Field Observations and modeling of the Brazil Current system - REMO and INCT

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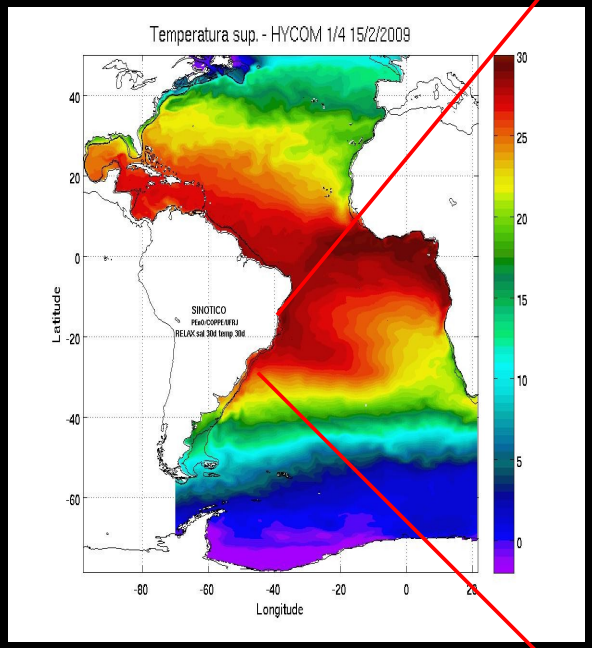
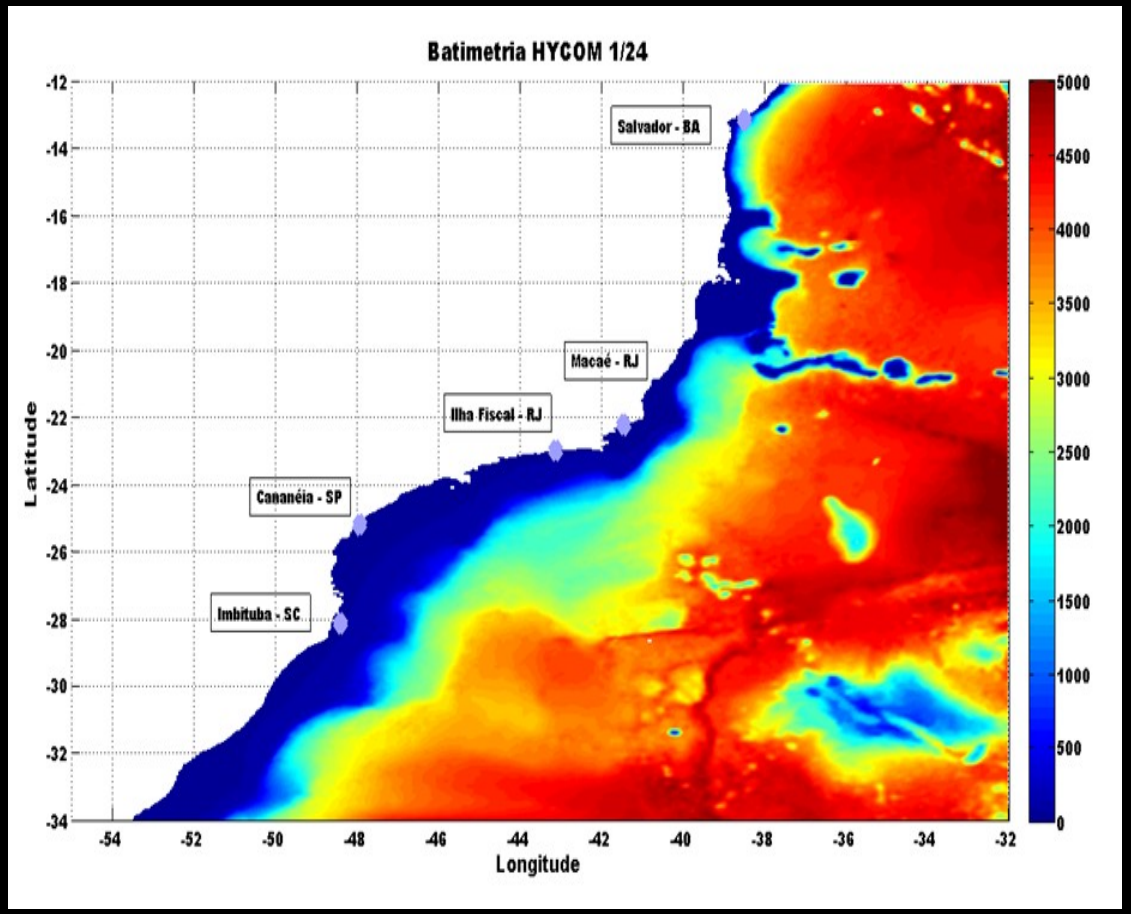
Two research projects:

REMO – a modeling initiative with an observational component

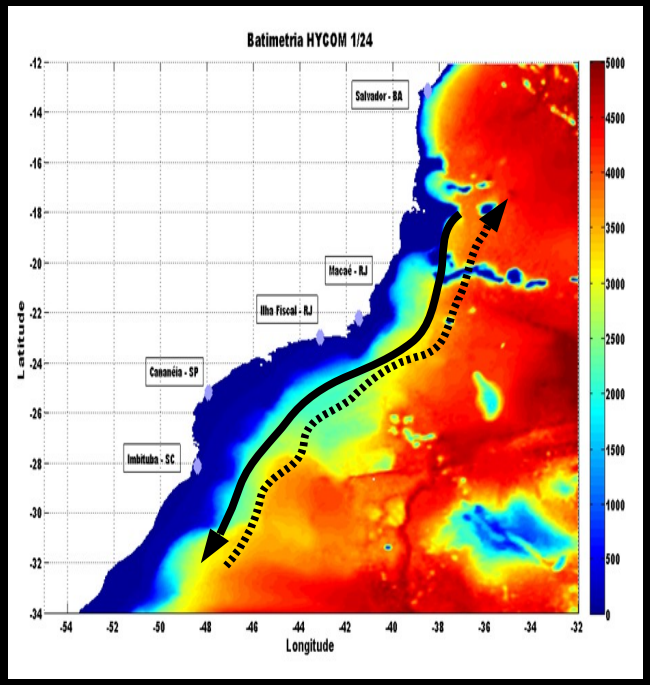
INCT – an observational program with a modeling component

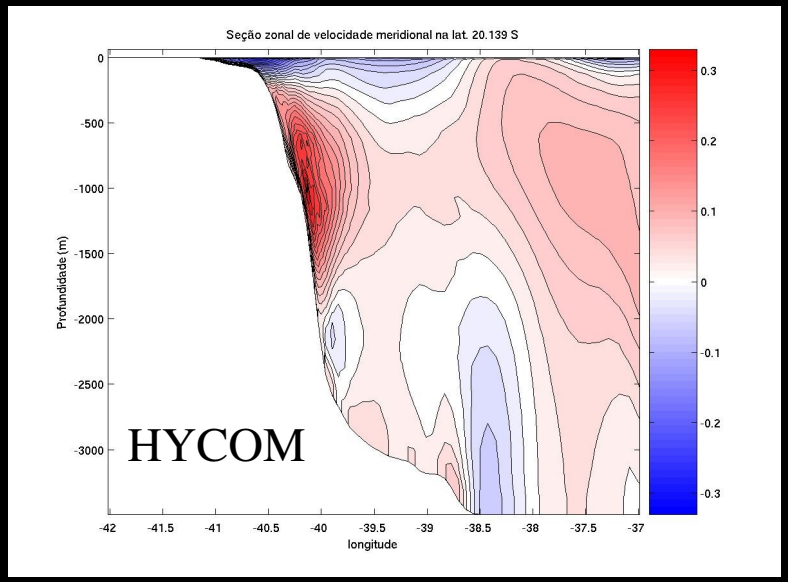
The region of interest:

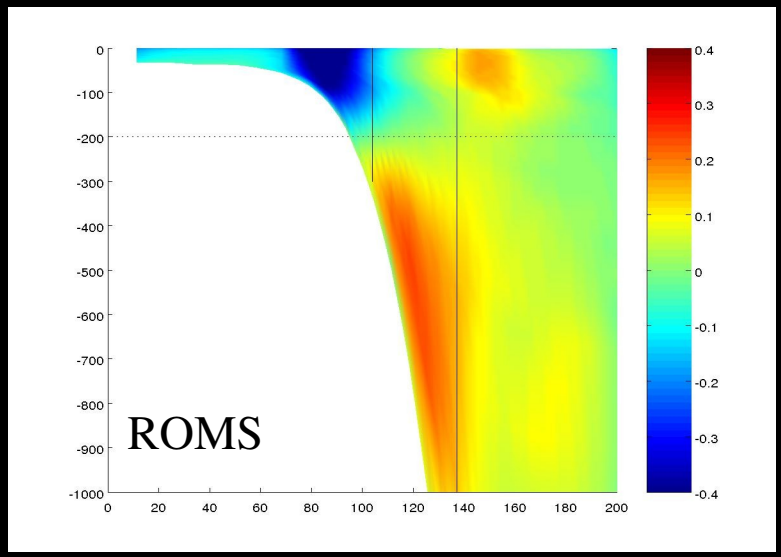




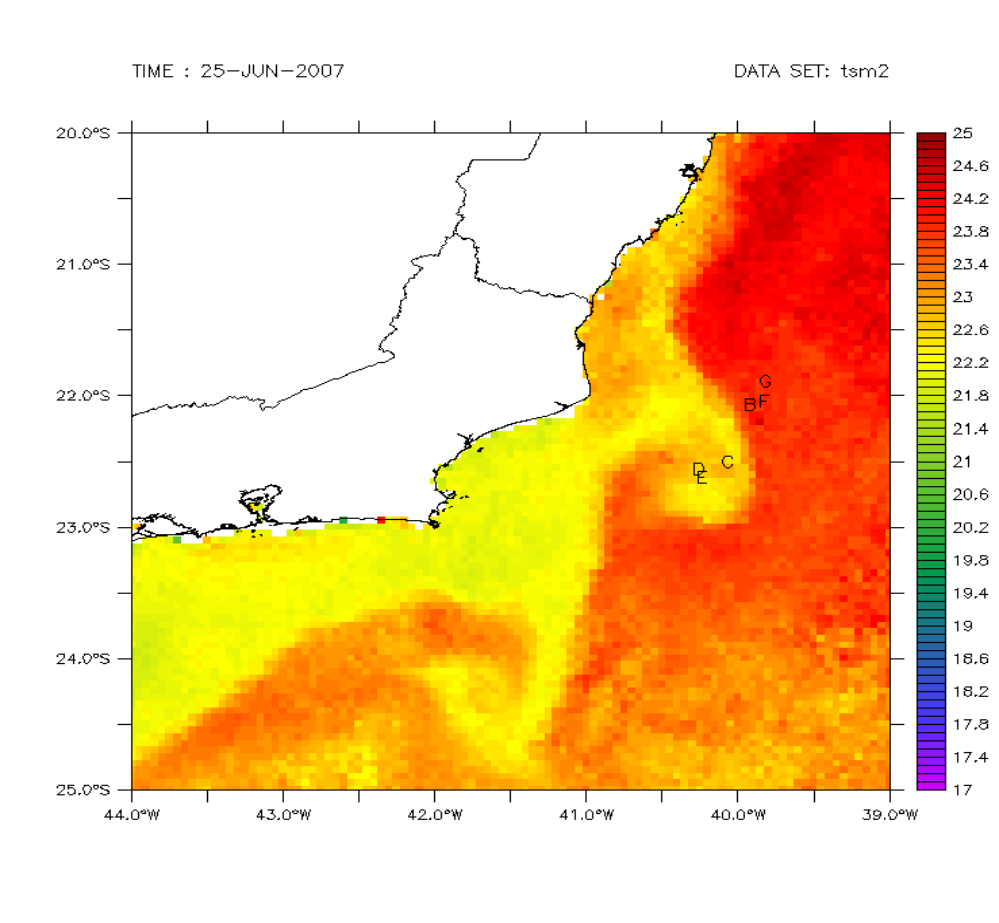
A little bit about the Oceanography of this region

