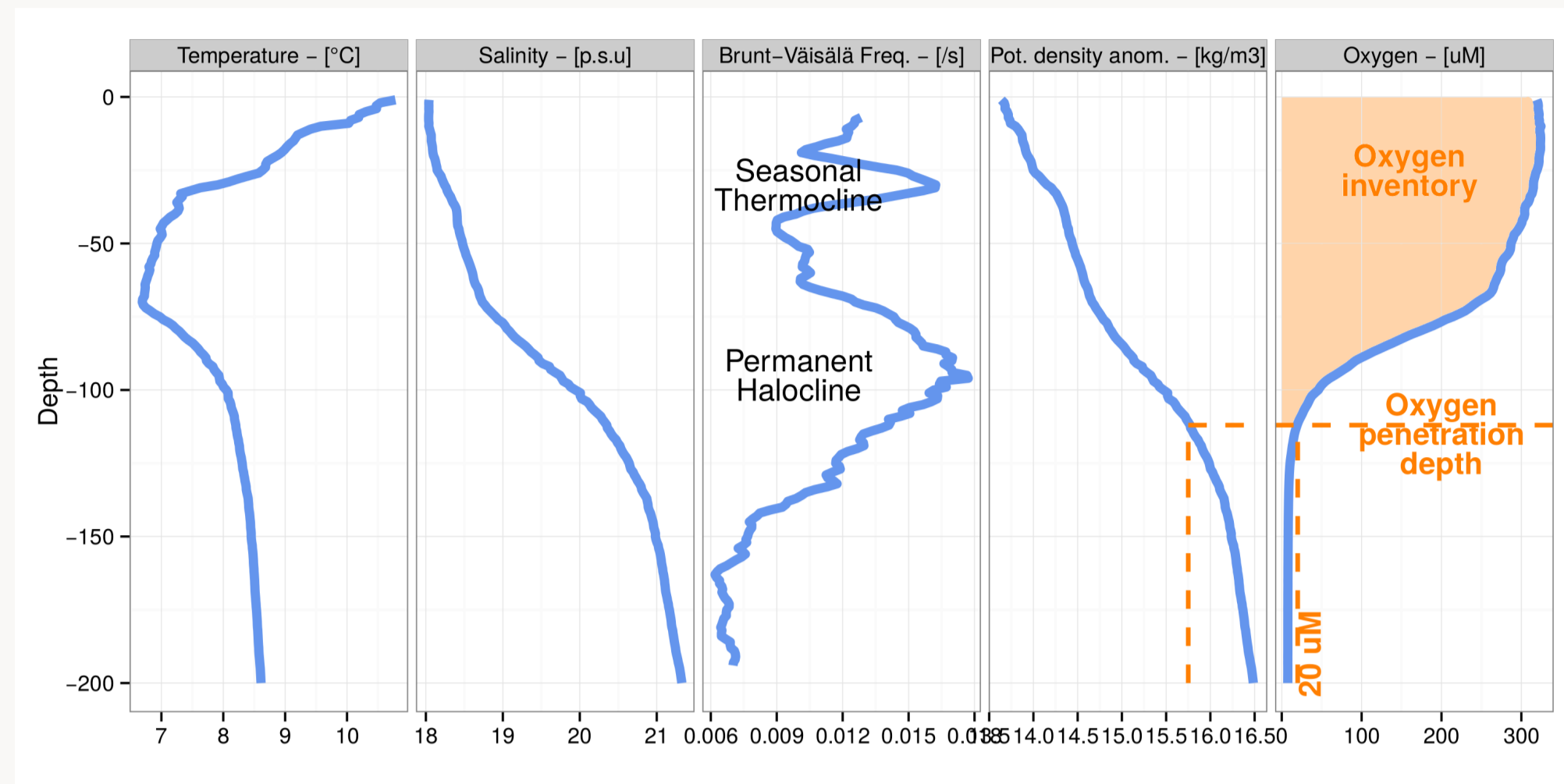
