20 years of monitoring the Brazil Current along the NOAA-AX97 High-Density XBT line: in situ observations and Ocean Forecasting and Analysis Systems (OFAS) assessment

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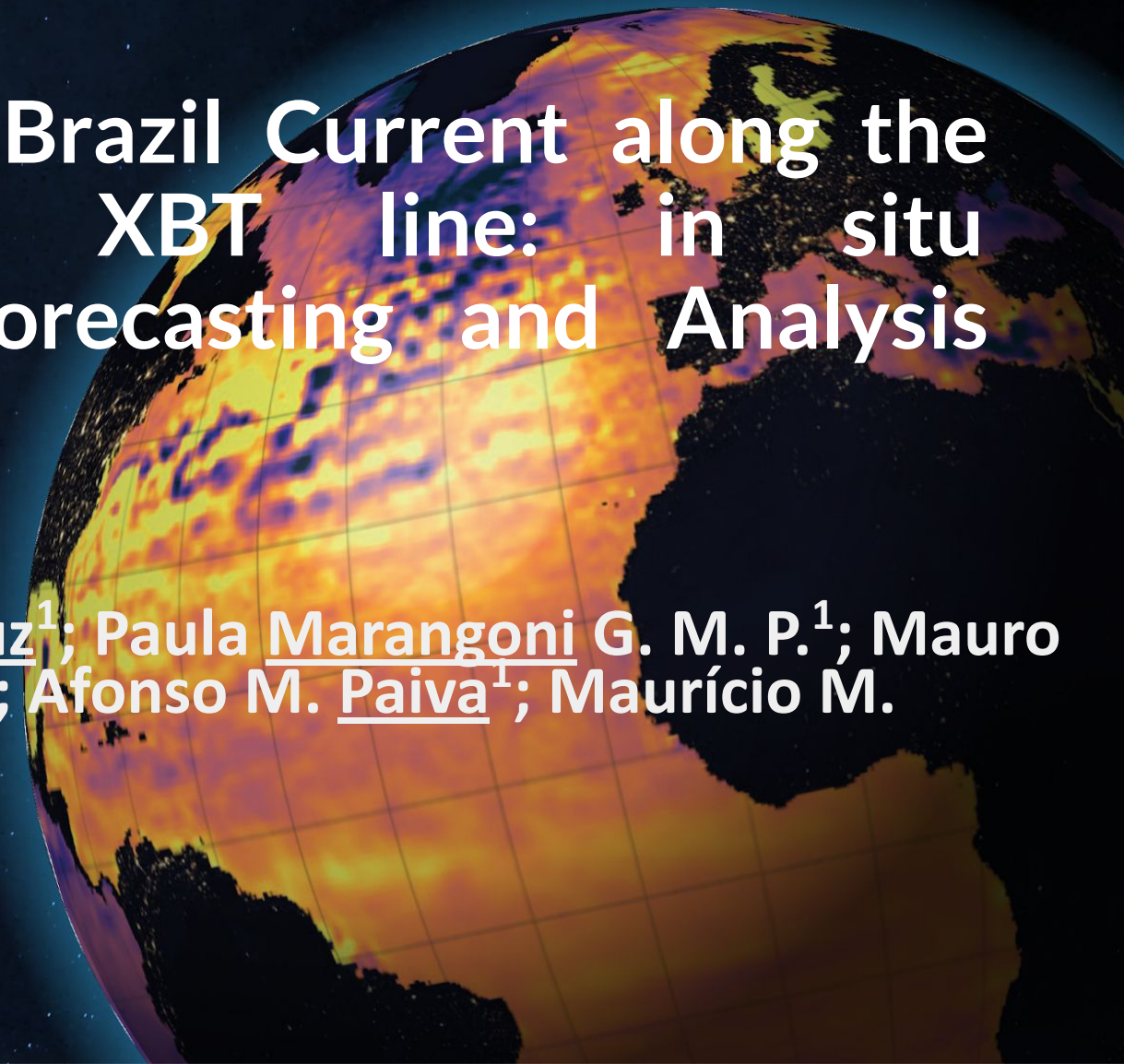
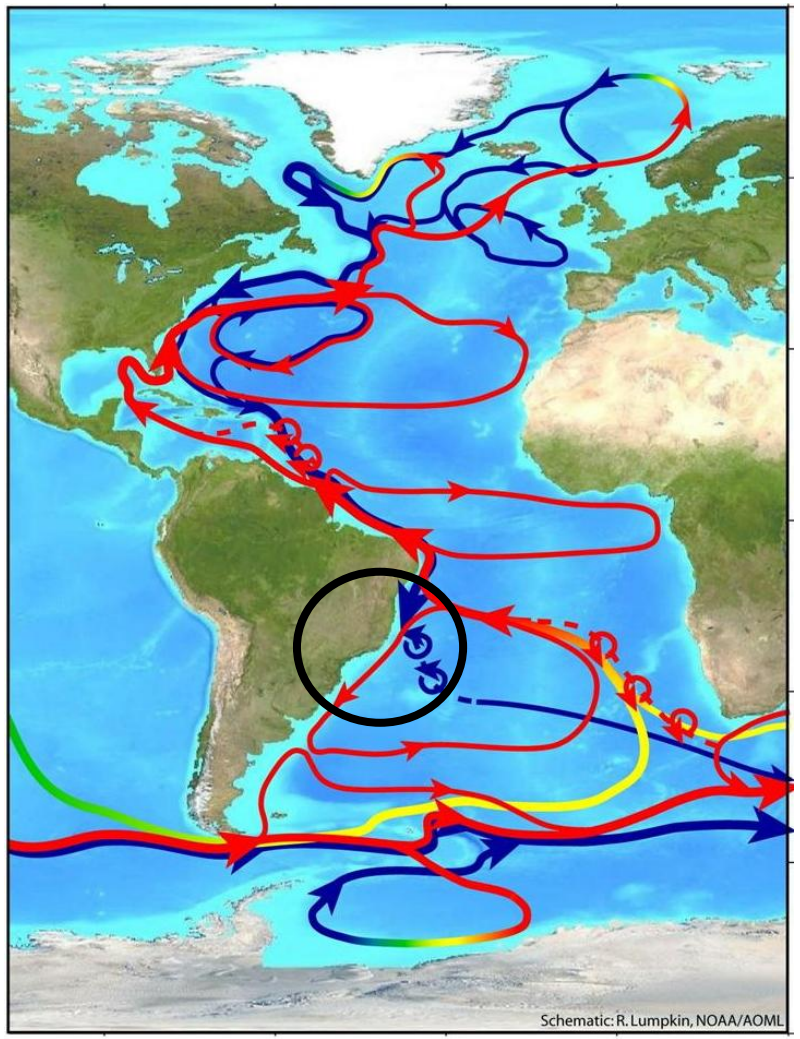


