

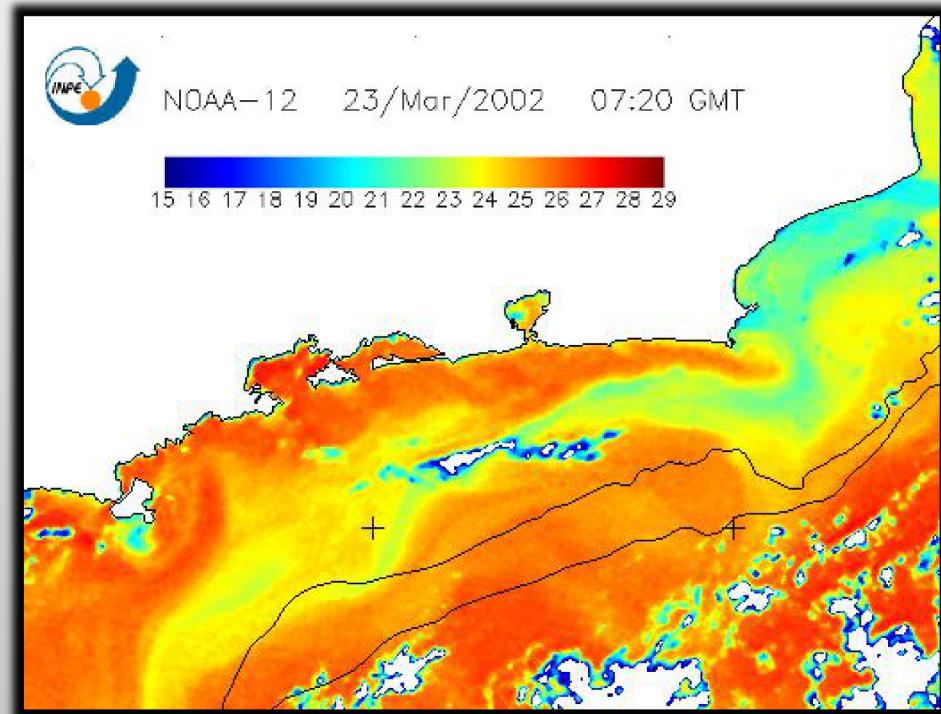
Cabo Frio upwelling response to spatially variable remote wind forcing

Rafael Soutelino

Brazilian Navy – IEAPM
Ocean Dynamics Division

Phellipe Couto

Brazilian Navy – IEAPM &
Universidade Federal do Paraná



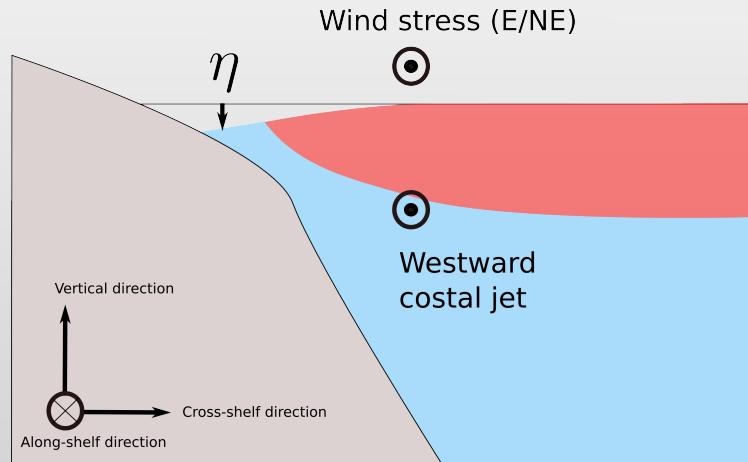
X OMAR-SAT – IEAPM
Arraial do Cabo, RJ, 15-18 October 2013