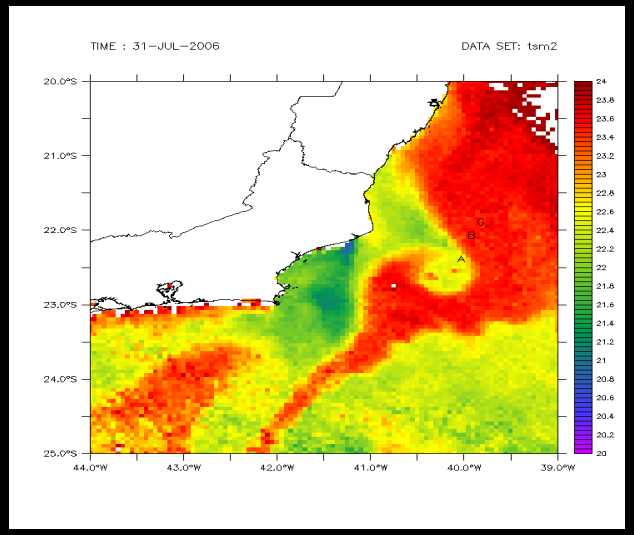


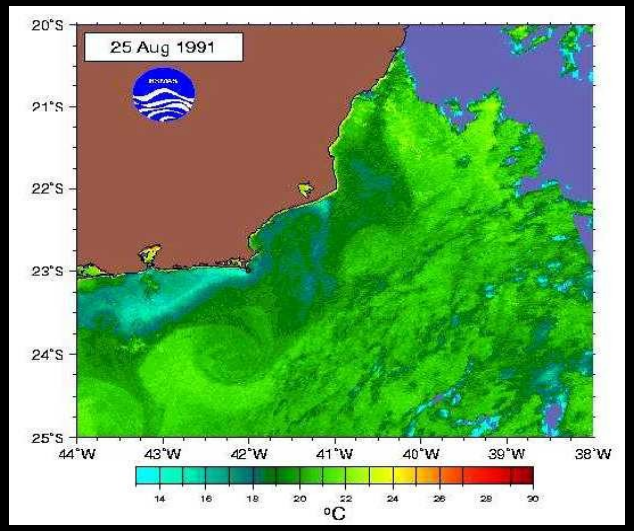


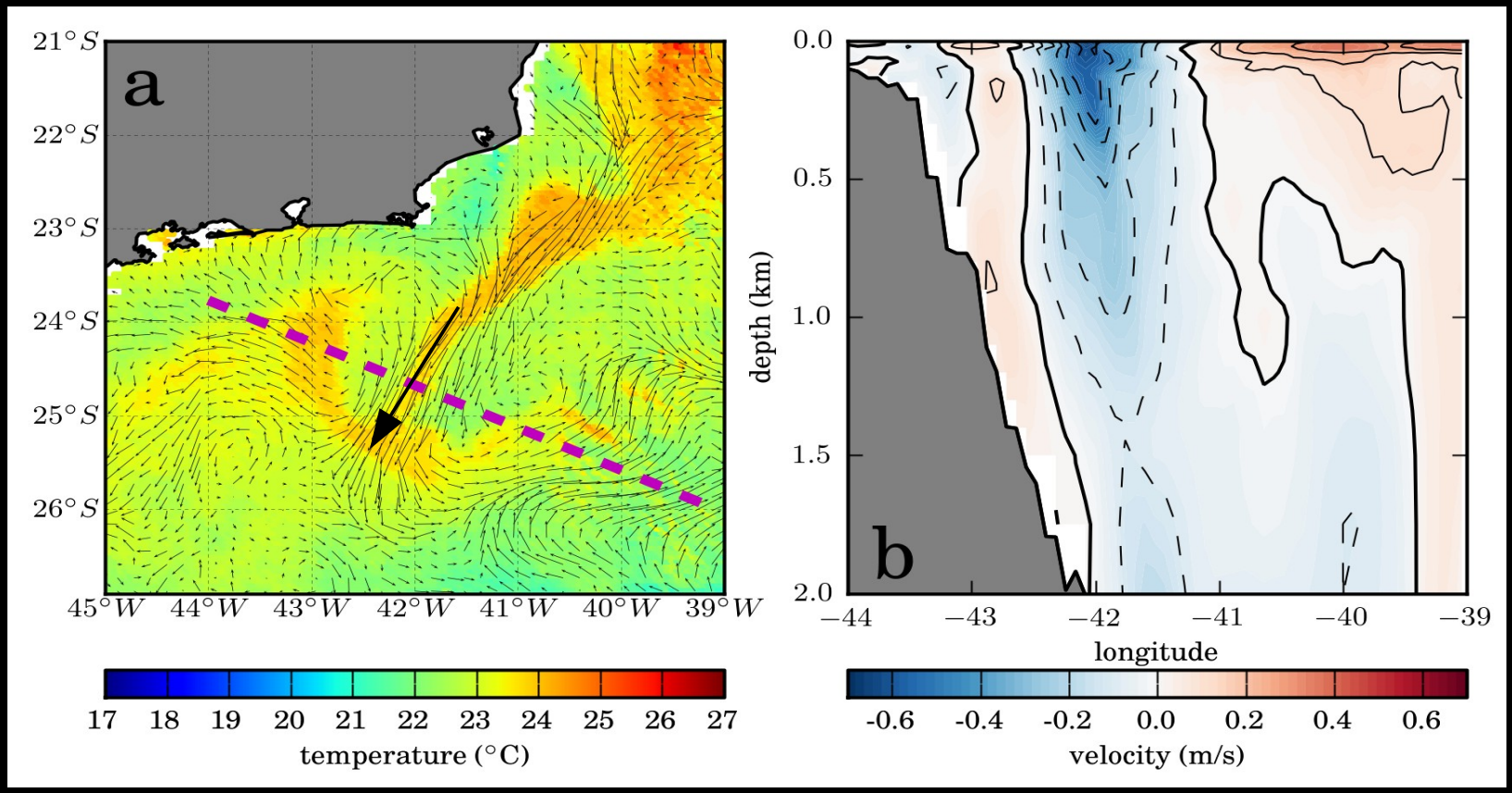


Intense mesoscale (eddy) activity









Guerra and Paiva, 2012

Intense surface currents – pick of 1.2 m/s during interaction of Brazil Current cyclone and Agulhas Ring anticyclone

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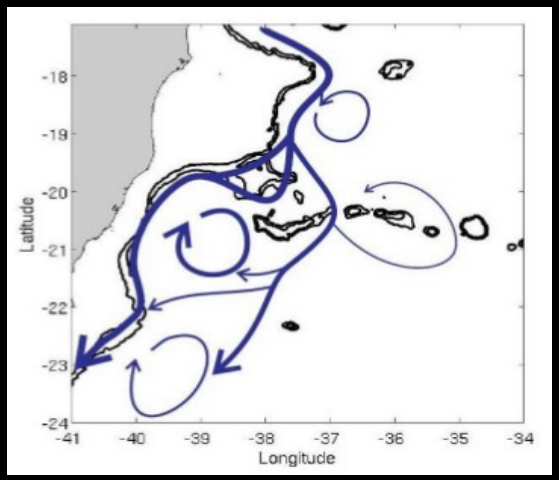
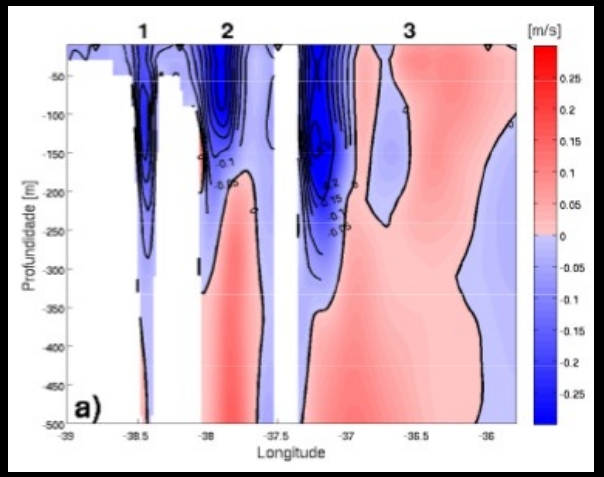
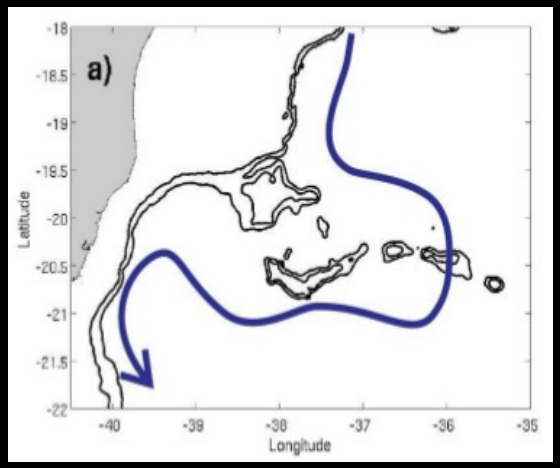
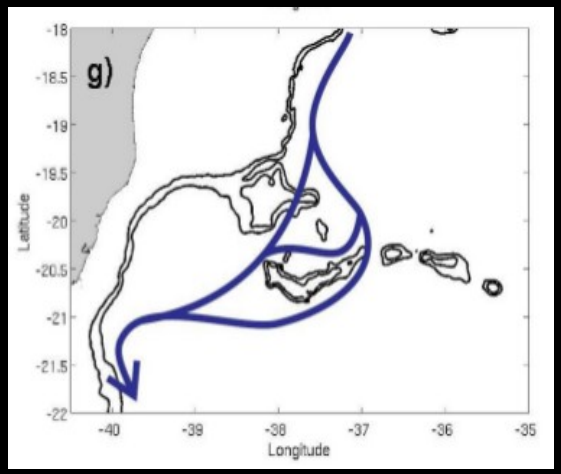
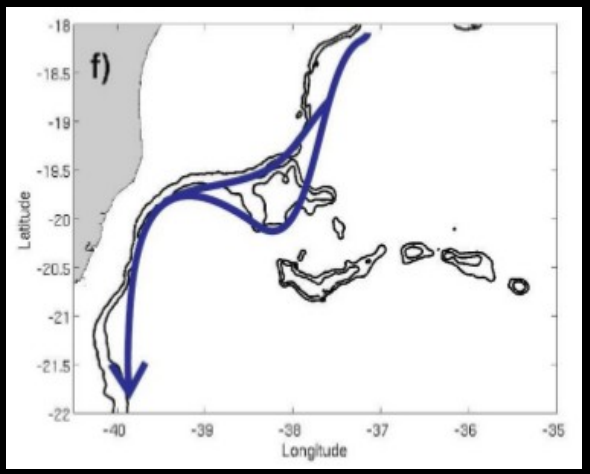
How does the Brazil Current "negotiate" the Vitoria-Trindade mountain chain?