Brazil Current System

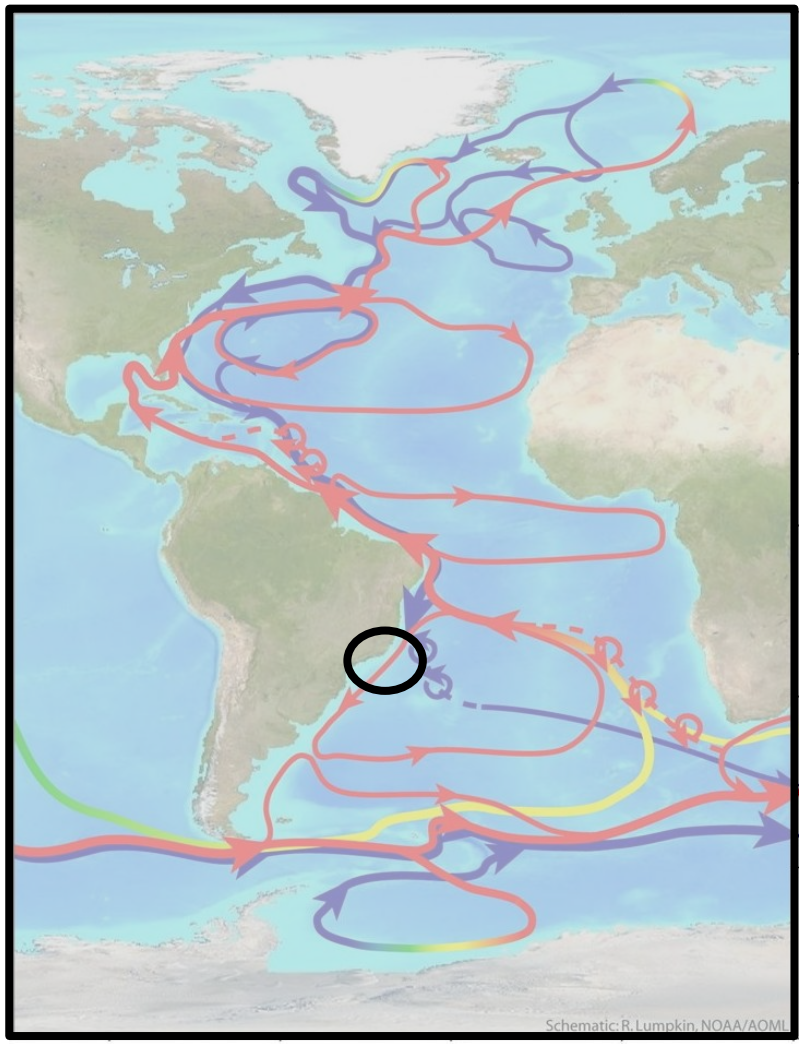


Source: BIO, 2015.

- Brazil Current & Intermediate WB Current
  - **BC-IWBC system**
    - **0-500 m**
    - **500-1200 m**

- Meandering of Brazil Current, eddy formation, eventual ring detachment

Brazil Current System



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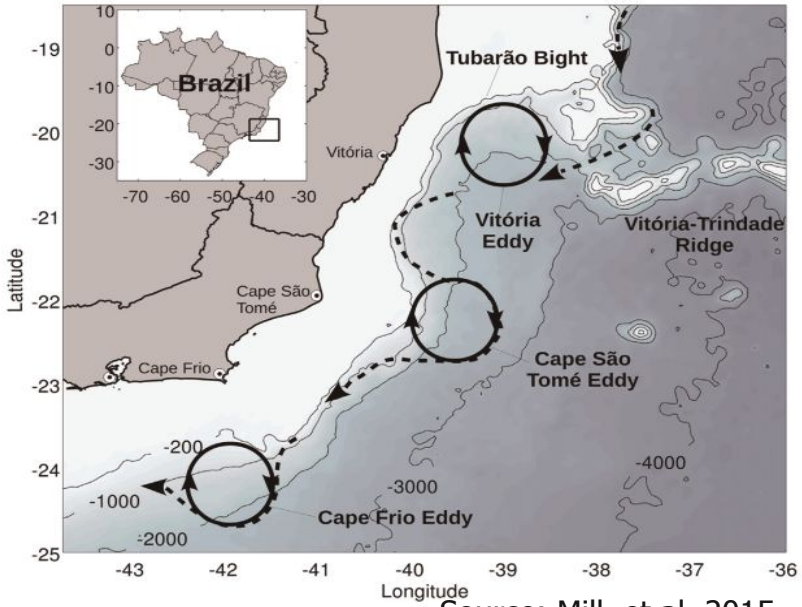
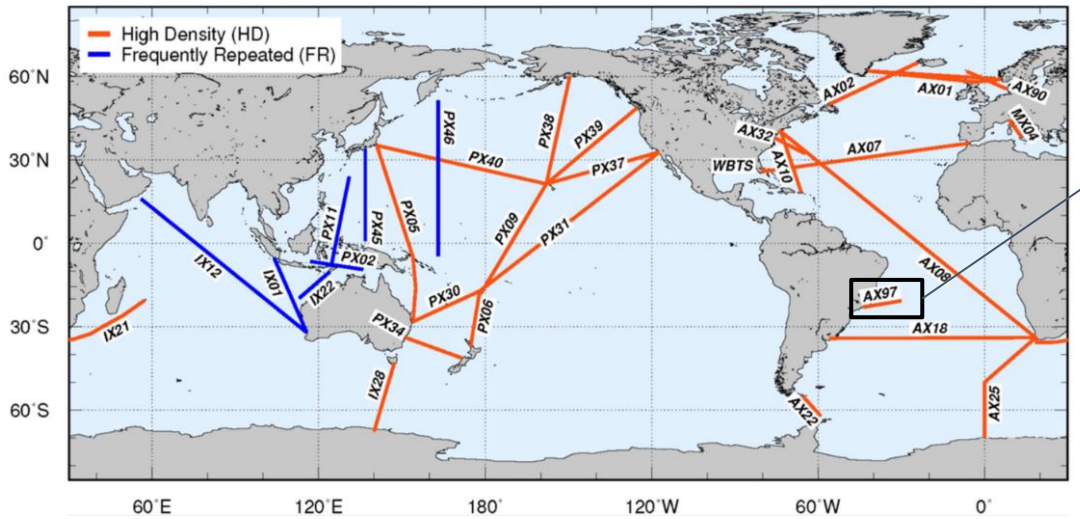


