



STUDY OF THE AZORES CURRENT SYSTEM USING INDIVIDUAL ARGO FLOATS



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SUMMARY

Data from 38 Argo floats (fig. 1) are used to study jets and turbulent structures of the Azores Current system. Argo data (trajectories, temperature and salinity profiles) are complemented with concurrent sea level anomaly data provided from satellite altimetry. The area of study considered was 45°W to 10°W and 28°N to 42°N. Argo floats with less than 3 cycles (~ 1 month) within this area were neglected.

1. The Azores Current System

The Azores Current (AzC) is an eastward jet-like flow south of the Azores at about 32°-36°N (fig. 2).

This current is associated with a thermohaline front, which separates fresher and colder waters of north and north-eastern origin from southern warmer and saltier waters ([2]; [3]). These horizontal thermohaline gradients, which can tilt upward toward the north near the surface (fig. 3), are not density compensated, resulting in strong geostrophic shears ([2]; [6]).

The dominant instability process that shapes the AzC system is a baroclinic instability ([1]). A zonal current that becomes unstable starts to meander with a wave-like pattern (fig. 6). For the AzC the most unstable wavelengths range from 200 to 400 km ([2]).

If the instability process progresses, the amplitude of the meanders will increase until the wave form of the current loses its coherence and breaks into closed rotating features. Cyclonic eddies are found south of the AzC and anticyclonic eddies in the north. These eddies will propagate westwards on both sides of the mean current while the meanders will propagate eastwards ([1]; [2]).