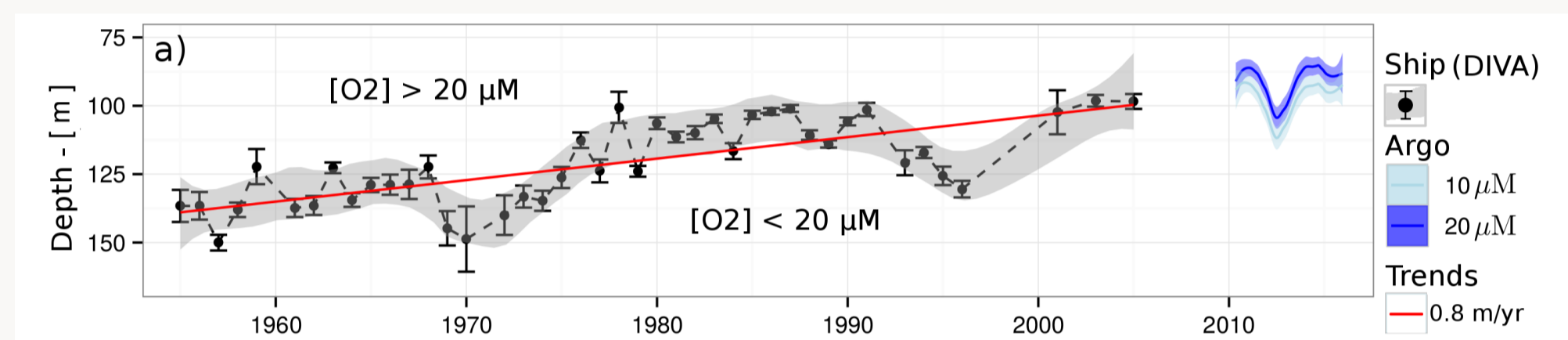


