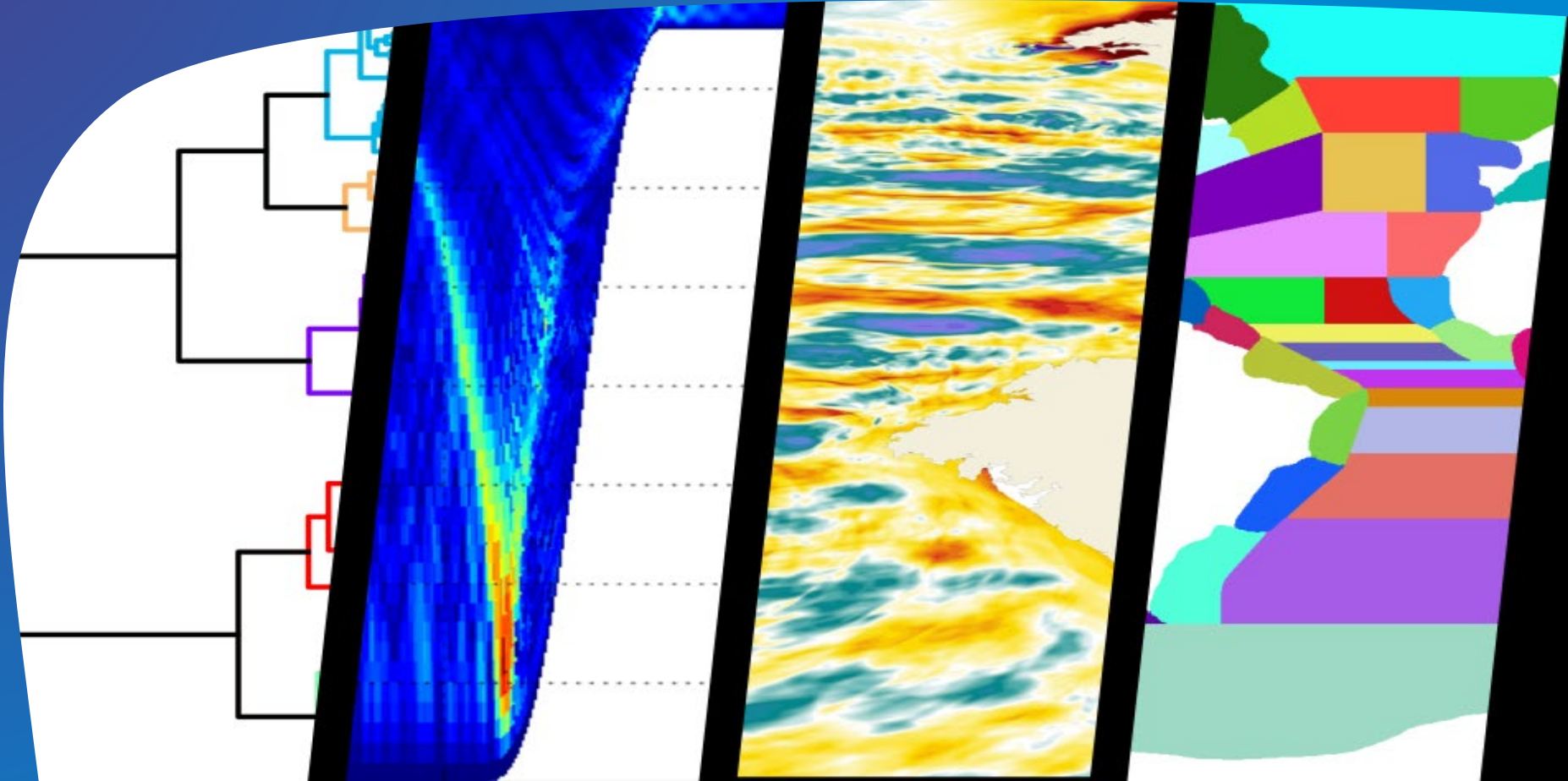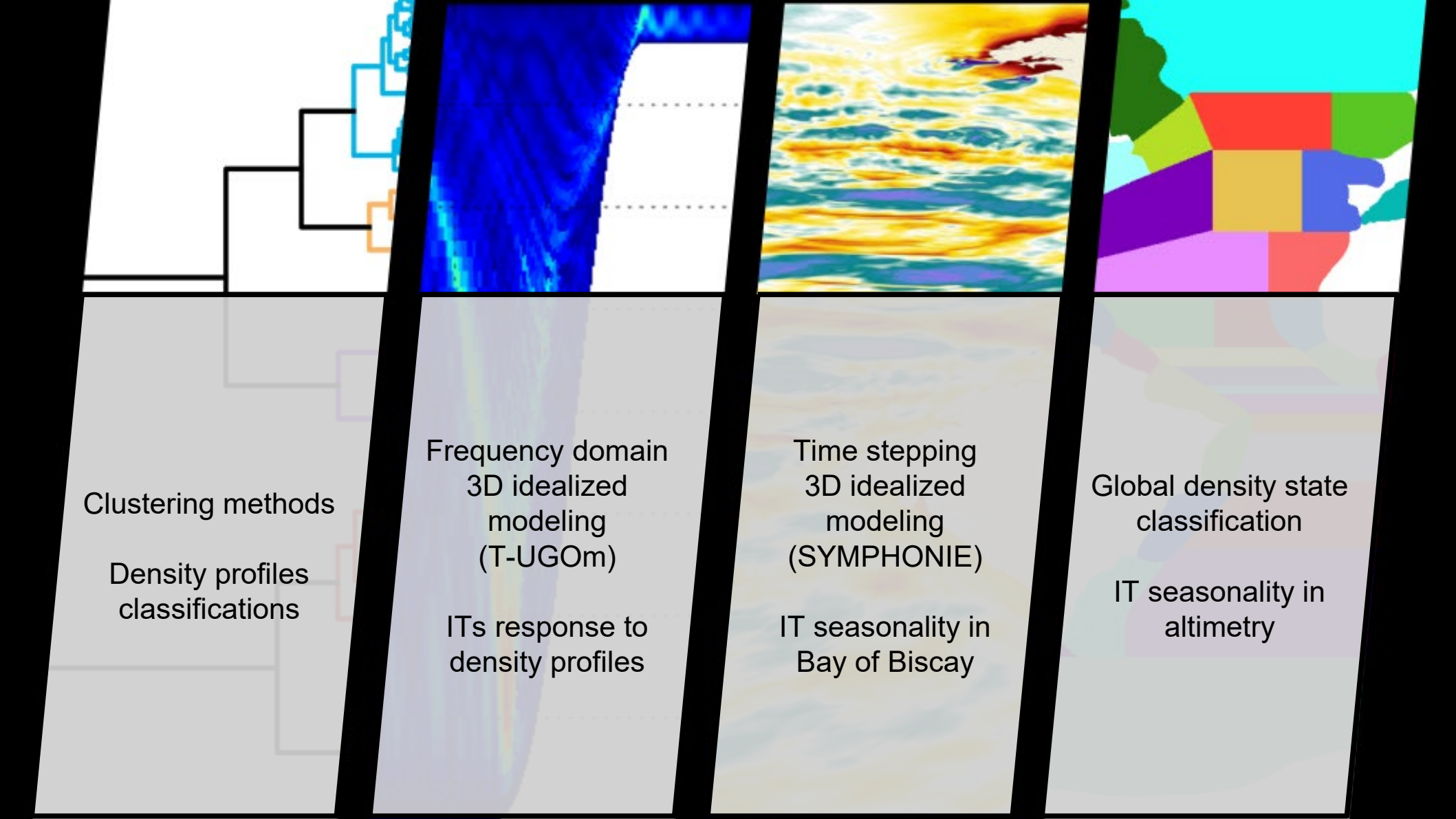# Internal tides response to density