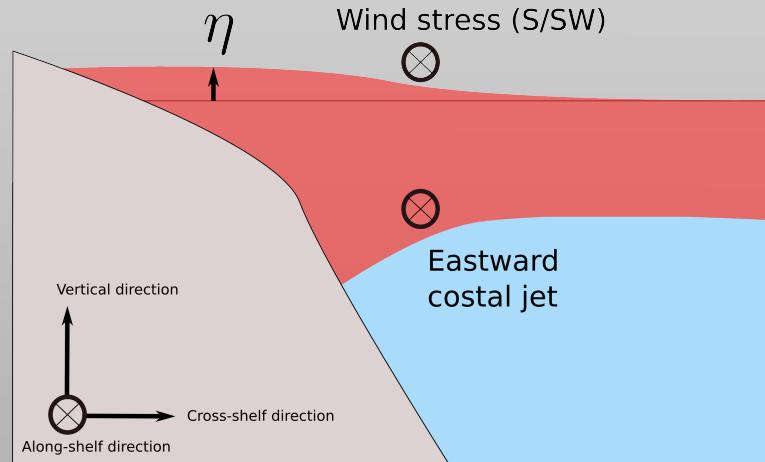
Shelf Dynamics at RJ central coast

Typical steady upwelling/downwelling response to the wind

E/NE winds → Ekman dynamics → geostrophic adjustment → westward coastal jet

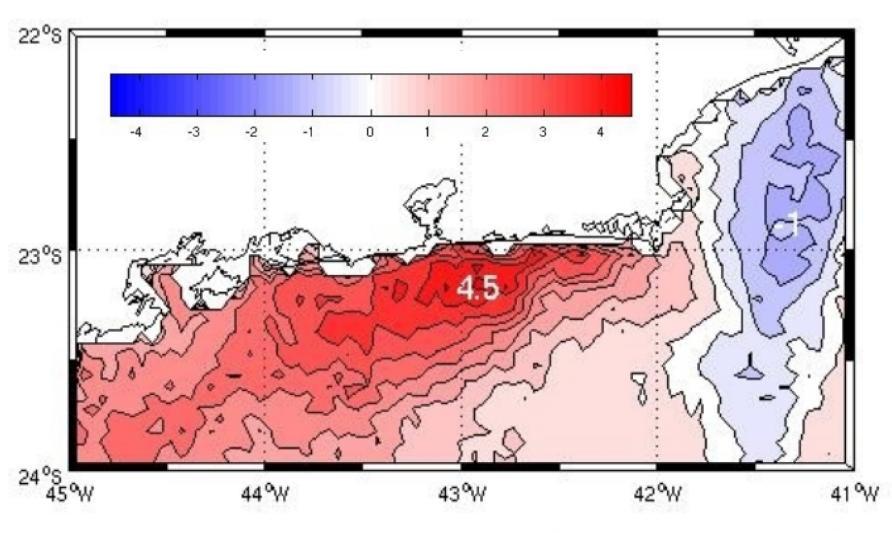


