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Turbulent mixing in anticyclonic eddies during the BOUM experiment (Mediterranean sea)

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One main purpose of BOUM experiment was to give evidence of the possible impact of submesoscale dynamics on biogeochemical cycles. To this aim physical as well as biogeochemical data were collected along a zonal transect through the western and eastern basins. Along this transect three day fixed point stations were performed within anticyclonic eddies during which both fine-scale CTD/LADCP profiles and microstructure measurements were collected over the first 500m and the first 100m respectively.

We focus here on the turbulent mixing generated by breaking internal waves within the anticyclonic eddies. Direct estimation of turbulent dissipation and turbulent diapycnal mixing is available over the first 100 meters depth. Relatively strong dissipation (10-6-10-8) W/kg is found at the location of the shallow seasonal pycnocline, below this pycnocline dissipation is distributed lognormally with a weak mean value of $\sim$10-10 W/kg. Corresponding vertical mixing can reach 10-4 m2/s in the upper 20m but does not exceed 10-5 m2/s below. The resulting nutrient turbulent fluxes at the nitracline are lower than previous estimates.

Fine scale measurements show evidence of near inertial oscillations propagating over the whole water column: in the surface layer, within the eddies and at the eddy base. Presence of these near inertia gravity waves is particulary marked in Cyprus eddy (Eastern mediterranean sea). A parameterization of turbulent dissipation based on nonlinear wave wave interaction is therefore proposed following the classical Gregg (1989) formulation with the addition of a strain dependence. The parameterization is compared with direct measurements in the first 100 meters and is used to infer turbulent mixing over the whole water comumn. Whereas the turbulent mixing remains fairly low over the whole eddy core, a dramatic increase of turbulent mixing resulting from large near inertial shear is found a the base of Cyprus eddy