Satellite Altimetry in Western Tropical Atlantic proposal: toward SWOT Ocean Brazil initiative

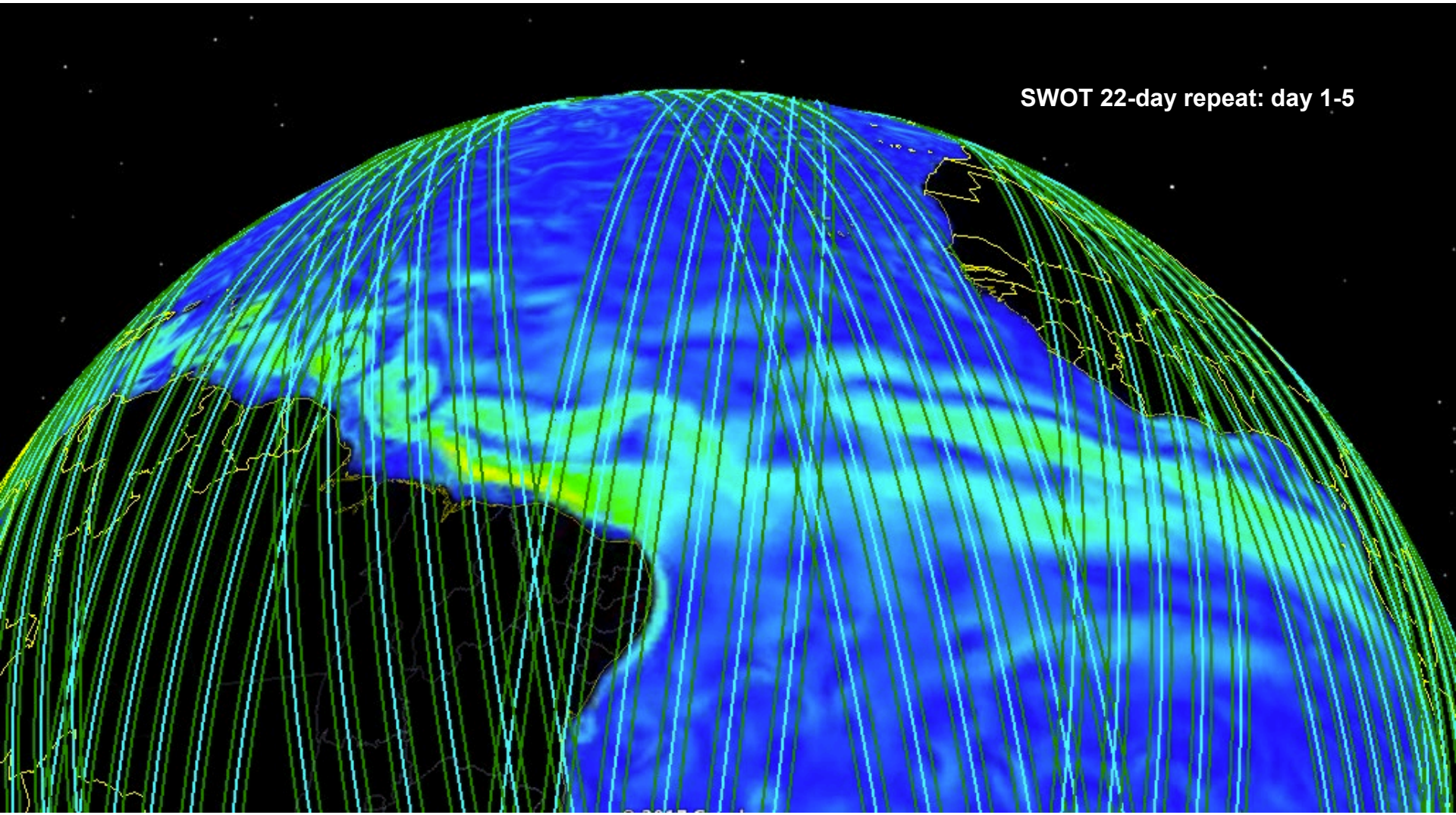
Proposed by F. Hernandez & A. Koch-Larrouy (IRD/LEGOS/Mercator Ocean), F. Durand (IRD/LEGOS)

As part of collaborations with Brazil (M. Araujo, UFPE, Recife, BR)