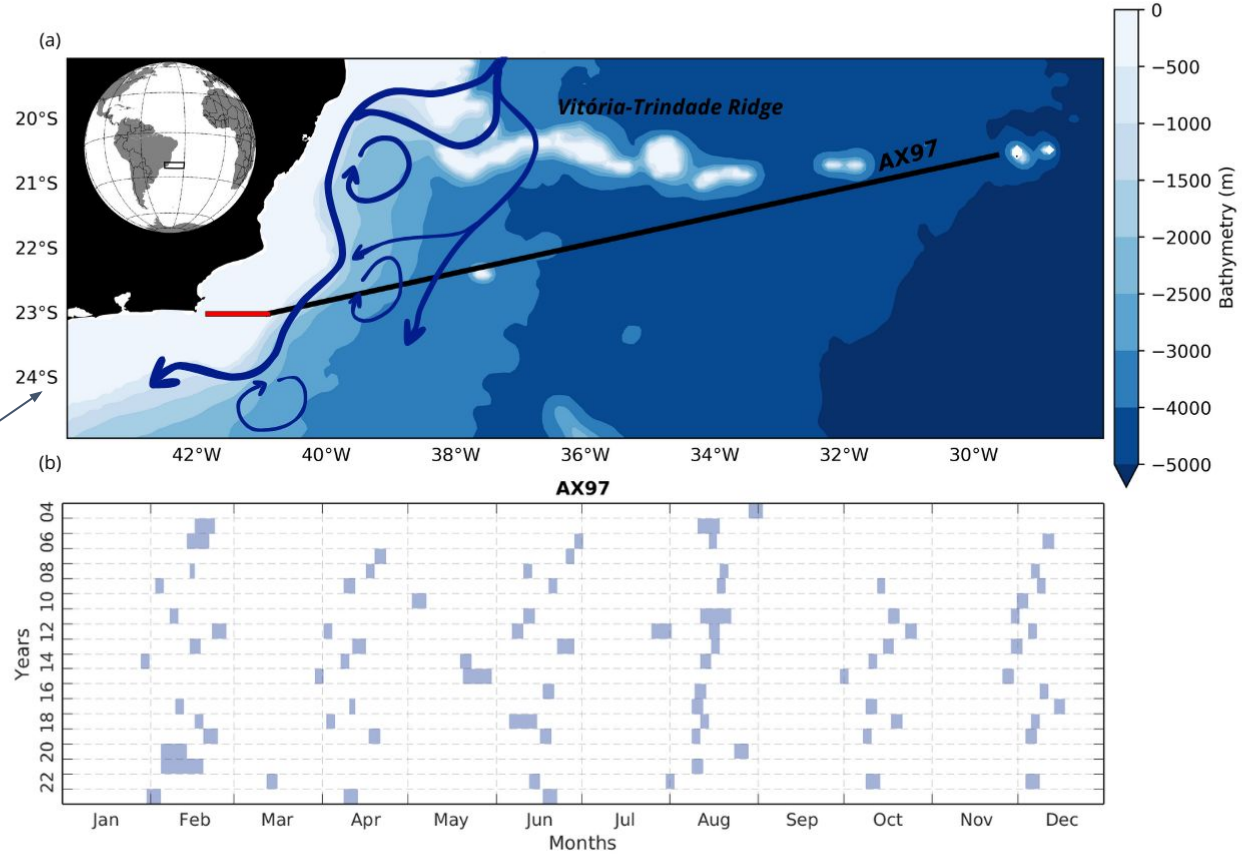
Source: Mill, et al. 2015.

The NOAA-AX97

- It is the longest continuous monitoring program of the Brazil Current, with data being successfully collected along the NOAA AX97 high density (10-15 nm) XBT transect since 2004

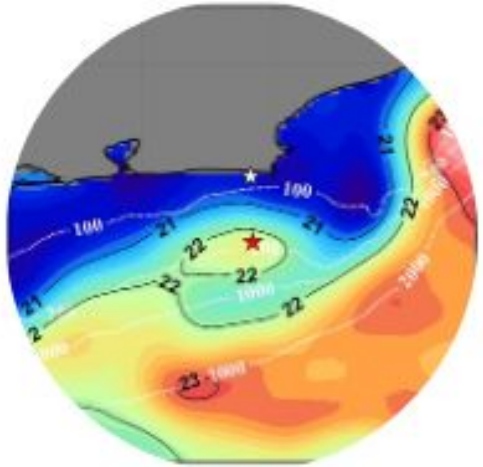
- Bimonthly sample
- Opportunity Brazilian navy ships



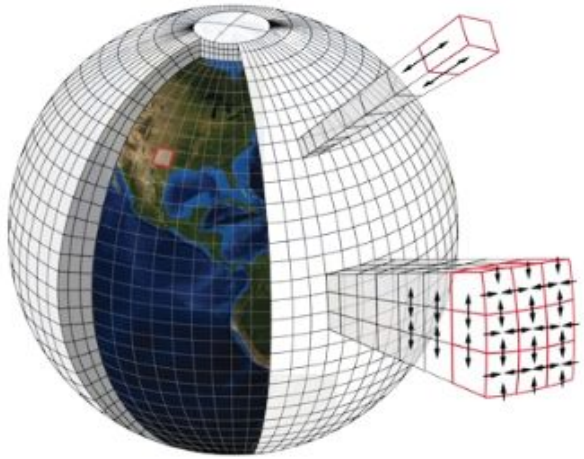


Source: Ferreira et al 2024 (in revision)

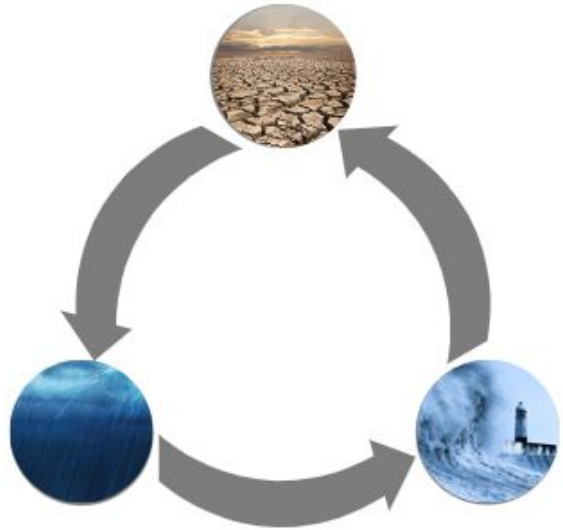
Where the NOAA AX97 data is used?