SWOT ST – Wednesday 29th, 2022

Barbot S., Lyard F., Tchilibou M., Marsaleix P., Carrere L., Ubelmann C., Dabat ML.

Clustering methods

Density profiles classifications

Frequency domain 3D idealized modeling (T-UGOm)

ITs response to density profiles

Time stepping 3D idealized modeling (SYMPHONIE)
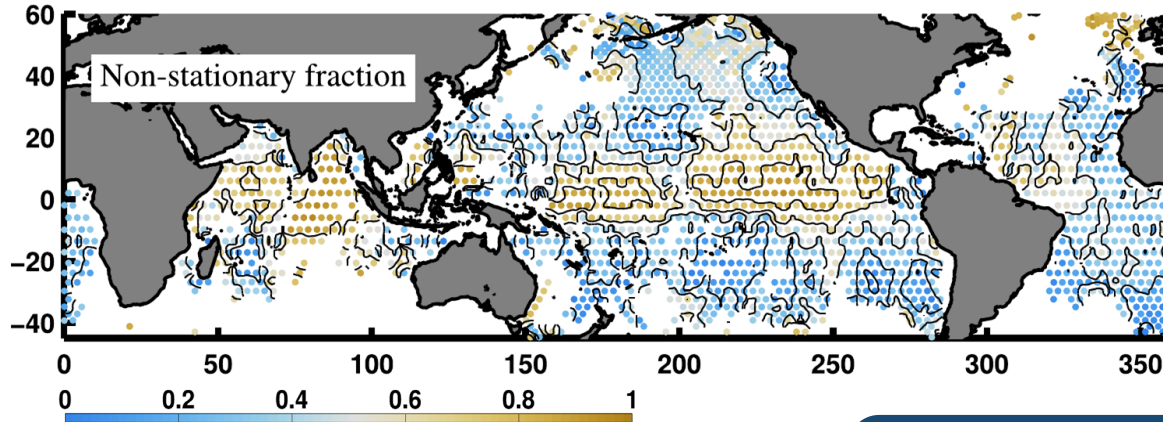
IT seasonality in Bay of Biscay

