Diel changes in the distribution of zooplankton over a steep submarine canyon: Is there evidence of canyon-induced transport?

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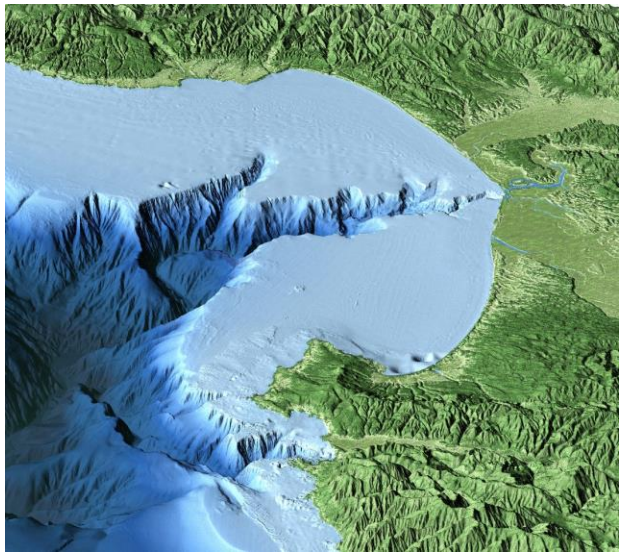
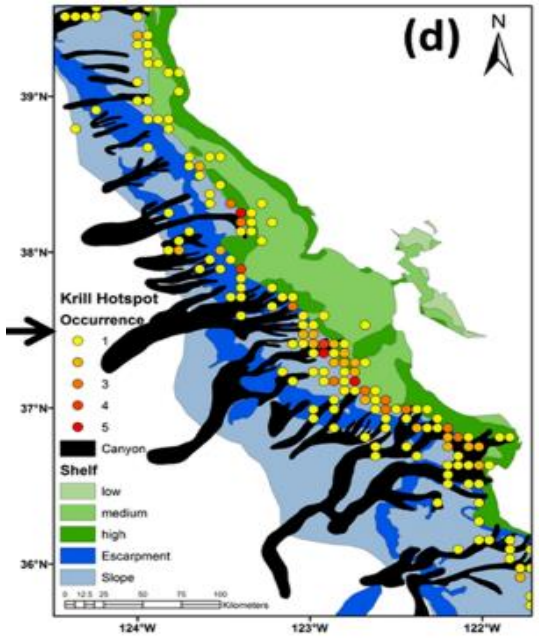
7th Zooplankton Production Symposium – S18

Submarine canyons

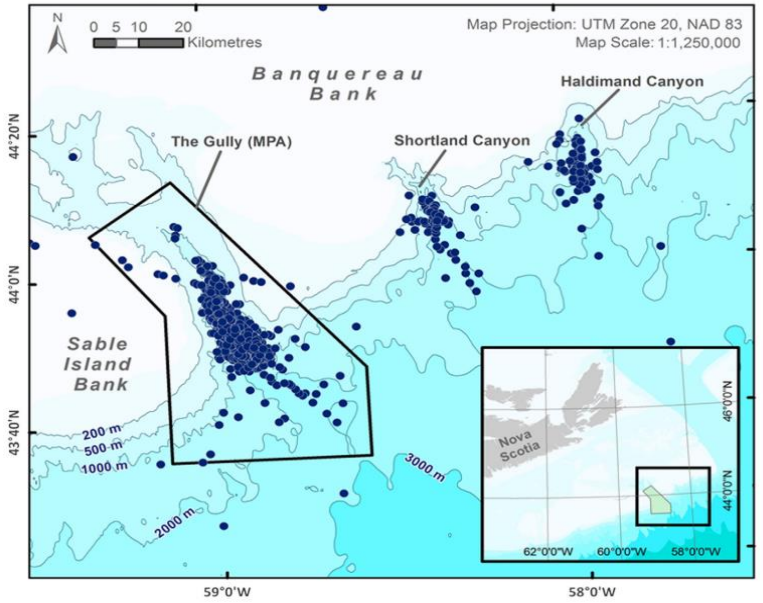
- Submarine canyons are topographic discontinuities where the isobaths significantly deepen.
- Canyons promote productivity by modifying local circulation.
- They often are diversity hotspots with enhanced biological productivity.



Monterey Sub. Canyon. MBFT 2024.



Santora et al. 2018

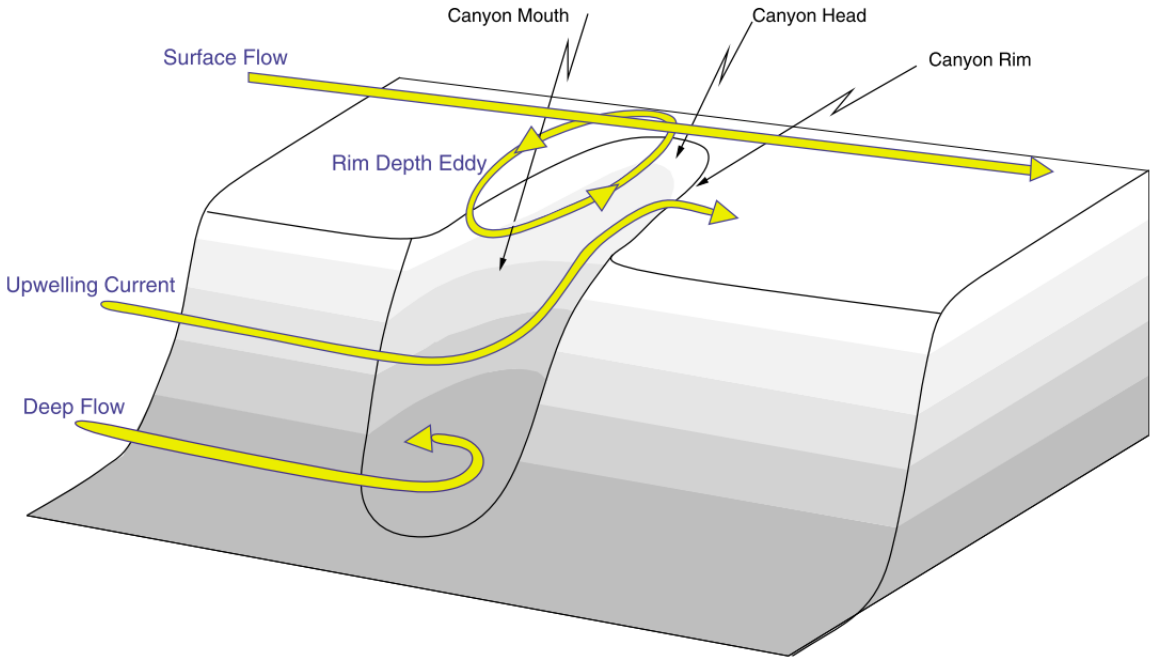


Moors-Murphy 2014

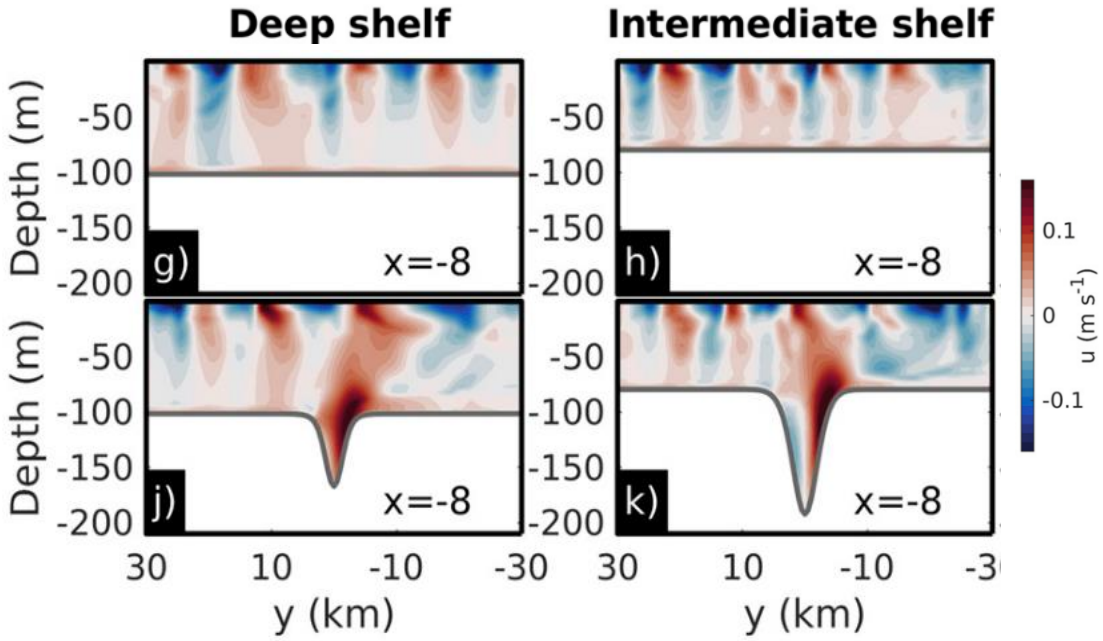
Fernández-Arcaya et al. 2017

Topographic upwelling and mixing

- The geostrophic flow along the isobaths is modified because of bathymetry
- The cross-isobaths flow channel deep water into the shelf and resuspends bottom particles
- This topographic upwelling enhances local biological productivity.



