



*Supplement of*

## **New insight into 3-D mesoscale eddy properties from CMEMS operational models in the western Mediterranean**

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## Supplementary materials

### Nonlinearity component maps

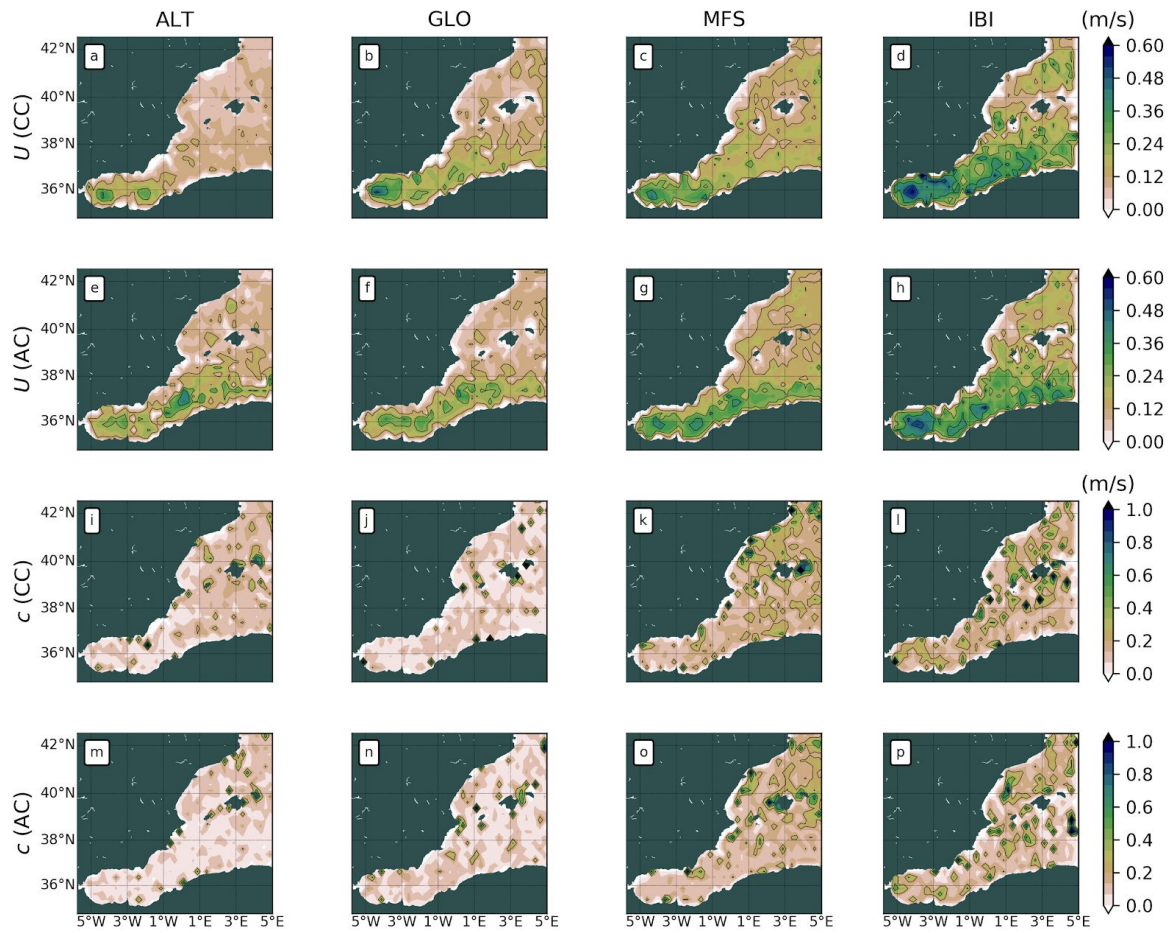


Fig. S1. Maps of mean eddy swirl speed (a-h) and celerity (i-p) over the western Mediterranean. Columns for ALT, GLO, MFS and IBI. Paired rows for cyclones (CC) and anticyclones (AC).

## Tilt correction

WAG

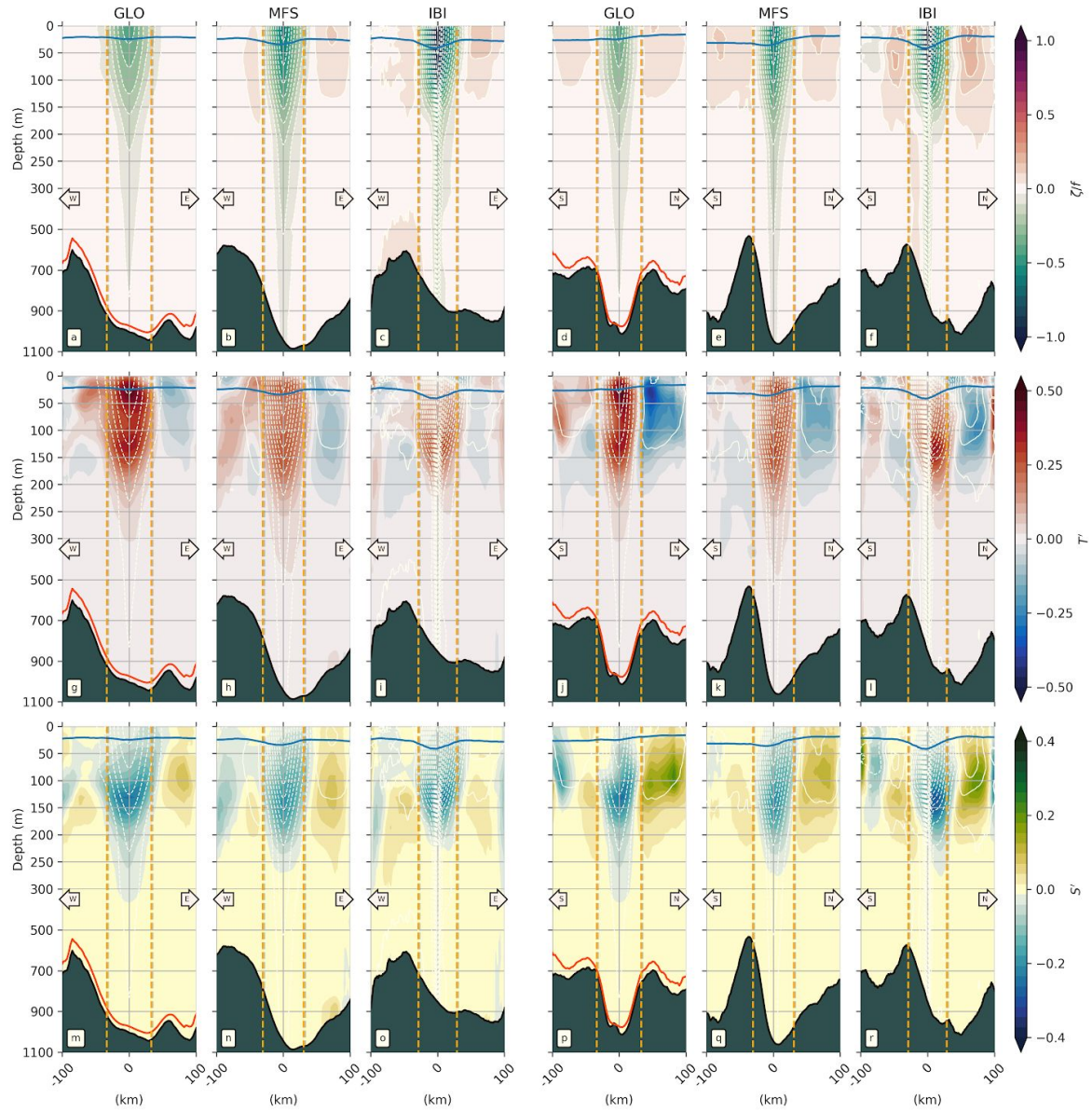


Fig. S2. Eddy composite sections with the tilt correction described in Sec. 3.6 from GLO, MFS and IBI in the western Alboran gyre. Compare the zonal and meridional sections with those of Fig. 7. Vertical orange dashed lines indicate the boundaries of each composite eddy based on its mean radius estimate from Tab.2. Composite topographic profiles in black from SRTM, and also in red from GLO. Note change of vertical scale at 300 m.