Brazil Current Variability and Processes



Data assimilation schemes by forecasting centers



Global oceanographic datasets, being used for various quantifications (e.g. ocean heat content)

- **Evaluation of Ocean Forecast and Analysis and Systems (high spatial resolution)** and Earth System Models (lower spatial resolution/climate scale - IPCC)

OFAS Assessment

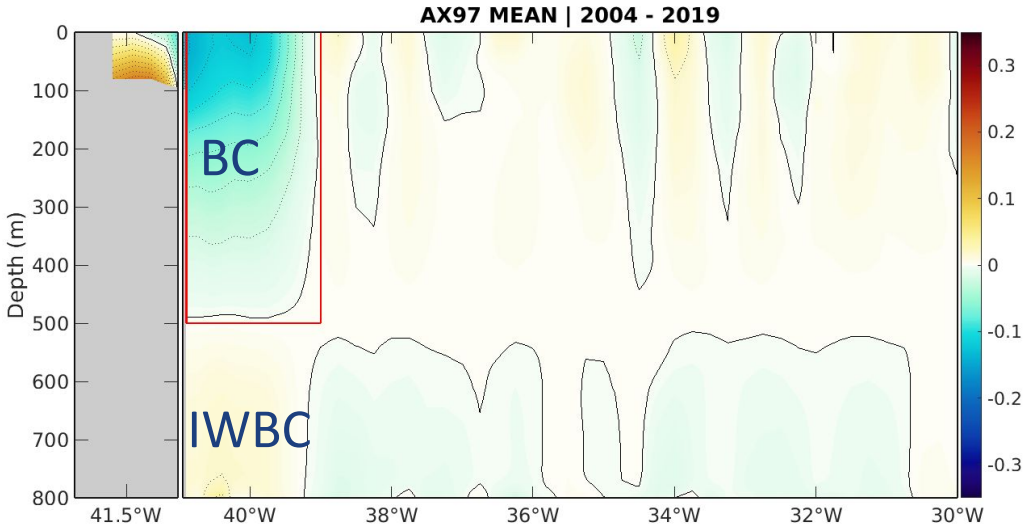
OFAS	GOFS3.1	GLORYS12v1C	BRAN2020	GLORYS2v4	ORAS5	C-GLORSv5
Origin	HYCOM/NCODA	Mercator Ocean	CSIRO	Mercator Ocean	ECMWF	CMCC
Vertical Resolution	41 levels	50 levels	50 levels	75 levels	75 levels	75 levels
Horizontal Resolution	1/12.5°	1/12°	1/10°	1/4°	1/4°	1/4°
Temporal Resolution	daily	daily	daily	daily	daily	daily
Availability	1994 to 2022*	1993 to 2024	1993 to 2023	1993 to 2022	1993 to 2022	1993 to 2022

