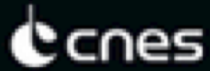


Ocean Surface Topography Science Team Meeting (OSTST)

19-23 October, 2020

Virtual meeting



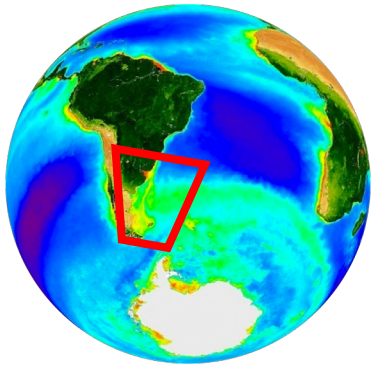
Anatomy of subinertial waves along the Patagonian shelf break in a $1/12^\circ$ global operational model.

Poli L., C. Artana, C. Provost, J. Sirven,
N. Sennéchal, Y. Cuypers, J-M. Lellouche



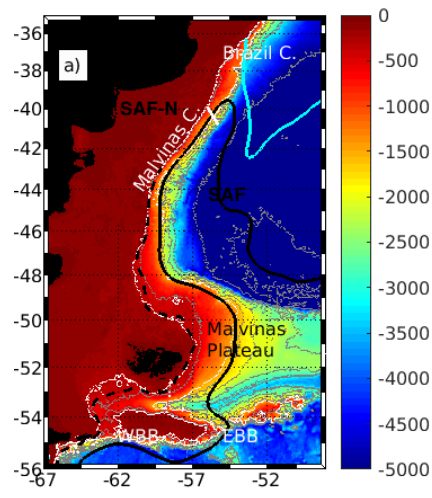
The Patagonian Platform :

A high primary productivity region



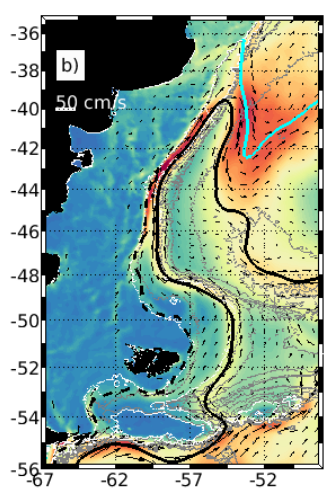
- The Malvinas Current comprises 2 main jets (dashed and full isolines in fig a –d).
- It carries nutrient-rich subantarctic waters that play a key role in the development of massive phytoplankton blooms over the continental platform (fig d).
- Shelf-break trapped waves have been proposed as a mechanism that could enhance upwelling at the shelf break and contribute to nutrient fluxes.

Bathymetry (in m)



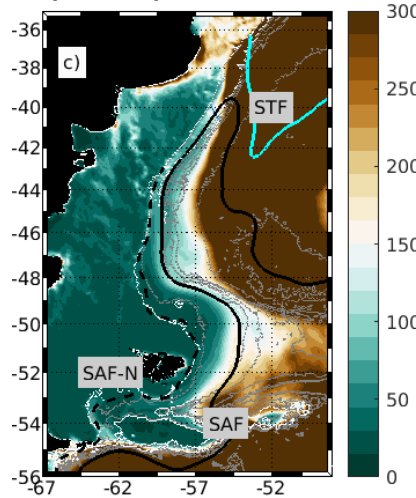
IBCAO

25-year mean surface velocity intensity (cm/s)



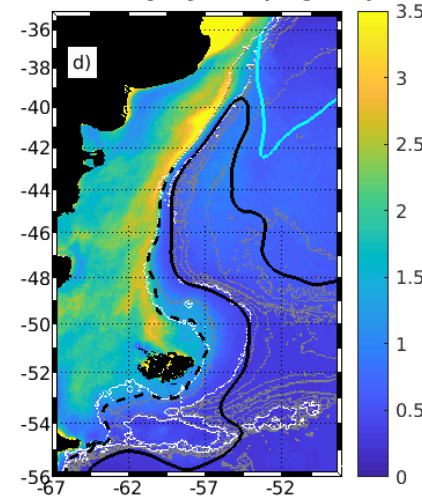
GLORYS12

25-year mean EKE (cm²/s²)