S/SW winds → Ekman dynamics → geostrophic adjustment → eastward coastal jet

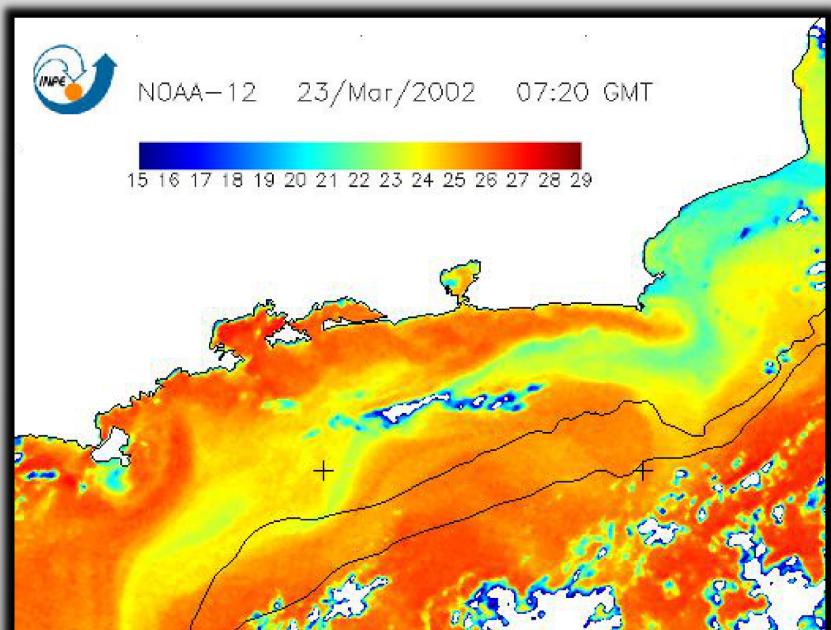


Motivation

Positive SST anomalies during upwelling-favorable conditions



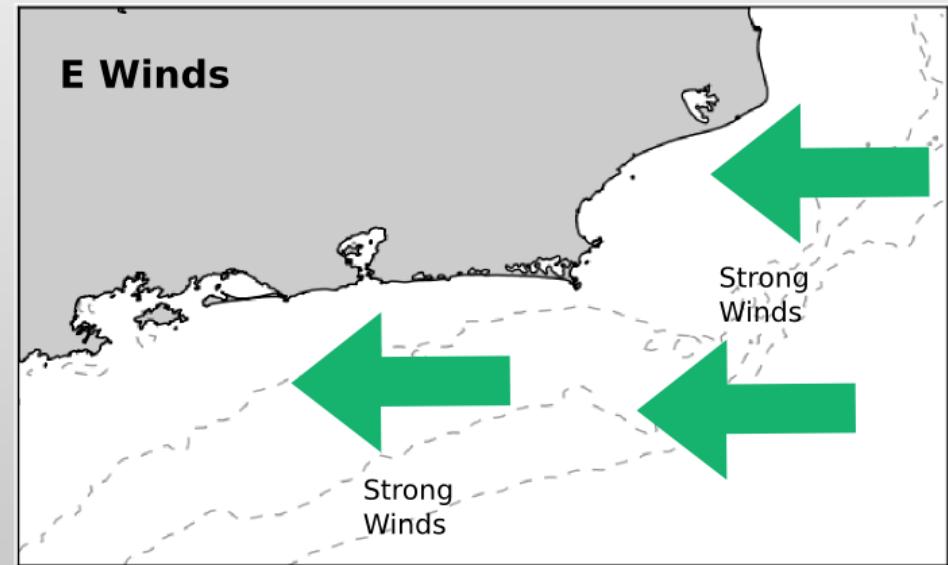
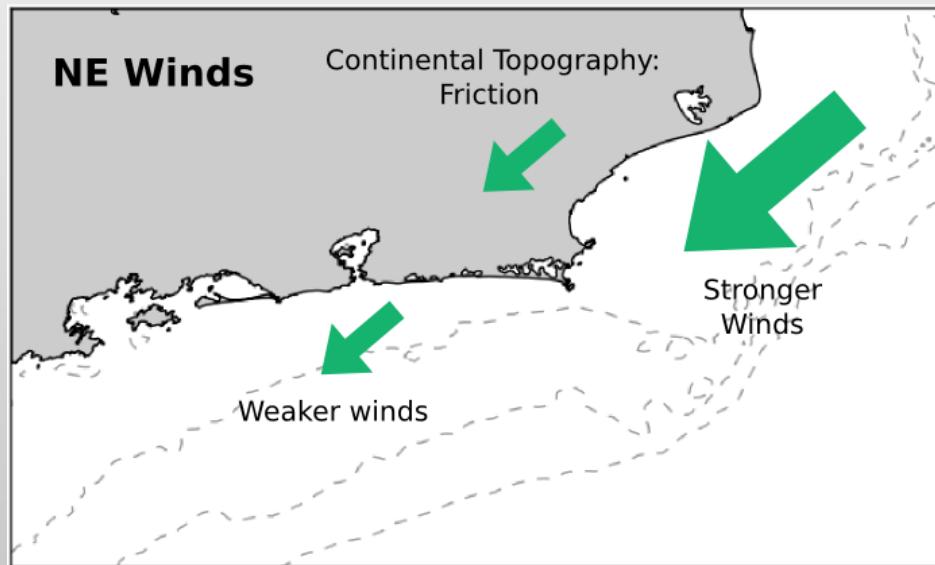
January 2010 episode
Da Silva (2011)