Contribution of mesoscale eddies to Black Sea ventilation

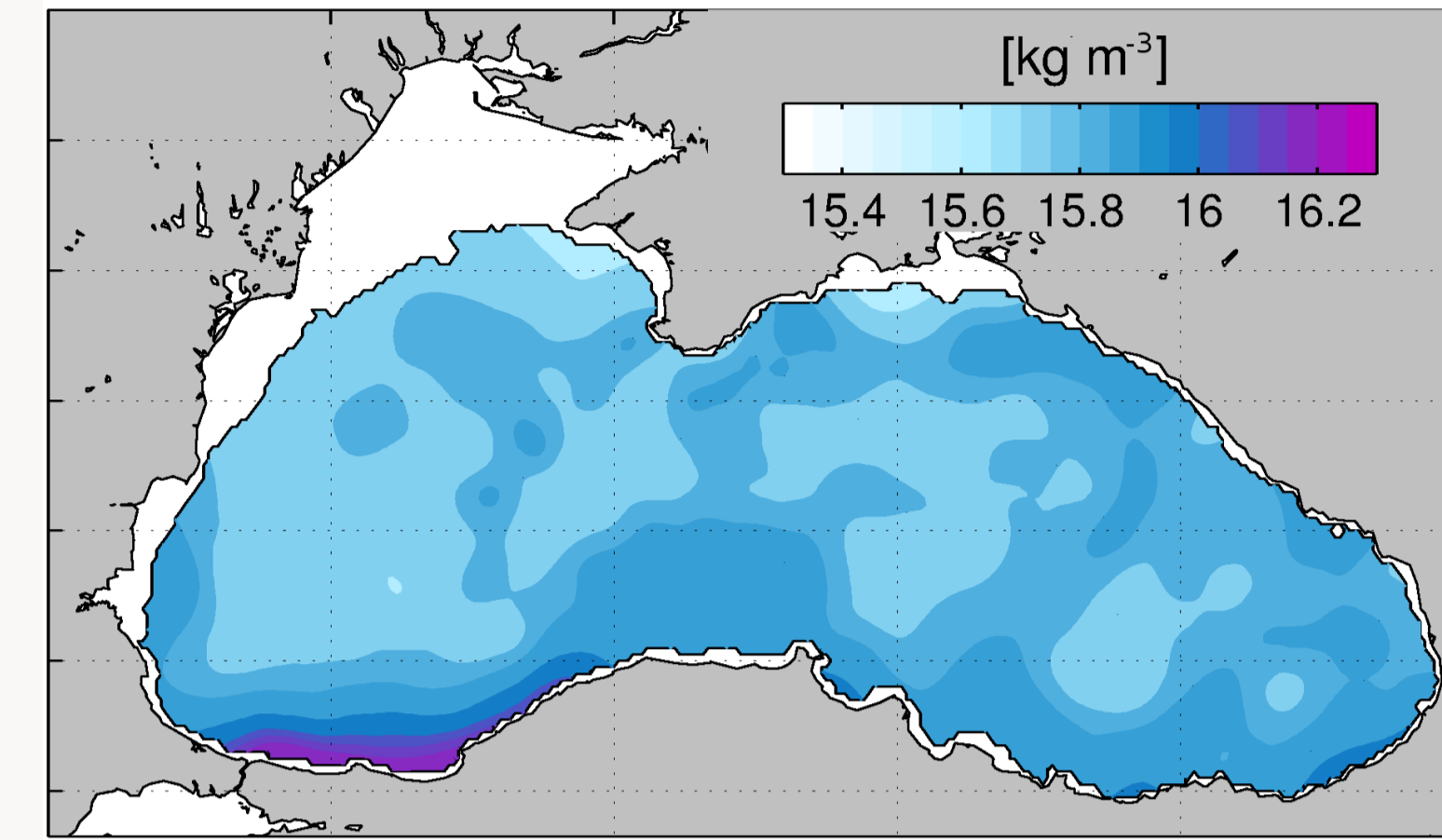
Context



1. The Black Sea vertical structure induces permanent anoxia over a large part of the water column (~2000 m).



2. Recent study revealed that the limit of oxygen penetration has shoaled substantially during the past decades [1].



3. Oxygen penetration depth (on a density vertical scale) suggest the occurrence of diapycnal ventilation along the basin periphery. This area is known to be populated with recurrent and semi-permanent eddies [2].

Approach

- ▶ Our objective is to characterize the role of persistent and semi-permanent meso-scale structures in the diapycnal transport of biogeochemical tracers, in particular oxygen.
- ▶ First, we characterize the vertical anomalies recurrently associated with meso-scale eddies.
- ▶ The eddy identification is based on sea-level anomaly [3].
- ▶ This methodology is applied on satellite altimetry, and outputs from the GHER-BHAMBI model.
- ▶ For satellite-derived eddies, we evaluate the potential to use Argo profiles to characterize a corresponding recurrent vertical anomaly.
- ▶ For model-derived eddies, we use the outputs of the biogeochemical model to identify recurrent anomalies associated with meso-scale eddies [3].

