IS-ENES2

1rst PERIODIC REPORT
Core Report

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Introduction to IS-ENES2

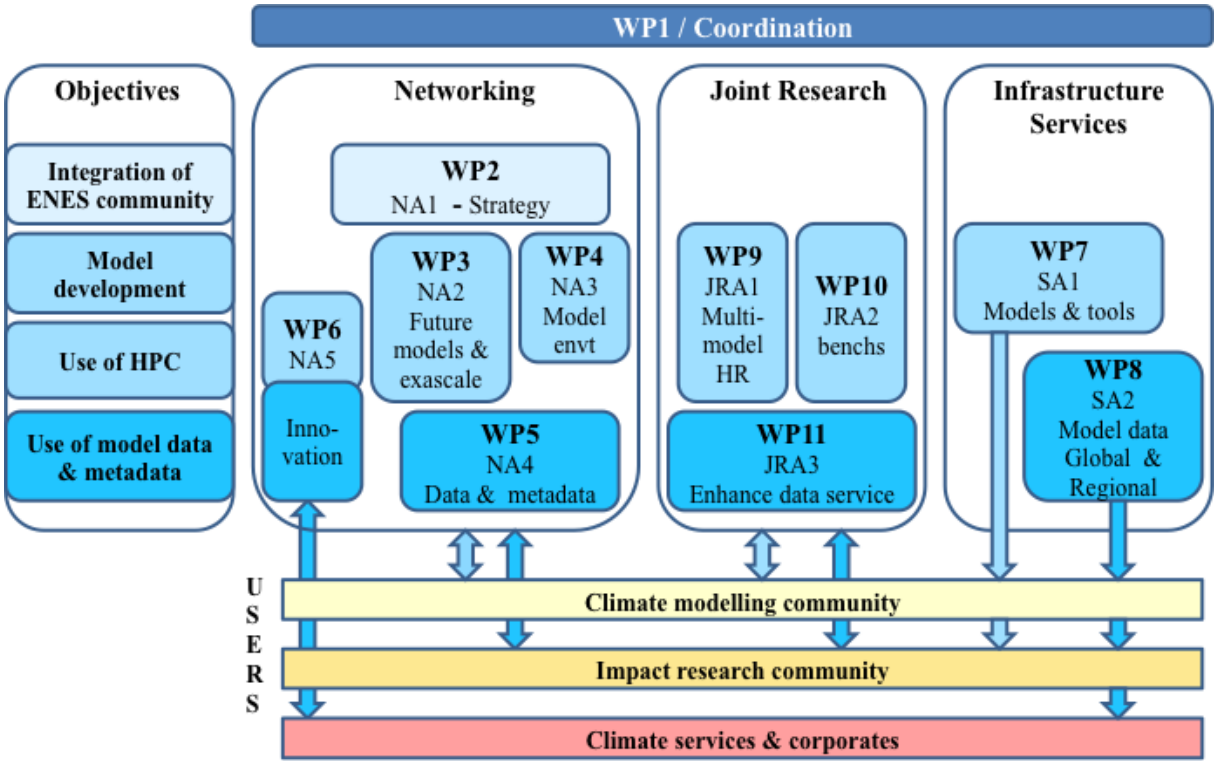
IS-ENES2 is the second phase project of the distributed e-infrastructure of models, model data and metadata of the European Network for Earth System Modelling (ENES). This network gathers together the European modelling community working on understanding and predicting climate variability and change. ENES organizes and supports European contributions to international experiments used in assessments of the Intergovernmental Panel on Climate Change. This activity provides the predictions on which EU mitigation and adaptation policies are built.
IS-ENES2 further integrates the European climate modelling community, stimulates common developments of software for models and their environments, fosters the execution and exploitation of high-end simulations and supports the dissemination of model results to the climate research and impact communities. IS-ENES2 implements the ENES strategy published in 2012 by: extending its services on data from global to regional climate models, supporting metadata developments based on the FP7 METAFOR project, easing access to climate projections for studies on climate impact and preparing common high-resolution modelling experiments for the large European computing facilities. IS-ENES2 also underpins the community's efforts to prepare for the challenge of future exascale architectures.
IS-ENES2 combines expertise in climate modelling, computational science, data management and climate impacts. The central point of entry to IS-ENES2 services, the ENES Portal, integrates information on the European climate models and provides access to models and software environments needed to run and exploit model simulations, as well as to simulation data, metadata and processing utilities. Joint research activities improve the efficient use of high-performance computers and enhance services on models and data. Networking activities increase the cohesion of the European ESM community and advance a coordinated European Network for Earth System modelling.

IS-ENES2 has four main objectives:

- To foster the integration of the European Climate and Earth system modelling community by strengthening ENES governance, further developing its strategy, especially with regards to model evaluation and model developments, stimulating interactions between global and regional climate modelling communities, developing training (WP2/NA1)
- To enhance the development of Earth System Models for the understanding of climate variability and change by networking on future model developments required to improve model quality and use of future computing architectures, by stimulating common software developments and providing a service on models and tools (WP3/NA2, WP4/NA3 and WP7/SA1)
- To support high-end simulations enabling us to better understand and predict climate variations and change by preparing for future exascale computing architectures (WP3/NA2), by preparing multi-model high resolution common experiments on the European PRACE high-performance computer facilities (WP9/JRA1), by stimulating collaboration with ICT companies (WP6/NA5 & WP10/JRA2)
- To facilitate the application of Earth system model simulations to better predict and understand the climate system and climate change impacts on society by enhancing the dissemination of model results from both global and regional model experiments (WP8/SA2), by developing an interface dedicated to the climate impact community and improving the

quality of information on simulations through metadata developments and guidance to users (WP5/NA4 & WP11/JRA3) and by enhancing interaction between the climate modelling activity and users from companies and the emerging climate services (WP6/NA5).

They aim to serve the needs of the climate modelling community as well as the needs of communities using model results to study the impacts of climate change and develop climate services.



Project objectives for the period

The first period of IS-ENES2 has been devoted to the following main objectives:

Sustain and enhance service activities on models and on model data:

- On models and tools (WP7/SA1): install a service on all the seven European climate models used in CMIP5 allowing to answer questions on models and, for two of them, helping the delivery and use of their models; sustain the service on model components and tools implemented in IS-ENES1
- On model data and metadata (WP8/SA2): start provision of access to the results of the CORDEX experiments for Europe and Africa, improve the help desk service for data users (CMIP5 and CORDEX) and data node providers, provide a service on metadata standard, implement access to the climate4impact portal developed during IS-ENES1 and devoted to ease access to model results for the climate impact communities

Develop network activity with a specific focus on:

- Strategy issues: strengthen ENES governance with the help of an ENES scientific officer, scope the infrastructure strategy for model evaluation (WP2/NA1)
- Community building: implement the second training school on Earth system modelling for young scientists and further develop the ENES portal (WP2/NA1)
- Strengthen the networking around radiation code and cloud simulator software (WP3/NA2)
- Enhance sharing of experience around environment tools for climate models, such as configuration management and workflow software (WP4/NA3)
- Prepare for future HPC architectures: with work on model performance through the analyses of kernels in atmosphere and ocean codes (WP3/NA2) and with technology tracking on exascale (WP3/NA2) and on innovation in HPC (WP6/NA5)
- Data and metadata standards (WP5/NA4): generate data archive interface specifications based on user requirements and need for standardization from data providers, clarify terms of use, in particular for commercial use (WP6/NA5), start extending the Common Information Model (CIM) used for metadata to downscaled model results at regional scale.
- Network with a range of users from the climate impact community as well as climate service providers (WP5/NA4 and WP6/NA5)

Develop joint research activity with a specific focus on:

- High-end experiments (WP9/JRA1): prepare multi-model, multi-member high resolution experiments
- Benchmarking (WP10/JRA2): establish a framework for coupled model benchmarks and prepare benchmarking experiments on different coupling approaches
- Improving data services (WP11/JRA3): maintain and improve software tools for the international Earth System Grid Federation (ESGF) model data base, maintain and develop software tools for the metadata CIM, enhance climate4impact portal functions with a particular focus on implementing downscaling tools and calculations of climate indices, develop monitoring tools for ESGF.

Main results for the first period

Results presented in the following descriptions of each work package (WP) activity show that the project has kept its main schedule. There has been some reorganization, activities being advanced or delayed, both due to external factors and internal developments, as detailed in WP descriptions below. But in overall none of these changes affect the course of the project.

Main achievements of IS-ENES2 first period, described by IS-ENES2 main objectives are:

To foster the integration of the European Climate and Earth system modelling community

- The ENES Scientific Officer has been recruited but only in month 16, delaying the revision of ENES governance. However, this did not prevent work on long-term strategic issues important for the sustainability of the climate modelling infrastructure: preparation of an ESFRI proposal CliM-ERI (Earth's climate system modelling European research infrastructure) sustaining IS-ENES on the long-term, and preparation of a Centre of Excellence for HPC applications in climate and weather. The first phase of the preparation of the infrastructure strategy for model evaluation has also been achieved with the provision of a green paper, elaborated in collaboration with an international team lead by IS-ENES2 partners, in the context of the next CMIP6 experiments (WP2/NA1).
- Community building with the young scientists has been achieved with the 2nd European summer school on Earth system modelling with a new special session on entrepreneurship (WP2/NA1).

To enhance the development of Earth System Models for the understanding of climate variability and change

- Dedicated workshops on environment tools, such as configuration management, metadata creation and workflow, have been an opportunity to share experience between software engineers from the different climate modelling groups. It has created a momentum to further exchange on software tools and cross-test some tools (WP4/NA3).
- Sharing radiation code has started although it proved to be more complex and more model dependant than initially foreseen (WP3/NA2).
- A benchmark suite to evaluate coupling strategies has been defined (WP10/JRA2) and guidelines for a common governance on coupler established (WP4/NA3).
- Services on models and environment tools (WP7/SA1) have been continued and extended to a service on climate models. Users can access documentation of models and ask questions on model when using mode results. A higher-level service has also been established and tested for two models, EC-Earth and UK Metoffice models, and proved to help some new users in Europe and worldwide.

To support high-end simulations enabling us to better understand and predict climate variations and change

- The third ENES HPC workshop in Hamburg has been an opportunity to gather the climate modelling community and vendors around technology tracking on exascale and around innovation in HPC.
- This workshop has been a strong incentive to develop plans with our US colleagues for an international model performance intercomparison. It defined a performance metrics, which is tested in IS-ENES2 to prepare high-end experiments in WP9/JRA1 and for the model benchmarks in WP10/JRA2.

- In order to prepare multi-model multi-member experiments, software for automatic submission of ensemble experiments has been developed and tested (WP9/JRA1).
- Discussions between ENES and PRACE have been launched with support from the ENES HPC Task force, in order to investigate the possibility to use a dedicated access to run some high-end experiments of CMIP6 on PRACE Tier0 machines.

To facilitate the application of Earth system model simulations to better predict and understand the climate system and climate change impacts on society

- ESGF organisation has encountered some reorganisation at the international level and IS-ENES2 teams have been very efficient to take leadership on some activities, such as the installation module of the software stack and the user support and security (WP11/JRA3). IS-ENES2 teams have also successfully developed a dashboard to monitor ESGF activity. IS-ENES2 is now very well recognised at the international level as being a key component of ESGF, as is shown by contacts with DoE to establish international governance (WP2/NA1).
- IS-ENES2 teams also play a critical role in developing ESGF data nodes for CORDEX results for the Euro-cordex and Africa cordex domains (WP11/JRA4 and WP8/SA2). Terms of use and archive specifications for CORDEX have been developed in close cooperation with IS-ENES2.
- IS-ENES2 is also strongly involved in the development of the metadata services in collaboration with US (WP11/JRA3). Developments using python have contributed to offer more flexibility in metadata capture and have led to a successful test to automate transfer of climate model configuration meta-data into the Earth System Documentation (ES-DOC).
- The climate4impact portal, aiming to ease access to ESGF model data for the climate impact community, has been successfully implemented and developments offer new functionalities such as the on-line computation of climate indices and improved sign in and data discovery functions.

Work progress and achievements during the period

Synthetic presentation of main results and assessment of next steps and, for some cases, deviations

	Positive aspects	*Deviations* / next steps
Integration NA1	Governance: ENES Scientific Officer recruited	*Governance still requires revision*
	Plans for a sustainable infrastructure (not initially planned): proposal for an ESFRI and preparing a COE for HPC application in climate and weather	ESFRI proposal in discussion at national level COE proposal in preparation within eINFRA-2015-5
	Foresight: first step for the strategy for model evaluation infrastructure. Contributes to the international CMIP6 preparation	Delivery of white paper and input the update of the ENES infrastructure strategy
	Summer school has been held in Barcelona, 9-20 June, 2014: three models used	
MODELS And Environment tools NA2, NA3 SA1, JRA2	Service on climate model set with: Level 1 (answer to questions) for all models Level 2 (support to model user) for 2 models	Service review on-going
	Further improved IS-ENES1 services on OASIS, NEMO and CDO	
	Successful dedicated workshops on environment tools: model configuration, metadata creation and workflows	Investigate possibility to share common tools
	Networking on common radiation code	*More complex than foreseen to have a common radiation code plugged in different models. Requires some more time.*
	Coupling methodologies Draft on common governance and evaluation suite for benchmarking different coupling methodologies	

HPC NA1, NA2, NA5, JRA1, JRA2	3rd ENES HPC workshop: Launch of model performance metrics for intercomparison, tested in IS-ENES2 WPs Contacts with vendors established	
	Preparation of high-end experiments started with performance analyses and ensemble submission software	Access to HPC to be obtained
	Discussion with PRACE for a dedicated access for high-end experiments within CMIP6	Still under discussion
	Coupled benchmarks started	Delivery to vendors still to be done

Data and metadata NA4, NA5 SA2 JRA3	ESGF reorganisation: successful leadership of IS-ENES2 team for some activities Contacts with DOE for establishing an international governance	*Forced short-term activities and delayed longer-term activities* International governance still lacking
	CORDEX datanodes: key role of IS-ENES2 in implementing CORDEX data in ESGF Leadership role recognised by WCRP	MoU under preparation with WCRP to set the international role of IS-ENES2
	Metadata standard: improvement of flexibility and metadata capture	
	Climate4impact portal: implemented in IS-ENES2 service. New functionalities implemented.	

WP2/NA1: ENES strategy

Work Package Number	*WP2/NA1*		Start Date or Starting Event				Month 1		
Work Package Title	ENES strategy								
Activity Type	*COORD*								
Participant Number	1	6	10	5	3	4	14	22	9
Participant Short Name	CNRS-IPSL	MetO	MPG	UREAD-NCAS	CERFACS	DKRZ	UIB	DLR	KNMI

Summary of progress of the work package:

WP2/NA1 aims at strengthening the integration of the ENES community. It includes three levels of action: strengthening the governance of ENES, further developing the ENES strategy and supporting community building.

