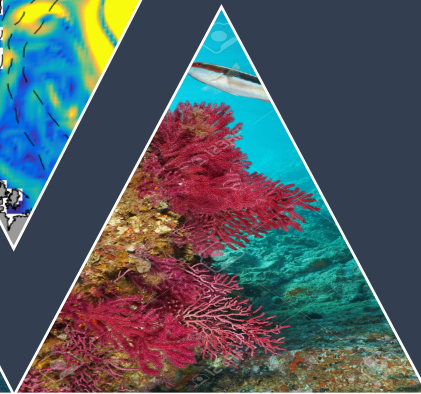
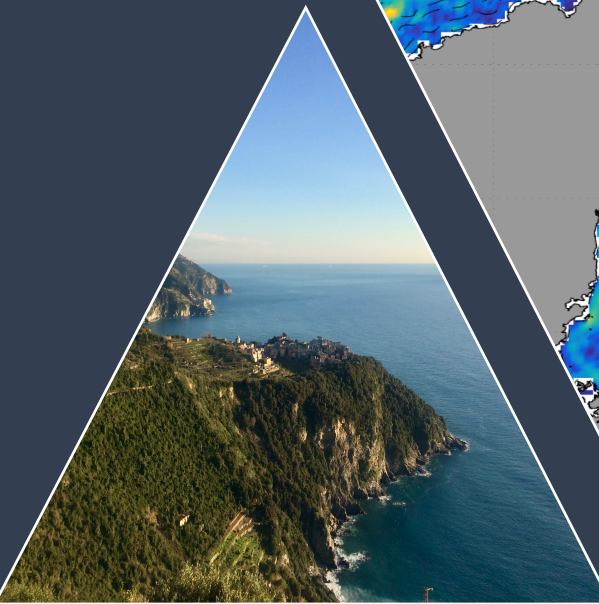


LINKING THE TYRRHENIAN AND LIGURIAN SEAS: current reversal and flow variability within the Corsica channel

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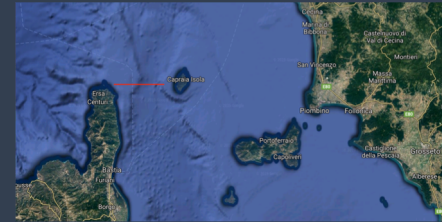
Fondo Europeo di Sviluppo Regionale



UMR 8222 UPMC - CNRS
Benthic Ecogeochemistry

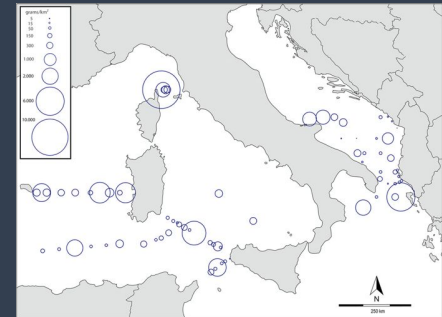


The Tyrrhenian and Ligurian seas are linked through the Corsica Channel, a strait located between the Corsica and Capraia Islands



The dynamics within the Corsica Channel are important for:

- › Deep Water Formation in the Gulf of Lion (Schroeder et al., 2010)
- › biological processes and species distribution (Aliani and Meloni, 1999)
- › dispersal of substances and pollutants (Suaria et al., 2016)



(Suaria et al., 2016)

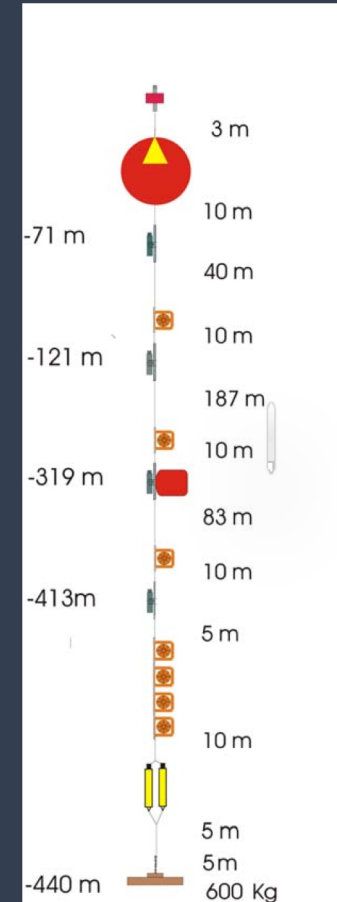
The low-frequency variability of the currents in the Channel is well established in the literature and it is dominated by a seasonal signal (Astraldi and Gasparini, 1992)