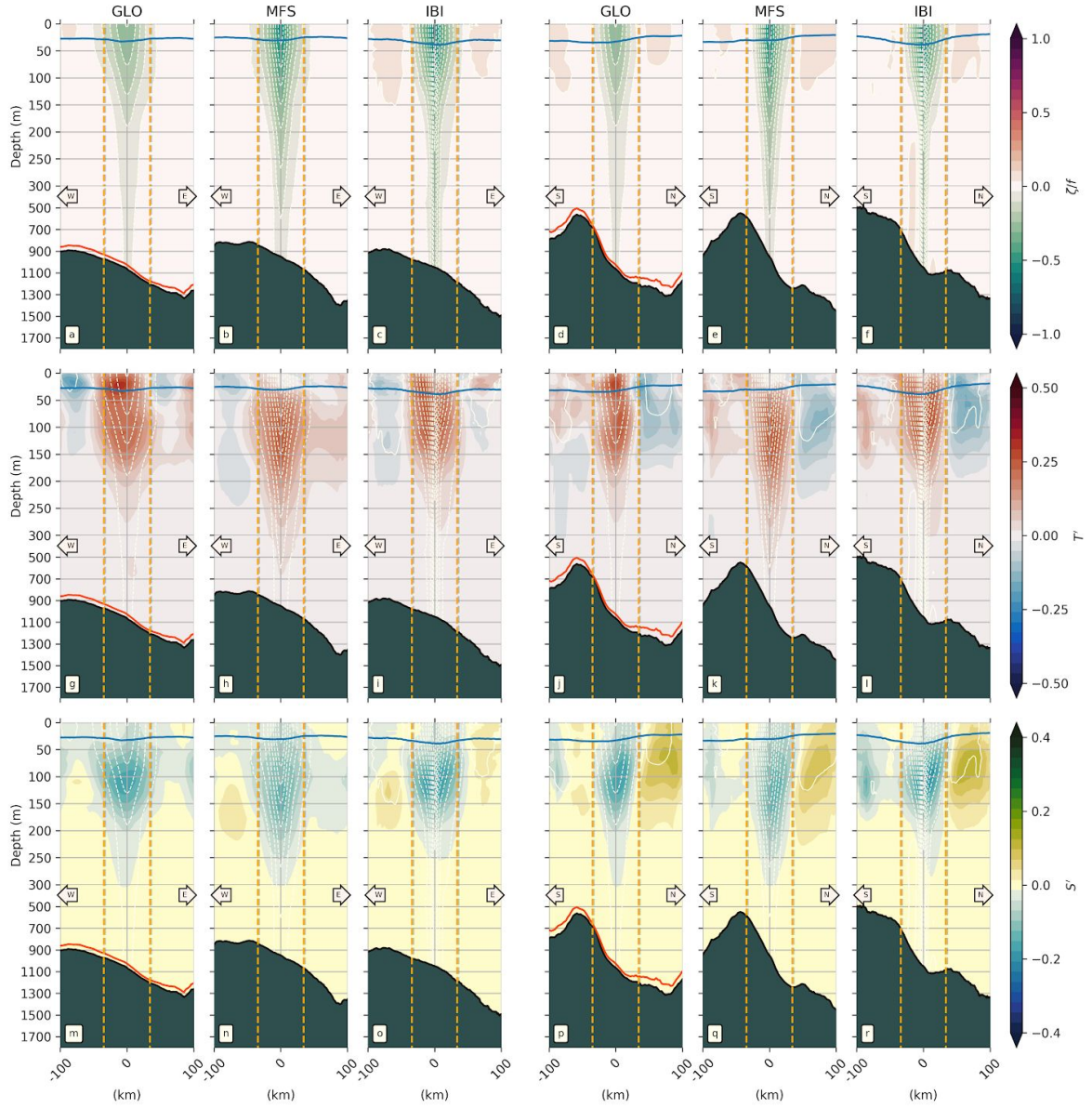


Fig. S3. Same as Fig. S2 but for the eastern Alboran gyre.



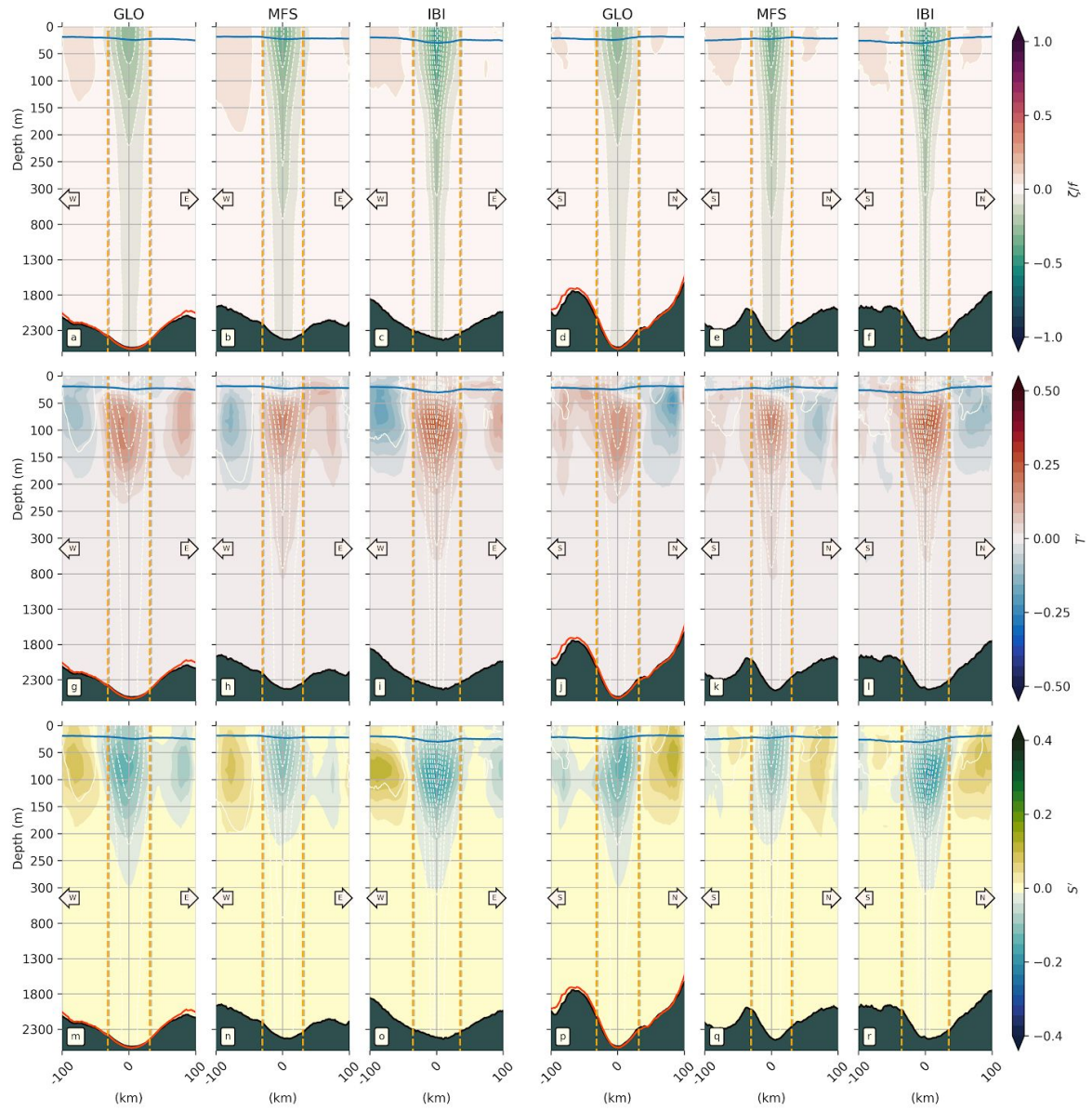


Fig. S4. Same as Fig. S2 but for the Cartagena frontal region.

## Anticyclonic eddy composite sections

AGW

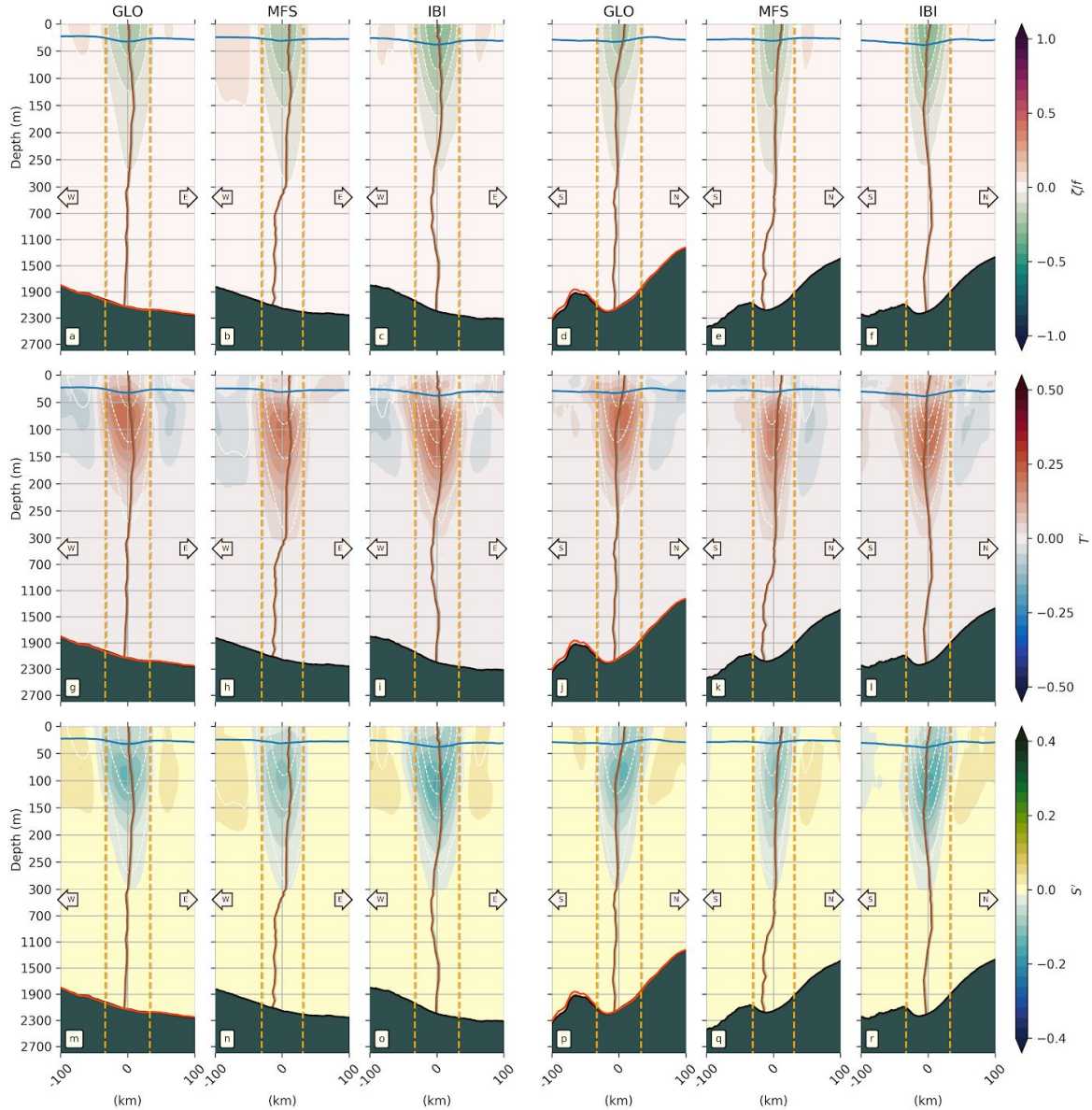


Fig. S5. Anticyclonic eddy composite sections from GLO, MFS and IBI in the Algerian western region ( $0^{\circ}\text{E}$ - $2.25^{\circ}\text{E}$ ,  $35.7^{\circ}\text{N}$ - $38.75^{\circ}\text{N}$ ). Left-hand-side (right-hand-side) columns show zonal (meridional) sections of (top to bottom) relative vorticity, temperature anomalies and salinity anomalies, from the surface to the ocean floor. The central position of each section is the median of the longitudes and latitudes associated with the eddy observations used to make the composites. Blue lines indicate the mixed layer depth. The vertical brown line in each section is the vorticity-based tilt correction (Sec. 3.6). Vertical orange dashed lines indicate the boundaries of each composite eddy based on its mean radius estimate. Composite topographic profiles in black from SRTM, and also in red from GLO. Note change of vertical scale at 300 m.

