Al Hoceima launches its First Functional Marine Observatory in North Africa

H. Nibani [1], K. Hilmi [2], A. Damghi [3], L. Beguery [4], O. Fommervault [4], H. Bouazzati[1],

1. President of AGIR Association & Moroccan ODYSSEA Observatory Leader.
2. Vice President of the Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO)
3. Phd student at Abdelmalek Essaadi University Tetouan
4. Alseamar France

Al Hoceima launches its First Functional Marine Observatory in North Africa

The association AGIR, Moroccan partner of the ODYSSEA Project funded by the European Union, has successfully deployed SeaExplorer (Alseamar, France) underwater gliders in the south Alboran Sea.

The first glider mission was mainly dedicated to the sampling of the western gyre of the Alboran Sea (WAG).

To our knowledge, this pioneer work is among on the first oceanographic survey entirely dedicated to the study of the WAG.

Student Oceanography Master FSTH Workshop

Student Oceanography Master FSTH working on the vehicle

Underwater gliders are autonomous buoyancy-controlled UUV that move through the water column by changing their density,

coming periodically to the surface for data transmission

Two marine prospection missions were achieved

Two marine prospection missions were achieved. The first mission took place in late fall, from November 10 to December 11, 2020 (30 days). During this 1-month mission the glider performed a total of 753 cycles. The second mission occurred in late winter – early spring, from February 11 to March 23, 2021 (40 days, 873 cycles).