March 2002

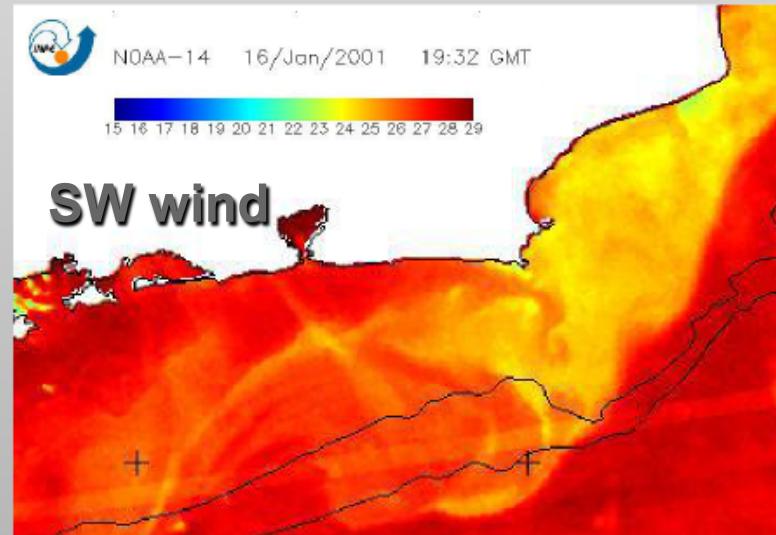
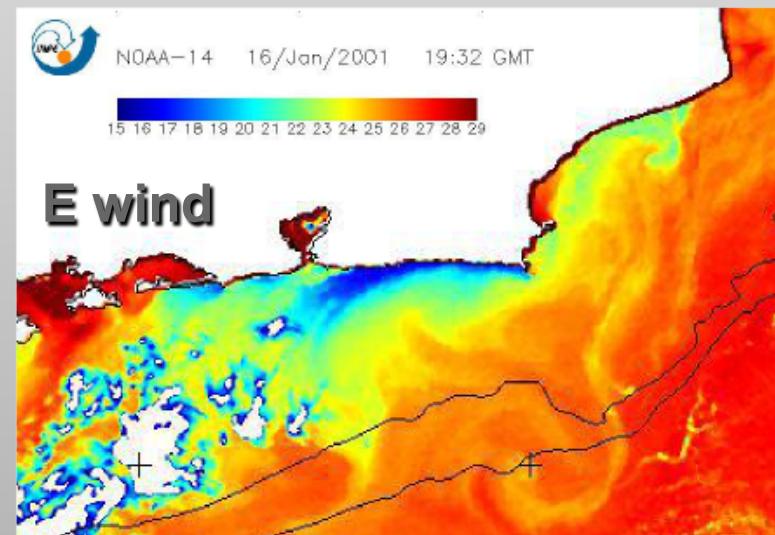