The dynamic within the channel have been observationally determined by a single mooring in the deepest part of the Channel (Astraldi and Gasparini, 1990)

The single mooring configuration is unable to explore the across-channel variability of the horizontal currents but it describes their vertical profiles (Vignudelli et al., 2005)

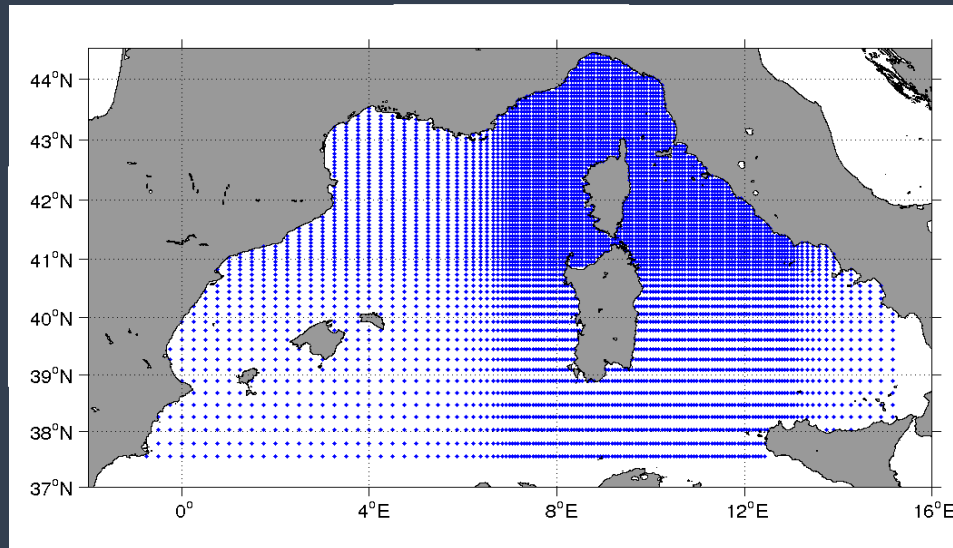
Less attention has been historically put in the high-frequency variability (order of a few days to a week) of the same currents (Manzella, 1985; Vignudelli et al., 1999; Ciuffardi 2016)

Little work has been done in modeling the Corsica Channel at high-resolution



LIME – ROMS Ligurian Integrated Modelling Effort

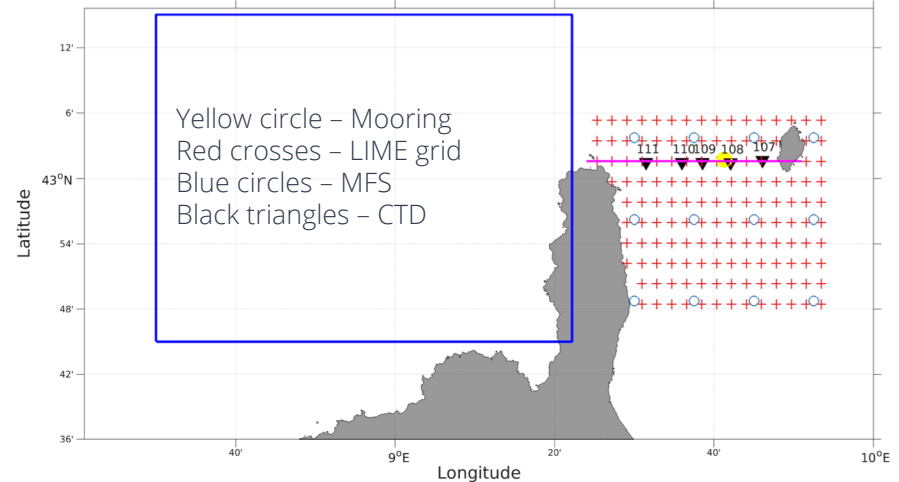
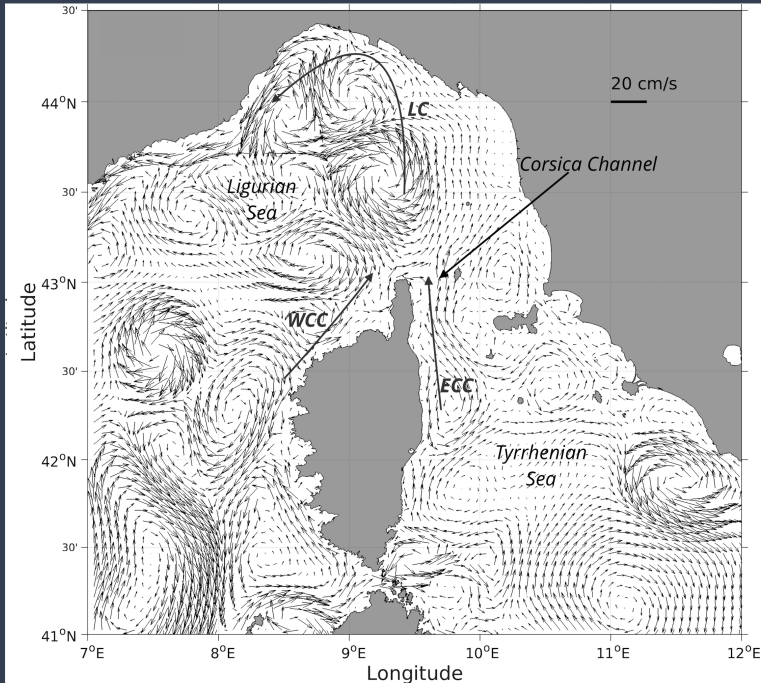
Simulated years	2004-2006
Min Horizontal resolution	$1/16 \times 1/16$ (~ 6 km)
Max Horizontal resolution	$1/64 \times 1/64$ (~1.5 km)
Vertical Coordinates	Sigma (50 levels)
Surface Forcing	ERA-INTERIM (3 hourly)
Boundary Condition	Mediterranean Forecasting System - SYS4a3 product (daily)
Bathymetry	ETOPO1