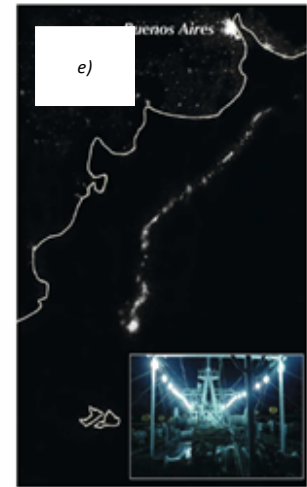
GLORYS12

Mean surface chlorophyll-a (mg/m³)



MODIS

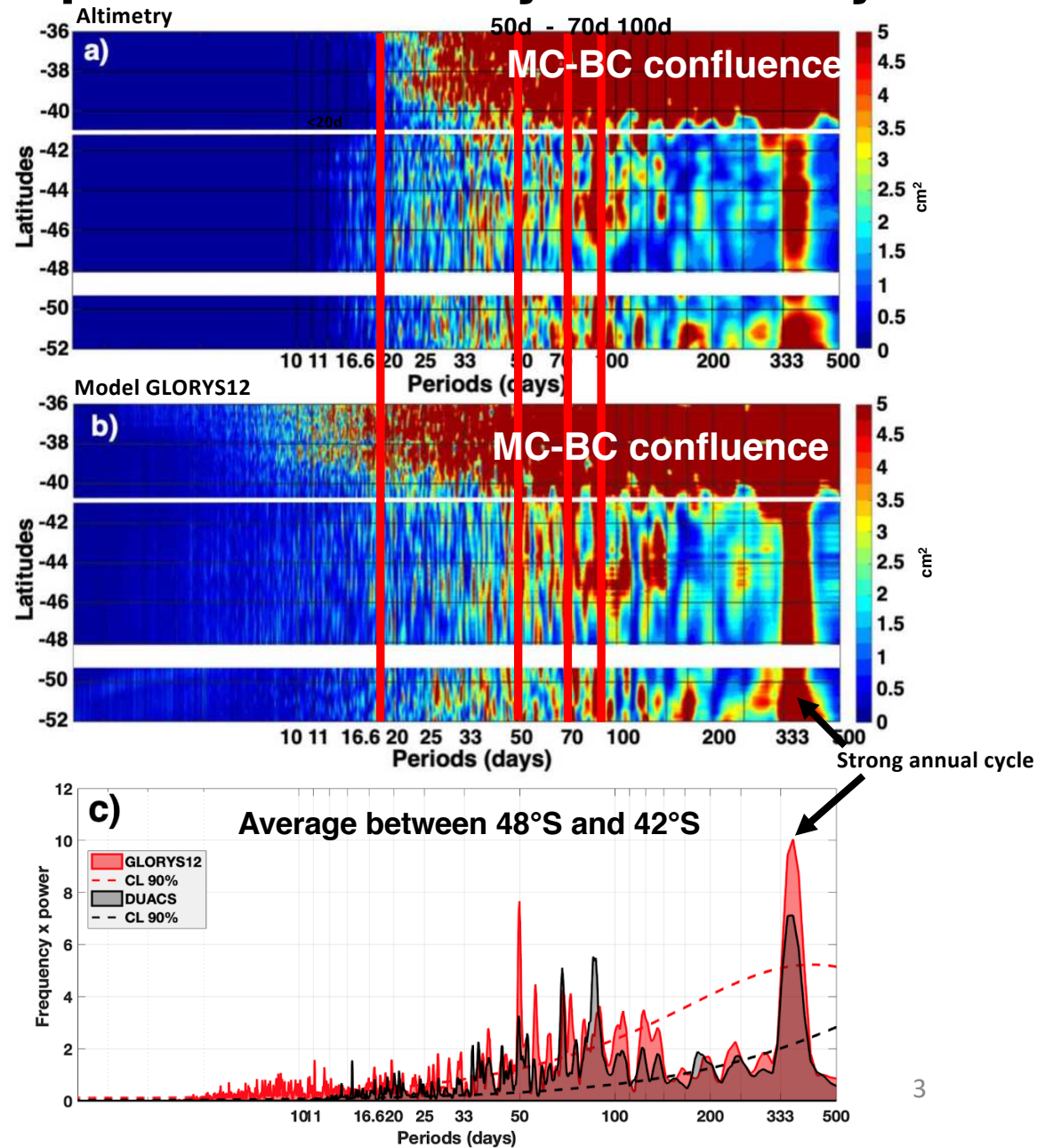
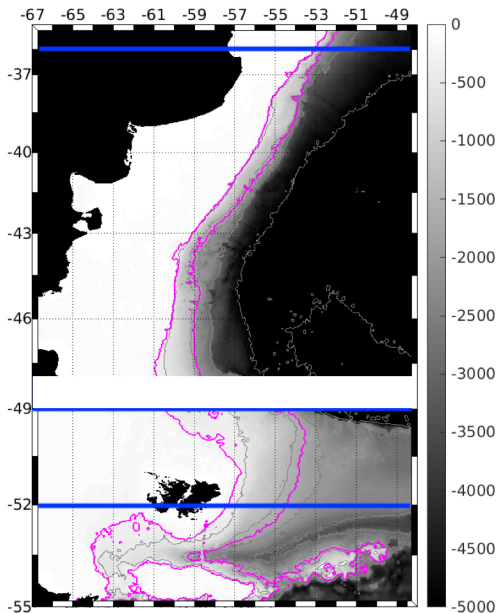
Night lights



