Geophysical Research Abstracts
Vol. 20, EGU2018-10586, 2018
EGU General Assembly 2018

Diapycnal Mixing in the Cape Ghir upwelling region: Double Diffusion and Diapycnal Shear Instability

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Diapycnal mixing plays an important role in modifying water masses, transporting heat and maintaining ocean stratification. Understanding its spatial and temporal variations is the key not only to improve the numerical large-scale ocean models but to understand the evolution of ocean systems such as upwelling systems. For this reason we decided to analyze the diapycnal mixing process in the Cape Ghir upwelling region.

We used the PROMECA cruise CTD data that was carried out from 18th to 29th October 2010 onboard the R/V García del Cid.

We analyzed the mixed layer depth with the Mignot et al. (2007) method, Holte and Talley (2009) method and Segment Method (Abdulla et al., 2016), using the most appropriate method for each station. The results oscillate between 13 m and 48.65 m.

In general, it can be seen that the region between potential density 26.1 and 26.6 kg m^{-3} is a stratified area with high diapycnal shear (with values between 2 to 4 $m^4 kg^{-1} s^{-1}$), low gradient Richardson number (Ri) and relative high values for divergence diapycnal ($\partial\omega\rho/\partial\rho$). This zone of the water column is probably affected by mesoscale structures associated to the upwelling system.

However, the area of potential density between 26.6 and 27.1 kg m^{-3} is a less stratified area, with moderate values of $\partial\omega\rho/\partial\rho$ where the mixing processes are dominated by double diffusion versus diapycnal shear instability, although there are some areas with high diapycnal shear and relative low Ri.

The high relative values of $\partial\omega\rho/\partial\rho$ were found in the upper thermocline, in the isopycnic range between 26.2 and 26.6 kg m^{-3}. The mixing processes associated with the diapycnal shear largely contribute to the change in the distribution of the density field, therefore affecting the geostrophic dynamics in the region.

Acknowledgments:

This work was supported by the project FLUXES (CTM2015-69392-C3-3-R) funded by the Spanish National Research Program.