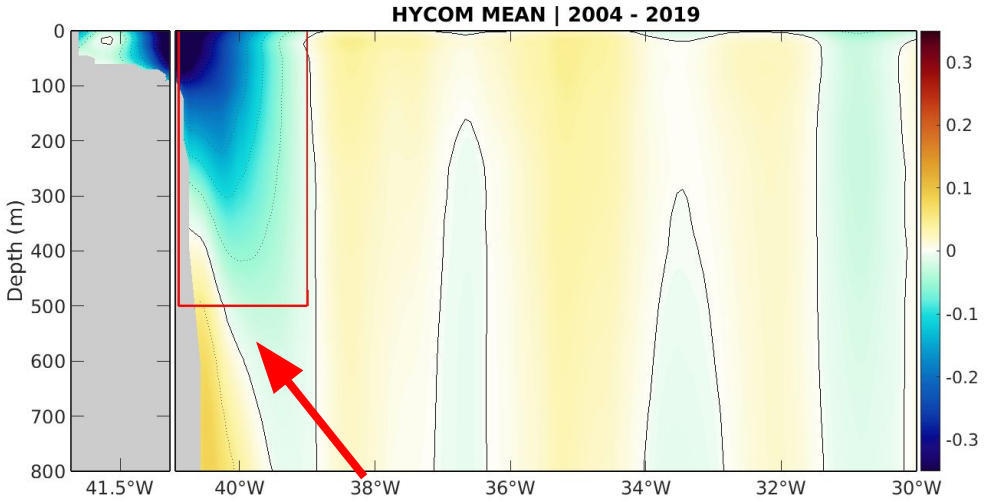
Higher Resolution

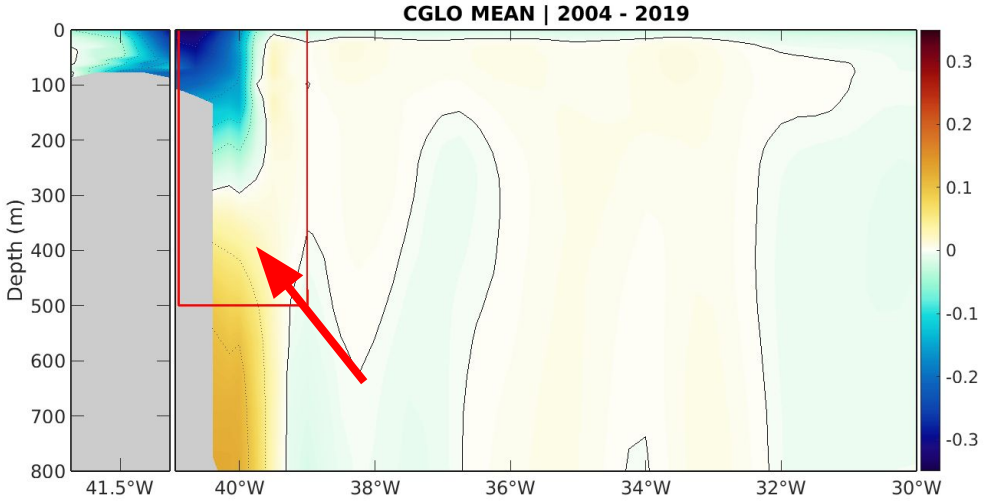
Lower Resolution

Methods

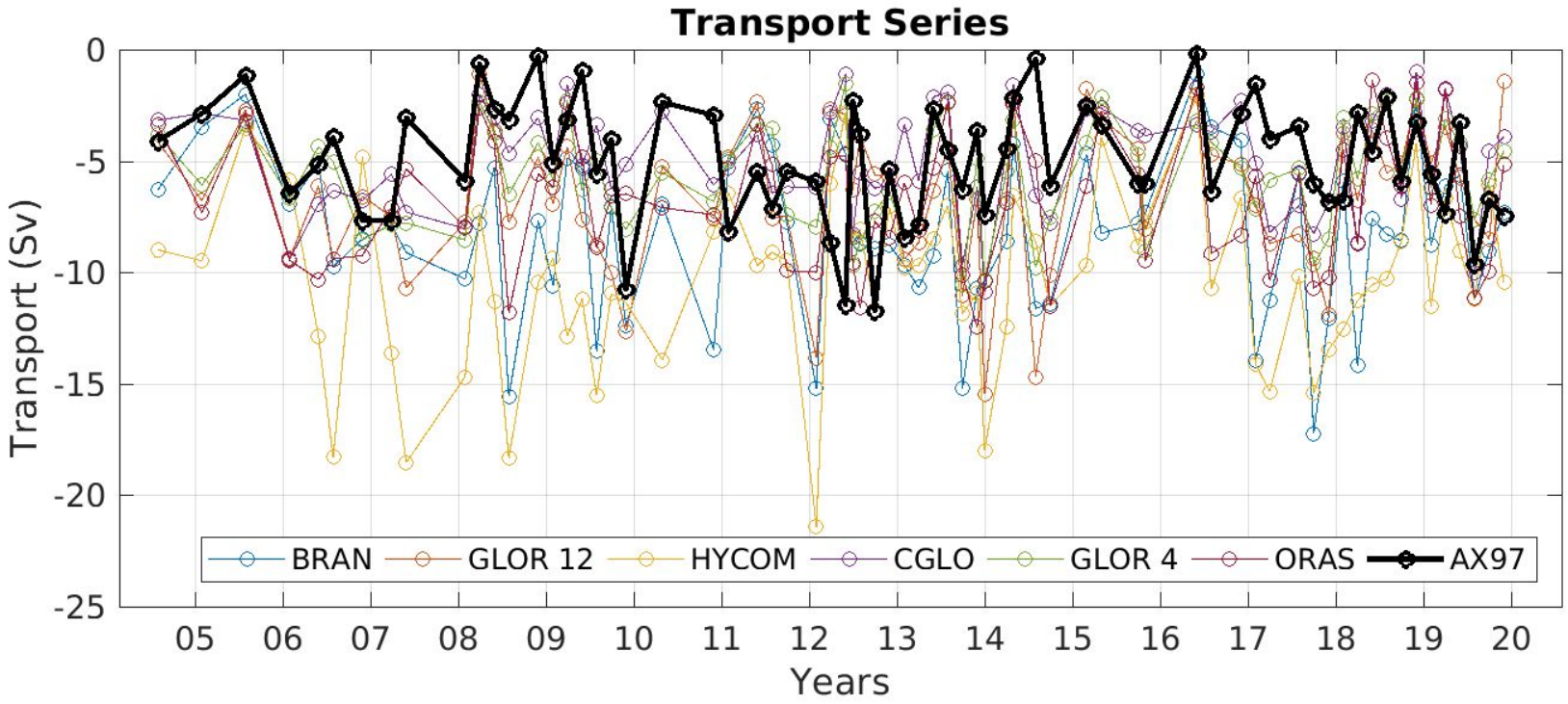
- 68 cruises (2004-2019)
  - Volume transport Limits
    - 41°W - 39°W
    - 0 -500 meters

