

Impact of the parametrisation of the bottom friction on the deep convection and general circulation of the Mediterranean Sea

Jonathan Beuvier^{1,2}, Karine Béranger^{1,3}, Cindy Lebeau-pin-Brossier^{1,4}, Samuel Somot², Charles Deltel³, Florent Lyard⁵, Romain Bourdallé-Badie⁶, Florence Sevaut², Olivier Le Galloudec⁶, Guillaume Refray⁶, Yann Drillet⁶, Pierre Testor³, Laurent Mortier³, Jean-Luc Fuda⁷, Isabelle Taupier-Letage⁷

1-ENSTA/UME

2-Météo-France/CNRS

3-IPSL/LOCEAN

4-IPSL/LMD

5-LEGOS

6-MERCATOR Océan

7-LOPB



General description of the MED12 model

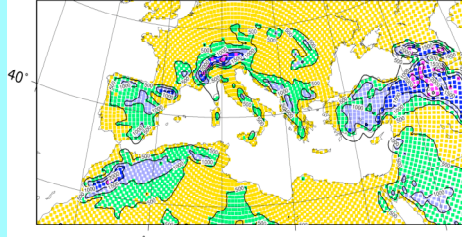
MED12 configuration:

- based on NEMO (Madec, 2008), v3.2,
- 1/12° ORCA grid (6-8 km resolution),
- 50 vertical levels (partial steps),
- exchanges with the Atlantic ocean performed through a buffer zone,
- climatological river forcing for 33 main rivers plus coastal runoff,
- Black Sea simulated as a river.

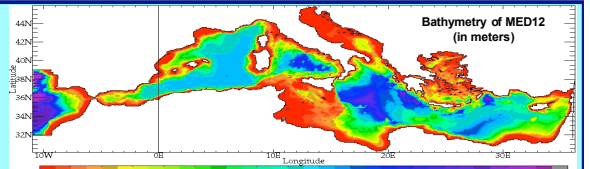
Twin simulations:

- from August 1998 to December 2008,
- forced (flux mode) by ARPERA, dynamical downscaling of ERA40 reanalyses and ECMWF analyses by ARPEGE-Climate (50 km resolution),
- Quickest+Ultimate advection scheme for tracers (Leonard, 1979, 1991),
- bottom friction F including a constant (simu1) or variable (simu2) averaged tidal energy E.

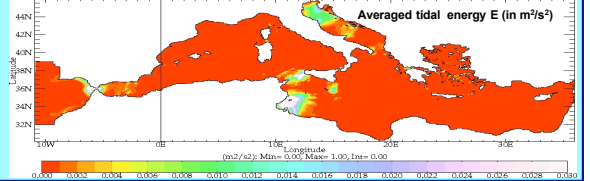
Surface topography and resolution of ARPERA



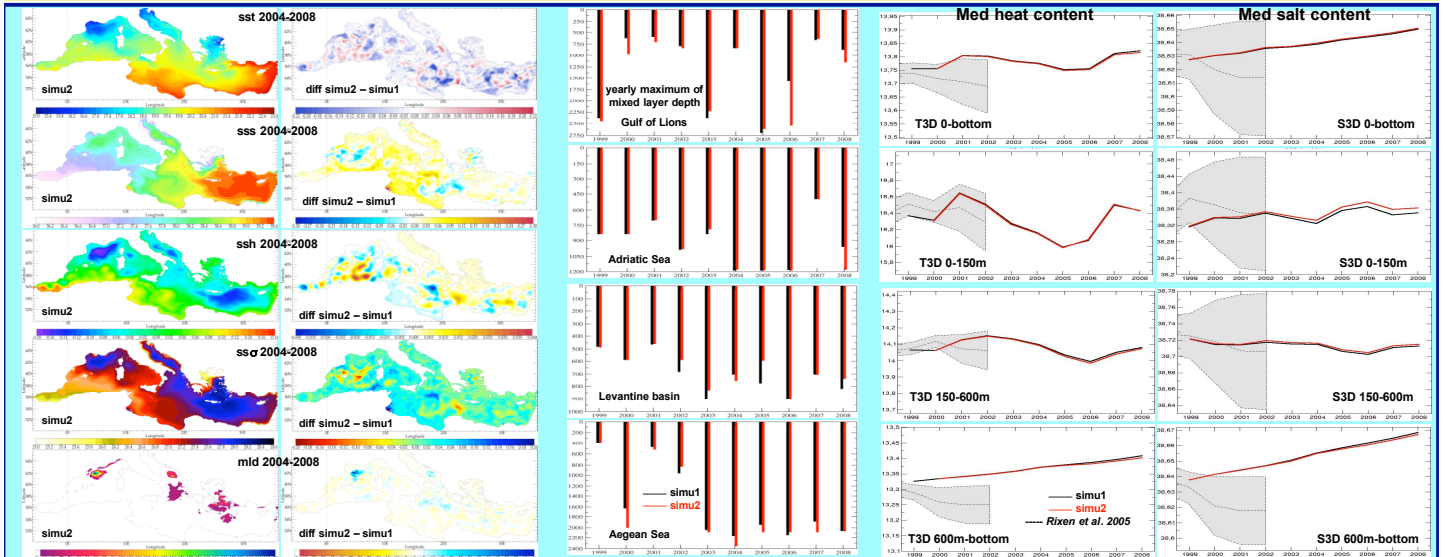
Bathymetry of MED12 (in meters)