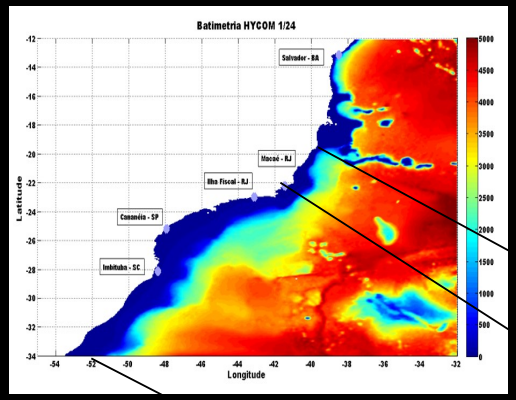


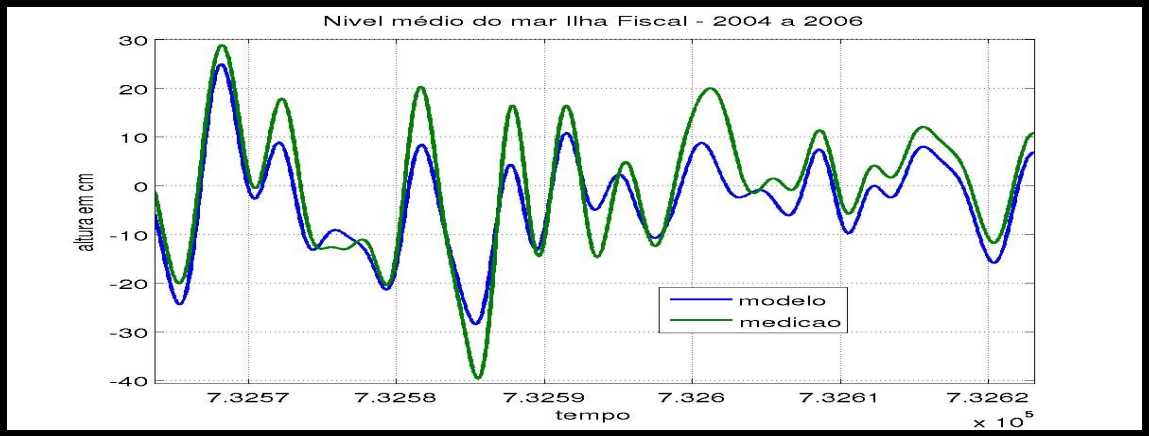


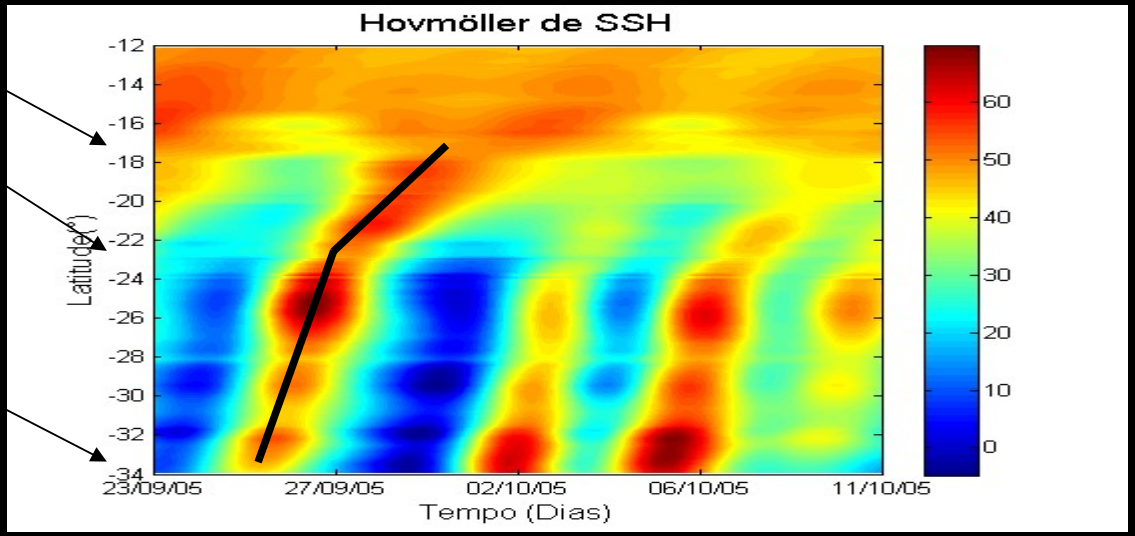




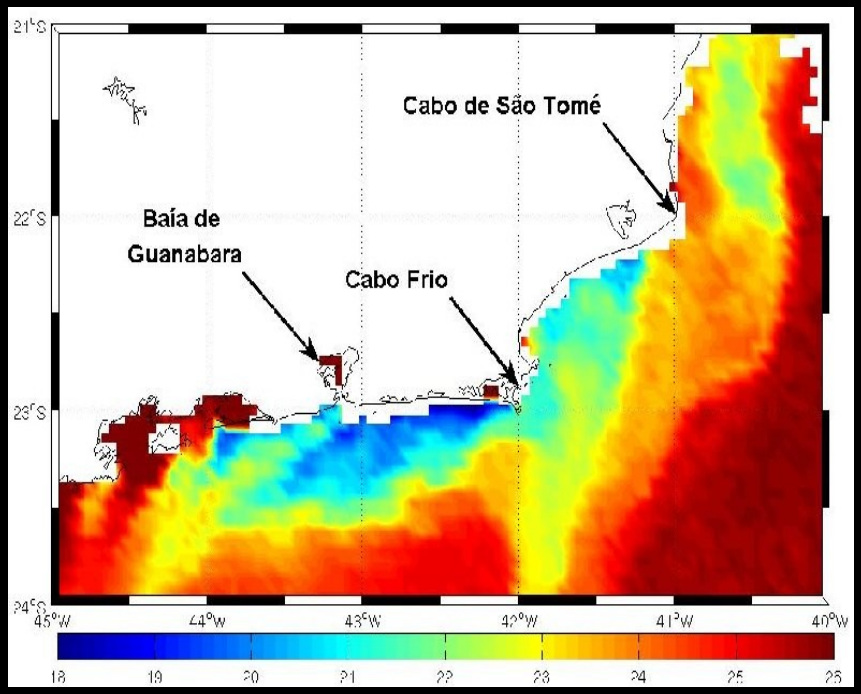
Propagation of continental shelf waves

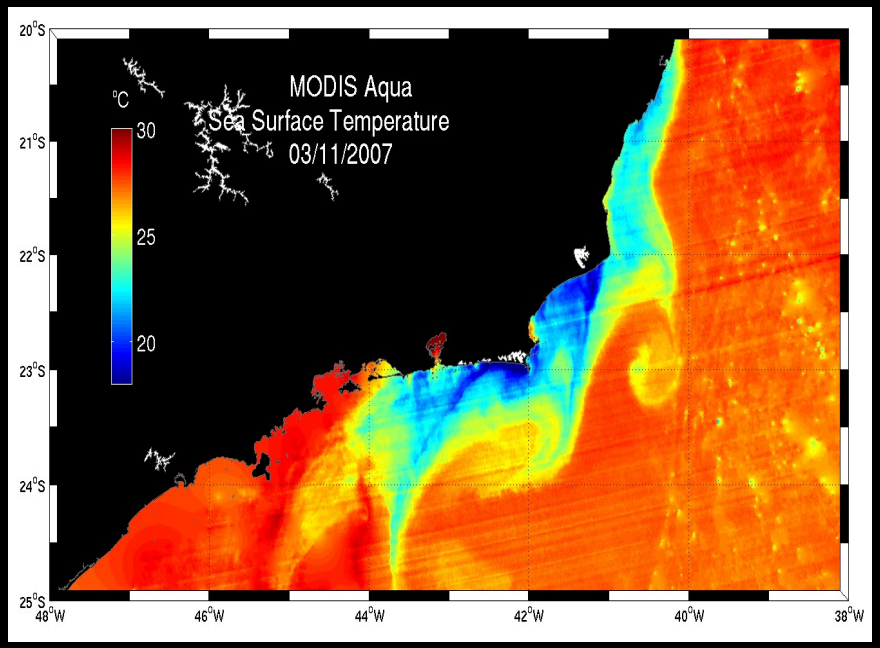


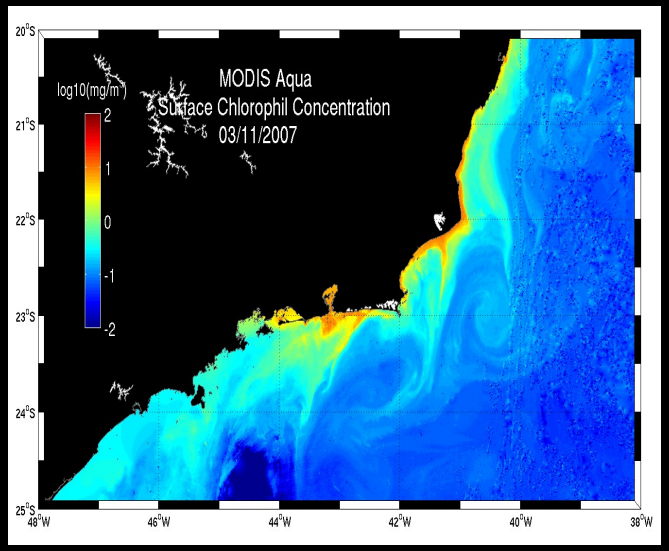




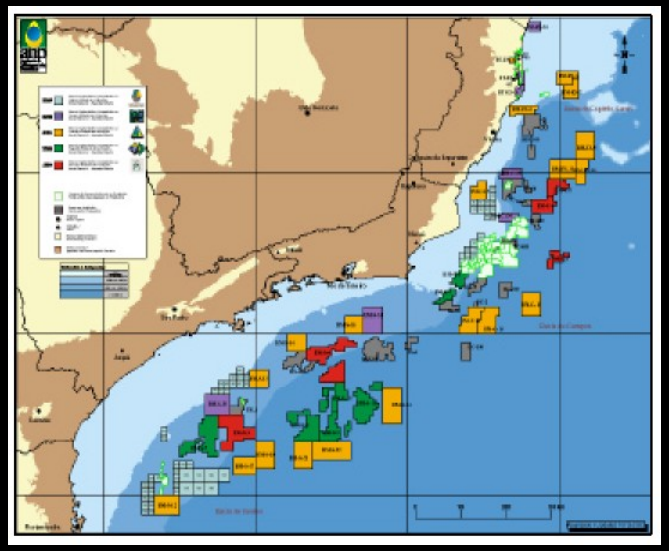
Coastal upwelling at Cabo Frio







Ecological implications



Practical implications

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REMO
Rede de Modelagem e Observação Oceanográfica
("Network for Ocean Modeling and Observations")

A Brazilian initiative towards operational oceanography
(ongoing project started in 2006)

General objectives:

- to contribute to the development of oceanography in Brazil
- to attend the demands of the oil industry
- to attend the demands of the Brazilian Navy (search and rescue, ...)

