



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

Afonso de Moraes Paiva

Coastal and Oceanographic Engineering Group
Program of Ocean Engineering – COPPE
Federal University of Rio de Janeiro

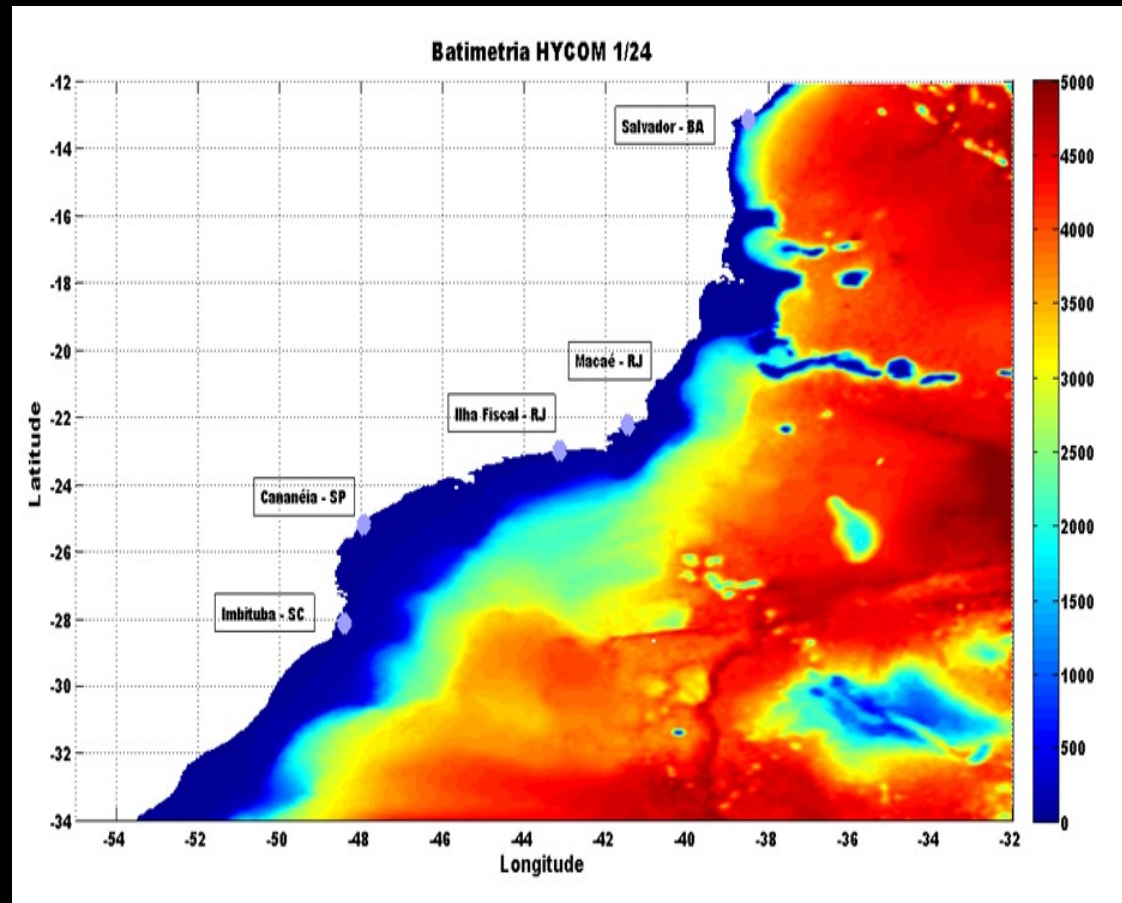
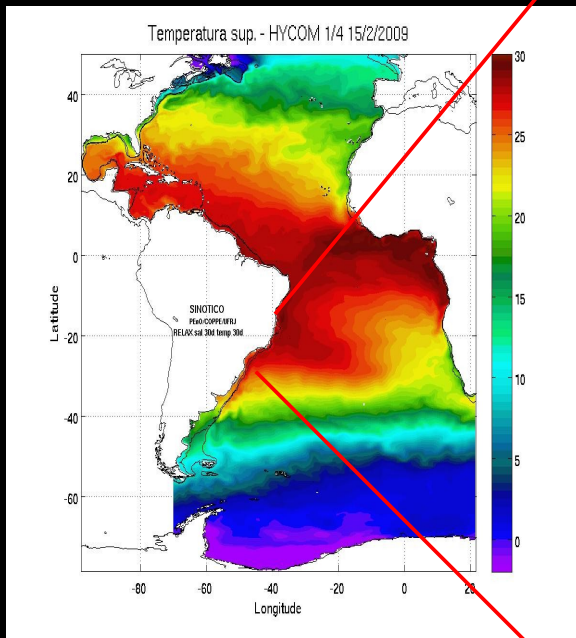


Two research projects:

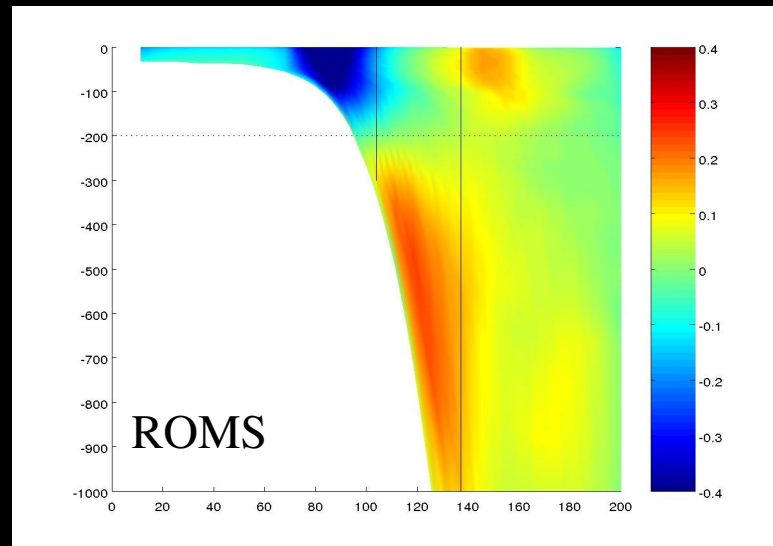
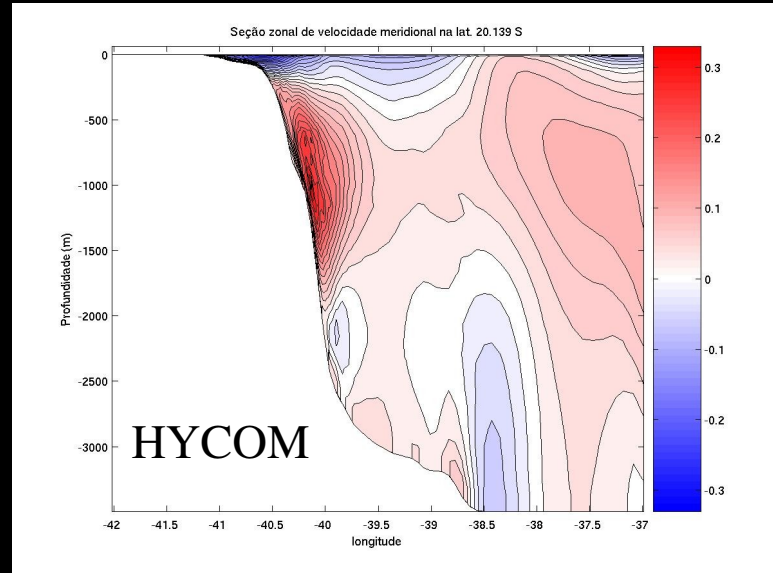
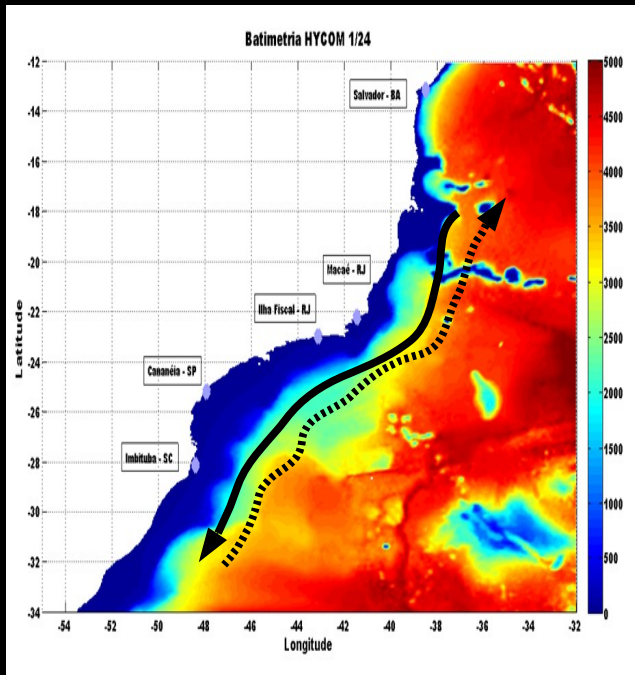
REMO – a modeling initiative with an observational component