Task 1: ENES governance

In order to strengthen ENES organisation and its role in enhancing the integration of the climate modelling community in Europe, an ENES Scientific Officer has been recruited since July 2014, Francesca Guglielmo. She will help in all the strategic and governance activities.
In order to prepare for a sustained infrastructure in climate modelling, a proposal for an ESFRI has been prepared, CliM-ERI for the "Earth's climate system modelling European Research Infrastructure", involving the ENES Board as well as the ENES task force on HPC and a precursor for a data task force. The proposal has been endorsed by JPI Climate in May 2014. IS-ENES2 also supports the preparation of a Centre of Excellence (CoE) proposal to support HPC application for climate and weather. Discussions are on-going with PRACE to prepare a dedicated access for high-end experiments within the next CMIP6 international coordinated experiments.
Concerning international governance for ESGF, discussions have started with DOE. IS-ENES2 is also a partner in the governance for the US CoG development. A MOU is under preparation with WCRP to explicit the role of IS-ENES2 for CORDEX implementation within ESGF.

Task 2: European Climate Community Strategy

During RP1, the strategy for model evaluation infrastructure has been launched. A green paper has been produced (M2.2) emphasizing infrastructure needs for Earth system models, observations and evaluation tools. M2.2 is based on an international SWOT analysis of CMIP5 practices. This was discussed at a small workshop held at KNMI prior to the EMBRACE FP7 general assembly in May 2014. A white paper is under preparation on "infrastructural needs for routine ESM evaluation in CMIP6". This paper is elaborated internationally with the US in order to help prepare the required infrastructure for the next phase of CMIP. The paper will be submitted for publication in the coming months and will then be used to elaborate the mid-term update of the ENES infrastructure strategy.

Task 3: Climate modelling community building

Summer School

The 2nd European Earth System and Climate Modelling school has been held in Barcelona in June 2014 (D2.2). 40 applications have been received and 30 students selected from 13 EU and 7 non-EU countries. Students followed lectures and tutorial from 16 researchers. They were trained on three different European climate models. A session on entrepreneurship was set as part of WP6/NA5 in collaboration with Climate KIC (M6.3).

ENES Portal

The ENES portal (https://portal.enes.org), setup in the IS-ENES1 project, has been maintained, upgraded and in some points extended and refined. The usage statistics of the last years suggest a stable use of the infrastructure, with an increase after the starting phase of IS-ENES2 to about 3000 unique visitors per month in 2014. Portal workflows and publication guidelines have been further extended, refined and improved. Further content has been added to the portal, as e.g. the performance benchmarks portal.

Significant results:

Task 1:

- Several meetings have been in Brussels on HPC for climate, with PRACE to prepare for high-end experiments in CMIP6, with EC on HPC strategy, with EC on CoE.
- July 2014, recruitment of Francesca Guglielmo as ENES Scientific Officer. Five applications were received among which three have been interviewed.
- March 2014, IS-ENES2 coordinator has been contacted by DOE concerning a draft for international governance. A meeting was held in Washington DC to further discuss this governance.
- July 2014, IS-ENES2 was invited to participate in the governance of the international Earth System web collaboration environment CoG (www.earthsystemcog.org).

Task 2:

- M2.2, the green paper on infrastructure needs for model evaluation has been provided as a first draft for the international paper in preparation for model evaluation by DLR and UiB
- M2.2 results were discussed at a workshop in KNMI organised by UiB and DLR.

Task 3:

- D2.2, the 2nd European Earth system and climate modelling school has been held in Barcelona from June 9 to June 22nd, 2014. It was hosted by BSC and was organised by MPG with collaboration from UREAD-NCAS and BSC.

Deviations from Annex I (DoW) :

D2.2, UREAD-NCAS and MPG swapped the order of execution of the schools from what was planned originally in the DoW, because it seemed appropriate to start with the institute more experienced with international schools. UREAD-NCAS will plan and carry out the 3rd school.

Reasons for failing to achieve critical objectives and/or not being on schedule

D2.1, update of ENES governance rules has been delayed to month 24, following the delay in recruitment of the ENES Scientific Officer. However, in practice, the ENES Board has already been extended to include the scientists leading the seven European global climate models having participated to CMP5 for the discussion of the CliM-ERI ESFRI proposal.

Use of resources:

CNRS-IPSL: 3.78 pm, co-leads WP2. CNRS-IPSL has led the recruitment of the ENES SO, chairs the ENES Board and is involved in the international governance and in the HPC Task Force.

MetO: 0 pm, participates to the HPC task force, the ENES Board and prepares governance rules for common software. However this partner has not charged to the project in this period yet.

MPG: 0 pm, participates to the HPC task force, the ENES Board. MPG has led the organisation of the 2nd ENES summer school. However, this partner does not charge personnel cost to the project in this period.

UREAD-NCAS: 1.1pm, leads WP2, participates to the HPC task force, the ENES Board. UREAD-NCAS is involved in preparing the international governance for ESGF and has collaborated in the preparation of the 2nd ENES summer school.

CERFACS: 1 pm, leads the HPC Task force and collaborates on preparing the governance on software.

DKRZ: 4.5 pm, is in charge of maintaining and upgrading the ENES Portal.

UiB: has organised the workshop on model evaluation. However this partner has not charged to the project in this period yet.

DLR: 1.78 pm, leads the paper on infrastructural needs for model evaluation. V. Eyring as chair of the CMIP Panel, ensures an international dimension to this activity and its insertion in the preparation of CMIP6.

KNMI: 0.296 pm, hosted the workshop on model evaluation and will be involved in the update of the ENES strategy.

Corrective actions: none

WP3/NA2: Towards next generation models

Work Package Number	*WP3 / NA2*		Start Date or Starting Event			Month 1			
Work Package Title	Towards next generation models								
Activity Type	*COORD*								
Participant Number	4	10	5	2	1	12	7	16	6
Participant Short Name	CMCC	MPG	UREAD-NCAS	DKRZ	CNRS-IPSL	UNIMAN	STFC	BSC	MET-O

Summary of progress of the work package:

WP3/NA2 is devoted to preparing the climate community for exascale and better connecting those working on climate models by establishing some code convergence and shared understanding of divergent codes.

The first reporting period led to the establishment of a community to work on a common radiation tool that set off with a preliminary document on a radiation library interface. Moreover, the computational convergence of climate codes has started by analysing the main relevant computational parts (kernels) of the NEMO European ocean model and the ICON atmospheric model, with the aim to gather in clusters the computational codes of different models that need analogous optimizations.
Finally, the workshop on Exascale Technologies has been organized to track the evolution of computer technology and algorithms and address the computational issues for climate models at exascale.

Details for each task:

Task 1: Building a community using common radiation tools

Task 1 is devoted to putting in place a community working on developing a common radiation library, as well as developing and extending the existing community work on optimising the observation system simulators.
An internal document has been delivered during RP1 reporting on how to standardize the exchange of information with the radiative transfer routines, allowing these later to be defined as libraries, which could then be exchanged and developed by different groups. The key components of the radiative transfer scheme have been identified to be the calculation of the solar insulation, the surface, aerosol, cloud and gas optical properties, and the radiative transfer solver. Critical problems for creating a common framework have been identified.
Moreover, the relative performance of the different modules of the COSP simulator has been achieved running the global configuration of the MetOffice Unified Model (MetUM) and evaluating the CPU time consumed by each module. Some optimizations have been also carried out on some modules (like CloudSat and MODIS) allowing to achieve significant performance improvements.

Task 2: Developing convergent model codes

Task 2 is devoted to the code convergence. During the first period, the activity has focused on the NEMO ocean model and the ICON atmospheric model. For each model, the identification of the main computational kernels and their performance analysis has been carried out. Several metrics have been used to evaluate and characterize the code from a computational view; among others the roofline model provides a way to identify common computational issues among different codes. Additionally, initial performance analysis of NEMO (using the PARAVER and DIMEMAS tools) has been carried out. The scalability of the ICON model was also evaluated on different massive parallel architectures.

These performance results have been reported in 5 working documents (3 on NEMO and 2 on ICON). A document reporting the methodology for evaluating and analysing the performance has been also internally delivered.
In addition, an initial analysis of the programming environments mostly used in the climate community has been carried out; work on the interoperability of coupling technologies and on techniques to evaluate deployment choices on large-scale architectures has been undertaken.

Task 3: Technology tracking
An international workshop on exascale technology has been organized in Hamburg in March 2014 (M3.1). The main topics have been technology, programming environments, algorithms and numerical schemes suitable for the exascale era. The main outcomes of the workshop have been reported in the deliverable D3.1 "Report on the technology tracking" issued in September 2014. Planning for the Coupling Workshop in 2015 has started.

Significant results:

Task 1:
- First draft towards the standardization of the treatment of radiative transfer in atmospheric models and delivery of the document "Toward a common framework for radiative transfer in ESM"
- Computational performance currently achieved on the CloudSat simulator software and delivery of the document "Progress report on COSP optimisations".

Task 2:
- Preliminary insights on NEMO performance & its scalability and definition of the NEMO main kernels. Delivery of the document "The NEMO Profiling: List of the main kernels"
- ICON scalability results and the list of kernels inside ICON. Delivery of the document "The ICON atmospheric model, Part 1: Kernel Profiling"
- Preliminary insights on ICON hybrid MPI/OpenMP performance using the VAMPIR and SCALASCA performance tools. Delivery of the document "The ICON atmospheric model, Part 2: Scaling Analysis based on the HD(CP)2 setup"
- List of programming languages used by the community. Evaluation of NEMO using the PARAVER and DIMEMAS tools. Delivery of two documents: "The NEMO oceanic model performance analysis" and "Trace analysis of NEMO model with PARAVER and DIMEMAS"
- Definition of a performance analysis methodology and delivery of the document "Performance Analysis"

Task 3:
- International workshop on exascale technology in March 2014 (M3.1) and associated report on main outcomes (D3.1)

Deviations from Annex I (DoW): none

Reasons for failing to achieve critical objectives and/or not being on schedule:
The milestone M3.2 "Workshop on Coupling/Framework Strategies" has been delayed from month 16 (July 2014) to April 2015 (mo 25) but with no impact on other activities of DoW.

Use of resources:

CMCC: 12.8pm, is leading the WP by organizing internal meetings and by scheduling the activities. It has also provided the performance analysis of the main kernels of NEMO and has contributed on the definition of metrics for computational performance. It has actively contributed to the organization of the exascale technology workshop and to the deliverable D3.1 "Report on the

technology tracking".

MPG: 4 pm, leads Task 1. The radiative transfer codes of the MPG (ECHAM6), MetO (UM) and CNRS-IPSL (LMD) atmospheric models have been reviewed and compared. MPG has identified the key components of the radiative transfer as well as the critical problems limiting the creation of a common framework.

UREAD-NCAS: 0 pm, no activities on Task 2.1 have been carried out, but there is no deviation from the DoW.

DKRZ: 1 pm, the scalability analysis and the identification of the main kernels inside ICON have been carried out by DKRZ. During this work, the ICON model has been ported to several HPC platforms and successfully tested on up to 65K cores. Furthermore, for the hybrid parallel version of ICON, different task/thread mappings on the underlying hardware have been examined. Additionally, DKRZ was involved in hosting the exascale technology workshop held in Hamburg.

CNRS-IPSL: 1.19 pm, has contributed to Task 1 through its work on the document "Toward a common framework for radiative transfer in ESM" and hosting an expert visit to IPSL to help design of a common user interface for the radiative transfer module. CNRS-IPSL has modified in its atmospheric model LMDZ the interface between the radiative code and the surface to allow a variable number of bands in the short-wave domain

UNIMAN: 2 pm, in task 3.2, UNIMAN has developed a prototype demonstrating the seamless integration of ESMF and MCT technologies into a single coupled application through a technology independent API. UNIMAN has also undertaken joint research (with Annette Osprey at the University of Reading) on a benchmark-driven approach to performance modelling for evaluating deployment choices on large-scale multi-core architectures. This work has resulted in two publications so far. In task 3.3, initial planning for the Coupling Workshop, which will be held in Manchester in 2015, has been undertaken.

STFC: 0.98 pm, in task 3.3, STFC, in collaboration with UNIMAN, have performed the initial planning and organisation of the 3rd International Coupling Workshop which is scheduled to take place in Manchester in 2015.

BSC: 6.3 pm, has identified the programming languages used by the European ESMs. BSC has also provided initial results on performance analysis of NEMO model using the PARAVER and DIMEMAS tools.

MetO: 5.4 pm, has contributed significantly to Task 1 through its work on the "Toward a common framework for radiative transfer in ESM" document and hosting an expert visit to the Met Office to help design of a common user interface for the radiative transfer module. MetO also worked on optimisation and efficiency improvements to the COSP code (code to calculate variables measured by satellites from model variables). One COSP module (radar) was optimised such that it is almost an order of magnitude faster. Other COSP work included fixing memory leaks in the COSP code and determining the optimum choice for user selected variables for splitting the (computationally expensive) workload.

Resources are being used according to plan and there are no deviations from budget.

Corrective actions : None

WP4/NA3: Earth System Modelling Environments

Work Package Number	*WP4/NA3*		Start Date or Starting Event				Month 1
Work Package Title	Earth System Modelling Environments						
Activity Type	*COORD*						
Participant Number	10	1	2	3	4	6	22
Participant Short Name	MPG	CNRS/ IPSL	DKRZ	CERFACS	CMCC	MetO	UiB

Summary of progress of the work package:

The objective of this work package is to provide networking activities to increase the pace of climate science employing modelling by sharing best practice in software environments for Earth System Models and encouraging more sharing of selected codes within the climate community.

Details for each task:

Task 1: Workflow solutions, including seasonal to decadal (S2D) climate prediction systems.
DKRZ and MPG planned and led the first workshop on Workflow solutions, which was hosted by DKRZ. Details about the workshop are given in the D4.2. A key finding was that there was a lot of interest in the workflow and meta-scheduler software Cylc. Many groups are using it, or evaluating it, or are planning to evaluate it. It is likely that coordinated support and maintenance of Cylc would be beneficial to the community.. With respect to CMIP6, we will be facing a data deluge: whether we can afford this and if there is room for optimization was discussed. Collecting experiment / provenance data is a topic which is receiving greater attention. This includes garnering details about the operating system, versions of libraries etc. Workflows can also play a part to making systems robust to hardware failures that will be a challenge on exascale architecture.

Task 2: Configuration Management Tools
MetO with MPG planned, hosted and led the first workshop on Configuration Management. Results from this workshop are described in D4.1. The FCM (Flexible Configuration Management) system developed at MetO was presented in detail.
MetO set up example configurations to build NEMO using fcm make and evaluated fcm make with MPIESM. This led to some bug fixes & enhancements to FCM. Both MPG and CNRS-IPSL took action to evaluate FCM's usefulness in their ESM environments.