LIME-ROMS domain

How are the Ligurian and Tyrrhenian basin linked?

Comprehensive joint observational-modeling approach



LC – Ligurian Current
WCC – West Corsica Current
ECC – East Corsica Current

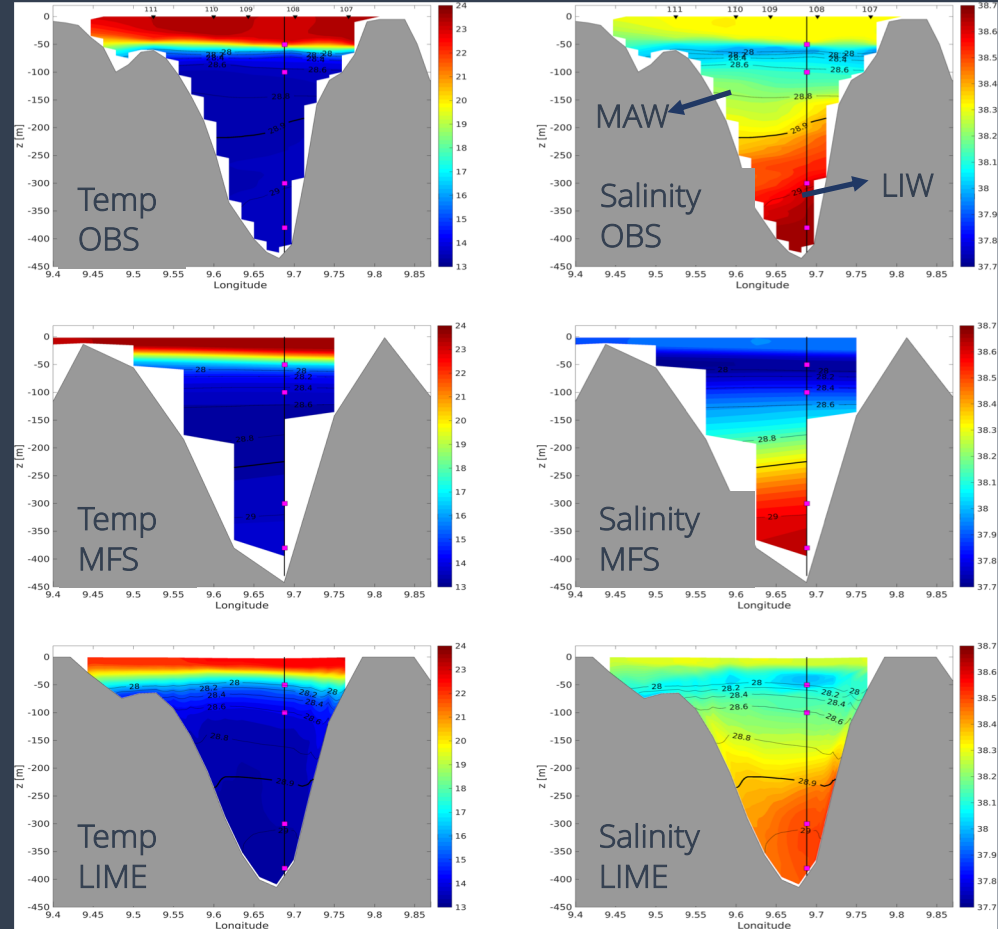
Sciaccia et al. (2019, DSR Part I)