Global density state classification

IT seasonality in altimetry

Problematic: Internal tides correction

Empirical IT atlas:
- Phase-lock
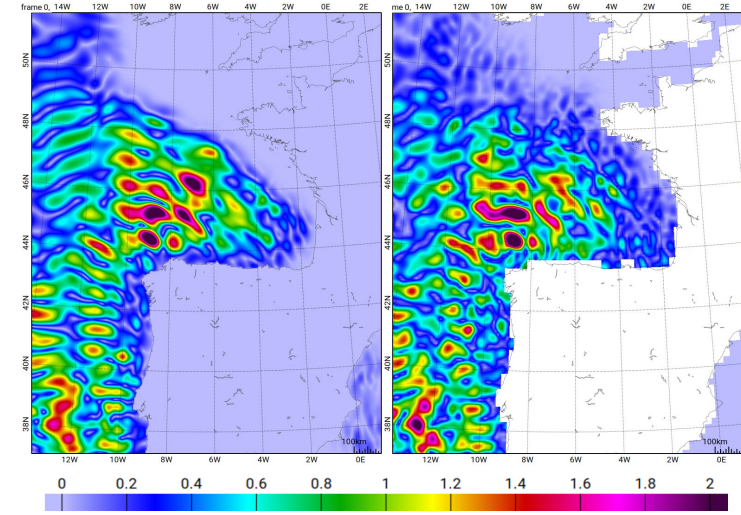- Plane wave approximation
- HRET only fit mode

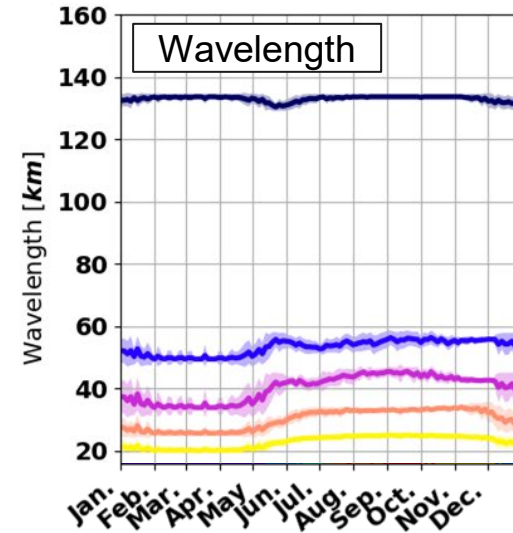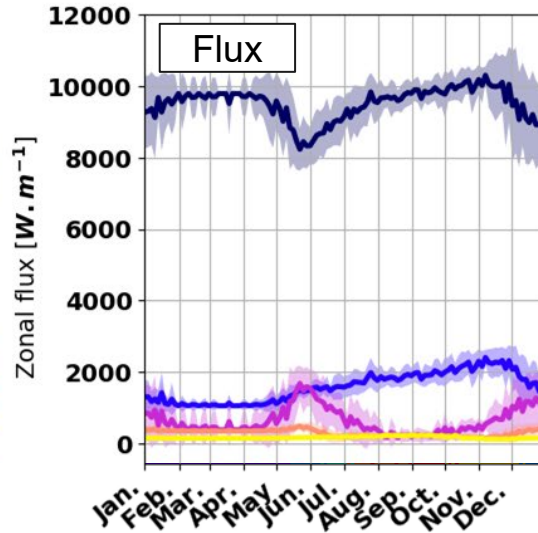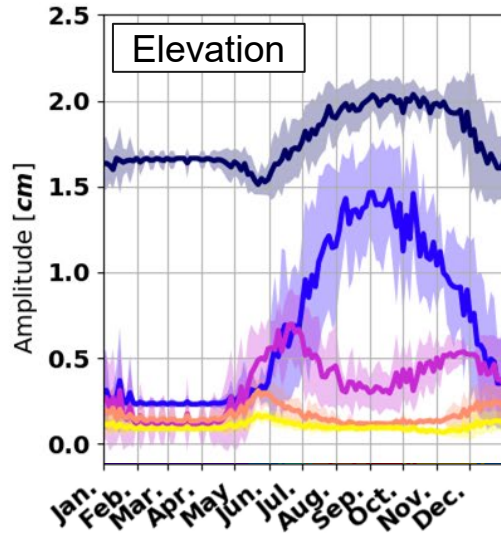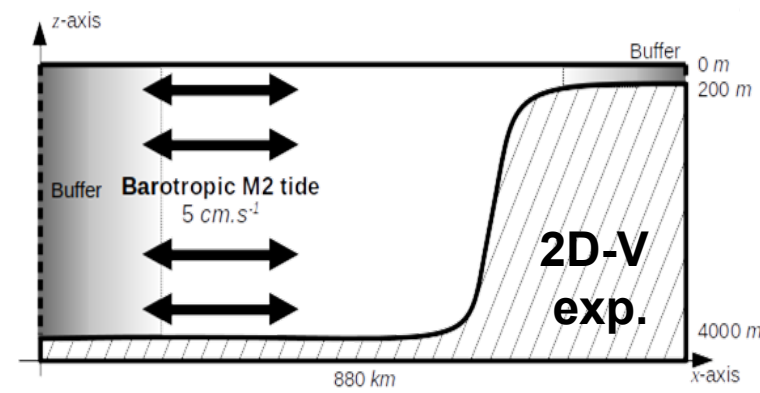IT non-stationarity ratio (Zaron, 2017)