Task 3: Metadata creation and usage
DKRZ prepared, led, and hosted a workshop on meta-data (MD) creation and usage in January 2014. DKRZ and MPG jointly prepared a report on the workshop. The major conclusion from the workshop was the need to plan better for automated MD Generation with stronger links to data productions processes. MetO and DKRZ also prepared material describing plans for metadata management on the CMIP6 timeframe and will propose a formal experiment specification standard to the WGCM Infrastructure Panel for use in CMIP6.
UiB has tested and evaluated the newly established Norwegian national data archive system (https://archive.norstore.no/) for long-term storage of ESM output. The use of the national archive will help to ensure preservation, integrity, documentation and future access of the Norwegian ESM output.
There was the proposition to capture user comments on the data into the meta-data for an experiment.

Task 4: Governance of a community coupler

To strengthen even further the European networking around the OASIS coupler, promote its use and start involving the community in its governance, active user support and 3-day training sessions have been offered by CERFACS, held twice in 2013. A session on the coupler governance was also organised during the First General Assembly and provided material for the milestone M4.3. Furthermore, preparation of the third international workshop on coupling technologies is planned in Manchester in April 2015, and will specifically address the question of the coupler governance in a session "Community aspects of coupling technology development: how to fund, govern and work together?"

Significant results:

Task 1:

- First workshop on workflow solutions, 3-5 June 2014, at DKRZ, Hamburg, was attended by 19 people from 9 institutions.
- D4.4 available November 2014

Task 2:

- First configuration management workshop, 23-24 September 2013, Exeter, has been attended by 20 people (6 people from MetO, 14 people from other institutions including GFDL)
- D4.1 "Configuration management initial workshop report" was produced in January 2014, in due time.

Task 3

- Workshop on meta-data creation and usage on 21st/22nd January 2014 at DKRZ, attended by 17 persons
- Internal report produced

Task 4

- M4.3 presents the current status of the governance of the coupler and how to develop it further. First release was elaborated during RP1 and final release delivered mo 20 before submission of RP1 report.

Deviations from Annex I (DoW): None

Reasons for failing to achieve critical objectives and/or not being on schedule: None

Use of resources:

MPG: 2.7 pm, MPG leads WP4/NA3. MPG co-organised the workshops on workflow and configuration management. MPG participated to all workshops. MPG contributed to the reports of the 3 workshops. MPG has provided advice on governance issue.

MetO: 9.6 pm, MetO co-leads WP4/NA3. MetO led and hosted the first workshop on configuration management. They prepared tests for this workshop and led D4.1. MetO also collaborated on D4.2 on workflow solutions and participated to all workshops of NA3. MetO also contributed to discussions on governance issue.

CNRS-IPSL: 0.84 pm, CNRS-IPSL participated to all 3 workshops.

DKRZ: 5.1 pm, DKRZ led and hosted the workshop on metadata generation and prepared the associated internal report. DKRZ participated to all 3 workshops

CERFACS: 7 pm, CERFACS provides training sessions on OASIS and leads the governance discussions on OASIS. CERFACS also contributes to the preparation of the third international workshop on coupling technologies.

CMCC: has not spent any pm on WP4 yet.

UiB: 1 pm, have tested and evaluated the newly established Norwegian national data archive system (https://archive.norstore.no/) for long-term storage of ESM output.

Corrective actions: None

WP5/NA4: Data Networking

Work Package Number	WP5/NA4	Start Date or Starting Event				Month 1
Work Package Title	Data Networking					
Activity Type	COORD					
Participant Number	1	2	3	4	7	8	9
Participant Short Name	CNRS-IPSL	DKRZ	CERFACS	CMCC	STFC	SMHI	KNMI
Participant Number	11	12	14	17	19	21	
Participant Short Name	CSAG	UNIMAN	WU	UC	DMI	MF-CNRM	

Summary of progress of the work package:

The WP activities were significant during this 1st period, but given international constraints and agenda changes with respect to the Earth System Grid Federation (ESGF) database, mainly concerning High Level Governance and Project Management, one milestone and one deliverable are delayed: M5.2 and D5.1. In Task 1, the Coordinated Regional Climate Downscaling Experiment (CORDEX) archive specifications have been done as expected, and M5.1 delivered. In Task 2 progress have been done on Metadata standards, notably with US within Earth System Documentation (ES-DOC), within the EU COST-VALUE, and also collaborating with the US on downscaling vocabulary (National Climate Predictions & Projections: NCPP). Finally in Task 3, User Requirements for the impacts and regional climate modelling communities have been gathered as planned.

Details for each task:

Task 1: Core data services

ESGF High Governance Level

High-level international governance needs to be established for ESGF. During RP1, work has been done in close collaboration with PCMDI to establish the WCRP Infrastructure Panel (WIP). This body that will drive requirements for ESGF, ESDOC, in support of international coordinated experiments (CMIP6 and other MIPs.) Several partners of IS-ENES2 are represented in the WIP (STFC, CNRS-IPSL, UREAD). A first draft of the Data archive governance and requirements document has been provided (M5.1).

ESGF Project Management

Working Teams have been established within ESGF and IS-ENES2 people have now authority in several groups (SMHI, DKRZ, CNRS-IPSL, STFC, CMCC), representing an important recognition of the European contribution to ESGF. The CORDEX Archive specifications and CORDEX Variable Requirement table have been developed.

Task 2: Meta-data, interoperability and standardisation

This activity is done in collaboration with the US within ES-DOC. Focus has been to improve the Common Information Model (CIM) previously developed in the FP7 METAFOR project. A CIM generation software has been developed. CIM Scientific Quality Control has been studied using lessons from CMIP5 and in preparation of CMIP6. CIM has been extended to include Statistical Downscaling common vocabulary specifications in collaboration with the US NCPP project and the EU COST VALUE. Work has also been done to extend CIM to regional climate model experiments from CORDEX. In the framework of MedCordex and Eurocordex, discussions allowed to define metadata about the driving conditions of the regional simulations.

STFC (in collaboration with UNIMAN) have developed a parser, which can take model code and generate the structure needed to develop a CIM description of the code. It has been tested on specific versions of both NEMO and the Met Office Unified Model. In the coming year, it will be used in task 2 of NA2, and feedback from that activity is expected to drive further improvements in the code. UNIMAN (in collaboration with STFC) investigated a metadata mark-up language to support, in a flexible, widget-based visual environment, the creation of documents based in part on content in other XML documents, the use of the content being constrained by their schemas.

Task 3: Requirements for the impact user communities

A special user session has been organised by IS-ENES2 at the Circle-2 Final Conference in Lisbon in collaboration with CLIPC project to inform on the climate4impact portal and get feedback from the impact community. Benefiting from the participation of CSAG, user statistics and user information needs were gathered from impact users in South Africa, which will be integrated with information already available for Europe.

Specifications of the downscaling process, based on the integration of the University of Cantabria Downscaling Portal, have been integrated in the climate4impact portal. Regional Climate Modelling community needs have been gathered. Continuous collaboration between US & Europe on Metadata and standards with respect to statistical downscaling metadata controlled vocabulary has been conducted with regular teleconferences under the leadership of NCAR/NCPP/CoG.

Significant results:

Task 1:

- Establishment of the World Climate Research Programme (WCRP) Infrastructure Panel (WIP) into which several IS-ENES2 partners are participating.
- Participation of several IS-ENES2 partners in the ESGF newly created Working Teams.
- CORDEX Archive specifications and CORDEX Variable Requirement table have been developed.
- M5.1 first draft of the D5.1 on Data archive governance and requirements document has been provided

Task 2:

- Extensions of the Metadata Common Information Model (CIM) to CORDEX and statistical downscaling.

Task 3:

- Organization of the IS-ENES2 special user session at the Circle-2 Final Conference in Lisbon.

Deviations from Annex I (DoW): No deviations from Annex I.

Reasons for failing to achieve critical objectives and/or not being on schedule:

- The milestone M5.2 has been delayed to month 27. Consisting of a consultation and collecting information and requirements for the Deliverable D5.3 (due in Month 42), this delay in delivery has no impact on other tasks. There are mainly two reasons for the delay: on the technical infrastructure side, the consultation should include experiences with the Globus data access protocol, which is not yet in production (deployments planned for early 2015), on the organizational side, discussions on generic conditions of use, especially for derived data products, are ongoing.
- D5.1 (Task 1, mo 18) "Data archive governance and requirements document" will be delayed to month 22 (January 2015). The document will be based around agreements reached within the WCRP Infrastructure Panel, which was only given the go ahead to start work in mid 2014. The greater community engagement enabled by the delay is expected to benefit the project through improved alignment with infrastructures in the US.

Use of resources:

CNRS-IPSL: 1.38 pm, WCRP Infrastructure Panel, ES-DOC coordination, ESGF coordination contribution

DKRZ: 0 pm, ensures the coordination of IS-ENES with EUDAT. DKRZ has also elaborated the CORDEX/ESGF specification documents including QC aspects. However this partner has not charged to the project in this period.

CERFACS: 5.3 pm, work package coordination, discussions on Metadata Controlled Vocabulary of statistical downscaling, several presentations at conferences and workshop to disseminate IS-ENES2 work related to the impact community portal climate4impact.eu, and at the same time gathering of user feedback.

CMCC: 0 pm, some PMs will be allocated starting from the second period.

STFC: 3.38 pm, WCRP Infrastructure Panel; CORDEX specifications and outreach; review of CMIP5 CIM metadata; initiation of a GO-ESSP meeting (to be held in early 2015).

SMHI: 0.66 pm, development of suitable meta data standards for CORDEX ESGF publishing. Contribution to CORDEX publishing conventions for ESGF nodes and participating in CORDEX Scientific Advisory Team (SAT).

KNMI: 3.1 pm, gathered user feedbacks for the climate4impact portal development priorities.

CSAG: 5 pm, participation in CORDEX Scientific Advisory Team (SAT): next phase of CORDEX

UNIMAN: 1.5 pm, researcher effort on metadata mark-up language in Task 2.

WU: 3.94 pm, preparation and facilitation of CIRCLE 2 workshops in Lisbon

UC: 3 pm, uses case and metadata definition and integration specification of the Downscaling and Climate4Impact portals. Evaluation and deployment of the ESGF/CORDEX specification including a ESGF test an production node deployment for publishing CORDEX datasets.

DMI: 1.22 pm, has participated in the development of archive specification in collaboration mainly with DKRZ and SMHI. Terms of use have been formulated with STFC and SMHI and have been agreed upon.

MF-CNRM: 0 pm, in the framework of MedCordex and Eurocordex, MF-CNRM has participated in the discussions about how to define metadata about the driving conditions of the regional simulations. However, this partner does not charge personnel cost to the project in this period.

Corrective actions: No corrective actions needed.

WP6/NA5: Innovating on climate modelling

Work Package Number	*WP6/NA5*	Start Date or Starting Event					Month 1
Work Package Title	Innovating on climate modelling						
Activity Type	*COORD for NA5*						
Participant Number	1	2	3	4	5	7	8	14
Participant Short Name	CNRS -IPSL	DKRZ	CERFACS	CMCC	UREAD-NCAS	STFC	SMHI	WU

Summary of progress of the work package:

This work package is addressing two groups of external users. The first is the ICT industry, where the aim is to improve collaboration and create a culture of co-design aiming to facilitate efficient use of future computer architectures and systems for climate models. This work package also aims to reinforce relations with providers of climate services in order to stimulate innovation in this field and better use results from IS-ENES2. Activities in this part of the WP have been seriously affected by the start of the FP7 Copernicus CLIP-C project in 2014. CLIP-C, which in part emerged from IS-ENES, integrates model results with observational datasets for a large range of users in the context of climate services and overlaps with initial task 3 objectives. Relations between IS-ENES2 and CLIP-C have evolved during this reporting period and the climate service user oriented activities are now being executed in cooperation between the two projects. This has resulted in some reorientation of tasks and deliverables.

Details for each task:

Task 1: Facilitate innovation through collaboration with ICT companies

The first important step was the strong involvement of ICT companies in the 3rd ENES HPC Workshop where leading international climate modellers discussed requirements and expected developments in the models and in HPC technology. The next steps will be the communication of the results from WP3/NA2 on code structure and the provision of benchmarks produced within WP10/JRA2 to ICT companies.

Task 2: Facilitate innovation through the transfer of climate knowledge to consultancies and corporates

Progress in this task is satisfactory. A report on access rights and IPR issues has been produced and is now under review (see D6.1) and a session on entrepreneurship for climate modellers was held by Harilaos Loukos, former director of SME CLIMPACT, and project leader for the climate KIC Climate Data Factory project, at the ENES Summer School in Barcelona on 12th June 2014. A master class pilot is scheduled for 18th-21st of March 2015. This master class is being organised in close cooperation with the Climate KIC's education lead.

Task 3: Facilitate societal innovation

This task has been impacted to the greatest extent by the new context of collaboration with CLIP-C. It was decided to postpone the production of deliverable 6.2 (Report on needs for climate services) as an extensive user needs survey organised by CLIP-C in collaboration with IS-ENES2 was conducted during the summer of 2014. Also the coordination with the EEA Climate-adapt platform has been influenced by a newly established coordination arrangement between CLIP-C and the EEA (focusing on Copernicus Climate Change Service requirements).
A milestone document (M6.1) was produced, but the scope of the document was reduced.

Significant results:

Task 1:

- Presentations of Workshop on Exascale Technologies & Innovation in HPC for Climate Models available at https://verc.enes.org/ISENES2/events/ws3 (M6.2)

Task 2:

- A report "Report on access rights for CMIP5 and CORDEX for commercial use" was produced. (D6.1)
- Session on entrepreneurship at the ENES summer school in June 2014 (M6.3)
- Agreement between IS-ENES2, CLIPC and Climate KIC to jointly organize a master class in March 2015.

Task 3:

- Collaboration between CLIPC and IS-ENES2 in executing an extensive European user needs survey.
- M6.1 report addresses The European Environment Agency data needs and maps working relations aimed at fulfillment of these needs. It is based on a workshop between CLIP-C and EEA in May 2014 at Copenhagen.

Milestones M6.1, M6. 2 and M6. 3 realized.

Deviations from Annex I (DoW) :

Task 3 "facilitate societal innovation" and the associated D6.2 need re-definition in view of the overlap with CLIP-C activities. Agreements with CLIP-C on collaboration have been made but, because of this, execution of activities met with delays. A dedicated workshop with members of the communities providing and using climate services will be held in February 2015. This event will be integrated with the CLIP-C conference on user needs scheduled at the same time.

We propose to extend the deadline for deliverable D6.2 to Month 27.

Reasons for failing to achieve critical objectives and/or not being on schedule: None

Use of resources:

The expenditure is going according to plan.

DKRZ: 1.4 pm, DKRZ organised and hosted the 3rd HPC Workshop on Exascale Technologies & Innovation in HPC for Climate Models held in March 2014 in Hamburg.

WU: 0 pm, has contributed to task 2 for development of the master class design and initiation of information campaign, and to task 3 for coordination of activities with CLIPC and support of user survey. However this partner does not charge in this work package in RP1.

SMHI: 0.93 pm, spent on task 3

CNRS-IPSL: 0.35 pm, organised the entrepreneurship session at the ENES summer school, and contributed to the organisation of the 3rd HPC workshop. CNRS-IPSL also participates to the European Climate service partnership to ensure the link with ENES.