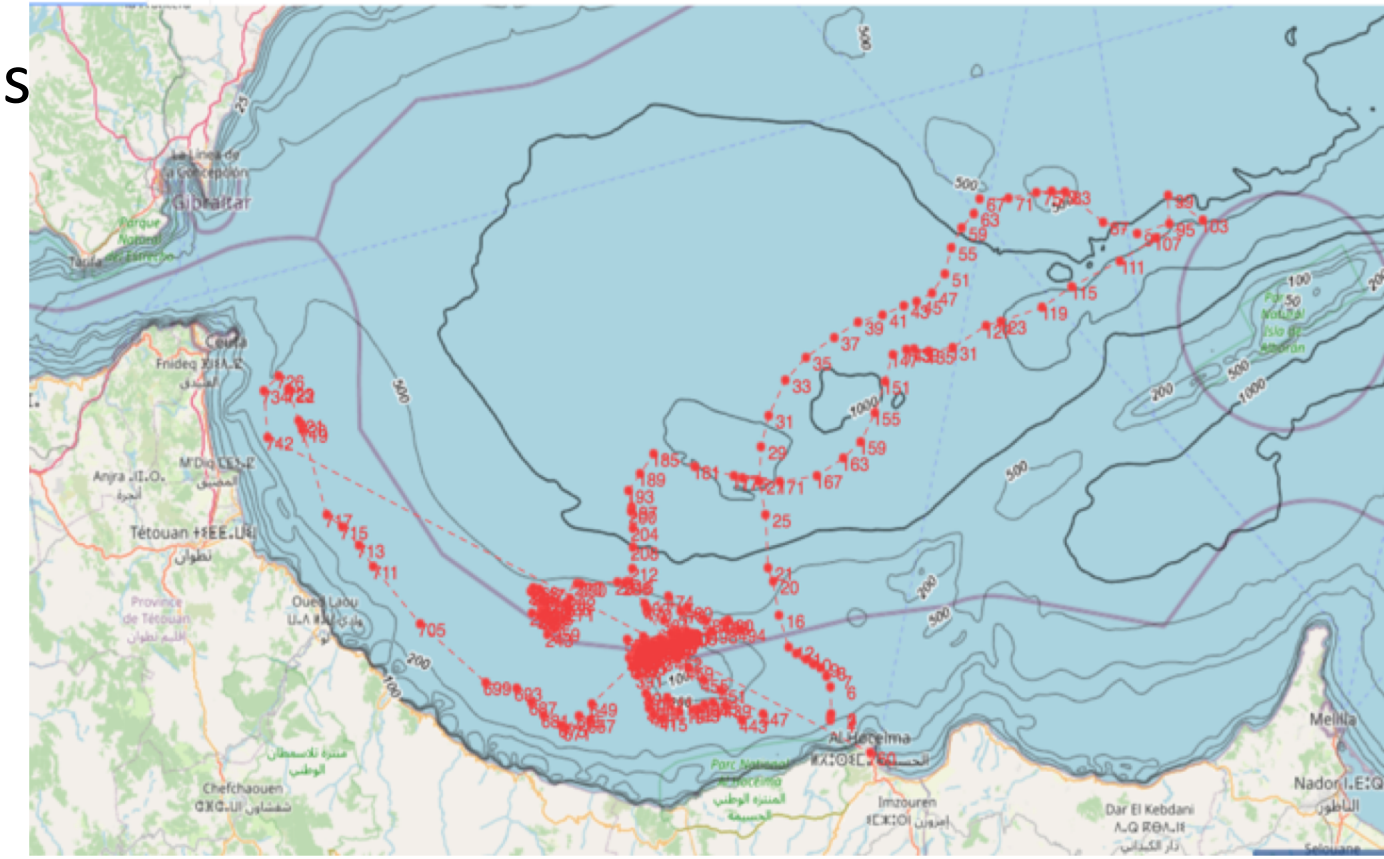


Figure 1. Map showing the route and cycles of the Glider during the first mission.

West Alboran GYRE Tracking (SST)

- The West Alboran GYRE (WAG) was first tracked using satellite maps of sea surface temperature (SST) :

characterized by warm waters (SST anomaly higher than 1°C in the gyre's core, at the time of the mission).

- Satellite maps confirmed the presence of the anticyclonic structure, although its size and location were varying in time (Figure 2).