How realistic are the simulated fields within the Corsica Channel?

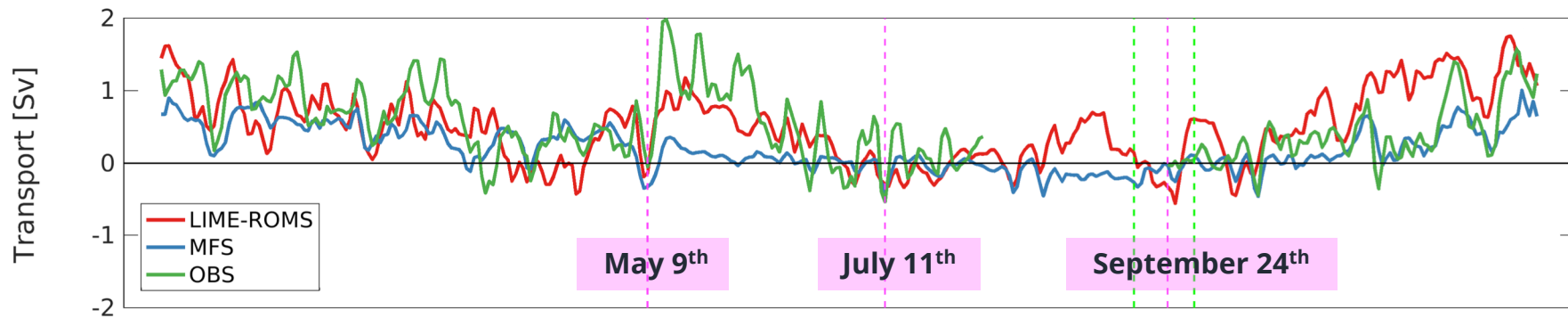
Hydrography of MFS and LIME in line with the observations