STFC: 0.4 pm, STFC has interacted with global modelling groups internationally to clarify IPR issues for commercial use for CMIP5 model results and their implication for CORDEX results.

CERFACS: 1 pm, has contributed to incorporate other FP7 projects data and documentation within the climate4impact web portal developed within JRA3, notably ECLISE, CLIM-RUN and EUPORIAS. CERFACS was also one of the main convener of the IS-ENES2/CLIPC session organized at the CIRCLE2 Adaptation Frontiers Final Conference in Lisbon that was held on March 10th -12th, 2014.

Corrective actions : *None*

WP7/SA1 The European Network of geographically distributed services on Earth System models, component models and tools

Work Package Number	WP7/SA1		Start Date or Starting Event		Month 1		
Work Package Title	The European Network of geographically distributed services on Earth System models, component models and tools						
Activity Type	*SUPP*						
Participant Number	3	1	8	9	21	6	22
Participant Short Name	CERFACS	CNRS-IPSL	SMHI	KNMI	MF-CNRM	MetO	UiB
Participant Number	10	4	23	2			
Participant Short Name	MPG	CMCC	met.no	DKRZ			

Summary of progress of the work package:

All services on Earth System Models (ESMs), component models and tools have been, and still are, offered as planed. Level 1 services (basically answer to questions) are offered for the seven European ESMs used to run the CMIP5 simulations. In addition, level 2 services (additional support for users) are offered for the Unified Model and EC-Earth. The services on the ocean model NEMO, the OASIS coupler and CDO are ensured as initially envisaged. Consequently, all WP milestones have been reached.

Details for each task:

Task 1: Managing the ENES Earth System Model Resources

During the first period of the project, frequent contacts and mail exchanges with the different ESMs groups were established to ensure that the ESM portal pages were kept up-to-date and that one contact person per ESM was identified and the contact details were available through the portal. Interaction with ENES portal manager also happened regularly to solve technical issues. Finally, the review committee that will report on the quality of the services was set-up.

Task 2: Services on European ESMs

Different levels of services were offered on the different ESMs.

For all European ESMs used to run the CMIP5 simulations, i.e. CMCC-CESM, CNRM-CM5, MPI-ESM, EC-Earth, IPSL-CM5, HadGEM2, and NorESM, level 1 services have been offered. These services ensure that the ESM CIM description established during IS-ENES1 is accessible through the ENES portal and that a contact person, with contact details available on the portal, is identified to answer specific questions about the ESM when needed. Statistics on portal hits for the ESMs pages and detail per ESM are available at https://verc.enes.org/awstats/awstats.pl?config=esm ; note that these statistics started to be collected only in August 2014 so the page will be more informative for the second period of the project.

At level 2, services have been offered by MetO on the Unified Model and by SMHI and KNMI on EC-Earth.

For EC-Earth, support for EC-Earth installation was provided to Wageningen University (NL) and to Karlsruhe Institute of Technology (DE). On-site support was also provided to solve technical issues at Lund U and Stockholm U in Sweden, and at the 2014 IS-ENES summer school in Barcelona. Finally the EC-Earth Development Portal at https://dev.ec-earth.org was maintained with two source releases

(EC-Earth 3.0.1 and 3.1 7), 79 issues worked on, 35 wiki pages created or updated, and 189 discussion forum messages managed in 25 topics during the period. These services greatly helped the outreach of EC-Earth as shown by the current 101 users including 42 new users during the period.

Level 2 services are offered on the Unified Model, which is the atmospheric part of the HadGEM2/3 and Earth System families of models developed at MetO. These services extend the use of European models outside the MetO and Europe and facilitate effective collaboration with scientists in the meteorological, climatological and university communities, e.g. the Air Force Weather Agency in the USA, the Weather Services in South Africa, the National Centre for Medium Range Weather Forecasting in India, the Meteorological Administration in Korea, Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation in Australia, and the National Institute of Water and Atmospheric Research in New Zealand. For all these users, a dedicated team maintains a twiki collaboration platform and a trac system with tickets for new developments and fixes, publishes newsletters and newsgroups for questions and discussions. Finally, in-person expertise is also provided through the UM User Workshop and the UM User Tutorial (one in 2013 and one in 2014).

Task 3: Services on NEMO ocean model component (installation 8) (CNRS-IPSL)

NEMO services are organized around the existing web site http://www.nemo-ocean.eu/ referenced on the ENES portal, which provides detailed and up-to-date information on the code sources (managed under Subversion), reference manuals, user guides, announcement and news on forums and meetings, development information using a Trac ticketing system. Statistics available for the last 12 months show that these services provided:

- 744 changes of the NEMO source code
- 233 tickets opened (for developments or bugs) by 53 reporters, and 140 bug fixed
- 482 edits of the wiki pages (documentation, description of on going work)
- about 300 mails sent to answer user questions

Finally, to maintain and enrich NEMO reference database build during IS-ENES1 with new experiments produced with, work on higher resolution reference configurations has started with the ORCA025 (~1/4 degree resolution) global configuration. Some reference simulations including the new sea-ice component NEMO-LIM3 have also started. This reference database, which leverages NEMO User Guides, will help the large community of NEMO users to better evaluate the validity of their oceanic simulations.

Task 4: Services on ESM tools

All these services are available since the beginning of the project.

OASIS (installation 9) (CNRS-IPSL, CERFACS)

During the second period, the services around OASIS have consisted in:

- Maintaining the most up-to-date sources and documentation available on the Subversion server (558 change sets registered during the period).
- Distributing them to the climate modelling community (230 download requests during the period) through the OASIS web site (https://verc.enes.org/oasis) accessible through the ENES portal.
- Updating the Redmine development tickets (219 ticket updates during the period, see https://inle.cerfacs.fr/projects/oasis3-mct).
- Active user support was also provided mainly through mail exchanges (~390 during the period) and few phone conversations.
- Following and updating OASIS forum conversations (26 conversations during the period).

These services helped users on specific issues and provided guidance on how to use the software on specific platforms and in particular configurations.

CDO (installation 10) (DKRZ)

The services included running the CDO helpdesk and webserver set up during IS-ENES1, accessible via the ENES portal. In particular, up-to-date documentation, FAQ, and help form are accessible through the ENES portal.

The new version CDO1.5.9. was released during the 1st reporting period of IS-ENES2 and has been progressed to version 1.6.4 by now. The source code and binary packages of CDO have been downloaded several thousand times from the download area. There are now more than 2700 contributions to the different forums on the website.

Significant results:

- All WP milestones were realised (see the specific reports):
  M 7.1 (mo 12): Contact person identified and contact details available for each European ESM
  M 7.2 (mo 12): Level 2 service on ESM available
  M 7.3 (mo 12): Set-up of the review committee
- Release of version 2.0 of OASIS3-MCT in May 2013: sources are available on the OASIS web site (https://verc.enes.org/oasis) accessible through the ENES portal. Since may 2013, more than 200 OASIS3-MCT_2.0 downloads were registered from groups in Europe but also in USA, Colombia, India, Japan, China, Saudi Arabia, etc.

Deviations from Annex I (DoW) : No deviation

Reasons for failing to achieve critical objectives and/or not being on schedule :
All objectives were reached on schedule.

Use of resources:

Operational costs / Access cost for each partner:

CERFACS: 2 pm, has coordinated the WP7/SA1 (task 1) and has provided services on OASIS.

- Operation costs for the first reporting period: 6 041€
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: 1 293€

CNRS-IPSL is the main provider of services on NEMO, is involved in services on OASIS and has provided level1 services on IPSL-CM5

Installation on ESM tool OASIS:

- Operation costs for the first reporting period: 72 591€
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: 15 535€

Installation on NEMO ocean model:

- Operation costs for the first reporting period: 184 392€
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: 39 460€

Installation on IPSL-CM5:

- Operation costs for the first reporting period: **98 805€**
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: **21 144€**

SMHI has provided level2 services on EC-Earth.

- Operation costs for the first reporting period: 21 **593€**
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: 4 **319€**

KNMI does not request access cost for this period, although has provided level2 services on EC-Earth.

MF-CNRM does not request access cost, although has provided level1 services on CNRM-CM5.

MetO has provided level2 services on Unified Model and HadGEM2

- Operation costs for the first reporting period: 74 **131€**
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: 14 **826€**
-

UiB does not request access cost for this period, although has provided level1 services on Nor.ESM.

MPG does not request access cost, although has provided level1 services on MPI-ESM and services on CDO.

CMCC does not request access cost, although has provided level1 services on CMCC-CESM

Met.No has provided level1 services on Nor.ESM

- Operation costs for the first reporting period: 1 **926€**
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: **385€**

DKRZ does not request access cost for this period, although has ensured the ENES portal maintenance.

Corrective actions: No action needed.

WP8/SA2: ENES Climate Data Services

Work Package Number	*WP8 / SA 2*		Start Date or Starting Event			Month 1
Work Package Title	ENES Climate Data Services					
Activity Type	*SUPP*					
Participant Number	1	2	7	9	15	19
Participant Short Name	CNRS-IPSL	DKRZ	STFC	KNMI	LIU	DMI

Summary of progress of the work package:

In the first project period the IS-ENES data service activities are focused on user support, ESGF and QC installation support, CIM services, data statistics and the review committee. User support streams of IS-ENES and ESGF have been harmonized and operated on routine basis. Installation support for ESGF data node software and for data quality control tools were provided. Application of CIM metadata services, which have been implemented prototypically, was supported. Data access statistics of the IS-ENES data portals have been generated and visualized. The Climate4Impact portal moved from prototype to operations to support the climate impact communities in climate model data usage. Finally the IS-ENES data services review committee had been established.

Details for each task:

Task 1: Core Data Services

1.1 User Support: The ENES Climate Data Infrastructure (CDI) Help Desk is provided internationally by the ESGF AskBot system. AskBot is a community-driven question and answer web application. It enables users to both ask and answer questions, provides a rating system in which quality answers are be identified and knowledgeable users recognised. After the first ESGF query system at NASA had gone out of operation, STFC (hard- and software, AskBot) and DKRZ (support service) took this task. The system turned out to be preferable to a request tracking system. In between, a FAQ page has grown from the queries. The good experiences with this service led to installing a second AskBot system supporting the Climate4Impact community (see below).
Information on CDI through the ENES portal (enes.org) and the IS-ENES2 data website (is.enes.org) has been continuously curated and supplemented.
In the context of the IS-ENES2 team (IPSL/LiU) being responsible for the ESGF installation software and release management IPSL offers a test federation allowing system components to be tested before deployment (upgrade and initial installation) together with hosting and managing for the community the main ESGF distribution repository. A test suite software stack has been released by IPSL along the test federation so as to help release manager and node manager to check their installation. Frequent expert support to node managers is provided to European or international partners when setting up or upgrading ESGF nodes.

1.2 CORDEX Support: LiU developed an automated system to notify users with failed downloads due to non-membership to the CORDEX and CMIP5 groups. Since April 2014, LiU answered to more than 100 user queries. Since the same time, LiU is functioning as one of the primary Certification Authorities for the global ESGF system including the CORDEX data nodes.

1.3 Quality Control: The quality control tools were run for CORDEX and CMIP5 data by various IS-ENES partners of the federation (LiU, KNMI, DMI, DKRZ, IPSL). Installation support was given.

1.4 Low Level Data Access: An ESGF data node was set up providing direct access to long term archived CMIP5 data, replicated from ESGF data nodes (DKRZ). This node is integrated into the

overall ESGF search index. Work on a download and user statistics gathering system for IS-ENES was conducted by LiU.

Task 2: Metadata Services

2.1 CIM Governance: The continuous biweekly transatlantic phone conferences of the ES-DOC project on CIM related issues went on. Here one main aspect was the transfer of the data collected by the questionnaire in the CMIP5 project to ease CMIP6 data input.

2.2 CIM Repository: Various services on CIM metadata (MD) have been prototypically implemented and are currently supported and further improved. They are periodically deployed on the operational system. These are CIM Creation Services (ES-DOC python client, CMIP5 questionnaire, ES-DOC questionnaire [DYCORE, NCPP]) and CIM Viewing Services with the CIM viewer plugin. In addition, a CIM Document Comparator (front-end and API) and search capabilities (front-end and API) were established. All those services can be accessed from es-doc.org.

Task 3: Enhanced Data and Information Access

3.1 ENES Data Portals: In the context of the ongoing maintenance of the ESGF/IS-ENES2 data portals, some of the statistics generated by CMCC using the dashboard (WP11) were evaluated and visualized by DKRZ (see below).

3.2 Support: After the Climate4Impact portal had gone operational, different support activities for developers and for users were taken up. For the former, besides wiki, repository and issue tracker, a Virtual Machine containing a full development version of climate4impact was established. For the latter, in addition to the AskBot (see above Task1), the users are supported by direct answers to their questions. For answering the questions in AskBot, a schedule for support was set up and will be enhanced.
Furthermore, the user interface was enhanced by integration of ES-DOC metadata in the catalogue browser and a Glossary, which is a product of the FP7 project EUPORIAS (euporias.eu). Services for climate indices calculation (five in total) developed in JRA3 have been integrated into the portal.

3.3 Outreach: Various talks were given at international conferences to present the ENES CDI and its associated services (see list of talks in RP1 report).

3.4 Review Procedure: A review committee composed of Tim Carter (SYKE) and Jens Klump (CSIRO/GFZ) was established (M.8.2) in September 2014. They agreed to review the IS-ENES2 data service activity. As a kick off, a phone conference has been held in October.

Significant results:

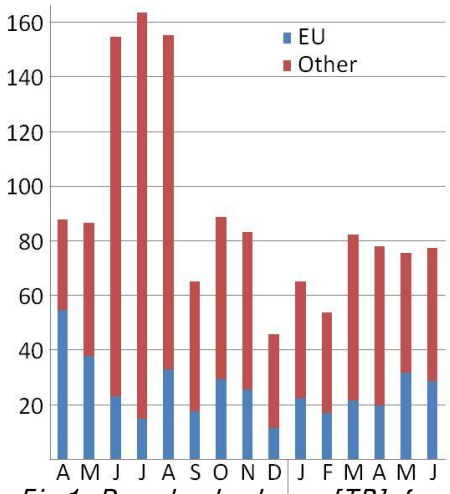


Fig 1: Download volumes [TB] from ENES ESGF nodes, accumulated over projects.