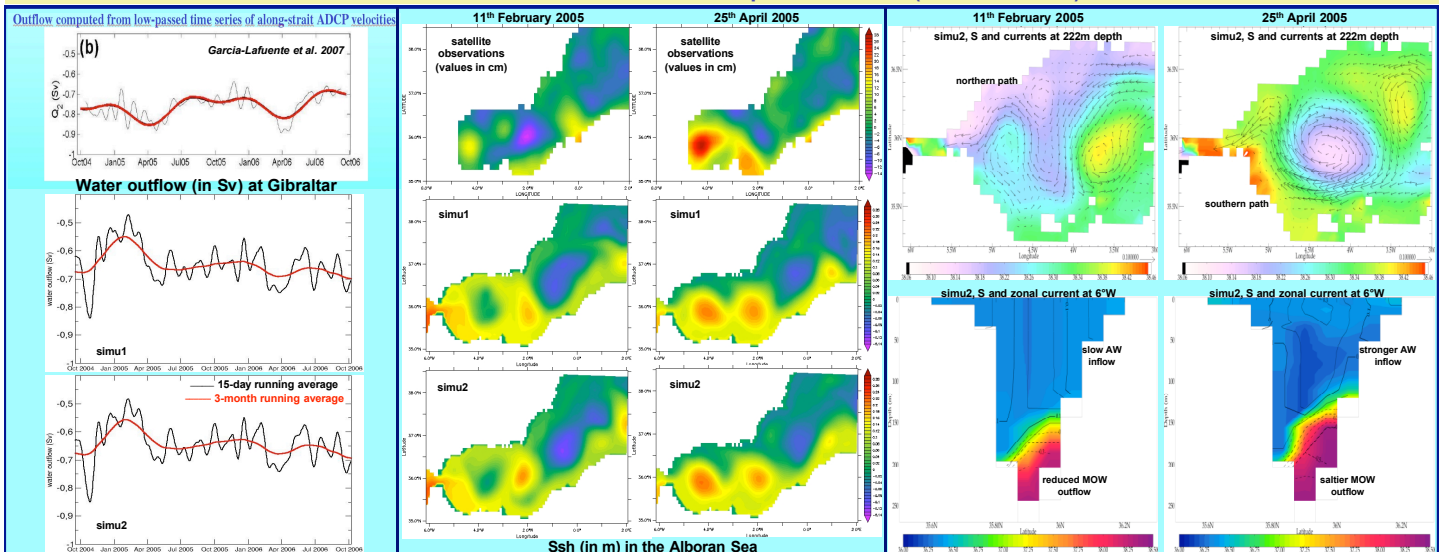
Averaged tidal energy E (in m²/s²)



Global impact of the new parametrisation



Focus on the Gibraltar area: different paths of MOW (see Millot 2009)



References:

- García-Lafuente J., Sanchez Roman A., Diaz del Rio G., Sannino G., Sanchez Garrido J.C. (2007) Recent observations of seasonal variability of the Mediterranean outflow in the strait of Gibraltar, *JGR* 112, C10005.
- Leonard B. P. (1979) A stable and accurate convective modelling procedure based on quadratic upstream interpolation, *Computer Methods in Applied Mechanics and Engineering*, 19(1), 59-98.
- Leonard B. P. (1991) The ULTIMATE conservative difference scheme applied to unsteady one-dimensional advection, *Computer Methods in Applied Mechanics and Engineering*, 88(1), 17-74.
- Madec G. (2008) *NEMO ocean engine*, Note du Pôle de modélisation, Institut Pierre-Simon Laplace (IPSL), France, n°27 ISSN n° 1288-1619.
- Millot C. (2009) Another description of the Mediterranean Sea outflow, *Progress in Oceanography*, 82, 101-124.
- Rixen M. et al. (2005) The Western Mediterranean Deep Water: A proxy for climate change, *Geophysical Research Letters*, 32(L12608), 1-4.