HRET
(Zaron, 2019)

MIOST-IT
(Ubelmann *et al.*, in review)

Surface elevation amplitude [cm]

Frequency domain modeling:
COMODO

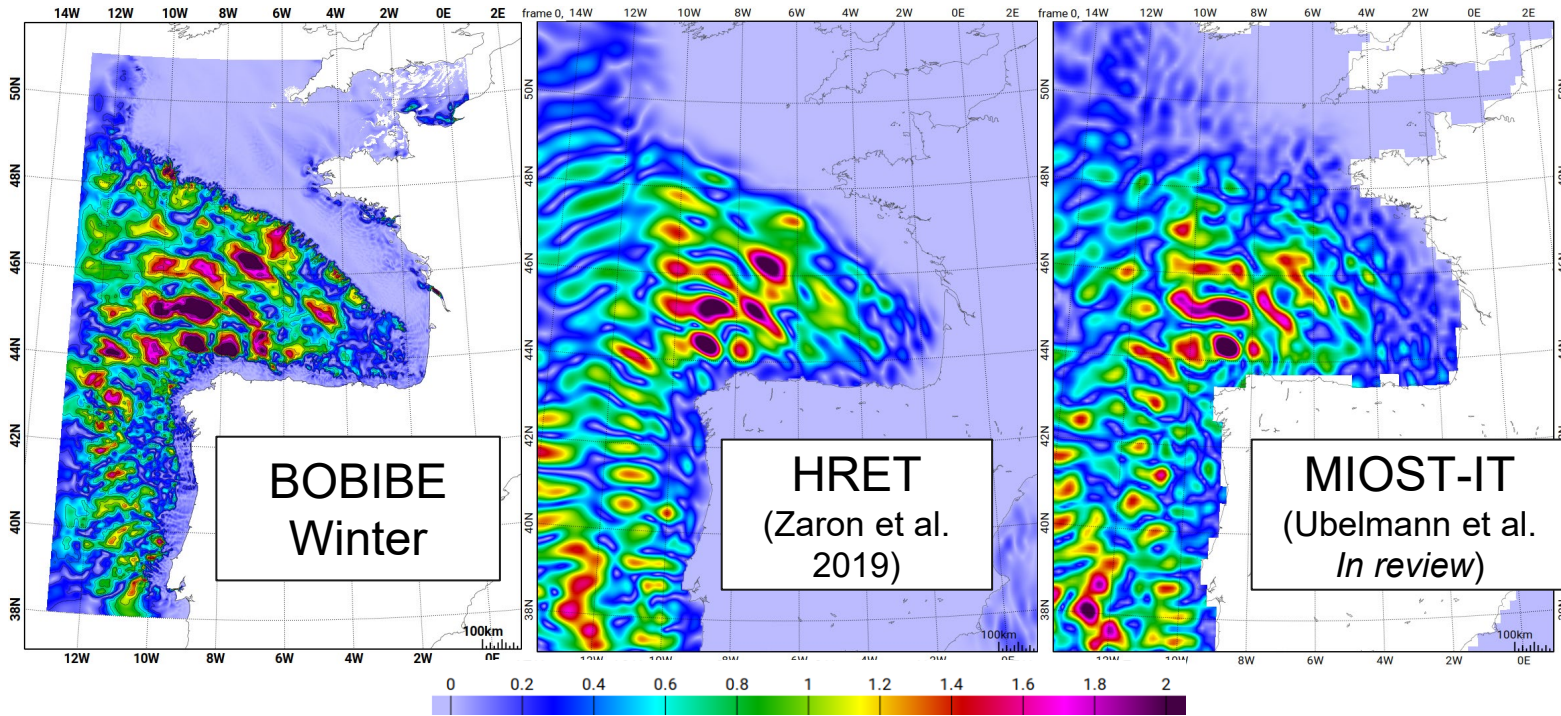Coupling density profile classification and idealized modeling