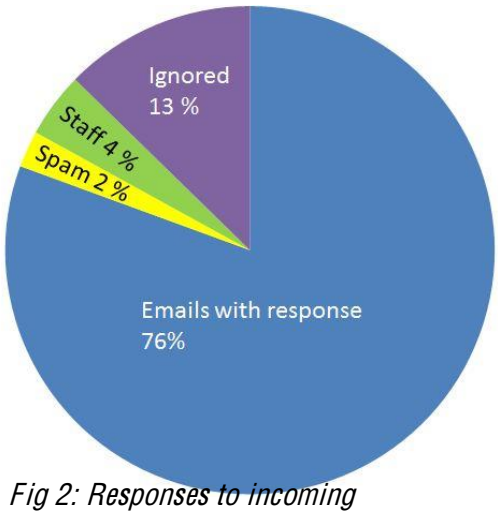


Fig 2: Responses to incoming mails

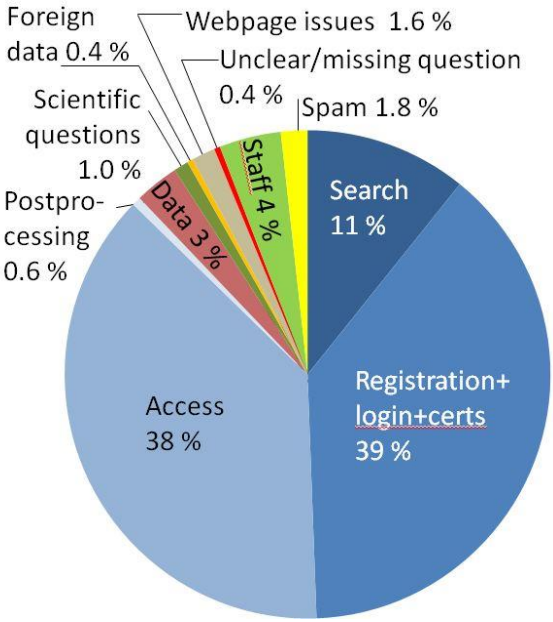


Fig 3: Topics of queries

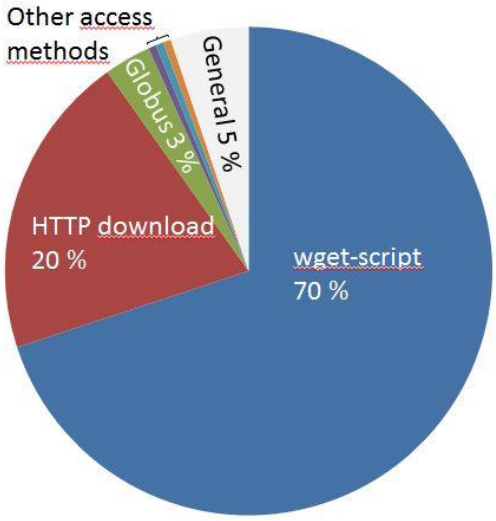


Fig 4: Subtopics of access queries

An interesting outcome of Task 1 is the user statistics. It consists of statistics on downloads (files/volume) from ENES/ESGF nodes (Fig. 1) and on the user support at the help desk (topics / responses) (Figs 2 to 4). The latter allows for improving the system and the user support, as the main weaknesses show up. The graphs show statistics on 510 issues on the mailing list from 2013-12-01 to 2014-06-30. 80% of all responded mails were answered by European engineers, i.e, members of IS-ENES2. Among the different topics, access issues of various kindsplay a dominant role (77%), about half of them (39%) refer to registration, login and certificates. In total, 76% of all mails were responded. The statistics of responses show a share of 13% of ignored mails. This is due to unknown answers and too few experts, e.g. in rarely used access methods or scientific details.

Status of milestones:

M8.1: The ENES CDI help desk was implemented in September 2013 through the AskBot (see separate milestone report). M8.2: The set up of the review committee was finalised at month 18 by a phone conference of the reviewers and project and WP leads.

Deviations from Annex I (DoW): None

Reasons for failing to achieve critical objectives and/or not being on schedule : n/a

Use of resources:

Operational costs / Access cost for each partner:

DKRZ has coordinated the WP7/SA1. DKRZ has provided services to users and data nodes (DN), support including DN statistics and maintenance of IS-ENES data website.

- Operation costs for the first reporting period: 1 **128 258€**
- Percentage of the operation costs charged to the project: 12.2%
- Access cost charged to the project for the first reporting period: **147 416€**

STFC has provided services on CIM, user and data node, which includes running the two software tools (AskBots) for user support).

- Operation costs for the first reporting period: 697 565€
- Percentage of the operation costs charged to the project: 8.2%
- Access cost charged to the project for the first reporting period: 61 493€

CNRS-IPSL has provided services to users and data nodes, as e.g., software deployment and installation support).

- Operation costs for the first reporting period: 91 831€
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: 19 652€

LiU has provided services on CORDEX to users and data nodes.

- Operation costs for the first reporting period: 104 581€
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: 20 916€

DMI has provided services on CORDEX to users and data nodes.

- Operation costs for the first reporting period: 118 203€
- Percentage of the operation costs charged to the project: 20%
- Access cost charged to the project for the first reporting period: 23 641€

KNMI does not request access cost for this period, although has provided services to users of the Climate4Impact portal.

Corrective actions: n/a

WP9/JRA1 Multi model, multi member high resolution Earth System Models

Work Package Number	*WP9/JRA1*		Start Date or Starting Event			Month 1	
Work Package Title	Multi-model, multi-member high resolution Earth System Models						
Activity Type	*RTD*						
Participant Number	8	3	1	2	4	10	6
Participant Short Name	SMHI	CERFACS	CNRS-IPSL	DKRZ	CMCC	MPG	MetO
Participant Number	9	21	23	18	5	20	16
Participant Short Name	KNMI	MF	met.no	DLR	UREAD-NCAS	IC3	BSC

Summary of progress of the work package:

JRA1 aims at developing and running a set of coordinated multi-model, multi-member (M4) coupled climate simulations, at high resolution (HR). For this, it identifies and tackles leading issues reducing the efficiency of HR M4 simulations.

Details for each task:

Task 1: Preparation of M4-HR simulations

Task 1.1: M4-HR configurations (models and libraries) of each participant have been defined and a first performance measurement achieved, according to a new set of metrics (D9.1). This later was discussed not only by WP participants but also involved a wider community, through interactions with WP10/JRA2 partners and GFDL (USA), and was developed in the context of a possible CPMIP (Computing Performance of Models Inter-comparison Project) definition. First M4-HR experiments have started, within the PRACE projects “SPRUCE” (seasonal forecasts) & “HiResClim” (decadal predictions) Regular Accesses.

Task 2: Improved coupling interface

The OASIS3 successor called "OASIS3-MCT", fully parallel coupler, has been released (v2) in May 2013. Main evolutions since v1 are additional interpolations, optimized initialization phase and coupler & load-balancing performance measures. This new coupler is already implemented in all the three OASIS-based JRA1 models.

Task 3: Improvements to I/O performance

New functionalities have been added to the XIOS server (task 3.1), like support for unstructured and reduced Gaussian handling or arithmetic operations over output fields. I/O Servers implementation started in other models (task 3.3): XIOS in EC-Earth (SMHI in collaboration with ICHEC) SURFEX & GELATO (MF-CNRM, CDI-PIO in ECHAM-Messy (DLR) Implementation of CDI-PIO in ECHAM6 is finished (task 3.2). The ECHAM6 port has been tested with different setups on two different HPC systems (blizzard (DKRZ) and thunder (ZMAW)). The significant performance benefits achievable on "blizzard" and "thunder" machines justify the chosen design of CDI-PIO.

Task 4: Post-processing analysis efficiency

MPG has started a review process for the CDO post-processing software, discussing possible improvements among developers. A requirement analysis is initiated, both in-house (MPG) and external. Preparation of the code for optimization activities has started.

Task 5: Submission and job control

Autosubmit software, that allows remote submission and monitoring of ESM simulation jobs, has been set up for EC-Earth 3 on the BSC MareNostrum machine and two different experiments (seasonal prediction and spin-up) have been run. A summary of the workflow and performance of those experiments is reported in M9.1. CNRM-CM has also been tested on ECMWF IBM P7 and this

experience has been reported in M9.2.

Significant results:

Task 1:

- Setting models participating to M4-HR (EC-Earth, CAM-NEMO, HadGem3, NorESM and ARPEGE-NEMO)
- Defining metric for model performance through discussing at the 3rd IS-ENES HPC workshop at Hamburg
- D9.1: results from model performance analyses for 5 models. Discussions involving research and computing scientists' leads to clear analysis of present Earth System Model performances. The following figure shows computing time balancing between components (models, coupler, I/O server) of 3 ESMs involved in JRA1. These separate measurements are mandatory to evaluate the expected progress of task 2-3-4 developments.

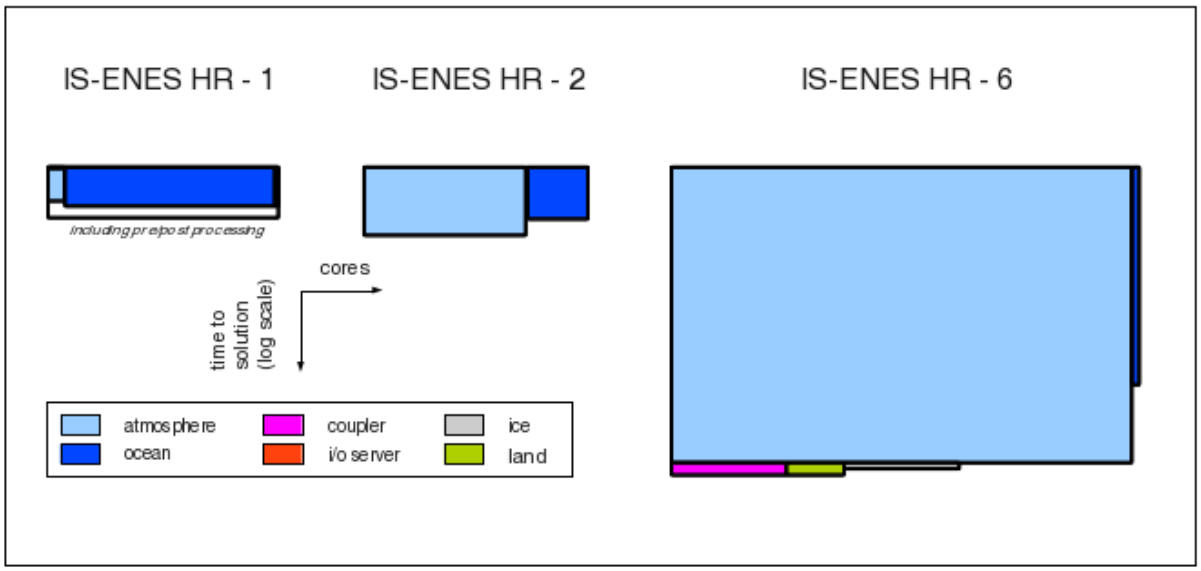


Fig 1: Parallelism and execution time for three of the WP9 HR models

Task 2:

- Release of OASIS3-MCT v2, May 2013
- First performance tests done with up to 8000 cores on PRACE tier-0 machines: it is therefore very likely that OASIS3-MCT is an efficient and easy-to-use solution to remove the current OASIS3 bottleneck. Compared to OASIS3 v1 (IS-ENES1), the new release includes bicubic and 2nd order conservative interpolation, data exchanging only on a subdomain, automatic suite tests developed under Buildbot. CERFACS also developed a Graphical User Interface based on C3SM (tcl/tk software developed at CERFACS), optimized the initialization phase (in collaboration with Met Office), included an analyse of the coupled component load imbalance (in collaboration SMHI and IPSL), give support organizing 3 training sessions gathering 20 people (03/2013, 05/2013, 05/2014) and set-up of a user forum (https://verc.enes.org/oasis/faq-forum/oasis3-forum)

Task 3: n/a

Task 4: n/a

Task 5:

- Autosubmit original characteristics have been described in M9.1. Adaptation to EC-Earth and CNRM-CM was reported in M9.1 and M9.2.

Deviations from Annex I (DoW): None

Reasons for failing to achieve critical objectives and/or not being on schedule: n/a

Use of resources:

SMHI: 6,18 pm, WP lead, Redmine website administration, M4 experiment -HiResClim- and performance measurement (T1), OASIS3-MCT integration on HR model (T2)

CERFACS: 7 pm, WP co-lead, Redmine website administration, M4 experiments -HiResClim, SPRUCE- and performance measurement (T1), OASIS3-MCT development & integration on HR model (T2)

CNRS-IPSL: 1.81 pm, XIOS enhancements (T3): new grids supported, new post-processing functionalities, integration into IPSL model

DKRZ: 3.3 pm, Implementation of CDI in ECHAM6 (T3)

CMCC: 0.4 pm, model performance measurement (T1)

NCAS: 0 pm, did not spend any pm on WP9 yet.

Met-Office: 4 pm, model performance measurement (T1)

DLR: 0 pm, EMAC ([E]CHAM/[M]ESSy [A]tmospheric [C]hemistry) model equipped with CDI (T3), although did not formally charge personnel cost in this period.

IC3: 6.37 pm, contribution to M4 experiment -HiResClim- (T1), Autosubmit tested with EC-Earth, CNRM-CM & NEMO at several platforms (T5)

Met.no: 0.7 pm, model performance measurement (T1)

MF-CNRM: 3.8 pm, contribution to M4 experiment -SPRUCE- (T1), OASIS3-MCT implementation on ARPEGE via SURFEX (T2), GELATO equipped with XIOS v1 (T3). Participation to two meetings on HPC in the framework of Governance on high-performance computing for ENES.

KNMI: 2.3 pm, further developed the high resolution version of EC-Earth

MPG: 3pm, CDO improvements and requirement analysis

BSC: 0 pm, did not contribute during RP1

Corrective actions: n/a

WP10/JRA2: Performance benchmarks for coupled climate models

Work Package Number	*WP10/JRA2*		Start Date or Starting Event				Month 1	
Work Package Title	Performance benchmarks for coupled climate models							
Activity Type	*RTD*							
Participant Number	1	2	3	4	6	7	10	12	15
Participant Short Name	CNRS-IPSL	DKRZ	CER FACS	CMCC	Met O	STFC	MPG	UNI MAN	LiU

Summary of progress of the work package:

During the first project phase major steps towards the preparation and evaluation of different kinds of benchmarks for climate modelling has been made by all participating institutes. So far, initial packaged versions of four coupled model benchmarks IPSL, MPI-ESM, EC-EARTH, and CESM-NEMO are available on request for vendors and partners within IS-ENES2 project.
During the workshop "Exascale Technologies and Innovation in HPC for Climate Models" the need for more attention to evaluation of real model performance as measure for production performance of Earth System Models was recognised by the participating international experts. Metrics that could provide a basis for such analysis of performance and allow for comparison across different Earth System Models and HPC systems have been identified and discussed.
First steps toward the establishment of a suite of coupled benchmarks to evaluate different coupling technologies used in the climate community have been achieved thanks to a very productive partner workshop in Exeter in February 2014.

