Modelling the Impact of Mesoscale Eddies on Water Mass Transport in the Black Sea

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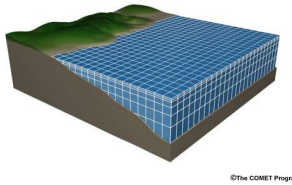


Hydrodynamic Model Setup

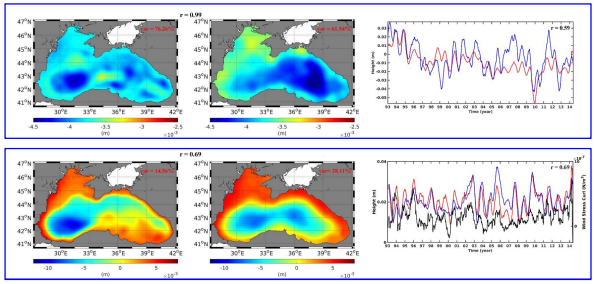
Nucleus for European Modeling of the Ocean (NEMO) Ocean General Circulation

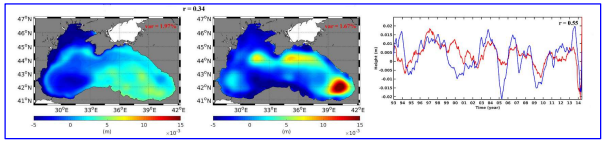
Horizontal resolution: **3 km × 3 km**
Vertical resolution: **61 z-levels**
Baroclinic time step: 240 s
Barotropic iterations: 30
3-years spin up
Simulation Period: **1985-2014**

Surface Boundary Conditions from ECMWF Era-Interim data
Initial conditions from WOA data
Bosphorus strait as open boundary.

SST restoring for heat flux correction.
Temperature and salinity nudging below 207 m to conserve pycnocline balance.

Spatial & Temporal EOF Analysis - SSH





EOF Spatial Mode:

Mode 1: Represents mean SSH and water fluxes of the Black Sea.

Mode 2: Represents main feature of the basin, the Rim Current.

Mode 3: Represents small scale features of the basin such as meso and sub-mesoscale eddies.

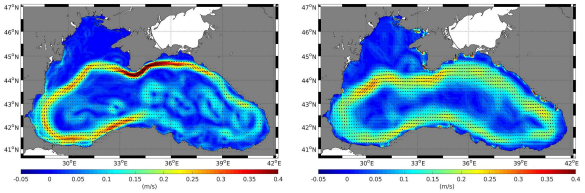
EOF Temporal Mode:

Mode 1: Represents temporal SSH changes of the Black Sea.

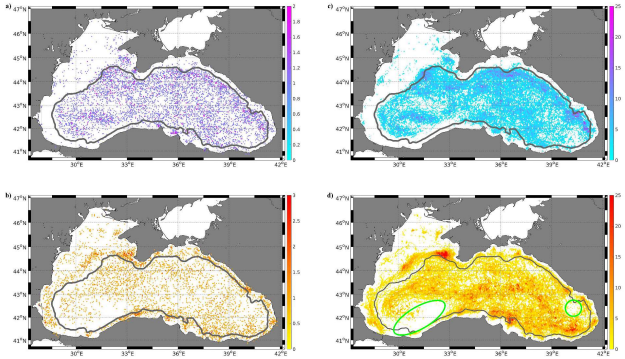
Mode 2: Is assumed to represent the rim current temporal changes with high values during strong Rim Current presence and low values at the time of its is integration.

Mode 3: Is assumed to be connected to small scale features temporal changes.

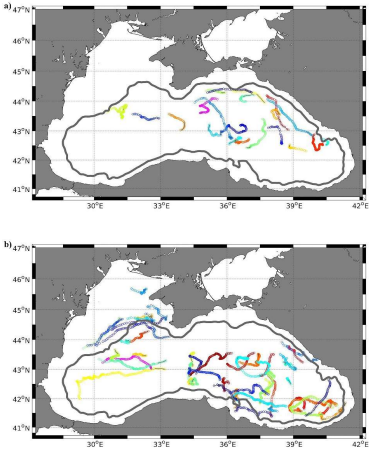
Model and Satellite Sea Surface Circulation (Mean Surface Circulation – March - 1985-2014)



Spatial Distribution of Eddy Formation and Occurrence Over the Time Frame 1985-2014



Trajectories of Eddy Tracks of Long-lived Eddies (> 30 days)



-Cyclonic eddies have smaller diameter than anticyclonic eddies.

-Lifetime of cyclonic eddies is shorter than anticyclonic eddies and the distance that they travel is shorter compared to anticyclonic eddies.

-Spatial distribution of anticyclonic eddies showed that eddy density in the regions where quasi-permanent eddies are detected using satellite data is higher than other regions.

-Cyclonic eddies are formed almost in the entire Black Sea with little formation points in the northwestern shelf.

-Density of anticyclonic eddies was higher in the eastern Black Sea while cyclones were spread out over entire basin.

-Anticyclonic eddies in the Black Sea may transport ~2 times more volume than cyclonic eddies and that at the same time their downwelling flux is ~2 times larger than the upwelling capacity of cyclones.