Application form

code: HPC17IUTPN

Section 1 - Personal data

Personal Data

Title	Dr
Name	thomas
Surname	arsouze
Email	thomas.arsouze@ensta-paristech.fr
Position	Experienced researcher (professional researcher, lecturer or higher)
Your Scientific Background	Earth Sciences & Environment
Date of Birth	14/10/1981
Gender	MALE
Nationality	FRANCE
Have you already participated in the past to similar initiatives?	No
Participation in the past to similar initiatives (other)	

Section 2: Your Organisation

Your Organisation

University/Organisation	ENSTA-ParisTech
Organisation Legal Status	University
Department	Unité de Mécanique
Organisation Address	Chemin de la Hunière
Town	Palaiseau
Post code	91761

Country	FRANCE
Telephone	+33 1 69 31 99 99

Your Research Group

Your Research Group	Laboratoire de Météorologie Dynamique (LMD) - INTRO
Name of your Group Leader	Sylvain Mailler
Email of your Group Leader	sylvain.mailler@lmd.polytechnique.fr
URL of your research group www page	http://www.lmd.polytechnique.fr/~intro/

Section 3: Your Visit

When do you plan to come?

Preferred Start Date (dd/mm/yyyy)	07/01/2018
Expected Duration in weeks	13
HPC Access Centre	BSC
HPC Access Centre (secondary choice)	

Collaboration with host

nº	Host	Contacted This Host?

Add new host

nº	Host Name	Host Family Name	Host Institute	Host Department	Host Institute Country	Discipline	Host Researcher Telephone	Host
1.	Virginie	Guemas	BSC	Climate	SPAIN	Earth Sciences	+34934137679	virginie.guem

nº	Host Name	Host Family Name	Host Institute	Host Department	Host Institute Country	Discipline	Host Researcher Telephone	Host
				Prediction		& Environment		
2.	Louis Philippe	Caron	BSC	Climate Prediction	SPAIN	Earth Sciences & Environment	+34934137644	louis-philippe
3.	Kim	Serradell Maronda	BSC	Computational Earth Sciences	SPAIN	Earth Sciences & Environment	+34934134051	kim.serradell

Host collaboration description

This HPC-Europa3 project is expected to be a first step toward both a technical and scientific collaboration between the IPSL/ENSTA and the BSC that will beneficiate to both parties.
I will participate in the production of simulations for the BSC and bring them a scientific expertise on the Mediterranean basin climate. The IPSL on its side will benefit from me gaining experience on Earth models optimization, running and manipulating very large configurations. Also, the simulations produced within this framework will be extremely valuable for comparison with regional simulations of the Mediterranean basin produced at IPSL. This collaboration will open possibilities for more tools and simulations expertise sharing in the future between these two key players in high performance computing.

Section 4: Your Proposed Project

Project

Project Title	Running a high resolution Earth Sytem Model : pre-processing, production and post-processing
1. Main Field	Earth Sciences & Environment
2. Specific Discipline	Earth - Global change & Climate observation
More about the code:	
Specify the code name	EC-Earth 3.2 (IFS T1279 - NEMO-ORCA12)
Specify the web site of the code (if any)	http://www.ec-earth.org/

Is there an existing serial code?	Yes
How big is it?	more than 10000 lines
What language is it written in?	Fortran 90
if other, please specify:	
How much of the code did you write yourself?	0 percent
Is there an existing parallel code?	Yes
What language is it written in?	Fortran 90
How was it parallelised?	MPI
if other, please specify:	
How big is it?	more than 10000 lines
How much of it did you write yourself?	1-10 percent
Libraries and Packages used:	netcdf, MPI, BLAS, LAPACK, HDF4, HDF5, NETCDF, PARMETIS, SCALAPACK, P-NETCDF, UDUNITS, GRIB_API, CDFTOOLS v2, CDO, NCO, PERL, PYTHON, AUTOCONF and AUTOMAKE
Will you produce new data during your visit?	Yes
If yes, will the produced data be of interest for your scientific community?	Yes
Will the data be accompanied by metadata to describe them?	Yes
Will it be possible for you to make data related to your project available in open-access?	Under certain conditions

Your motivation for a visit - what do you intend to do?