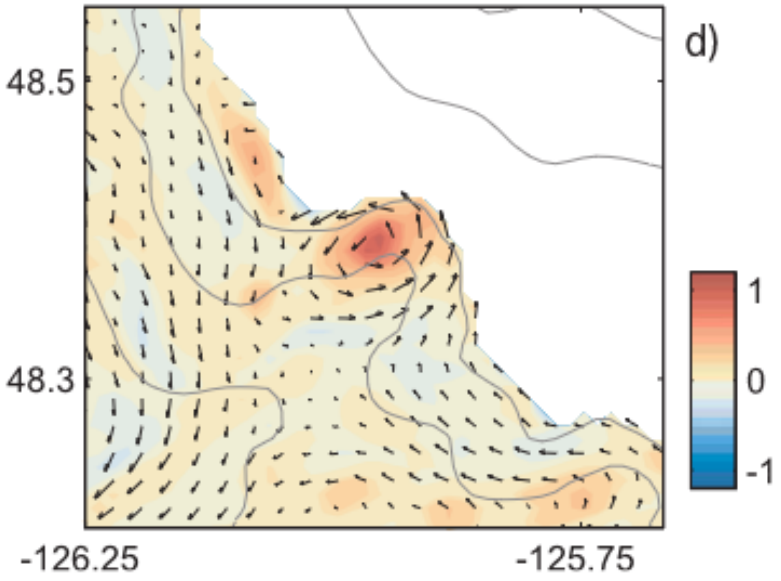
Allen & Hickey 2010



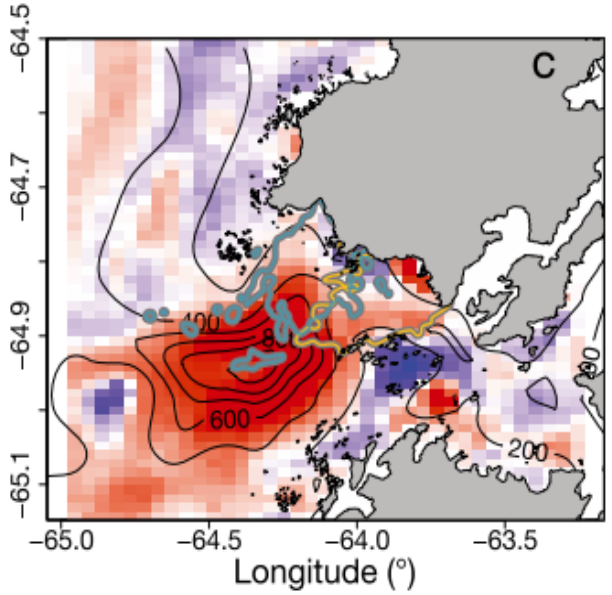
Saldías & Allen 2020

Local aggregation and retention

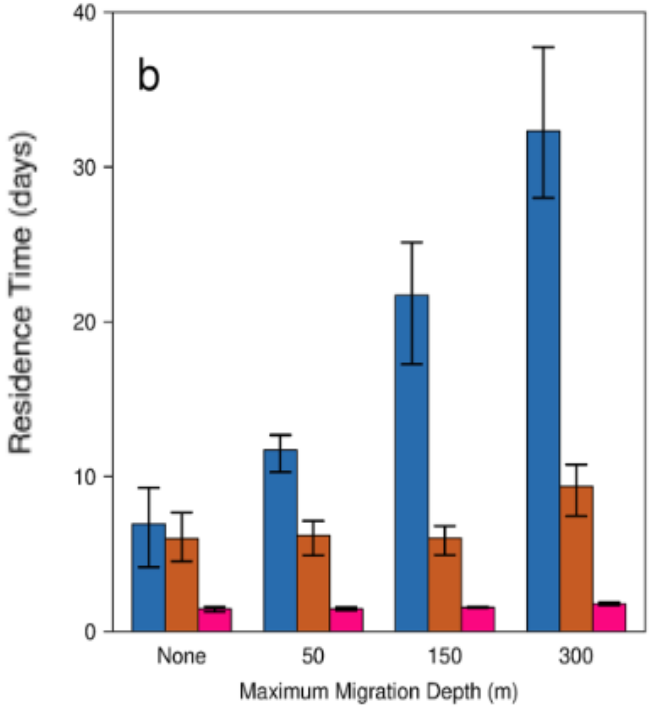
- Ageostrophic dynamics can force the formation of a cyclonic eddy near the canyon rim.
- The eddy induces upwelling and/or retains particles.
- The interaction between vertical migrations , canyon currents, and canyon topography can cause retention and agregation.



Conolly & Hickey 2014



Hudson et al. 2022a



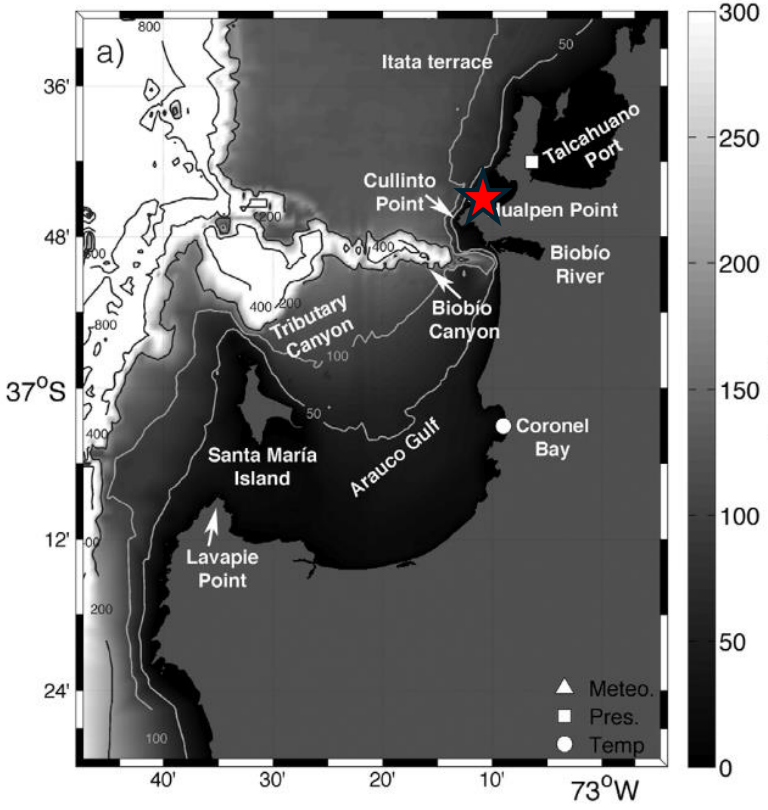
Hudson et al. 2022b

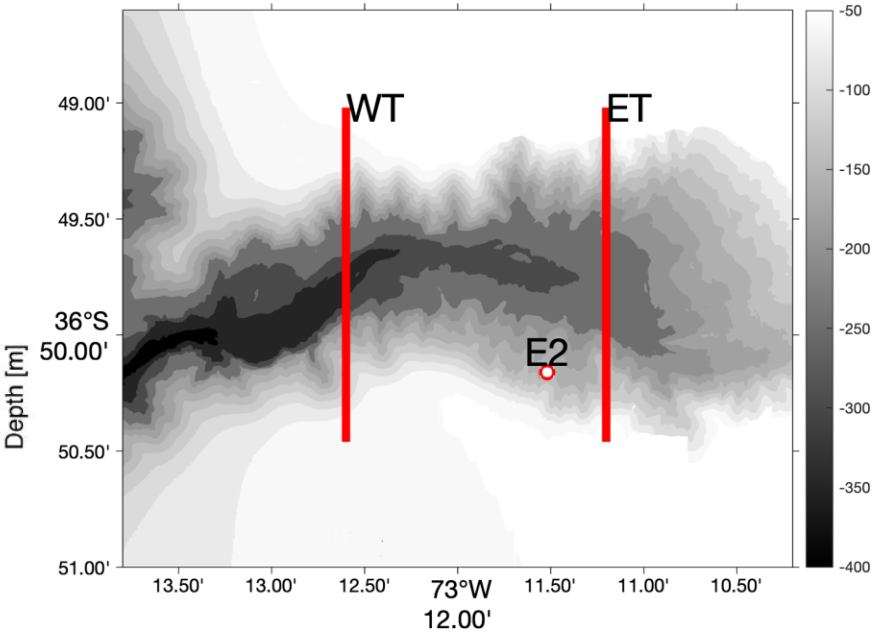
The Bío-Bío canyon experiment

The Bío-Bío Canyon is a long (~100 km) and narrow (5 km half-width) shelf-incising, river-influenced submarine canyon.

