travel and subsistence		20.000 €
Overheads		170.750 €
Consumables		€
Equipment		€
Sub-contract		€
Total		853.750€

Principal Investigator 3. BRGM/D3E		
		Totals
Permanent Position	Time dedicated to this project (# months)	25.8 months
	Salaries	195.105 €
Non permanent position with funding requested	Time dedicated to this project (# months)	0 months
	Salaries	0 €
Travel and subsistence		14.400 €
Overheads		53.376 €
Consumables		4.000 €
Equipment		€
Sub-contract		€
Total		266.881 €

Principal Investigator 4. IRPI(CNR-DTA)		
		Totals
Permanent Position	Time dedicated to this project (# months)	63 months
	Salaries	300.714 €
Non permanent position with funding requested	Time dedicated to this project (# months)	15 months
	Salaries	54.430 €
Travel and subsistence		4.000 €
Overheads		90.285 €
Consumables		0.500 €
Equipment		1.500 €
Sub-contract		0.000 €
Total		451.429 €

Principal Investigator 5. UCH/IHC		
		Totals
Permanent Position	Time dedicated to this project (# months)	101 months
	Salaries	328.971 €
Non permanent position with funding requested	Time dedicated to this project (# months)	47 months
	Salaries	132.400 €
Travel and subsistence		19.100 €
Overheads		120.117 €
Consumables		0.00 €
Equipment		0.00 €
Sub-contract		0.00 €
Total		600.588 €

Principal Investigator 6. SMHI		
		Totals
Permanent Position	Time dedicated to this project (# months)	7 months
	Salaries	47.600 €
Non permanent position with funding requested	Time dedicated to this project (# months)	months
	Salaries	€
Travel and subsistence		3.000 €
Overheads		12.650 €
Consumables		€
Equipment		€
Sub-contract		€
Total		63.250 €

Principal Investigator 7. MET EIREANN		
		Totals
Permanent Position	Time dedicated to this project (# months)	12 months
	Salaries	88.801 €
Non permanent position with funding requested	Time dedicated to this project (# months)	months
	Salaries	
Travel and subsistence		2.000 €
Overheads		22.825 €
Consumables		0 €
Equipment		500 €
Sub-contract		0€
Total		114.126 €

Principal Investigator 8. AEMET		
		Totals
Permanent Position	Time dedicated to this project (# months)	60 months
	Salaries	270.000 €
Non permanent position with funding requested	Time dedicated to this project (# months)	30 months
	Salaries	120.000 €
Travel and subsistence		20.000 €
Overheads (20%)		82.000 €
Consumables		0 €
Equipment		0 €
Sub-contract		0 €
Total		492.000€

Principal Investigator 9. BSC		
		Totals
Permanent Position	Time dedicated to this project (# months)	103 months
	Salaries	412.000 €
Non permanent position with funding requested	Time dedicated to this project (# months)	51 months
	Salaries	204.000 €
Travel and subsistence		12.000 €
Overheads		157.000 €
Consumables		0 €
Equipment		0 €
Sub-contract		0 €
Total		785.000 €

Principal Investigator 10. FFCUL		
		Totals
Permanent Position	Time dedicated to this project (# months)	24 months
	Salaries	112.000 €
Non permanent position with funding requested	Time dedicated to this project (# months)	16 months
	Salaries	39.000 €
Travel and subsistence		9.000 €
Overheads		40.000 €
Consumables		0 €
Equipment		0 €
Sub-contract		0 €
Total		200.000€

Principal Investigator 10. GCRI		
		Totals
Permanent Position	Time dedicated to this project (# months)	36 months
	Salaries	96.000 €
Non permanent position with funding requested	Time dedicated to this project (# months)	18 months
	Salaries	37.600 €
Travel and subsistence		8.000 €
Overheads		39.525 €
Consumables		4.000 €
Equipment		0 €
Sub-contract		12.500 €
Total		197.625 €

Principal Investigator 12. KNMI		
		Totals
Permanent Position	Time dedicated to this project (# months)	12 months
	Salaries	90.005€
Non permanent position with funding requested	Time dedicated to this project (# months)	months
	Salaries	€
Travel and subsistence		5.000€
Overheads		27.002 €
Consumables		1.000 €
Equipment		0 €
Sub-contract		0 €
Total		123.007 €

Principal Investigator 13. RMI		
		Totals
Permanent Position	Time dedicated to this project (# months)	8 months
	Salaries	64.000 €
Non permanent position with funding requested	Time dedicated to this project (# months)	2 months
	Salaries	12.166 €
Travel and subsistence		3.000 €
Overheads		21.041 €
Consumables		0 €
Equipment		5.000 €
Sub-contract		0 €
Total		105.207 €

Principal Investigator 14. METEOROM		
		Totals
Permanent Position	Time dedicated to this project (# months)	23 months
	Salaries	46.000 €
Non permanent position with funding requested	Time dedicated to this project (# months)	0 months
	Salaries	0 €
Travel and subsistence		5.500 €
Overheads		14.125 €
Consumables		3.800 €
Equipment		1.200 €
Sub-contract		0 €
Total		70.625€

Principal Investigator 15. IP/CSIC		
		Totals
Permanent Position	Time dedicated to this project (# months)	97 months
	Salaries	396.495 €
Non permanent position with funding requested	Time dedicated to this project (# months)	18 months
	Salaries	53.501 €
Travel and subsistence		28.000 €
Overheads		119.749 €
Consumables		1.000 €
Equipment		0 €
Sub-contract		1.000 €
Total		599.995 €

Add more Partner-Boxes if required

16. Potential reviewers to avoid for direct competition reasons or conflict of interest
List the names (and provide his/her country and affiliation) of potential reviewers who, you think, should not be asked to evaluate the project for reasons of direct competition and partiality. Also provide the names of significant collaborators that should not be used as reviewers due to conflicts of interest.

(*Details for section 17 will need to be uploaded in the form of a pdf document as an annex of the proposal*)

17. Curriculum Vitae
Uploaded as Annex short CVs of all PIs.

(*Details for section 18 will need to be uploaded in the form of a pdf document as an annex of the proposal*)

18. Supporting Letters

We include supporting letters from:

- Dr. Thomas C. Peterson (President, World Meteorological Organisation's Commission for Climatology, CCl)
- Pedro Viterbo, Instituto Portuguès do Mar e da Atmosfera, I.P, Portugal
- Pilar Aparicio Azcárraga, Directora, Escuela Nacional de Sanidad, Instituto Carlos III, Spain
- Dr. Carlo Tansi, Director, Civil Protection, Calabrian Region, Italy
- Carme Rubió, Deputy Director Touristic Planning, Dir. General Turisme, Generalitati de Catalunya, Spain
- Ana Teresa Pérez, Agencia Portuguesa do Ambiente