Benchmarking:	Secondary motivation	Code development:	If time permits
Collaborative project:	Main motivation	Consultancy:	Not interested
Data Analysis:	Secondary	Establishing Academic	Main motivation

	motivation	Link:	
Optimisation:	Secondary motivation	Parallelisation:	If time permits
Porting code:	Secondary motivation	Production runs:	Main motivation
Training:	Main motivation	Visualisation:	Secondary motivation
Other:			

Tell us about your programming experience

	Level	Years experience
Unix	Advanced	More than 5 years
Fortran	Advanced	More than 5 years
C	Beginner	Less than 1 year
C++	No experience	Not applicable
MPI	Intermediate (high)	2-5 years
Open MP	Beginner	Less than 1 year
CUDA	No experience	Not applicable
OpenACC	No experience	Not applicable
OpenCl	No experience	Not applicable
OmpSS	No experience	Not applicable

Please characterise your typical production runs

Tell us about your present computing resources	
Machine architecture (please specify)	IBM x3750-M4, 332 nodes of 8 procs (Ada machine, at IDRIS) Local cluster (Climserv machine, IPSL) B510 bullx, 5040 nodes of 2 procs (Curie machine, TGCC)

Processor speed (please specify)	2.7 GHz, 233 Tflop/s (Ada machine, at IDRIS) 2.4 GHz (Climserv machine, IPSL) 2.7 GHz (Curie machine, TGCC)
Processor type (please specify)	Intel Sandy Bridge E5-4650 8-cores (Ada machine, at IDRIS) AMD Opteron 6378 16 cores (Climserv machine, IPSL) Intel Sandy Bridge EP (E5-2680) 8 cores (Curie machine, TGCC)
Number of nodes	101-1.000
Typical execution time per run	6-12 hours
Please estimate the computing resources that you would expect to use during your visit	
Total CPU requirements (CPU hours)	> 500.000
Please specify the value = (elapsed time of a single run)*(number of CPU used in a single run) * (total number of runs)	7.25*2521*120 = 2 193 270
Number of nodes	> 1.000
Total Memory requirements	9.001-90.000 Gb
Temporary disk space requirements for a single run	don't know
Library requirements	netcdf, mpi
Compatible architectures (Select one or more, as applicable)	IntelX86 (e.g. Sandy Bridge, Ivy Bridge, Haswell, Broadwell, Skylake) AMD
Compatible architectures (other)	
Please justify your choice of resources (e.g. CPU requirements, no. of processors, compatible architectures)	During the 3 month stay at BSC, I intend to run a 10 years period of the high resolution version of the EC-Earth 3.2 model. A 2-years test run with this model has already been done at BSC (MareNostrum supercompter) and all

	the components of the model have been benchmarked. 1 month of simulation takes 7h15mn on 2521 cores. Please note that this effort is part of a larger production run and that these hours of simulations are already scheduled and reserved for the Climate Prediction group at BSC.

Project Proposal

Background information	Current status of my research : Within the context of climate change, it is critical to assess and quantify the evolution of the climatic system, both in terms of mean state or variability, and understand the processes affecting it. Due to the large number of data points and the high complexity of the physical processes involved, Earth System Global Climate Models (GCMs) used to describe the climate system require a large amount of computational resources to integrate, and thus usually use relatively coarse temporal and horizontal resolutions. Regional Climate Models (RCMs) are used to downscale GCM simulations using the GCM output data as lateral boundary conditions. RCM integrations are typically run at 10-50 km horizontal resolution over a specific region of interest. Through a combination of explicitly resolved important processes (e.g., mountain circulations, land-ocean contrasts) and parameterization schemes adapted to higher resolutions, RCMs are able to provide more detailed characteristics of regional to local climate. The Mediterranean basin has quite a unique character that results both from his complex morphology (topography and coastline) and socio-economic conditions (surrounded by very urbanized littorals). It is thus subject to fine scale spatial and temporal variability, strong land-sea contrast, land-atmosphere feedback, intense air-sea coupling and aerosol-radiation interaction. In addition, the region features an enclosed sea, connected to the Atlantic ocean only by Gibraltar strait, with a very active regional thermohaline circulation. Therefore, the Mediterranean region is a particularly interesting case study for climate regionalization which is why the active research community has developed the MED-CORDEX initiative. This coordinated program aims at improving RCMs for increasing the reliability of past and future regional climate information and understanding the processes that are responsible for the Mediterranean climate variability and trends. Since 2011, I am responsible at Institut Pierre Simon Laplace (IPSL) for the development, maintenance and distribution of the NEMO-MED regional configuration of the Mediterranean Sea (currently used by 4 groups involved in MED-CORDEX) based on the NEMO general circulation model. I am also co-