INCT – an observational program with a modeling component

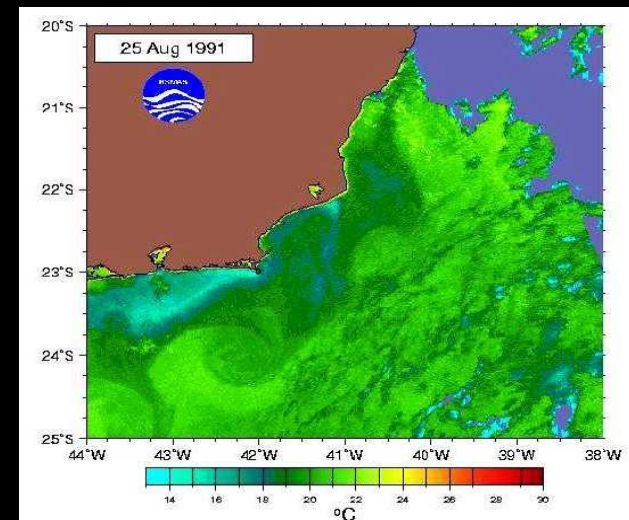
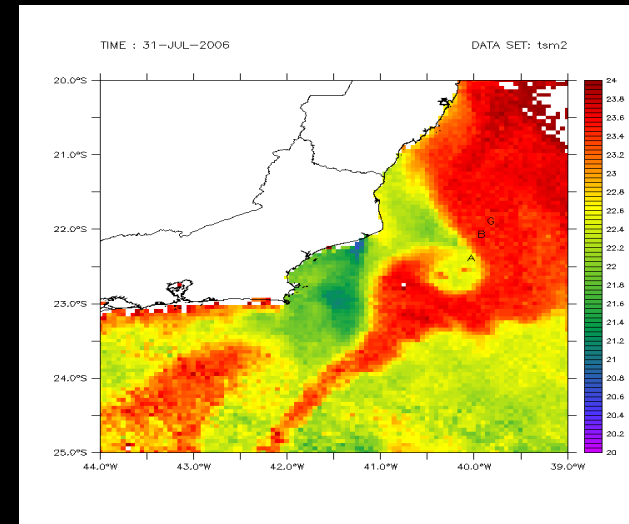
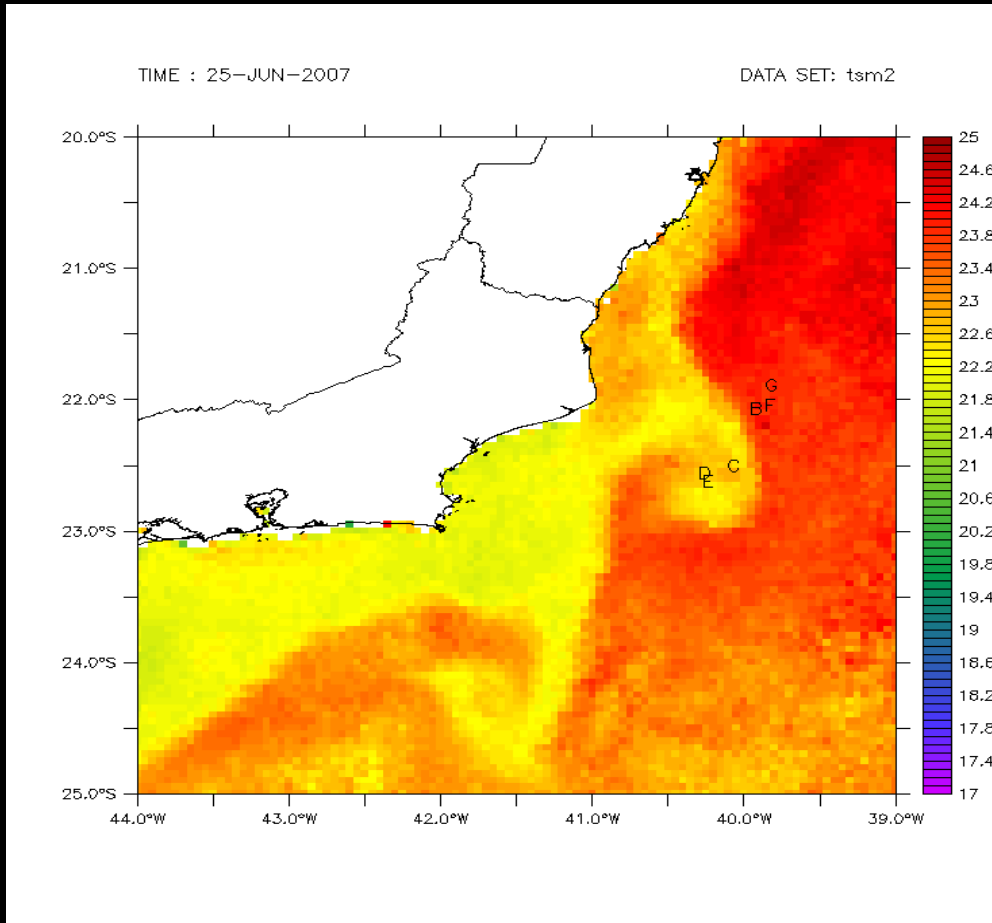
The region of interest:

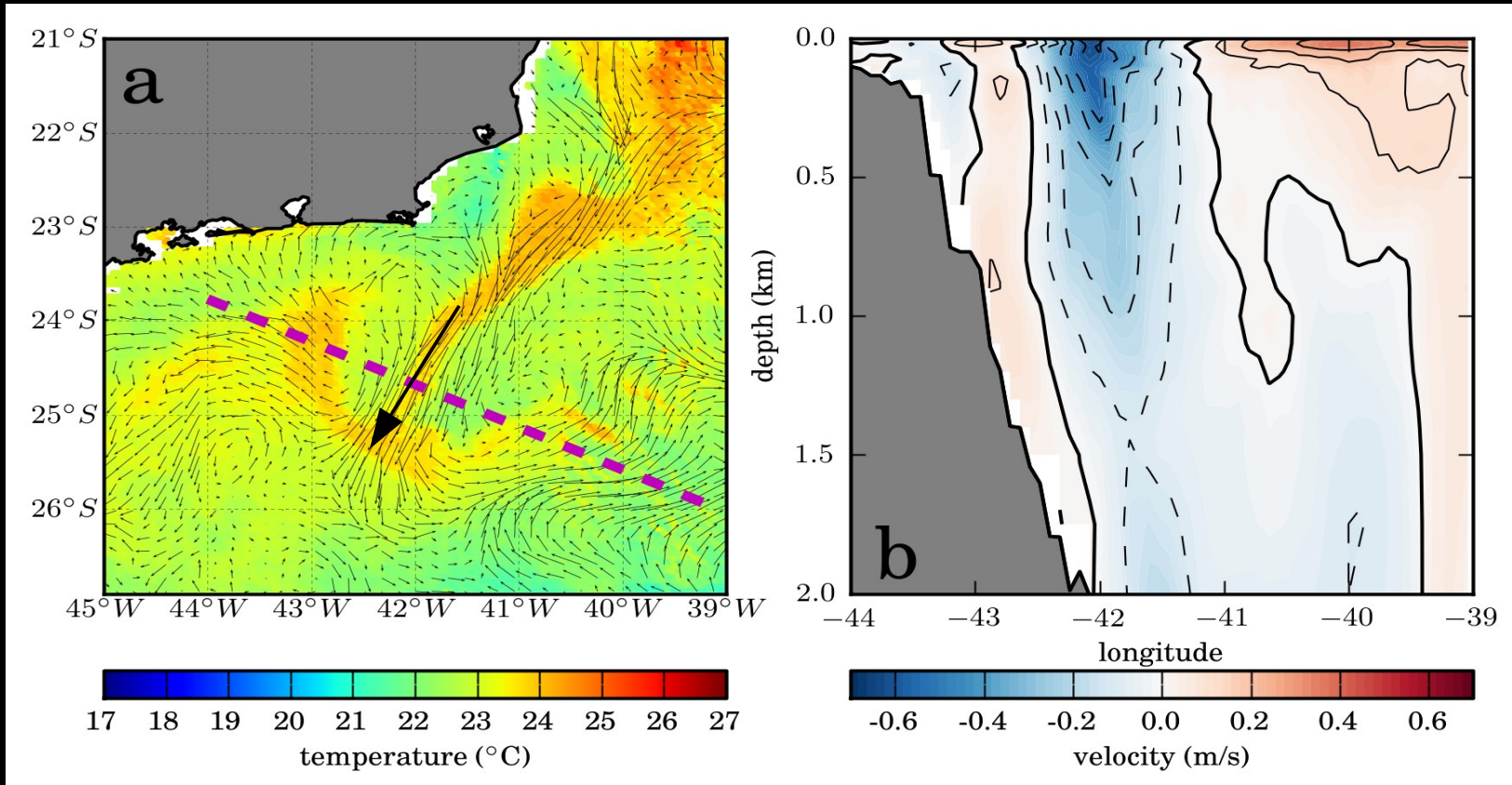


A little bit about the Oceanography of this region



Intense mesoscale (eddy) activity

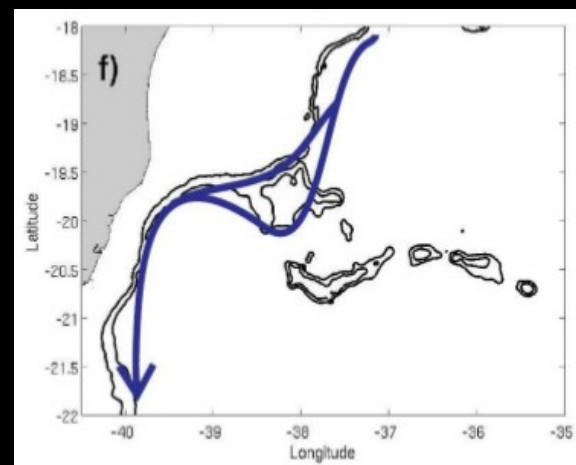
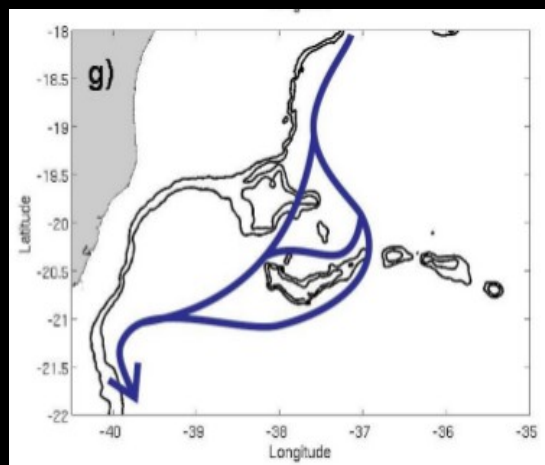
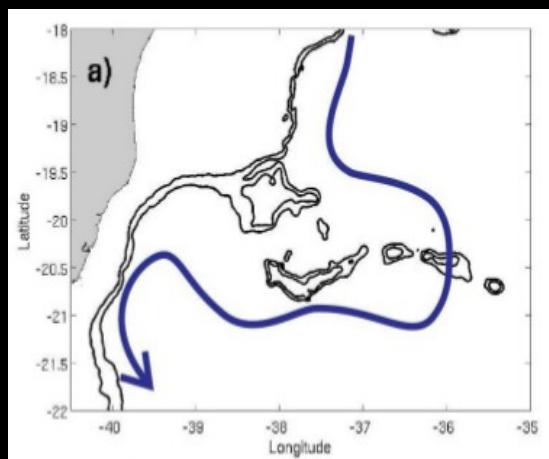
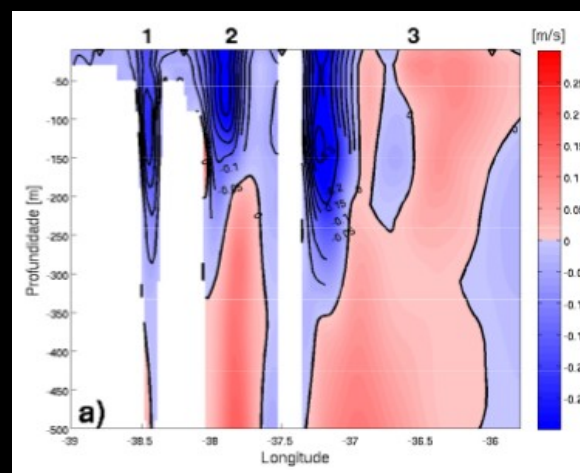
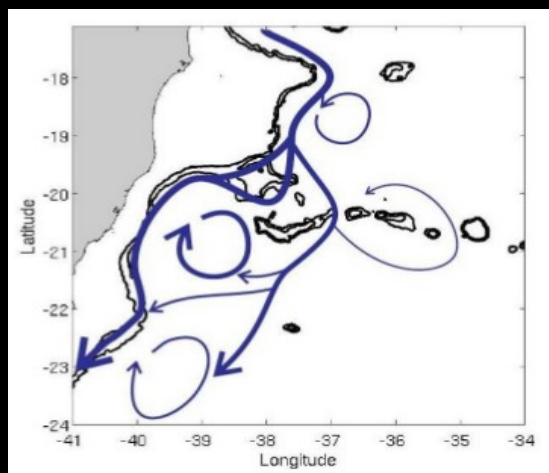




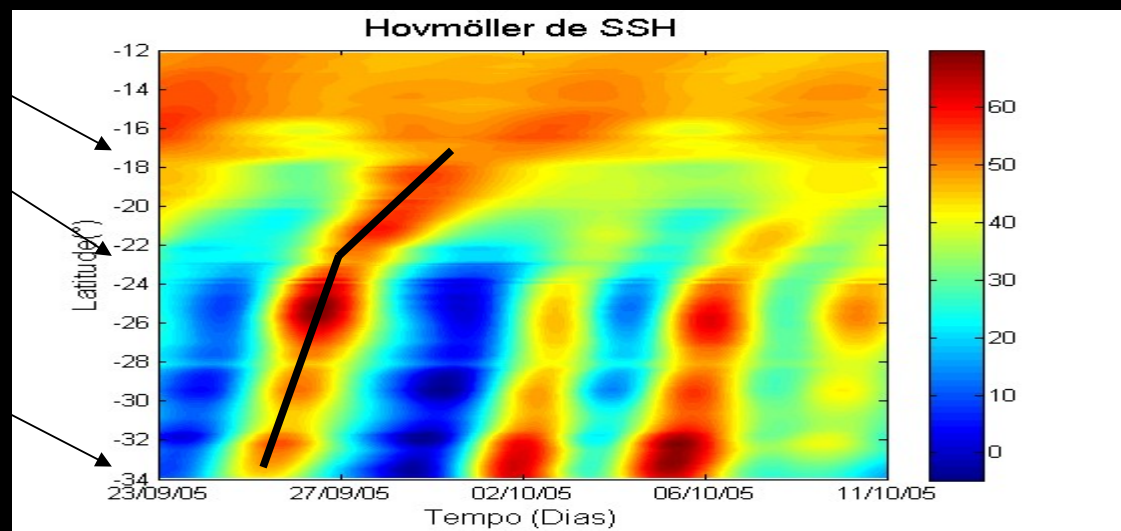
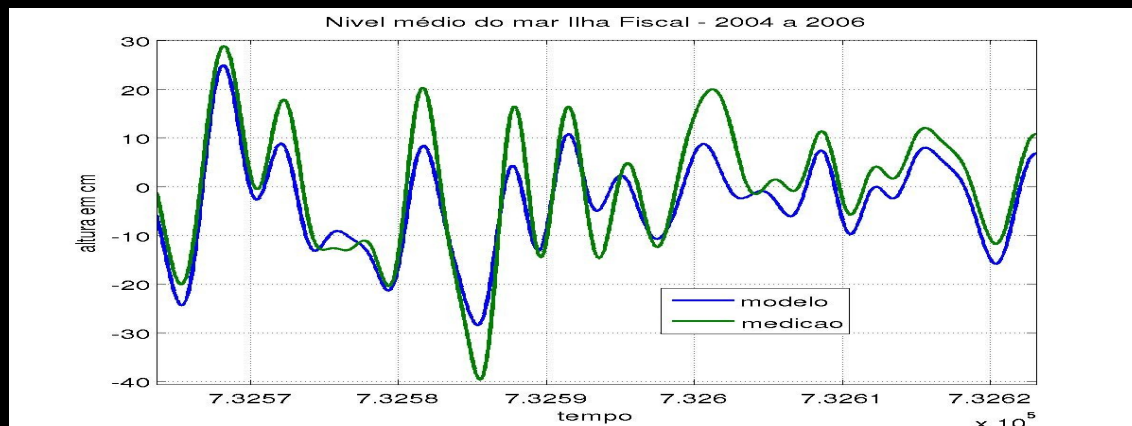
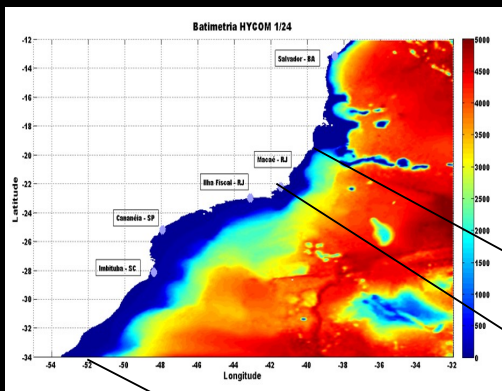
Guerra and Paiva, 2012

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

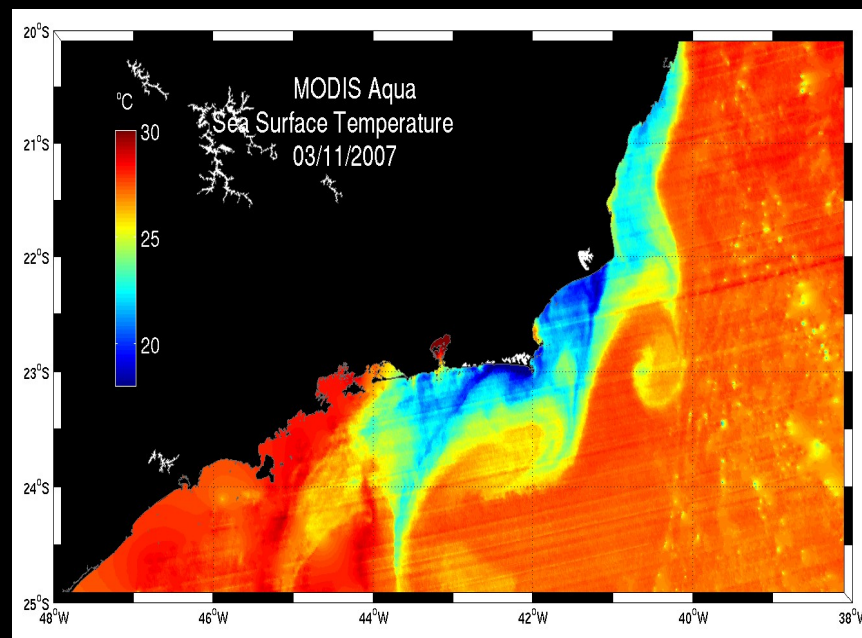
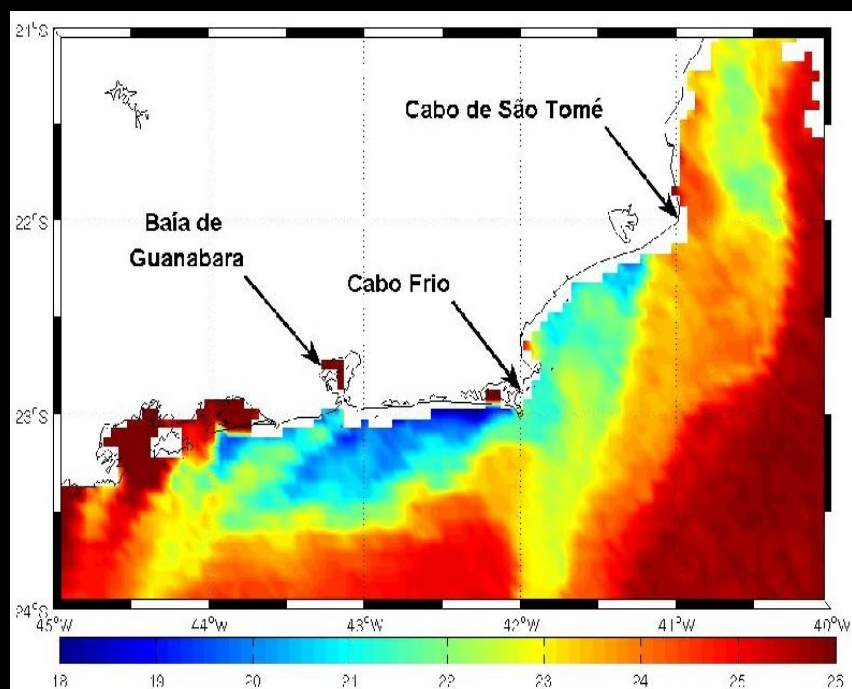
How does the Brazil Current “negotiate” the Vitoria-Trindade mountain chain?

