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New insights of the Northern Current in the Western Mediterranean Sea from Gliders data: Mean structure, Transport, and Seasonal Variability

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In the last 5 years, an unprecedented effort in the sampling of the Northern Current (NC) has been carried out using gliders which collected more than 50 000 profiles down to 1000m maximum along a few repeated sections perpendicular to the French coast.

Based on this dataset, this study presents a very first quantitative picture of the NC on 0-1000m depth. We show its mean structure of temperature and salinity characterized by the different Water Masses of the basin (Atlantic Water, Winter Intermediate Water, Levantine Intermediate Water and Western Mediterranean Deep Water) for each season and at different location. Geostrophic currents are derived from the integration of the thermal-wind balance using the mean glider-estimate of the current during each dive as a reference. Estimates of the heat, salt, and volume transport are then computed in order to draw an heat and salt budget of the NC.

The results show a strong seasonal variability due to the intense surface buoyancy loss in winter resulting in a vertical mixing offshore that makes the mixed layer depth reaching several hundreds of meters in the whole basin and in a very particular area down to the bottom of the sea-floor (deep convection area). The horizontal density gradient intensifies in winter leading to geostrophic currents that are more intense and more confined to the continental slope, and thus to the enhancement of the mesoscale activity (meandering, formation of eddies through baroclinic instability...). The mean transport estimates of the NC is found to be about 2-3Sv greater than previous spurious estimates. The heat budget of the NC also provides an estimate of the mean across shore heat/salt flux directly impacting the region in the Gulf of Lion where deep ocean convection, a key process in the thermohaline circulation of the Mediterranean Sea, can occur in Winter.