Data:

- Winds from Meteo. St. at Hualpen Point ( )
- Towed RDI ADCP (150 kHz) for currents and **MVBS**
- RapidPro CTD
- Stratified zooplankton samples in E2 before (day) and after (night) the experiment



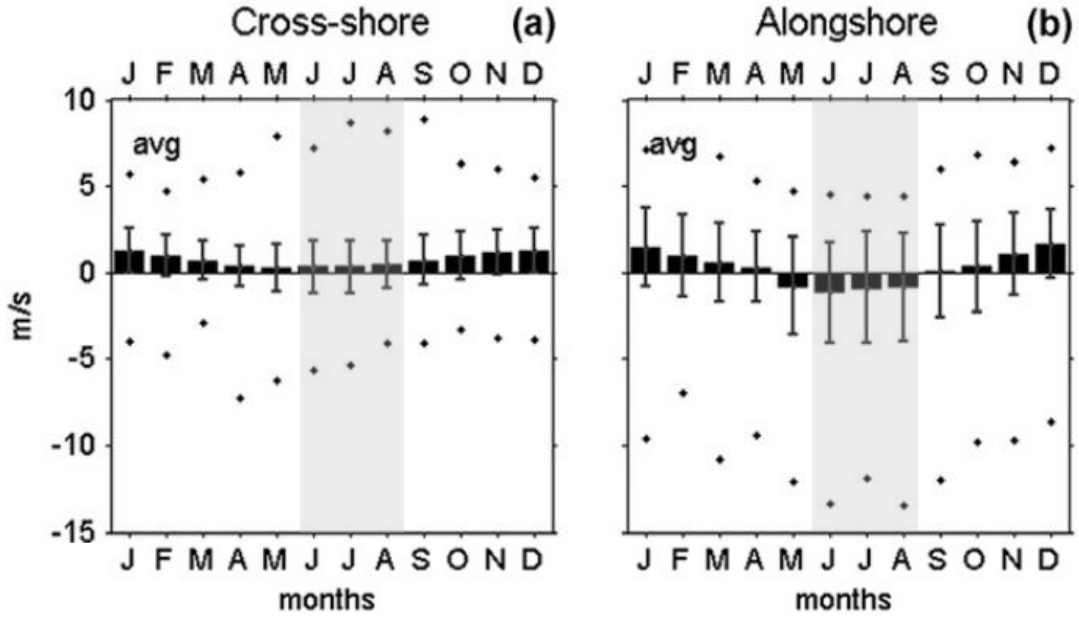


ET=eastern transect
WT=western transect

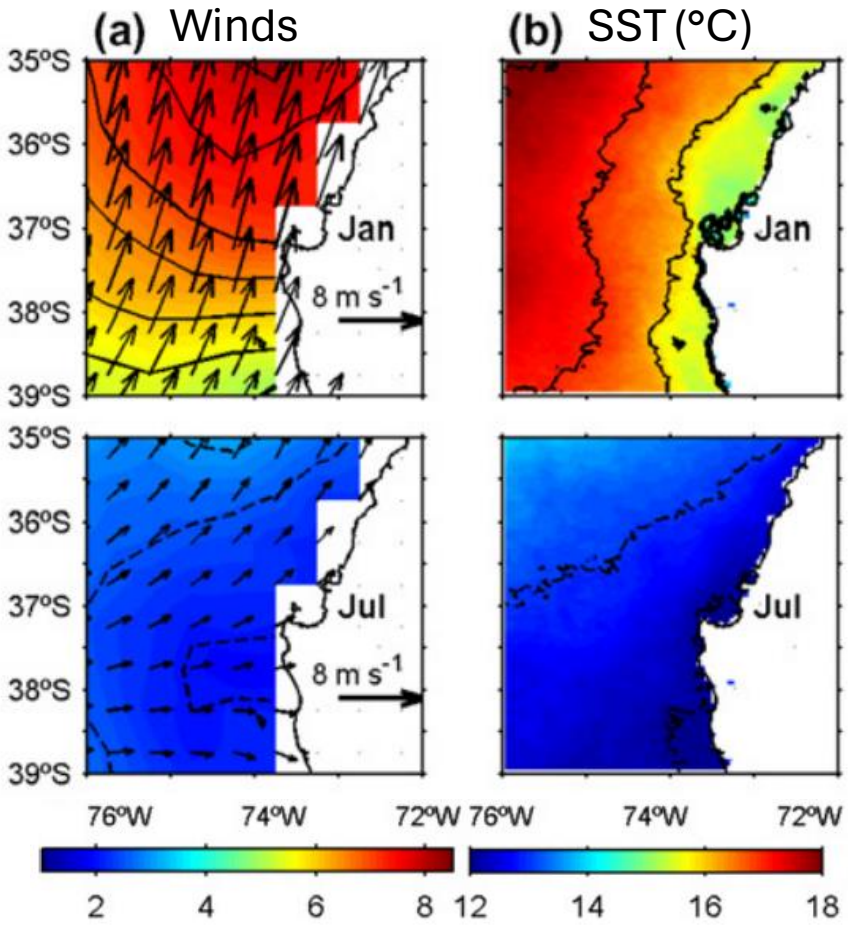
Sobarzo et al. 2016

The Bío-Bío canyon experiment

- The experiment was conducted during austral winter (27-28 of July 2023)
- Winter has downwellng favorable climatological conditions