Details for each task:

Task 1: Framework and benchmarking guide

Technical and organizational framework for distribution of benchmarks for climate modelling and keeping of performance data has been installed as a branch in the ENES portal (https://verc.enes.org/pa). This platform is intended to be used for the distribution of the benchmarks and for hosting performance analysis data for comparison. Some available benchmarks and tools as well as performance data for first codes have been already published at this site. DKRZ also developed lightweight profiling tool SCT (simple context timer) enabling fine granular timing of benchmark runs and retrieval of performance data from hardware counters

Task 2: Suite of base benchmarks

CNRS-IPSL has focused on the preparation and maintenance of the IPSL coupled benchmark that is currently running at two different supercomputer centers: TGCC (PRACE center) and IDRIS (National center). DKRZ has prepared packaged version of the coupled MPI-ESM benchmark, examined the performance of the new generation atmosphere model ICON for different hardware architectures. CMCC has worked on initial definition of the benchmark suite analyzing the NEMO model and CESM-NEMO coupled model. LiU has ported EC-EARTH on 'triolith' cluster at NSC/LiU, run some standard test cases and conducted correctness checks for IFS, OASIS and NEMO. Furthermore, negotiations with ECMWF on permissions for usage of IFS as part of benchmark suite have been started.

Task 3: Evaluation of coupling strategies

The Exeter workshop (February 2014), which gathered the partners of this task, lead to the production of a series of mindmaps gathering the possible functions/characteristics of coupling technologies. The top mindmap "CouplingSystem" includes 5 sub mindmaps "CouplingTechnology", "Components", "Metadata", "Composition" and "Deployment" to describe all the characteristics of the coupling

technology itself but also the characteristics of the components and of the coupled model supported by the coupling technology. These mindmaps are now developed further in collaboration with the US project "Earth System Bridge" currently working on the definition of an Earth System Framework Description Language (ES-FDL). The workshop also allowed identifying the priorities to benchmark in terms of coupling characteristics and to define the test cases that will be implemented by the different partners (milestone M10.1).

Significant results:

Task 1:

- The deliverable D10.1 (Documentation and User Guide for benchmarking framework) will be extended to include metrics for real model performance as discussed at the Hamburg workshop. It will be based on the documentation made available online on the service and information platform (https://verc.enes.org/pa) embedded into the ENES portal. It is delayed.
- The low-overhead measurement library SCT, which can be used for profiling of serial, OpenMP, MPI and hybrid OpenMP-MPI applications, is available for download on https://redmine.dkrz.de/doc/sct/html.

Task 2:

- IPSL benchmark is available on request for vendors and project partners. Currently, the benchmark runs every two days at two different computing centres (TGCC and IDRIS) for trusting. Checks of restartability, parallel implementation and performance are conducted at regular basis. IPSL benchmark was also used to perform 200 years long climate simulations at six different HPC systems. Results showing and explaining why the simulated climate does not differ for all six experiments are summarised in report "Comparison of the preindustrial climate of the IPSL-CM5A-LR model on different computers used at IPSL" publically available on http://lmdz.lmd.jussieu.fr/communication/lmdzinfo/contributions-individuelles-lmdzinfo-numero-9.
- MPI-ESM and ICON benchmarks are available on request for vendors and project partners. Some scalability and performance data for both benchmarks are published on the performance portal.
- The performance of the main NEMO computational kernels has been analysed using the Roofline Model. From the Roofline analysis, it can be argued that further optimizations of the code are needed and are mainly related to (I) the improvement of the vectorization level, (II) a better exploitation of the memory usage, by improving the data prefetching and reducing the data movement.
- The coupled model CESM-NEMO has been also analysed on the iDataPlex cluster at CMCC, where the scalability analysis of each component of the NEMO code has been carried out. Moreover, the optimal configuration, in terms of allocated resources for each component, has been derived. It improves the load balancing among components and reduces the total execution time.
- The EC-EARTH benchmark has been successfully built and run on different number of cores. Bit reproducibility checks were accomplished for IFS component.

Task 3:

- The milestone M10.1 (Definition of the benchmark suite for evaluation of coupling strategies) has been reached as planned thanks to a workshop held in Exeter in February 2014 and additional in-person discussions or teleconferences.

Deviations from Annex I (DoW): none

Reasons for failing to achieve critical objectives and/or not being on schedule:

- Deliverable D10.1 will be delayed to month 24 because it was realized during the project that we need more discussion between partners on what is needed and how to integrate a new metrics proposed by V. Balaji (NOAA). This delay is not critical to the project.
- Licensing issues for EC-EARTH component IFS are not resolved yet. It needs to be further discussed how the coupled EC-EARTH model can be provided as part of the benchmark suite.

Use of resources:

Task	Total pm	Used pm	Work performed
1: Framework for benchmarks	16	DKRZ (1.5 pm) UNIMAN (0.5 pm)	• Providing of service platform for performance analysis of climate models • Interaction between Task 3 (coupling benchmarking) and Task 1
2: Suite of benchmarks	36	CNRS-IPSL (4.88 pm)	• Benchmarking of the IPSL model and its components
		DKRZ (4.4 pm)	• Benchmarking of the MPI-ESM model and its components • Benchmarking of the ICON model and extraction of performance sensitive computational kernels • Development and documentation of SCT (Simple Context Timer) library
		CMCC (2.3 pm)	• Extraction of main NEMO kernels and their performance analysis • Benchmarking of CESM-NEMO model and analysis of load balancing among its components
		LiU (1.94 pm)	• Benchmarking of EC-EARTH model and its components
3: Evaluation of coupling strategies	30	CERFACS (1 pm)	• Task leading: organization of the workshop and teleconferences, writing of the minutes and milestone document. • Contribution to the production of a series of mindmaps gathering the possible functional and performance characteristics of coupling technologies. • Contribution to the identification of the priorities to benchmark in terms of coupling characteristics and to the definition of the test cases.
		UNIMAN (2.0 pm) STFC (0 pm)	• Contributing to definition of functional and performance characteristics, including interaction with US partners (ES-FDL). • Design of benchmark components and benchmarking strategy.

Corrective actions: None

WP11/JRA3: Developing software infrastructure for data archive services

Work Package Number	*WP11/JRA 3*		Start Date or Starting Event			Month 1			
Work Package Title	Developing software infrastructure for data archive services								
Activity Type	*RTD*								
Participant Number	1	2	3	4	5	6	7	8	9
Participant Short Name	CNRS-IPSL	DKRZ	CERFACS	CMCC	UREAD	MetO	STFC	SMHI	KNMI
Participant Number	11	13	15	17	19				
Participant Short Name	CSAG	INHGA	LiU	UC	DMI				

Summary of progress of the work package:

WP11/JRA3 aims to enhance the existing data archives services of WP8/SA2. Main achievements during RP1 have focused on ESGF with key contributions to the international working teams from the IS-ENES2 partners and the development and implementation of the dashboard monitoring system. Improvements have also been achieved in metadata standards in collaboration with the US within ES-DOC. The climate4 impact portal, which aims to provide an access to ESGF model results to the climate impact community, has been released as well as improved tools implemented.

Details for each task:

Task 1: Core data service software development

ESGF development has been reorganised into 15 internal projects. Following staffing changes at PCMDI and a resulting expertise gap which threatened continuity of ESGF services, the IS-ENES2 team (CNRS-IPSL/LiU) has led work to streamline the installation module of the software stack. This work has been supported through the creation of a test federation allowing system components to be tested before deployment (upgrade and initial installation). A test suite software stack has been released by CNRS-IPSL so as to help release manager and node manager to check their installation. STFC has led ESGF working teams on user support and security, and participated in the “compute” working team. Anew module to simplify the security system from a user perspective has been developed by STFC. DKRZ has developed services to support CORDEX: developing a tailored quality control package and integrating it in a WPS framework.

Task 2: Meta-data Services Package

Within the scope of task 2.1 CNRS-IPSL developed a first CIM python client offering flexibility to metadata capture. Based on this development, MetO has successfully tested a system which automates the transfer of climate model configuration meta-data into the Earth System Documentation (ES-DOC) system, which is in turn integrated into the ESGF federated archive infrastructure.Within the scope of task 2.2 CNRS-IPSL released a first version of a revised storage back-end based on JSON storage artefacts and extended the web services interfaces accordingly. See http://es-doc.org.

Task 3: Data access services for climate impacts

KNMI/CERFACS enhanced climate4impact portal (D11.2) interface design based on supplemental Use Cases. Both the ergonomy and functionalities have been extended. KNMI improved the sign in security and the data discovery. CERFACS also created and developed icclim, a python/C open source code to calculate climate indices. The integration of icclim into OpenClimateGIS NCAR/NCPP package https://github.com/tatarinova/icclim has also been done. The documentation of icclim has been written and is available at http://icclim.readthedocs.org. The integration of icclim within climate4impact as a backend for on-demand calculations has been completed with the climate4impact pyWPS by KNMI. KNMI also integrated the EUPORIAS Glossary of terms throughout the portal and

also ES-DOC is integrated (in 'data discovery').

Task 4: Federated archive system monitoring (FASM)

The complete design of the FASM system has been performed (M11.1) The first release of the FASM system has been implemented and released into the software stack (both in version 1.6.x and 1.7.0). The new release includes the monitoring of multiple metrics both at *system* and *user* level. In the former case, long-term metrics (e.g. CPU, memory and service availability) are now managed by the FASM module, with a scalable and optimized storage model. New real-time statistics module for CPU and memory (both ram and swap) have also been developed. New web interfaces (gadgets) at the federation level for (i) the data nodes deployment, (ii) the service availability, (iii) the registered users and (iv) the clients' access statistics have been also implemented in the new release. All the activities have been carried out in close synergy with EU partners and PCMDI. With regard to the collaboration with PMCDI, a 2-month visit has been carried out by CMCC scientists at LLNL at the beginning of the project.

Significant results:

Task 1:

- CNRS-IPSL repaired the ESGF component build process, enabling ESGF to release again after 1.6.2. They host the master ESGF distribution server and acted as release manager for versions 17.0 and 1.7.1 of the ESGF software stack.
- LiU acted as release manager for version 1.7.2 of the ESGF software stack (15 September 2014).
- M11.2 Web processing services: report on synergies between task 1 and 3: the report has been delayed to December 2014 to take advantage of the joint IS-ENES2/CLIPC meeting on Science Portals to be held at KNMI, Nov. 17th-19th, 2014.
- M11.4 Core services: through the work of the ESGF installation working team, stable releases of ESGF core services have been provided.

Task 2:

- CNRS-IPSL enhanced es-doc software ecosystem (portal, user interface and back-end API) to support supplemental use cases (NCAR/NCPP/CMIP5).
- M11.3 Generic Questionnaire Software Package (UREAD): Within ES-DOC it has been decided to adopt the software package developed by NOAA for future use. UREAD is supporting this process. The timing of delivery of an operational package has been delayed.

Task 3:

- KNMI/CERFACS enhanced climate4impact portal interface design based on supplemental use cases.D11.2: Report on Climate4impact portal, version 1. Completed

Task 4:

- M11.1 - Monitoring system and dashboard design delivered at the end of Y1
- First FASM release integrated into the official software stack (both 1.6.x and 1.7.0)

Deviations from Annex I (DoW) :

Following an unexpected change of staff, PCDMI where, from January 2014, unable to support the software systems used for installation of the ESGF software. This software was in use by IS-ENES2 partners for routine upgrades to the existing ESGF services. An international team, with contributions from the US and Europe was established to maintain and improve the installation software. This effort was led by LIU and CNRS-IPSL thanks to IS-ENES2.

Reasons for failing to achieve critical objectives and/or not being on schedule - *if applicable*:

D11.1 delayed to month 26: The deliverable was initially delayed to align completion with the planning schedule of PCMDI and other ESGF partners. A further delay was caused by significant and unexpected staff changes at PCMDI. Since then IS-ENES2 has provided support and leadership in the efforts needed to keep the federated archive running smoothly. This led, however, to a focus on short-term objectives. It has become clear that the ENES Data Service needs clearer objectives and leadership in order to maintain a strategic focus in the face of volatility in critical external partnerships. Setting up a task force to provide strategy and objectives and formulate a plan for project delivery and sustainability of the infrastructure will be critical for D11.1.

M11.2: Delayed to take advantage of joint workshop with the Climate Information Portal for Copernicus (CLIPC) project. The delay will not interrupt on-going work and will result in a more valuable document. The Milestone will be delivered in January 2015 (mo 22).

M11.3: The delay of the questionnaire is not critical: it will be needed for core services in 2016 and there is no indication that it will not be ready. Rescheduled to Sept. 2015 (mo 30).

Use of resources:

STFC: 17.21 pm. Leadership of WP, preparation of the delivery plan (delayed to accommodate timetable of changes at PCMDI). Started integration of CEDA ExArch WPS service (http://ceda-wps2.badc.rl.ac.uk/ui/home) into ESGF services. Quality control support for CORDEX, CCMI and FP7 project SPECS. Security extension to streamline user access to ESGF data. Note that STFC has for internal reasons used a large fraction of their RTD resources in this reporting period, but will continue RTD activities using resources from other projects.

CNRS-IPSL: 2.83 pm, Co-leadership of WP. Co-leading the ESGF Installation Working Team, acting as an ESGF release manager and developing the ESGF test suite. Designing and developing a large portion of the es-doc software ecosystem.

CMCC: 16.3 pm, The complete design of the FASM system has been performed. The related M11.1 report (milestone) has been delivered in time at the end of the Y1. The first release of the FASM system has been implemented and released into the software stack (both in version 1.6.x and 1.7.0).

UC: 6 pm, UC carried out the development of a RESTFul API to link the Downscaling Portal services to Climate4Impact portal. Because of the implementation of the Climate4Impact side requires a special downscaling expertise and it could take a lof of effort to KNMI to code, UC also assumed its development on March meeting. PM's assigned to UC should be recalculated. Planned person-months was 6 and it will take more effort.

LIU: 1.88 pm, Coleading the development of ESGF installer since February 2014; Coleading the development of ESGF node manager; Release manager for ESGF version 1.7.2; Working on development of ESGF update manager

CERFACS: 13 pm, The icclim python/C open source code (climate indices) has been developed, released https://github.com/tatarinova/icclim) and documented (http://icclim.readthedocs.org). The package is integrated into the OpenClimateGIS NCAR/NCPP package.
The integration of icclim within climate4impact as a backend for on-demand calculations has been done with the climate4impact WPS implementation.

CSAG: Work on developing derived data products for users. Prototype python code for producing derived products applied to early CORDEX data and other independent downscaled data and tested

with users through the UC/CSAG Climate Information Platform and through direct engagement with users through the CSAG Winter School in July 2014. Initial work to deploy Cape Town ESGF node to host CORDEX statistical downscaling output and engagement with statistical downscaling community to facilitate submission of CORDEX Empirical Statistical Downscaled (ESD) data to ESGF.
However this partner has not charged to the project in this period yet.

KNMI: 8.65 pm, climate4impact portal interface: integration of ESDOC, EUPORIAS Glossary, Visualisation services, data discovery, security interface and services, integration of icclim services using WPS. Organisation of coding sprints.

DKRZ: 13 pm, Task 1.3: Test of WPS integration with CORDEX quality control software as well as CDO integration; Task 1.4 CORDEX quality control package development and PID service development

DMI: 3.13 pm, The DMI has worked on task 1.4. During the establishment of a CORDEX ESGF datanode, data from several institutions have been quality checked, with the software developed by the DKRZ and by BADC. This test of the quality control programs with real input has helped in their development.