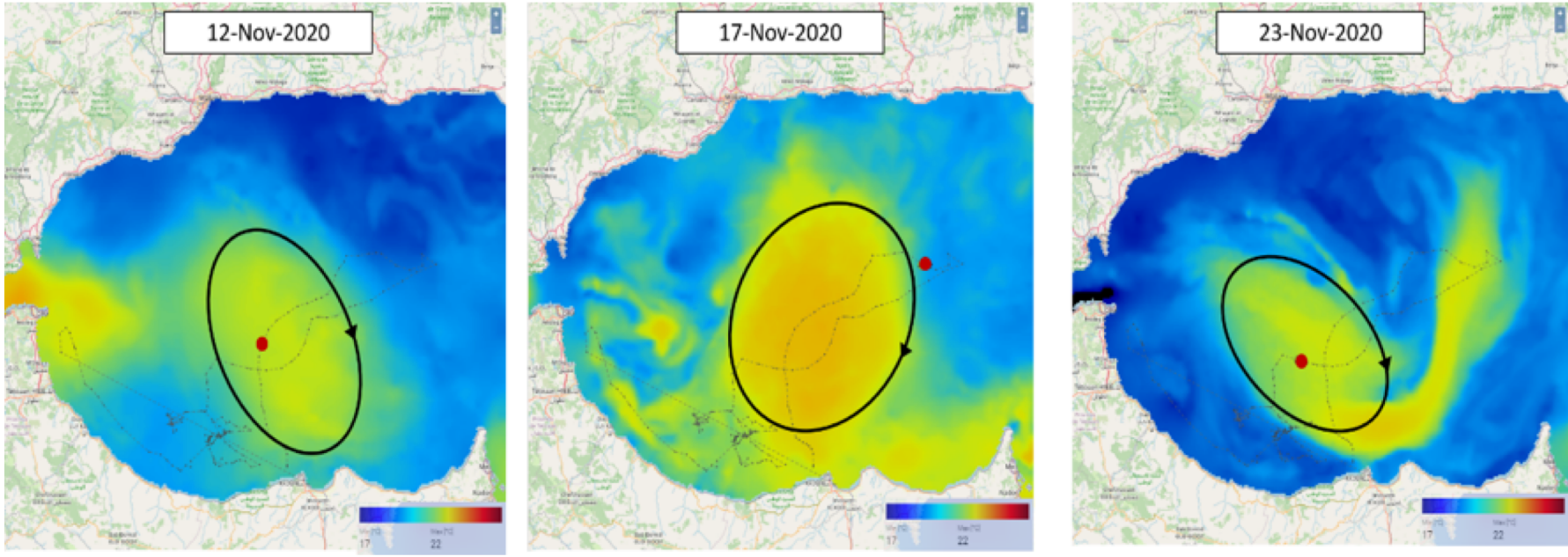


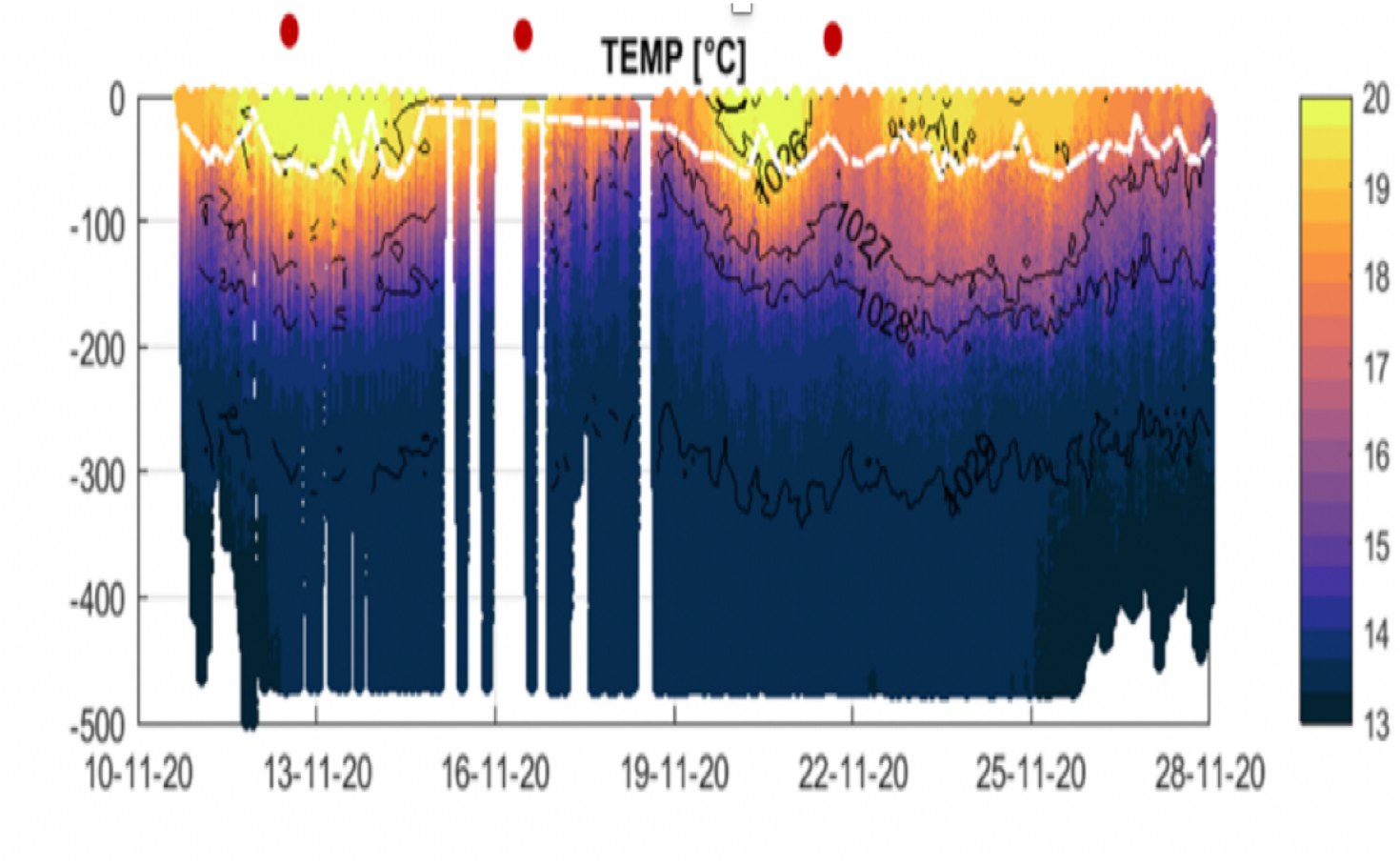
fig 2 :map of the SST (data downloaded on https://marine.copernicus.eu/)and glider trajectory. The position of the glider on the date of the map is indicated by the red dot.

- information were used in real-time by glider pilots. The objective was to cross the WAG, passing approximately through its center. At the end, two transects were realized (Figure 2).

Results obtained with the glider :*GPCTD data*

Temperature and salinity data acquired during the first part of the mission.