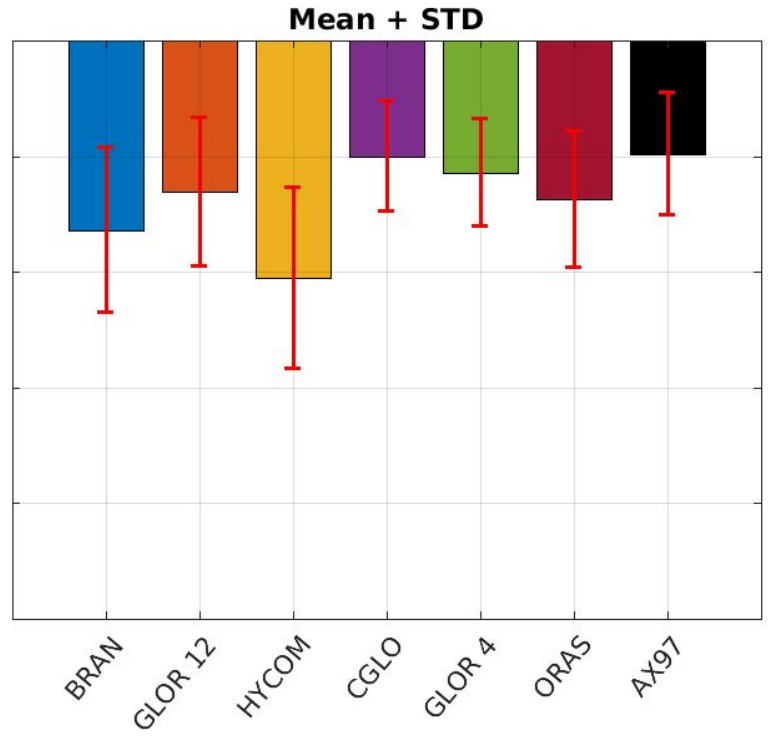






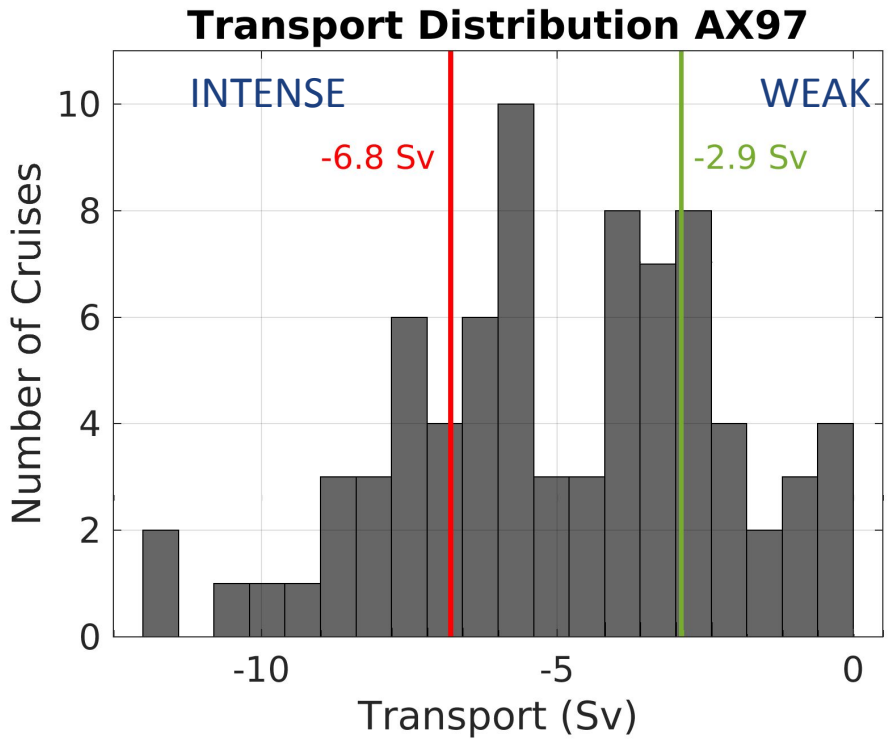
Transport - OFAS x AX97

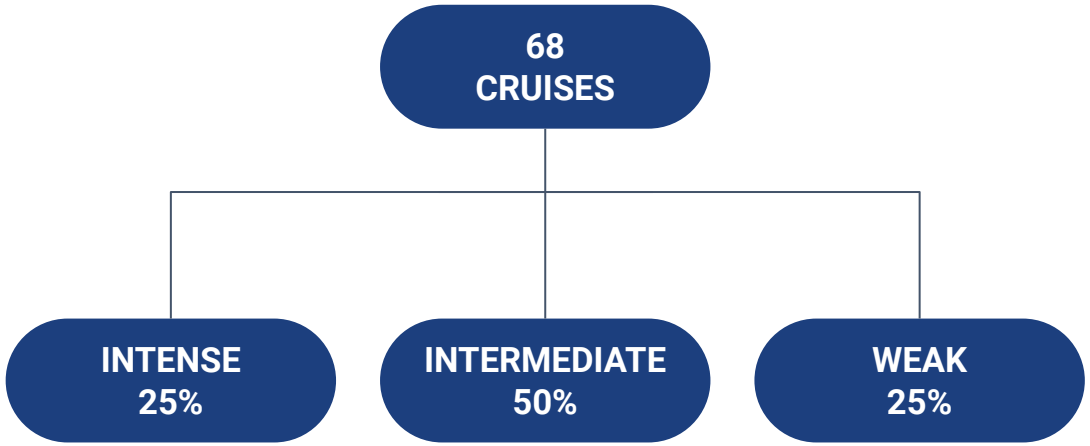




Methods

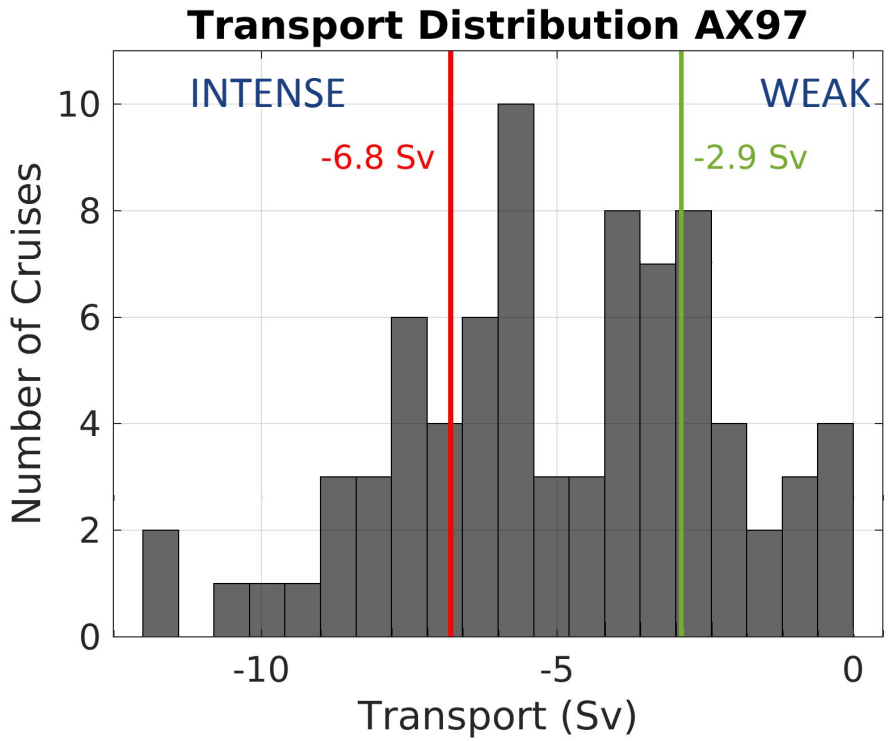
- The definition of BC events
  - Based on Lima et al (2016)