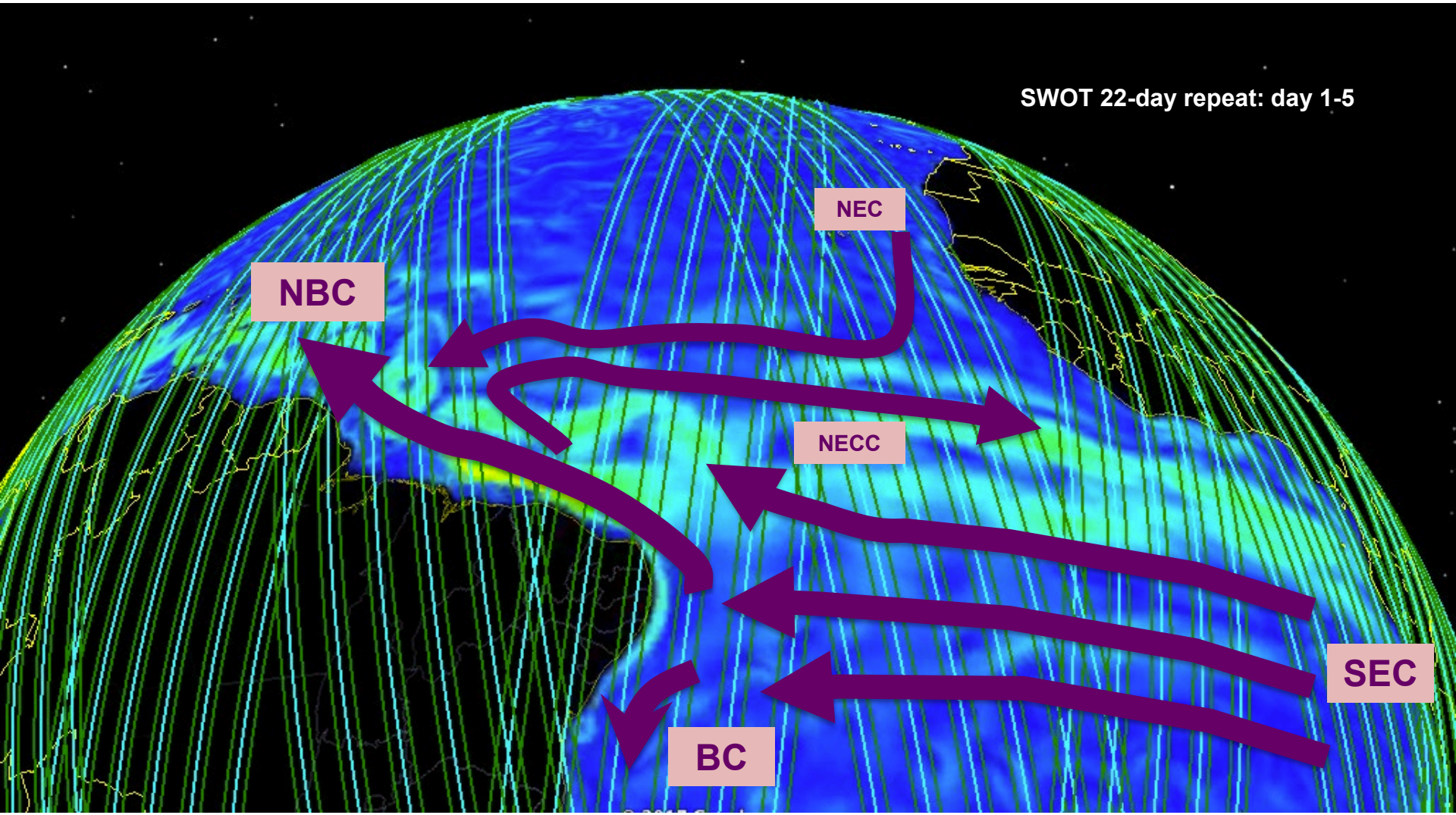
- Submitted ***International Joint Laboratory TAPIOCA***, with objective **to raise a Tropical Ocean Study Centre of Excellence in Recife**.
- Associated with existing ***I J L OCE*** supporting SWOT Hydro South America initiatives (F. Papa, JF Cretaux, S. Calmant et al., LEGOS)

As part of the BATIDAO Tasks at LEGOS, including modelling work of J. Jouanno, F. Marin, and support of LEGOS CTOH altimetry expertise group (F. Birol, R. Morrow et al.)