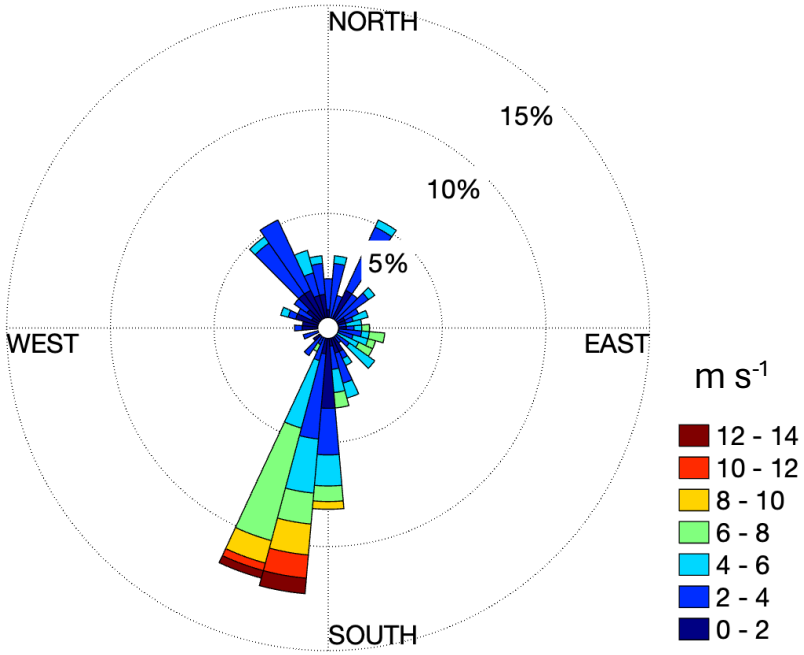


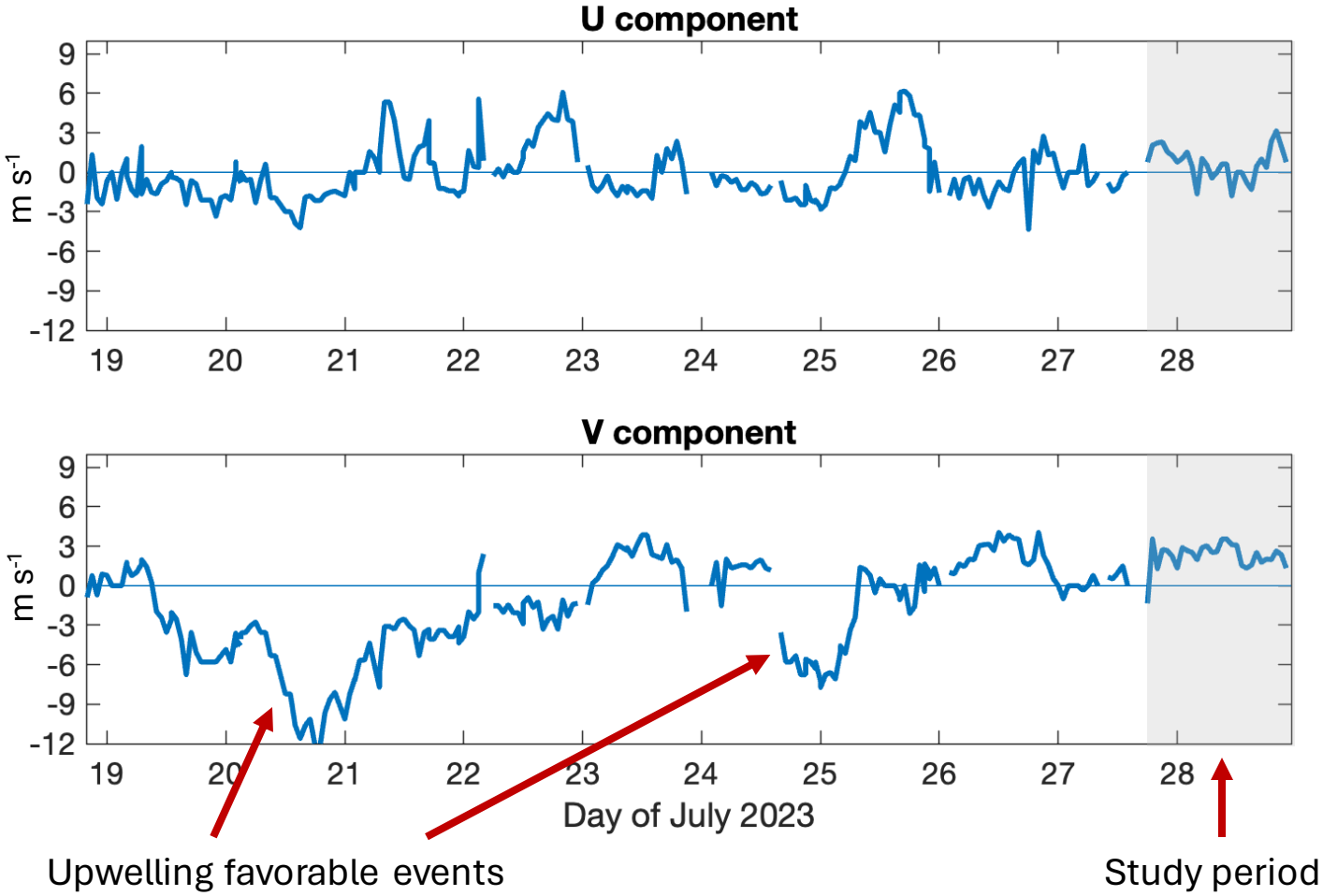
Sobarzo et al. 2007



Wind conditions

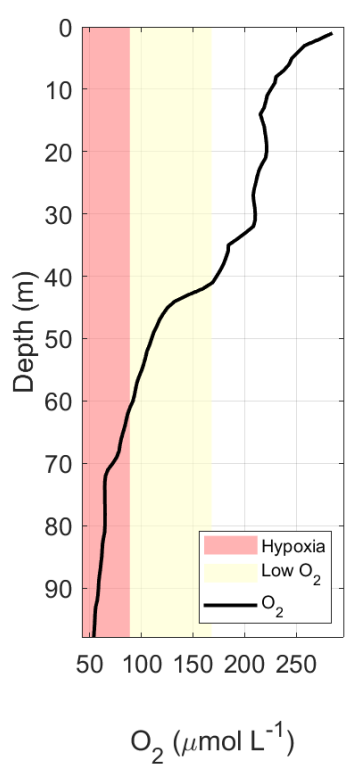
The 10 day window prior to the experiment was dominated by strong upwelling-favorable southern winds

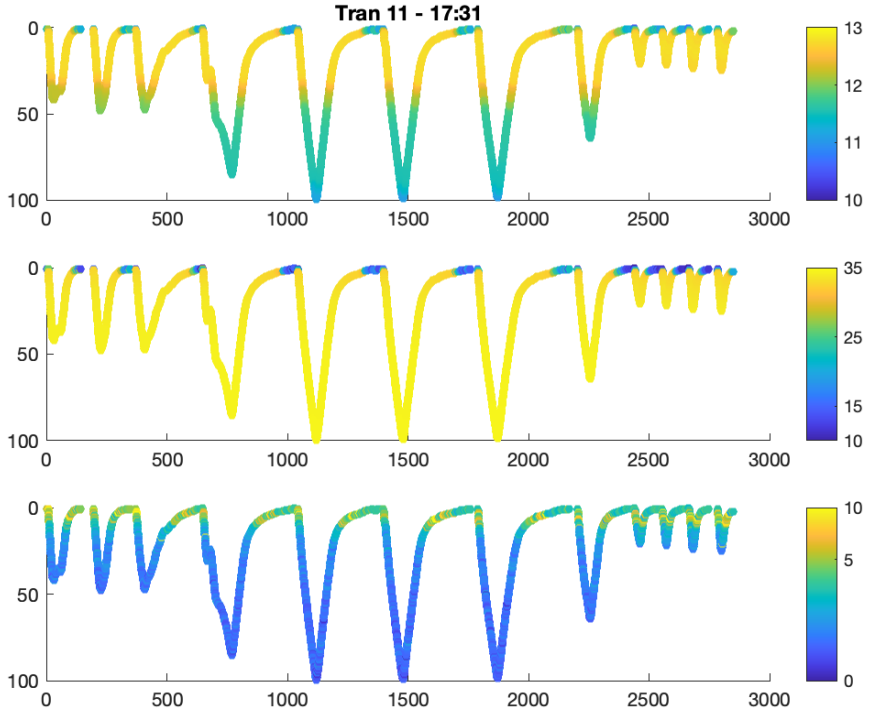


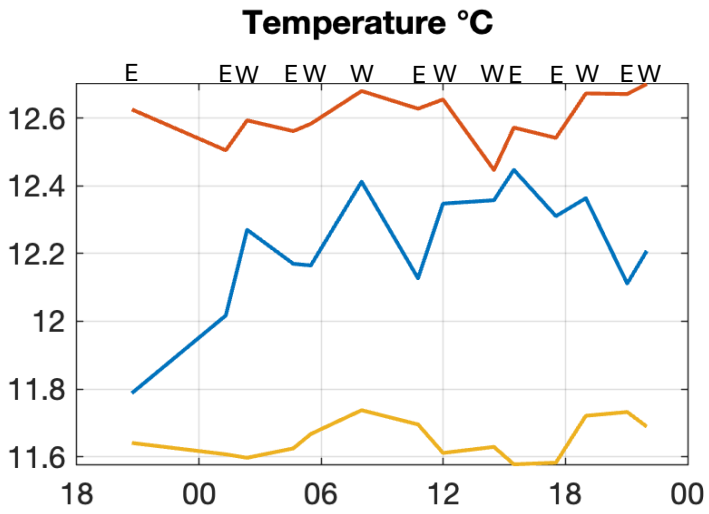


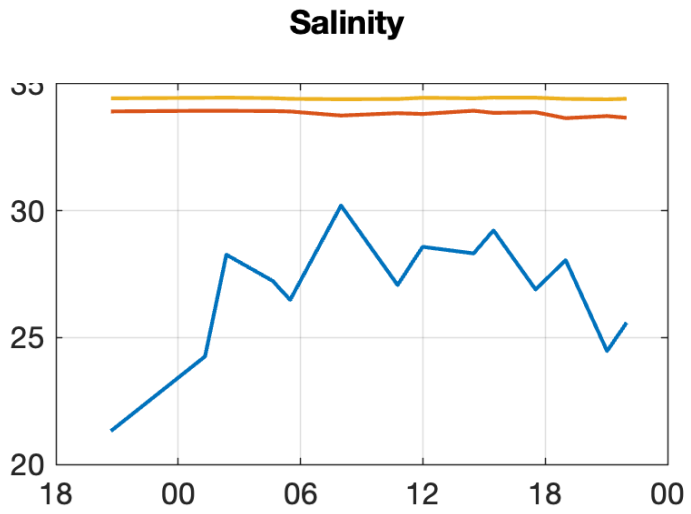
Hydrographic conditions

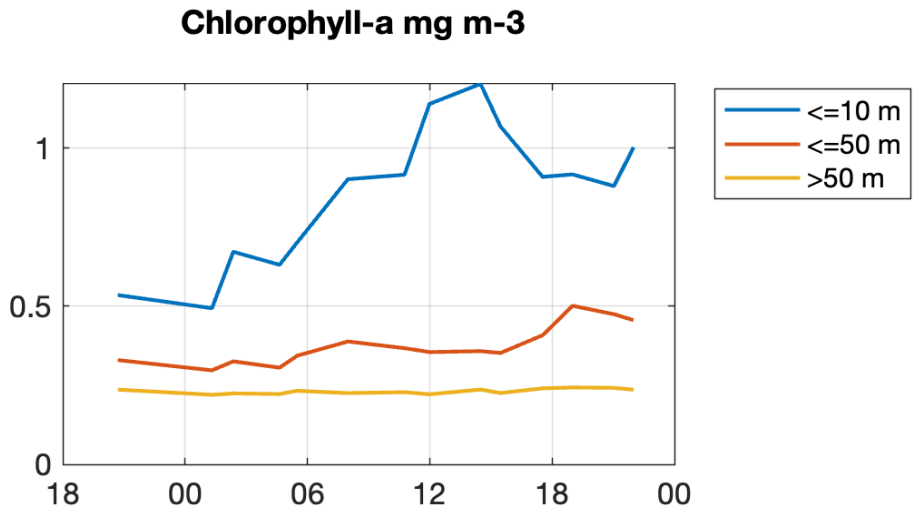
- Permanent 3-layer estructure
- Deep layer → ESSW → active upwelling
- Shallow hypoxia
- Diurnal signal in chl-a in surface layer