Sea Level Anomaly Spectral content : CMEMS gridded altimetric product vs Glorys12 reanalysis

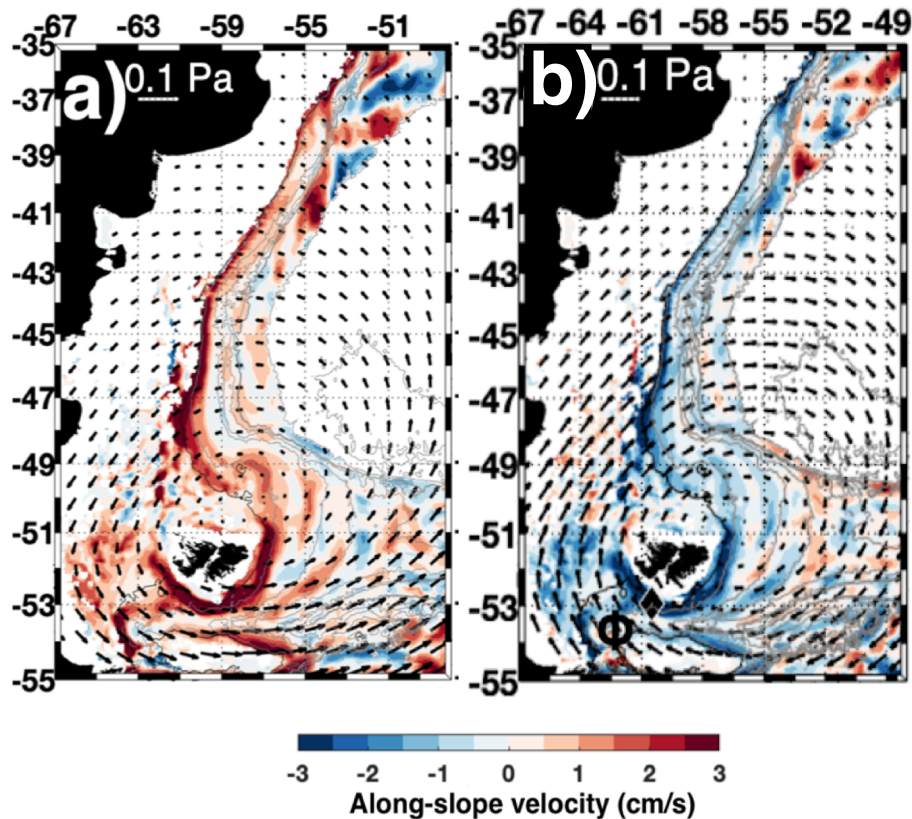
Time series of SLA - zonally averaged between 300m and 1700m isobaths (pink isolines)- were produced.

Their spectral content was analyzed
(a : altimetry and b : Glorys12 reanalysis):



Shelf-break trapped waves : spatial structures.

GLORYS12

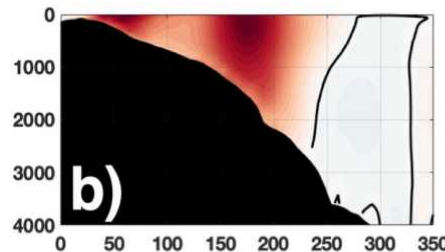
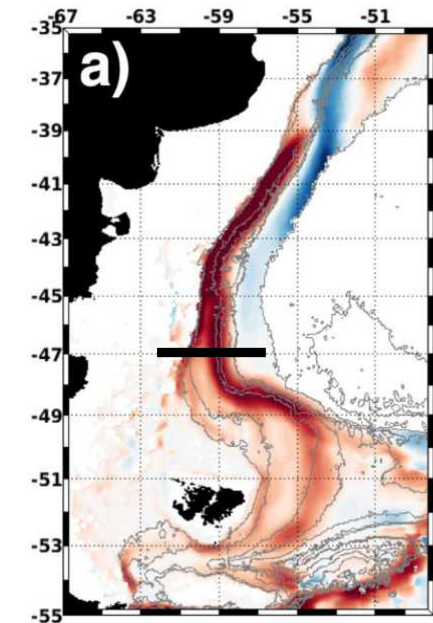


a, b along-slope velocity composites at 100 m for positive and negative phase of the wave from Glorys12