MFS Levantine Intermediate Waters more in line with the observations

LIME surface salinity agrees better with the observations compared to MFS



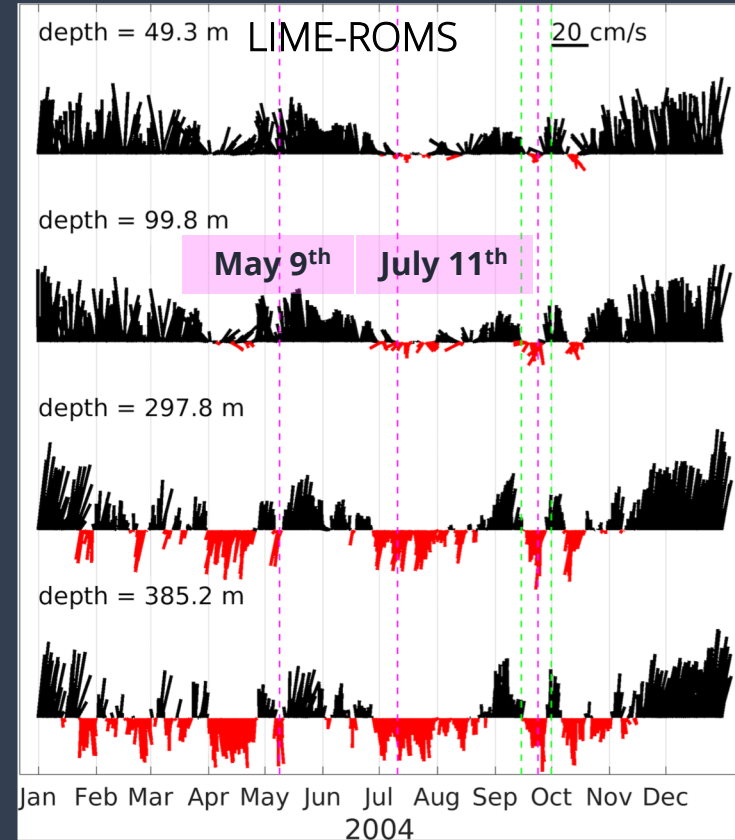
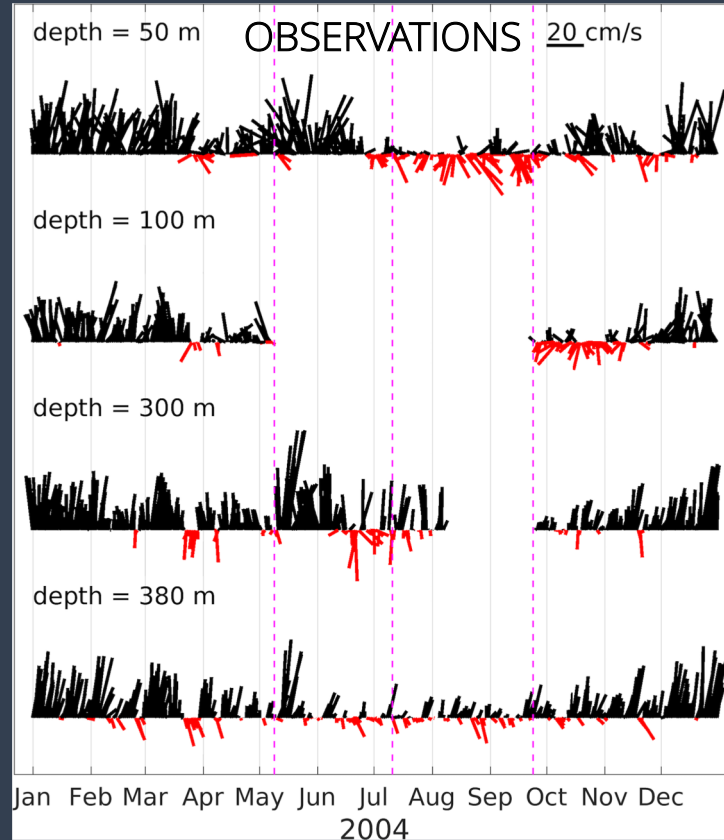
Can the model reproduce the observed seasonal variability in the water mass transport through the Channel?



LIME-ROMS	0.49 ± 0.48 Sv
MFS	0.19 ± 0.30 Sv
OBS	0.54 ± 0.49 Sv

- › Water mass transport similar to the observations
- › Higher variability compared to low resolution models

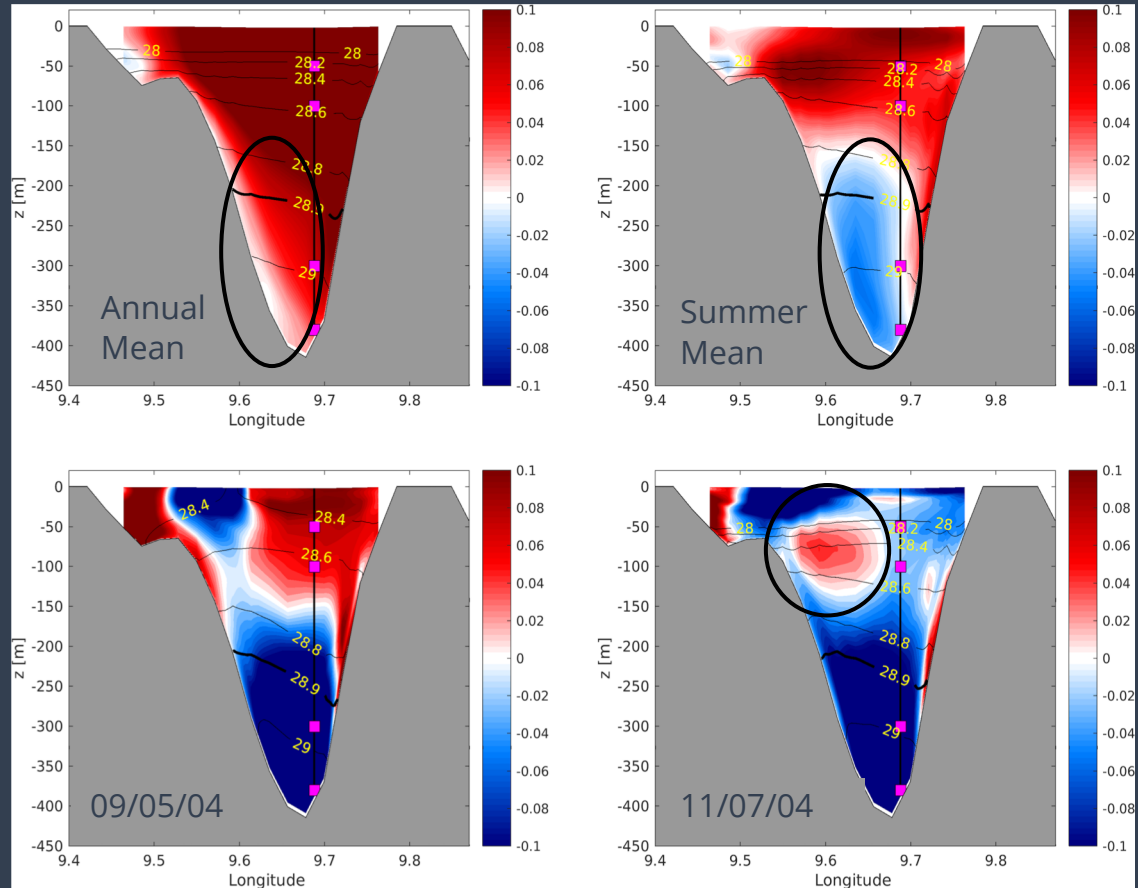
Are Corsica Channel reversals present and important in the model solutions?