Specific objectives:

- to generate short-term forecast of ocean currents
- to generate long series of 3D current fields to be used in engineering projects and for studies of oil dispersion in the ocean (process of “licensing” by the environmental agency)

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Modeling strategy

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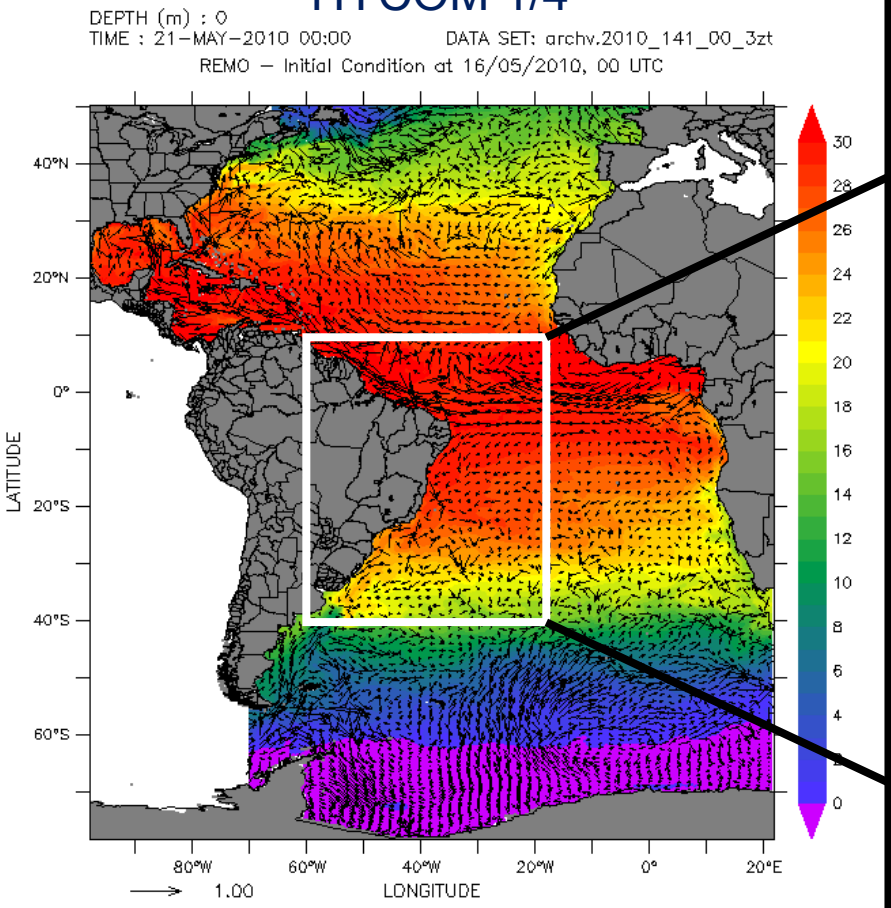

Temperatura e Correntes Superficiais

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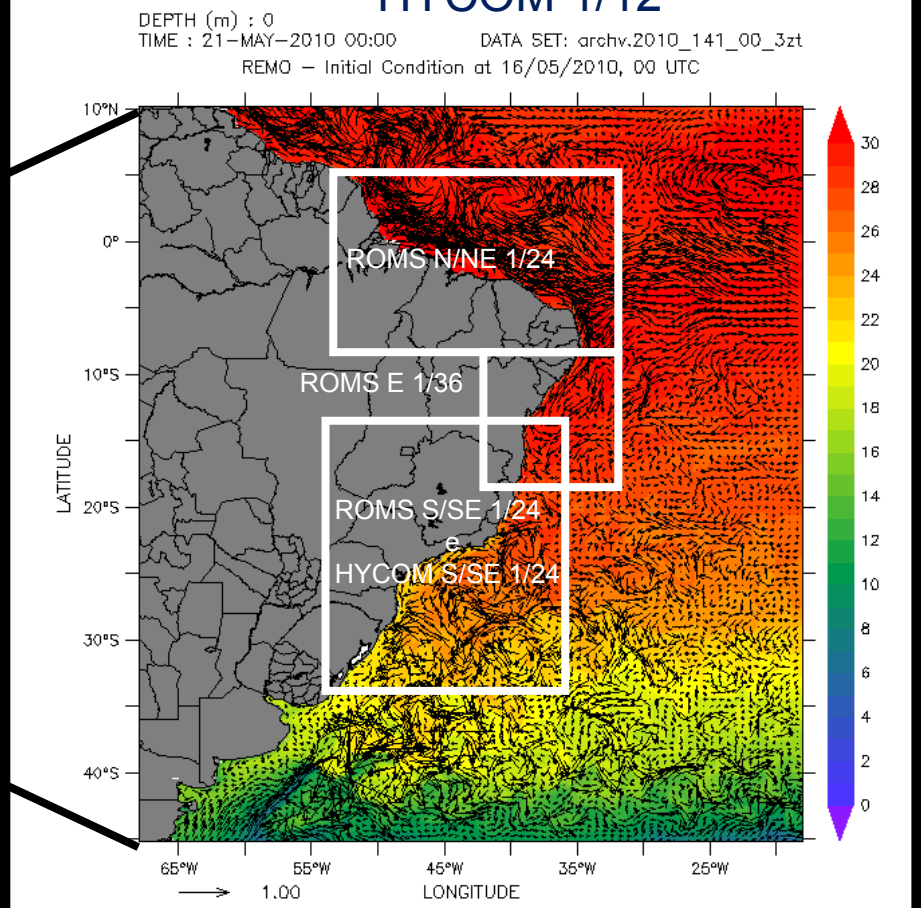


Temperatura e Correntes Superficiais

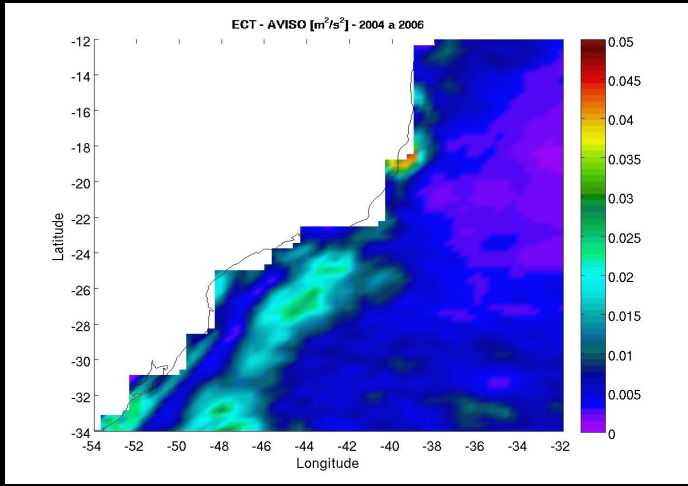
We need good quality data to:

- better understand the reality we are trying to model

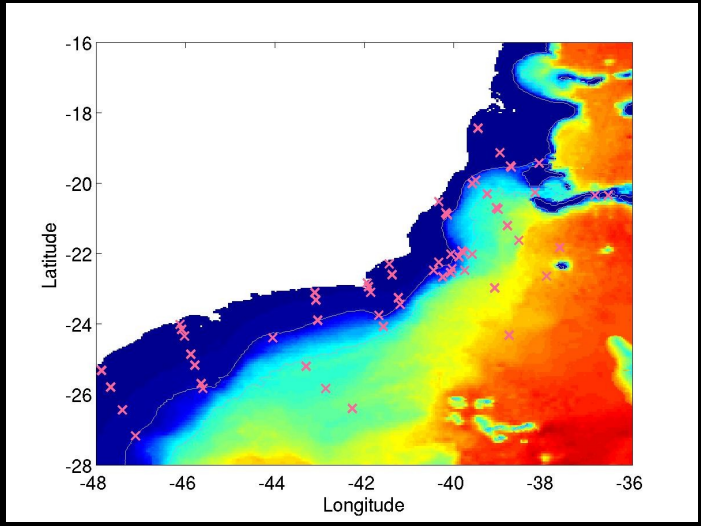
- validate model simulations and forecasts