MetO: Successful development of a full CIM production script to generate complete CIM documents from local metadata repositories consistent with the equivalent documents produced for the CMIP5 project using manual entry via an online questionnaire. This involved close working interaction with the ES-DOC project including a workshop to successfully resolve defects and omissions in the python API.
However this partner has not charged to the project in this period yet.

UREAD, 0 pm: Taking advantage of funding available from other sources, UREAD has not been charging to the project in this period. However this partner has not charged to the project in this period yet.

SMHI: 3.53 pm, Establishing data access infrastructure towards impact communities through coordination of CORDEX data archiving onto the ESGF nodes (Grigory Nikulin is responsible for CORDEX data archiving as a member of the CORDEX Scientific Advisory Team). This has involved coordination across a wider community than the IS-ENES2 consortium to provide greater data access and impact.

INHGA: 3.75 pm, Research and testing for atmospheric indices (e.g. Balkan index-BIN), having a good correlation with the hydrological regime on the lower Danube. Preliminary general design for the case study on the hydrology of the lower Danube basin. This is to serve as a basis for a Use Case to be incorporated in climate4impact, along with associated data such as the hydrological database.

Corrective actions: Not applicable

Project Management Report

The FP7 IS-ENES2 project was launched by the Kick off Meeting (M1.1), hosted by CNRS-IPSL and held in Meudon, France, from the 28th to the 30th May 2013. The work done during this meeting facilitated the launch of the second phase of IS-ENES and set the first basis of the organisation and management of the project.

During the first reporting period, the Coordinator, with the assistance of the European Project Manager, ensured the management tasks such as the day to day management, the organisation of meetings, the communication between the European Commission and the Beneficiaries, the management of the budget and the dissemination of the information related to the project. The Coordinator, helped by the European Project Manager, also ensured the scientific coordination of the project as described in the Annex I of the Grant Agreement.

In order to ensure an efficient dissemination of general information about the project, the IS-ENES2 website was developed (M1.2) and is accessible through the existing IS-ENES website (https://is.enes.org). Moreover, it was decided to create an intranet space where partners can share all work documentation, in order to ensure a fruitful collaboration, using the Redmine project management web application.

The IS-ENES2 General Assembly (M1.3), hosted by BSC and held in Barcelona from the 11th to the 13th June 2014, enabled to look back on what has been performed during the first reporting period, to discuss the next steps of the project and to prepare the first periodic report from a scientific and financial point of view.

At last, the Management Team coordinated the reporting of the project from the beginning of July 2014 until the end of November 2014.

Overall Management and scientific coordination of the Project

The Kick of meeting:

The Kick off Meeting was organised by the Management Team.

Most Beneficiaries were represented with 51 participants from 20 partners. Unfortunately DLR, UNIMAN and INHGA were unable to attend. Aims of this meeting were to define the general orientations of this second phase of IS-ENES, in accordance with current European and International climate challenges. More specifically, it was the place to discuss the overall plan for the Work Packages, and to prepare the first actions.

The first day of the meeting gave an overview of the climate modelling challenges and of the European and International initiatives relevant for IS-ENES2 (PRACE, ESGF). The scientific coordinator also made a presentation of the European Strategy Forum on Research Infrastructures (ESFRI) to IS-ENES2 partners, highlighting how this instrument would help sustain IS-ENES on the long term and support climate modelling research in Europe.

The next day was dedicated to the description of the project background and work packages. It was divided into two sessions, in accordance with the two main areas of expertise developed within IS-ENES2: one session on Data and another one on Models and HPC.

Each session was an opportunity for partners to learn about international and European projects that will interact with IS-ENES2, such as CORDEX and CLIPC for the data part, and SPECS and EESI2 for Models and HPC. Work Package Leaders also gave a short introduction of each work package, presenting the objectives, the tasks and the first actions to be addressed. These sessions enabled the participants of the meeting to get an exhaustive overview of the project.

The last day of the Kick-off was mainly dedicated to breakout sessions. Working Groups gathered IS-ENES2 work packages with the objectives to prepare future work and enable interactions between

work packages. Two parallel sessions were organised following the same logic as the day before: one session gathered partners working on issues related to data (WP5, part of WP6 on data, WP8, WP11) and another one dealt with models and HPC issues (WP2, WP3, WP4, part of WP6 on HPC, WP7, WP9, WP10).

Before the closure of the meeting, a debriefing of these breakout group sessions and a general discussion helped to better define the objectives, procedure and planning of the next steps of IS-ENES2.

Presentations given during the Kick off meeting can be found at:

https://verc.enes.org/ISENES2/events/is-enes2-kick-off-meeting

Management and scientific coordination of the Project:

The management and the scientific coordination of IS-ENES2 have been ensured by the Executive Board, composed by the work packages Leaders/Co-leaders and the Management Team. The Coordinator, helped by the European Project Manager, has organised and chaired 8 teleconferences and one face-to-face meeting, gathering the Executive Board during the first period of the project. Minutes of these teleconferences are archived on the Redmine plateform (internal collaboration).

The structure of these teleconferences was always the same: a first part dedicated to the debriefing of work packages by the WPLs, followed by one or various sessions dealing with consortium management issues (general information on the project, organisation of meetings, setting of the IS-ENES website, announcement of meetings of general interest for the project and the community) as well as on strategic issues such as the international governance of ESGF, preparing a long term infrastructure for IS-ENES and implementing a Center of Excellence on HPC for climate and weather.

The role of the Management Team was to disseminate information on the project, be sure that work packages Leaders respected the work plan and the timeline of IS-ENES2 and propose corrective actions if necessary.

Moreover mailing lists have been created since the beginning of the project with the objective of enabling fruitful communication.

A general IS-ENES2 mailing list has been set up in order to disseminate general information about the project. This list gathers people interested in IS-ENES2 (inside and outside the project).

Other mailing lists have been created in order to ensure the communication between beneficiaries:

- The scientific contact list has the objective to help the scientific coordination of the project. At least one representative of each beneficiary is member of this list.
- The financial and administrative mailing list is dedicated to financial and administrative issues. At least two representatives of each beneficiary is member of this list (one for the financial issues, one for the administrative issues.)
- The work package leader mailing list is a key tool for the project management and the coordination of the project. It gathers the work package leaders and co-leaders.
- The consortium agreement mailing list dedicated to jurists of every partner institutions, appointed to negotiate and participate to the drafting of the project consortium agreement
- The data mailing list was created for all IS-ENES2 partners working on data activities, in order to keep them up-to date and exchange more easily on cross-cutting data issues.
- A specific mailing list was created for work-package 3 (NA2), at the request of the work-package leader, in order to facilitate collaboration among involved partners.

The General Assembly:

The IS-ENES2 First General Assembly was hosted by the Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC), Beneficiary 16 of the project.

This meeting was organised jointly by the Management Team and BSC, with the help of the Executive Board.

At least one representative of each Beneficiary attended this meeting, DLR attending by visio-conference. Representatives from the European climate modelling community were also invited. Kamal Puri, from Australia, one of the member of the review panel for the service on models. An expert scientist from the United States of America gave a presentation by visio-conference, with the aim to strengthen links between USA and Europe.

The first two days of the General Assembly were structured into thematic sessions:

- General talks on the climate community challenges,
- Information from other EU Projects (ECOMS projects, CLIPC, EUDAT) and international activities (RDA, US NCPP project, plans for CMIP6, ESGF, ES-DOC)
- Debriefing from each work package by work package Leaders or Co-leaders,
- And breakout sessions with the same working groups created during the Kick off meeting.

The General Assembly showed a general good progress of the work and provided all partners an overall vision of the activities. It helped to prepare the first period report and the work of the next period. It was also an opportunity to discuss future plans such as ESFRI proposal for climate modelling and preparation of future calls related to IS-ENES2 (FET, CoE, ITN calls)

The third day of the General Assembly was an opportunity to debrief on Break-out Group sessions, and to explain to the partners what will be required by the European Commission for the first project report, presenting the timeline of the reporting phase and answering to questions about this issue.

A parallel meeting of the IS-ENES2 Work-Package Leaders was planned on the third day of the General Assembly, after the final lunch. The executive Board took advantage of being gathered in order to have a face-to-face debriefing of the General Assembly.

Presentations given during the General Assembly can be found at:

https://verc.enes.org/ISENES2/events/is-enes2-first-general-assembly

The reporting of the project:

This period began after the IS-ENES2 General Assembly by the registration of all the Beneficiaries on FORCE coordinated by the European Project Manager under the control of the Coordinator.

Work Package Leaders sent their contributions for the scientific report (work package report, deliverables and milestones due to the Period 1) by mid October 2014. These documents were collected by the European Project Manager. The Coordinator reviewed the work package reports, commented them and asked for corrections to have a final version by mid November.

During the General Assembly a review process for the deliverables has been set up. Each deliverable is reviewed by at least two Work Package Leaders or co-leaders not involved in the work prior to the final publication of the deliverable on the IS-ENES2 web site.

The European Project Manager coordinated the financial reporting to have all the Form Cs on FORCE by the end of October 2014 with the Use of Resources table of each Beneficiary.

The Coordinator, helped by the European Project Manager, wrote the Publishable summary, the Project objectives for the period and Project management report. The European Project Manager had to upload all the required information on the SESAM platform.

Communication

Website:

The IS-ENES2 dedicated website (http://is.enes.org/) was set up by DKRZ (Beneficiary 4), and CNRS-IPSL (Beneficiary 1). It was launched in July 2014.The content management system used is Plone. Results from the IS-ENES Phase 1 project were archived on the same web site.

The website presents the project, its aims and objectives and gives a short description of each work package. It also provides the list of beneficiaries with a short description. A section of the website is dedicated to the project management and provides some information on the organisational structure of the Consortium. The IS-ENES2 website also provides access to resources such as the model and data services (link to the ENES portal, central point of entry to these services).

Visitors can find news about the project and information about the IS-ENES2 meetings.

The "documents" folder offers the possibility to visitors to download documents related to the project.

The IS-ENES2 website has a specific folder in which all content related to the first phase of the project is gathered.

At last the folder "Internal" provides information about how to access the collaboration area.

Talks about IS-ENES given during the first period:

During the first reporting period the Coordinator, work package Leaders and Partners have given talks on IS-ENES2 or have participated to poster sessions. Please find below the list of talks about the project given during this period:

Joussaume S., InfraStructure for the European Network for Earth System modelling « IS-ENES », *European Geosciences Union*, invited talk session NH1.8, April 8th, 2013

Joussaume S., HPC for climate, *Strategy Meeting on High Performance Computing (HPC)*, European Commission, April 30th, 2013

Joussaume S., InfraStructure for the European Network for Earth System modelling, *International Computing in Atmospheric Sciences 2013 (CAS2K13)*, 9-12 September 2013, Annecy, France

Kornblueh L., Real Applications on Parallel Systems, *International Computing in Atmospheric Sciences 2013 (CAS2K13)*, 9-12 September 2013, Annecy, France

Valcke S., OASIS3-MCT, a coupler for climate modelling, *International Computing in Atmospheric Sciences 2013 (CAS2K13)*, 9-12 September 2013, Annecy, France

Lautenschlager M., CMIP5 Data Management, *International Computing in Atmospheric Sciences 2013 (CAS2K13)*, 9-12 September 2013, Annecy, France

Joussaume S., Climate models: data and computing challenges, invited talk, *Joint International Conference on Supercomputing in Nuclear Applications and Monte Carlo*, 31rst October 2013, Paris

Joussaume S., InfraStructure for the European Network for Earth System modelling: From « IS-ENES » to IS-ENES2, *CLIPC Kick-off meeting*, 14-15 January 2014, London

Joussaume, S., The European InfraStructure for Earth System modelling, *invited seminar at Geophysical Fluid Dynamic Laboratory*, Princeton (USA), 27/01/2014

Joussaume S., HPC for climate models: Lessons from IS-ENES projects, *ECMWF Workshop on Scalability*, April 14-15th, 2014, Reading UK

Chris Jack, Update on IS-ENES2, *2nd CORDEX-ESDM Workshop*, Buenos Aires July 30-August 1, 2014

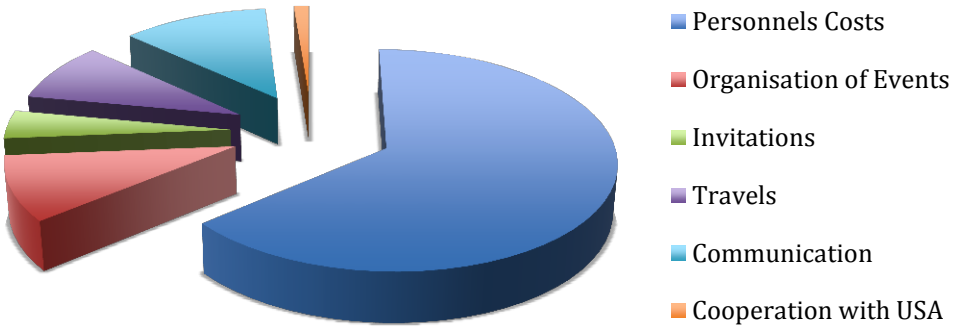
Papers on IS-ENES published during the first period:

- S. Joussaume, *Climate modelling in support to climate change understanding*, Science and Technology 10, March 2014.
- Jean-Claude André, Giovanni Aloisio, Joachim Biercamp, Reinhard Budich, Sylvie Joussaume, Bryan Lawrence, and Sophie Valcke, *High-Performance Computing for Climate Modeling*, Bulletin of the American Meteorological Society, May 2014.
- C. Deandreis, with Pascale Braconnot; Christian Pagé; Lars Bärrin; Edoardo Bucchignani; Wim Som de Cerff; Ronald Hutjes; Sylvie Joussaume; Constantin Mares; Serge Planton; Maarten Plieger, *Towards a dedicated impact portal to bridge the gap between the impact and climate communities: lessons from use cases*, Climatic Change, June 2014.

All three papers are available here:

https://verc.enes.org/ISENES2/documents/papers-on-is-enes

WP1 use of resources



Staff efforts:

CNRS-IPSL (Beneficiary 1) devoted 16,01 person months (PMs) for the management of the project. The Coordinator spent *2,01* PMs on the overall management and scientific coordination of the project for the first 18 months. The European project manager, paid by IS-ENES2, spent *14* PMs in order to assist the coordinator in their tasks.

Staff efforts represent *64*% of the total direct costs for the first period.

Organisation of events:

10% of the total direct costs were spent in order to organise the IS-ENES Kick-Off meeting and other work meetings. Due to delays of reimbursement procedure, costs related to the organisation of IS-ENES2 First General Assembly will be affected to period 2, although the meeting took place within period 1, as planned in the DoW.

The Kick-Off meeting cost was 9 735€.

Travels:

9% of the total direct costs were devoted to travels, essentially to attend to the Kick-Off meeting in Meudon as well as the IS-ENES2 General Assembly in Barcelona, and participate to events to promote the project.

Invitations:

Invitations of expert scientists from the community represent *4*% of the total direct costs spent during the first period. We have invited expert scientists to the Kick-Off Meeting and to the General Assembly, to give talks or represent their organisations.

