A WESTERN MEDITERRANEAN SEA GENERAL CIRCULATION MODEL

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A high resolution general circulation model of the Mediterranean Sea was forced during 20 years by imposing daily atmospheric forcing and transports through the straits. The daily atmospheric forcing is provided by the analyzed outputs of the Météo-France Arpége operational model and the transports through the straits are driven by the density gradients between the Mediterranean sea and the Atlantic ocean (strait of Gibraltar) and the Eastern Mediterranean Sea (strait of Sicily). The grid mesh is 10km*10km and 31 levels are used on the vertical. The turbulence is parametrized by a second order closure scheme based on the mixing length as defined in BLANKE and DELECLUSE (1993).

After 20 years the model is in equilibrium. Energy is quite steady. The Levantine Intermediate Water has progressed from the Sicily strait until the Gibraltar strait following the West coast of Sardinia and the northern coast of the Western basin. Deep water formation is occurring every winter at the end of February. During summer, a realistic re stratification is observed. The transport through the Gibraltar strait is maximum during the January-June period where it reaches a value of 1.3 Sv. up to 1.5 Sv and minimum between July-October with 1.1 Sv.

A large anticyclonic eddy forms in the western basin of the Alboran Sea. The surface current is very unstable in the eastern Alboran Sea and along the Algerian coast where strong velocities are observed (up to 40 cm/s). At the level of the Sicily Strait, the current splits into two branches : one enters the strait while the other one continues along the Italian coast. The latter crosses the Corsican Channel and forms the Northern Current. The surface circulation is qualitatively consistent with the pattern described in MILLOT (1987 b). Meanwhile the Levantine Intermediate Water (LIW) exits the Strait of Sicily, turns eastward along the Italian coast and flows cyclonically around the Tyrrhenian Sea. Outflowing south of Sardinia, the LIW current follows the western coast of that island and progresses towards the northern basin. It then flows westward, trapped along the Italian and French coasts. Velocities in the current are typically 4 to 5 cm/s.

The most surprising result of the simulation is the importance of the barotropic circulation. The Northern Current barotropic transport is about 1 Sv, comparable to the observed transport that varies between 1.5 and 2.2 Sv. The barotropic transport amounts 2 Sv in the Tyrrhenian Sea, while it reaches about 10 Sv in the Alboran Sea gyre.

The transports through the different straits show strong annual variability which is investigated in terms of atmospheric forcing.