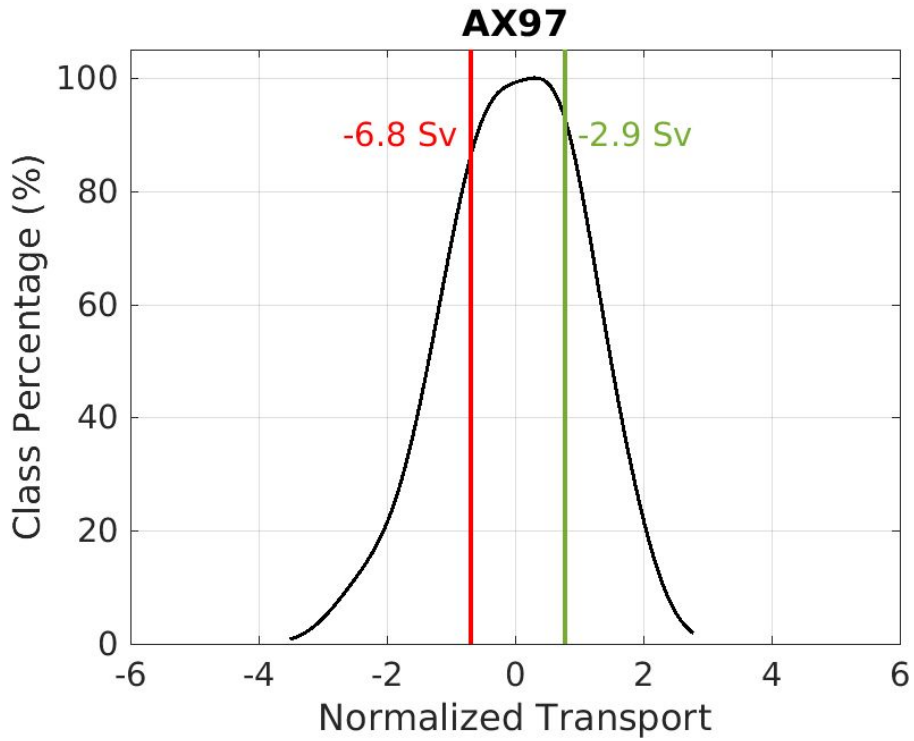




Events

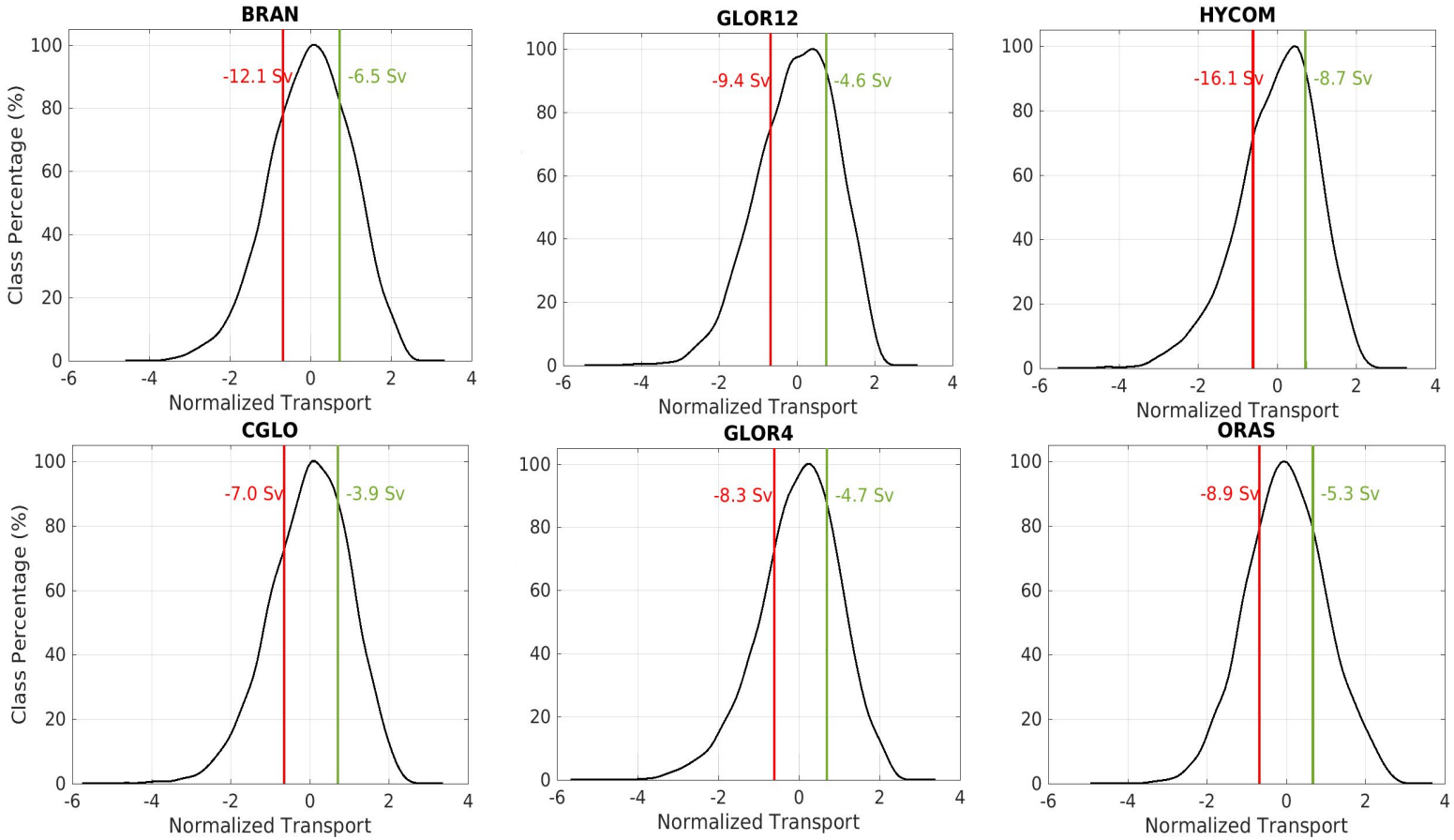
- Normalization - AX97





Events

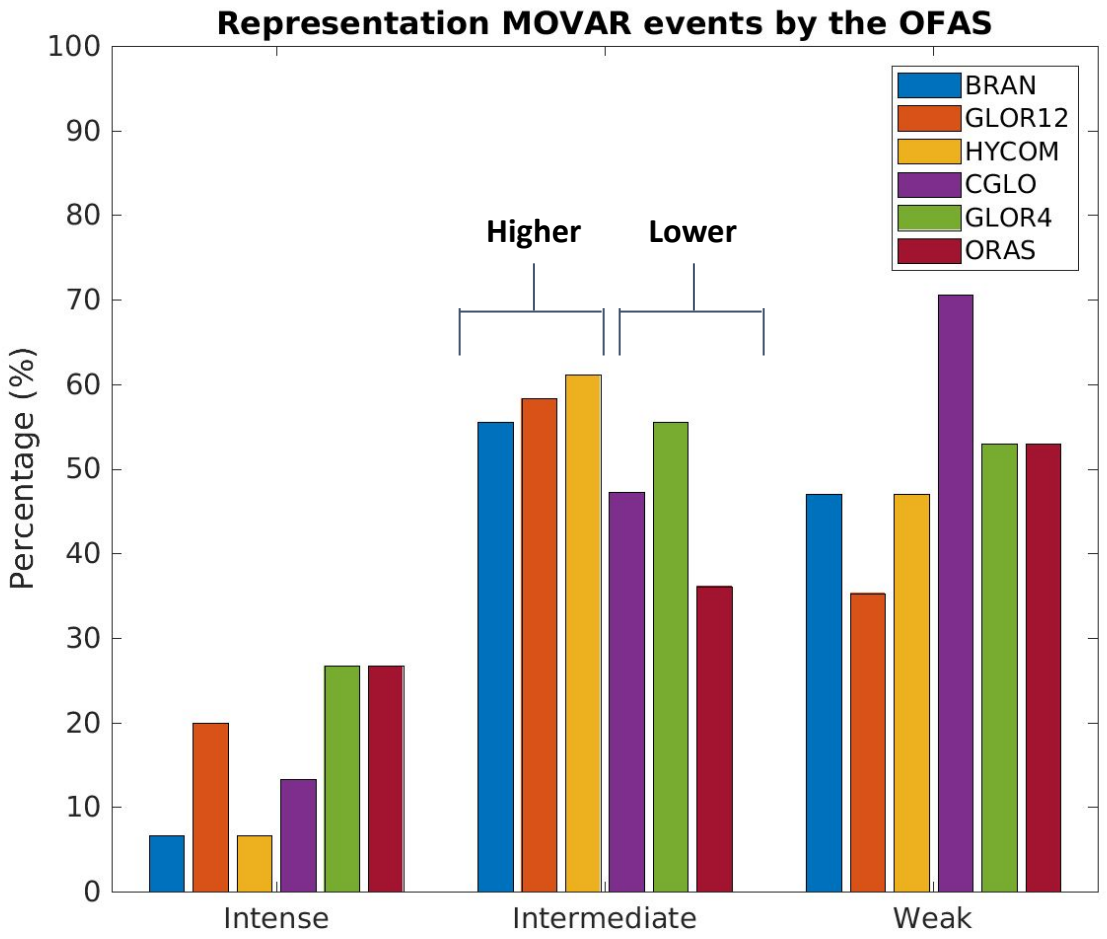
- OFAS

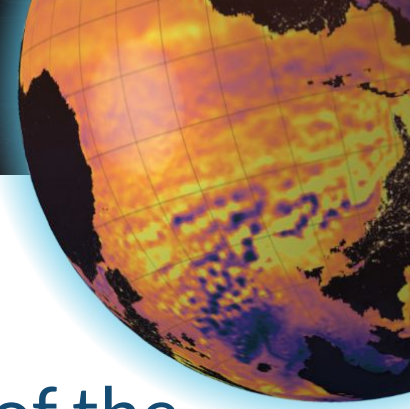


OFAS	Intense	Weak
BRAN	-12.1 Sv	-6.4 Sv
GLORYS12	-9.4 Sv	-4.6 Sv
HYCOM	-16.0 Sv	-8.6 Sv
C-GLO	-7.0 Sv	-3.8 Sv
GLORYS4	-8.2 Sv	-4.6 Sv
ORAS	-8.9 Sv	-5.3 Sv
AX97	-6.8 Sv	-2.9 Sv

How well OFAS represent the events

- OFAS
  - Better representation of **weak** and **intermediate** events
    - Lower resolution (three lower bars) perform better in weak events
    - Higher resolution (three upper bars) perform better in intermediate events
  - **Pour representation of intense events (<30%)**
  - GLOR4 best represents BC



