Numerical modelling of the Mesoscale activity and the deep mean flow generation in the Algerian Current

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Algerian eddies are of primary importance to the circulation of all the water masses in the western Mediterranean. Analytical models suitable for stability analysis show the primary importance of baroclinic instability of the Algerian current in determining the caracteristic of these eddies. A numerical modelling of the generation of an eddy is presented using the LODYC 3DPE model in a periodic channel.

Using the same numerical model, these eddies are shown to generate a deep mean flow. The flow appears as a system of two meandering jets: a jet flowing westward near the coast and an offshore jet flowing eastward, both having an enhanced barotropic componant. It is shown that this system is barotropically unstable at longer wavelength than the most baroclinically unstable wave of the initial instability. This instability process generates an eastward coastal surface and deep mean flow. In most cases, during this reversing of two jets system, the surface coastal anticyclones split, creating anticyclones offshore.

Cascade of energy toward larger scale is shown to be a process able to generate larger anticyclones offshore, through successive merging of small coastal anticyclones or small offshore anticyclones previously generated by splitting. This cascade is inhibited by the planetary vorticity gradient. Nevertheless, in this case, large anticyclones are directly created offshore by the meandering of the new mean flow generated at the coast after the barotropic instability.

The introduction of a schematic summer thermocline lowers the available potential of the system: the flow in unstable at smaller wavelengths and the surface and deep mean flow created are much weaker. Nevertheless, offshore anticyclones are still generated through similar processes.

Accurate comparisons with in-situ measurements and remote sensed images, prove that these processes account for most of the observed caracteristics of the circulation in the Algerian Basin.

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