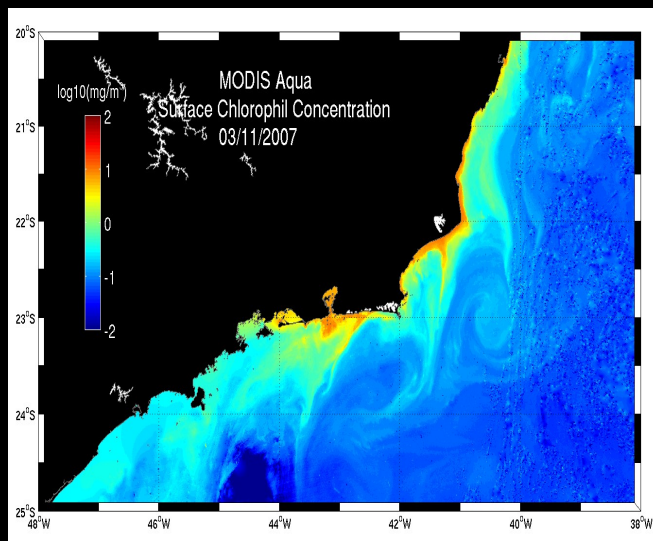


Propagation of continental shelf waves

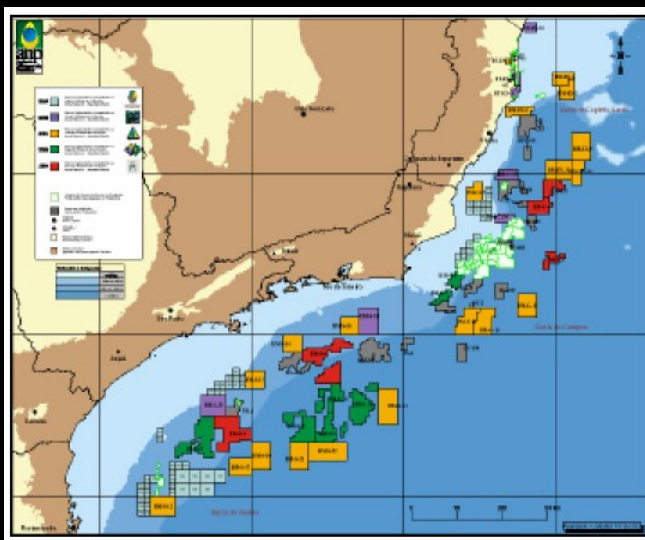


Coastal upwelling at Cabo Frio





Ecological implications



Practical implications



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, ...)

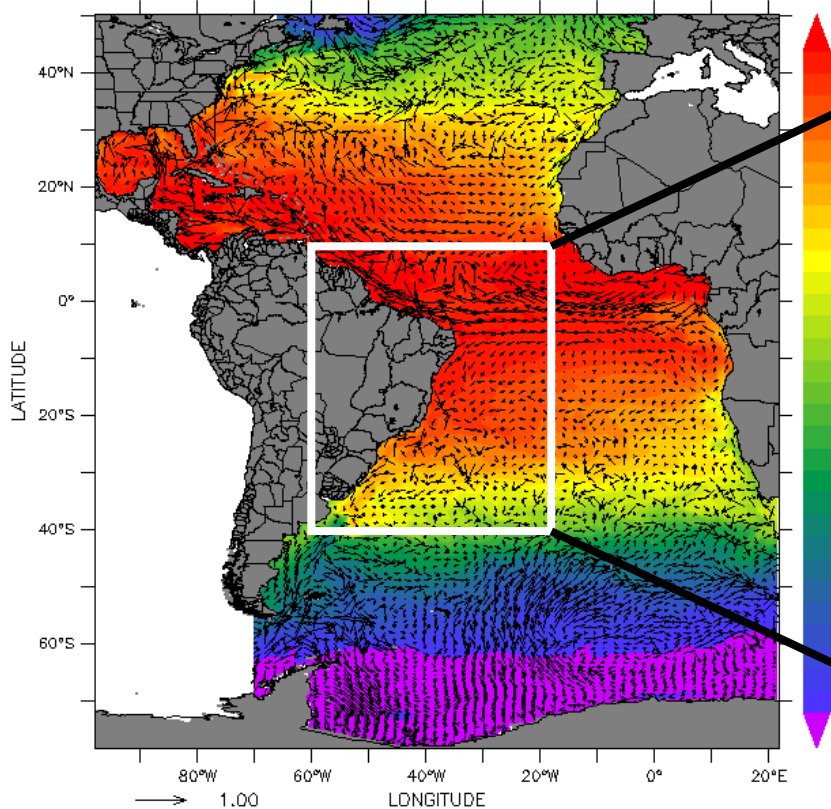
Specific objectives:

- 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)

Modeling strategy

HYCOM 1/4

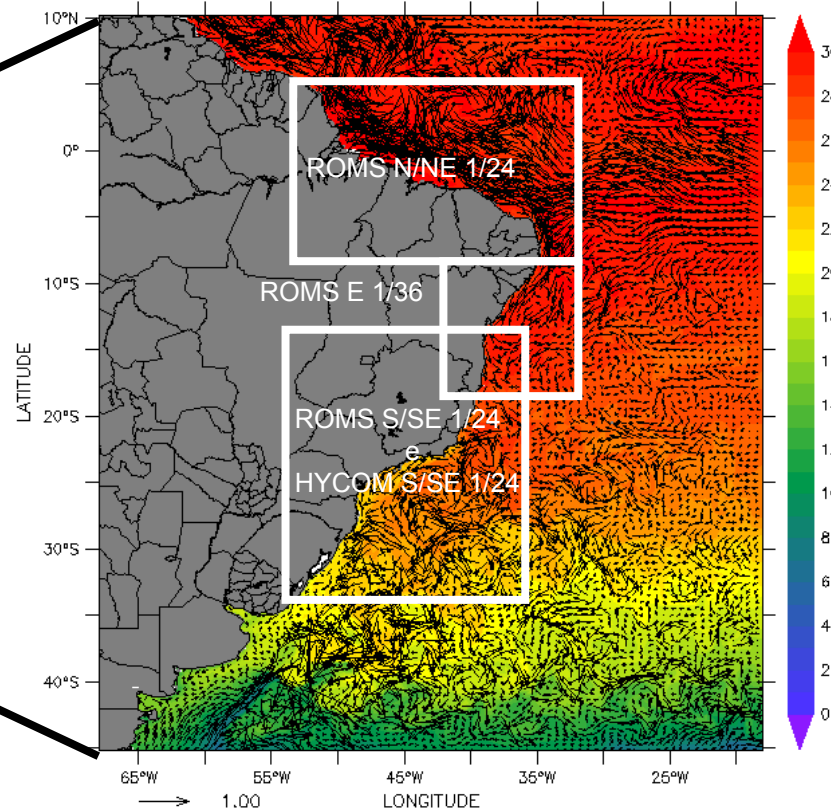
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 REMO - Initial Condition at 16/05/2010, 00 UTC



Temperatura e Correntes Superficiais

HYCOM 1/12

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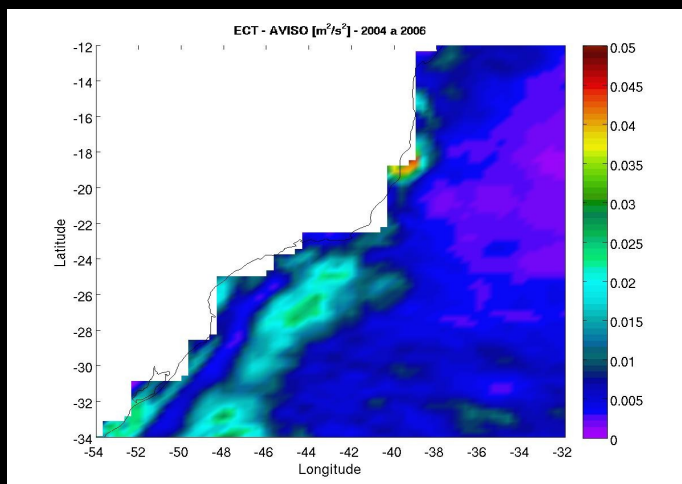
Temperatura e Correntes Superficiais