Barbot *et al.* (2021)
https://doi.org/10.5194/os-17-1563-2021

Time-stepping modeling: BOBIBE

Elevation amplitude [cm]

Seasonal state simulations:
- No atmospheric forcing
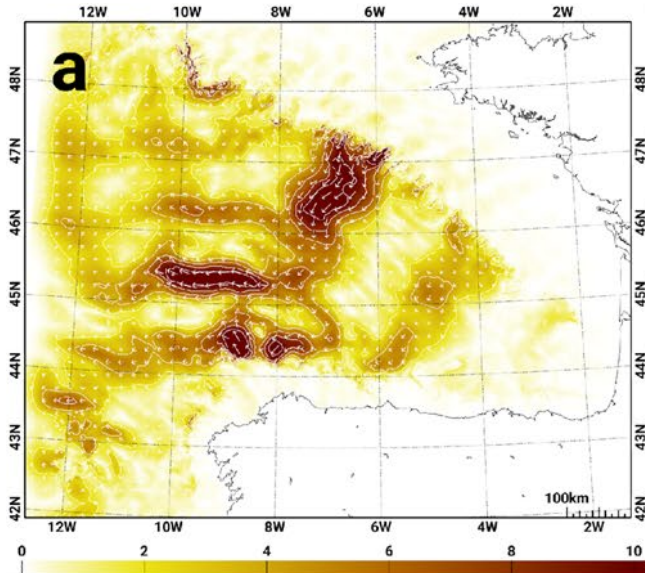- Stable T,S,u,v forcing
- Nudging for T,S at all nodes

Empirical IT atlas:
- Phase-lock
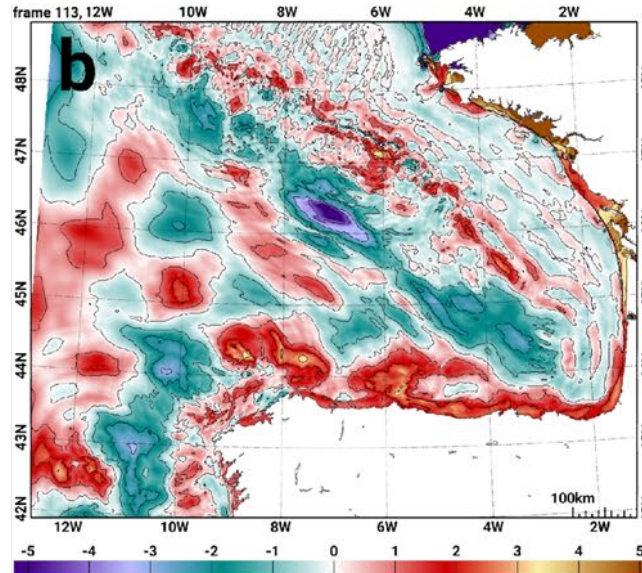- Plane wave approximation
- Fit to mode 1 only

BOBIBE: Harmonics VS Hourly

Harmonic IT flux:
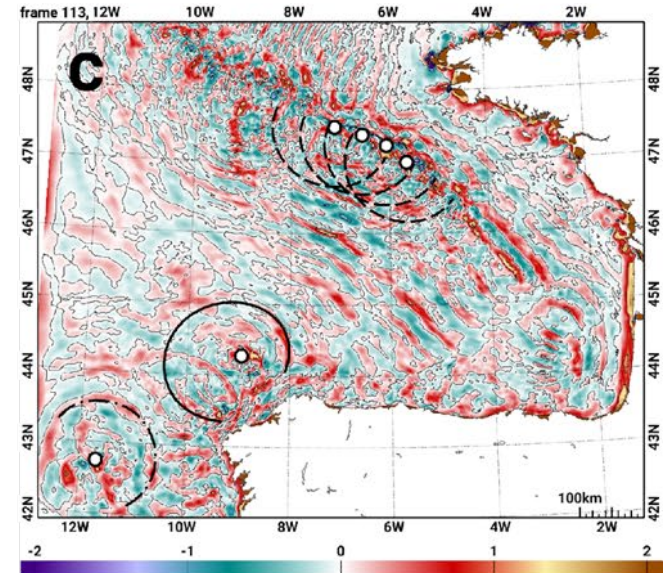- Main sites evidences
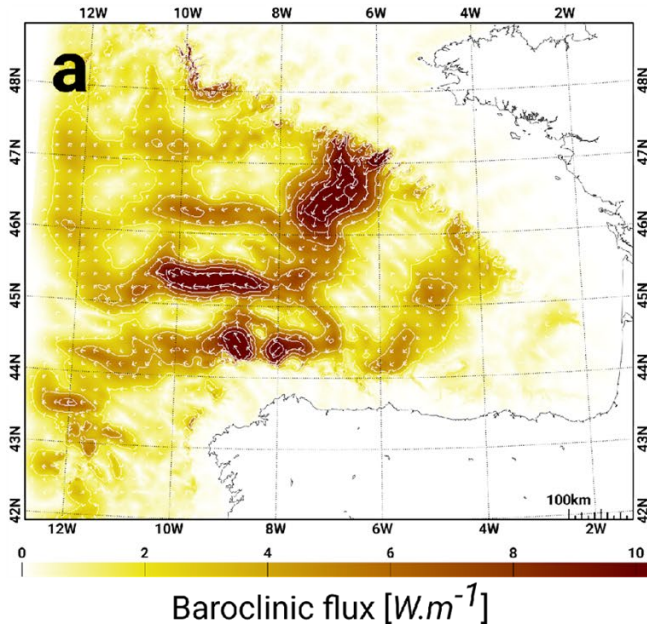- Hard to separate each sites