	responsible of the IPSL effort to develop the MORCE (Model of the Regional Coupled Earth system) platform for process and climate studies of the Regional Earth system. This platform, first used for the Mediterranean basin (MORCE-MED) now integrates 5 components : the WRF atmospheric model, ORCHIDEE land-surface model, NEMO oceanic model, XIOS server for outputs management and OASIS coupler for communications between each components (XIOS, ORCHIDEE and NEMO being developed at IPSL). The new version of this platform is used for running the set of simulations defined in the MED-CORDEX protocol. I am in charge of coupling the NEMO-MED oceanic component with the atmosphere (heat and water fluxes, wind stress, sea surface currents and temperature) and land-surfaces (river discharge and coastal runoff) within MORCE-MED. This work also involves technical aspects like model portability and readability for further distribution, run production management and output management to make them compliant with the requirements of MED-CORDEX for distribution of the outputs to the community. In addition to this model development, my scientific research activities mainly focus on the role of meso-scale and sub-mesoscale oceanic structures on oceanic circulation (deep-convection, cross-shore exchanges, eddies detection and tracking, thermohaline criculation, etc...) and air-sea exchanges. Current status of the hosts research : The Barcelona Supercomputing Center (BSC) is a involved in the PRIMAVERA European project (Horizon2020, 2015-2019). This project aims to develop a new generation of advanced and well-evaluated high-resolution global climate models, capable of simulating and predicting regional climate. In particular, this new generation of GCM should provide insights questions such as "To what extent are recent heat waves, floods and droughts in Europe attributable to natural variability or human influences on the global climate system?" or "What are the physical and dynamical reasons induced by resolution change that affect the representation of mean state, variability and teleconnections on a wide range of timescales ?" In this framework, the BSC has developed a coupled version of the EC-Earth 3.2 climate model at a groundbreaking horizontal resolution of about 15km in each climate system component (EC-Earth3_T1279). The HighResMIP coordinated exercise, as part of the Sixth Phase of the Coupled Model Intercomparison Project (CMIP6), offers a framework for building a large multi-model ensemble of high resolution simulations with a low resolution counterpart following a common experimental protocol. This coordinated exercise will allow for identifying the robust benefits of increased model resolution based on multi-model ensemble simulations. The Glob15km simulation planned in the PRIMAVERA project proposes to follow the entire HighResMIP protocol for coupled climate simulations. This new configuration of high-resolution GCM offers an unprecedented tool to evaluate the improvement of models due to resolution increase at global scale but also benefits from the added value of regional models (access to finer temporal and geographical scales, better representation of extremas, explicit

	representation of physical processes, etc...). It thus appears as a key link between GCMs and RCMs, and will provide insight on errors of RCMs models due to GMCs forcings on lateral boundary conditions, influence of better representation of large scale phenomenas on regional climate, influence of regional climate on large scale, etc... The main counterpart of this kind of experiment (which is also the reason that makes it so challenging !) is of course the extremely high computational cost and the need to develop suitable postprocessing tools to diagnose and analyse the large amount of output produced. Indeed, the total set of simulations of 250 years of production (50 years of spin-up of the model, 100 years over the 1950-2050 period for historical and scenario forcing and 100 years over the same period for control run) is expected to request over 50 millions of core-hours and more than 350 TB of archives. Dealing with these ground-breaking resources for such a simulation will help prepare the next generation of configurations of RCMs at convection permitting scale (i.e. 2-3km for all components)
Case for HPC-EUROPA funding	My research would benefit from HPC-Europa funding by the rich interaction with the local scientific host that it will allow. The IPSL and the BSC are two very active groups producing / performing Earth system simulations (global low-resolution and regional high-resolution at IPSL, global high-resolution at BSC). The Glob15km simulation lies at the interface of global GCMs simulations and regional simulations and as such will allow a transfer of knowledge from both a technical (management of a high-complexity configuration) and scientific (analysis of a global simulation, with global large-scale interactions, at a regional scale resolution) perspective. Considering the aspects mentioned above, participating to this PRIMAVERA project is a unique opportunity for both BSC and IPSL to establish a communication channel between these two fields (global climate modeling and regional climate modeling) which co-exist but seldom interact and to benefit from the other partner's expertise. During this 3 month period, I intend to participate in the production of the Glob15km simulation at the super computer MareNostrum (located at the BSC). Knowing that a two years test period has already been performed, I intend to integrate the spin-up simulation over a ten years period. The performing of this short spin-up will allow me : 1) to be trained to the tools developed and used at BSC for managing the simulations but also to prepare them (configuration of the simulation setup, workflow management) and analizing them (post-processing of very large dataset), 2) to continue the benchmarking of the EC-Earth3_T1279 configuration already started at BSC using tools developed by the Computational Earth Science team (Paraver software), 3) to analyse the dynamical structures that develop over the Mediterranean basin and compare them with simulations with similar setup with the MORCE-MED RCM. Achieving these goals will provide me a strong expertise on numerical methodes used in climatical simulations and develop a scientific collaboration on analysis of oceanic processes at small scale. This HPC-Europa3 project also aims at initiating a long-term collaboration between my institute (LMD / IPSL) and the BSC. The PRIMAVERA project will end in 2019 which is the expected time required to run the 250 years of simulation and develop the tools to allow post processing and visualization. I