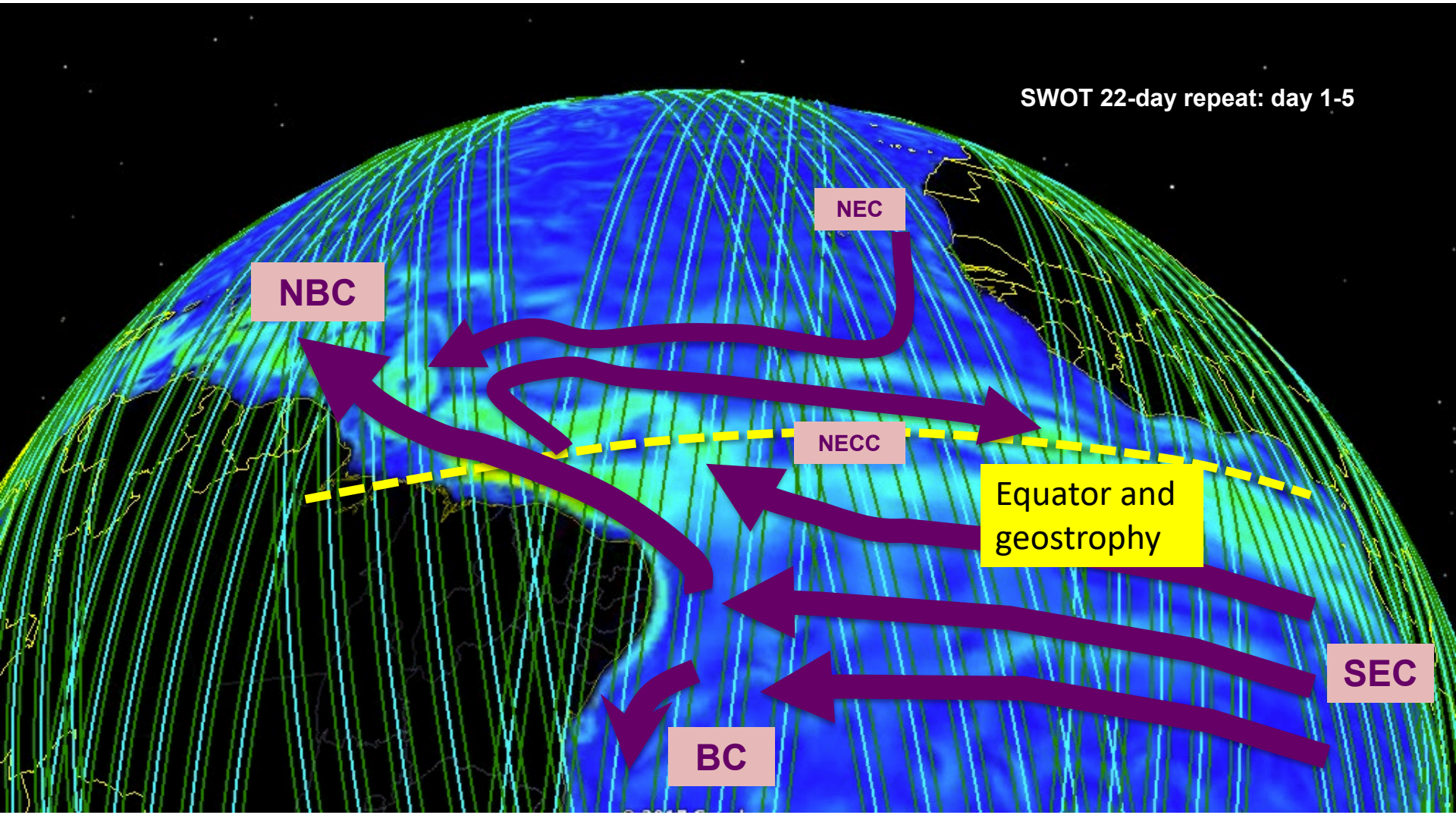
Ocean Processes of interest



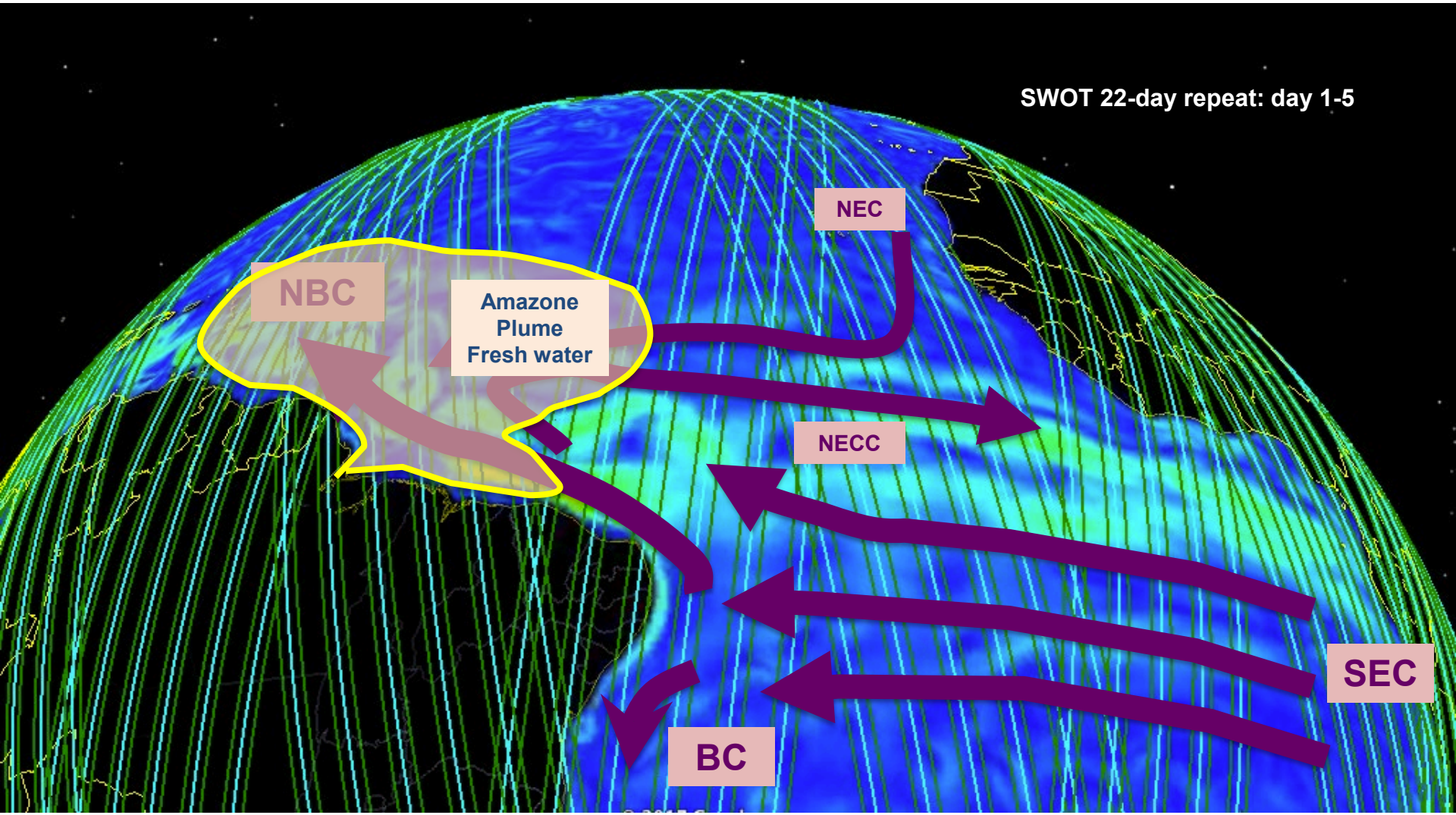
Ocean Processes of interest



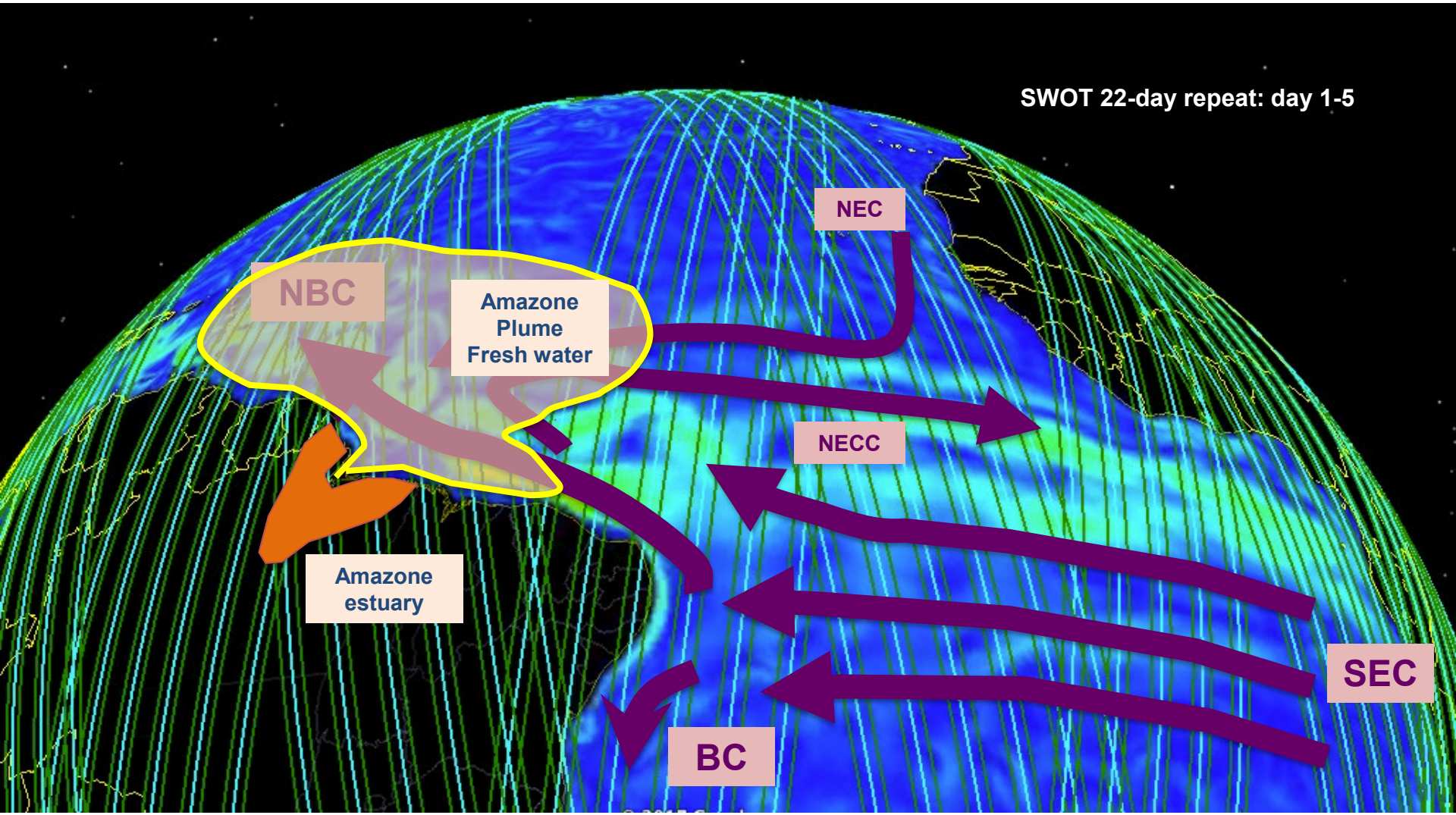
Ocean Processes of interest



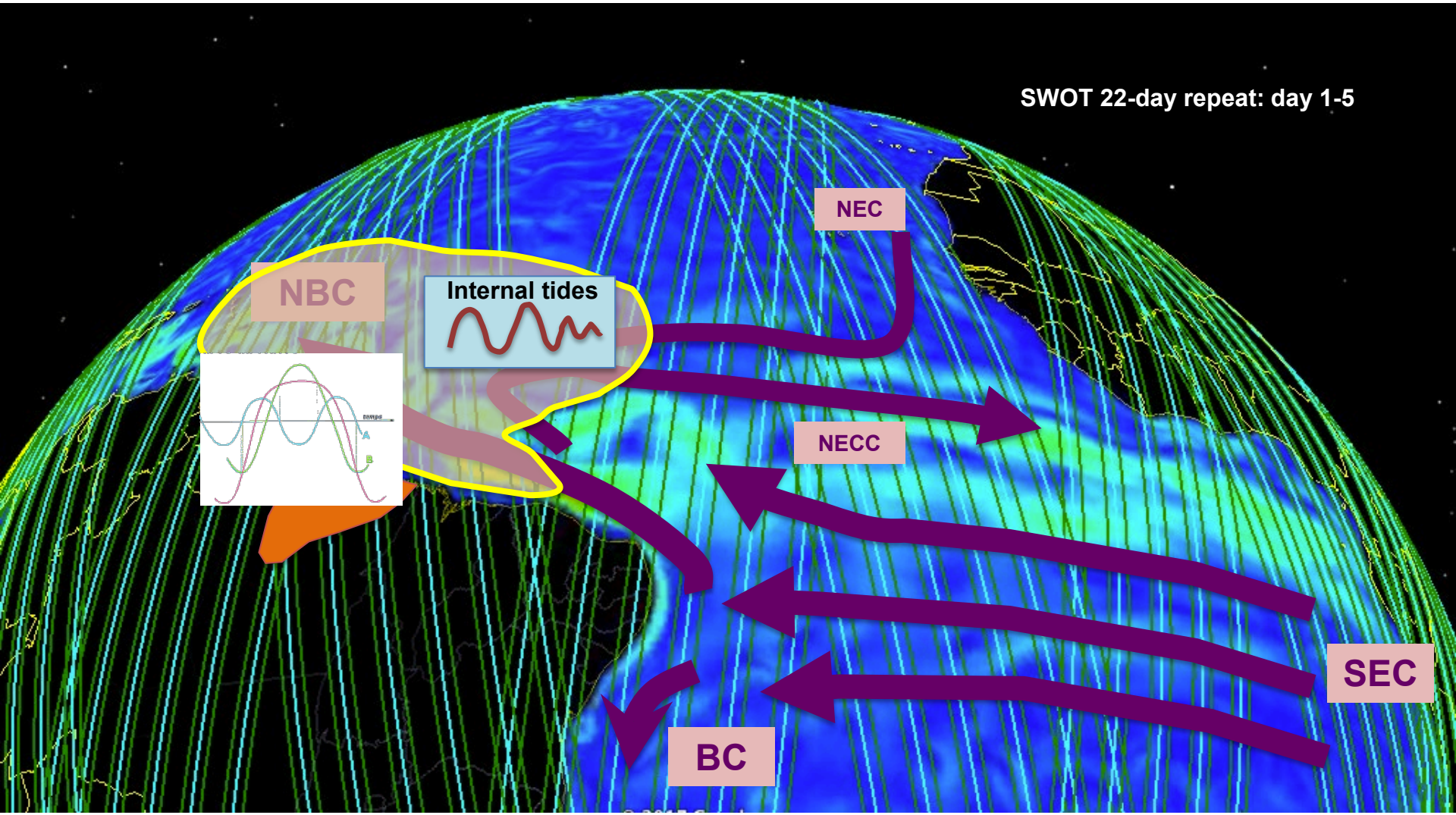
Ocean Processes of interest



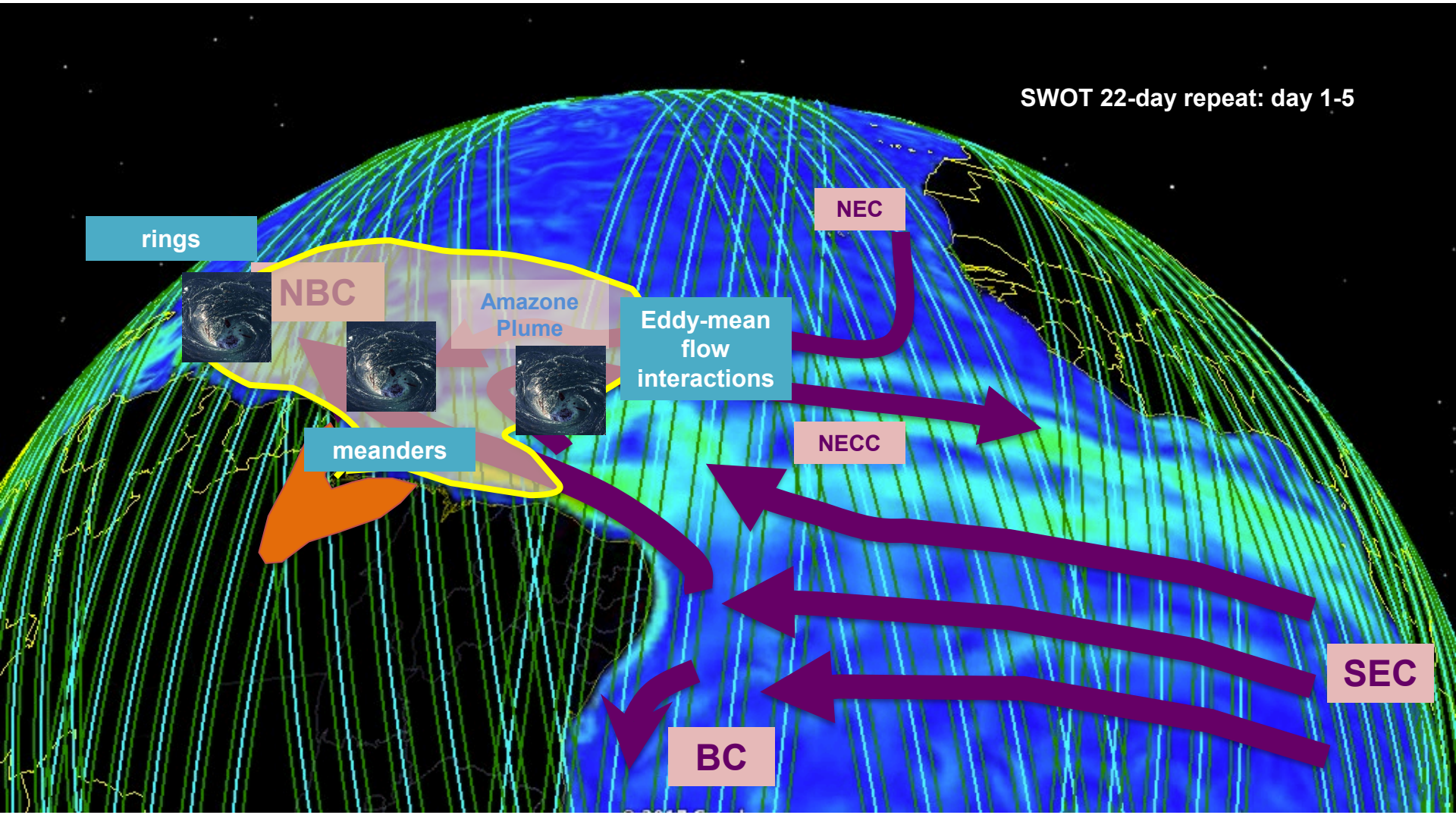
Ocean Processes of interest



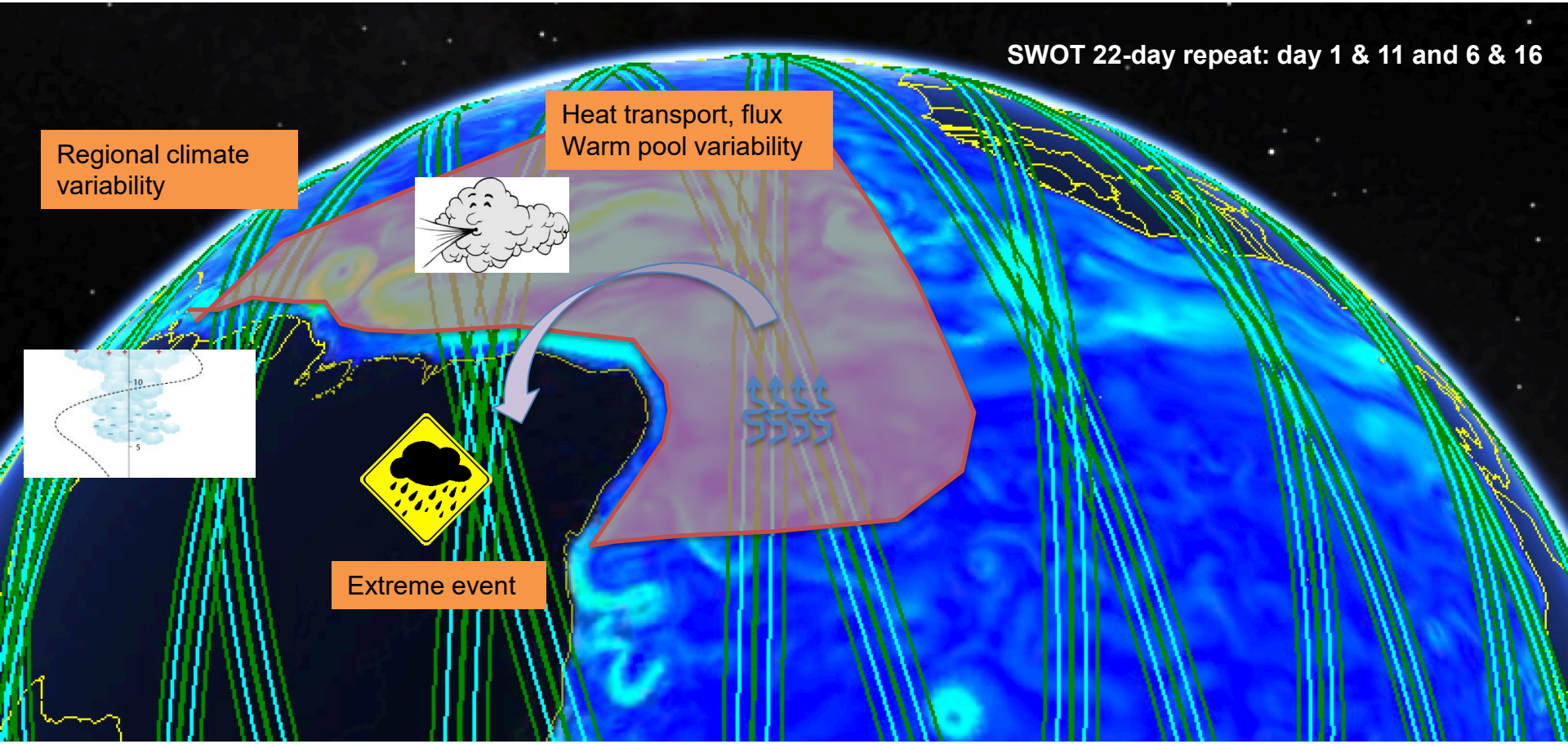
Ocean Processes of interest



Ocean Processes of interest