- assimilate into the models

Model validation: a few examples

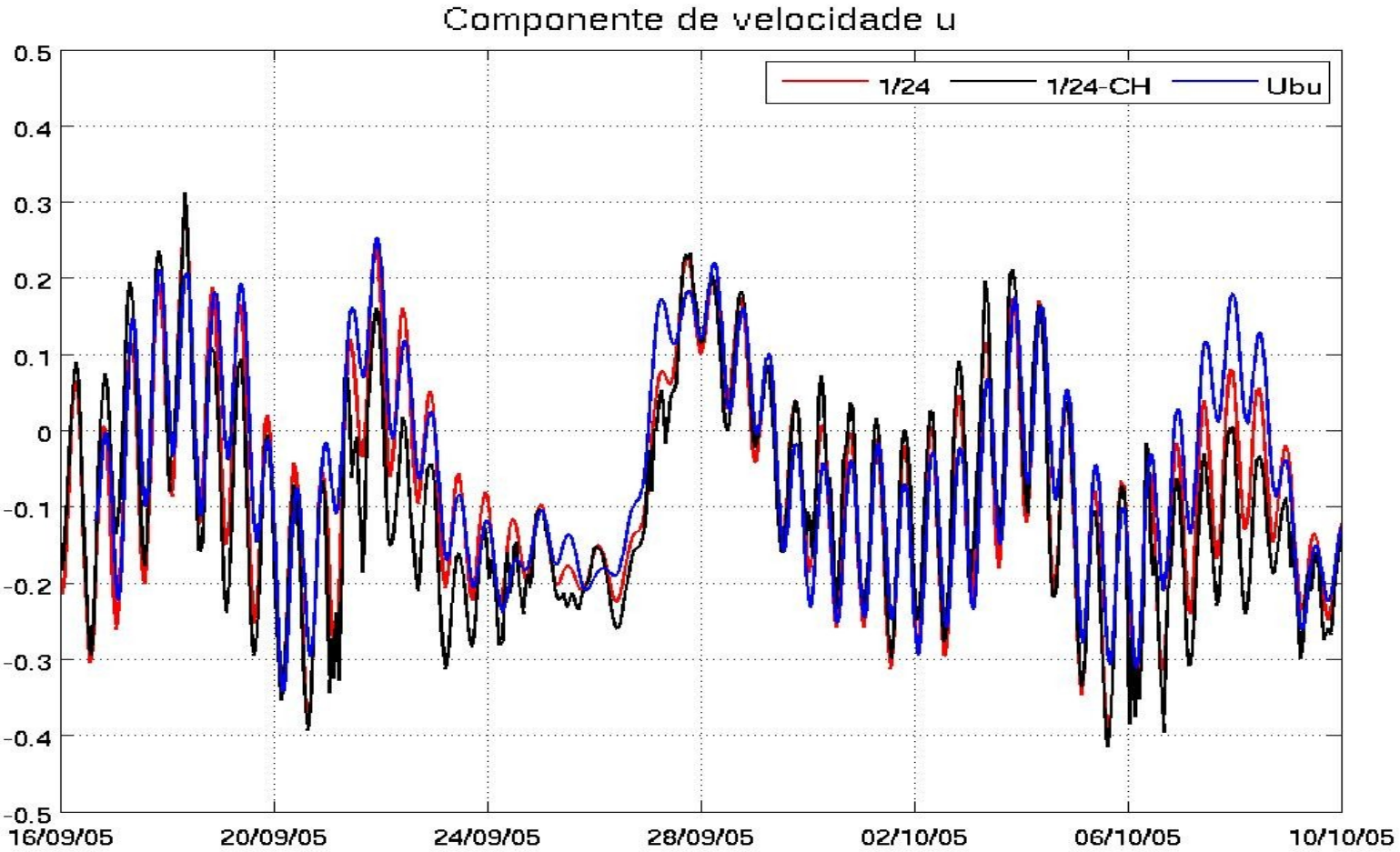


Basic comparisons
(e.g. TKE)

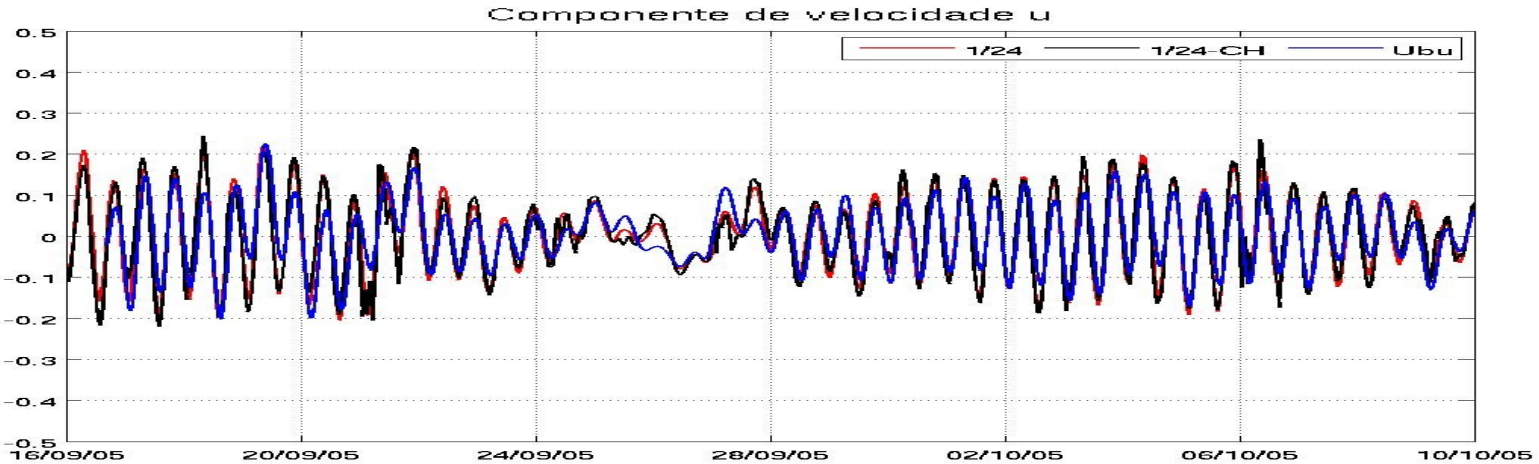


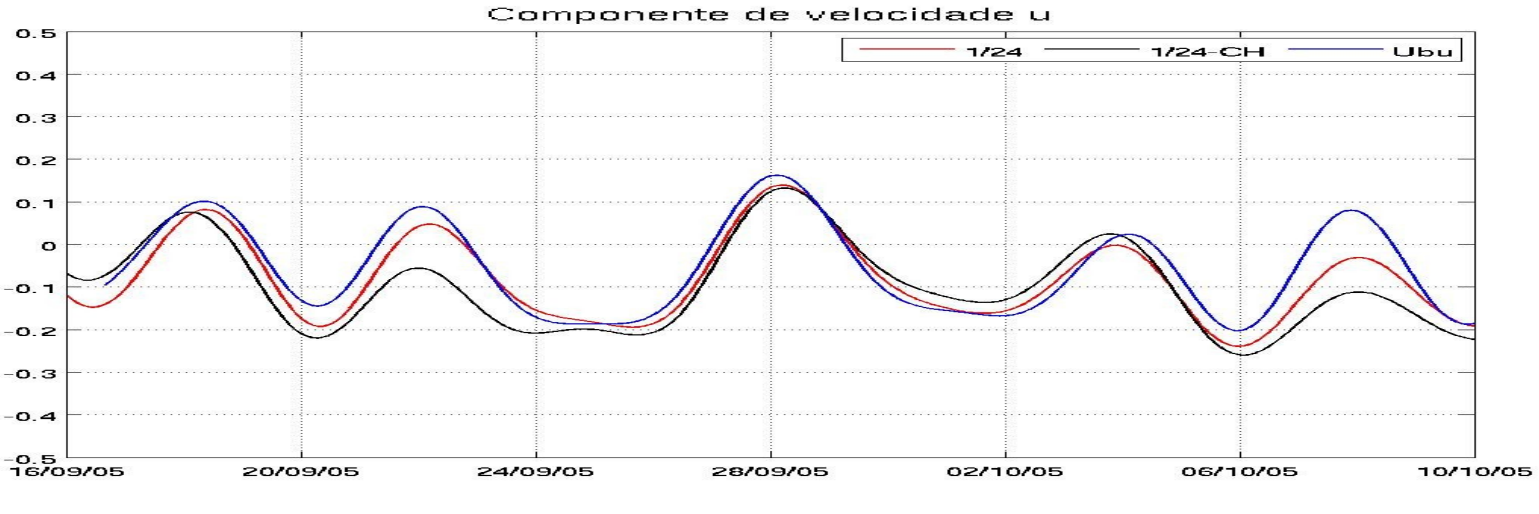
Point to point comparisons
Time series
Model virtual moorings