	plan to participate into the production of the simulations over the whole period and be able to analyse it over the Mediterranean basin in comparison with the MED-CORDEX simulations. Furthermore, dealing with these ground-breaking resources (technical difficulties encountered in running and managing this simulation, handling the very large set of outputs) for Glob15km simulation will help prepare the next generation of configurations of RCMs. Indeed, the protocol for the next set of MED-CORDEX simulations includes Flagship Pilot Studies (i.e. sensitivity tests based on identified case study) with simulations at convection-permitting resolution (~2-3km), or coupled simulations with explicit resolution of sub-mesoscale oceanic structures (~2-3km in the Mediterranean basin) on air-sea exchanges. These configurations are a first step toward RCMs with ~2-3km resolution for all components, and will reach an approximately comparable complexity as for EC-Earth3_T1279 configuration used for Glob15km simulation. All things considered, this strong experience will be extremely valuable for IPSL and myself on the long run.

Project Workplan

The objectives for this 13 weeks visit at BSC are :
1) Get hands-on with the EC-Earth coupled model on MareNostrum supercomputer and simulation tools developed at BSC : compilation of the code, checking the input files, preparing the simulation with automatic build configuration tool ("ec-conf"), workflow manager ("Autosubmit").
Expected time needed for that task : 4 weeks

2) Benchmark and run the Glob15km simulation : performing the 10-years simulation, consisting of the first years of the spin-up of the simulation, including checking the consistency of computing performance and of outputs.
Expected time needed for that task : 6 weeks. This simulation needs 870h in machine but it also includes time spent in queue between each re-submission of the run and potential errors.

3) Learn how to use developed tools by the Computational Earth Science team : as a side project of the simulation done with the EC-Earth model, computational Earth services and Earth model performance analysis done at BSC are of particular interest for the regional Earth climate model we develop at IPSL. I expect to train with these tools and apply them on the Mediterranean MORCE-MED configuration, in particular for the benchmarking, analysis of performance of the models, workflow management and post-processing tools.
Expected time needed for that task : 3 weeks. Note that this tasks will be done in parallel with task 2.

4) Initiate the analysis of the simulation : this 10-years spin-up simulation will be sufficient to allow for physical structures to develop. A particular focus on the Mediterranean basin will be done : comparison with similar structures obtained with lower resolution models will allow the estimation of the added value of increase of resolution, and their comparison with the simulations of the MORCE-MED configuration of IPSL will provide a comparison between a global and a regional

coupled model at similar resolutions. This task will also allow to use the post-treatment tools used for manipulating and visualizing the extremely large dataset of output files created.
Expected time needed for that task : 3 weeks.

The requested time visit of 13 weeks is longer than the average visit length of 7 weeks. However, this is necessary because of the long time needed to perform the simulation (6 weeks for a 10 years period simulation). Thirteen weeks is therefore the minimum time required to initiate the analysis and the tools used for post-treatment (task 4).