Baroclinic filtering spinup:
- Distinguish sites

30 km filtering spinup:
- Radiative pattern
- Multiple sites along shelf break
- → plane wave

BOBIBE: Harmonics VS Hourly

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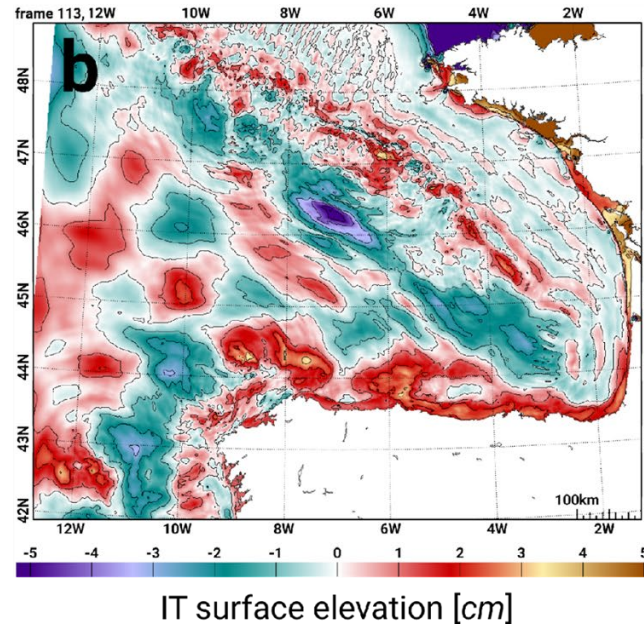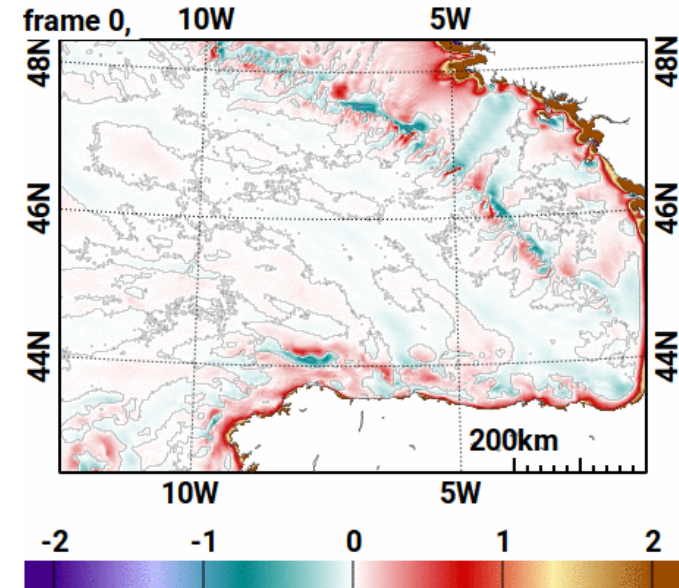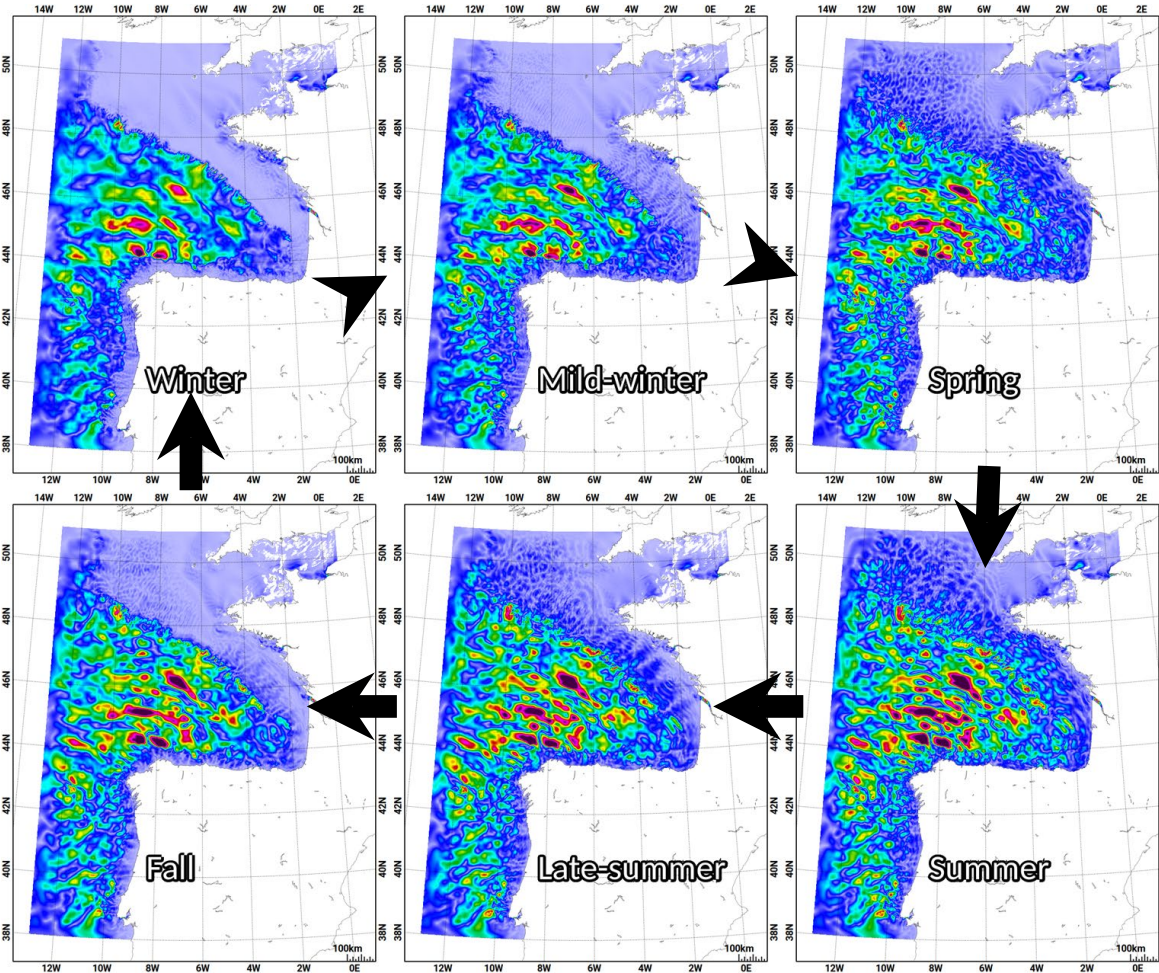- Multiple sites along shelf break
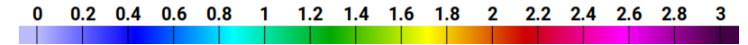- → plane wave