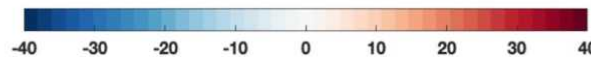
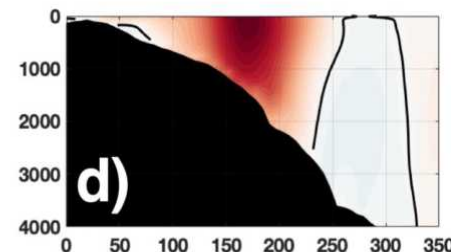
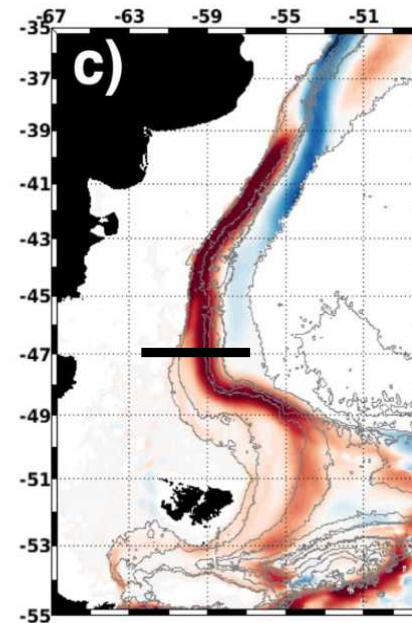
- Fast waves trapped at the shelf break with phase velocities between 1.4 and 3 m/s
- Wind-forced
- Simultaneous wave departures
- Large-scale SLA signal over the Patagonian platform associated with the shelf-break waves.

Shelf-Break trapped waves : Impact on the in-shore jet

Total along-shore velocity during the
positive phase of the wave :
Intensification of the inner-jet



Total along-shore velocity during the
negative phase of the wave :
Attenuation of the inner-jet



a) Along slope velocities corresponding to the positive phase of the fast waves at 47°S (Mean flow plus twice the composite of along slope velocity anomalies from Figure 7b)s. The 47°S vertical section is shown b).