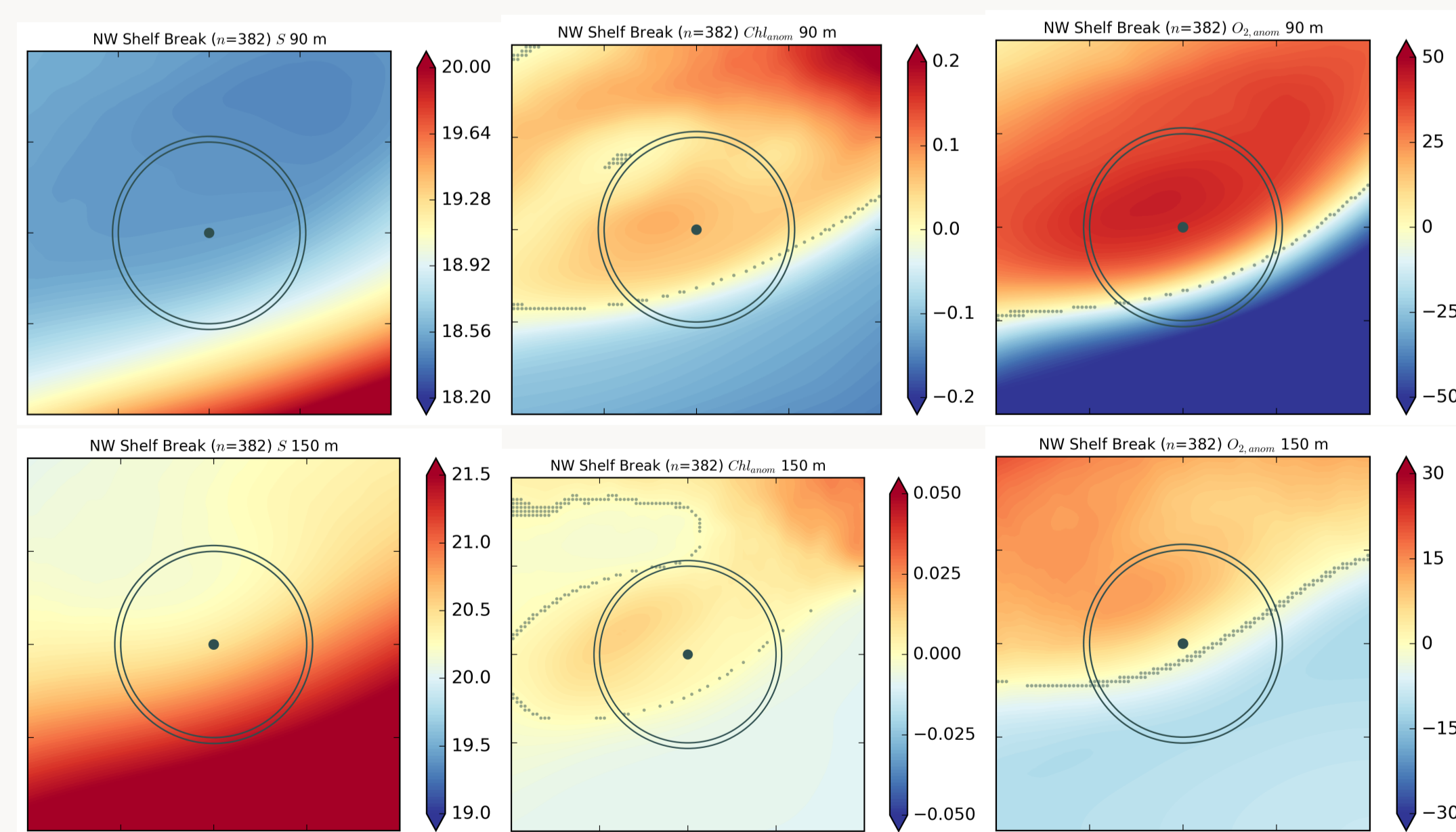
