Tropical Channel NEMO-OASIS-WRF Coupled simulations at very high resolution

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started: 1 February 2012
length: 39 months
equivalent of 6 persons full time
Our project

**small scales ⇔ large scales**

- identify, quantify upscaling processes
- propose an original solution...
Combine the advantages of regional and global models

**Upscaling processes in coastal upwelling areas**

1. Quantify the impact of small scale processes on global climate
2. Reduce large scale and recurrent biases in climate simulations

**multi scales coupled models**

- Original methodology
- Optimum use of resources
- Prepare future climate models
Our models

• **Atmosphere**: The Weather Research and Forecasting (WRF)

• **Ocean**: **NEMO** (Consortium of 6 European patterns) is a state-of-the-art modeling framework for oceanographic research, operational oceanography seasonal forecast and climate studies.

• **Coupler**: **OASIS3-MCT** software is allowing synchronized exchanges of coupling information between numerical codes representing different components of the climate system. Portability and flexibility are OASIS key design concepts and the reason of its success (Meteo France, IPSL, ECMWF, Met-Office, EC-Earth community, CMCC, MPI-Met…).
Our methodology

Compare the climate mean state, variability and biases in a set of coupled experiments with resolutions of 27km to 9km (in zooms or at global scale).

**step 1:**

Tropical Channel (45°S - 45°N)
27km resolution in ocean and atmosphere
step 2:
embedded zooms only in 1 component (ocean or atmosphere) of the coupled model

27km tropical channel + 9km zooms
step 3:

embedded zooms on both components (ocean and atmosphere) of the coupled model.

27km tropical grid + 9km zooms
Step 4:
Tropical Channel (45°S - 45°N)
9km resolution in ocean and atmosphere
Where are we now?

**9km** tropical Channel (45°S-45°N)

- 8204 WRF
  - 6h elapsed /1 month.
  - 1.1To/months
  - 2 × 2 years

- 1024 NEMO
  - 3 years of spin-up

- 8204 WRF
  - 512 NEMO
  - first tests: 1 month

- **WRF Single-Moment 6-Class Microphysics**
- **longwave Rapid Radiative Transfer Model**
- **Dudhia shortwave radiation**
- **MM5 Monin-Obukhov scheme**
- **unified Noah land-surface model**
- **Yonsei University PBL**
  - Kain-Fritsch (new Eta) scheme
  - or Betts-Miller-Janjic scheme
numerical performances

CURIE Thin Nodes: WRF 3.3.1 Tropical Channel (45S–45N). Resolution: 9km, full 10

WRF

6h outputs

10s elapsed time

model time-step

WRF+NEMO = +5%

parallel efficiency (%) normalized to 136 cores
SST from coupled expériment
10m wind speed
OLR