Dissemination

In the third period, 14 661€ were spent for publications on scientific journals (paper and website), which represents 12% of WP1 costs.

PCMDI (USA)

A budget of 55 k€ was planned for collaboration with the USA. During the first period, 1 521€ were spent to support the trip of one scientist, Eric Guilyardi, to work between CNRS-IPSL, UREAD and PCMDI on the set up of the WGCM Infrastructure Panel (WIP), which will oversee software and standards infrastructure needed for model intercomparison projects (MIPs such as CMIP5). This work was helpful to ease the interactions and integration of IS-ENES2 and CMIP6 developments.

List of Project Meetings

Dates	Meeting Title	Venues
April 11th 2013	EGU 2013, SPM 1.27 Splinter Meeting "Climate4impact portal"	Vienna, Austria
May 28-30th, 2013	IS-ENES2 Kick-off meeting	Meudon, France
June 28th, 2013	ENES HPC Task Force-PRACE Board meeting	Brussels, Belgium
August 12-15th, 2013	Climate4impact workshop	KNMI, De Bilt, Netherlands
September 23-24th 2013	Configuration Management Tools Workshop	Met-Office, Exeter, UK
September. 23-24th, 2013	IS-ENES2 data meeting	Trieste, Italy
December 19-20th, 2013	Climate4impact coding sprint	CERFACS, Toulouse, France
January 21st-22nd 2014	Metadata Generation Workshop	DKRZ, Hamburg, Germany
February 12-13th, 2014,	Workshop on coupling technologies characterization	Met Office, Exeter, UK
February 27th, 2014	HPC for climate modelling and simulation, organised with DG-Conect	Brussels, Belgium
March 10th 2014	IS-ENES & CLIP-C Engagement Workshops at the CIRCLE-2 final conference	Lisbon, Portugal
March 17th-19th, 2014	Exascale Technologies & Innovation in HPC for Climate Models - 3rd HPC Workshop	Hamburg, Germany
March 24th-26th, 2014	Climate4impact coding sprint	KNMI, De Bilt, Netherlands
April 7-11th 2014	IS-ENES2 Coding Sprint	Hamburg, Germany
May 12-13th, 2014	Future perspectives for scientific and infrastructural needs in Earth system model evaluation	KNMI, De Bilt, Netherlands
May 13-14th 2014	Climate and climate impact indicators. EEA – CLIP-C. Participation of IS-ENES2 partners	Copenhagen, Denmark
June 3rd-5th 2014	Workflow Solutions workshop	DKRZ, hamburg, Germany
June 4-5th 2014	Expert visit at MetO for radiation code	Met Office, Exeter, UK
June 9-20th, 2014	2nd European Earth System and Climate Modelling school	BSC, Barcelona, Spain
June 11-13th, 2014	IS-ENES2 First General Assembly	BSC, Barcelona, Spain
July 1st-2nd 2014	Expert visit at IPSL for radiation code	IPSL, Paris, France
July 10th, 2014	First meeting of members of the ENES Board to prepare a CoE on climate and weather	Heathrow, UK
August 28th, 2014	Second meeting of members of the ENES Board to prepare a CoE on climate and weather	Paris, France
September 17th, 2014	Informal meeting with DOE	Washington, USA
September 29th, 2014	Climate and weather CoE preparatory meeting 1	UREAD, Reading, UK

Use of Staff Effort per Beneficiary during the first reporting period

Workpackage	WP1		WP2		WP3		WP4		WP5		WP6		WP7		WP8		WP9		WP10		WP11		Total per Beneficiary	
	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period	Planned in the Annex I	Used during the 1st Period
CNRS	54	16,01	29	3,78	12	1,19	4	0,84	3	1,38	5	0,35	0	0	0	0	19	1,81	11	4,88	21	2,83	**158**	**33,07**
DKRZ	0	0	24	4,5	9	1	7	5,1	12	0	4	1,4	0	0	0	0	12	3,3	18	5,9	20	13	**106**	**34,2**
CERFACS	0	0	2	1	0	0	11	7	18	5,3	2	1	4	2	0	0	25	7	9	1	24	13	**95**	**37,3**
CMCC	0	0	0	0	14	12,8	3	0	4	0	2	0	0	0	0	0	4	0,4	12	2,3	21	16,3	**60**	**31,8**
UREAD	0	0	8	1,1	12	0	0	0	0	0	2	0	0	0	0	0	16	0	0	0	21	0	**59**	**1,1**
MetO	0	0	2	0	12	5,4	12	9,6	0	0	0	0	0	0	0	0	13	4	11	2,9	6	0	**56**	**21,9**
STFC	0	0	0	0	3	0,98	0	0	2	3,38	2	0,4	0	0	0	0	0	0	5	0	18	17,21	**30**	**21,97**
SMHI	0	0	0	0	0	0	0	0	9	0,66	3	0,93	0	0	0	0	19	6,18	0	0	8	3,53	**39**	**11,3**
KNMI	0	0	2	0,296	0	0	0	0	8	3,1	0	0	0	0	0	0	5	2,3	0	0	20	8,648	**35**	**14,344**
MPG	0	0	3	0	14	4	6	2,7	0	0	0	0	0	0	0	0	8	3	3	2	0	0	**34**	**11,7**
CSAG	0	0	0	0	0	0	0	0	14	5	0	0	0	0	0	0	0	0	0	0	15	0	**29**	**5**
UNIMAN	0	0	0	0	3	2	0	0	4	1,5	0	0	0	0	0	0	0	0	7	2,5	0	0	**14**	**6**
INHGA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	3,75	**15**	**3,75**
WU	0	0	0	0	0	0	0	0	8	3,94	8	0	0	0	0	0	0	0	0	0	0	0	**16**	**3,94**
LiU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1,94	7	1,88	**13**	**3,82**
BSC	0	0	0	0	12	6,3	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	**16**	**6,3**
UC	0	0	0	0	0	0	0	0	6	3	0	0	0	0	0	0	0	0	0	0	6	6	**12**	**9**
DLR	0	0	6	1,78	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	**10**	**1,78**
DMI	0	0	0	0	0	0	0	0	2	1,22	0	0	0	0	0	0	0	0	0	0	7	3,13	**9**	**4,35**
IC3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	6,37	0	0	0	0	**11**	**6,37**
MF-CNRM	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	5	4,39	0	0	0	0	**8**	**4,39**
UiB	0	0	6	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	**1**
met.no	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0,7	0	0	0	0	**6**	**0,7**
TOTAL	54	16,01	82	12,456	91	33,67	46	26,24	93	28,48	28	4,08	4	2	0	0	151	39,45	82	23,42	209	89,278	840	275,084
REMAIN	37,99		69,544		57,33		19,76		64,52		23,92		2		0		111,55		58,58		119,722		564,916	
% of Use	29,65		15,19		37,00		57,04		0,00		0,00		50,00		0,00		26,13		28,56		42,72		32,75	

Cooperation with other projects/programme

European Projects

SPECS

IS-ENES2 collaborates with the FP7 SPECS project on seasonal to decadal climate predictions for climate services. Indeed, SPECS provides its model results on ESGF. SPECS benefits from IS-ENES2 experience to install data nodes on ESGF through STFC, and benefits from access to provider support and access to software tools.

ECOMMS

ECOMMS is the coordination of European projects on climate modelling and climate services. IS-ENES2 has participated to ECOMMS and provided input to recommendations prepared for H2020.

EUDAT

ENES community is represented in EUDAT through IS-ENES2 partners (DKRZ, MPG and CERFACS). A strong link is established with issues such as metadata and data citation. IS-ENES2 will continue collaboration with EUDAT2 including STFC in the collaboration.

International programmes

WCRP

IS-ENES2 is strongly linked to WCRP activity in climate modelling. It supports the European contribution to the data infrastructure ESGF for international global and regional climate model experiments. A MoU is under preparation to recognise the role of IS-ENES2 in the implementation of CORDEX results on ESGF. Several partners of IS-ENES2 participate to the newly established Infrastructure Panel (WIP).

ESGF

Earth System Grid Federation is the international database for climate model results. Thanks to IS-ENES and IS-ENES2, European partners have acquired a strong role in ESGF software maintenance and development and are responsible for some activities. International governance is under discussion with DoE.

ES-DOC

Earth System Documentation is an international collaboration led by US on metadata standard for climate models. IS-ENES2 partners play a key role in the development of metadata software and standard.

NCPP

The National Climate Predictions and Projections Platform is a US program that aims to provide local climate information to inform decision on climate adaptation. Collaboration has been established with IS-ENES2 with developments done within the climate4impact portal. Common work is done on metadata for downscaled products and some common software will be used.

RDA

ENES is represented in the international Research Data Alliance by Michael Lautenschlager. This allows linking our activities with RDA.

Annex: Acronyms

CDO: Climate Data Operators (http://www.mpimet.mpg.de/cdo) - collection of about 100 functions developed by the MPG for handling and analyzing data produced by a variety of climate and NWP models - e.g. for file operations, simple statistics, or the calculation of climate indices. The code is used by around 150 groups (220 users) world-wide, including some of the project partners, calling the CDO around 200000 times per day.

CF: Climate and Forecast Metadata Convention (http://cf-pcmdi.llnl.gov/) - International standard for model data files format.

CIM: Common Information Model - The FP7 METAFOR project has developed this standard.

CIRCLE2: FP7 Eranet « Climate Impact Research & Response Coordination for Europe" http://www.circle-era.eu/ promotes networking activities and common calls on adaptation to climate change. It focuses at the interface between research and policy.

CLIMATE4IMPACT: ENES Portal for Climate Impact Communities (http://climate4impact.eu) developed within IS-ENES and IS-ENES2 to ease access to model data for the climate impact research communities

CMIP5: Coupled Model Intercomparison Project Phase 5, under the auspices of WCRP to prepare IPCC AR5 (http://cmip-pcmdi.llnl.gov/cmip5/)

COPERNICUS: European initiative for the implementation of information services dealing with environment and security (previous Global Monitoring for Environment and Security) (http://www.copernicus.eu).

CORDEX: "Coordinated Regional downscaling Experiments" under WCRP auspices (http://wcrp.ipsl.jussieu.fr/SF_RCD_CORDEX.html).

COSP: Cloud Observing System Package (http://cfmip.metoffice.com/COSP.html) has been developed to simulate cloud satellite observed parameters from climate model data in order to allow a more direct comparison with satellite data. It is available from MetO.

EEA: European Environment Agency (http://www.eea.europa.eu)

ENES: European Network for Earth System Modelling (http://www.enes.org) - A consortium of European institutions aiming at helping the development of use of ESMs for climate and Earth System studies.

EPM: IS-ENES European Project Manager

ES-DOC: Earth System Documentation (http://es-doc.org) is an international collaboration led by US on metadata standard for climate models.

ESGF: Earth System Grid Federation (http://www.earthsystemgrid.org/) is an international collaboration with a current focus on serving the WCRP CMIP project and supporting climate and environmental science in general. The ESGF grew out of the larger GO-ESSP community.

ESM(s): Earth System Model(s). These models are developed to simulate the climate system in its full complexity, i.e. atmosphere, ocean and land which are the basic components included in climate models together with biogeochemical cycles, i.e., carbon cycle, vegetation, aerosol and chemistry processes.

ESMF: Earth System Modelling Framework (http://www.esmf.ucar.edu/)- Devoted to define standards in the designing of climate model components for easier exchange and coupling, US-led

EUDAT: FP7 project "European Data Infrastructure" (http://www.eudat.eu/) launched on Oct 1rst 2011, aims at providing a pan-European solution to the challenge of data proliferation in Europe's scientific and research communities. MPG and Cerfacs represent ENES in this consortium

Exascale: for exascale computing, refers to computing power corresponding to 10^{18} operations per second. It is thousand times more powerful than present top computing facilities. It is expected to be available around 2018.

GO-ESSP: Global Organization for Earth System Science Portal (http://go-essp.gfdl.noaa.gov/) - Addresses the development and dissemination of standards for exchange of datasets in the field of Earth system science.

HPC: High Performance Computing

I/O: Input/Output is the generic process of exchanging data during a simulation, either as input to the model or as output of model simulations

ICON: is a new dynamical core project run by MPG and Deutscher Wetter Dienst based on icosaedral grids for atmosphere and ocean global models (http://icon.enes.org/)

ICT: Information & Communication Technology

IPCC: Intergovernmental Panel on Climate Change (http://www.ipcc.ch) - Provides regular scientific assessments reports (AR) on climate change issue under the auspices of UNEP and ICSU. The last one is the AR4 produced in 2007; the next one is AR5 to be issued in 2013

IS-ENES (or IS-ENES1) : InfraStructure for the European Network for Earth System Modelling, first phase; FP7 project (http://is.enes.org)

LIM: Louvain-la-Neuve sea ice model (http://www.astr.ucl.ac.be/index.php?page=LIM Description) – A Sea Ice Model

METAFOR: Common Metadata for Climate Modelling Digital repositories (http://ncas-cms.nerc.ac.uk/METAFOR/) - FP7 infrastructure project under ENES, which focuses on developing common standards for data and model information exchange that will be implemented in IS-ENES.

NCAR: National Center for Atmospheric Research in Boulder, USA (http://www.ncar.ucar.edu/)

NEMO: Nucleus for European Modelling of the Ocean (http://www.locean-ipsl.upmc.fr/NEMO/) - State-of-the-art modelling framework including 3 components: an ocean general circulation model (OPA), a sea-ice model (LIM) and a biogeochemistry model (TOP); NEMO is interfaced with all European atmospheric models via the OASIS coupler.

netCDF: network Common Data Form (http://www.unidata.ucar.edu/software/netcdf/) - A set of software libraries and machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data

NCPP: US National Climate Predictions and Projections Platform

NOAA: National Oceanographic and Atmospheric Organisation, USA (http://www.noaa.gov/)

OASIS: Ocean Atmosphere Sea Ice and Soil coupler (http://www.cerfacs.fr/globc/software/oasis/) – A software component allowing synchronized exchanges of coupling information between numerical codes representing different components of the climate system.

PCMDI: Program for Climate Model diagnosis and Intercomparison, (http://www-pcmdi.llnl.gov/) at Lawrence Livermore National Laboratory (USA) has the responsibility for supporting modelling studies CMIP5.

PRACE: Partnership for Advanced Computing in Europe (http://www.prace-project.eu/) - An FP7 infrastructure project devoted to prepare the implementation of world-class high-performance computers in Europe.

SPECS: new Environment FP7 project "Seasonal-to-decadal climate Prediction for the improvement of European Climate Services » (2012-2016)

v.E.R.C.: virtual Earth System Modelling Resource Centre

WCRP: World Climate Research Programme (http://www.wmo.ch/pages/prog/wcrp)

WGCM: Working Group on Coupled Models (http://www.clivar.org/organization/ wgcm/wgcm.php) - Under WCRP defines the international strategy for climate model evaluation and simulations for IPCC reports

XML: Extensible Markup Language