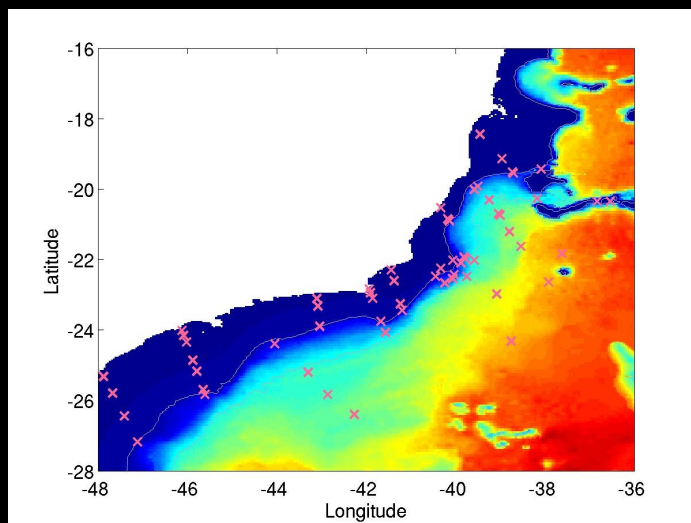
We need good quality data to:

- better understand the reality we are trying to model
- validate model simulations and forecasts
- assimilate into the models

Model validation: a few examples



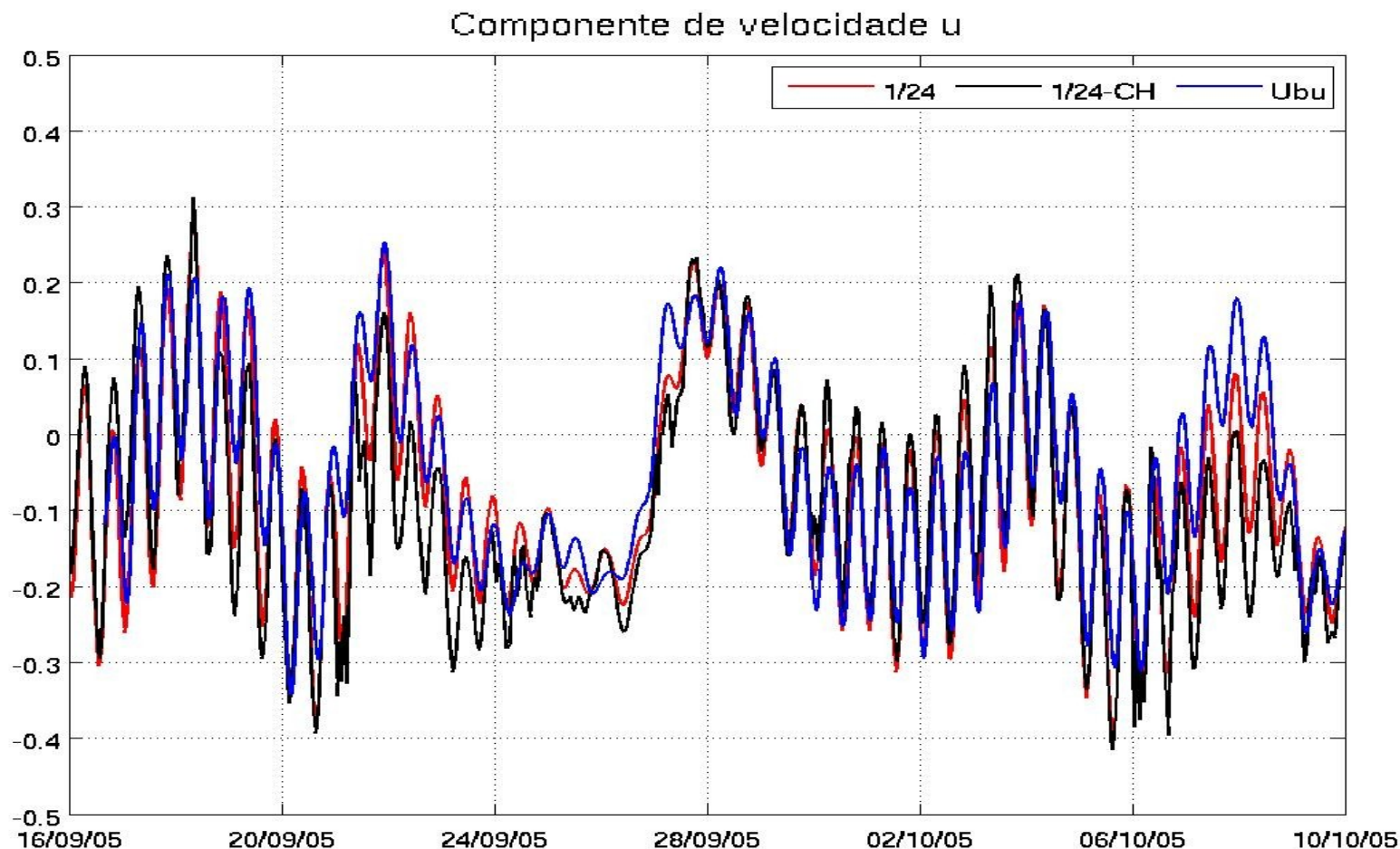
Basic comparisons
(e.g. TKE)



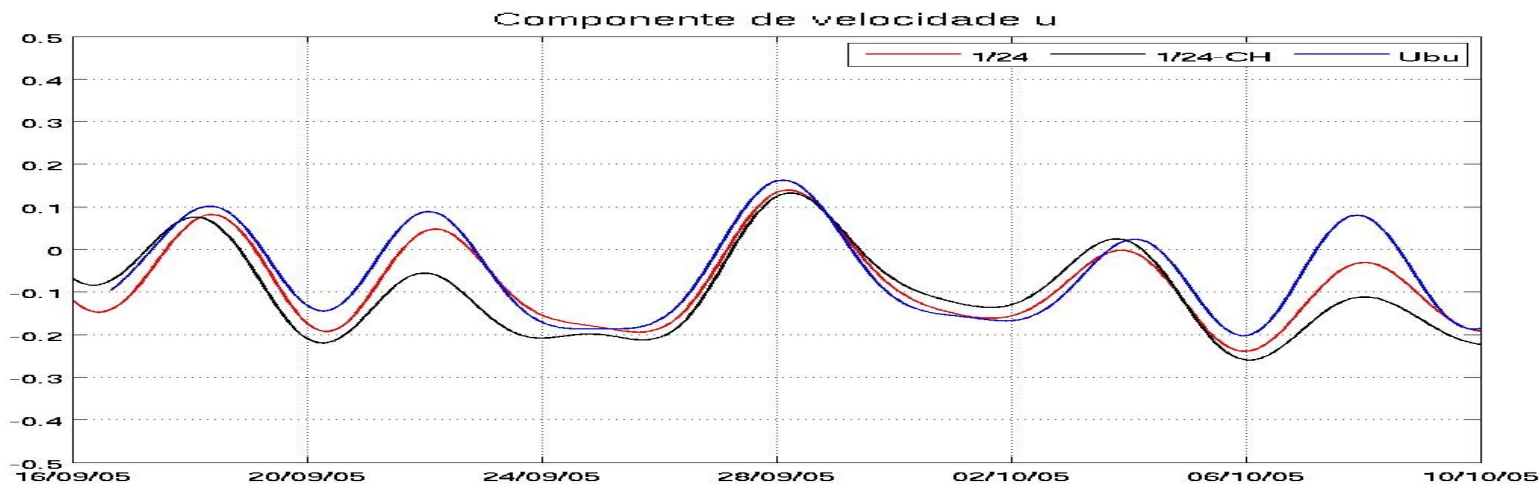
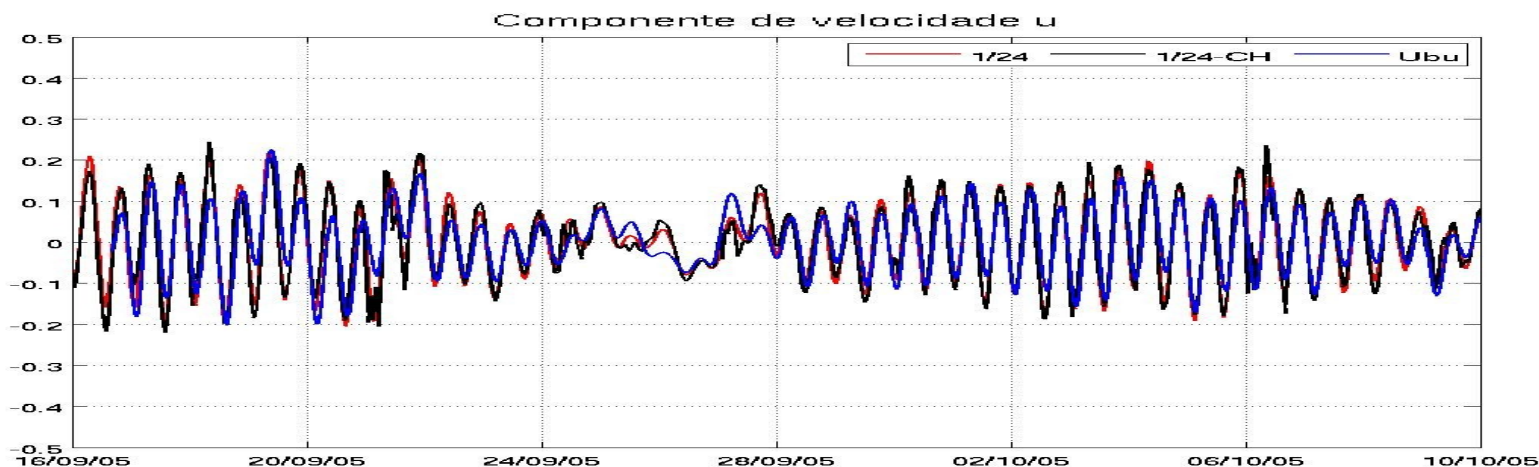
Point to point comparisons
Time series
Model virtual moorings