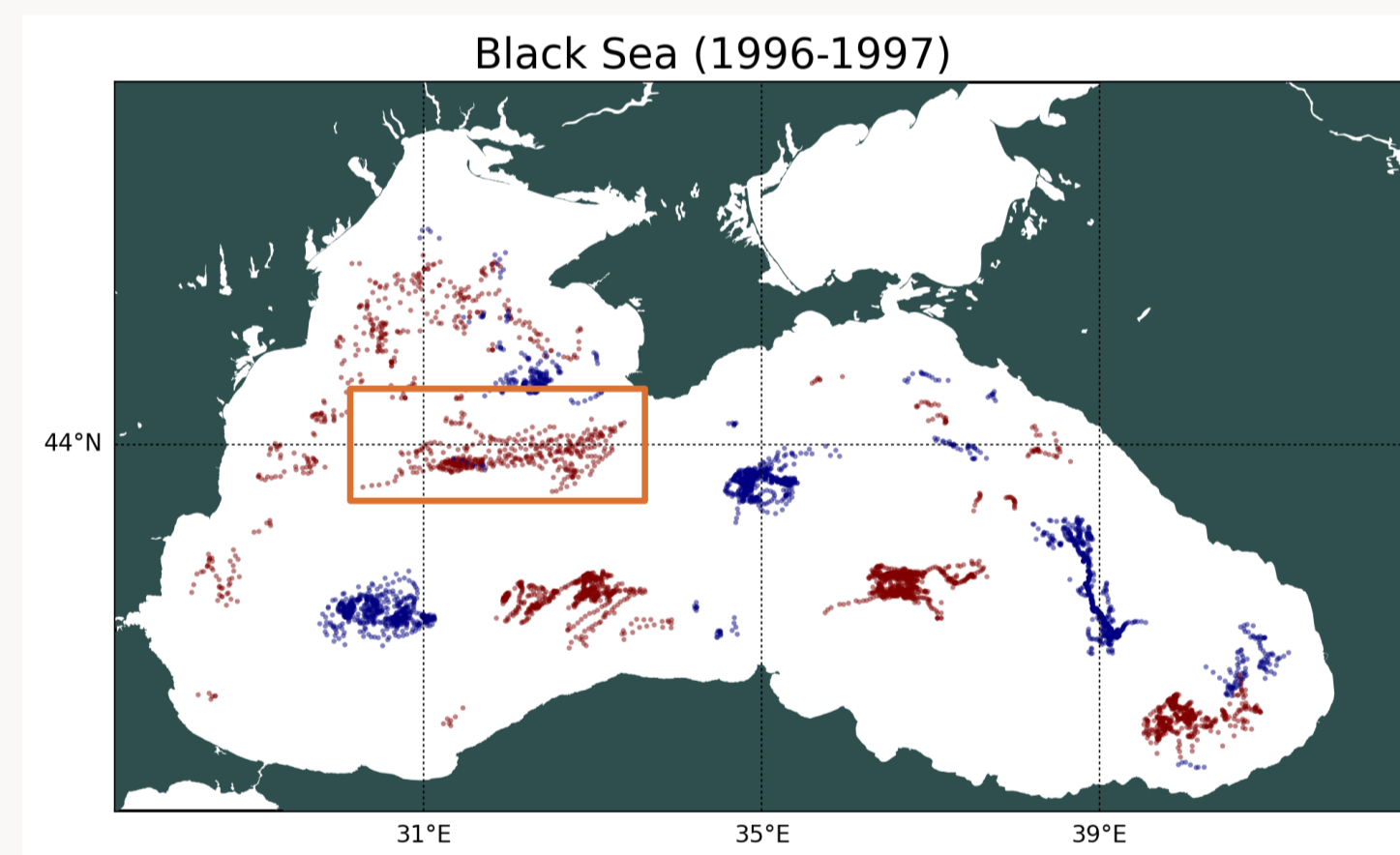
References