Model validation: a few examples
Continental shelf – surface velocity

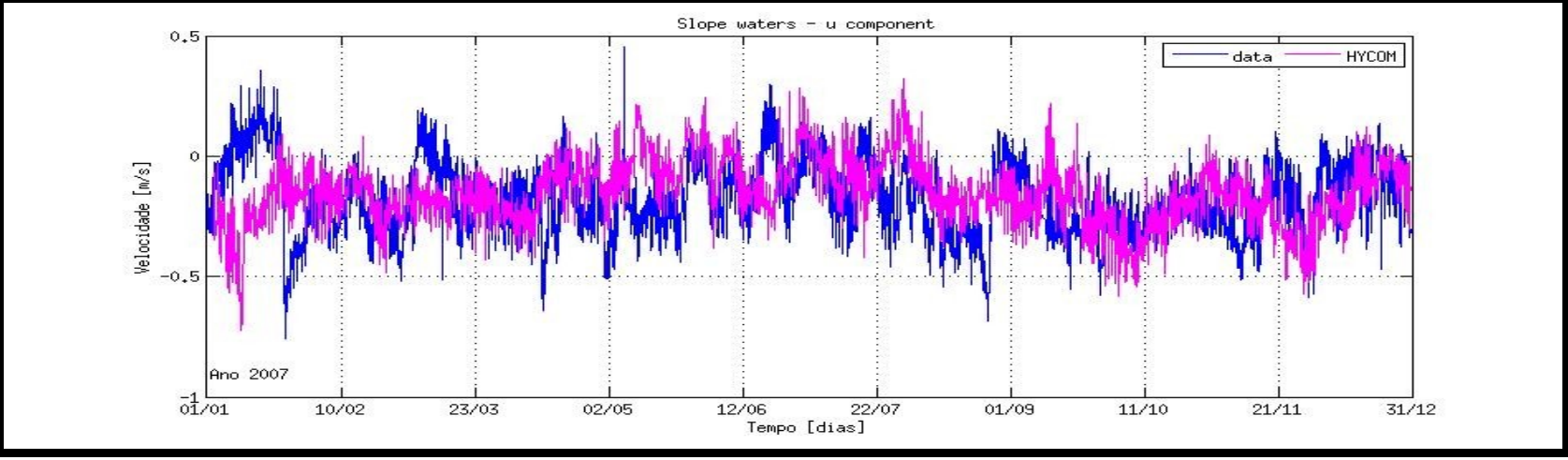


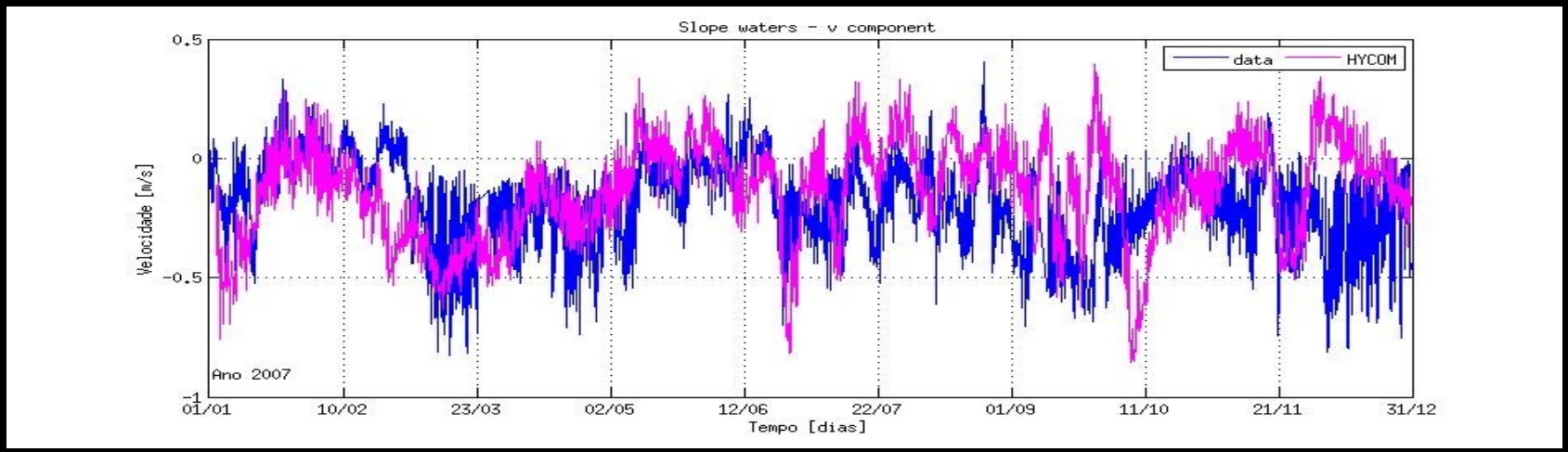
Model validation: a few examples
Continental shelf – surface velocity





Model validation: a few examples
Slope waters – velocities at 40m

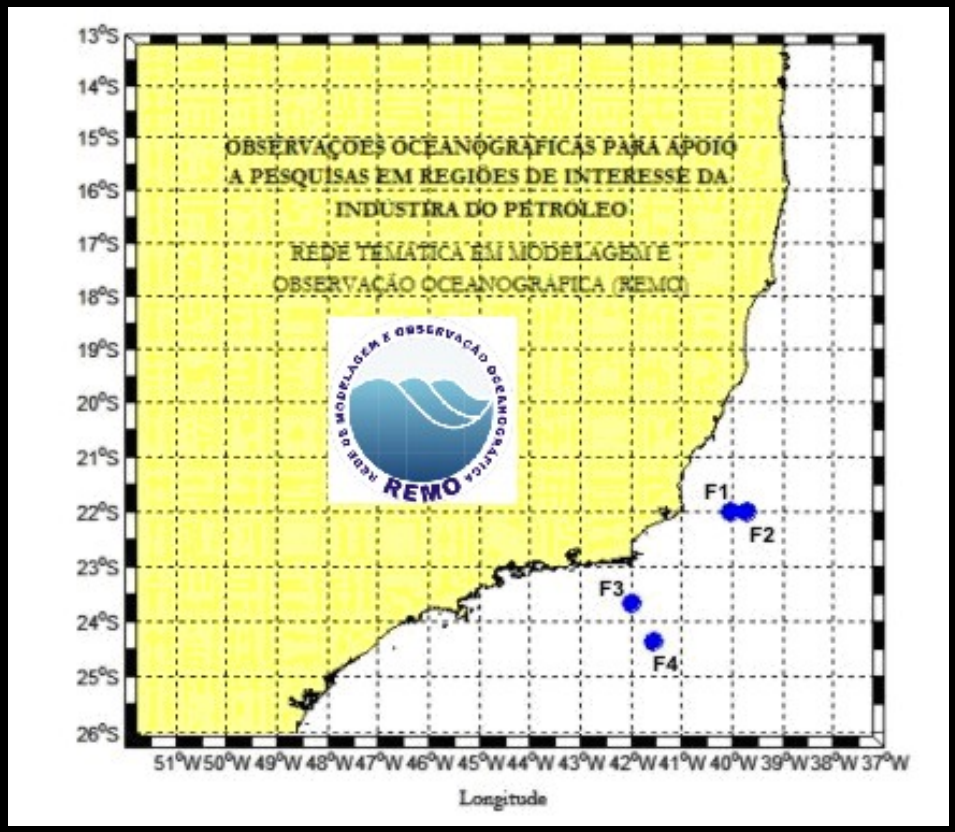




Observational programs supported by REMO → PNBOIA

Brazilian contribution (via the Brazilian Navy – DHN) to GOOS

Real time oceanographic and meteorological data along the Brazilian coast

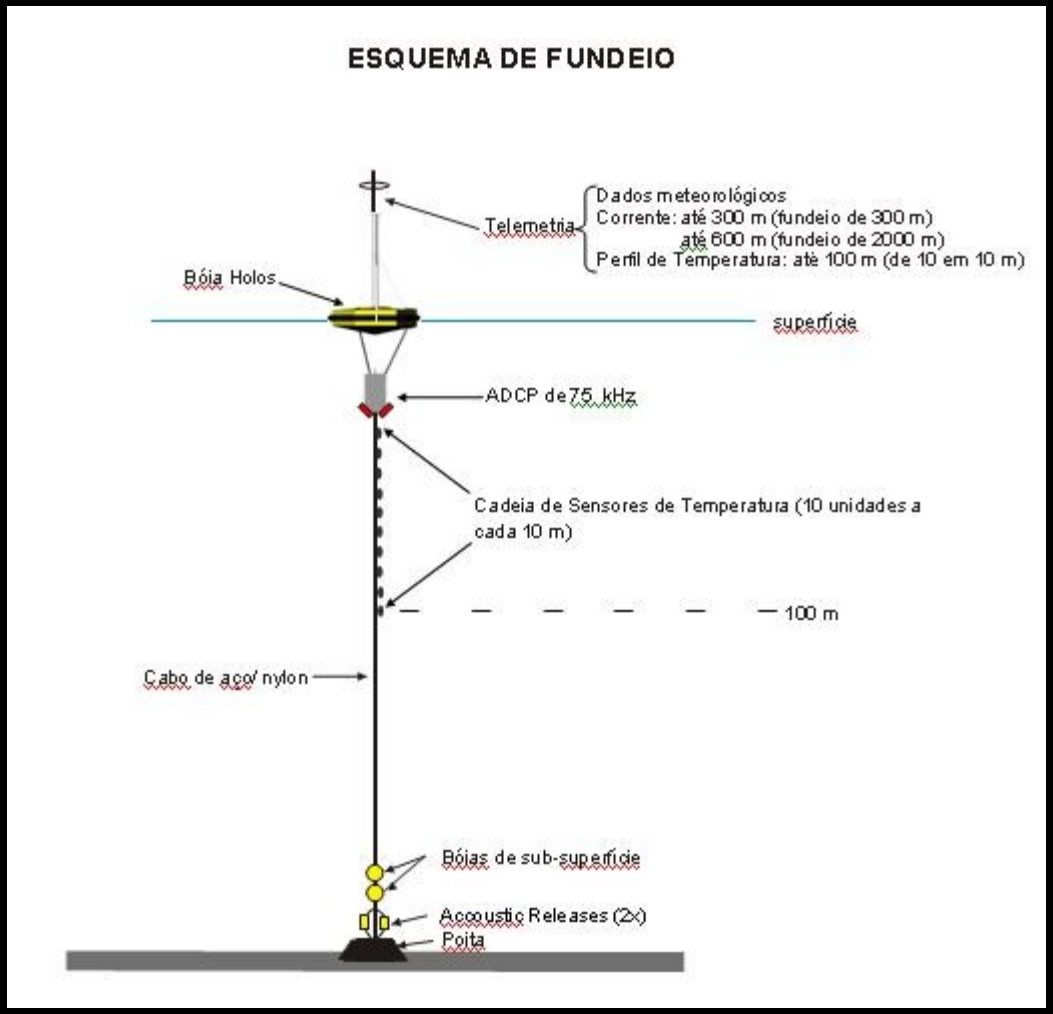


Shallow and deep water moorings with real time data transmission

REMO and UFRJ/COPPE/PENO/ Lab. de Instrumentação Oceanográfica (LIOc) REMO

Start: 2014

Fundeio	Coordenada (Lat./ Lon.)	Profundidade (m)
F1- São Tomé 300m	-21.94 S -40.03 W	300
F2- São Tomé 2000m	-21.92 S -39.82 W	2.000
F3- Cabo Frio 300m	-23.77 S -41.94 W	300
F4- Cabo Frio 2000m	-24.42 S -41.45 W	2.000



Deep water moorings

REMO web page

Rede de Modelagem e Observação Oceanográfica

Uma iniciativa brasileira em oceanografia operacional

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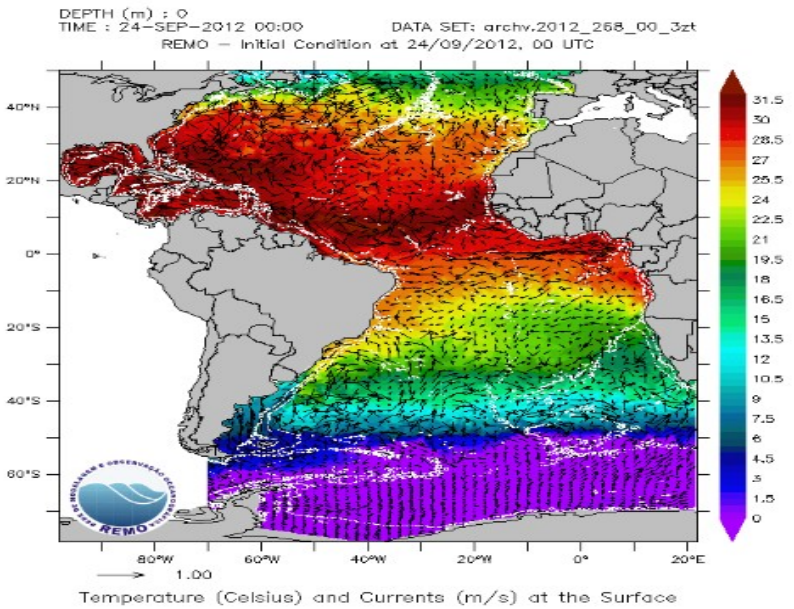
- O que é a REMO
- Equipe
- Publicações
- Notícias
- Documentos
- Agenda
- Contatos
- Links
- Sistema

Produtos

LAS

Vetores de Corrente Superficial em Temperatura da Superfície do Mar | 24 / 09 / 2012

0h | 24h | 48h | 72h | 96h | 120h | 144h | 168h | Filme



Temperature (Celsius) and Currents (m/s) at the Surface

Os produtos apresentados nessa página são resultados de modelos oceânicos em desenvolvimento científico, sujeitos aos desvios de algoritmos numéricos e hipóteses simplificadoras de suas equações governantes. Seu uso atual é apenas para avaliação científica. A REMO em nenhum caso pode ser responsabilizada pelo uso inadequado desses produtos.