Model validation: a few examples

Continental shelf – surface velocity

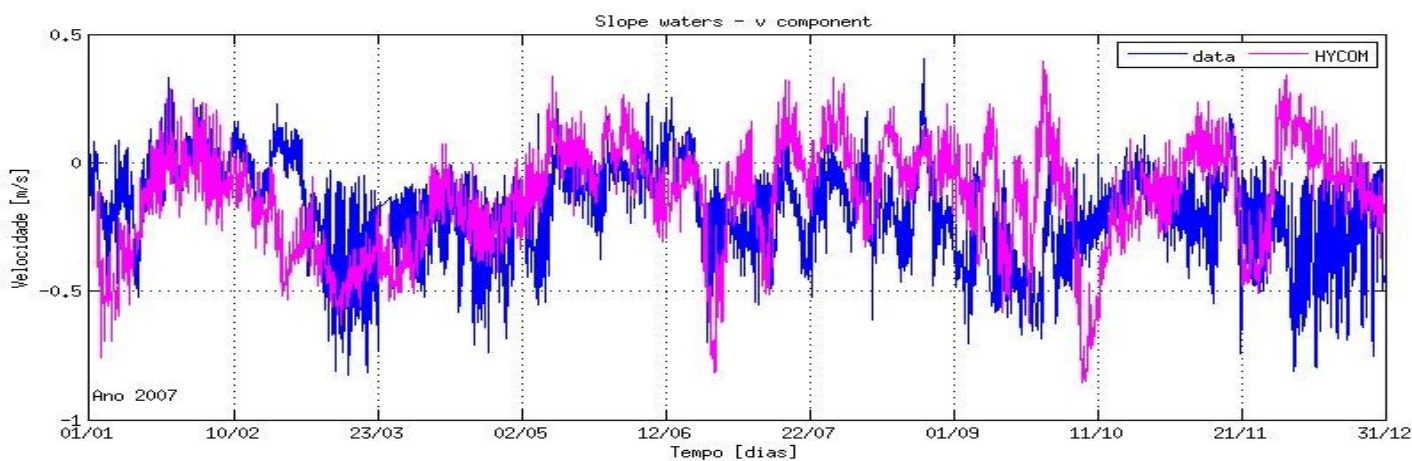
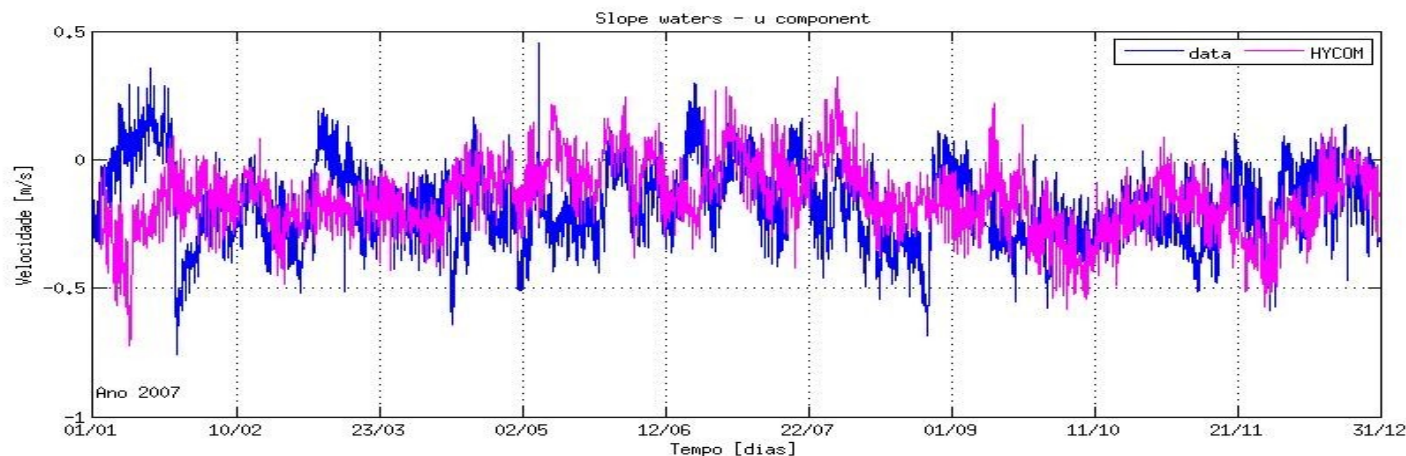


Model validation: a few examples Continental shelf – surface velocity



Model validation: a few examples

Slope waters – velocities at 40m

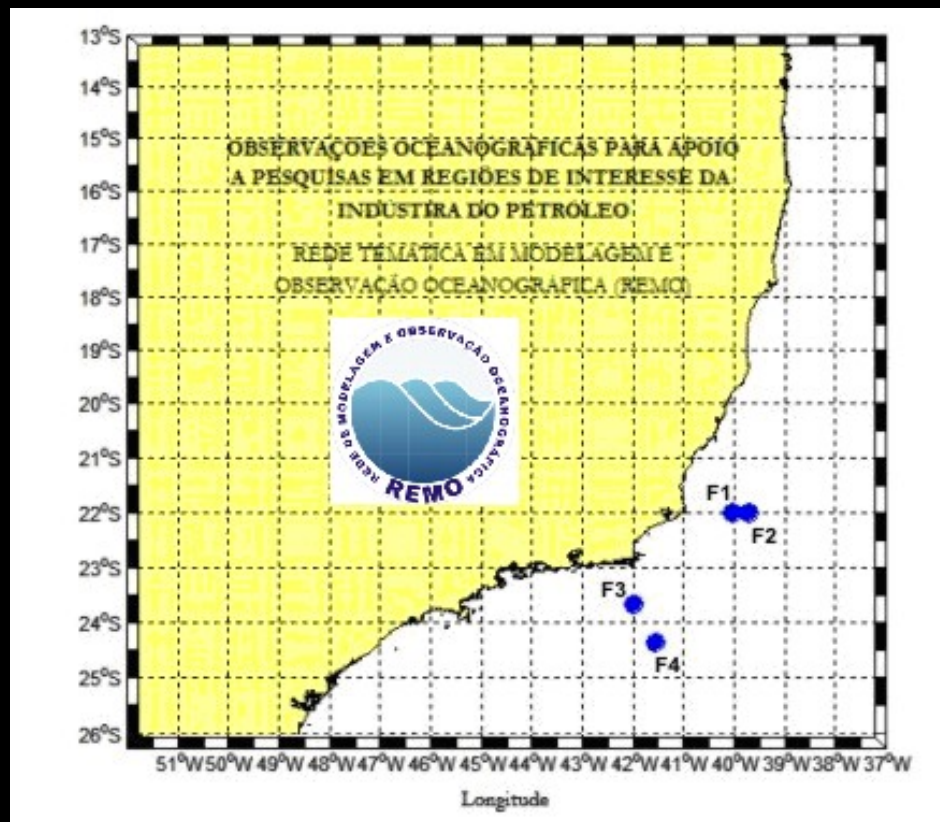


Observational programs supported by REMO → PNBOIA



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

Real time
oceanographic and
meteorological data
along the Brazilian
coast



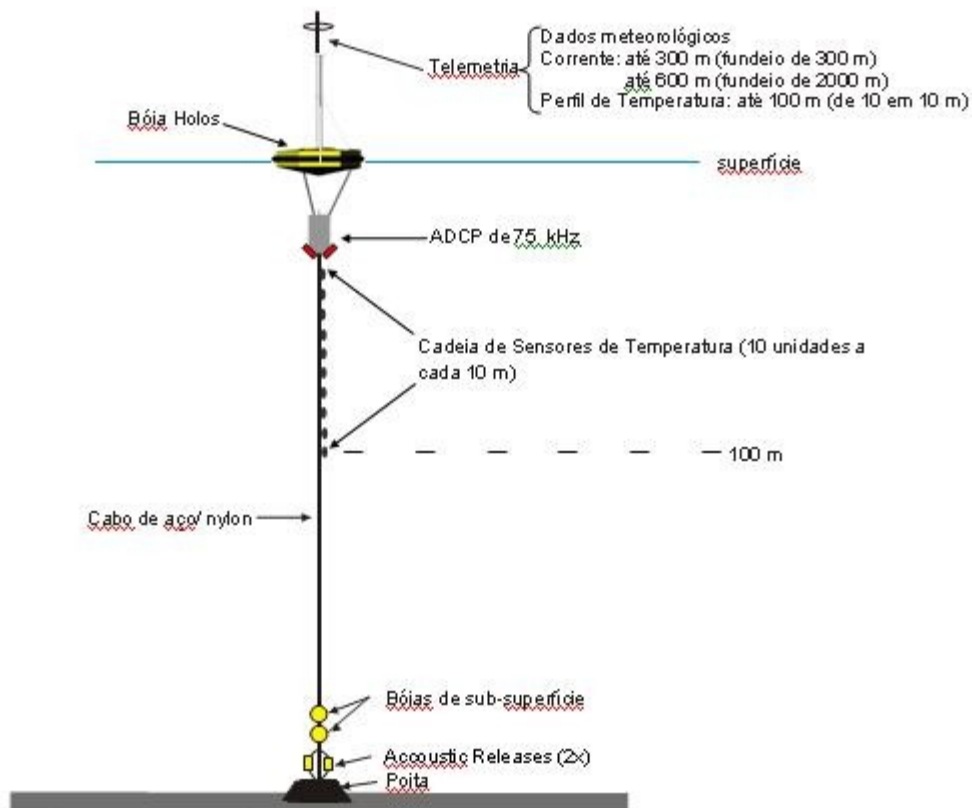
Shallow and deep water moorings with real time data transmission