- *The black lines are the isopycnal levels*
- *the white dashed line is the depth of the mixed layer (density criterion of 0.003 kg.m-3).*
- *The red dots are related to the same profile as in Figure 2.*

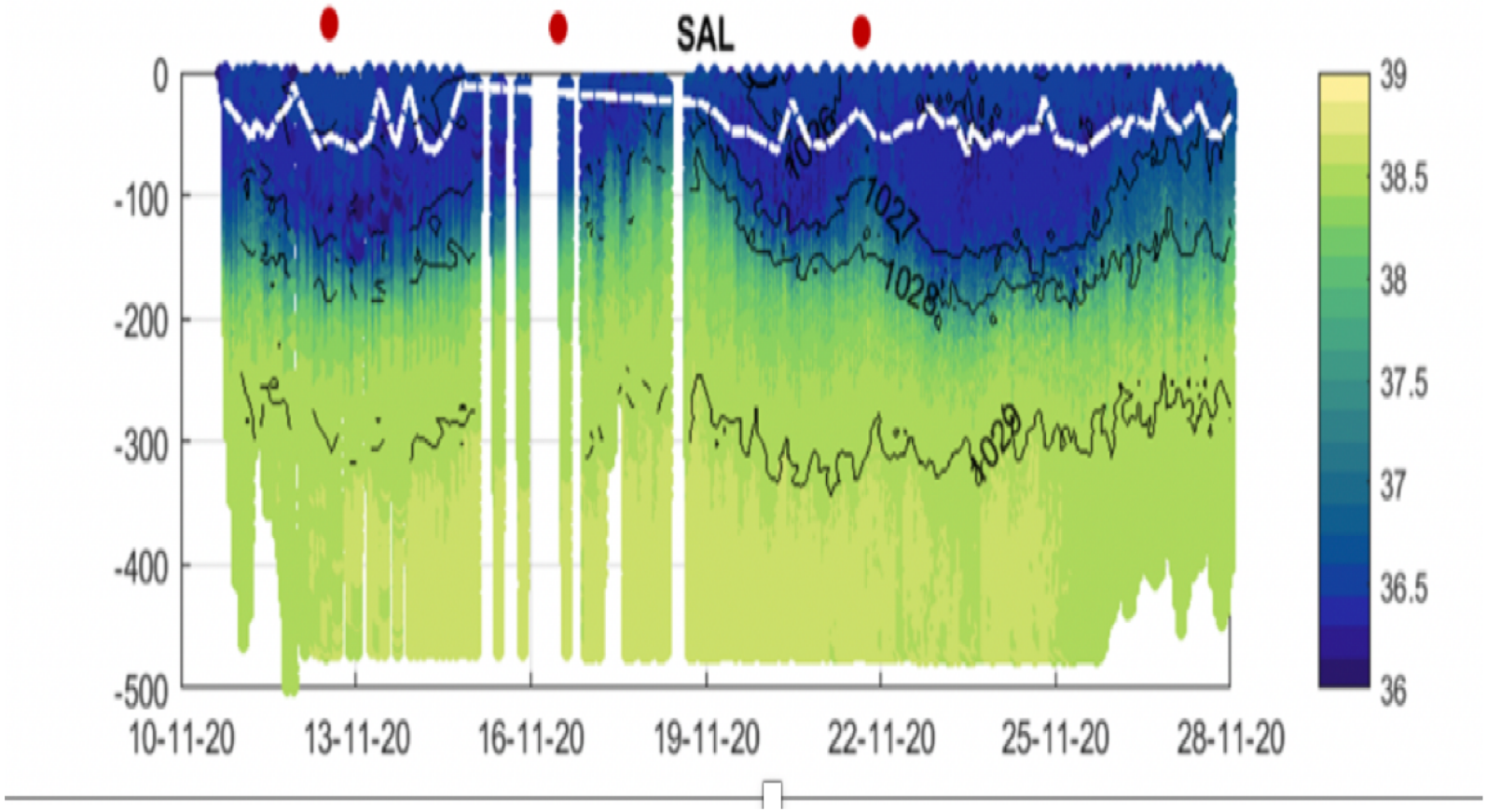


Results obtained with the glider :*GPCTD data the Vertical*

glider data although highlight a large variability, specifically in the first 300m of the water-column.

It can be observed isopycnal vertical excursions (black lines on Figure 3) that are directly related to position of the glider relative to the WAG.

At the time when the glider is located within the WAG, surface waters are warm (>20°C) and relatively fresh (<36.5), up to about 150m-depth.




