

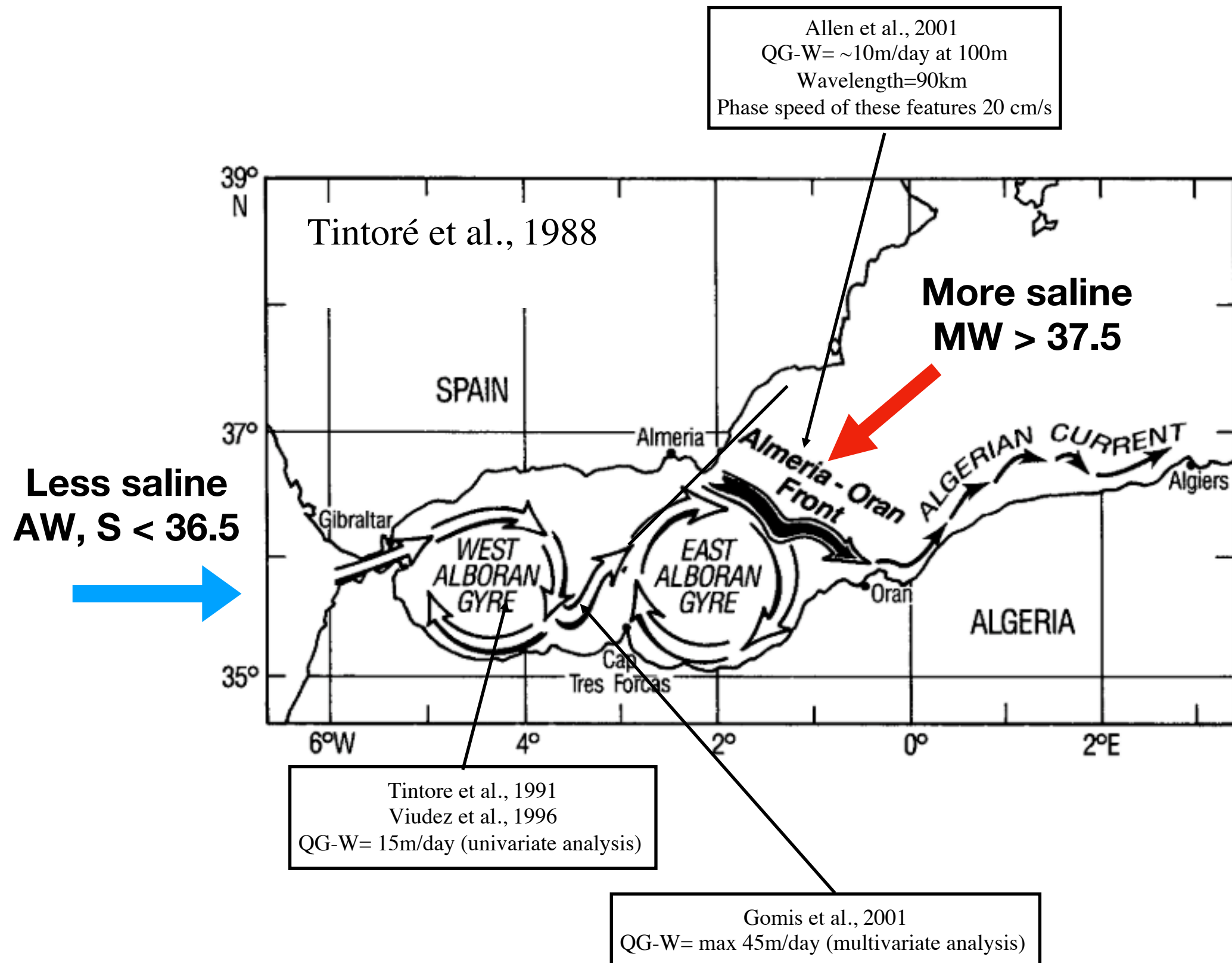
The physical and biochemical role of the Almeria-Oran front during the Spring to Summer transition period

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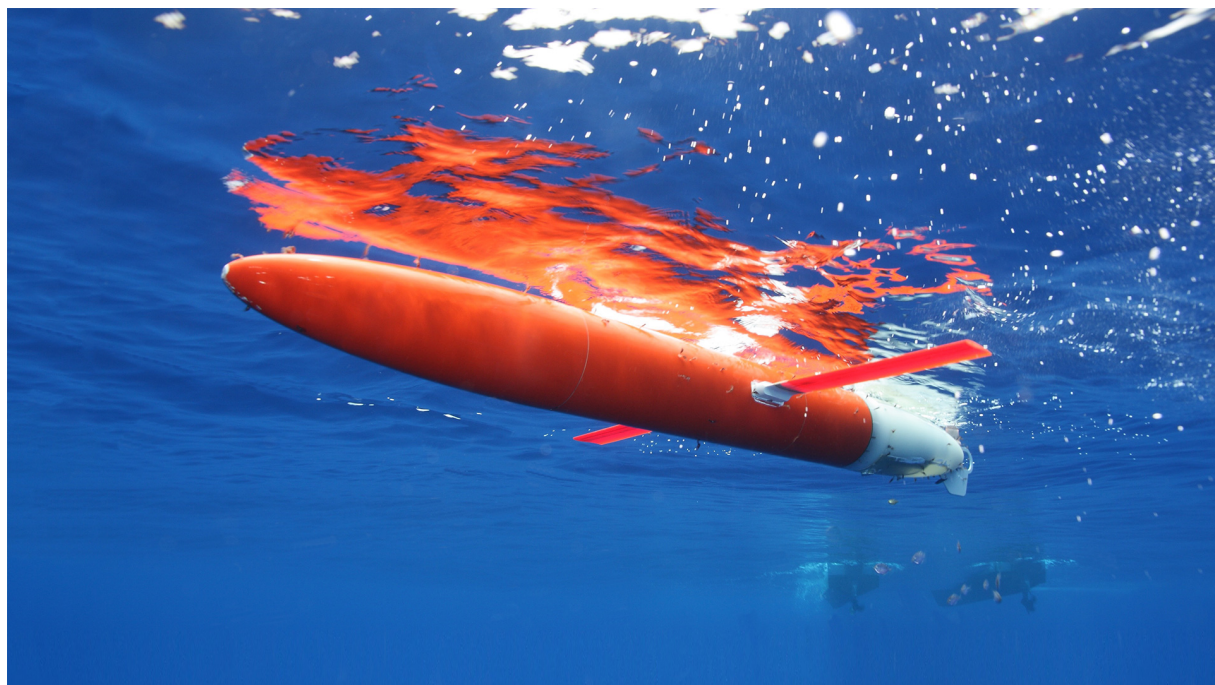


Background: Alboran Sea (Western Mediterranean)