BOBIBE: Seasonality

Winter → Mode 1

Summer → Modes 1, 2, 3

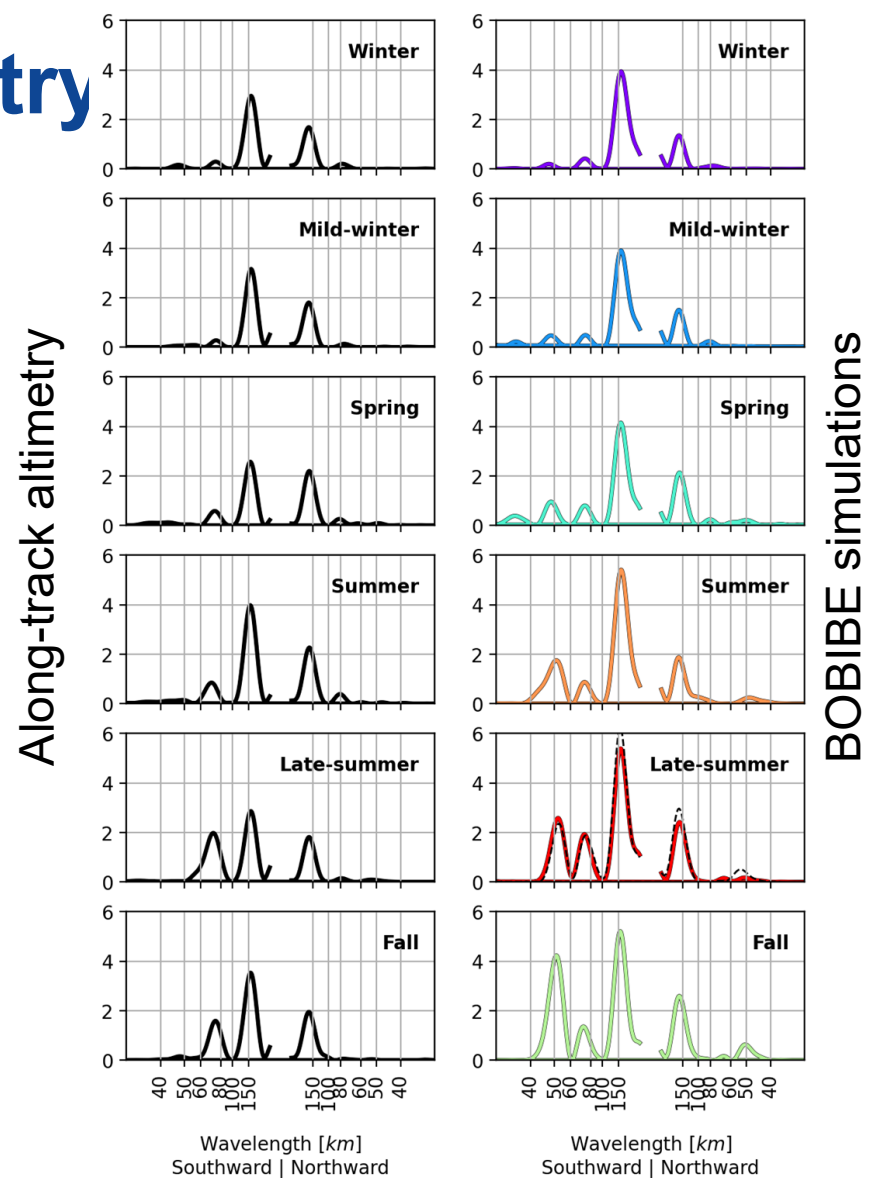The addition of smaller scales complexify the IT surface signal.