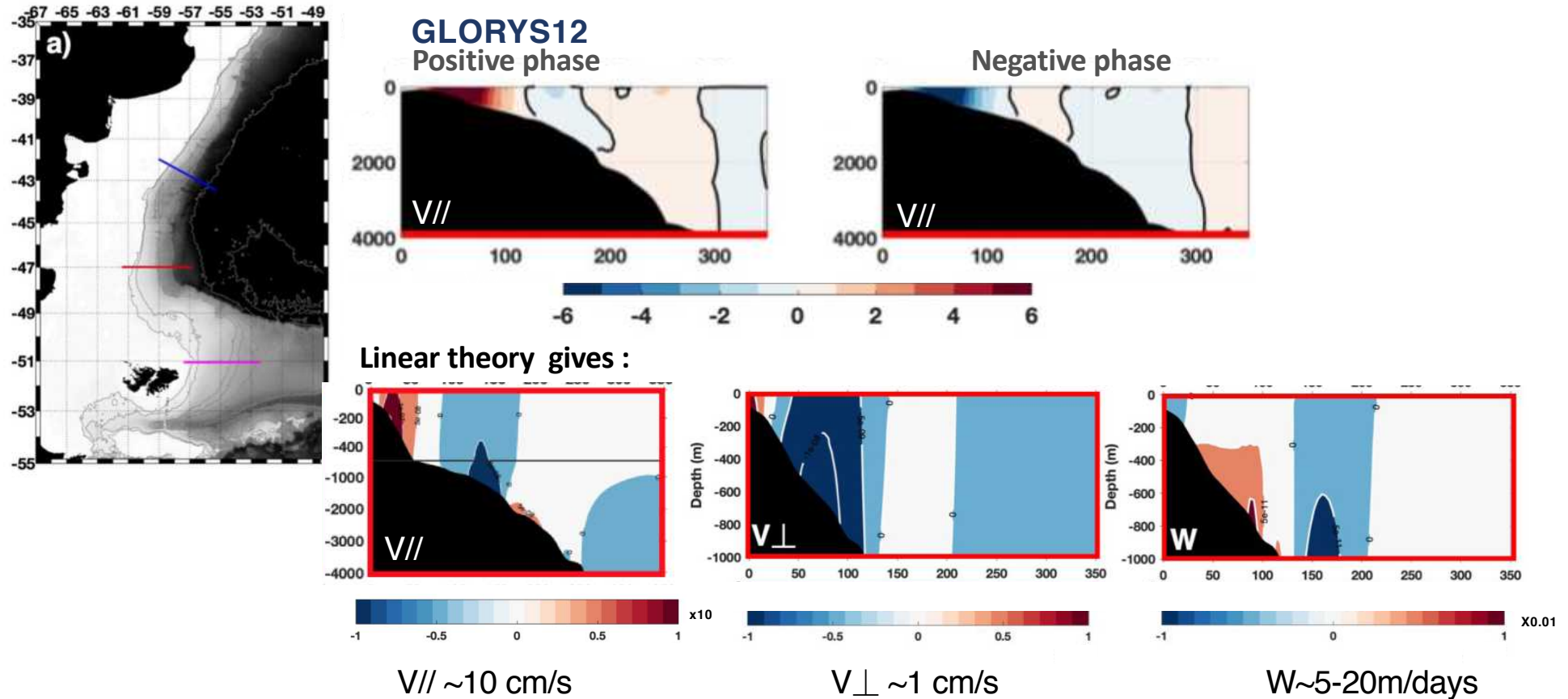
b) Along-slope velocity at 47°S section corresponding to a). c) Same a) for the negative phase.

d) Along slope velocity at 47°S section corresponding to c). Colorbar in cm/s.

Shelf-Break trapped waves : Impact on upwelling

Vertical structure

Composites of along-slope velocities anomalies along the red section :