Questions and objectives

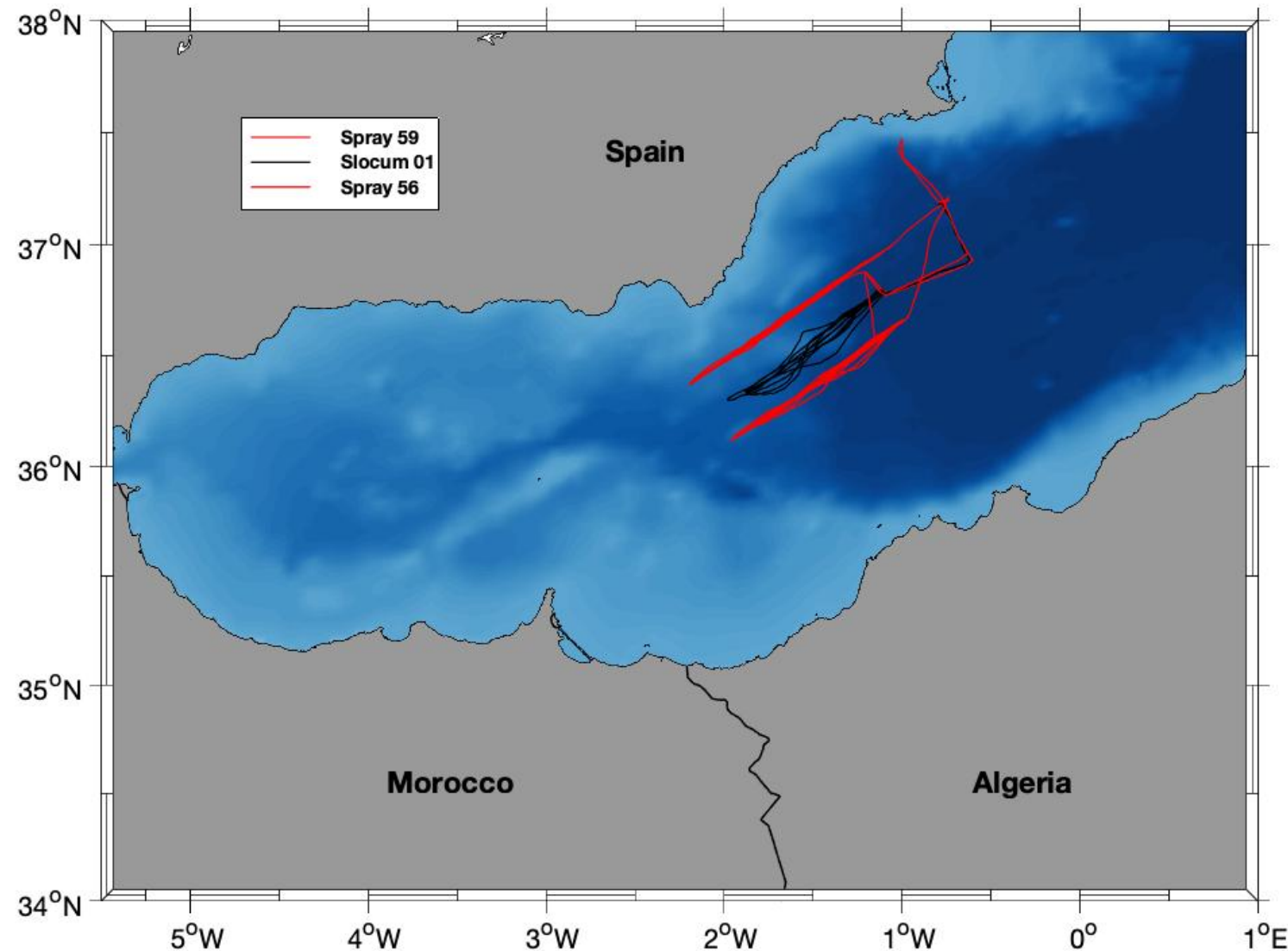
- Using underwater gliders:
- Quantify mesoscale vertical vorticity using survey data and diagnostic approaches
- Resolve the submesoscale three-dimensional flow through direct measurement
- Examine the biogeochemical signatures of the dynamics of the Almeria-Oran front.



Underwater glider surveys

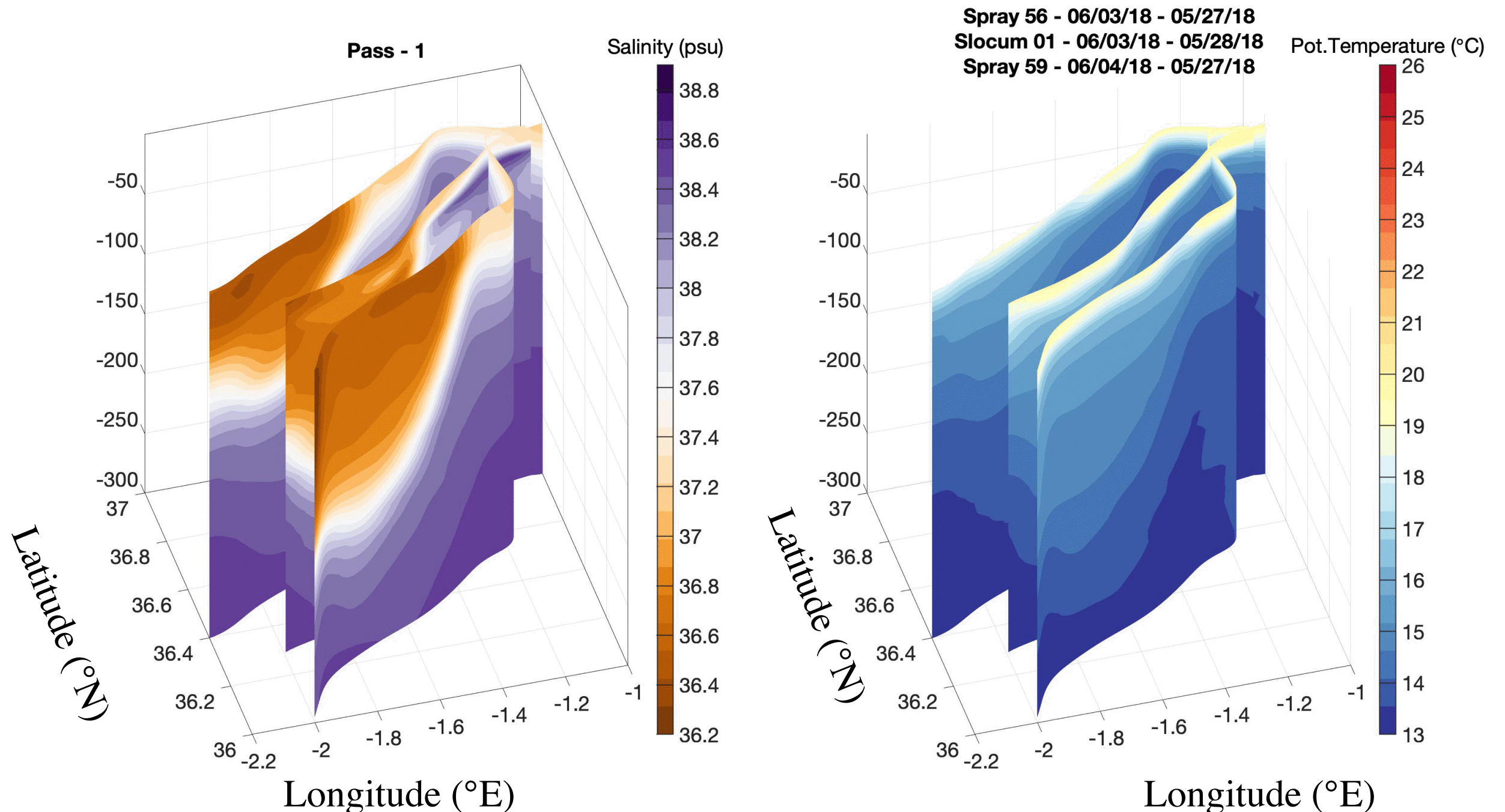
Glider observations:

- Period: 05/24/2018 – 08/03/2018
- 3 gliders (2 Spray & 1 Slocum)
- 17.5 km each glider line apart
- 1160 dives
- Surface to 700 m
- 31 sections in total
- 9 repeated section for the 3 gliders (100-135km)
- 4768 km