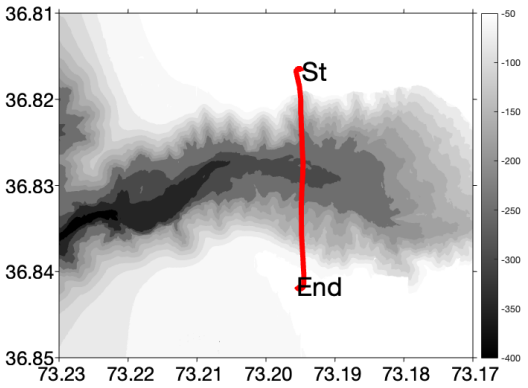




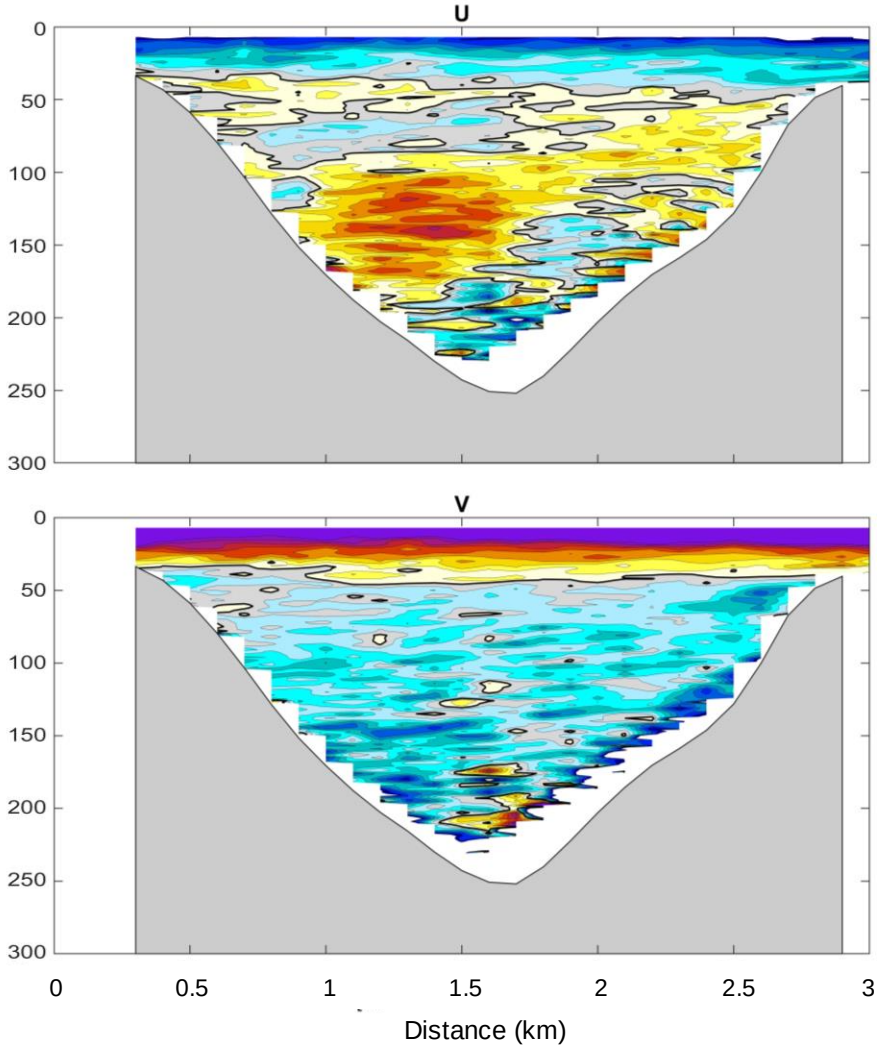


Currents

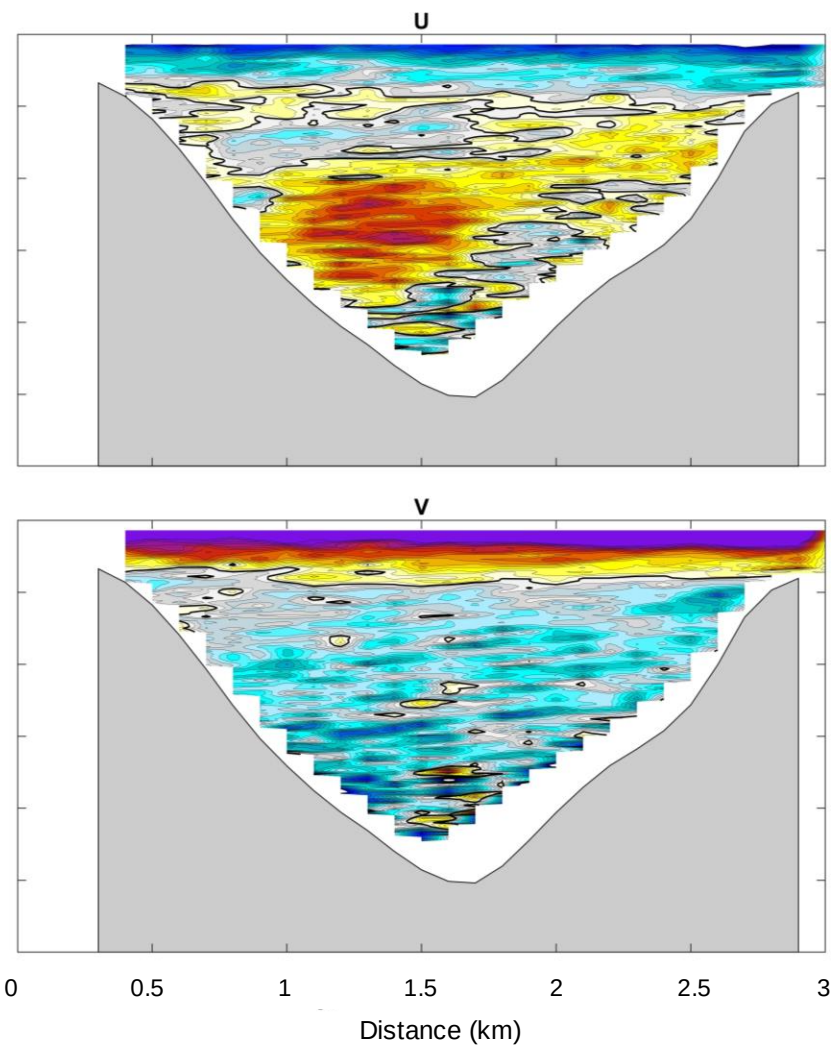
Eastern transect

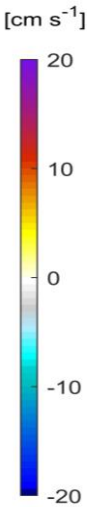


Mean velocities