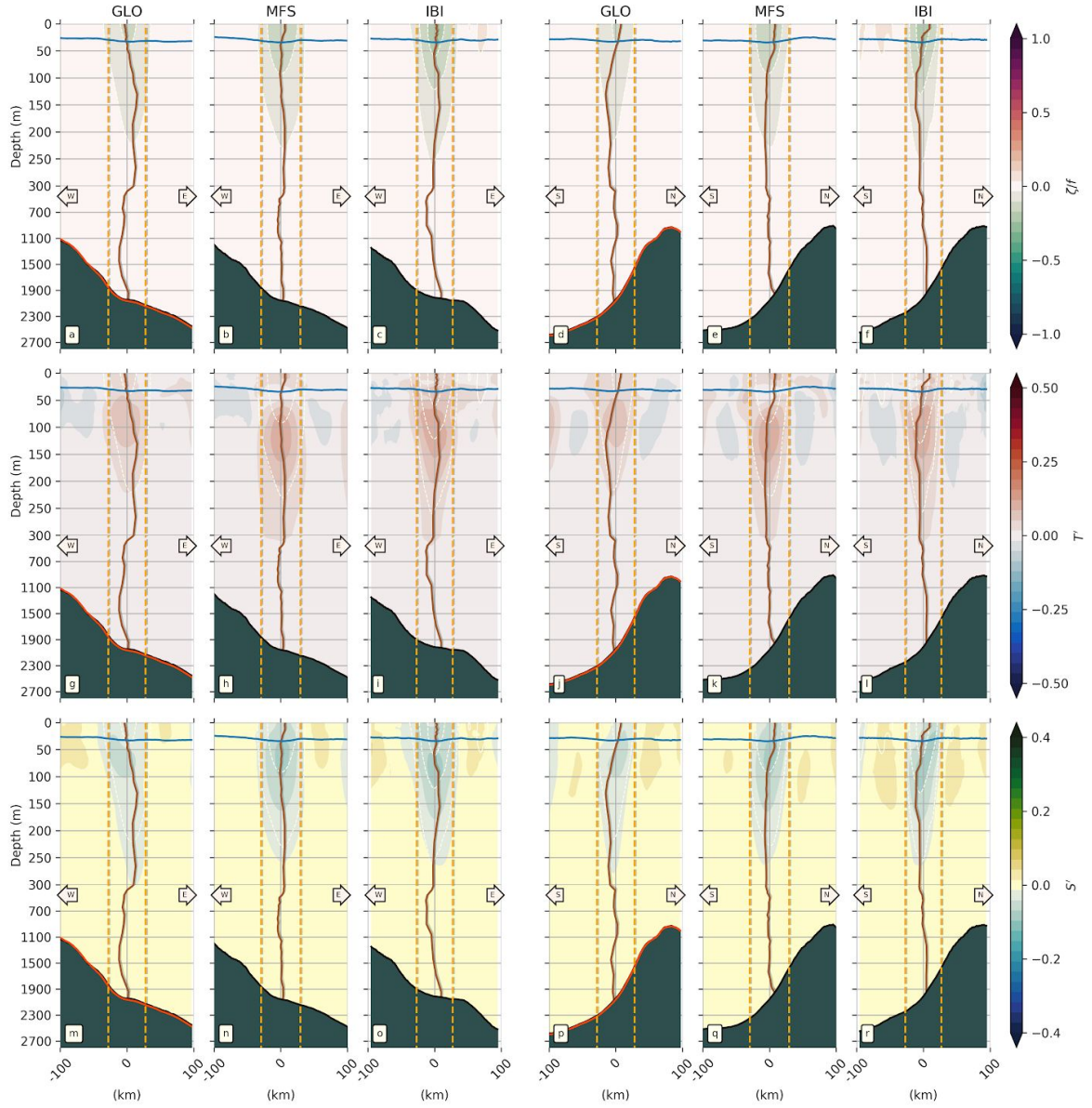


Fig. S6. Same as Fig. S5 but for the Algerian east (northern) region (2.25°E-4.5°E, 38.25°N-36.65°N).



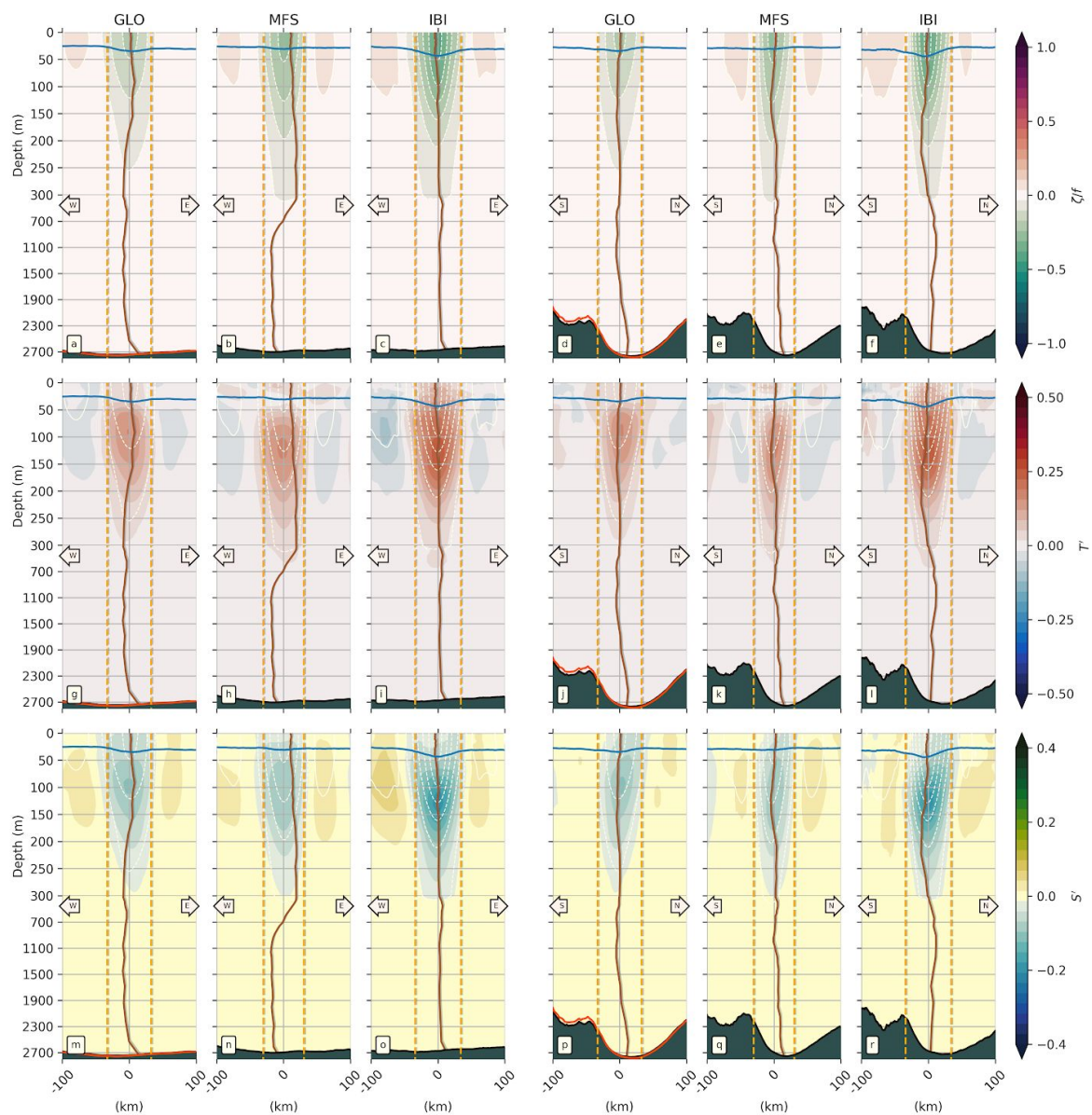


Fig. S7. Same as Fig. S5 but for the Algerian east (southern) region (2.25°E-4.5°E, 35.7°N-38.25°N).