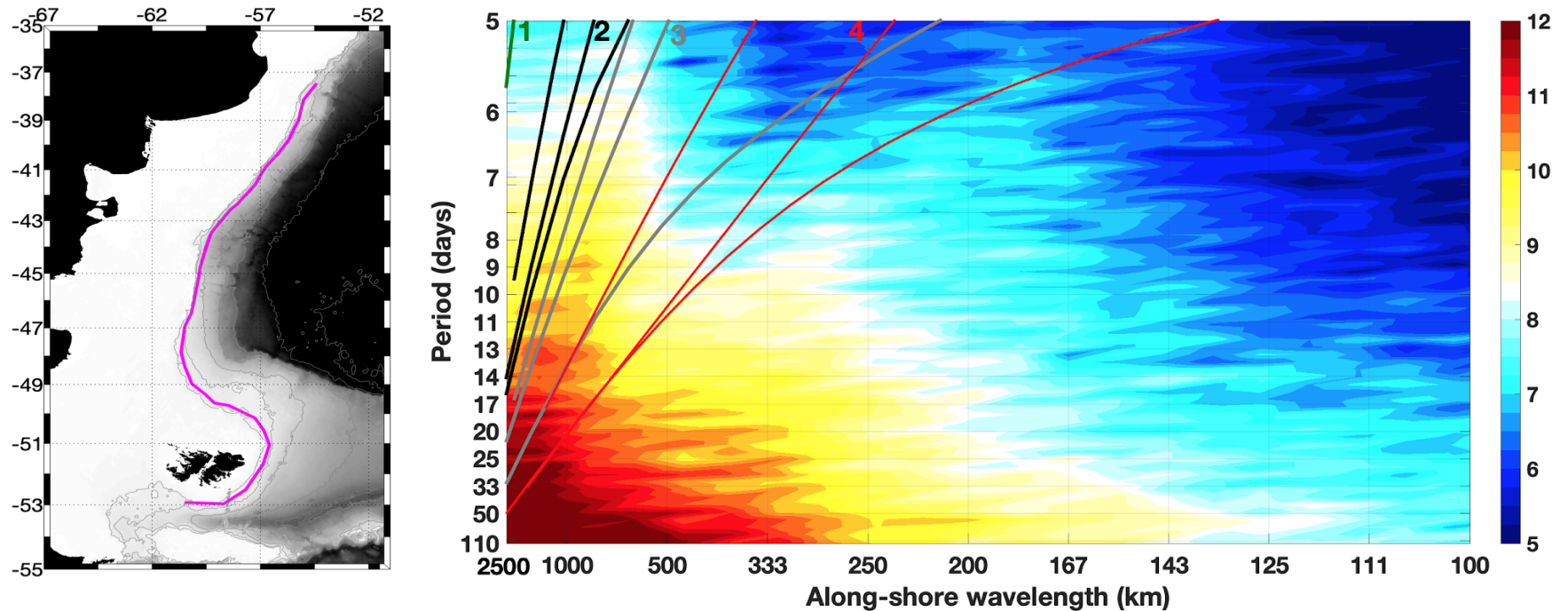


- Composites consistent with linear theory (wavelength and phase speed)
- Positive/ negative phase associated with in-shore/offshore velocities and positive/negative vertical velocities.

(Positive phase of shelf-break trapped waves contributes to bringing nutrients to the shelf)

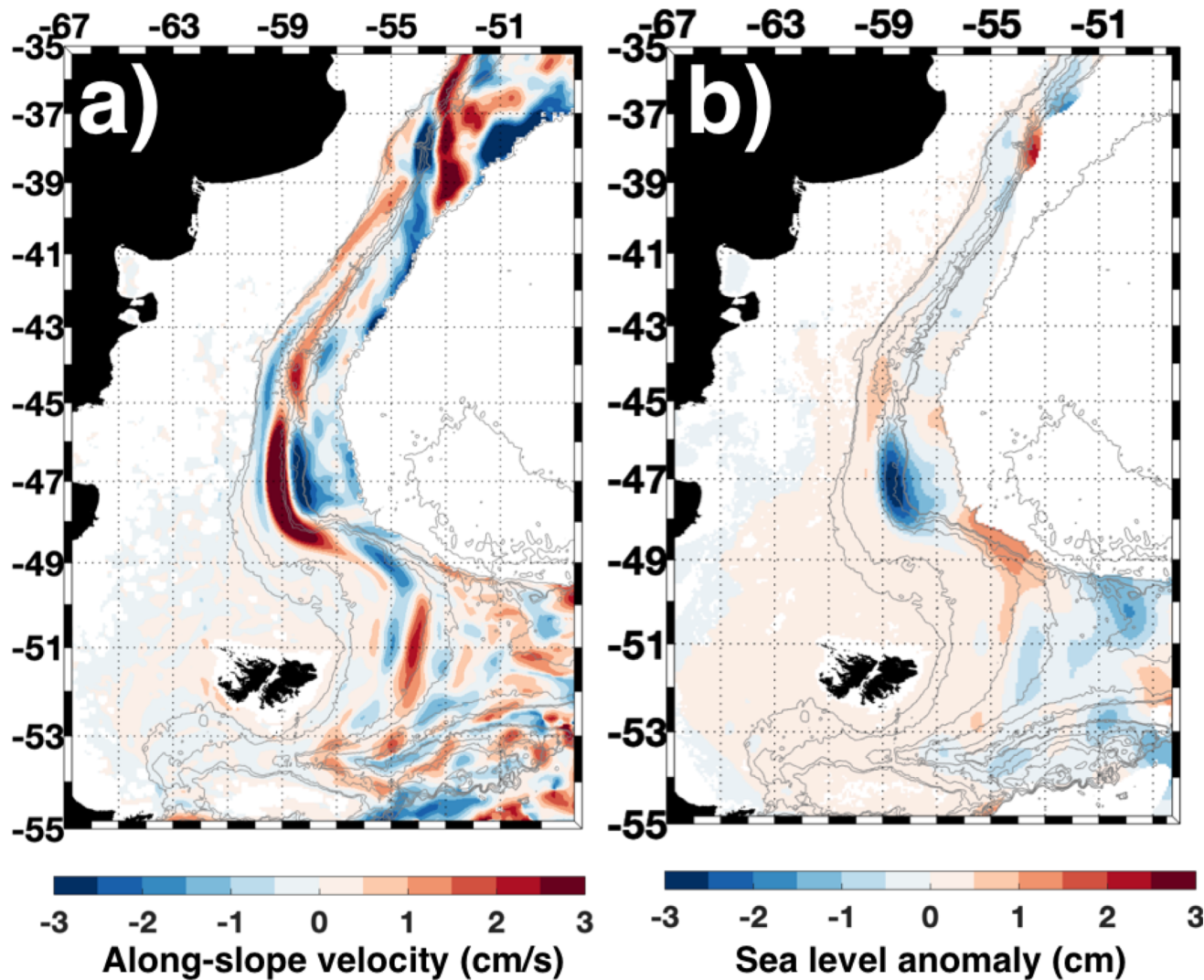
Shelf-Break trapped waves : Modes

Period-wavelength spectrum of along-slope velocity :