– Elevation amplitude [cm] –
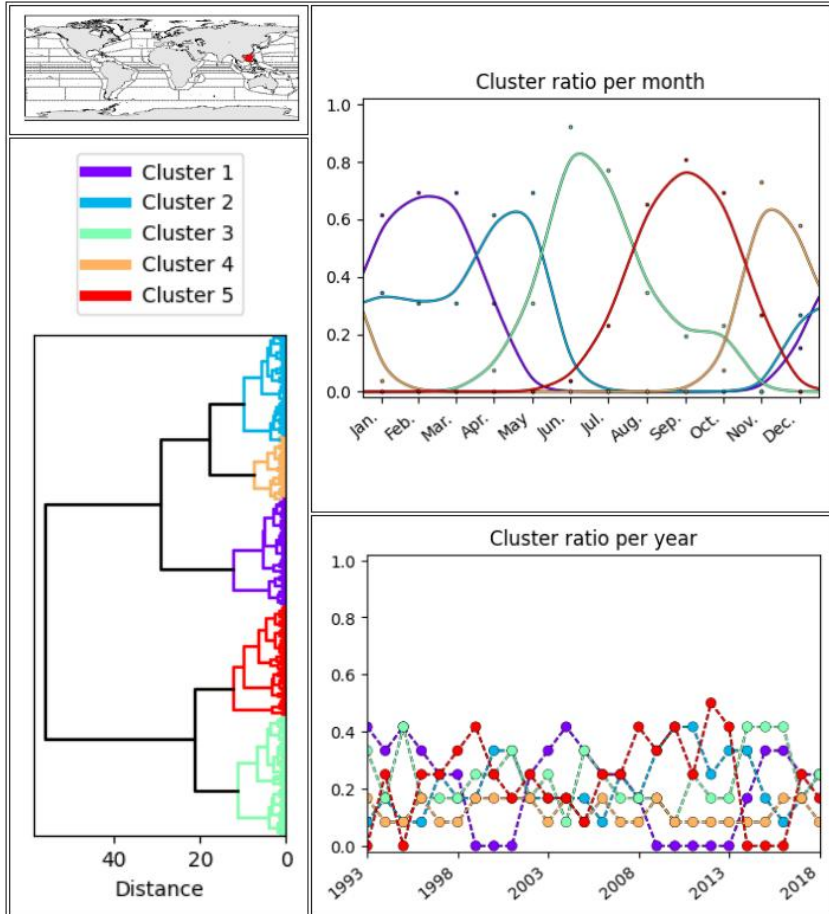
Along-track seasonal altimetry

The variability of the modes >1 imply a change in IT surface signal (modes 2 & 3).

Altimetry can capture modes 1 & 2 variability

→ **How to capture IT seasonality for global empirical IT atlas ?**

Global density classification

Processed:
- 110 areas based on physical dynamics

- 3D density state density classification with common threshold globally

To be done:
- ◆ Produce mode 1 & 2 wavelength from the density state

- ◆ Extract tidal harmonics from altimetric timeseries over the corresponding season

- ◆ Map ITs by fitting both mode 1 & 2 wavelength

Available for feed back at: http://ftp.legos.obs-mip.fr/pub/tmp3m/barbot/clustering_global_density/interp-mask1.svg

NASA – visible earth

Brazil

Thank you for your attention !

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