2. Observations

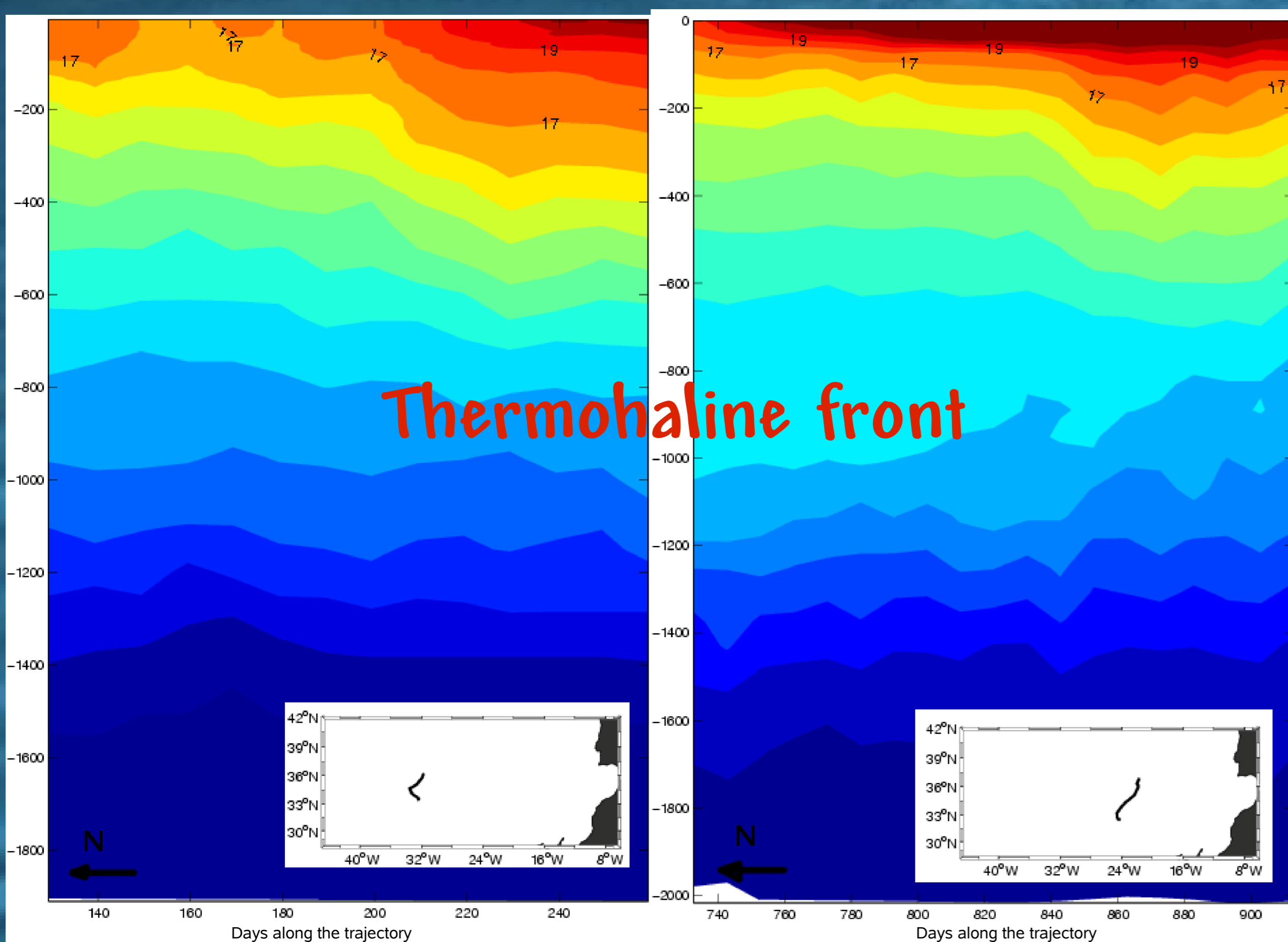


Fig. 3 - Argo float temperature profiles for the fraction of the respective trajectory that crosses the AzC (~34°N). These vertical sections compared well with previous observations of the thermohaline structure of the AzC.