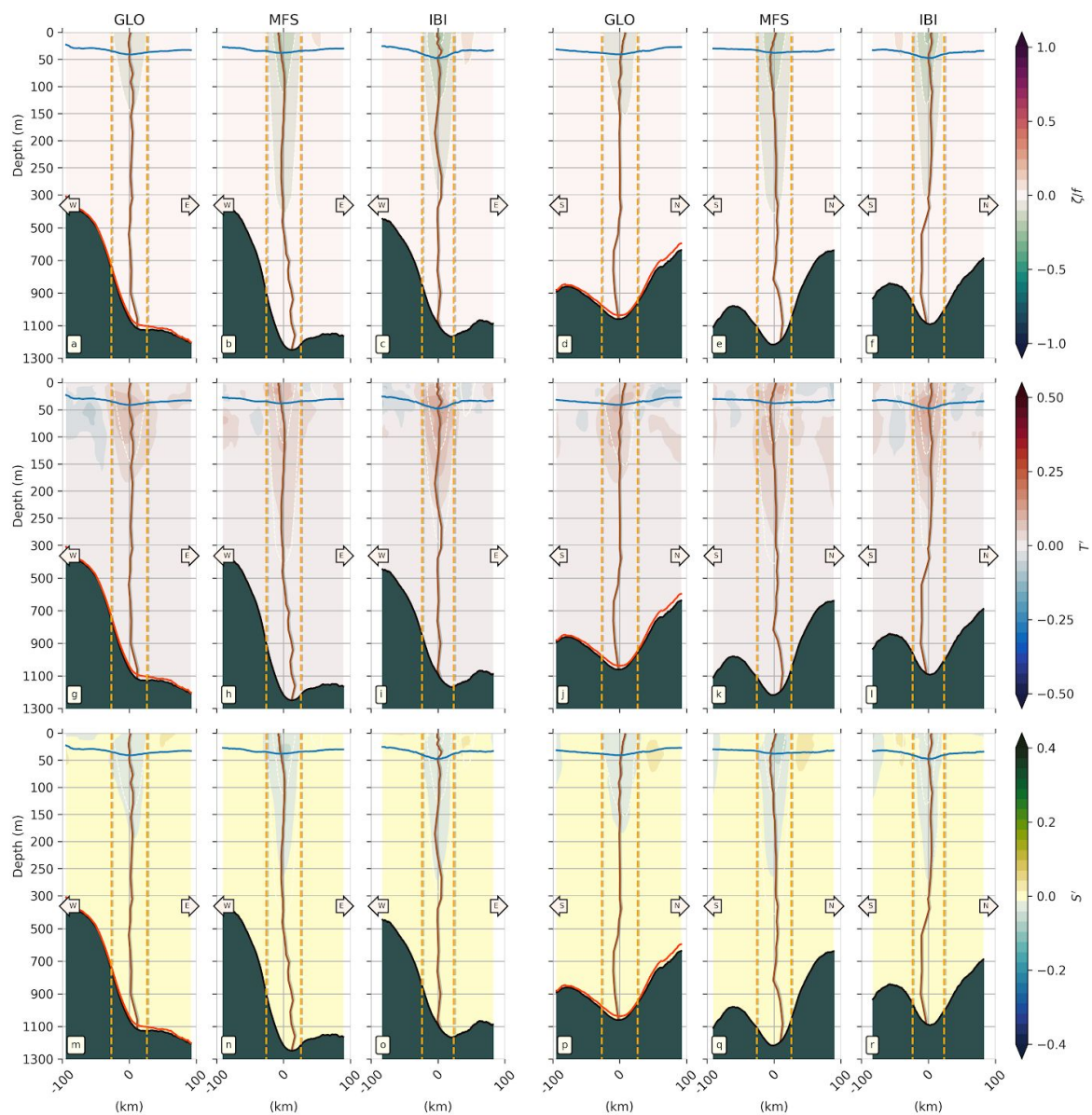


Fig. S8. Same as Fig. S5 but for the Balearic western region (0.5°W-2.25°E, 38.75°N-41.5°N).

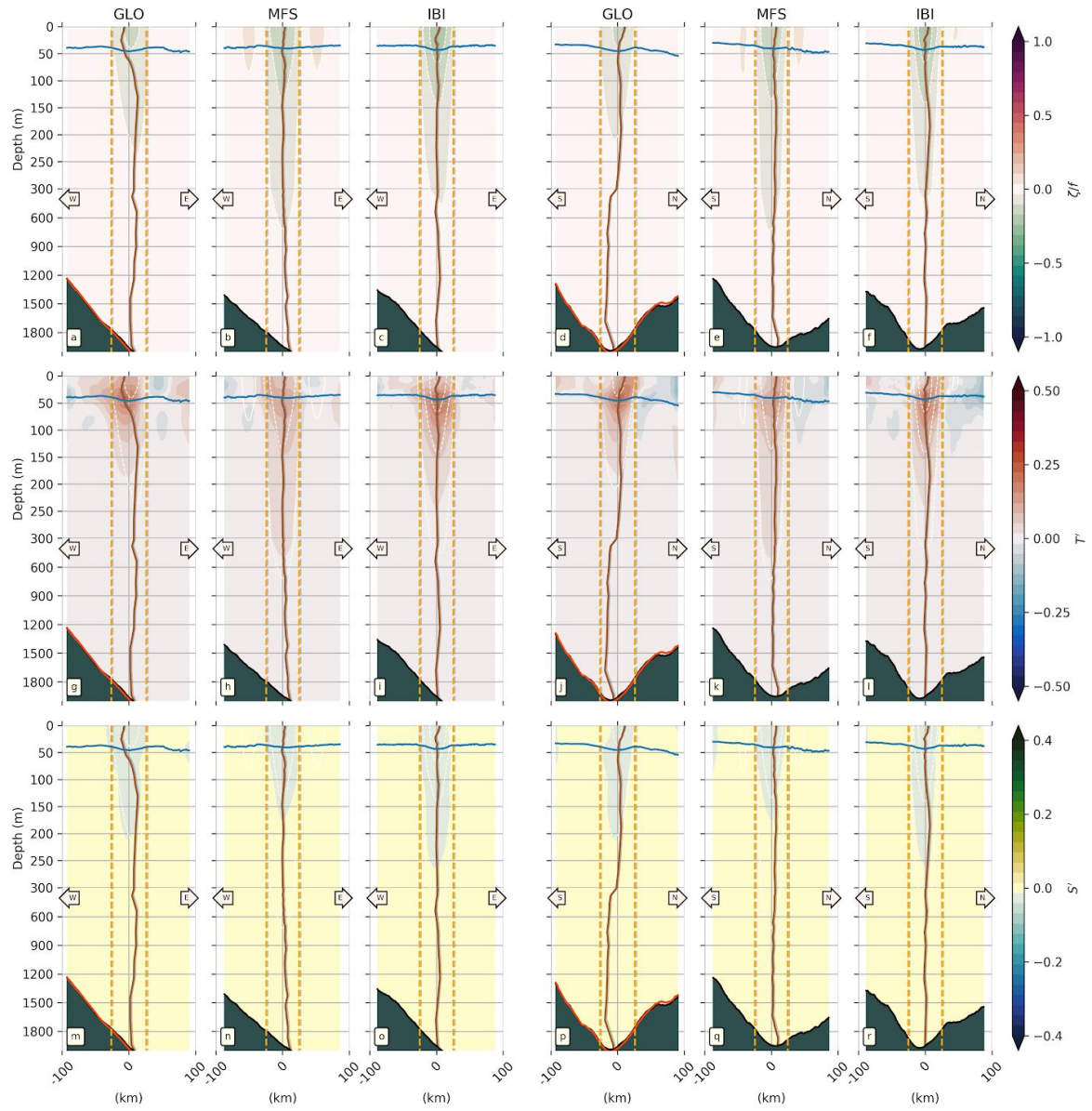


Fig. S9. Same as Fig. S5 but for the Balearic eastern region (2.25°E-4.5°E, 39.65°N-41.5°N).

## Cyclonic eddy composite sections

WAG

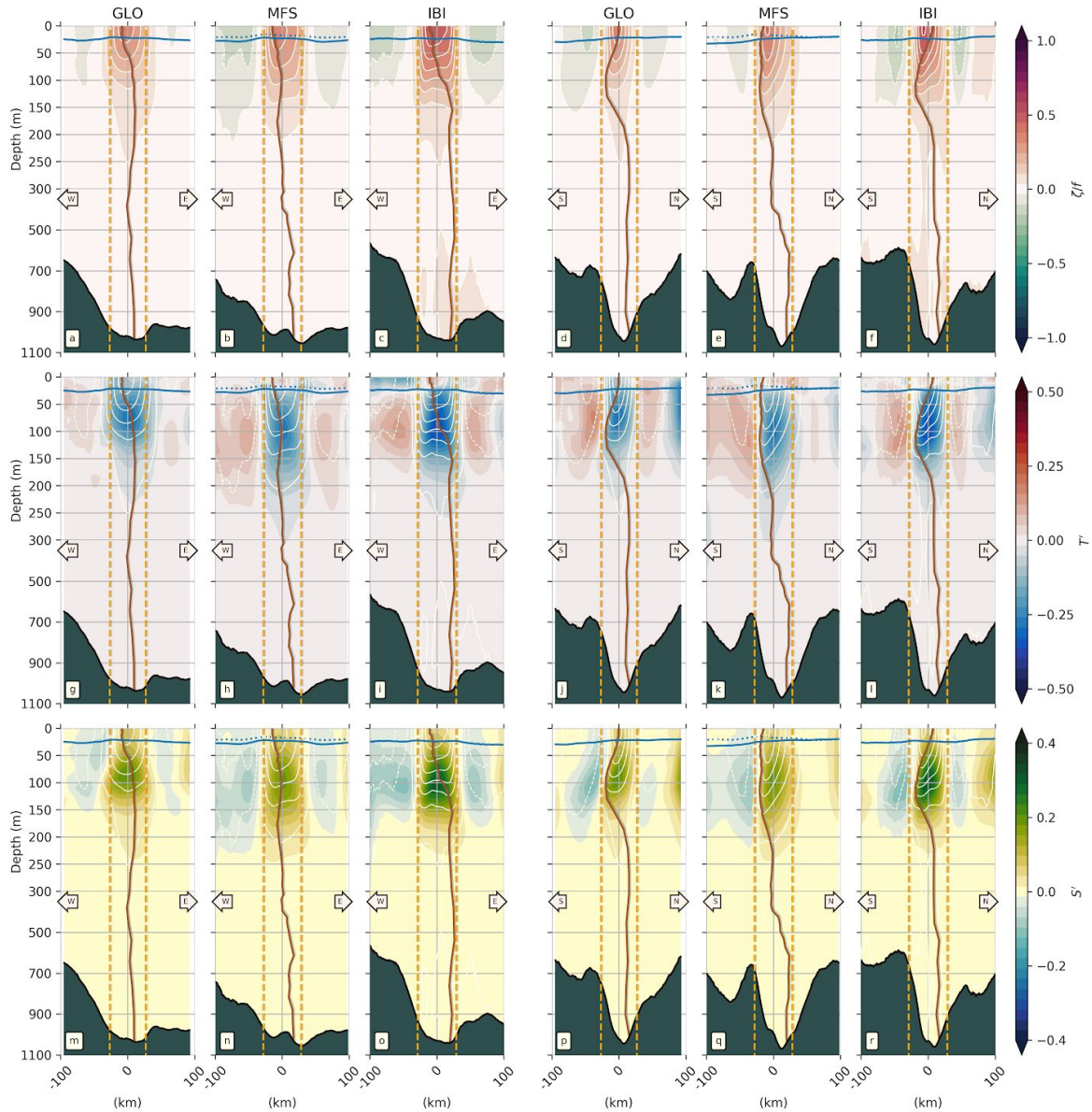


Fig. S10. Cyclonic eddy composite sections from GLO, MFS and IBI in the western Alboran gyre (see Fig. 1 for location). Left-hand-side (right-hand-side) columns show zonal (meridional) sections of (top to bottom) relative vorticity, temperature anomalies and salinity anomalies, from the surface to the ocean floor. The central position of each section is the median of the longitudes and latitudes associated with the eddy observations used to make the composites. Blue lines indicate the mixed layer depth; the dotted blue line corresponds to the MLD from the MFS model. The vertical brown line in each section is the vorticity-based tilt correction (Sec. 3.6). Vertical orange dashed lines indicate the boundaries of each composite eddy based on its mean radius estimate. Composite topographic profiles in black from SRTM. Note change of vertical scale at 300 m.