- 1 Capet, Arthur et al, "Decline of the Black Sea oxygen inventory", *Biogeosciences*, 2016
- 2 Kubryakov, A. A., and S. V. Stanichny. "Mesoscale eddies in the Black Sea from satellite altimetry data.", *Oceanology*, 2015
- 3 Mason, Evan, et al. "Subregional characterization of mesoscale eddies across the Brazil-Malvinas Confluence." *Journal of Geophysical Research: Oceans*, 2017

Results: Composite Eddies from model outputs

Anticyclonic (red) and cyclonic (blue) eddies, → detected on the basis of model outputs.

- ▶ High anticyclonic activities occurs over the shelf break separating the northwestern shelf from the open basin.

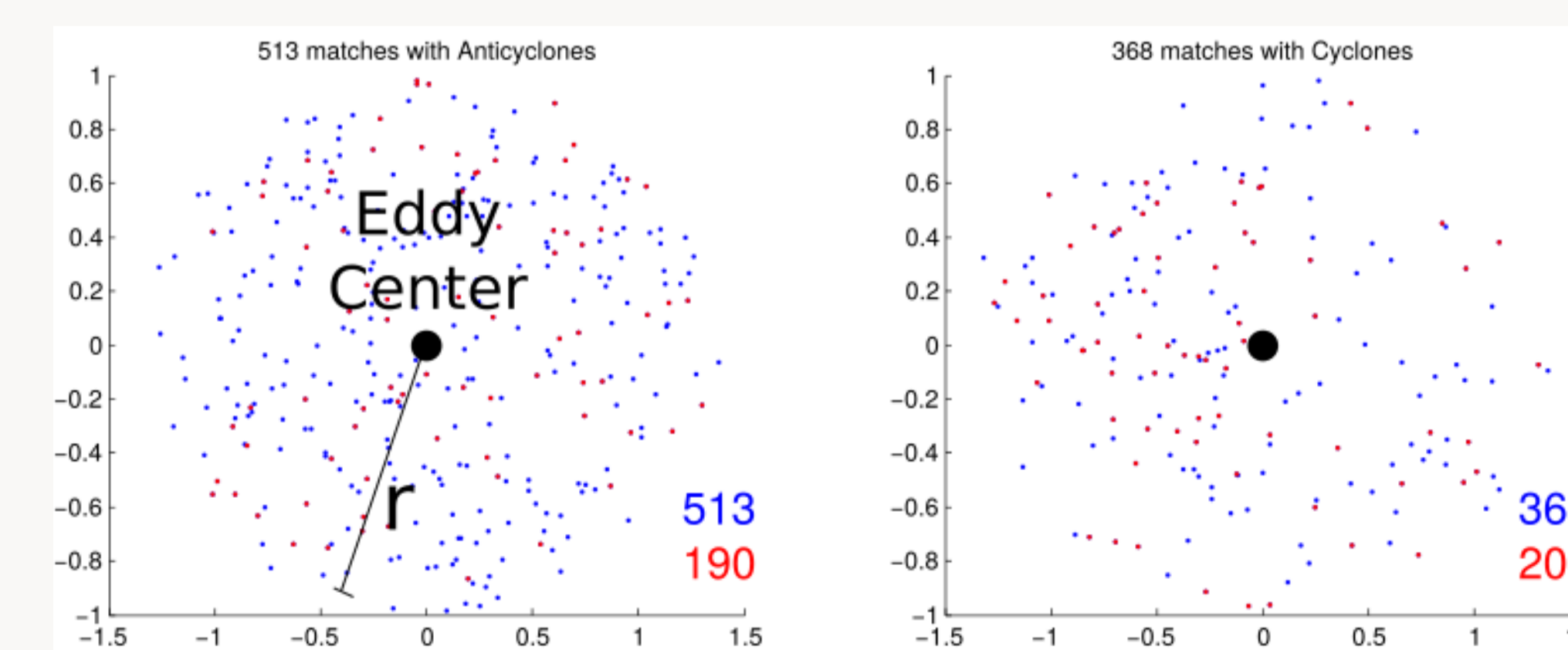
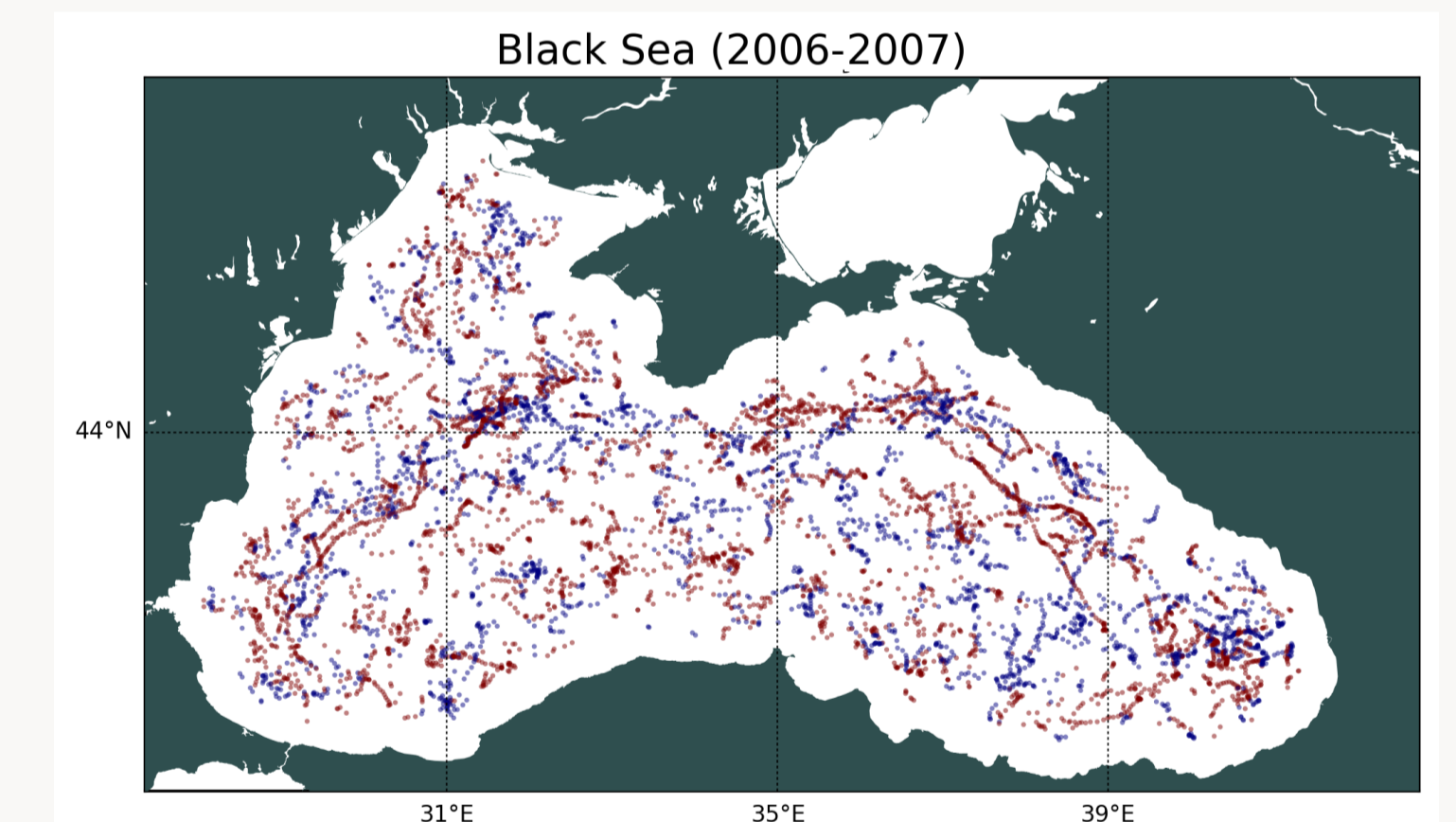


- ← Persistent anomalies associated with anticyclonic eddies along the northwestern shelf break.
- ▶ Salinity mean field shows the iso-haline curvature.
- ▶ Chlorophyll anomaly evidence the meso-scale eddies structuring of biogeochemical processes.
- ▶ Oxygen anomaly, visible down to 150 m, suggests associated ventilation.

Results: Composite Eddies from observations

Anticyclonic (red) and cyclonic (blue) eddies, → detected on the basis of satellite altimetry.

- ▶ Anticyclonic eddies along the northwestern depicts longer tracks than in the current model results.
- ▶ Basin-wide cover might be due to noise in the altimetry gridded products or over-smoothed model results.



- ← Matches between ARGO (blue) and Bio-Argo (red) tracks and detected eddies, in the eddy-centered cylindrical reference frame (2010-2016).
- ▶ There is potential for composite analysis merging satellite and Argo data.
- ▶ This approach will benefit from enhanced coastal altimetry products (SWOT).