REMO and UFRJ/COPPE/PEN/O 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

ESQUEMA DE FUNDEIO



Deep water moorings

REMO web page



Rede de Modelagem e Observação Oceanográfica

Uma iniciativa brasileira em oceanografia operacional



HYCOM 1/4

O que é a REMO

Equipe

Publicações

Notícias

Documentos

Agenda

Contatos

Links

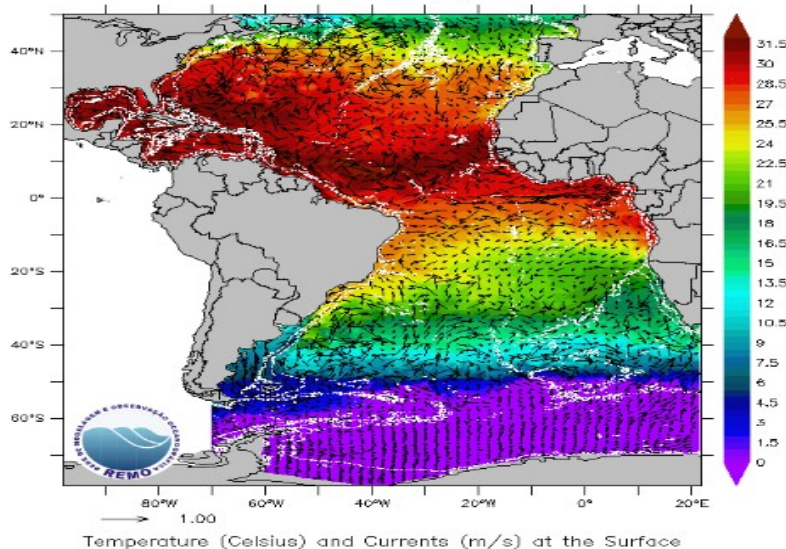
Sistema

Produtos

LAS

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

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REMO - Initial Condition at 24/09/2012, 00 UTC



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.



The screenshot shows the GODAE OceanView homepage. At the top, there is a navigation menu with links for Home, About, Organisation, Science, Outreach, Publications, Documents, News, Calendar, and Contacts. Below the menu, there is a search bar and a location indicator set to 'Home /'. The main content area features a large banner for 'Ocean Forecasting Systems' with a background image of a person working at a computer displaying ocean maps. To the left of the banner, there is a sidebar with sections for 'Documents', 'News', 'Calendar', 'Contacts', and 'Members Login' with fields for 'Username:' and 'Password:'. Below the banner, there are three columns: 'OceanView Work Plan' with an image of a document, 'Task Team Activities' with an image of a map, and 'Organisation & Partners' with a group photo. At the bottom, there is a section for 'GODAE OceanView Principle Sponsors' featuring logos for Met Office, IOC, NASA, NOAA, ESA, Mercator Ocean, Australian Government Bureau of Meteorology, CNES, Ifremer, and EUMETSAT.

REMO is a participant of GODAE Ocean View

The screenshot shows the 'System descriptions' page on the GODAE OceanView website. The page has a similar layout to the homepage, with a navigation menu and a search bar. The main content area is titled 'System descriptions' and contains a section for 'Work Plan' and 'Task Teams'. Below this, there is a section for 'Ocean forecasting systems' with a list of links: 'System descriptions', 'Ocean models', 'Assimilation characteristics', 'System set-up', and 'System website links'. The page is divided into two columns. The left column is titled 'NMEFC' and describes the National Marine Environmental Forecast Centre of China, mentioning its operational ocean analysis system for ENSO events. The right column is titled 'REMO' and describes the Rede de Modelagem e Observação Oceânica, a Brazilian effort on operational short-range ocean forecasting. It mentions the REMO logo and lists participating institutions: Federal University of Bahia (UFBA), Federal University of Rio de Janeiro (UFRJ), University of São Paulo (USP), and Petrobras Research and Development Center Leopoldo Américo Miguez de Mello (CENPES). The text states that the general goals are to do research in physical oceanography and to develop operational ocean forecasting systems over the tropical Atlantic and the South Atlantic for a broad range of users of oceanographic information, including the off-shore petroleum industry.



INCT – ProOceano

Instituto Nacional de Ciência e Tecnologia
(“National Institute for Science and
Technology”)

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...”



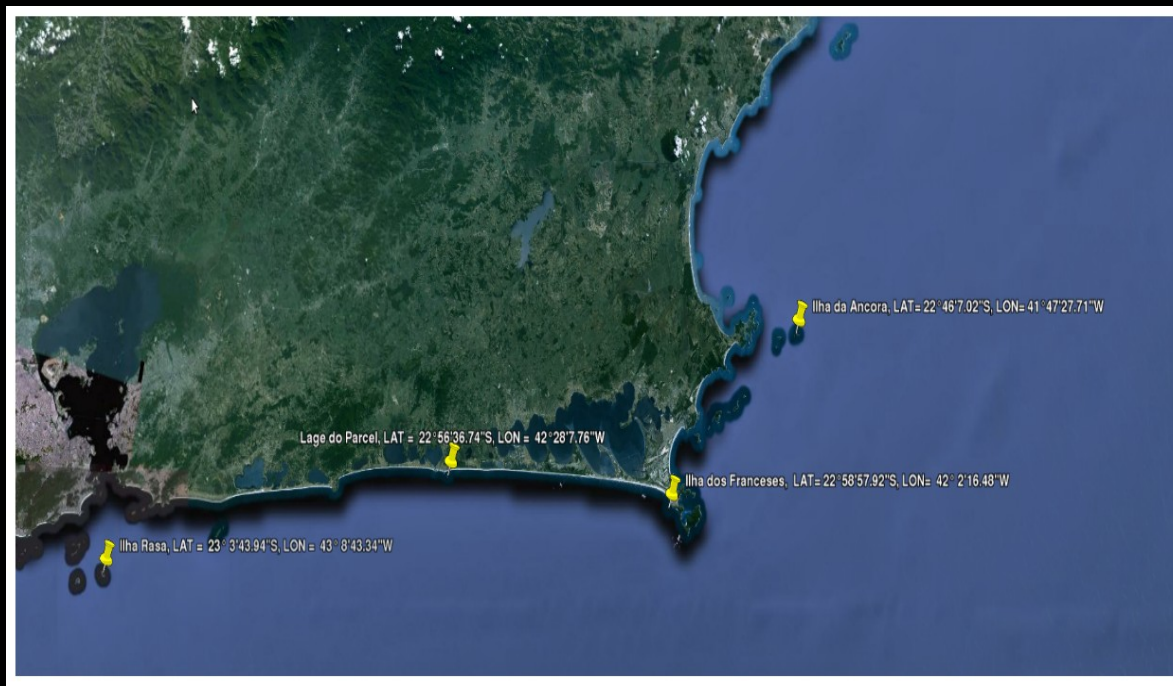
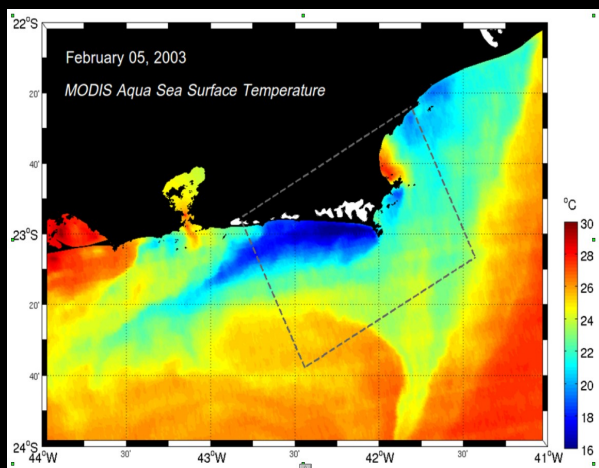
“Regarding biodiversity and economic use, the area of study encompass two of the most important ecosystems in the Brazilian coast: **the main upwelling region (Cabo Frio) and the larger coral reef complex (Abrolhos)**. The project aims to identify in a integrated way the principal oceanographic processes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

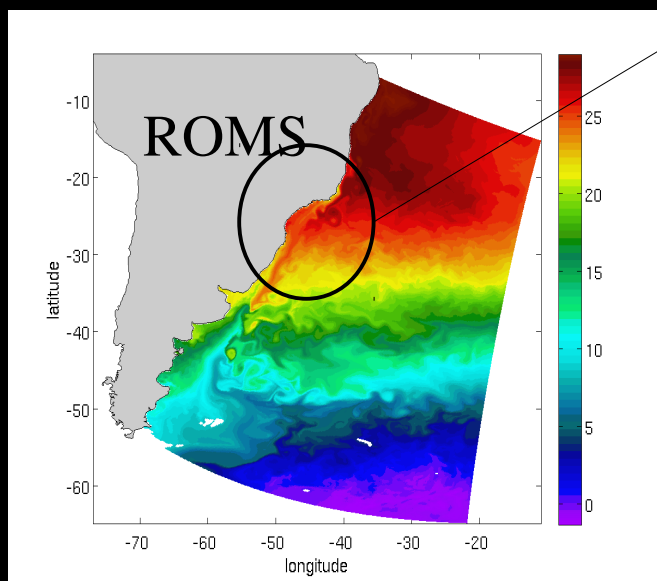
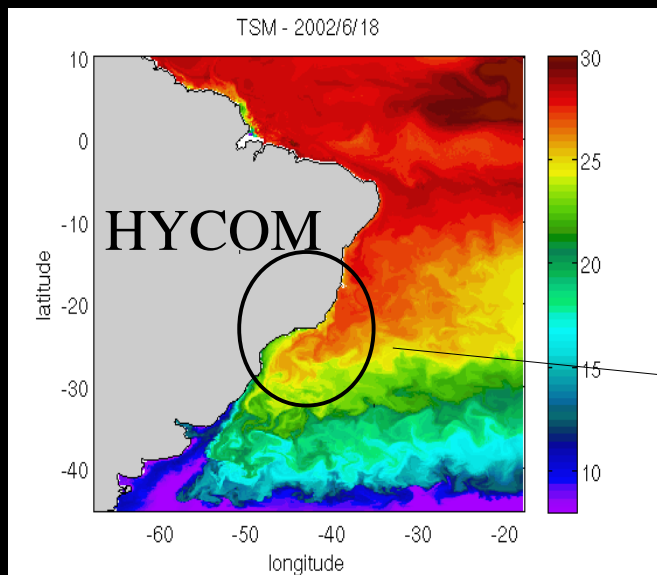