Nice image from yesterday that illustrates the internal wave phenomenon in the Alboran Sea!
Algeciras
Ceuta
Tangier
Tétouan

Water-current data

- At the surface, the measured velocities are high even offshore, and can reach up to 1 $m.s^{-1}$,
- In the subsurface, the average value of the current in the 0-500m layer is in the range 0.05-0.3 $m.s^{-1}$ which is quite high challenging for the glider navigation
- (one can compare these values with the horizontal speed of the glider ~0.2-0.3 $m.s^{-1}$).

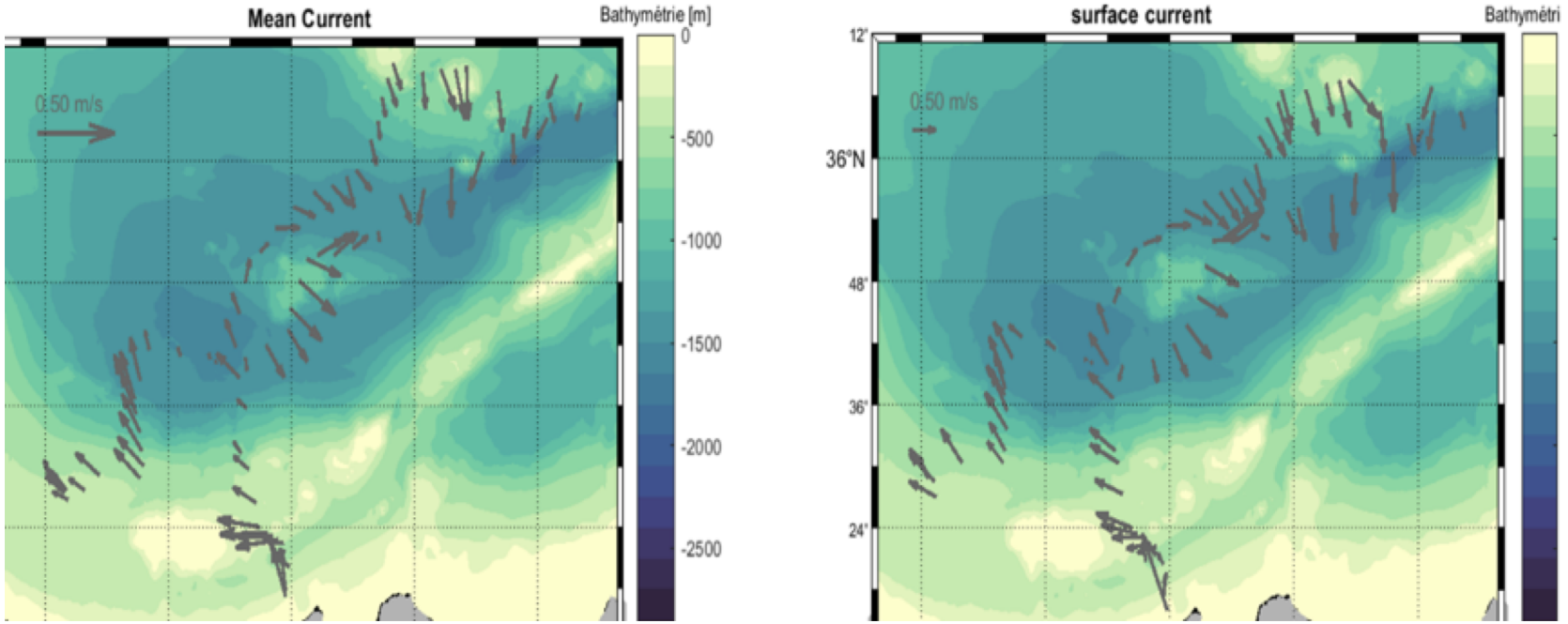


Figure 4. map of (left) average current from dead-reckoned track and (right) surface current estimated from GPS position. The color bar indicates bathymetry (EMODnet).

Water-current data : confirmation of the presence of the WAG

- The rotating structure of the current again confirms the presence of the WAG.
- WAG plays a key role in dynamic of the whole the area.
- the strong westward coastal current observed at low bathymetry, when the glider approached the coast.