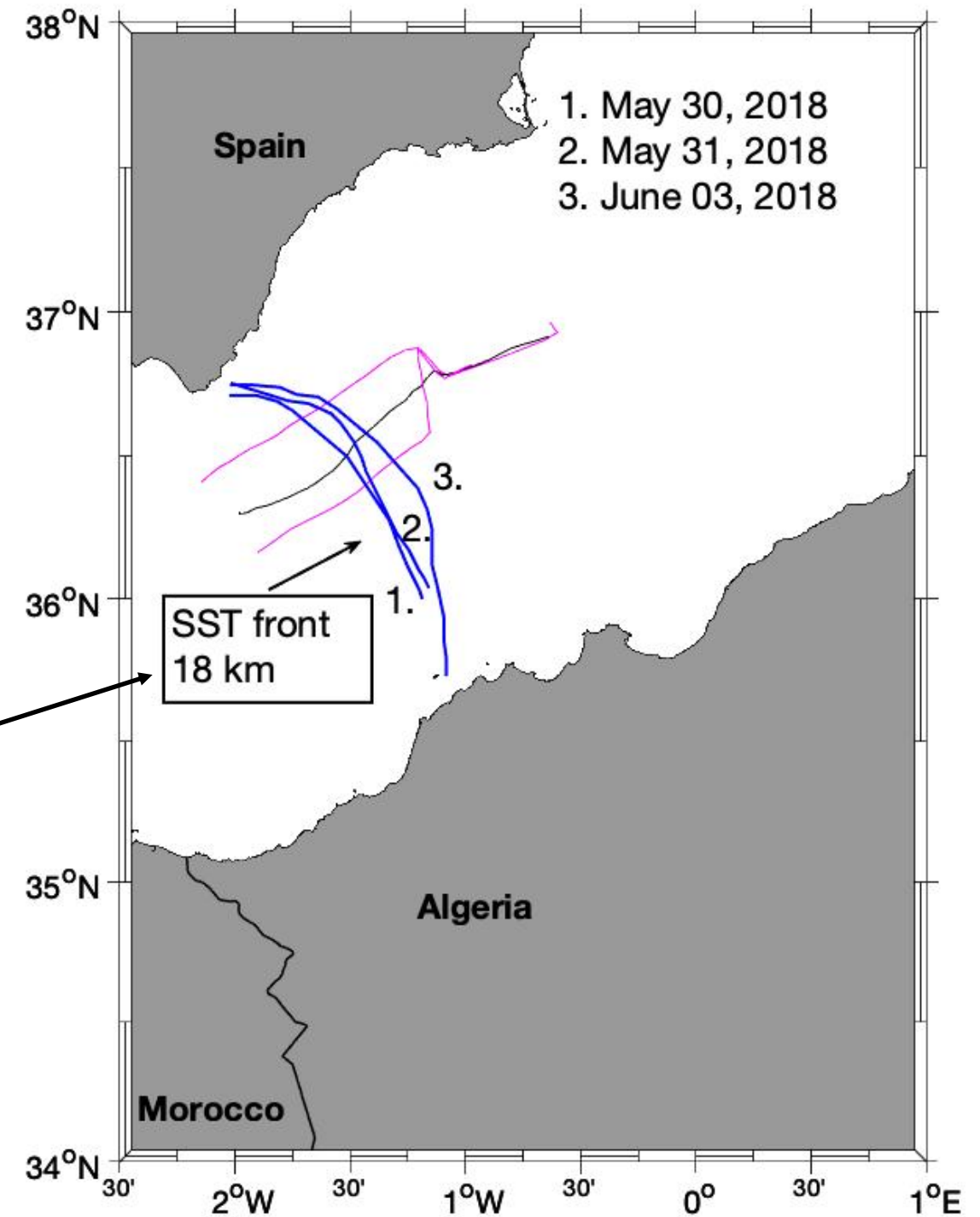
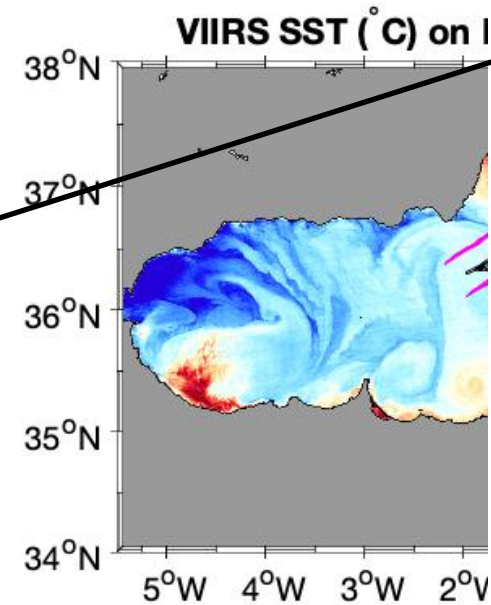
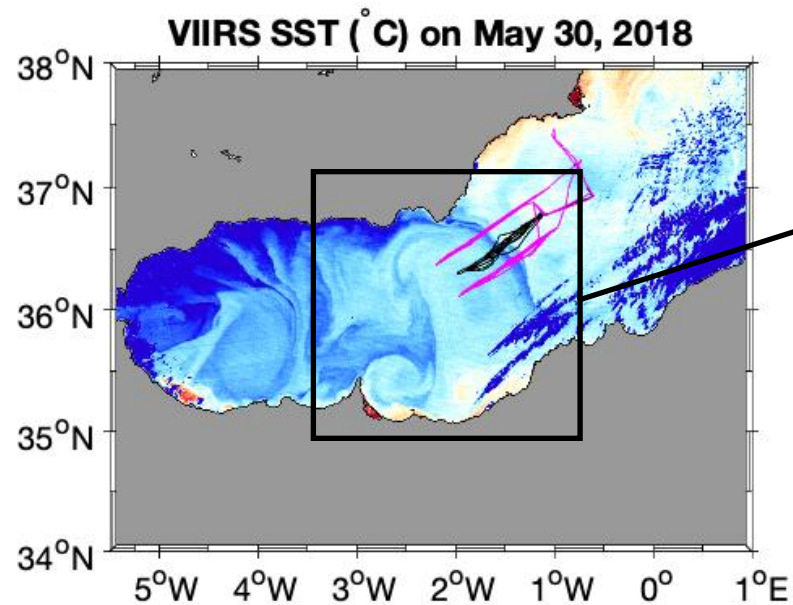
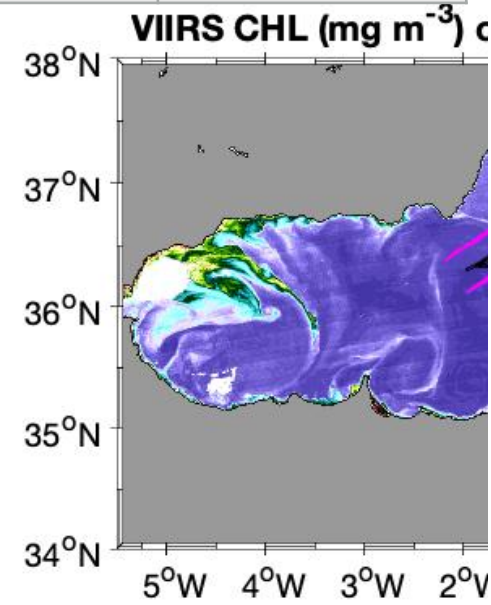
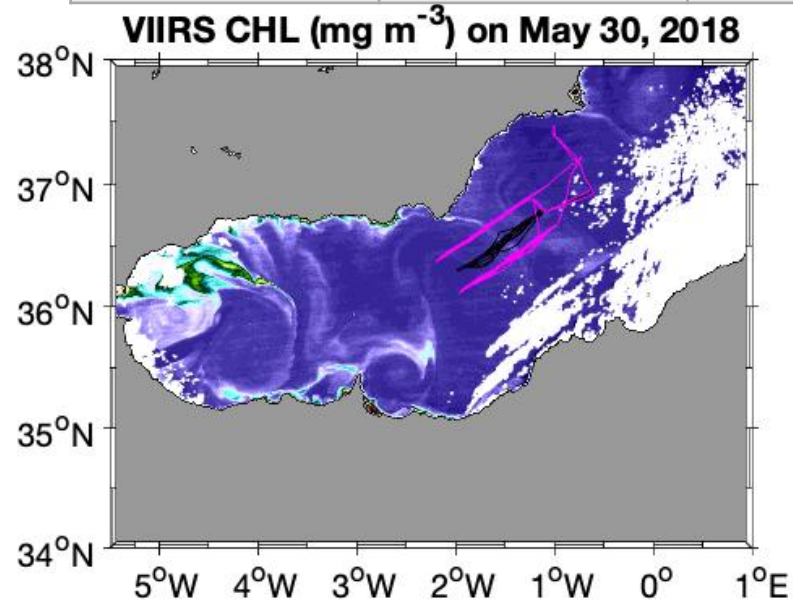
Almeria-Oran front

- Rapid changes of the slope and position of the Almeria-Oran front have been observed in the past [Allen et al., (2001)]
- These observations are consistent with baroclinic instability and the propagation of wavelike meanders along the front [Hoskins and Bretherton, (1972)]