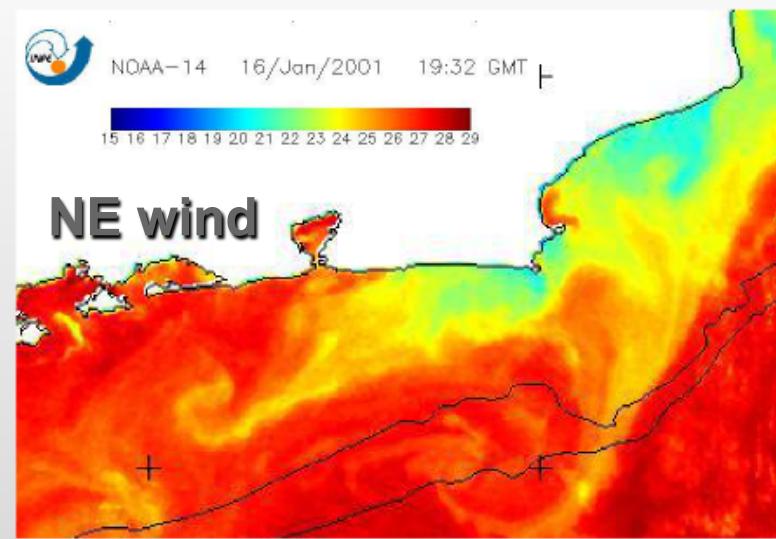
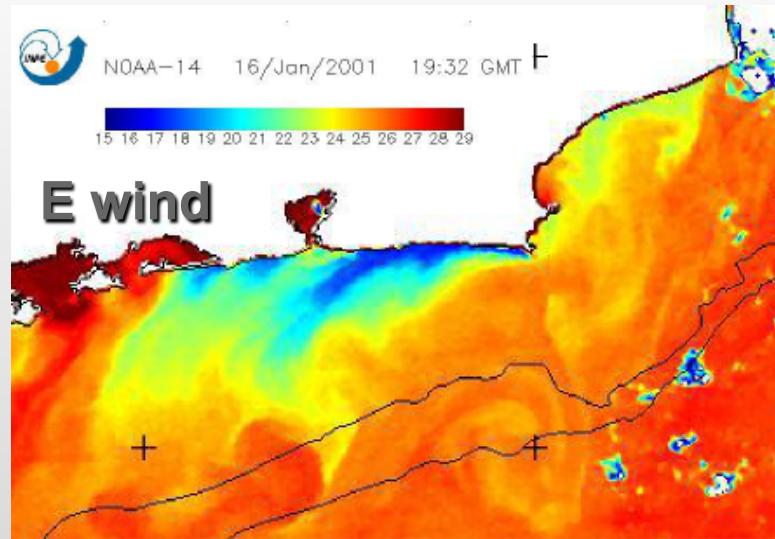
Motivation

