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Estimating the Mediterranean Sea Water Budget: impact of RCM design

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The Mediterranean Sea can be considered as a thermodynamic machine that exchanges water and heat with the Atlantic Ocean through the Strait of Gibraltar and with the atmosphere through its surface. Considering the Mediterranean Sea Water Budget (MSWB) multi-year mean, the Mediterranean basin looses water at the surface due to an excess of evaporation over freshwater input (precipitation, river runoff, Black Sea input). Moreover the MSWB largely drives the Mediterranean Sea water mass formation and therefore a large part of its thermohaline circulation. This could even have an impact on the characteristics of the Atlantic thermohaline circulation through the Mediterranean Outflow Waters that flow into the Atlantic at a depth of about 1000 m. From a climate point of view, the MSWB acts as a water source for the Mediterranean countries and therefore plays an important role on the water resources of the region.

The regional physical characteristics of the Mediterranean basin (complex orography, strong land-sea contrast, land-atmosphere coupling, air-sea coupling, river inflow, Gibraltar Strait constraint and complex ocean bathymetry) strongly influence the various components of the MSWB. Moreover extreme precipitation events over land and strong evaporation events over the sea due to local winds can play a non-negligible role on the mean MSWB despite their small spatial and temporal scales.

Therefore, modelling the mean behaviour, the interannual variability and the trends of the MSWB is a challenging task of the Regional Climate Model community in the context of climate change. It is actually one of the highlighted issues of the HyMex project planned for the 2010-2020 period. We propose here to start investigating some key scientific issues of the regional modelling of the Mediterranean Sea Water Budget using a wide range of regional climate simulations performed at Météo-France or in the framework of FP6 European projects (ENSEMBLES, CIRCE). The addressed scientific questions deal with the RCM design for the following points:

Q1. the horizontal resolution

Q2. the physics of the RCM

Q3. the regional modelling technique (stretched-grid model, limited area model, spectral nudging technique)

Q4. the regional air-sea-river coupling

Q5. the RCM internal variability

Up-to-date observation estimates of the various terms of the MSWB are used to sort out between the different configurations of the RCMs.