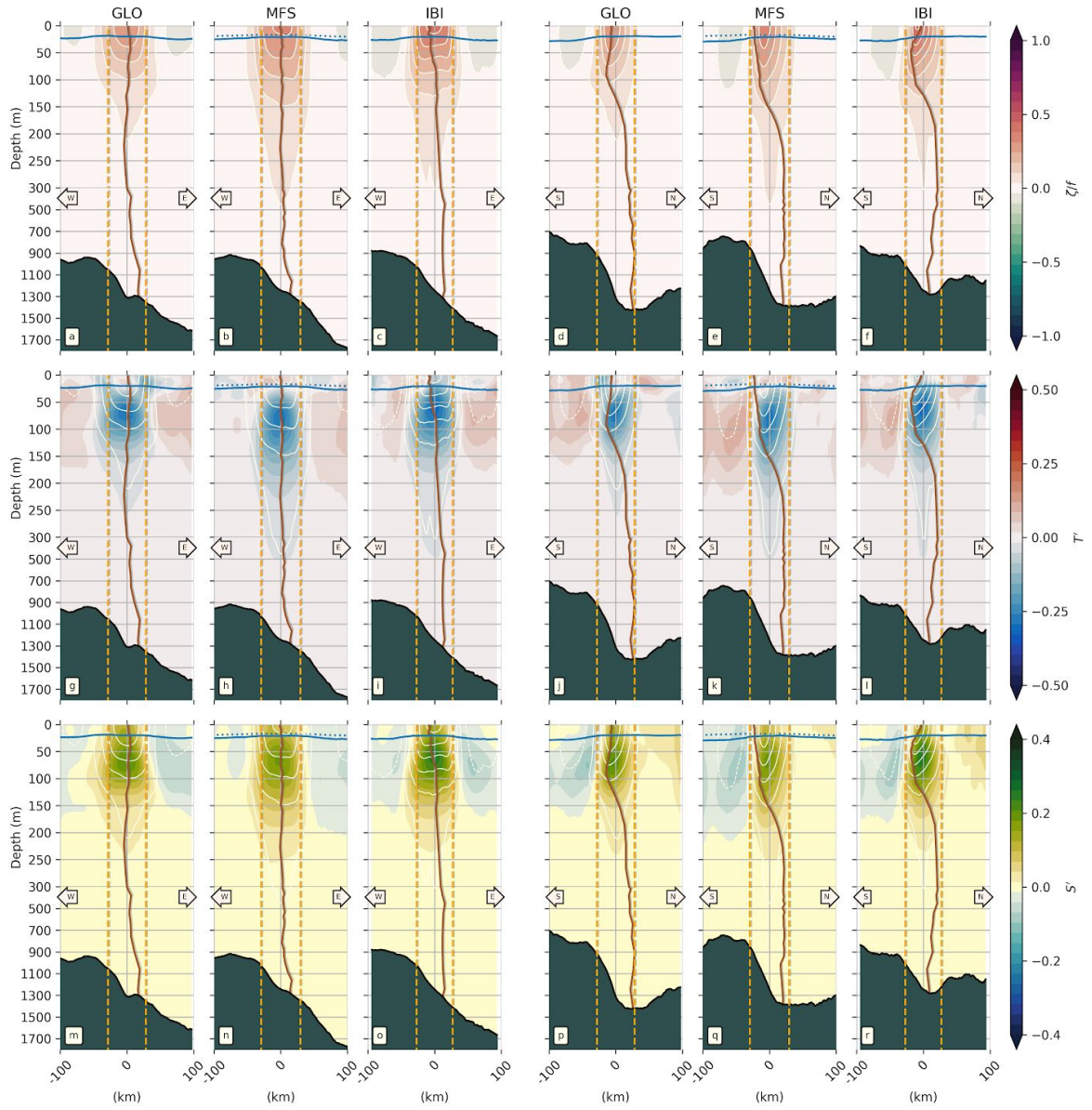


Fig. S11. Same as Fig. S10 but for the eastern Alboran gyre.

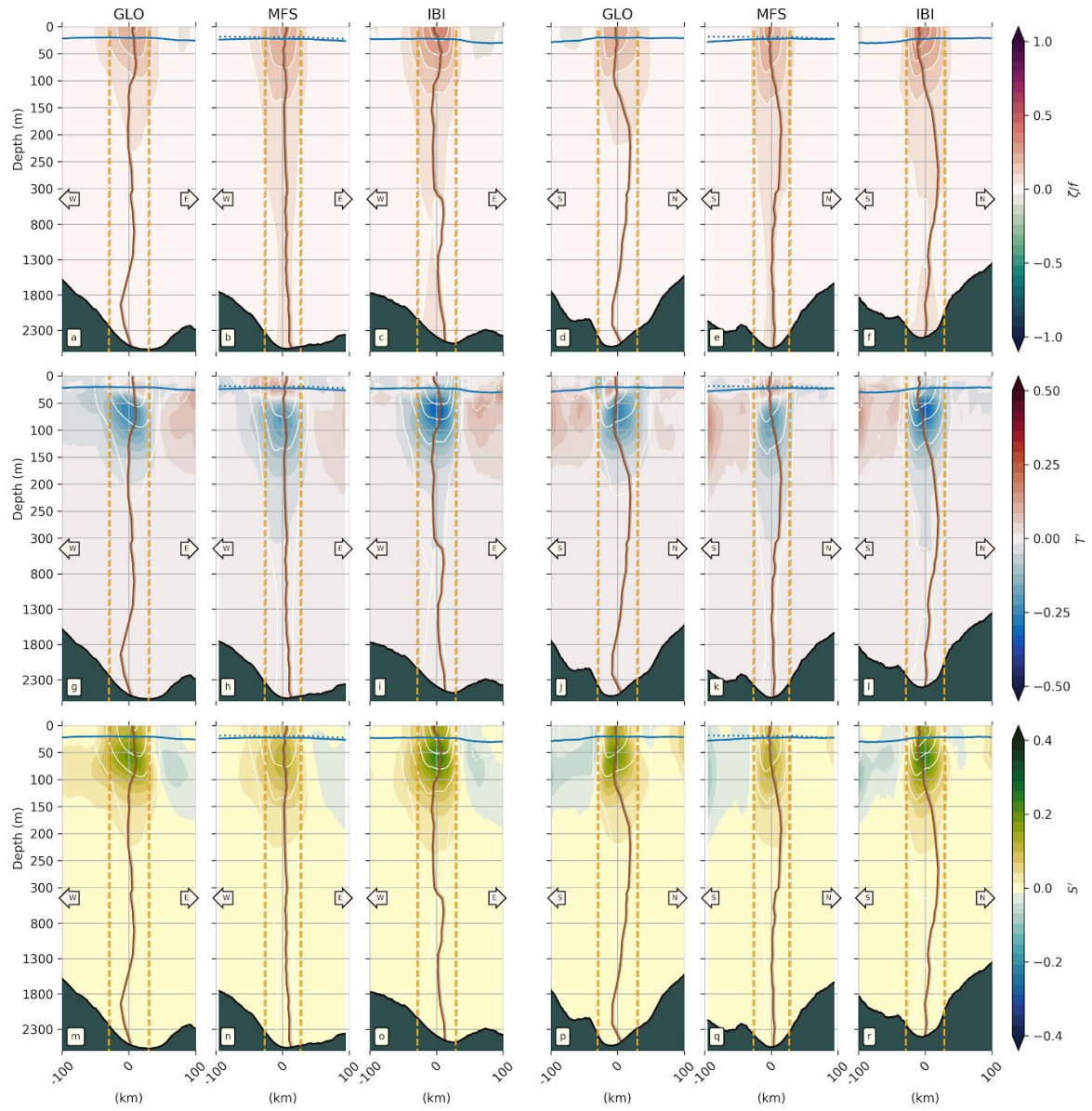


Fig. S12. Same as Fig. S10 but for the Cartagena frontal region.