Two types of upwelling favorable winds: E and NE



Motivation

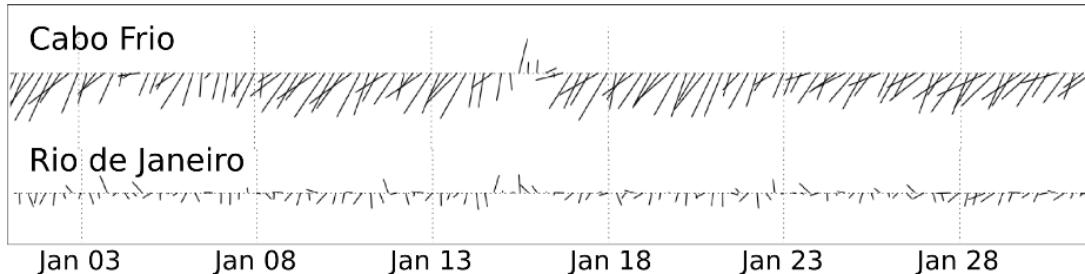
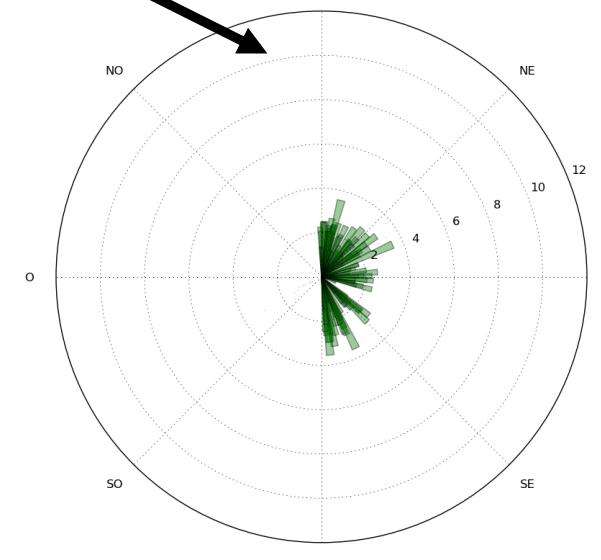
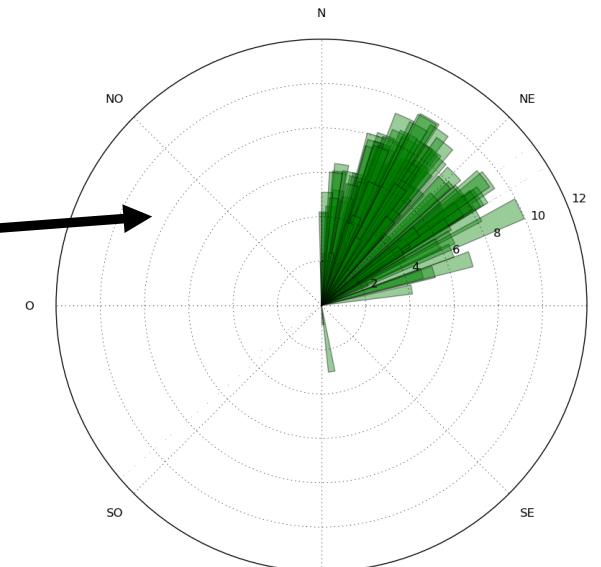
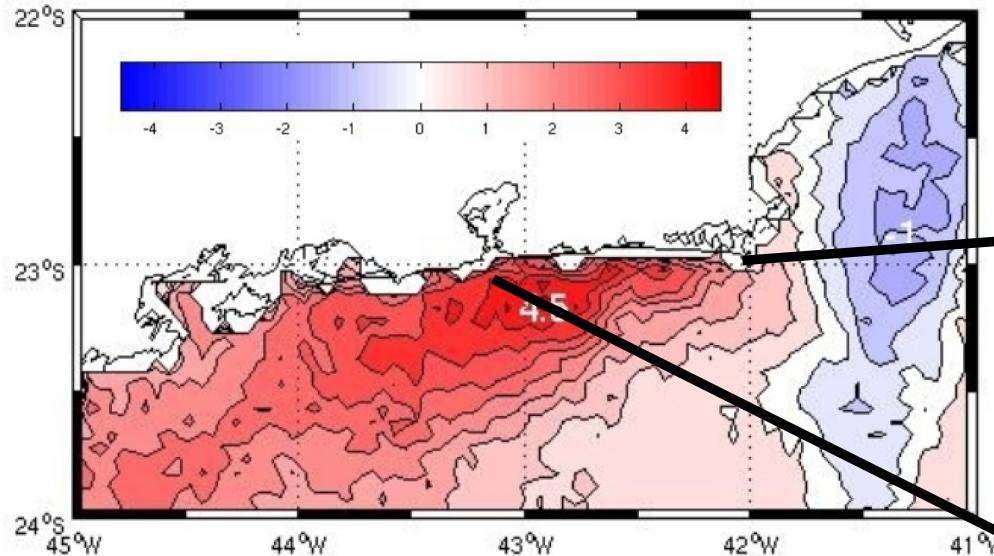
Different spatial patterns of upwelling plume