Physical oceanography:

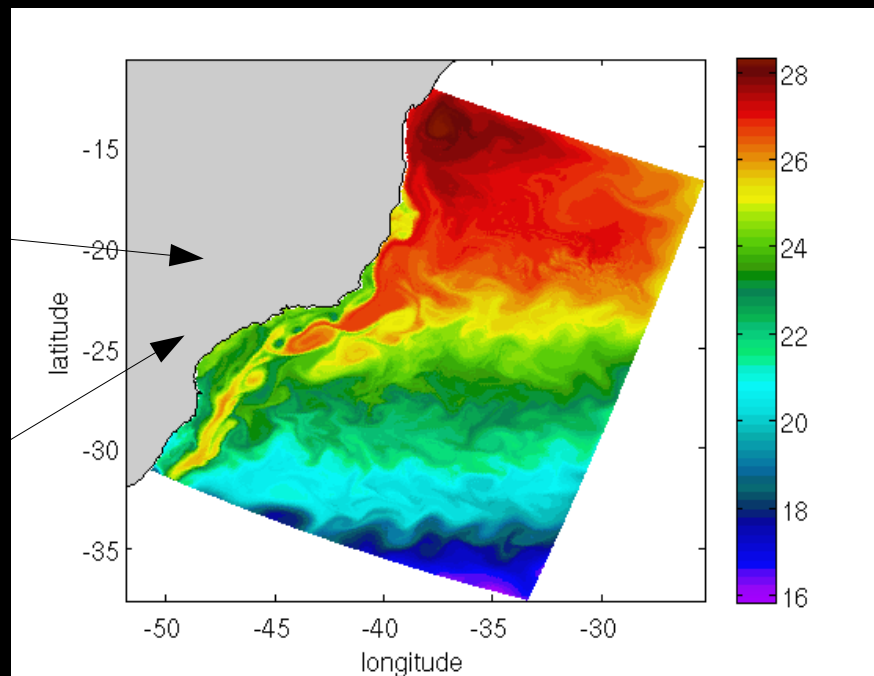
In general, “...we seek to understand how the mesoscale activity in the slope waters, primarily that associated with the Vitoria-Trindade mountain chain and with the formation of Cabo de São Tomé e Cabo Frio eddies, affects coastal processes, in particular the upwelling of rich subsurface waters, and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

Temperature sensors distributed along the coast at different depths





Modeling approaches

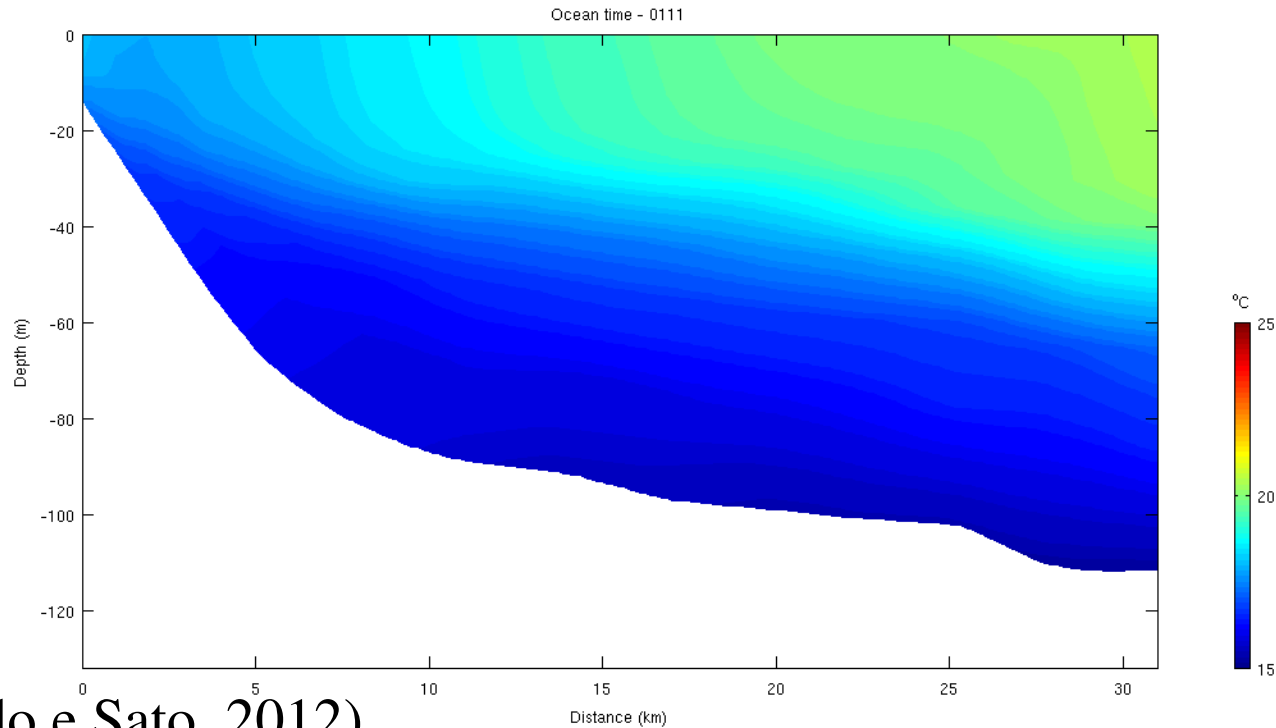
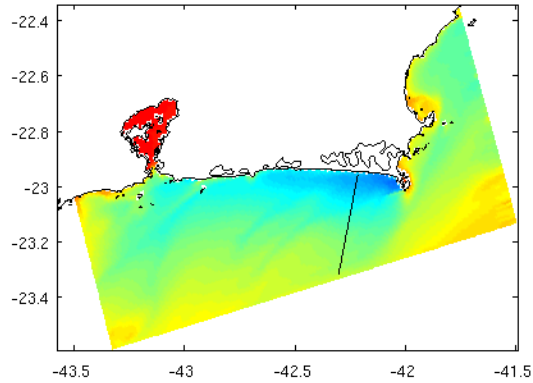


(Costa e Paiva, 2012)

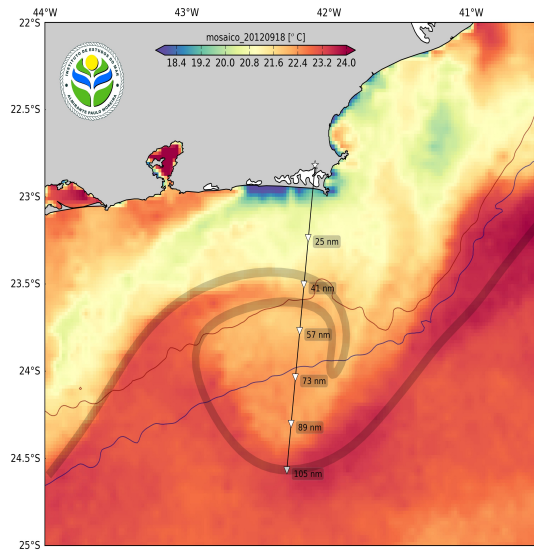
Downscaling
Process studies: idealized forcing and bathymetry

Modeling approaches

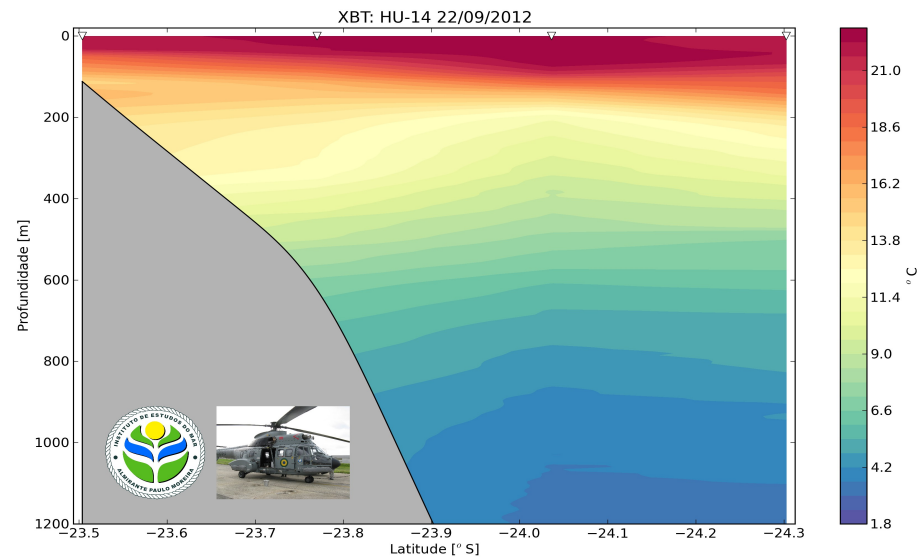
Very fine grid simulations of the Cabo Frio upwelling with ROMS



(Calado e Sato, 2012)



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



Work developed by
Leandro Calado, from
IEAPM, 2012



Grupo de Estudos de Processos Oceânicos
Área de Engenharia Costeira e Oceanográfica
Programa de Engenharia Oceânica - COPPE/UFRJ

