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The Mediterranean sea interannual and decadal variability over the last 40 years: comparison of model results with observations

S. Somot (1), J. Colin (1), M. Rixen (2)

(1) Météo-France, CNRM, France, (2) Département d'astrophys., géophysique et océanographie, Univ. Liège, Belgium (samuel.somot@meteo.fr, Fax : +33561079610)

The Mediterranean Sea hydrology characteristics (temperature, salinity) show a high decadal variability as well as long-term trends over the last decades. Both these variabilities present complex basin-scale and vertical spatial patterns, which are not fully understood yet. Therefore, modelling the evolution of the Mediterranean Sea over the last decades is needed to understand better these behaviours. Furthermore, it should allow to foresee its possible future evolution. However, due to the Mediterranean specificities, this modelling is rather a challenging task because it requires high resolution ocean models forced by a high resolution atmospheric forcings that follows the observed chronology over a long period of time. To achieve this goal, a 40-year high-resolution simulation of the Mediterranean Sea (OPA-MED8 model, 1/8°, Somot et al. 2006) was carried out using high resolution air-sea fluxes coming from a dynamical downscaling of the ERA40 reanalysis. The downscaling method was based on the spectral nudging of the ARPEGE-Climate model (global atmosphere GCM with a stretched grid and a 50 km resolution over the Mediterranean basin) by the ERA40 reanalysis. It is worth noting that no surface salinity relaxation was applied letting free the spatial and temporal variability of this field. Explicit river runoff fluxes were applied with an additive constant correction instead. The temporal evolution of the heat and salt contents of the whole Mediterranean Sea is analyzed using recent observed dataset (Rixen et al. 2005). The average value, the interannual variability and the observed trend of the heat content are well simulated by the Mediterranean model apart from a weak bias at the end of the 20th century. The spatial pattern (horizontal and vertical) of the heat content variability and its correlation with the North-Atlantic Oscillation are also studied compared with the observations. Concerning the salinity,

only the average value is well reproduced, proving a deficiency in the way the sources of the salinity interannual variability are modelled. Sensitivity studies to the resolution of the air-sea fluxes and to the water flux correction are carried out. In the future, the impact of the interannual variability of the river fluxes and of the Atlantic ocean and the choice of the initial conditions should also be tested.