Is a single mooring adequate enough to capture the current reversals variability?

Annual meridional velocity averages are northward/positive and almost uniform over the Channel

Seasonally and daily negative meridional velocities are found in some areas

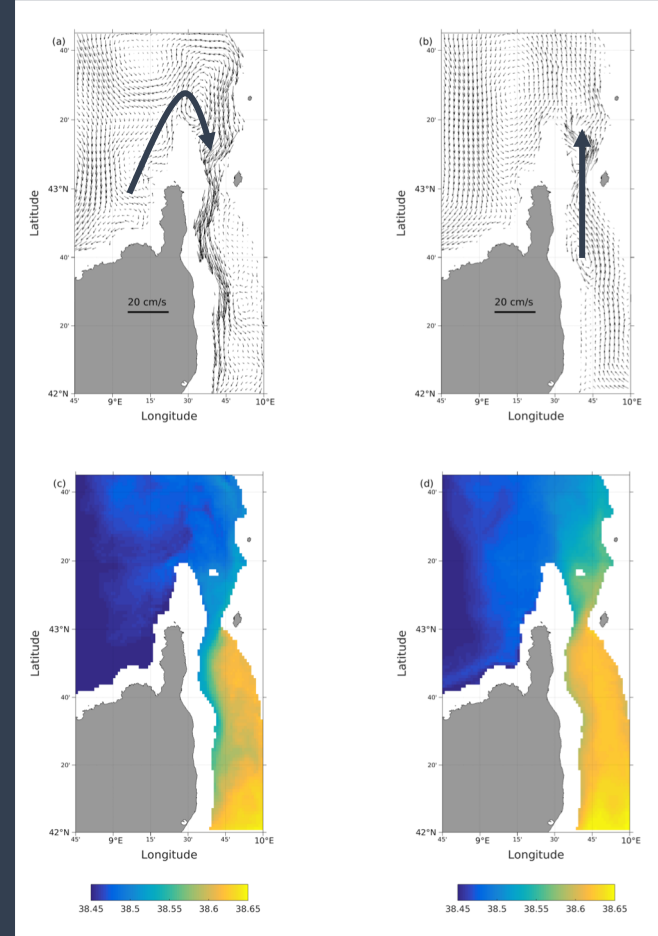


What is the circulation pattern during current reversals?