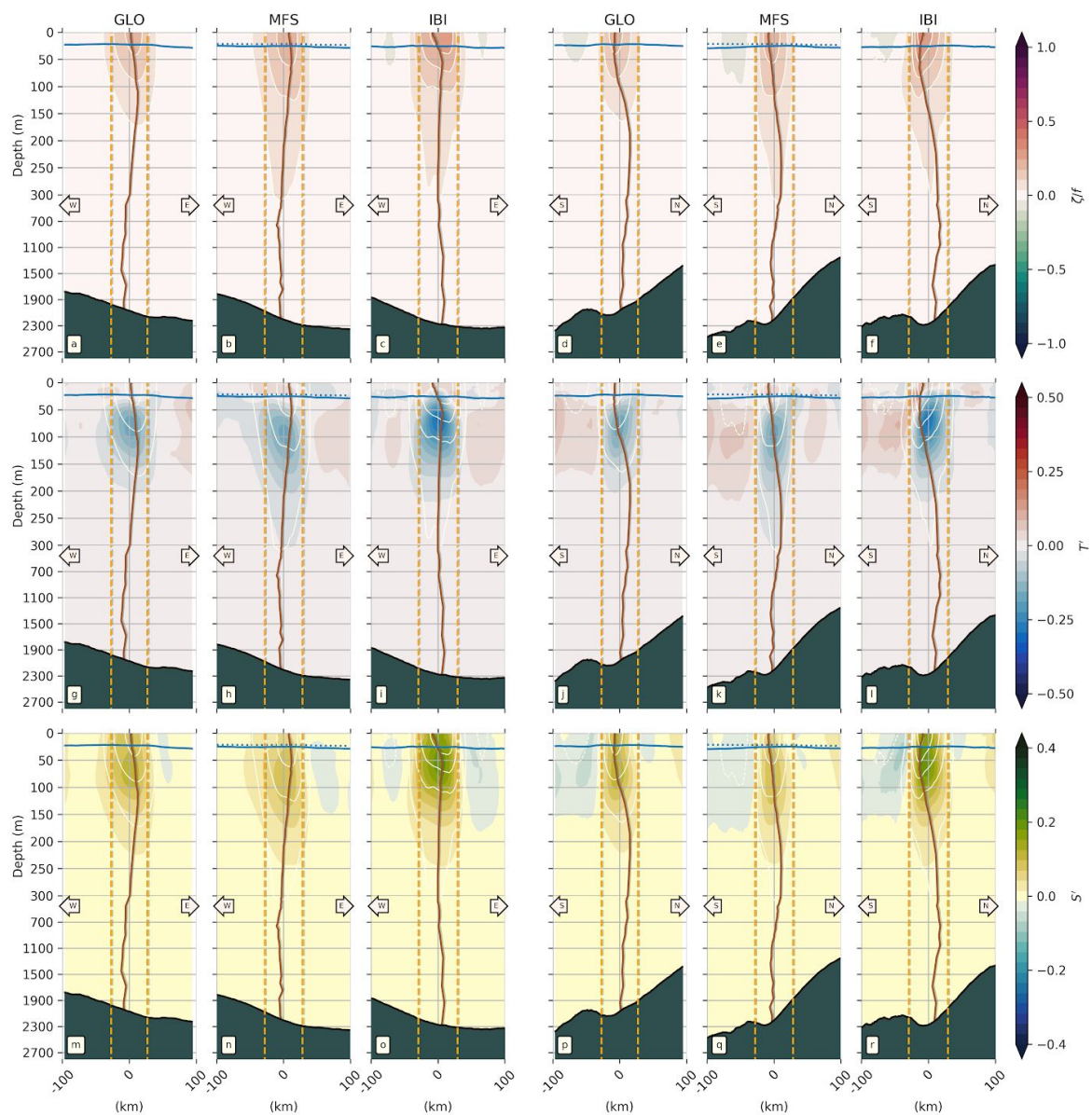


Fig. S13. Same as Fig. S10 but for the Algerian western region ( $0^{\circ}\text{E}$ - $2.25^{\circ}\text{E}$ ,  $35.7^{\circ}\text{N}$ - $38.75^{\circ}\text{N}$ ).



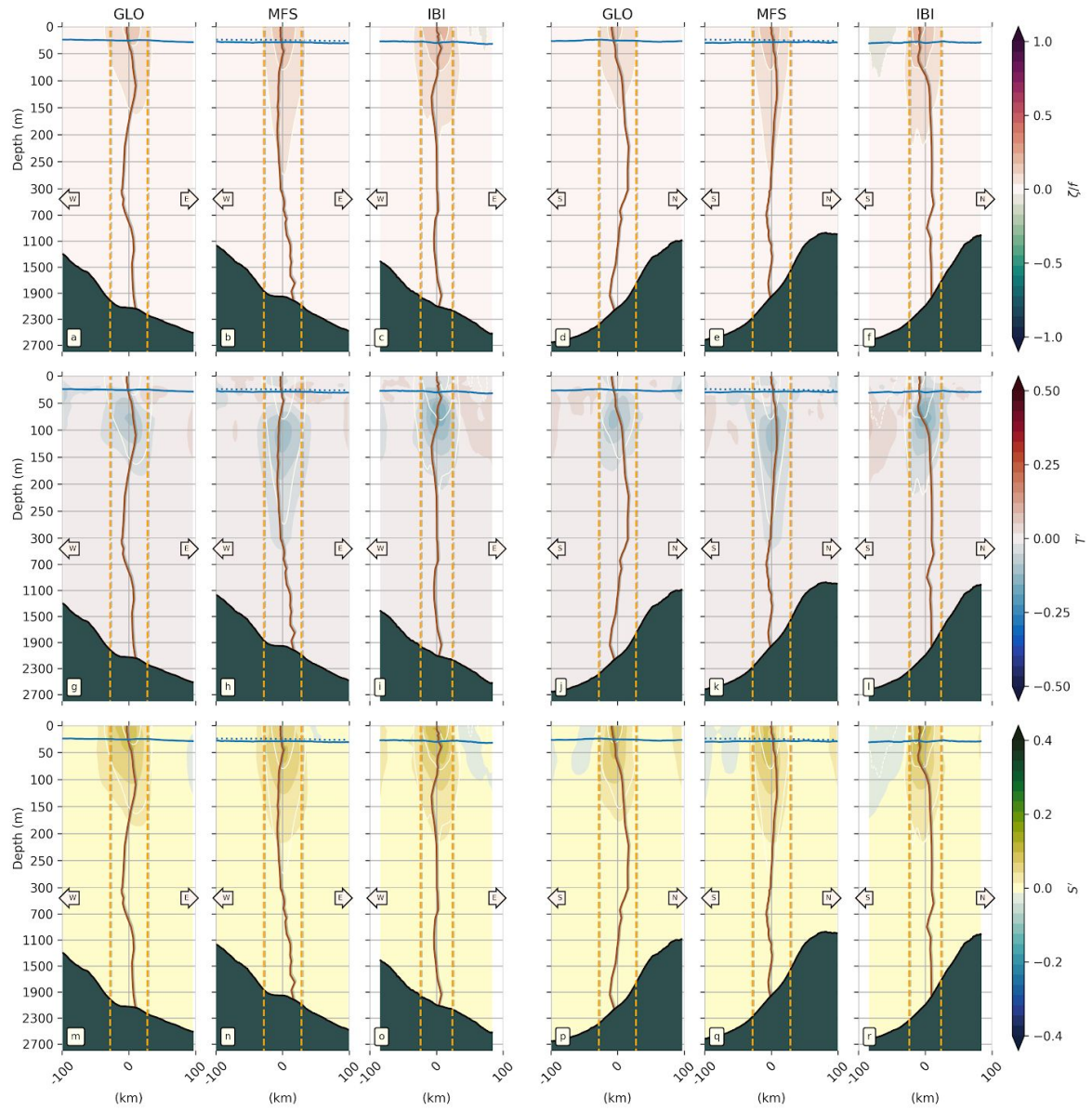


Fig. S14. Same as Fig. S10 but for the Algerian east (northern) region (2.25°E–4.5°E, 38.25°N–36.65°N).

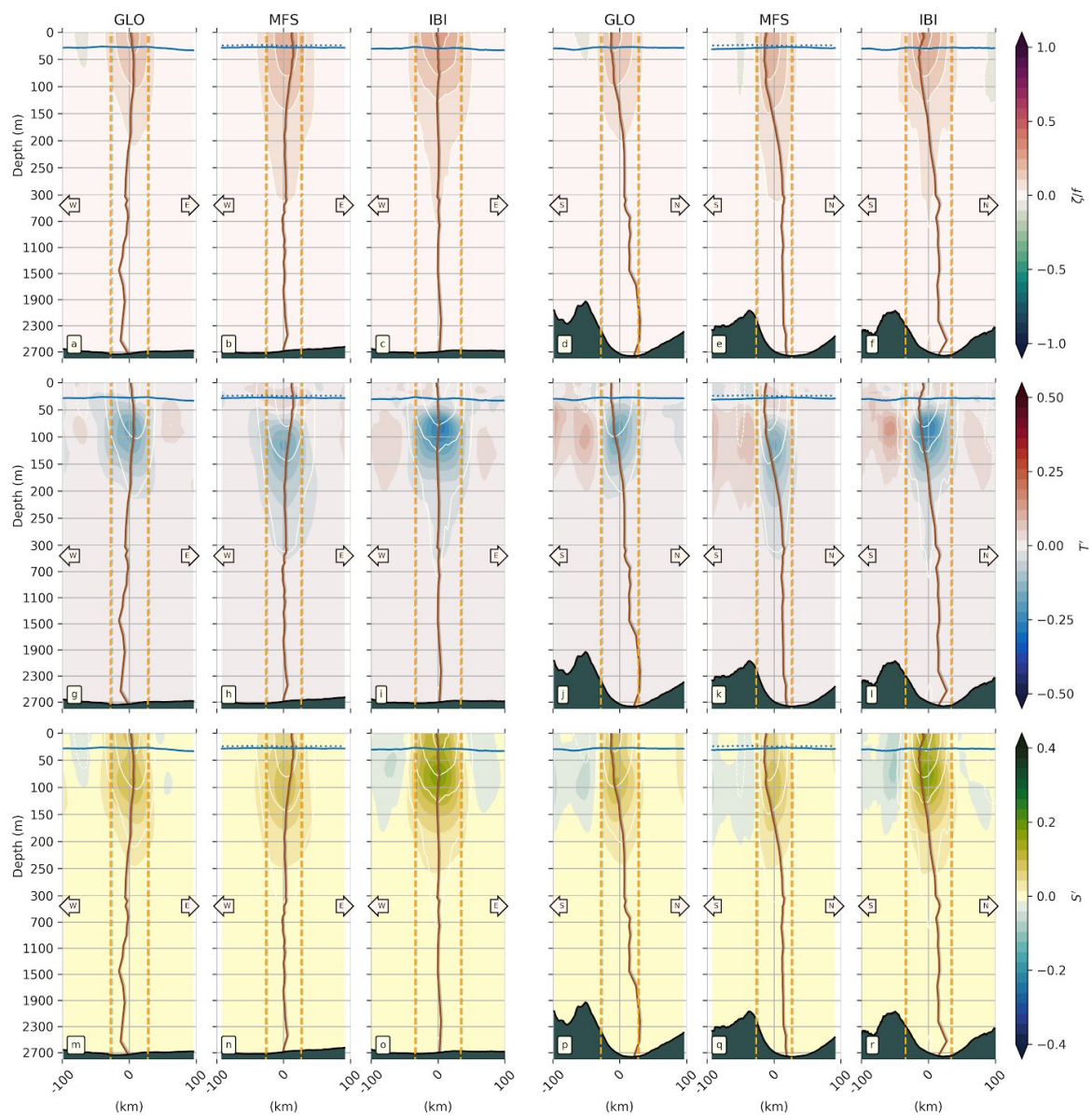


Fig. S15. Same as Fig. S10 but for the Algerian east (southern) region (2.25°E-4.5°E, 35.7°N-38.25°N).

