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Origin and evolutions of Internal waves and their role on the deep mixing and deep circulation in different Mediterranean sub-basins

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The internal waves and the related mixing processes contribute significantly to the eddy energy level in the ocean and on the mean flow variability. The bottom mixing, in particular in rough bathymetry, creates horizontal and vertical density gradients that drive deep ocean currents, both locally and on the scale of the global thermohaline circulation.
This work focus on Inertial and Near Inertial Waves (NIWs). The Near-inertial oscillations in the open ocean are internal waves with a frequency close to the Coriolis frequency f. Because the internal wave band supports frequencies $f \leq \omega \leq N$, where N is buoyancy frequency, freely propagating near-inertial oscillations are restricted to frequencies higher than the local f. The NIWs represent one of the main high-frequency variabilities in the ocean, and they contain around half the kinetic energy observed in the oceans (Simmons et al. 2012) appearing as a prominent peak rising well above the Garrett & Munk (1975) continuum internal wave spectrum.
The results of the analysis carried out on long time series (more than one year long) temperature, salinity and current speed collected in two different deep regions (Ionian Sea, 2100m; Tyrrhenian sea, 3400m) of the Mediterranean Sea are presented here. From these results it is worth underling the different spectral contents of the two deep current signals: the Ionian site is characterized by the formation of NIWs characterized by a frequency band “blue shifted” with respect to the expected local frequency f, whereas in the Tyrrhenian case we observed the highest energy peak exactly centred at the local inertial frequency. As such, NIWs likely affect the mixing of the deep ocean in ways that are just beginning to be understood. Although dynamics, deep current driving forcing and processes have quite different behaviours, the different shape of the two basins, and also of the roughness of the bottom topography may have played a predominant role in such spectral evolution of those signals.
These preliminary results are very promising primarily to understand how the heat can be redistributed along the deep layers and from the deep layers to more superficial ones and secondly to better represent deep mixing processes in numerical models through more accurate parametrizations.