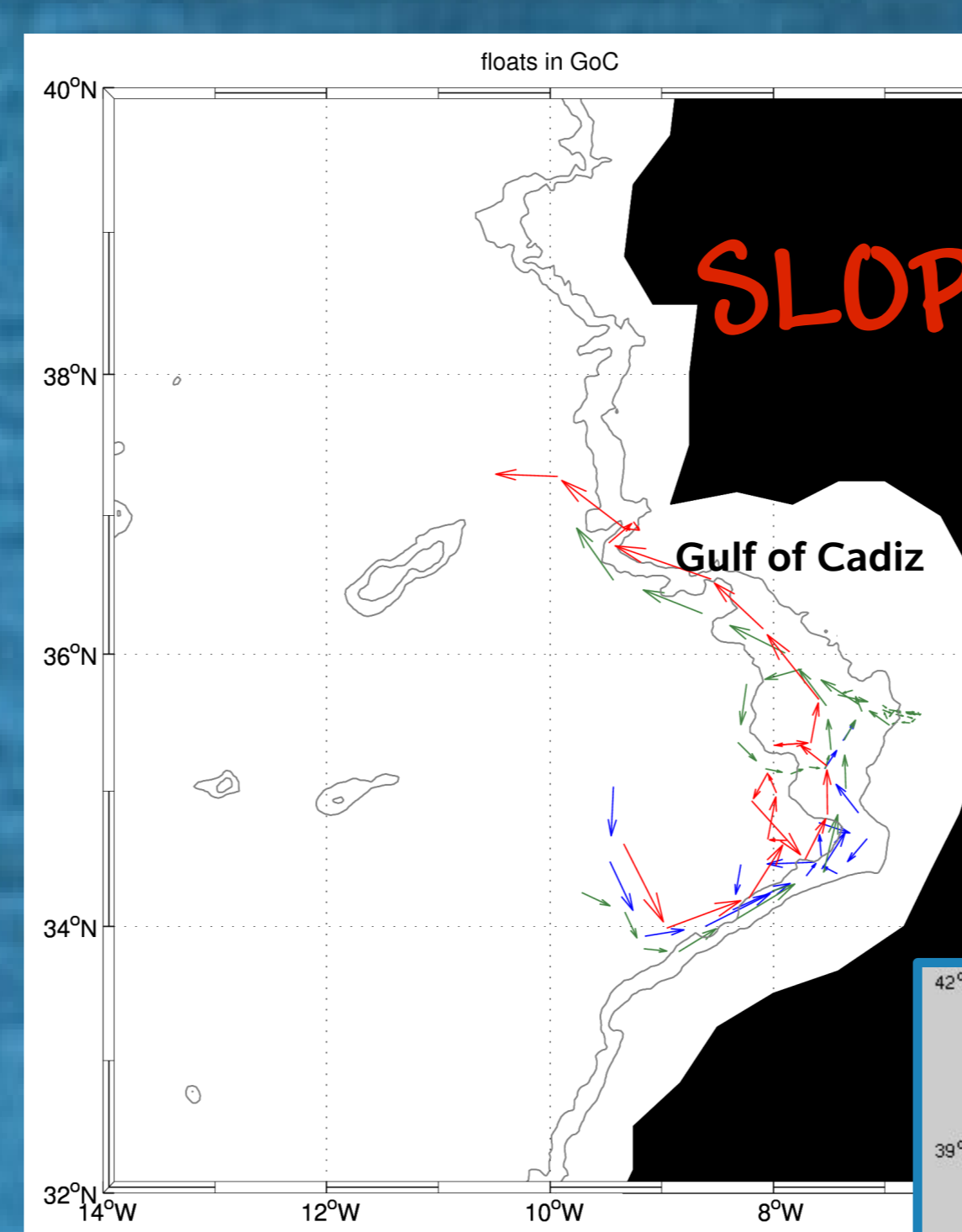


Fig. 4 - Slope flows in Gulf of Cadiz (GoC) (top left). Slope flows in the Mid Atlantic Ridge (MAR) (top right).

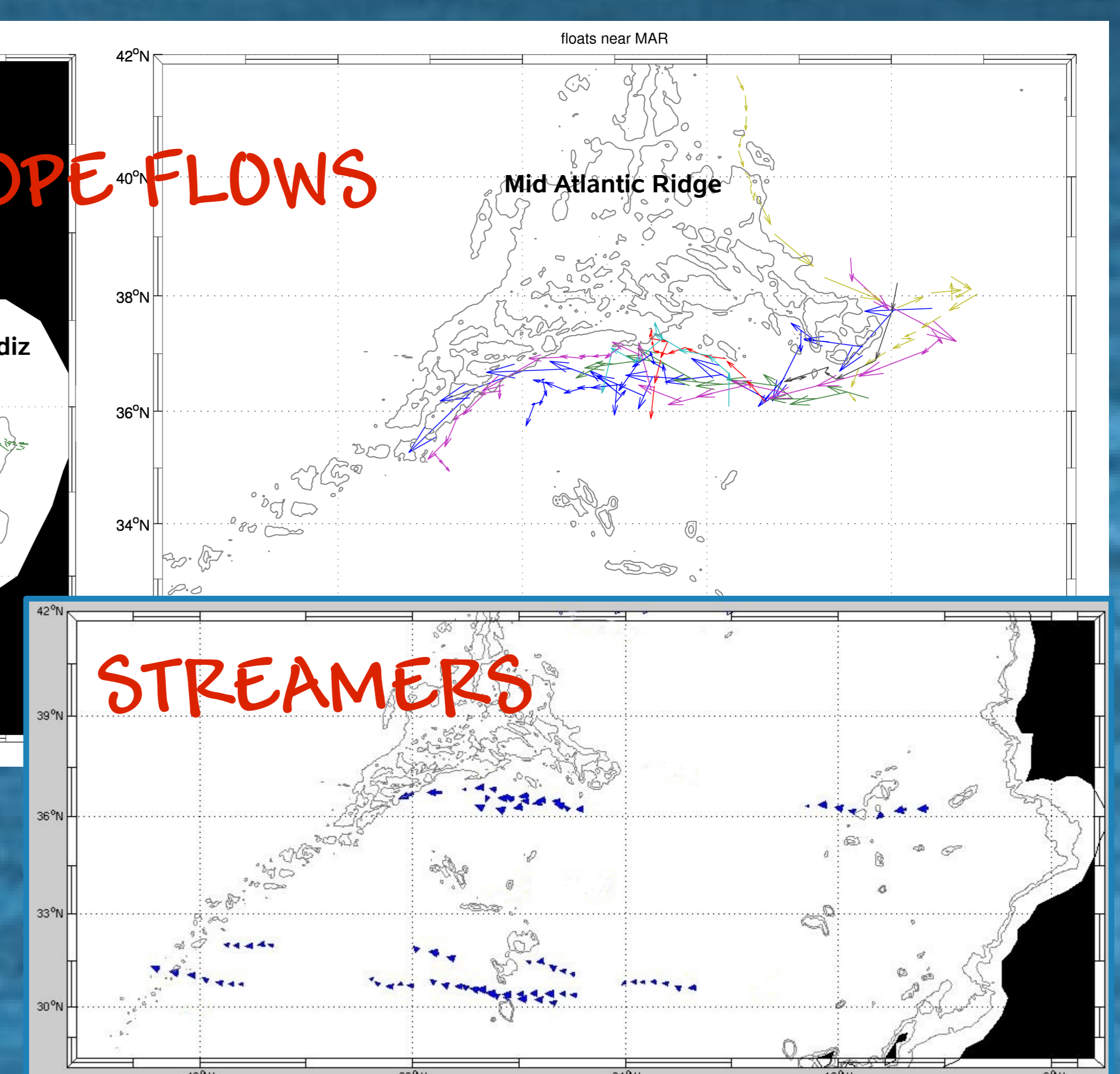


Fig. 5 - Quasi-zonal jets (streamers) identified with Argo float trajectories (right)