- Energy at periods corresponding to theoretical modes 2 to 4

In the core of the MC : Slow waves



- Phase velocities between 0.14 to 0.3 m/s
- Periods of 20-60-100 days
- Along-shore wavelength from 450 to 1500 km
- Remote forcing.

Composites for positive phase of the waves from Glorys12 outputs : a) along-shore velocities anomaly at 100m depth and b) SLA

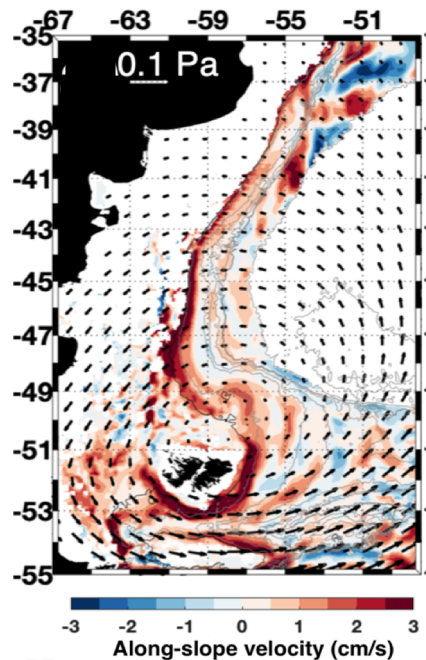
CONCLUSIONS

Fast waves
at the shelf
break

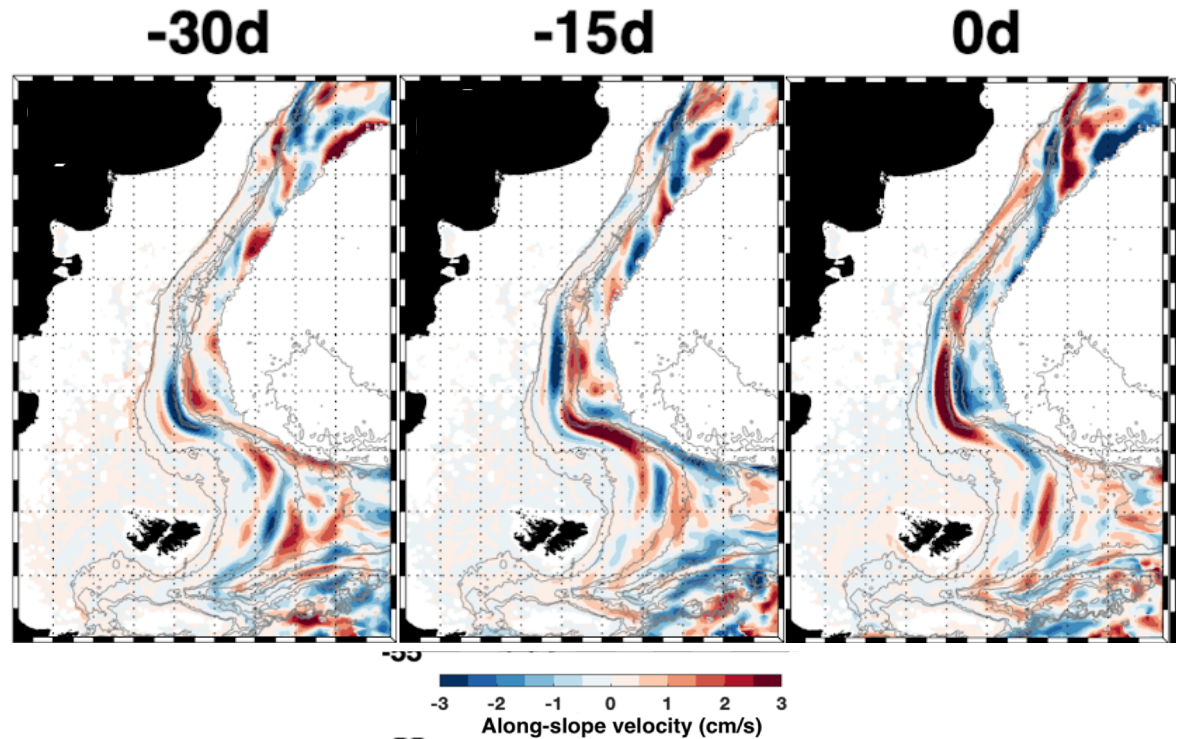
- Phase speed: 1.4-1.8 m/s
- ~5-110 day period
- Wind forced
- Mode 2 to 4
- Modulating the inner jet
- Contributing to upwelling