Section 5: Attachments

Curriculum vitae

RESEARCH THEMES :
- Regional climate and ocean modelling
- Influence of oceanic meso and sub-mesoscale over large scale circulation

EDUCATION :
2005-2008 PhD in marine geochemistry and modelling. LEGOS (CNRS, Toulouse), LSCE (CEA/CNRS, Saclay) et LPO (IFREMER/CNRS, Plouzané).
"Modelling the neodymium oceanic cycle"
2004-2005 Master degree in "Océan, Atmosphere and Land Surfaces", UPS, Toulouse
2003-2004 Master degree in "Applied mathematics", UPS, Toulouse
1999-2004 Engineer degree INSA Toulouse. Specialisation : Mathematics and modelling / Numerical models and methods

EXPERIENCES :
Nov 2011 - Now : Research Engineer at ENSTA-ParisTech; assignment at Laboratoire de Météorologie Dynamique (Palaiseau)
- Maintenance and developpement of the Mediterranean regional oceanic model NEMO-MED (configurations at 1/12°, 1/36°, regional coupling, nesting in regions of interest)
- Distribute and help collaborators with the use of simulations and the model.
- Research focus on small scale and climatic related dynamical processes : dynamical scales interactions, meso- and submeso-scale eddies, deep convection, eddies detection and tracking.

2011 : Research Engineer at LSCE (CEA/CNRS, Saclay).
Biogeochemical analysis of IPCC-CM5 simulations and coupling of the high trophic model APECOSM to the dynamical-biogeochemical model NEMO-PISCES.

2009-2010 : Post-doctorate at LDEO-Columbia University (NY, USA).
Development and application of numerical methods (Transport Matrix Method) to the simulation of passive oceanic tracers.

SKILLS - High performance computing :
Languages : Fortran (77 & 90), C, Python, Shell scripting, Matlab
Libraries : MPI, NetCDF, OpenMP
Platforms : NEC-SX, IBM, local clusters
Tools : ferret, IDL

Curriculum vitae (attachment)

- ARSOUZE_CV_2017_anglais_2p+annex.pdf

List of publications

1. K. Tachikawa, T. Arsouze, G. Bayon, A. Bory, C. Colin, J.-C. Dutay, N. Frank, X. Giraud, A. T. Gourlan, C. Jeandel, F. Lacan, L. Meynadier, P. Montagna, A. M. Piotrowski, Y. Plancherel, E. Pucéat, M. Roy-Barman, C. Waelbroeck, The large-scale evolution of neodymium isotopic composition in the global modern and Holocene ocean revealed from seawater and archive data. Chemical Geology, Volume 457, Pages 131-148, ISSN 0009-2541, https://doi.org/10.1016/j.chemgeo.2017.03.018, 2017.
2. P. Drobinski, S. Bastin, T. Arsouze, K. Beranger, E. Flaounas, M. Stefanon. North-western Mediterranean sea-breeze circulation in a regional climate system model. Climate Dynamics, 1-17. 2017.
3. H. Omrani, P. Drobinski, T. Arsouze, S. Bastin, C. Lebeaupin-Brossier, S. Mailler. Spatial and temporal variability of wind energy resource and production over the North Western Mediterranean Sea: Sensitivity to air-sea interactions. Renewable Energy, Volume 101, Pages 680-689, ISSN 0960-1481, https://doi.org/10.1016/j.renene.2016.09.028. 2017.
4. M. Ayache, J. C. Dutay, T. Arsouze, S. Révillon, J. Beuvier, C. Jeandel. High-resolution neodymium characterization along the Mediterranean margins and modelling of ε Nd distribution in the Mediterranean basins. Biogeosciences, 13(18), 5259-5276. 2016.
5. P.M. Ruti, S. Somot, F. Giorgi, C. Dubois, E. Flaounas, A. Obermann, A. Dell'Aquila, G. Pisacane, A. Harzallah, E. Lombardi, B. Ahrens, N. Akhtar, A. Alias, T. Arsouze, et al. Med-CORDEX Initiative for Mediterranean Climate Studies. Bull. Amer. Meteor. Soc., 97, 1187–1208, https://doi.org/10.1175/BAMS-D-14-00176.1. 2016.
6. A. Harzallah, G. Jordà, C. Dubois, G. Sannino, A. Carillo, L. Li, T. Arsouze, L. Cavicchia, J. Beuvier, N. Akhtar. Long term evolution of heat budget in the Mediterranean Sea from Med-CORDEX forced and coupled simulations. Climate Dynamics, 1-21. 2016.
7. J. Llasses, G. Jordà, D. Gomis, F. Adloff, D. Macías, A. Harzallah, T. Arsouze, N. Akthar, L. Li,