Ocean Processes of interest



Open ocean and shelf: satellite altimetry and planned studies

Satellite altimetry dedicated analysis on:

- **Western boundary current** system variability (SEC, NEC, BC, NBC, NECC…)
- **Eddy-Mean flow interactions**, **shelf interactions** (eg, upwelling)
- Finer structure on **the shelf, submesoscale and coastal** dynamics
- **Amazon plume** variability (+ ocean colour + SST)

Variability using satellite altimetry since 1992

T/P, Jason1,2,3 , ERS-1/2, GFO, En, C2, HY2A, AltiK

Fine scale description (present and future):

Jason2,3 & S3A, S3B, & C2, AltiK, HY2A

Future: Enhanced studies adding SWOT

Associated studies

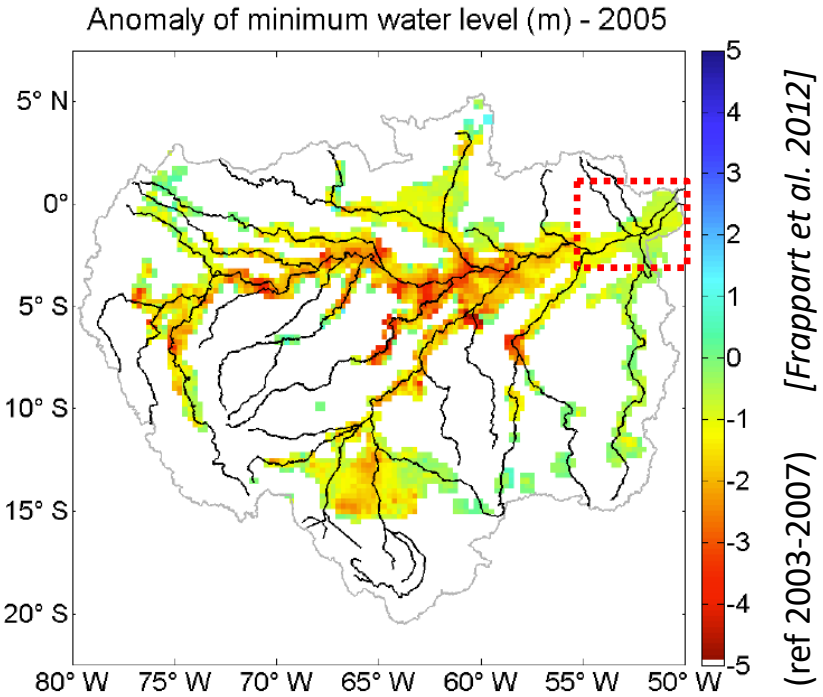
- **Internal tide generation** on shelf-break, **propagation on shelf and open ocean**, **modelling** and observation (ship campaign)
- Tropical Atlantic **modelling and zoom** on the Amazone plume (2-way nesting)
- **Modelling the Amazon estuary** with SCHISM: proposition for a real time **correction of tidal signals**

De-aliasing estuarine tides in SWOT data over the lower Amazon river

Fabien Durand (IRD/LEGOS, Toulouse) *fabien.durand@ird.fr*

Collab. Daniel Moreira (CPRM, Rio de Janeiro) , Joecila Silva (Univ. Manaus),

Stephane Calmant (IRD/LEGOS, Toulouse), Fabrice Papa (IRD/LEGOS, Toulouse), Florent Lyard (CNRS/LEGOS, Toulouse)



Tidal part of the Amazon :