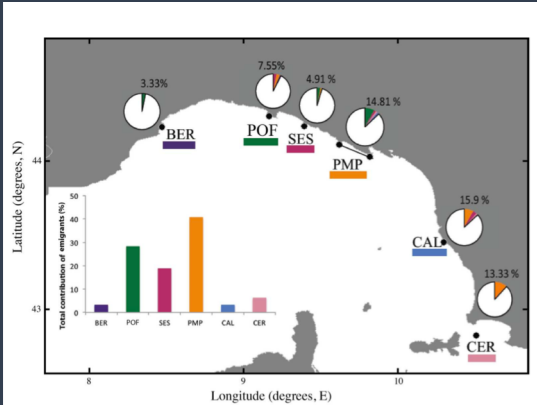
WCC veers right flows into the Channel and keeps moving southward pushing the warmer saltier ECC waters toward the eastern flank of the Channel

The meridional flow is characterized by colder and fresher Atlantic Waters brought by the WCC

These intrusions have been observed by Stocchino and Testoni (1966) and have so far been neglected



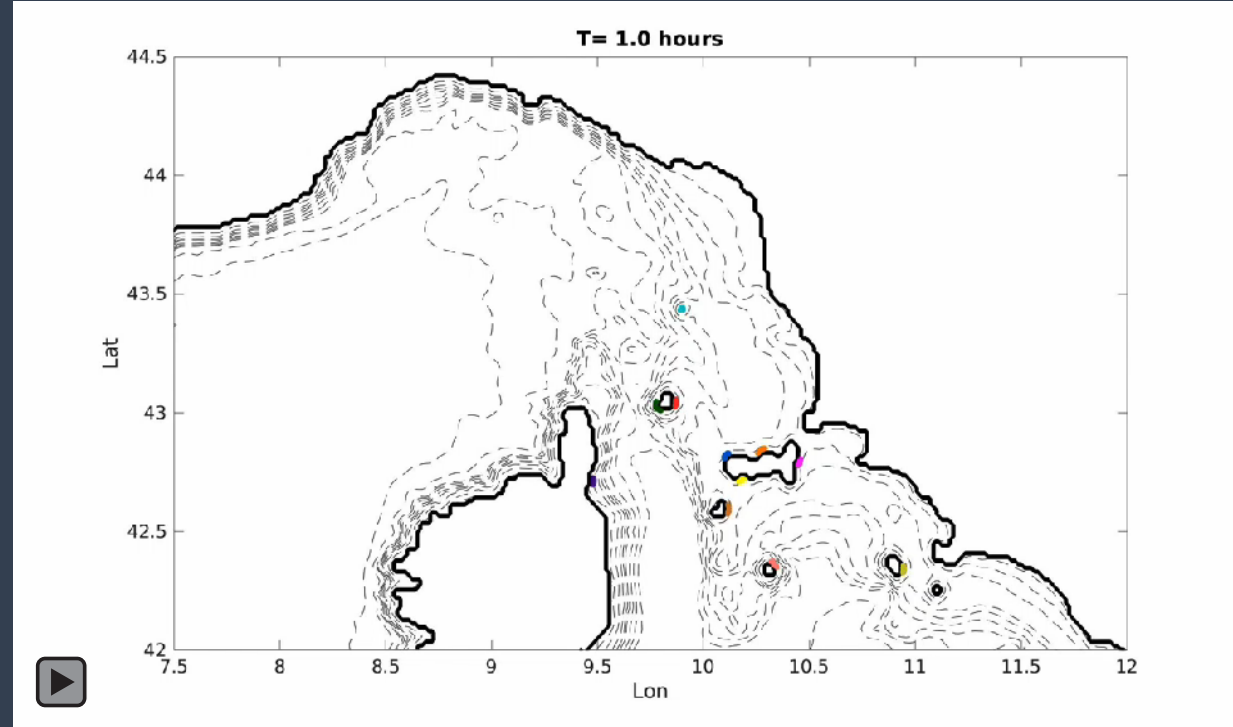
Larval flow among red gorgonian populations



Padron et al., 2018

Lagrangian model	LTRANS
# of particles	163680
Simulated months	June-September 2004 2006
Larval behavior	Passive/Sinking

Sciascia et al., in preparation



The larval flow and the connectivity between populations suggests trans-border conservation practices

Conclusions

We explored the link between the Ligurian and Tyrrhenian seas

the Corsica channel is characterized by a **high-frequency variability** associated with **current reversal** within the channel

current reversals are more **frequent** near the **western flank** and in **summer and early fall**

the reversals start from the tip of the Corsica Island and are due to **WCC intrusions** into the Channel.

The link between the two basins favors the connectivity between red gorgonian populations and suggest **trans-border conservation practices**

The background of the slide is a wide-angle aerial photograph of a coastal town, likely Cinque Terre in Italy. The town is built on a steep, green cliffside that drops down to a rocky shore. The sea is a deep blue, and the sky is clear and bright. The text 'Thank you' is overlaid on the right side of the image.

Thank you