A. Elizalde, G. Sannino. Heat and salt redistribution within the Mediterranean Sea in the Med-CORDEX model ensemble. Climate Dynamics, pp 1-25, DOI: 10.1007/s00382-016-3242-0, 2016.
8. H. Omrani, T. Arsouze, K. Béranger, M. Boukthir, P. Drobinski, C. Lebeaupin-Brossier, H. Mairech. Sensitivity of the sea circulation to the atmospheric forcing in the Sicily Channel. Progress in Oceanography, 140, 54-68, doi:10.1016/j.pocean.2015.10.007, 2016.
9. F. Léger, C. Lebeaupin Brossier, H. Giordani, T. Arsouze, J. Beuvier, M.-N. Bouin, É. Bresson, V. Ducrocq, N. Fourrié, M. Nuret. Dense water formation in the north-western mediterranean area during HyMeX-SOP2 in 1/36° ocean simulations: Sensitivity to initial conditions. Journal of Geophysical Research: Oceans. DOI: 10.1002/2015JC011542, 2016.
10. M.Hamon,J.Beuvier,S.Somot,J.-M.Lellouche,E.Greiner,G.Jordà,M.-N.Bouin,T.Arsouze, K. Béranger, F. Sevault, C. Dubois, M. Drevillon, Y. Drillet. Ocean Science, 12(2), 577-599, doi: 10.5194/os-12-577-2016, 2016.
11. S. Berthou, S. Mailler, P. Drobinski, T. Arsouze, S. Bastin, K. Béranger, C. Lebeaupin Brossier. Lagged effects of the Mistral wind on heavy precipitation through ocean-atmosphere coupling in the region of Valencia (Spain). Climate Dynamics, pp 1-15, DOI: 10.1007/s00382-016-3153-0, 2016.
12. M. Jouini, K. Béranger, T. Arsouze, J. Beuvier, S. Thiria, M. Crépon, I. Taupier-Letage. The Sicily Channel surface circulation revisited using a neural clustering analysis of a high-resolution simulation. Journal of Geophysical Research: Oceans. DOI: 10.1002/2015JC011472, 2016.
13. E. Flaounas, A. Di Luca, P. Drobinski, S. Mailler, T. Arsouze, S. Bastin, K. Beranger, C. L. Brossier. Cyclone contribution to the Mediterranean Sea water budget. Climate Dynamics, 46, 3-4, 913-927, 2016.
14. A. Guyennon, M. Baklouti, F. Diaz, J. Palmieri, J. Beuvier, C. Lebaupin-Brossier, T. Arsouze, K. Béranger, J.-C. Dutay, T. Moutin. New insights into the organic carbon export in the Mediterranean Sea from 3-D modeling. Biogeosciences Discussions, 12(8), 2015.
15. S. Berthou, S. Mailler, P. Drobinski, T. Arsouze, S. Bastin, K. Béranger, E. Flaounas, C. Lebeaupin Brossier, S. Somot, M. Stéfanon. Influence of submonthly air-sea coupling on heavy precipitation events in the Western Mediterranean basin. Quarterly Journal of the Royal Meteorological Society, DOI:10.1002/qj.2717, 2015.
16. M. Ayache, J. C. Dutay, P. Jean-Baptiste, K. Beranger, T. Arsouze, J. Beuvier, J. Palmieri, B. Le-vu, W. Roether. Modelling of the anthropogenic tritium transient and its decay product helium-3 in the Mediterranean Sea using a high-resolution regional model. Ocean Science, 11(3), 323-342, 2015.
17. S. Lefort, O. Aumont, L. Bopp, T. Arsouze, M. Gehlen, O. Maury. Response of marine pelagic communities to global climate change. Global change biology, 21(1), 154-164, 2015.
18. S. Berthou, S. Mailler, P. Drobinski, T. Arsouze, S. Bastin, K. Béranger, C. Lebeaupin-Brossier. Sensitivity of an intense rain event between an atmosphere only and an atmosphere-ocean regional coupled model: 19 September 1996. Quart. Journ. of the Roy. Met. Soc. Quarterly Journal of the Royal Meteorological Society, 141(686), 258-271, 2015.
19. S. Berthou, S. Mailler, P. Drobinski, T. Arsouze, S. Bastin, K. Béranger and C. Lebeaupin-Brossier. When are Mediterranean heavy precipitation events most sensitive to atmosphere-ocean coupled processes? An analysis in southern France. Tellus, A 66, 2014.
20. N. Mkhinini, A. L. S. Coimbra, A. Stegner, T. Arsouze, I. Taupier-Letage, K. Béranger. Long-lived mesoscale eddies in the eastern Mediterranean Sea: Analysis of 20 years of AVISO