Slow waves
In the core
of the MC

- Phase speed: 0.25 m/s
- 20-60-100 day periods
- Remotely forced
- Tracked back to Malvinas Escarpment and Drake Passage



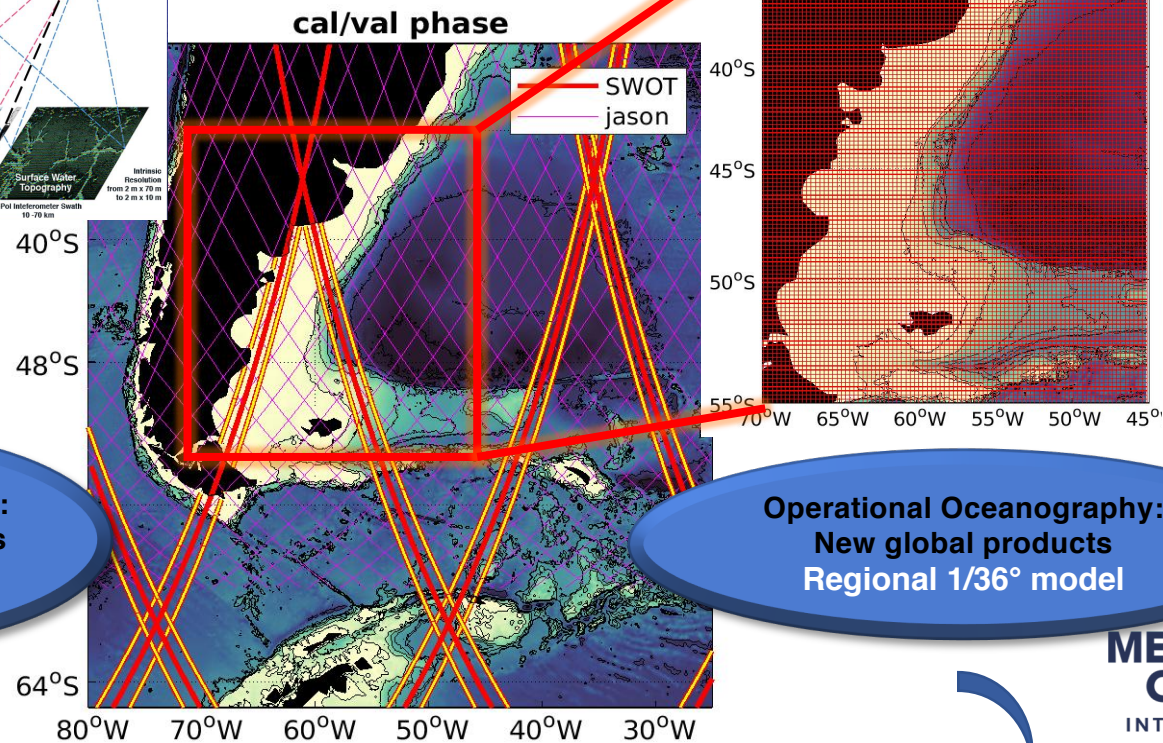
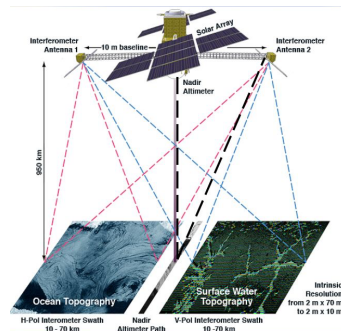
Velocity anomalies at 100 m depth



Velocity anomalies at 100 m depth

Perspectives

BACI proposal submitted to OSTST call 2020



Satellite altimetry data:
New regional products
SWOT Nadir data

Operational Oceanography:
New global products
Regional 1/36° model



Increasing spatio temporal resolution
Longer time series

Ostst virtual meeting (19-23 october 2020) 10

Thank You !