REMO is a participant of GODAE Ocean View

INCT – ProOceano

Instituto Nacional de Ciência e Tecnologia ("National Institute for Science and Tecnology)

Estudos integrados de processos oceanográficos de plataforma e talude ("Integrated studies of oceanographic processes in the continental shelf and slope")

More ambitious research project

Congregates around 30 institutions and more than 100 researchers

Objectives goes from scientific (physical, chemical, biological, and geological oceanography) to formation of human resources, and transfer to society

"… emphasis on an integrated view of the oceanographic processes in shelf and slope waters, together with an effective transfers of knowledge to society..."

"...to establish concrete scientific basis for the sustainable use of the renewable and non-renewable resources in the area of interest..."

"Regarding biodiversity and economic use, the area of study encompass two of the most important ecosystems in the Brazilian coast: the main upwelling region (Cabo Frio) and the larger coral reef complex (Abrolhos). The project aims to identify in a integrated way the principal oceanographic processes - physical, chemical, biological and geological - which are responsible for the structuring and functioning of these ecosystems"

Physical oceanography:

In general, "...we seek to understand how the mesoscale activity in the slope waters, primarily that associated with the Vitoria-Trindade mountain chain and with the formation of Cabo de São Tomé e Cabo Frio eddies, affects coastal processes, in particular the upwelling of rich subsurface waters, and how these processes contribute to the structure of these diverse ecossystems."

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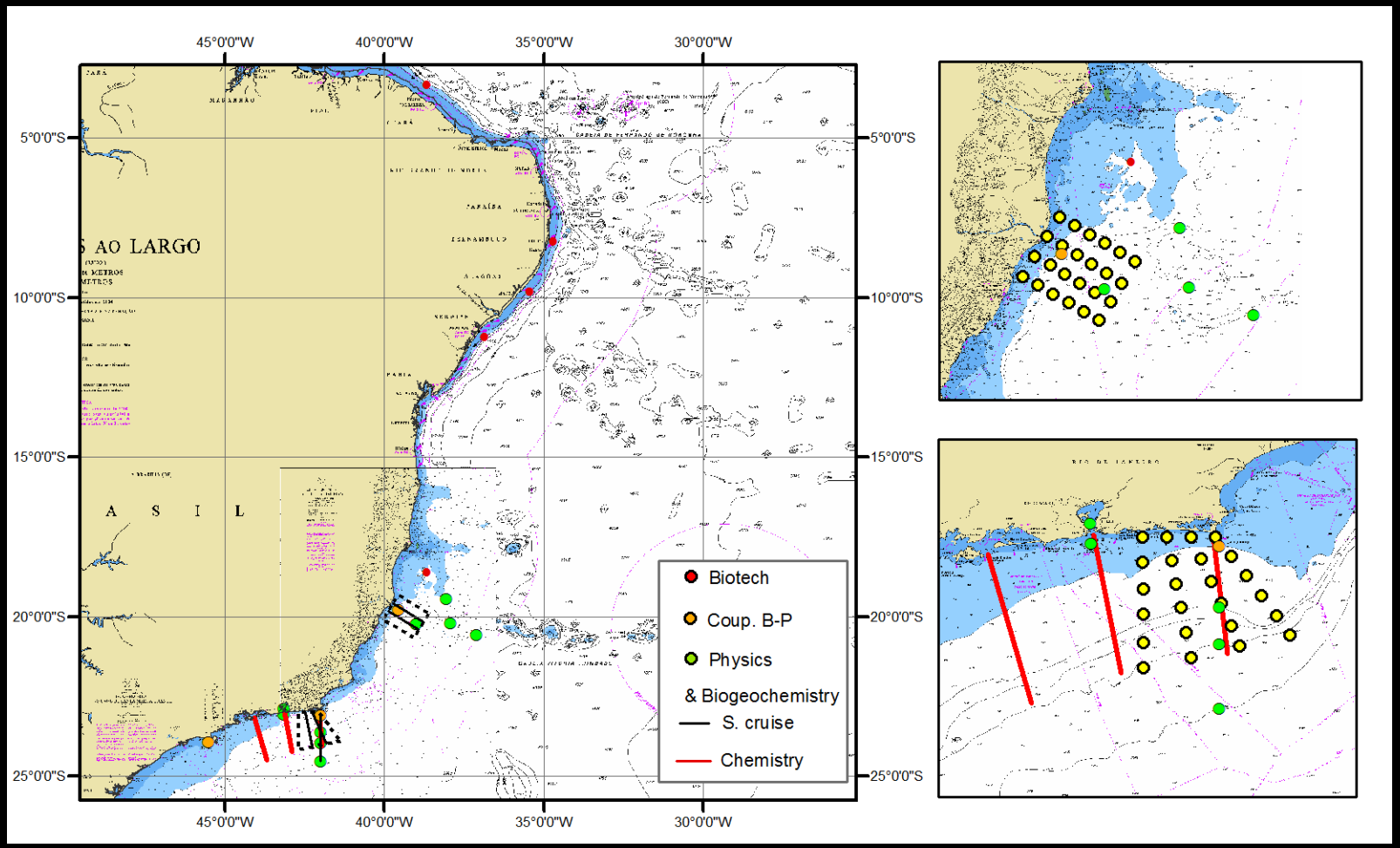
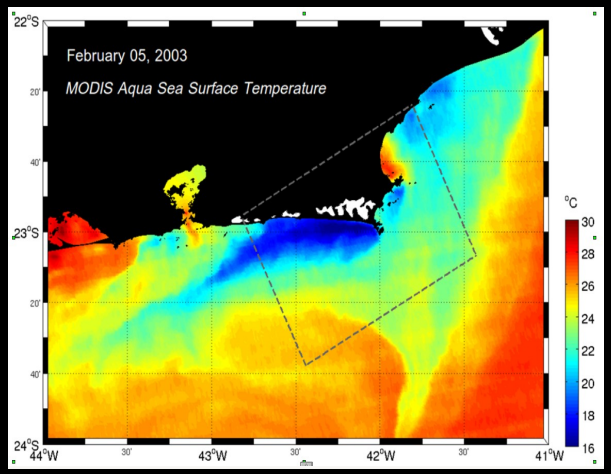
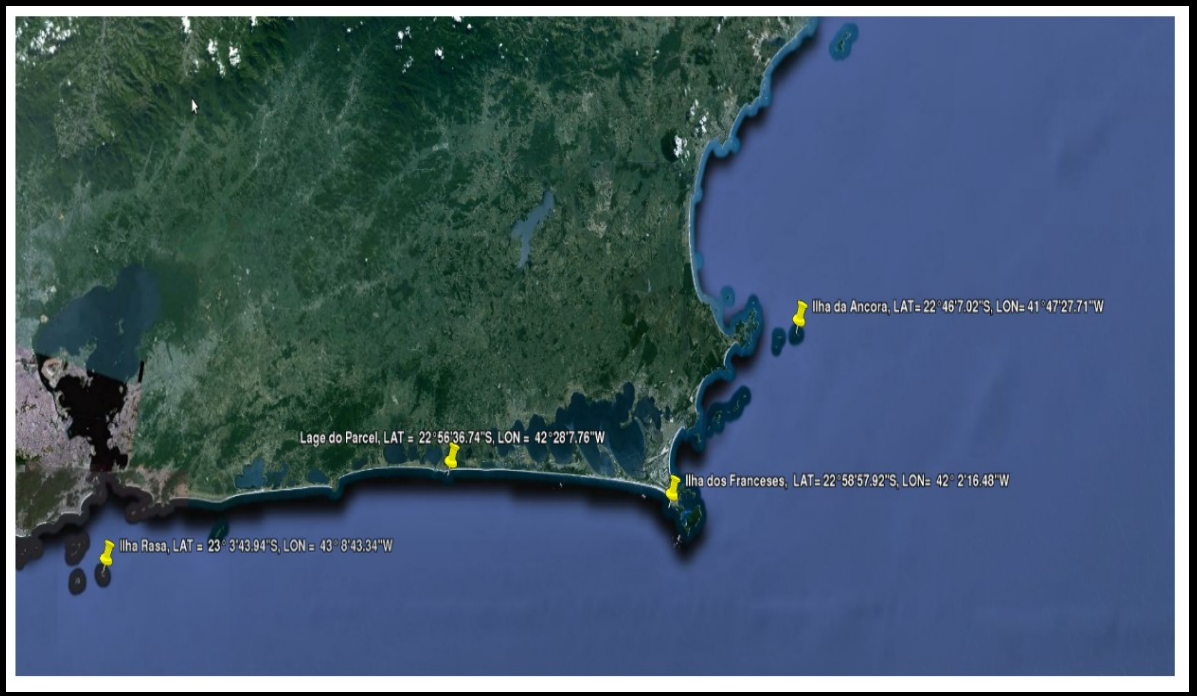
Sampling strategy