geostrophic velocities. Journal of Geophysical Research: Oceans, 119(12), 8603-8626, 2014.
21. C. L. Brossier, T. Arsouze, K. Béranger, M. N. Bouin, E. Bresson, V. Ducrocq, I. Taupier-Letage. Ocean Mixed Layer responses to intense meteorological events during HyMeX-SOP1 from a high- resolution ocean simulation. Ocean Modelling, 84, 84-103, 2014.
22. Sepulchre P., Arsouze T., Donnadieu Y., Dutay J.-C., Jaramillo C., Le Bras J., Martin E. E., Montes C., Waite A. Consequences of shoaling of the Central American Seaway determined from modelling Nd isotopes, Paleoceanography, DOI: 10.1002/2013PA002501, 2013.
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24. Arsouze T., Treguier A. –M., Peronne S., Dutay J. –C., Lacan F. and Jeandel C. Modeling the Nd isotopic composition in the North Atlantic basin using an eddy-permitting model. Ocean Sci., Vol. 6, N. 3, P. 789-797. 2010.
25. Peucker−Ehrenbrink B., Miller M. W., Arsouze T. and Jeandel C. Continental bedrock and riverine fluxes of strontium and neodymium isotopes to the oceans. Geochem. Geophys. Geosyst., 11, Q03016, doi:10.1029/2009GC002869, 2010.
26. Arsouze T., Dutay J.-C., Lacan F. and Jeandel C. Reconstructing the Nd oceanic cycle using a coupled dynamical – biogeochemical model. Biogeosc., 6, 2829-2846, 2009.
27. Arsouze T., Dutay J.-C., Kageyama M., Lacan F., Alkama R., Marti O., Jeandel C. Influence of the Atlantic meridional overturning circulation on neodymium isotopic composition at the Last Glacial Maximum, a modelling sensitivity study. Clim. Past, 4, 191-203, 2008.
28. Arsouze T., Dutay J-C., Lacan F. and Jeandel C. Modeling the the Neodymium isotopic composition with a global circulation model. Chem. Geol., 239, 165-177, 2007.
29. Jeandel C., Arsouze T., Lacan F., Téchiné P. and Dutay J.-C. Isotopic Nd compositions and concentrations of the lithogenic inputs into the ocean: a compilation, with an emphasis on the margins. Chem. Geol., 239, 156-164, 2007.

Section 6: Marketing HPC-Europa3

About HPC-Europa3

Where did you hear about HPC-Europa3?	Colleague
If possible, please provide us with more details. For example, if you heard about us from a direct boss or colleague, how did they hear about us? If you found us from a link on another web site, tell us	A colleague who applied to this funding in 2008 told me he really enjoyed his stay in his host laboratory, and that he made a fruitfull collaboration out of it. He hear about HPC-Europa projects from his boss. I think you should advertise more inside labs concerned by HPC (mails, posters).

the URL of that site. If you selected "Other", please let us know where!

Any further suggestions for a more effective marketing of the HPC-Europa3 Programme

Data protection and privacy of personal information

The collection of personal data is conducted in accordance with Italian laws and regulations. Such data will only be used for purposes connected to the fulfilment of the contract/service. Any information provided to CINECA during the supply/service will be treated as strictly confidential and in according to the terms of law.
As the form is closed you automatically authorise CINECA to use all your personal data for the selection procedure of the HPC-Europa3 Project, and for any further utilisation in the frame of the project, (according to the D.lgs. 196/2003 of 30/06/2003 about "Personal data protection").