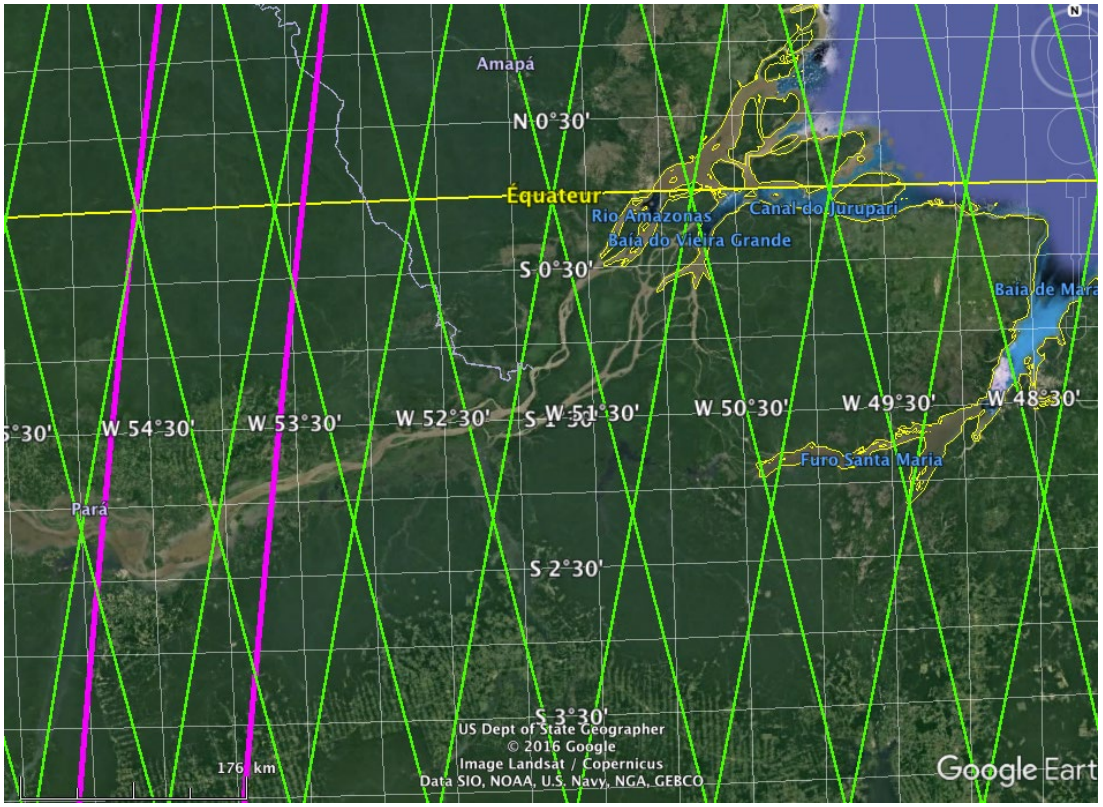
- Complex dynamics, under combined influence of the watershed climatic variability and ocean forcing (with comparable magnitude in terms of water level)
- Strong variability of water level and flow at all timescales, not yet observable by altimetry
- Impact on water storage in wetlands, impact on river-ocean connexion (tidal modulation)
- Implications on wetlands ecosystem, on social and economic conditions of local communities

Motivation for SWOT:
make it usable in the tidal zone of estuaries

Swaths for SWOT 1day and S3A:

Good news:
Tidal estuary within the 1-day orbit swath !

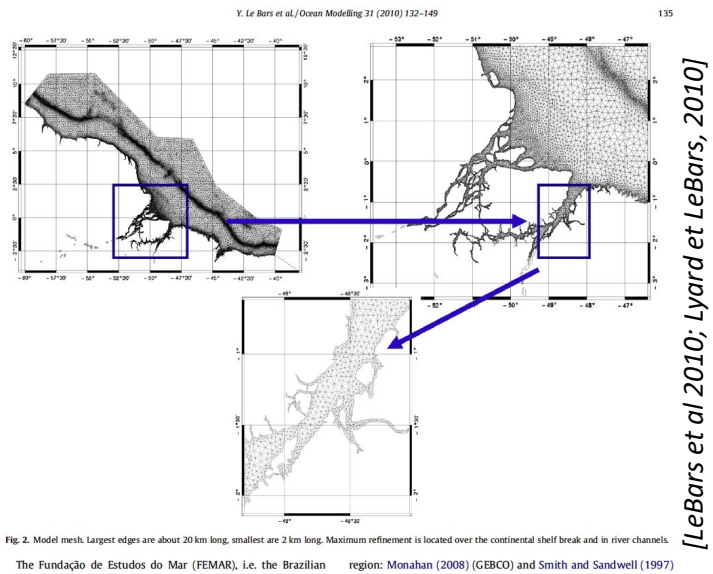
But…
Without clean de-aliasing of the tides, SWOT will not be easily usable for hydrology purpose, in the lower Amazon



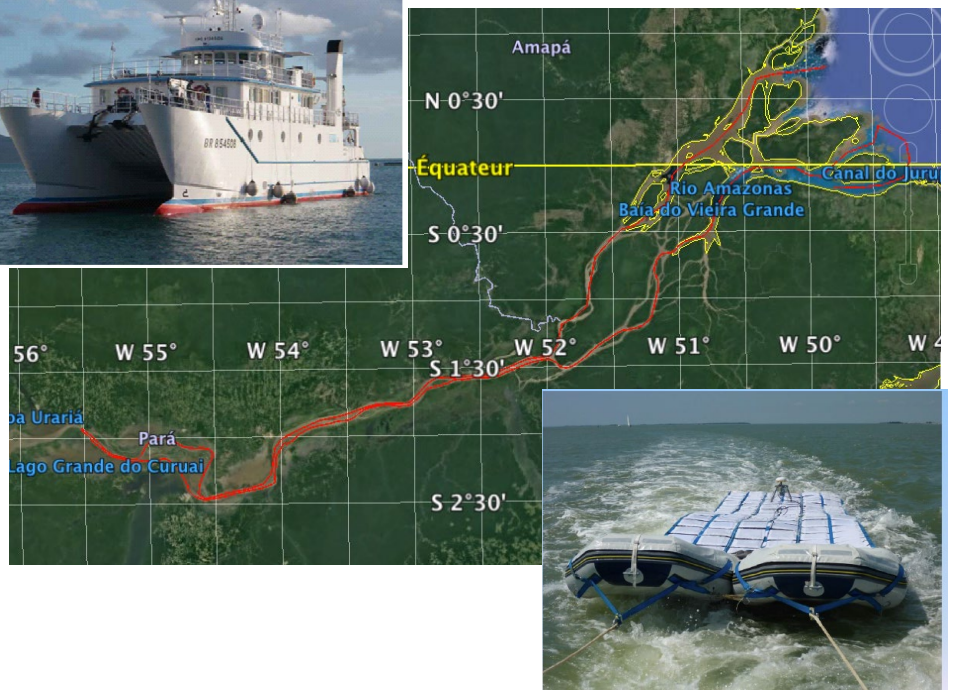
=> A properly defined model, calibrated and validated against up-to-date water level records: the most straightforward way to de-alias the tide signature in SWOT (as well as other ongoing and future altimetry missions…), throughout the tidal estuary