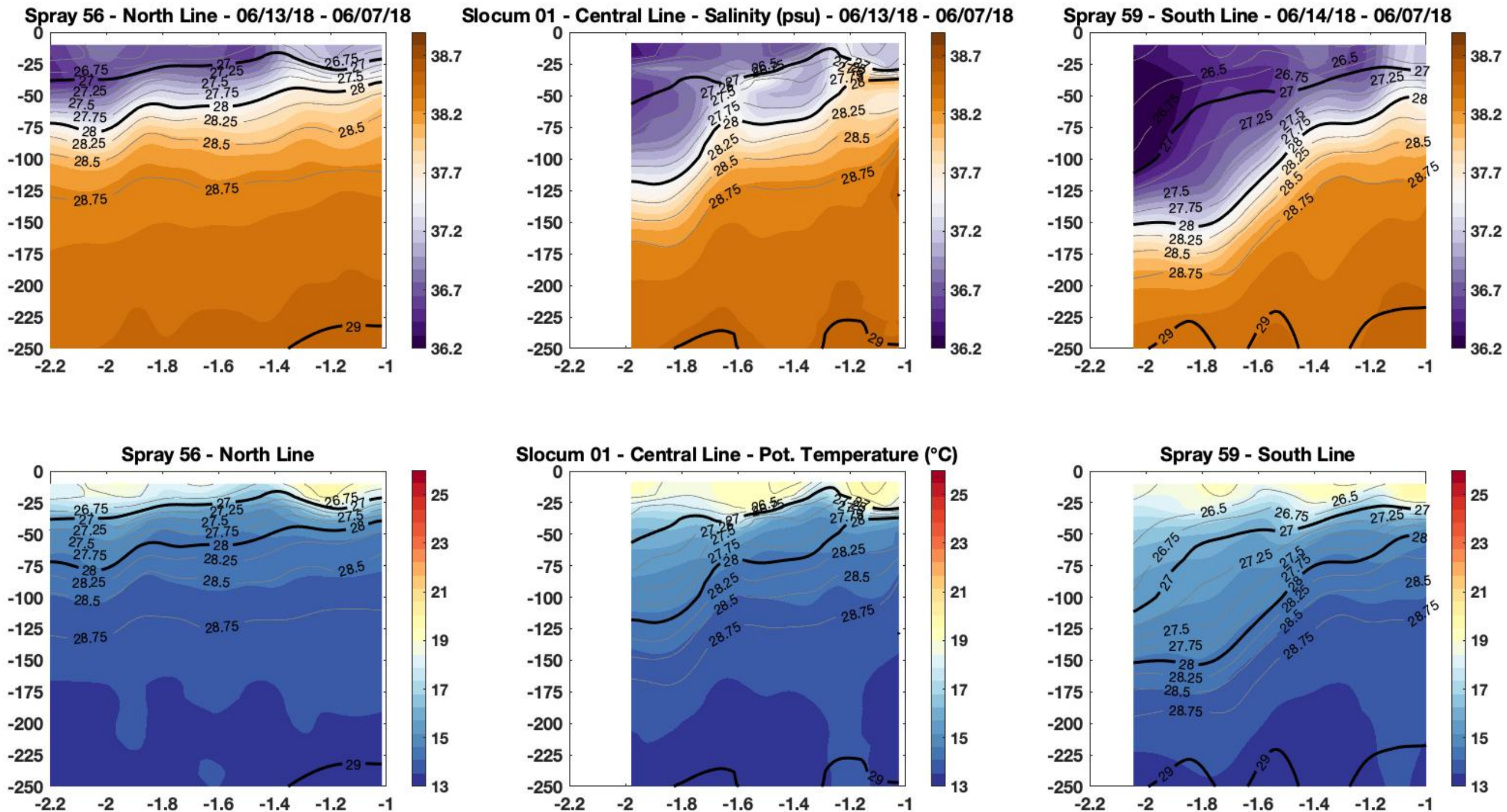
Remote sensing imagery

Number of Good satellite images	MODIS (1km)	VIIRS (700m)	OLCI (300m)
	20	20	12



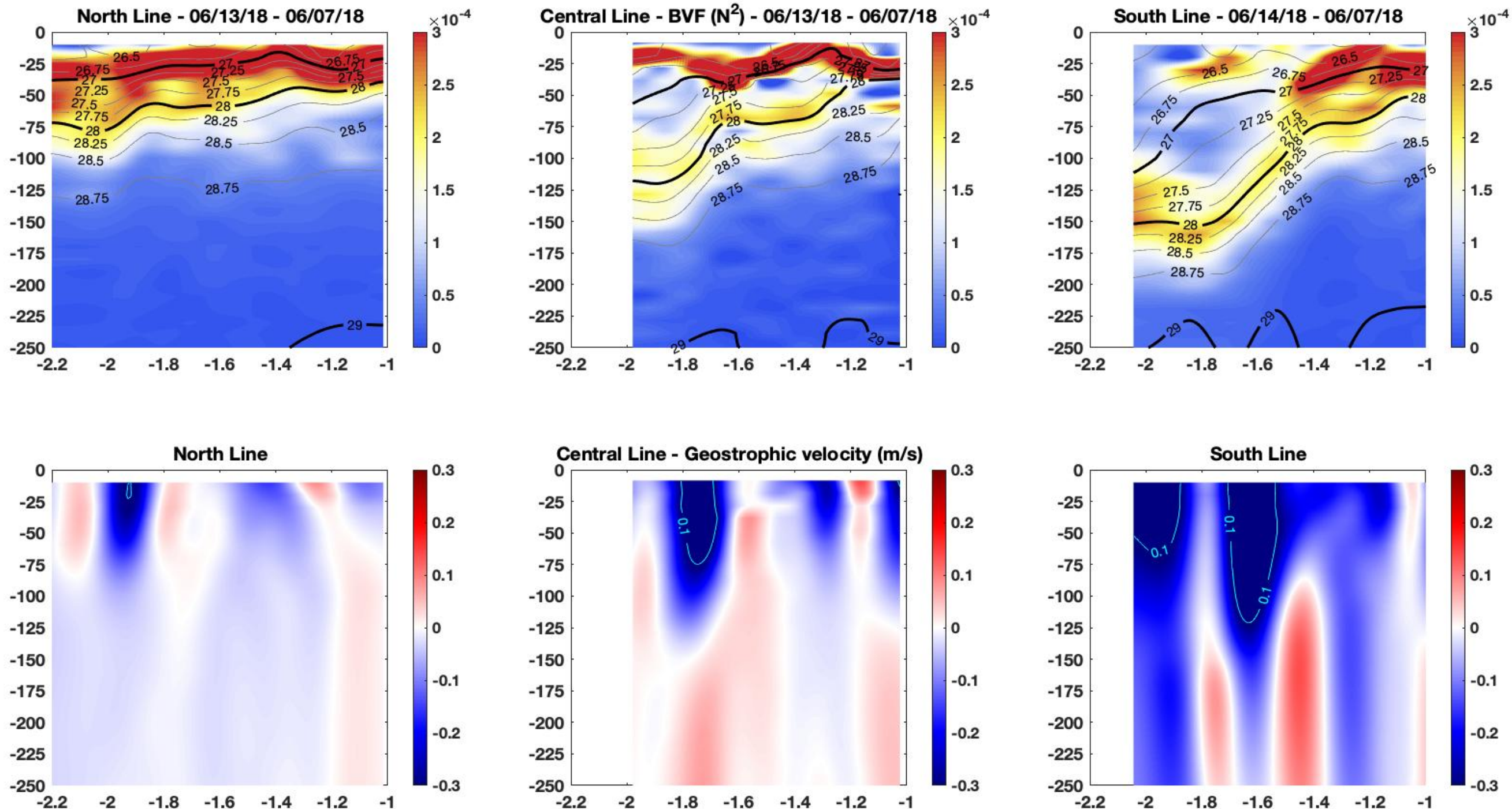
Front characteristics during the relaxation phase

- Width: 25-45km
- Vertical extension: 150-250m
- Does not always have the same surface expression of the front