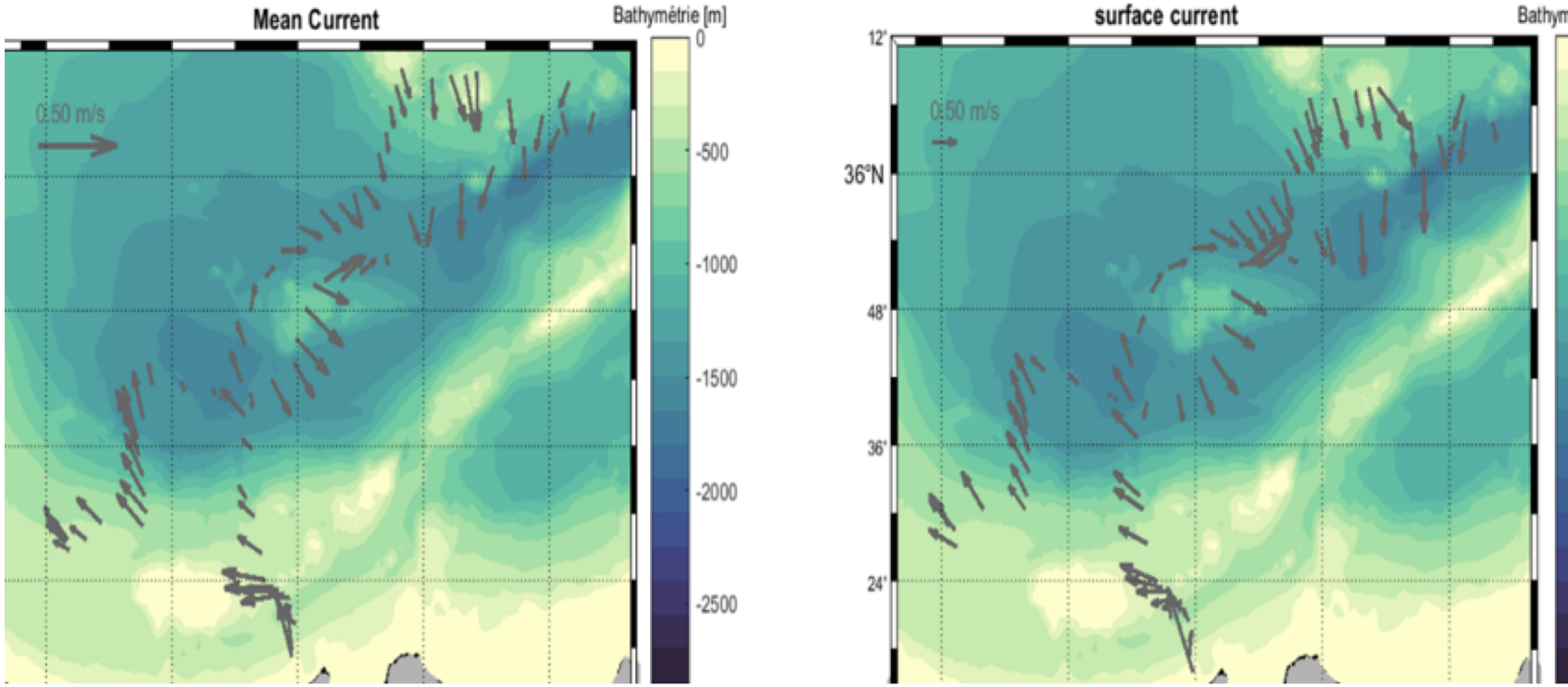


Figure 4. map of (left) average current from dead-reckoned track and (right) surface current estimated from GPS position. The color bar indicates bathymetry (EMODnet).

Conclusions

- This glider mission, as such, can be considered of huge interest considering the amount of new data collected and the overall historical data scarcity in the south Alboran Sea.
- This mission can also be considered as one of the very few works done on the WAG using in-situ measurements.
- Glider data provided crucial information that complement satellite observations and revealed the vertical structure of the WAG at an unprecedented spatio-temporal resolution.
- These results are a preliminary analysis. Further work is needed to fully investigate the mechanism involved, to highlight the suspected role of the WAG in homogenizing the freshwater masses of the Atlantic jet with the warmer and saltier water masses of the Mediterranean,
- Suspected WAG rule to increase the resilience of the Alboran marine ecosystem to the effects of climate change.
- This mission also shows the great potential of using gliders in integrated, multi-platform marine observatories.