



**Barcelona
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BSC-ES CES Performance Team Activities, March 2016

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- Nucleus for European Modelling of the Ocean
 - State-of-the-art modelling framework → Research & Operation
 - EU Consortium → CNRS, NERC, UKMO, Mercator, CMCC, INGV
- What has already been done? 2014-2015 (Highlights)
 - Collaboration with the NEMO dev. team, now NEMO HPC Group
 - 2 optimization branches created, one already merged to 3.6 stable (June 2015), the other going to be merged soon
 - Technical memorandum (Autumn 2015) and poster at SC15
 - Collaboration @ NEMO merging party '16
- Ongoing work
 - Paper: “Finding, analyzing and optimizing MPI communication bottlenecks in Earth System models”
 - Establishing benchmark configurations → ORCA025-LIM3 (BSC) ready
 - Test optimization on ORCA025 (HiRes) configuration → Problems with XIOS (I/O server)

- Integrated Forecasting System
 - The IFS model is used for weather prediction at ECMWF (European Center for Medium-range Weather Forecasts)
 - IFS model discretizes the 3D Navier-Stokes equations and it uses a spectral method to compute the dynamics of the atmosphere
- What has already been done?
 - Compilation of the new version of OpenIFS
 - Complete description report about the numerical model and how it works the parallel algorithm of IFS
- Ongoing work
 - Run the new version of OpenIFS using simple tests and standard configurations
 - Profiling of OpenIFS using V-Tune and Paraver.

- A European Earth System Model
 - EC-EARTH is a project, a consortium and a model system
 - The EC-EARTH model is a state-of-the-art numerical earth system model where IFS atmosphere model and the NEMO ocean model are the main components of the coupled EC-Earth
- What has already been done?
 - A wide scalability analysis automated with Autosubmit
- Ongoing work
 - Technical Memorandum
 - Analyze the communication and interaction among IFS, NEMO, OASIS, XIOS and Run-off mapper.
- Next future work
 - Dimemas analysis
 - Optimize IFS serialization (ask to Glenn Carver)

- HARMONIE
 - Non-Hydrostatic spectral, convection permitting, mesoscale NWP (numerical weather prediction) model.
 - Code cooperation with Météo-France and ALADIN.
- Ongoing work
 - Daniel Santos from AEMET (technical project manager) provided operational information to run the experiments.
 - Studying the model workflow (mSMS, ecFlow)
 - Checking w. Ch. Simarro the Extrae installation on cca & ccb
- Next future work
 - Determine the most critical parts in the workflow
 - Performance analysis on HARMONIE model (interaction with IFS studies)

- Reproducibility of EC-earth
 - Experiments to achieve a balance among accuracy, reproducibility and performance.
- What has already been done?
 - Study of different compiler flags to control optimization options and floating point operations
 - Several experiments to compare quality of the results and computational time
- Ongoing work
 - Compare the results and write the proper documentation for the presentation and paper

- **Technical memorandum:**
 - Tintó Prims, O., M. Castrillo, K. Serradell , O. Mula-Valls and F.J. Doblas-Reyes (2015). Optimization of an ocean model using performance tools
 - X. Yepes, M. Acosta, K. Serradell, O. Mula-Valls and F.J. Doblas-Reyes (2016). “Performance analysis of the EC-Earth 3.2beta model using HPC tools”
- **Poster:**
 - BSC International Doctoral Symposium, Barcelona, 5-7 May 2015 Understanding Scientific Application’s Performance
 - SC15, Austin, United States, 15 - 20 November 2015, Optimization of an Ocean Model Using Performance Tools
- **Paper:**
 - “Finding, analyzing and optimizing MPI communication bottlenecks in Earth System Models”
 - “Reproducibility of Earth System Models: A computational Point of View”
- **Deliverables:**
 - IS-ENES2 D3.X: DIMEMAS analysis on EC-Earth

- Applying clustering and folding techniques to study performance issues on the NEMO global ocean model (HPC Knowledge Meeting '15, Barcelona, Spain, 3-4 February 2015)
- BSC tools to study the computational efficiency of EC-Earth components (EC-Earth meeting, Reading, UK, 5-6 May 2015)
- Understanding Scientific Application's Performance using BSC tools (ICCS Reykjavik, Iceland, 1-3 June 2015)
- BSC Performance tools suite: study cases on improving the efficiency of the EC-EARTH model components (3rd JLESC, Barcelona, Spain, 29 June - 1 July 2015)
- Understanding Scientific Application's Performance (Jornadas SARTECO Cordoba, Spain, 23-25 September 2015)
- Reproducibility of EC-EARTH (EC-Earth meeting, Rome, Italy, 2-3 February 2016)
- Reproducibility of Earth System Models: A computational Point of View (4th ENES HPC-Workshop, Toulouse, France, 5-7 April, 2016)



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EXCELENCIA
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OCHOA

Thank you!

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