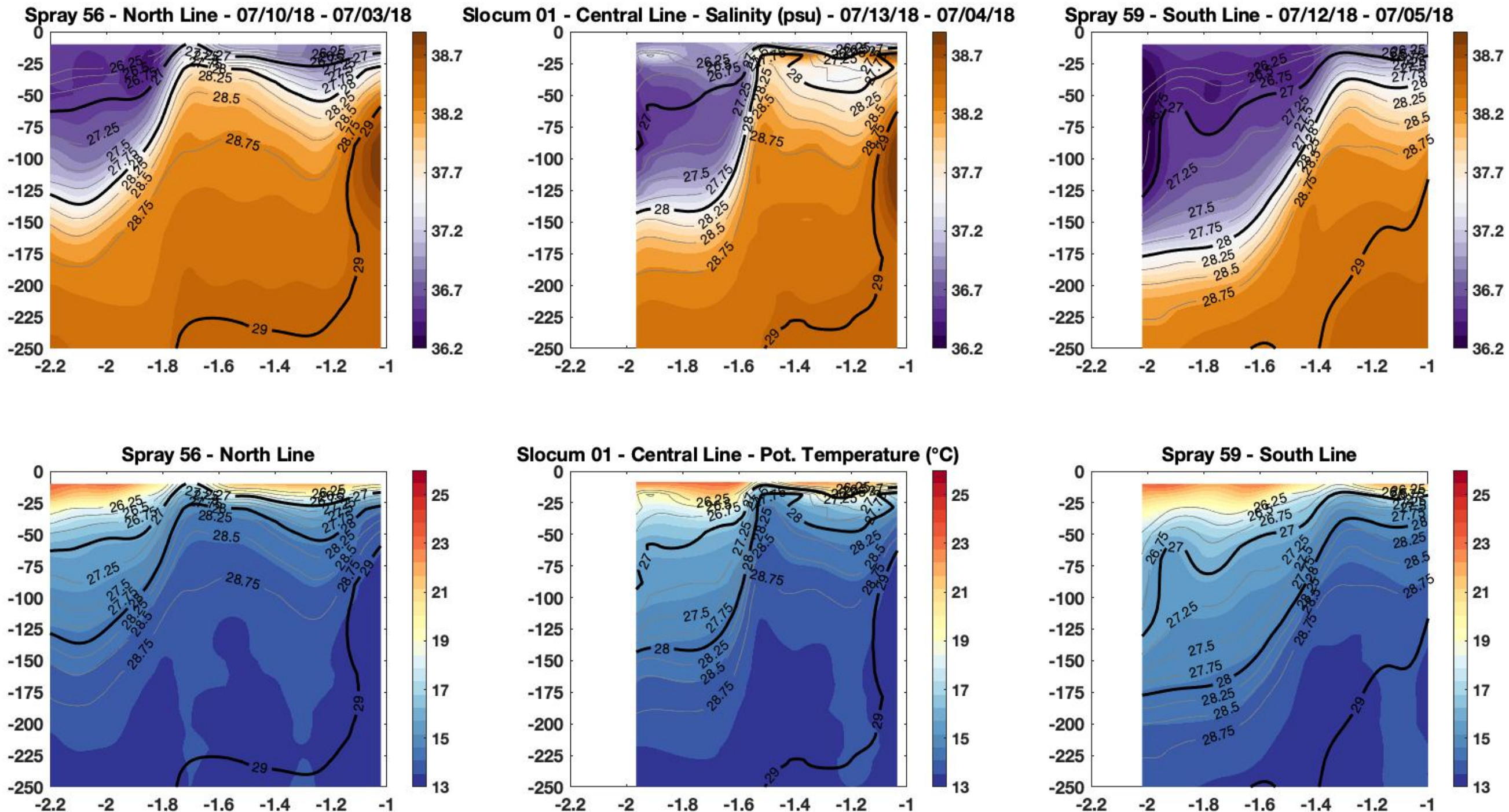
Front characteristics during the relaxation phase

- A higher thickness of N^2 has been observed in the northern line
- In this snapshot the intensity of the front increase from North to South



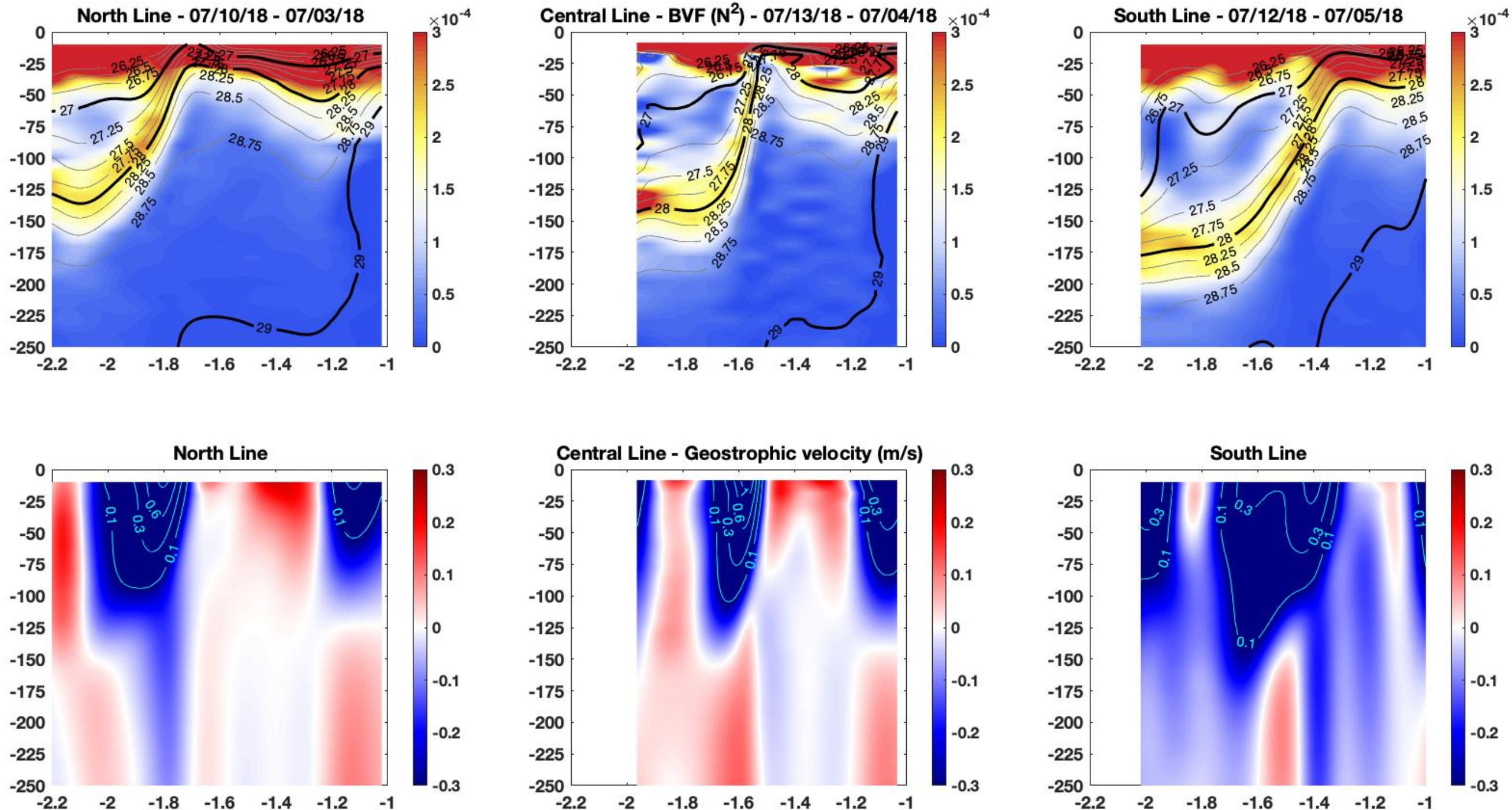
Front characteristics during the intensification phase

- The middle glider observing probably the steepest the front that can get without getting statically unstable