Proposed approach: hydrodynamic modeling + in situ survey

Heritage from past Brasil-France collaboration (AMANDES project):



[LeBars et al 2010; Lyard et LeBars, 2010]



Hydrodyn modeling: cross-scale capability is a must in estuaries

target resolution: 50m (upstream →30km (deep ocean)

Forcing: by time-varying discharge and tides

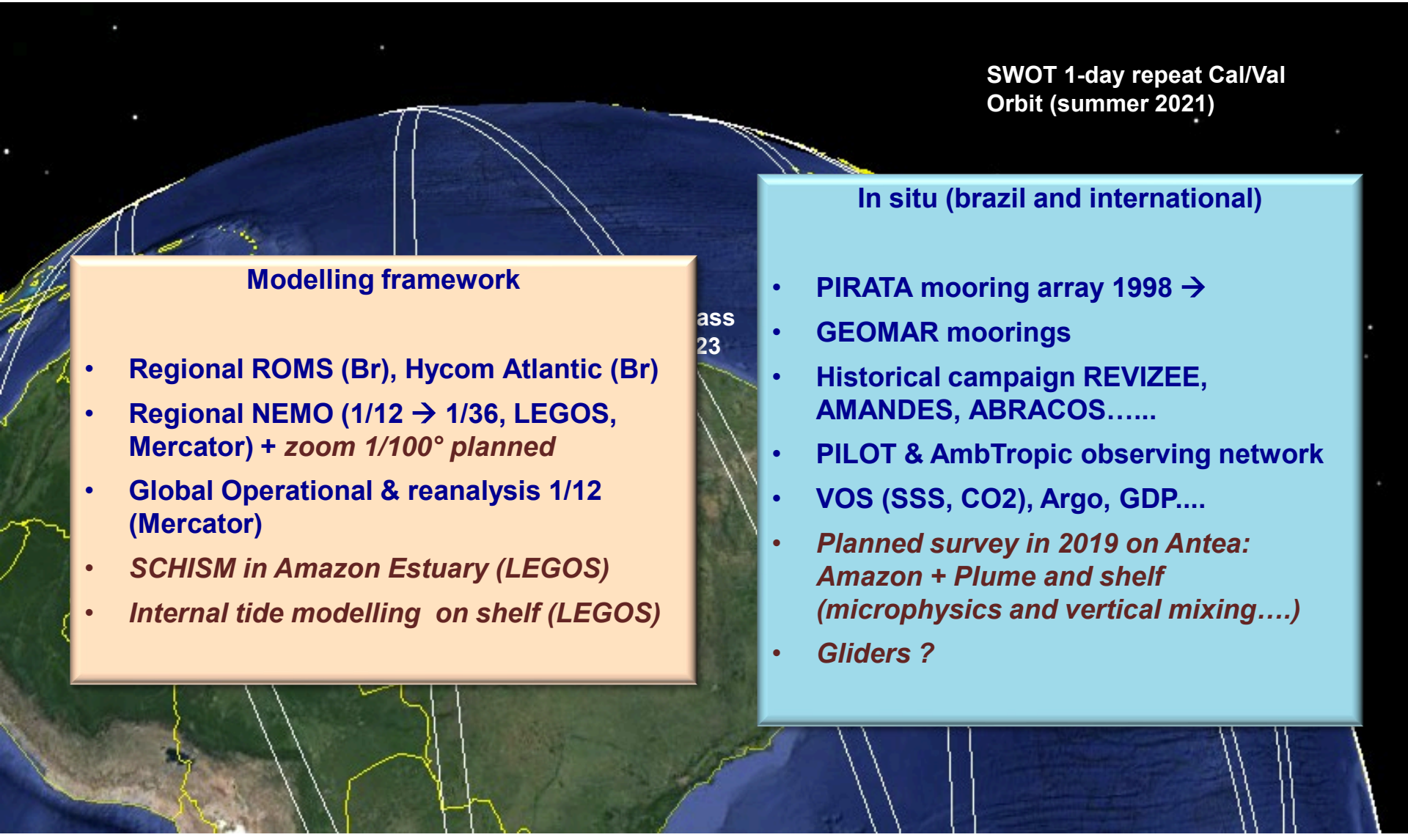
Key issue for successful modeling: good quality bathymetry !

In situ survey: R/V Antea (IRD), Feb 2019

Bathymetric survey (multibeam echosounder)

Absolute water height monitoring (GNSS blanket)

Existing framework in the Western tropical Atlantic supporting future initiatives and SWOT Ocean Brazil



Modelling framework

- Regional ROMS (Br), Hycom Atlantic (Br)
- Regional NEMO (1/12 → 1/36, LEGOS, Mercator) + *zoom 1/100° planned*
- Global Operational & reanalysis 1/12 (Mercator)
- *SCHISM in Amazon Estuary (LEGOS)*
- *Internal tide modelling on shelf (LEGOS)*

In situ (brazil and international)

- PIRATA mooring array 1998 →
- GEOMAR moorings
- Historical campaign REVIZEE, AMANDES, ABRACOS…...
- PILOT & AmbTropic observing network
- VOS (SSS, CO2), Argo, GDP....
- *Planned survey in 2019 on Antea: Amazon + Plume and shelf (microphysics and vertical mixing….)*
- *Gliders ?*