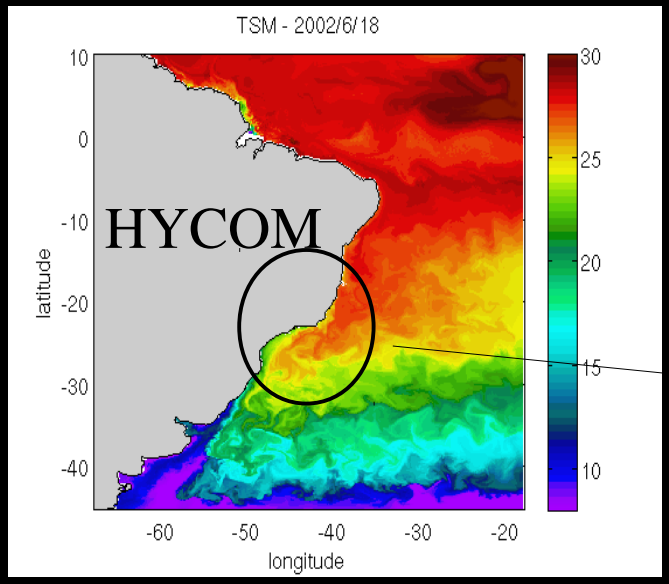


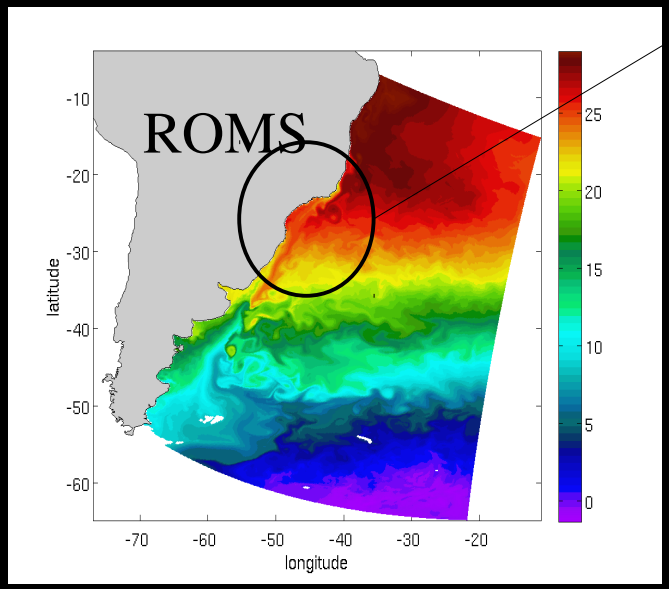
Mooring lines, fine spatial resolution oceanographic cruises

Temperature sensors distributed along the coast at different depths

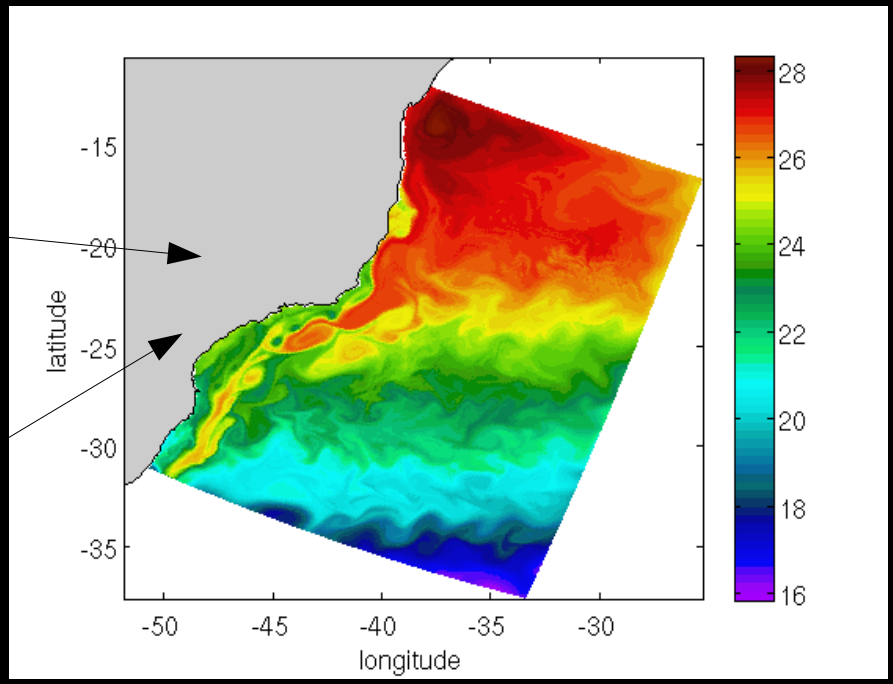








Modeling approaches

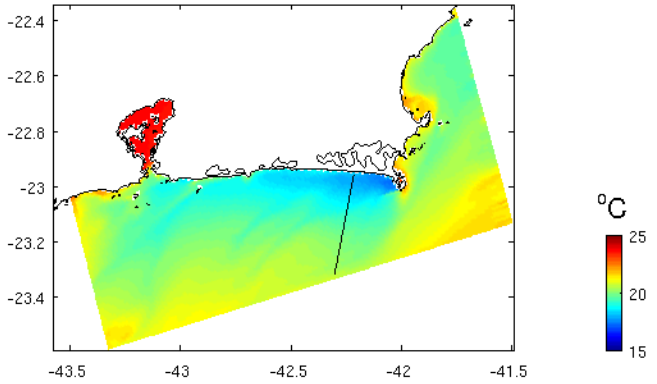


(Costa e Paiva, 2012)

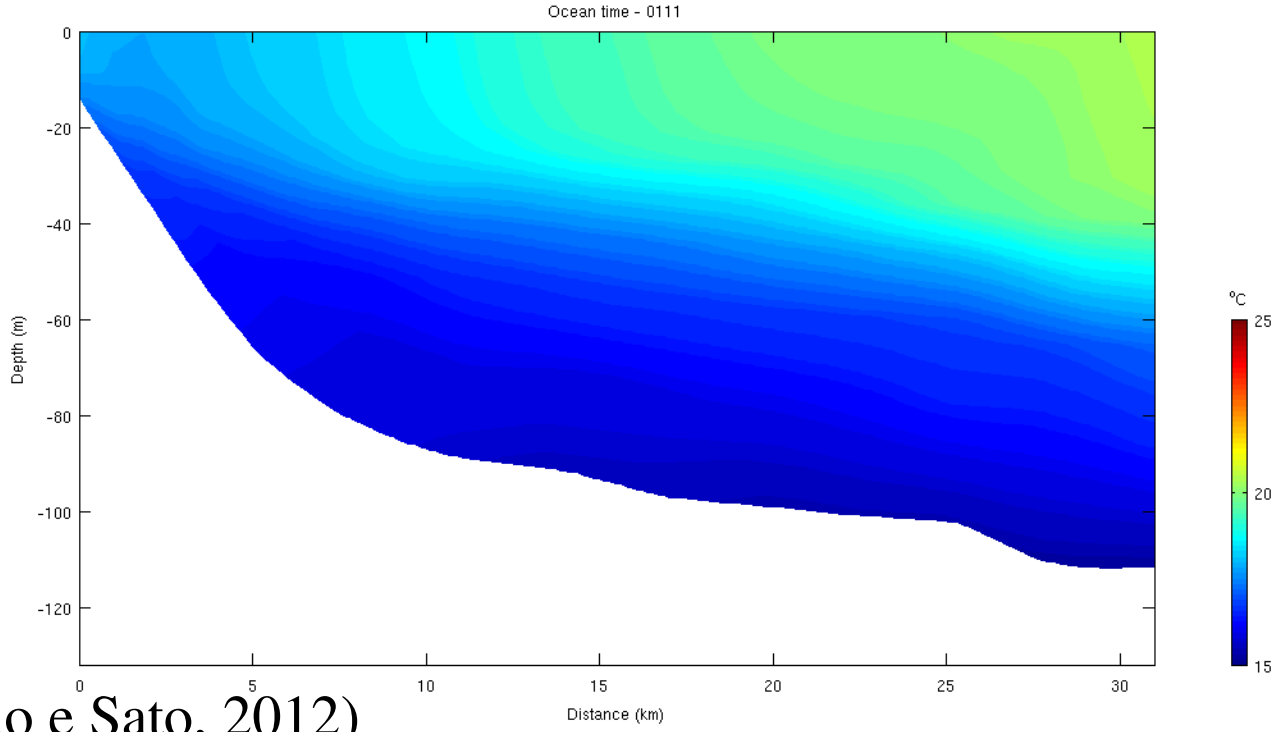
Downscaling

Process studies: idealized forcing and bathymetry

Modeling approaches



Very fine grid simulations of the Cabo Frio upwelling with ROMS



(Calado e Sato, 2012)

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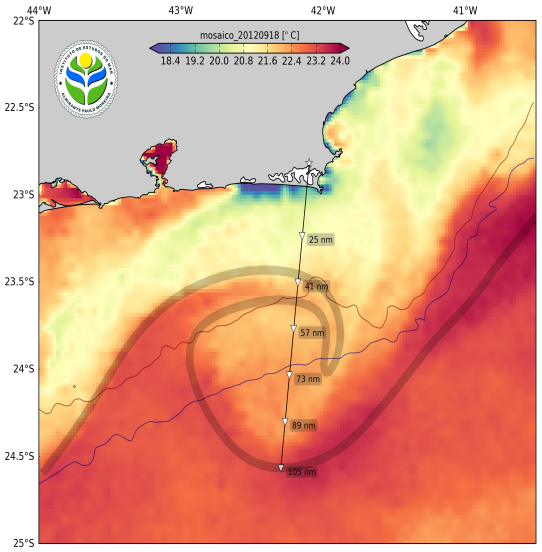
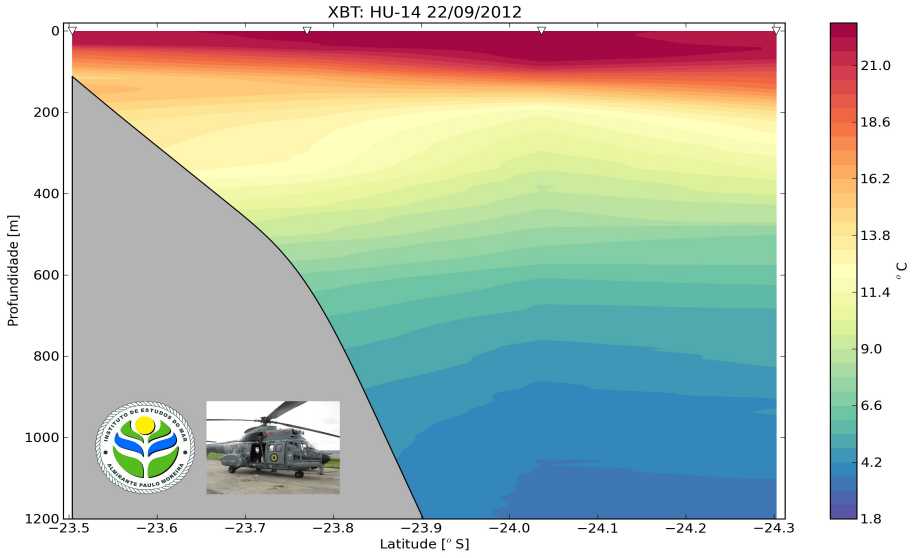
Preliminary results: sampling Cabo Frio upwelling and eddies with XBT dropped from helicopters





Work developed by Leandro Calado, from IEAPM, 2012