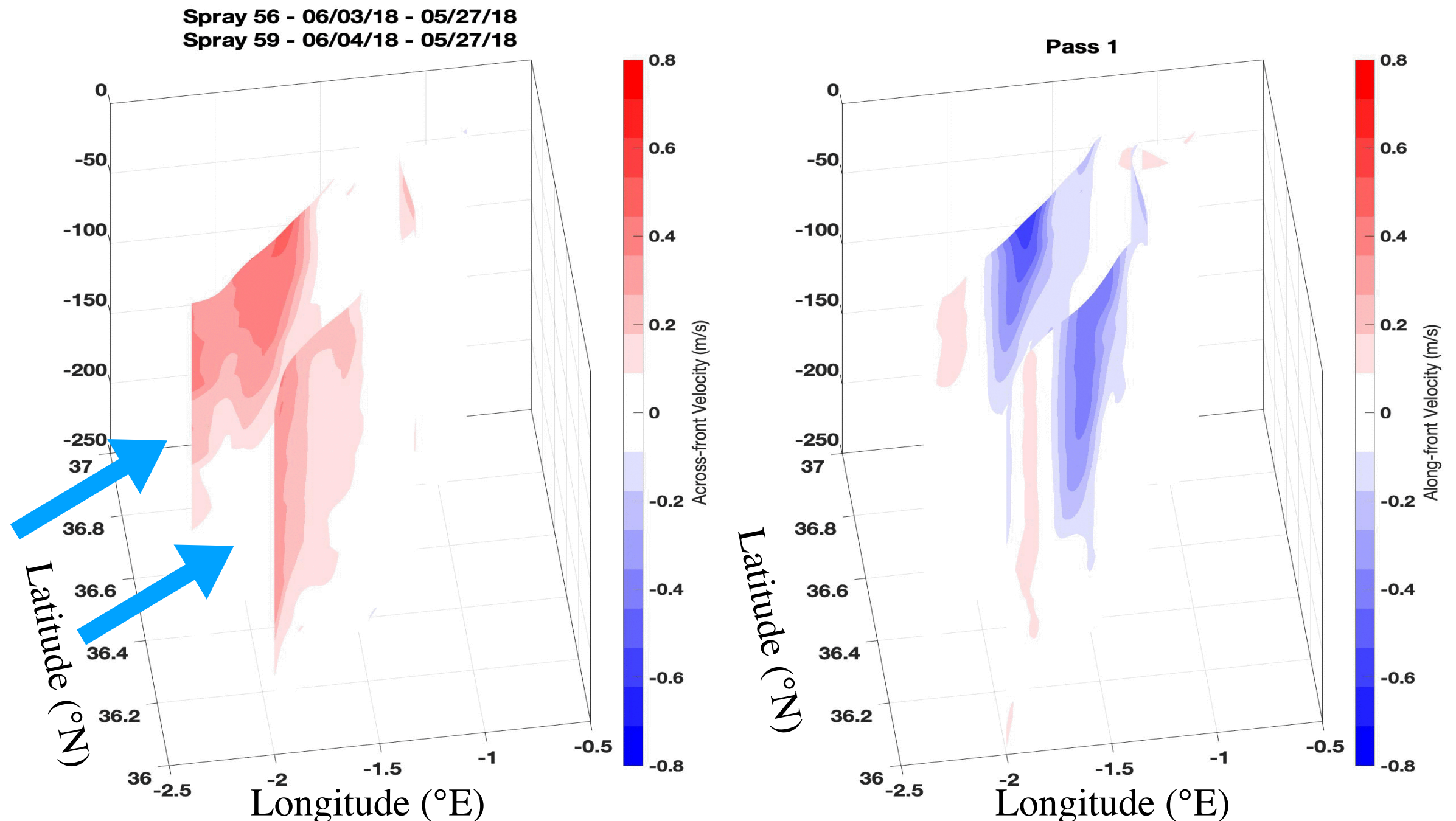
Front characteristics during the intensification phase

- During the intensification of the front higher geostrophic shear observed



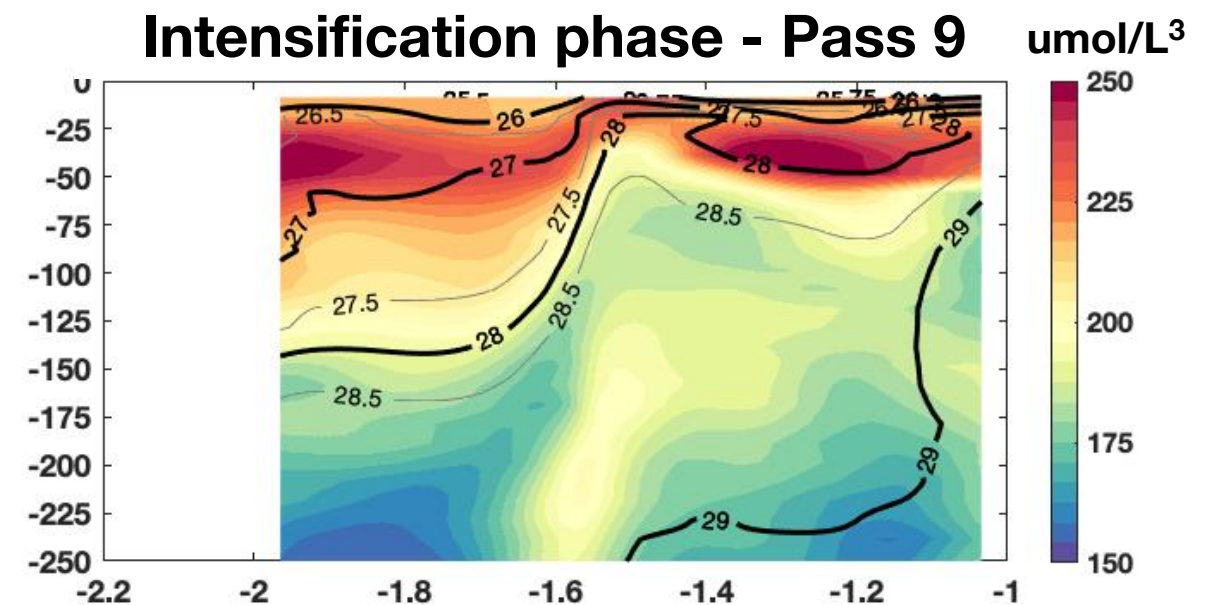
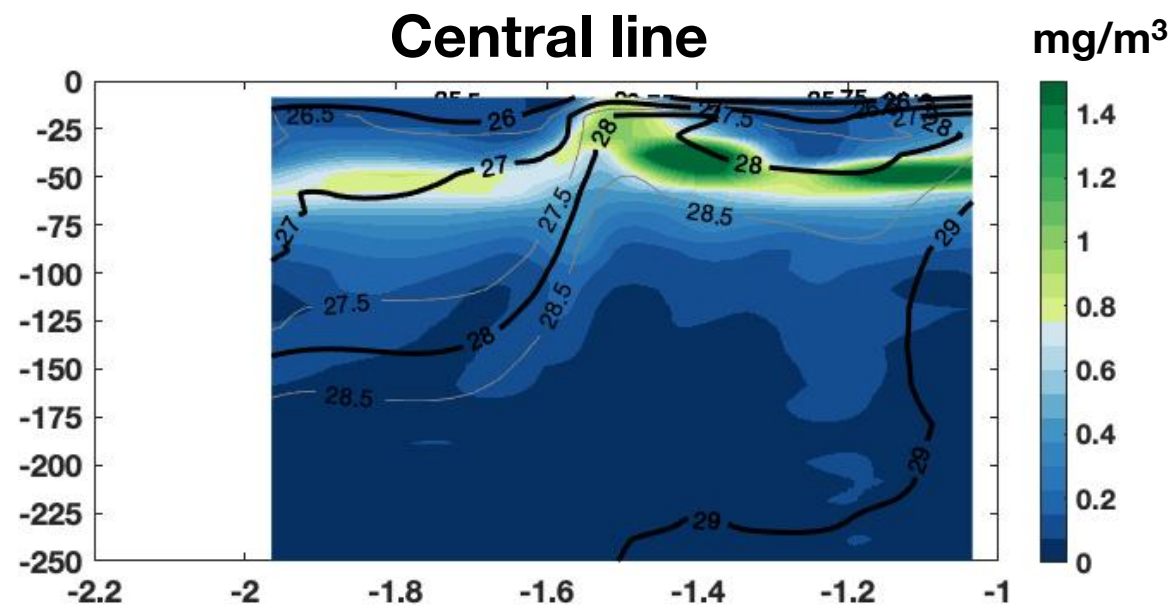
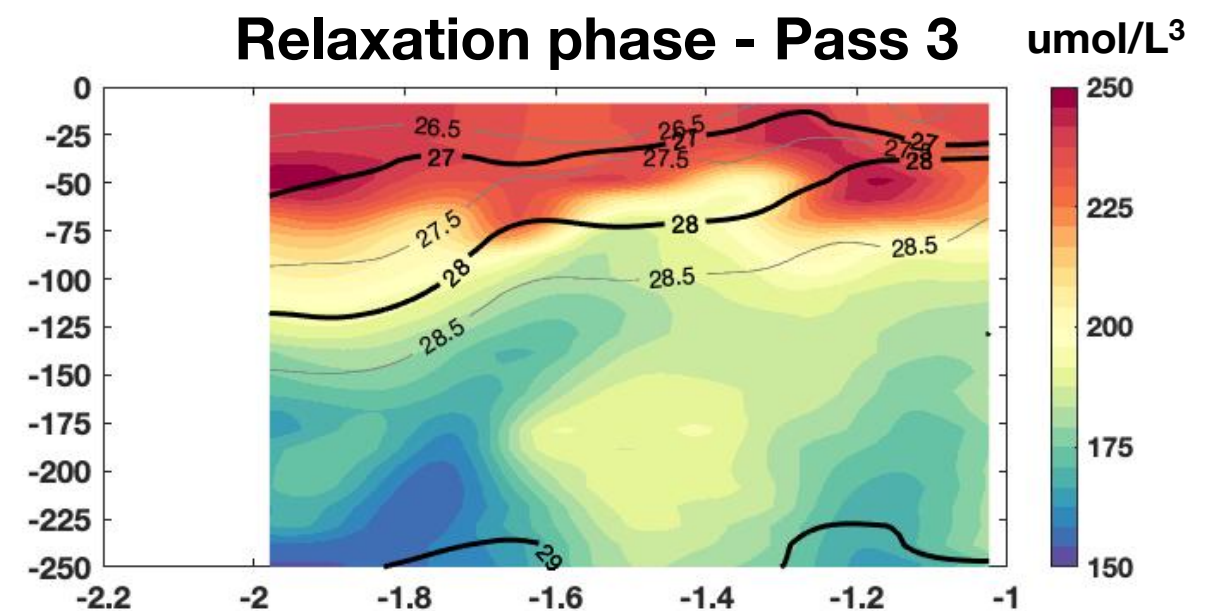
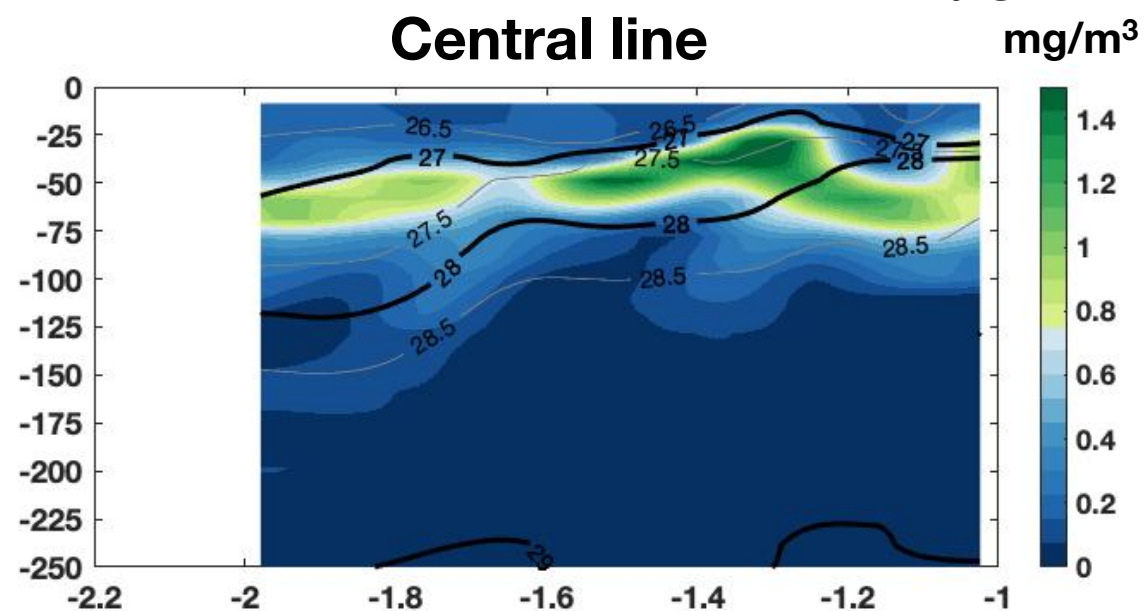
ADCP Velocity measurements in the Almeria-Oran Front