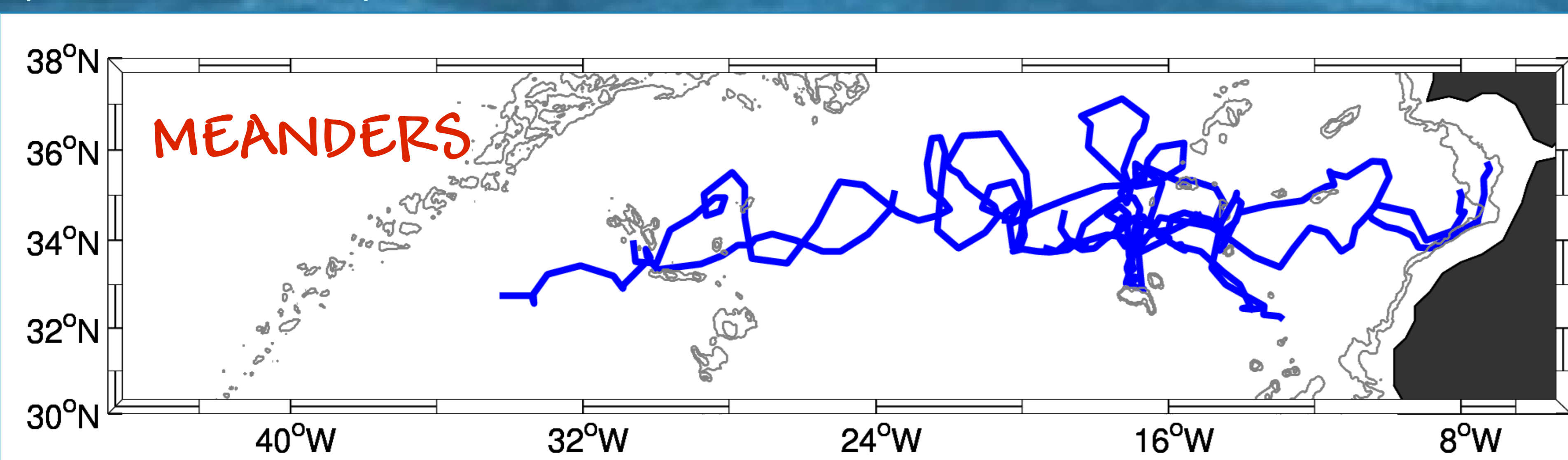


Fig. 6 - Six Argo floats traveled eastwards in several meanders of the AzC System. Through their trajectories the wave-like structure of the AzC can be seen and it allowed to calculate the typical wavelength for this system.