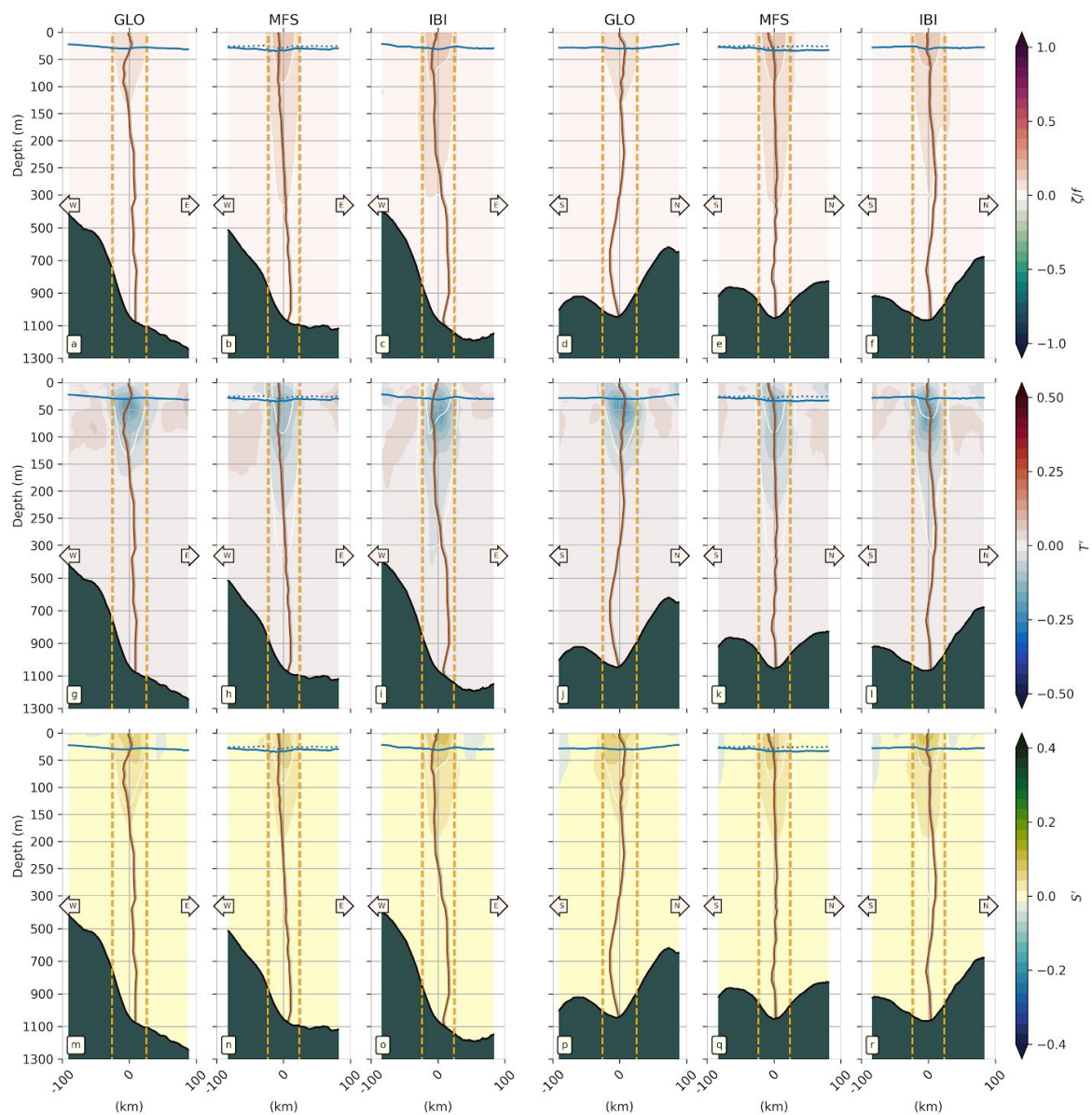


Fig. S16. Same as Fig. S10 but for the Balearic western region (0.5°W-2.25°E, 38.75°N-41.5°N).



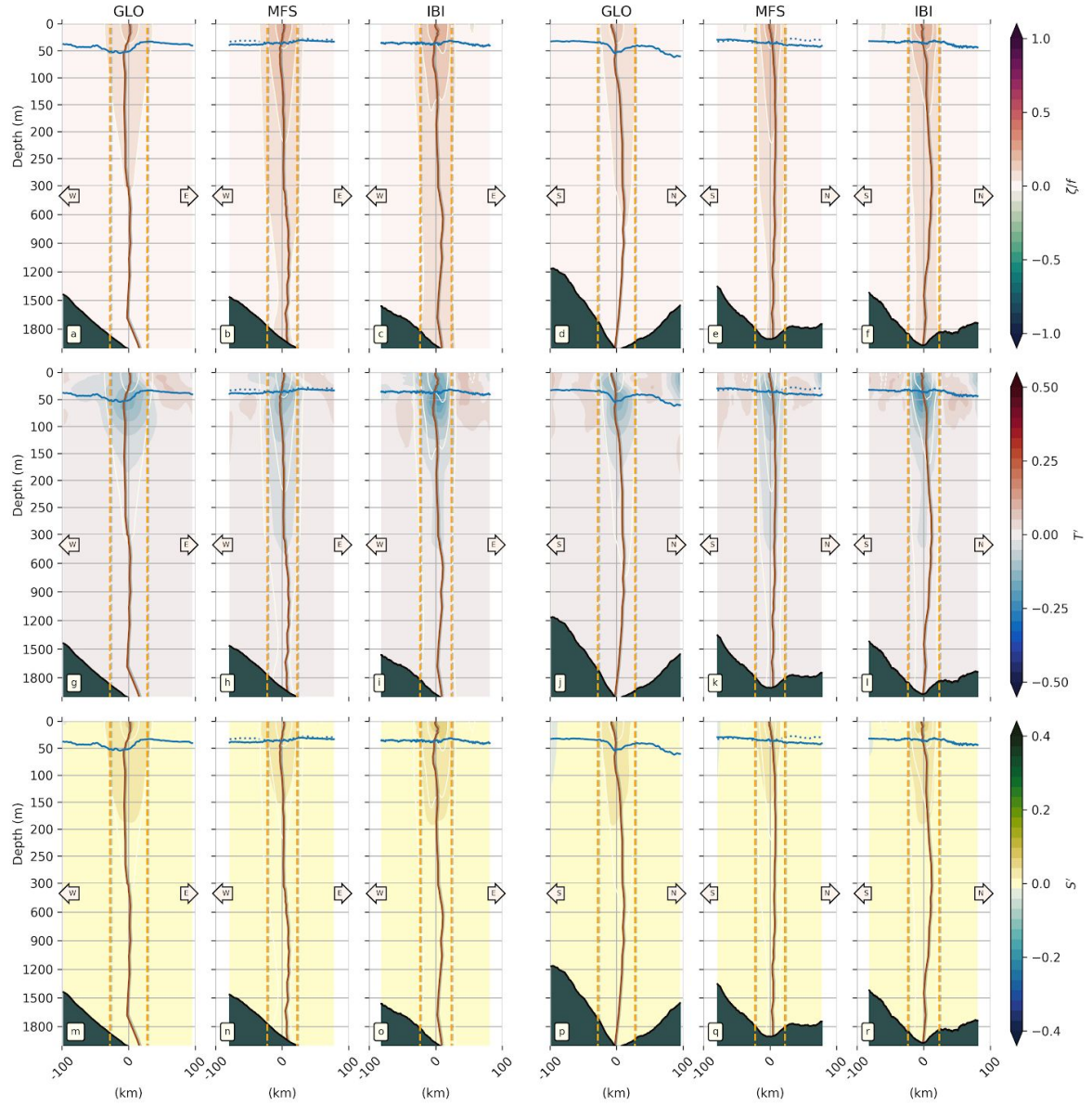


Fig. S17. Same as Fig. S10 but for the Balearic eastern region (2.25°E-4.5°E, 39.65°N-41.5°N).

## Seasonal mean MLD for the EAG and CRT subregions

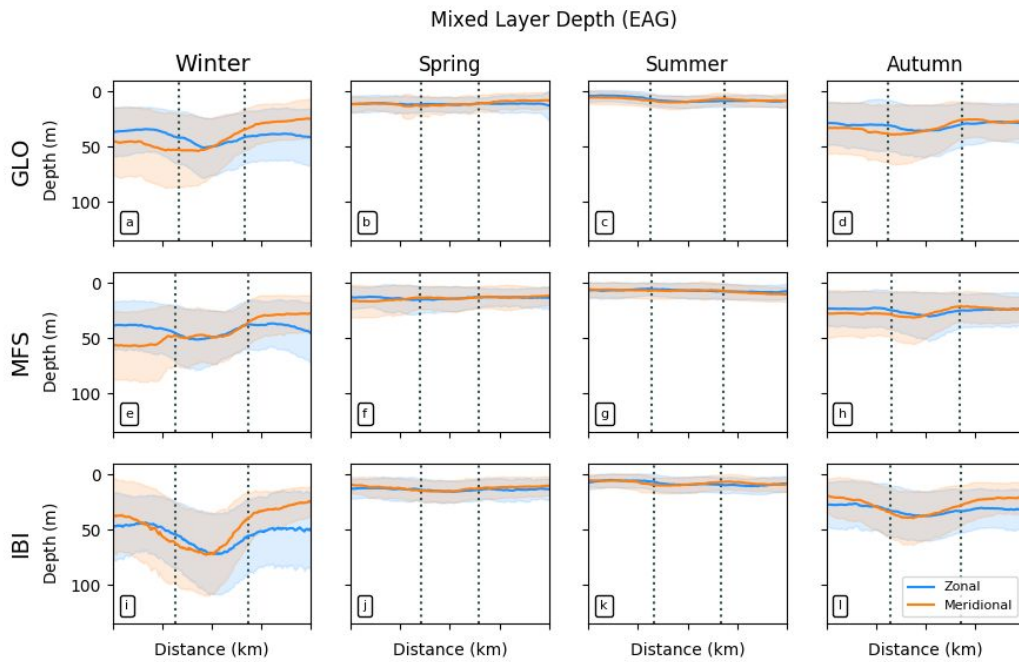


Fig. S18. Mean and standard deviation of the seasonal mixed layer depth in anticyclones in the eastern Alboran gyre for GLO (left column), MFS (middle column) and IBI (right column). Zonal (meridional) profiles in blue (orange). Vertical dotted lines mark the mean eddy radius from the center.