- Baroclinic instability release dense Mediterranean water across the front underneath of the Atlantic Water
- Strong along-front flow in the frontal area
- Changing convergence across at the frontal area



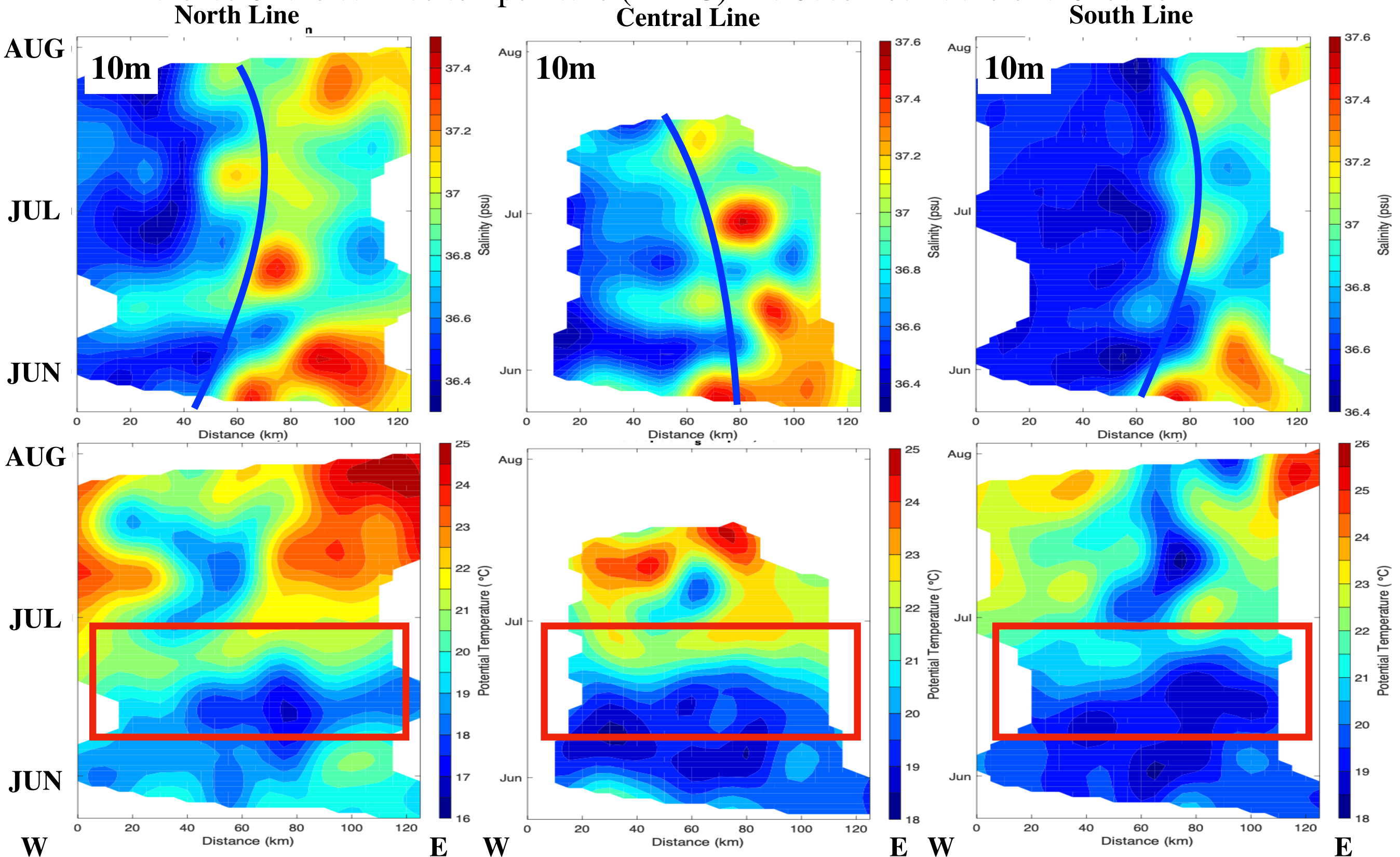
Biogeochemical signatures of the Almeria-Oran front

- DCM located between the isopycnal of 27.5 and 28.5 kg/m³
- Evidence of CHL subduction between the isopycnal of 27.5 and 28.5 kg/m³
- Enchantment of CHL and Oxygen saturation at the frontal interface