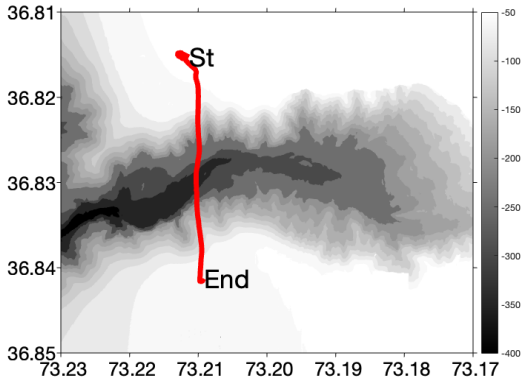
Residual velocities





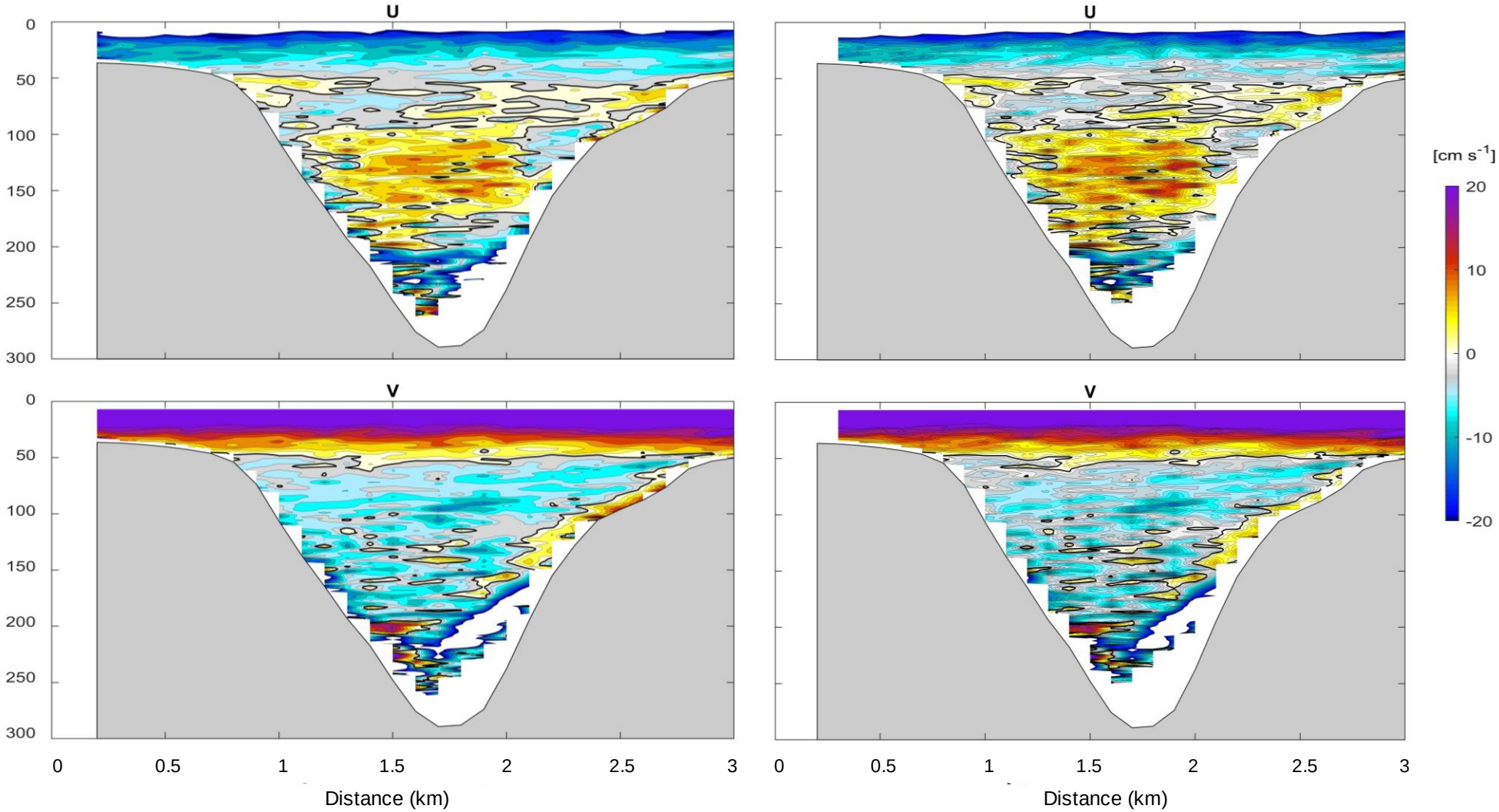
Currents

Western transect



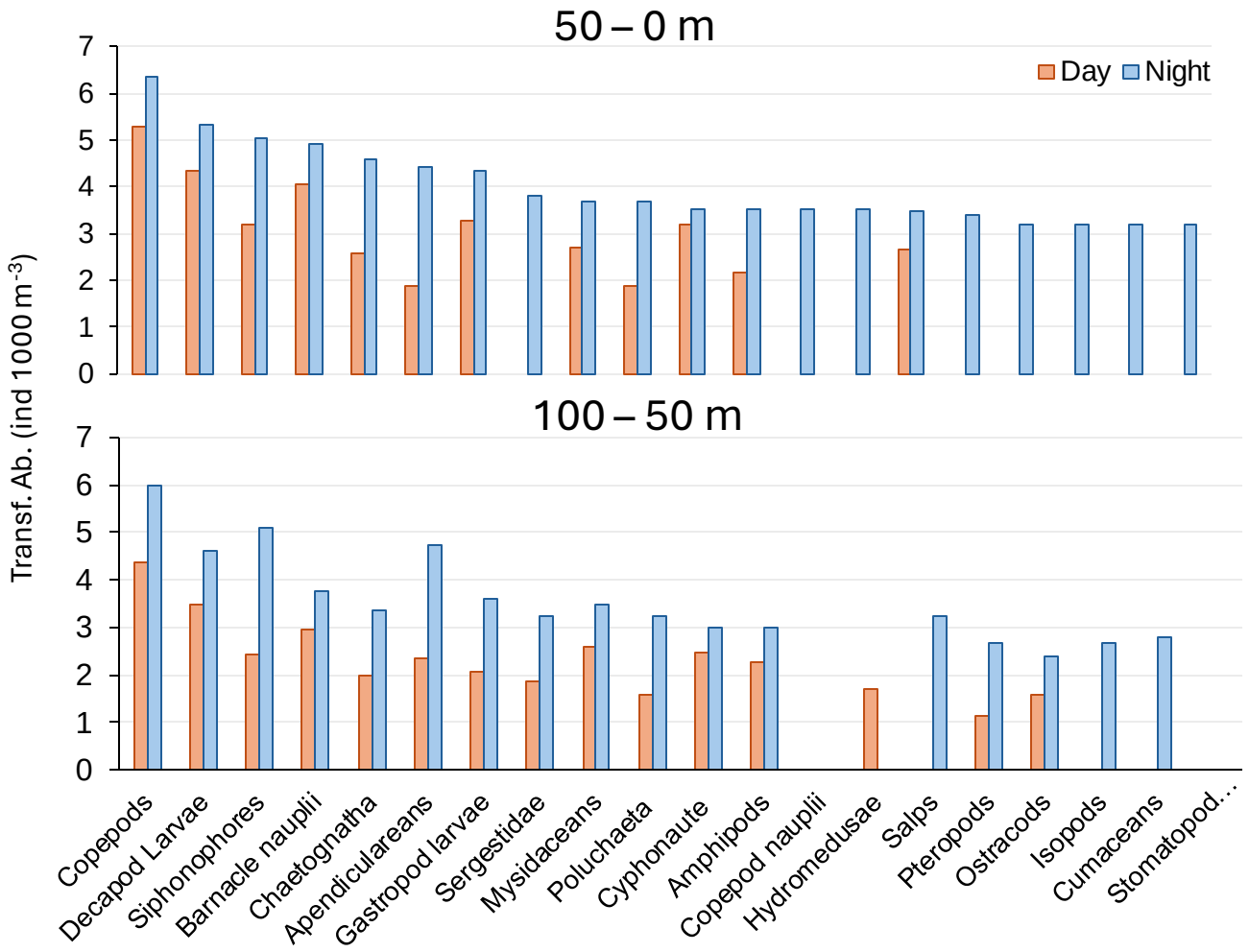
Mean velocities

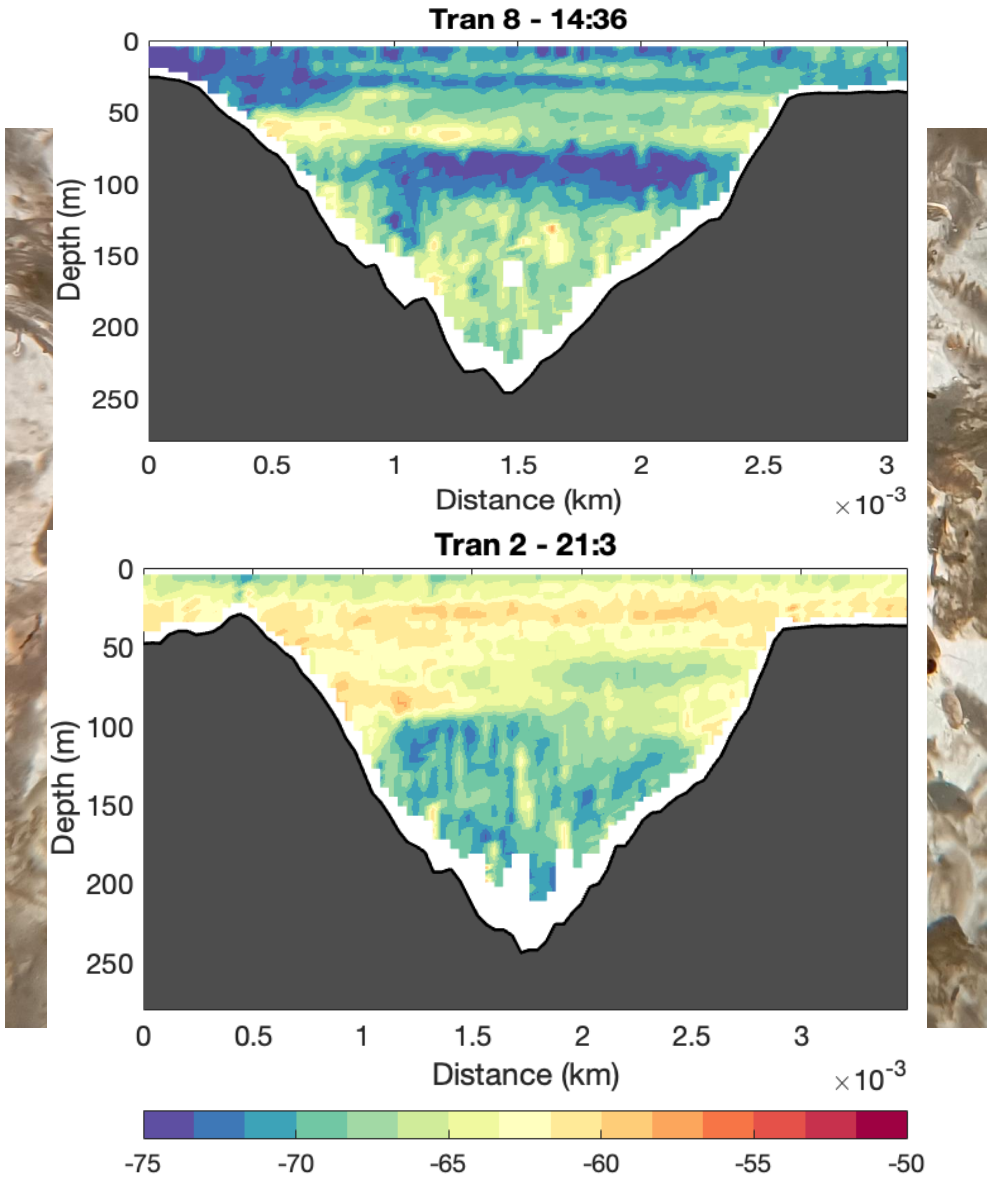
