
High-resolution coupled modelling at CERFACS (CNRM/CERFACS CMIP5 group)

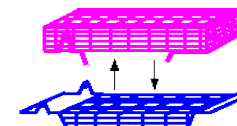
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Current state of the art simulations at CERFACS

Current model: CERFACS-HR, high-resolution ESM prototype



- **ARPEGE V5.3 T359/31L** – (OASIS3-MCT) - **NEMO V3.4 ORCA025/75L**
- With climatological sea-ice, used in PRACE project SPRUCE (27 Mcore-hours on Bullx Curie in 2013) for seasonal prediction.
- **LIM2** sea-ice model activated and currently used to perform a full set of decadal predictions 1993-2009 initialized from GLORYS ocean reanalysis.
- Performances: 512 cores for NEMO, 64 cores for ARPEGE (~load balanced)
 - 2. simulated-year/day, 3800 cores-hours/simulated year
- To be used in EU FP7 projects: IS-ENES2, PREFACE and SPECS:
 - control + historical + decadal: 17 dates x 10 members x 10 years
 - 3400 simulated years and 133 TB of data
 - supported by PRACE : HiResClim I & 2 (20 M cores-hours at BSC).

Next model: CNRM-CM6 HR, to be used in CMIP6/HIRESMIP

ARPEGE V6 T359/91L – (OASIS3-MCT) - **NEMO V3.6 ORCA025/75L**

New atmospheric physics, surface scheme, ice model

Scientific Questions

- Sensitivity of large-scale variability modes to horizontal and vertical resolution (ENSO, NAM/SAM, AMV/PDV)?
- What is the influence of small-scale SST fronts on the atmosphere locally and is there any remote influence (storm-track) ? Does an explicit representation of small-scale air-sea coupling matter for climate questions ?
- Are climate sensitivities (including hydrological ones) depending on resolution (role of ocean eddies for instance) ?

Main Challenges

- Improve the physical understanding of air-sea coupling at small-scale (need to go to sub-meso scale for climate problems ?)
- Strong need for observational data sets needed to evaluate high-resolution models at small scale. Do they exist ?
- Technical challenges:
 1. Weak throughput on HPC machines (ok for ensemble runs, not for PiCtrl ones) : need to make models run more efficiently
 2. Post-processing: amount of data exp. Increasing, data mining, transfer strategies, networks

Questions to be discussed at the meeting

- How to ensure consistency between horizontal and vertical resolution (in each coupled model component) and between the resolution of the ocean, sea-ice and atmosphere models ?
- The issue of coupling with sea-ice models
- Identify the model biases (not just mean state, variability too) that are the most sensitive to resolution
- What are the best metrics to assess improvement due to increase in resolution ?
- Use of stochastic physics to represent unresolved scales