DRAKKAR coordination of global ocean at High resolution and developments of the NEMO ocean system

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1 DRAKKAR: A COORDINATION

- A scientific and technical coordination between research teams in FRANCE (LGGE Grenoble, LOPS Brest, LCEAN Paris, MERCATOR-Ocean Toulouse), UK (NOC Southampton) and GERMANY (GEOMAR Kiel).

Main activities:
- Improve and maintain a hierarchy of state-of-the-art ocean/sea-ice model configurations for operational and research applications based on the NEMO modeling framework.
- Design, carry out, assess, and distribute high-resolution global ocean/sea-ice numerical simulations performed over long periods (1958-2015)

Major realizations period 2014-2015
- Contribute to the development of ORCA025, the “eddy-permitting” ocean component to be used in Earth System Models for CMP6 and beyond.
- “Eddy-resolving” simulations with the 1/12° ORCA12 configurations.

Selected results
- ORCA12: The benefits of the international coordination (Frame No 2)
- The Drakkar Forcing Set: an achievements useful to a wide community (Frame No 3)
- Somali Current: Example of a process study (Frame No 4)

2 DRAKKAR International coordination

The European DRAKKAR consortium has gathered efforts to develop, improve and validate ORCA12, the global 1/12° configuration of NEMO. At this horizontal resolution (from 2km around Antarctica to 9km at the equator), mesoscale eddy structures are well represented between 50°N and 50°S. This significantly improves the large scale circulation variability (Mercator-Ocean ORCA12-T321 experiment), including in Western Boundary Currents (NOC and GEOMAR-Kiel experiments), when compared to coarser resolution simulations.

3 DF55.2: the latest DRAKKAR FORCING SET

Surface atmospheric variables (0.7°x0.7°)
- 10-m wind components : u10, v10

2-m air humidity : q2
- 2-m air temperature : T2

downward shortwave radiation at the sea surface : radsw

downward longwave radiation at the sea surface : radlw

precipitation total and solid : P

temperature at the sea surface : T2

wind speed at 10 m : u10, v10

Parameterizations
- Resolution (1/4 or 1/12°) - Length of integration
- Parameterizations - Atmospheric forcing used to study the fast interactions between the Southern Gyre & the Great Whirl

Period 1958-1978:
- U10, v10, q2, T2: ERAi daily climatology with ERA40 3-hourly

Period 1979-2015:
- U10, v10, q2: ERAi 3-hourly

ERSA*: a corrected version of ERA-interim reanalysis

Effect of corrections:

Time series of the Global average of the Net Heat Flux, Qnet, for the period 1958-2010 (in Wm⁻²):
- Red line: annual mean
- Black line: time-mean.

Mean (1979-2015) differences between the surface atmospheric variables of DF55.2 and those of the original ERA-interim (DF55.2 minus ERA-interim).

4 Process study: Interactions between the Somali Current eddies during the summer monsoon

Simulations of the Global Ocean Circulation differing by:
- Resolution (1/4 or 1/12°) - Length of integration
- Parameterizations - Atmospheric forcing used to study the fast interactions between the Southern Gyre & the Great Whirl

Interaction scenario in the model hierarchy (22 time / 30 years)

Between June and September:
- 5G moves northward along the Somali coast and encounter the GW

Interaction between the 5G and the GW is a collision without merging
- The GW is pushed to the east of Socotra Island
- The 5G takes the place of the GW
- The distribution of spiciness in the GW area shows that there is no mixing between 5G and GW water masses during the collision.

5 CONCLUSION: BILAN 2014-2015

26 peer reviewed publications
4 PhD theses defended
4 PhD theses on going
DRAKKAR simulations/configurations distributed to more than 20 projects / year
Drakkar workshops attended by more than 80 scientists (~ 15 different countries)

The comparison of the Model SSH Sample like AVISO altimetry (7 days, 1/3°) show that satellite observations do not exclude the possibility of the collision scenario but clearly lack of resolution.