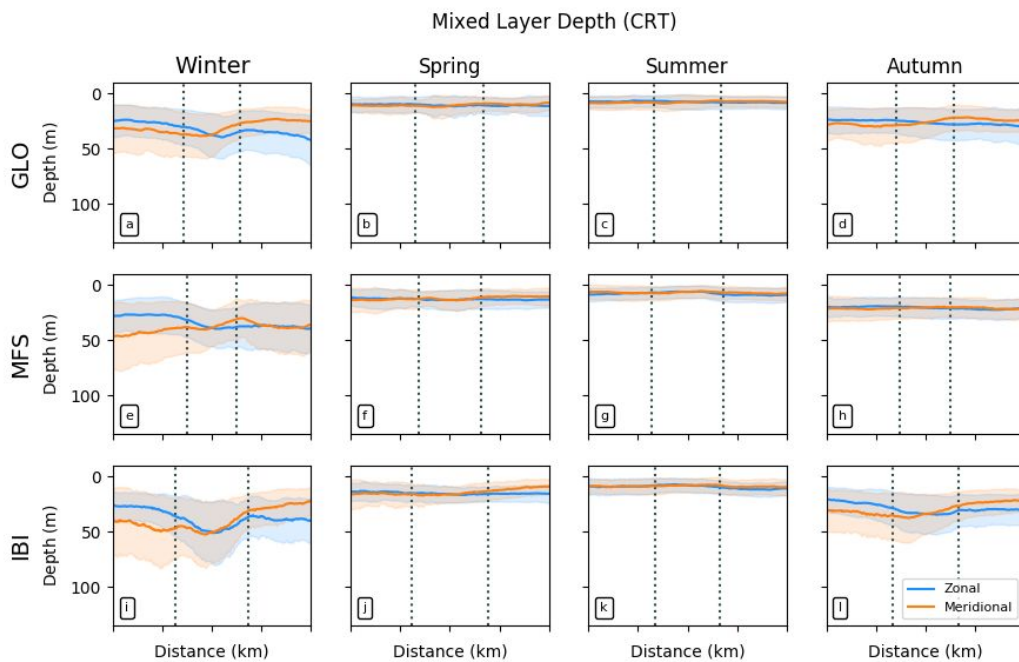


Fig. S19. Same as Fig. S18 but for the Cartagena frontal region.

## Validation with Argo data

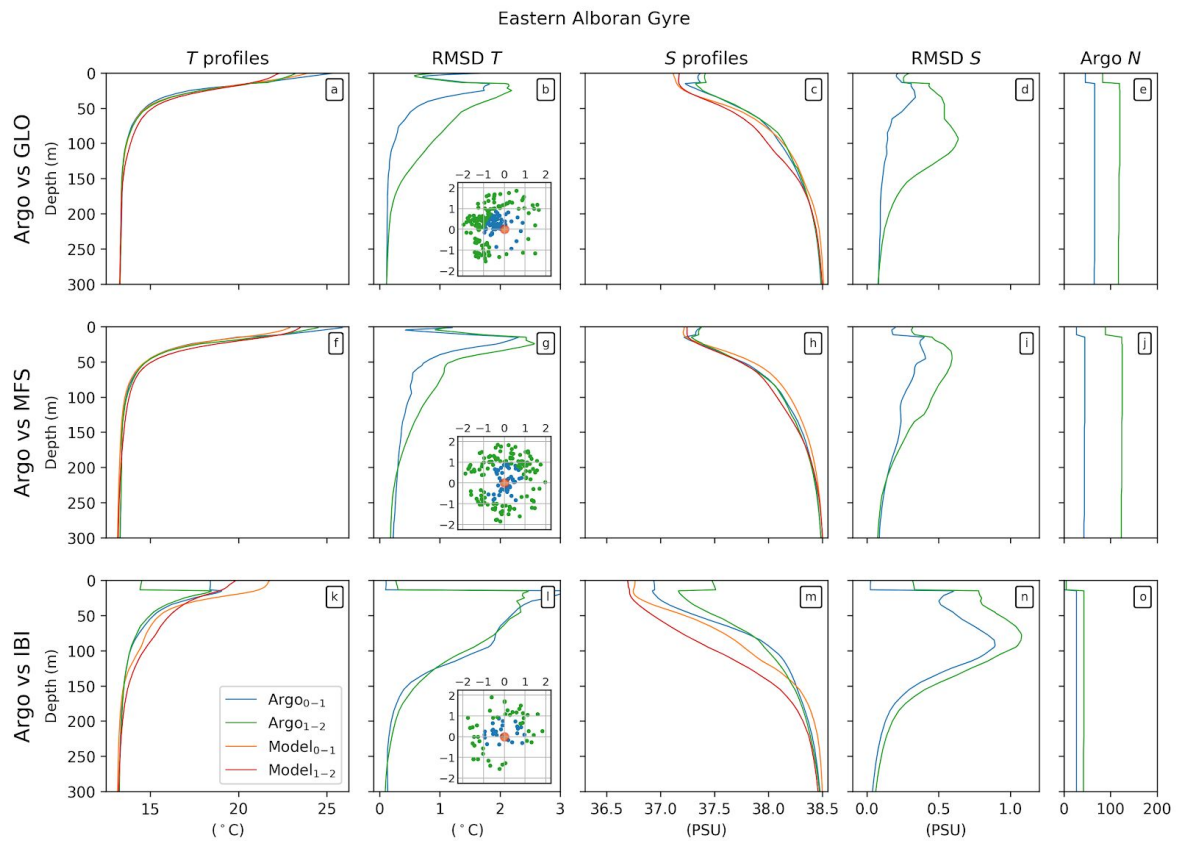


Fig. S20. Comparison of temperature and salinity depth profiles at the center of each model anticyclonic eddy and its nearest Argo observation in the eastern Alboran gyre subregion. The first column shows mean  $T$  and the second the root mean square differences at each vertical level between the individual model and Argo  $T$  observations. Argo profiles coloured blue (green) are located inside (outside) the eddy radius, viz. 0-1L, 1L-2L, as indicated in the inset eddy-centric-coordinate maps in column two that show the relative (to the eddy center) positions of each Argo profile. The respective model profiles corresponding to the Argo selections are coloured orange and red. Profiles in columns three and four show the results for  $S$ . The Argo sample size  $N$  at each depth for each model is found in the final column. Rows one to three show GLO (top), MFS (middle) and IBI (bottom).



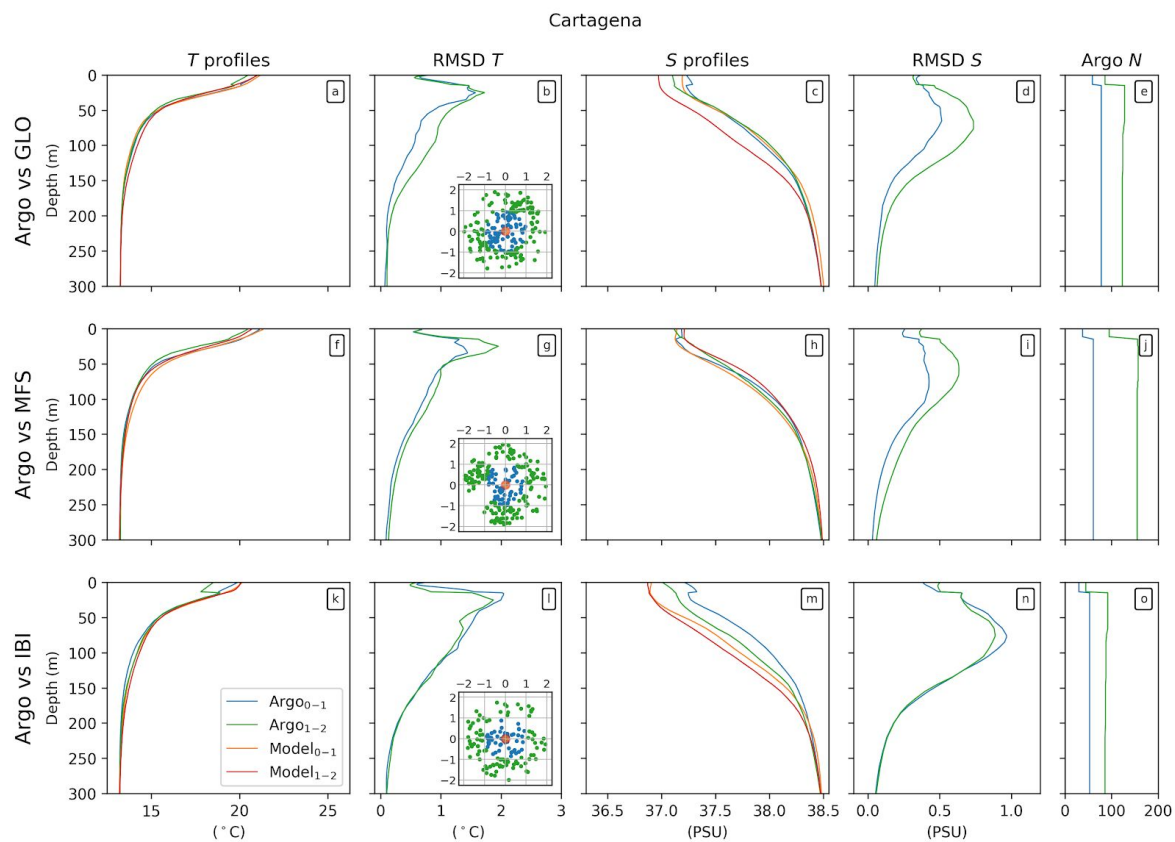


Fig. S21. Same as Fig. S20 but for the Cartagena frontal region.