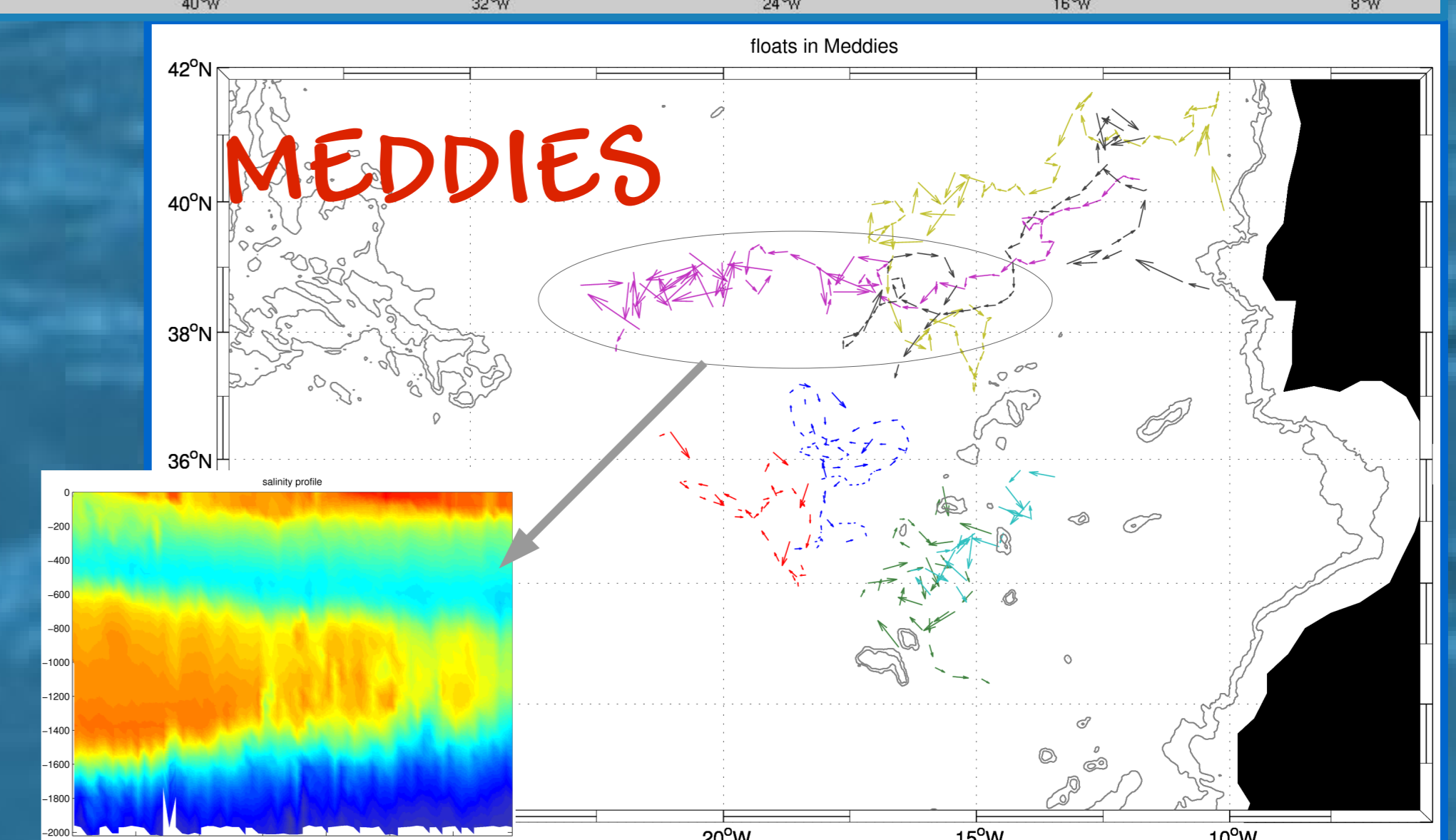


Fig. 7 - Argo floats caught in meddies.

3. Conclusions

- ✓ The layer thickness between isotherms 17°C and 19°C increases from the northern side of the AzC axis (at about 34°N) to the southern side (fig. 3), as seen in previous studies ([1]; [6]).
- ✓ The wavelength of the Azores Current meandering system, calculated using 6 Argo float trajectories (fig. 6), showed a value of approximately 260 km, comparable to previous studies ([1]; [2]; [6]). The meanders have a latitudinal extent between 100 and 200 km and a lifetime of 3 to 5 months. The velocities of the floats travelling in the meanders ranged between 0.01 to 0.02 ms⁻¹.
- ✓ 8 Argo floats were caught on quasi-zonal jets (streamers) near the AzC (fig. 5). These streamers showed preferred latitudinal locations, north and south of the Azores current, respectively at 36° and 30°N. They are usually observed within a preferred zonal band between 25°W and 31°W. All the floats caught in these streamers traveled westwards with velocity values between 0.03 ms⁻¹ and 0.06 ms⁻¹.
- ✓ 10 Argo float trajectories showed coherent slope flows near the MAR and near the GoC (fig. 4). These flows had zonal velocities of about 0.03 ms⁻¹ near the MAR and meridional velocities of about 0.01 ms⁻¹ near the GoC. In the Gulf of Cadiz the floats described a cyclonic trajectory that might be related to the cyclonic recirculation described in [4].
- ✓ Events of floats being captured by the Azores Current system large cyclones ("Storms" as referred in [5]) were not registered. In the area of study, 7 Argo floats were captured by Meddies (fig. 7).

4. References

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5. Acknowledgments

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