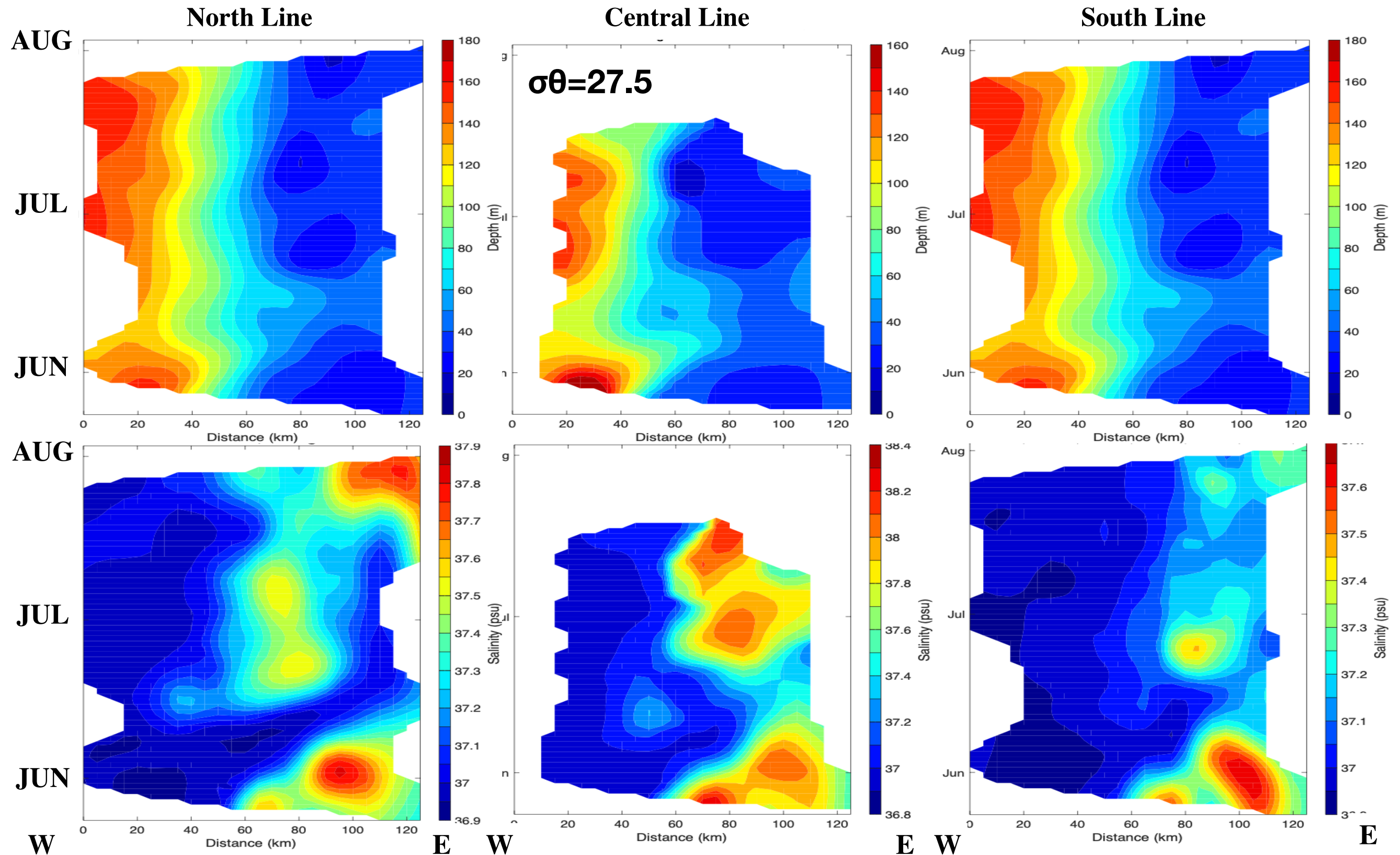
Temporal evolution of the Almeria-Oran Front

- Salinity has been increased up to 0.4 psu in less than 10km at the frontal area
- An increase of the surface temperature ($\sim 3^\circ\text{C}$) has observed at the end of June



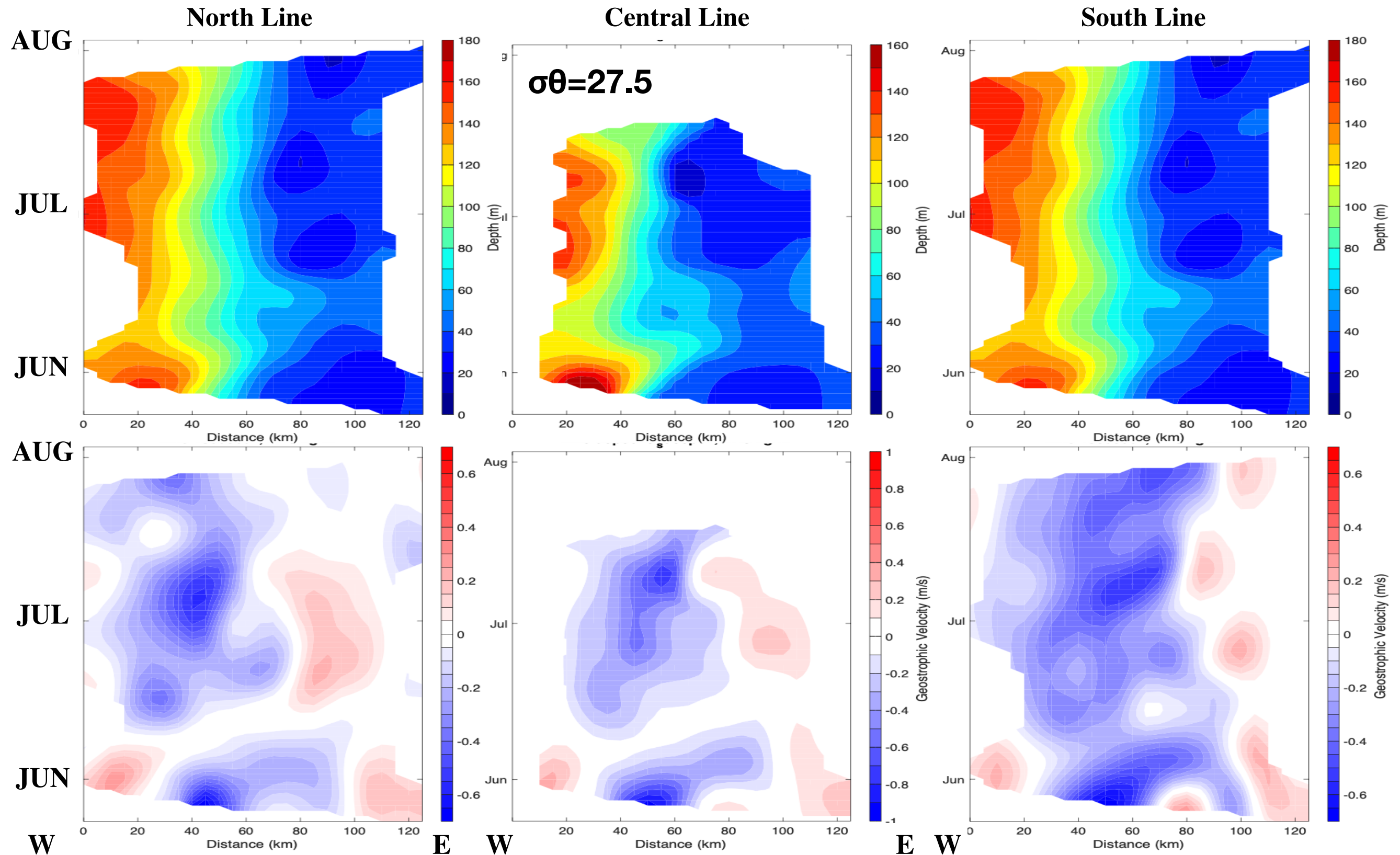
Temporal evolution of the Almeria-Oran Front

- The east-west change in depth approximates a mean gradient of the isopycnal across the front
- Small scale structures of the salinity field in the SL in the Mediterranean side of the front



Temporal evolution of the Almeria-Oran Front

- During the relaxation of the front the along Geo. Velocity goes low & vise-versa



Conclusions and future plans

- The glider network across the Almeria-Oran front gave us new insights about the three-dimensional pathways of transport from the upper ocean to the interior
- Investigate how mesoscale activity affect the spatial variability of the Almeria front
- A better understanding of this vertical exchange will help us to evaluate changes in the biological storage of carbon and improve our prediction for future global climate change