Residual velocities



Zooplankton community

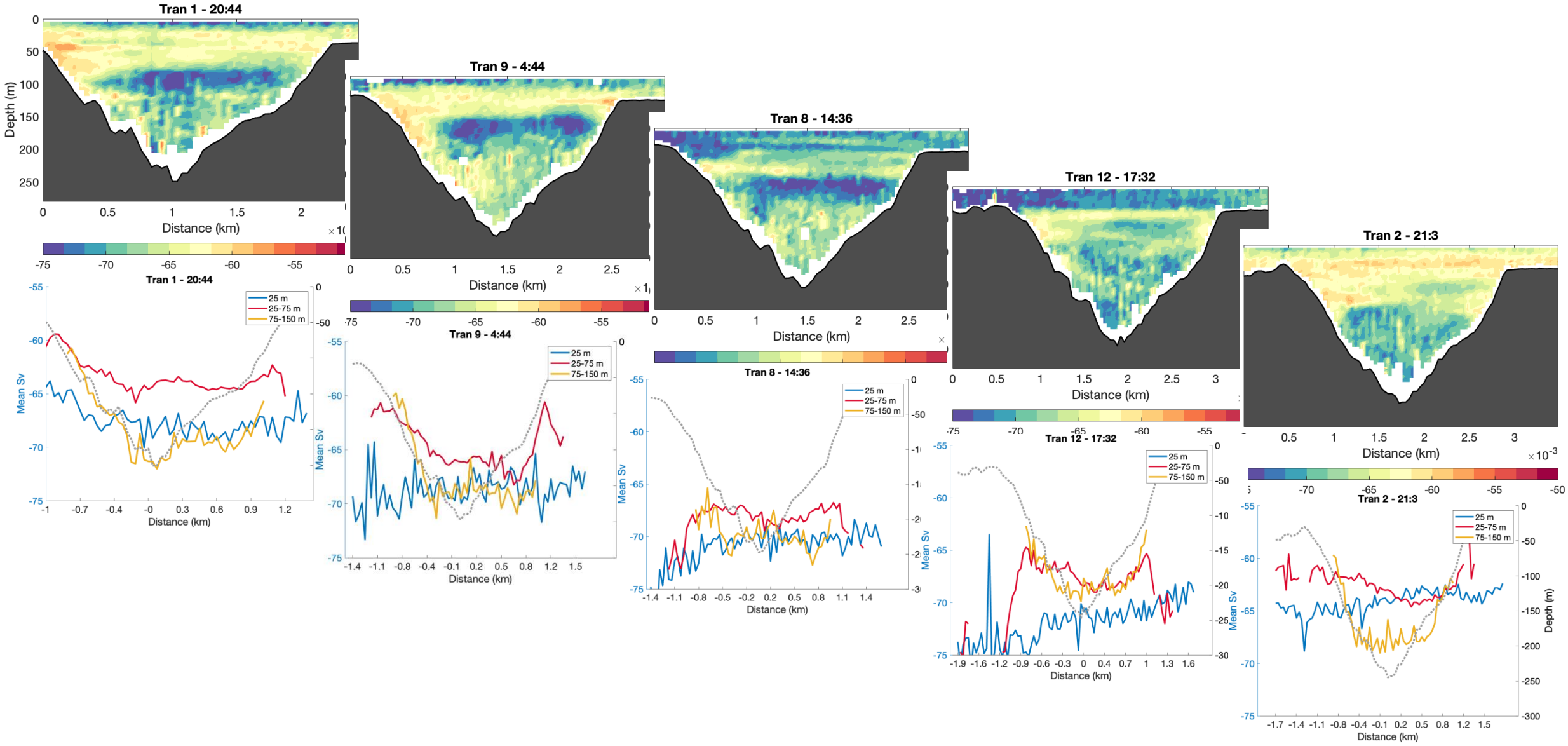
Diel differences attributed to diel vertical migrations





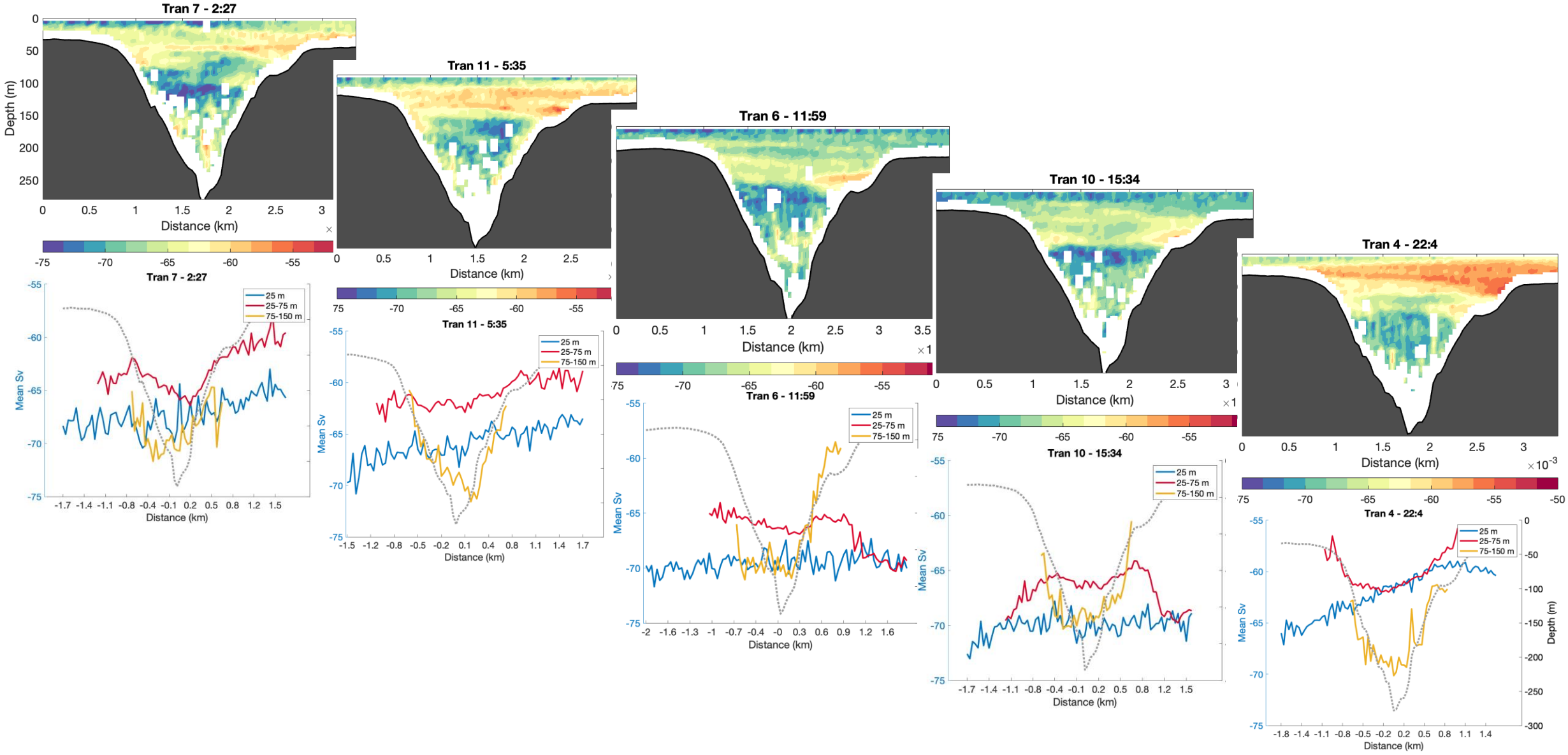
Mean Volume Backscattering Strength (Sv)

