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Vertical structure of Mediterranean vortices : a dive within Pelops and Ierapetra Eddies

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The Mediterranean Sea exhibits an intense mesoscale activity superimposed on its mean circulation. It is highly constrained by the basin shape which is quite narrow, and the mesoscale eddies are strongly impacted by the coastal bathymetry and orographic effects. We give some insight of their description.
The detection and tracking of mesoscale eddies are performed by the AMEDA algorithm (DOI : 10.1175/JTECH-D-17-0010.1), based on daily absolute dynamic topography maps. AMEDA provides the daily contours of the eddies and some dynamical parameters (Radius, maximal velocity, Rossby number, etc). A data base of these tracked eddies is available over the Mediterranean Sea for the period 2000-2017.
In this study, in situ temperature and salinity profiles from the CORA database (DOI : 10.5194/os-9-1-2013) are colocalised with the $\sim$11500 AMEDA trajectories available from 2000 to 2016 over the entire Mediterranean Sea. We have 684 anticyclonic trajectories and 1128 cyclonic trajectories monitored by these in situ measurements, sampled by 8440 and 12876 profiles, respectively.
There is a large diversity of mesoscale structures captured by the analysed altimetric fields, spanning a wide range of time and space scales. Here we focus on the Pelops and Ierapetra Eddies. These two large and recurrent anticyclonic eddies are easily tracked over months ; the Pelops eddies are generated South of the Pelopponese Peninsula and the Ierapetra eddies at the South Eastern corner of Crete. 3 Pelops eddies and 3 Ierapetra eddies lasting more than one year are identified, with in situ sampling between 20 and 120 times. We have described their vertical structure, taking into account their variations across their radius and over the eddy's lifetimes, and highlight their similarities and differences. These eddies appear as globally positive temperature and salinity anomalies compared to their environnement. We also investigate whether the local vertical displacement of the water column due to the passing eddy (heaving) or the lateral transport of water in their cores from the generating area (horizontal advection) contribute most to these thermohaline anomalies. The stronger the eddy, the deeper the vertical displacement of isopycnals inducing local temperature and salinity anomalies. The anomalies due to horizontal advection are localized within the eddy's core and are enhanced when the local environment differs greatly from that at the eddy's generation position.