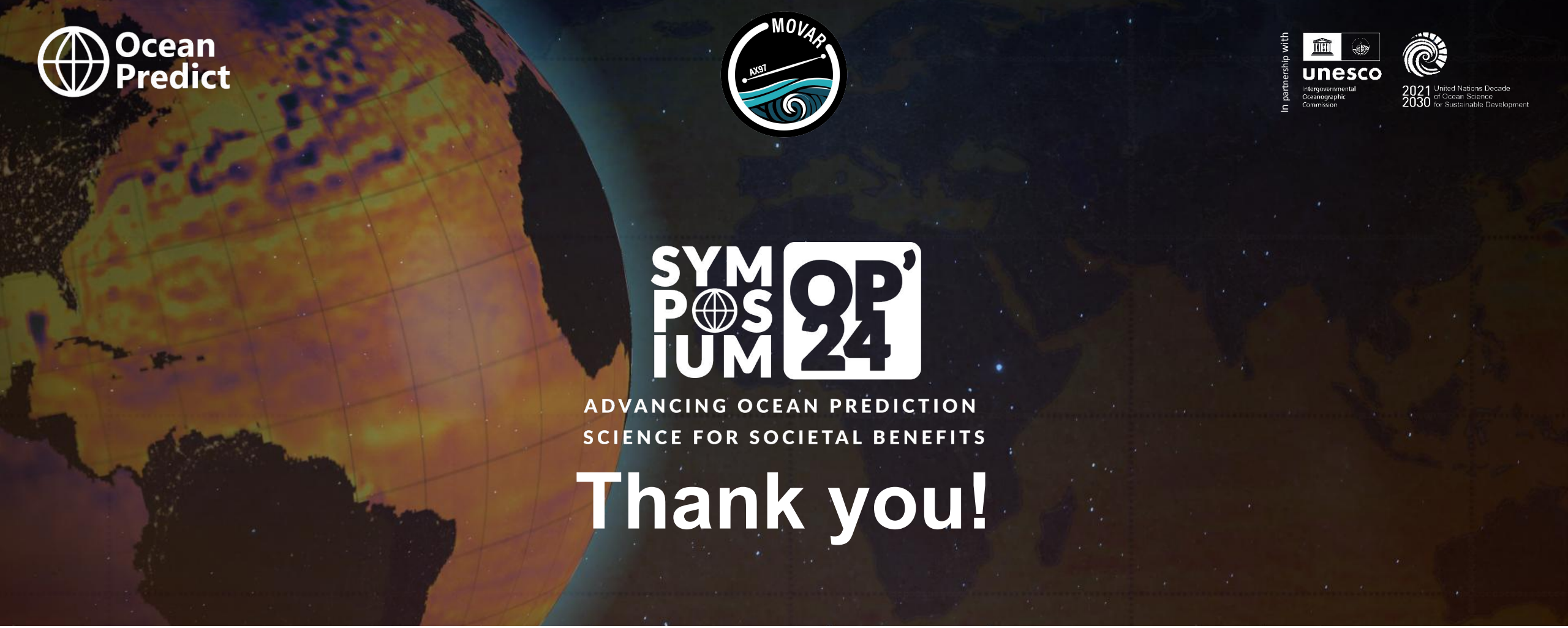


Conclusions

- OFAS present a higher mean transport and similar variability of the BC when compared with the observations
  - Higher resolution systems overestimate more the BC transport
- Different representation of vertical structure of the BC/IWBC system
  - BC/IWBC shallower/deeper than AX97
- Among all system Glorys appears to be the OFAS that best represented the conditions at both higher and lower resolutions.

Future Perspectives

- Start launching XBT at the continental shelf - to improve BC transport estimate
- Evaluate the role of seasonality, interannual variability and mesoscale activity
- Extend analysis to the near present - depending of model availability



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