Differences between slopes - ET



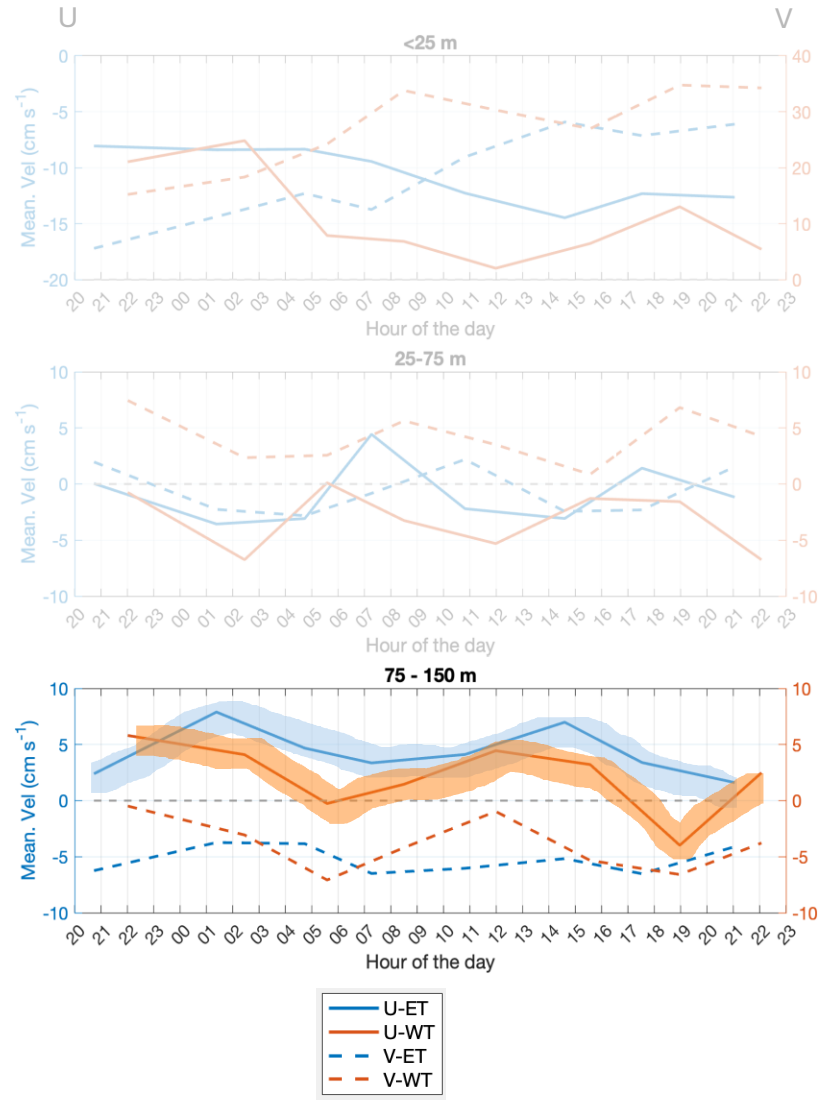
Mean Volume Backscattering Strength (Sv)

Differences between slopes - WT

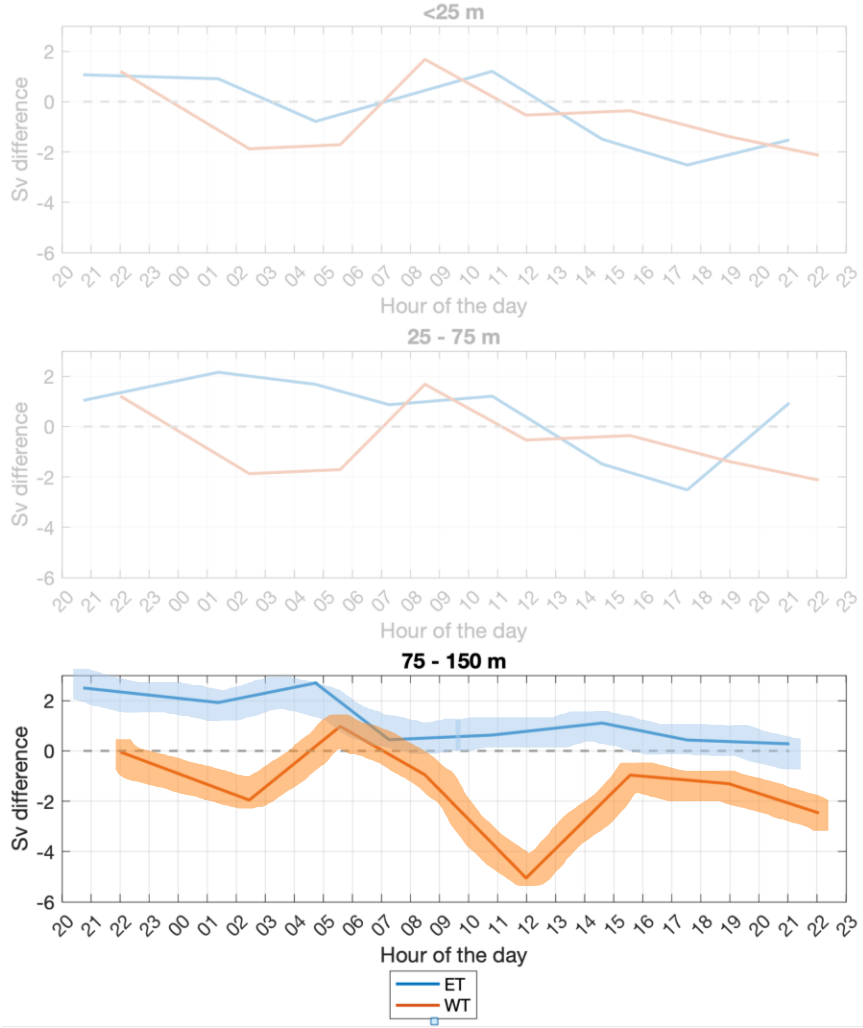


Mean Volume Backscattering Strength (Sv)

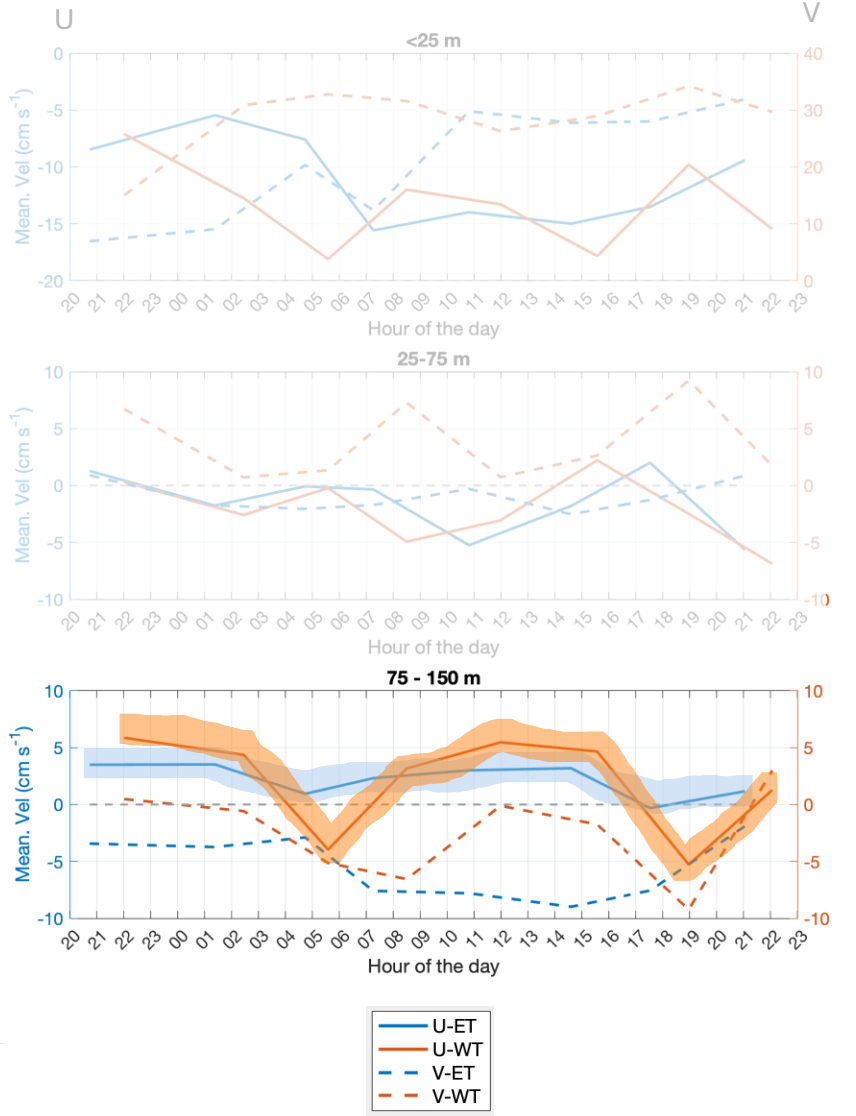
NS Currents



Sv



SS Currents



Positive difference means higher Sv in NS

Conclusions

- Zooplankton aggregated more near the slopes than in the center of the canyon.
- There were differences in zooplankton abundance between the canyon slopes.
- These are probably related to asymetrical currents within the canyon, more analysis are currently being conducted to prove this.
- Slope differences were magnified during the night, probably because zooplankton vertical migration causes higher abundances during that time.

Acknowledgements

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Thank you for your attention.

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