Cortesy: Dr. João Lorenzetti - INPE

Motivation

Spatially variable winds during January 2010: *Da Silva (2011)*



Hypothesis

**Spatial variability in the wind field is correlated with positive
sst anomalies during upwelling favorable events**

Objectives

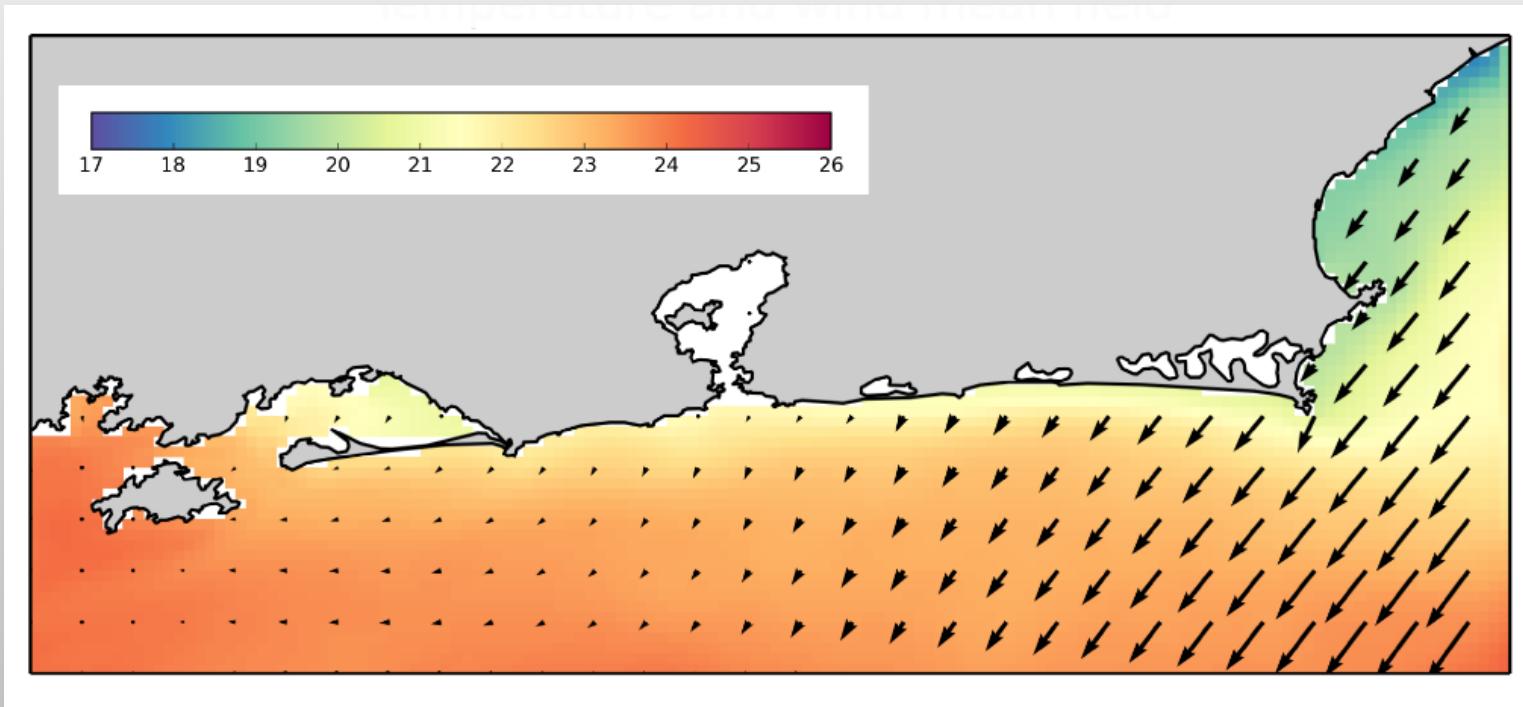
**Investigate the response of spatially variable wind forcing
in Cabo Frio upwelling system**

Methodology

Methodology synthesis

Process-study modeling

Semi-idealized experiment with constant but spatially variable wind field



CFSR snapshot during January 2010: date of the anomalous event described by Da Silva (2011)

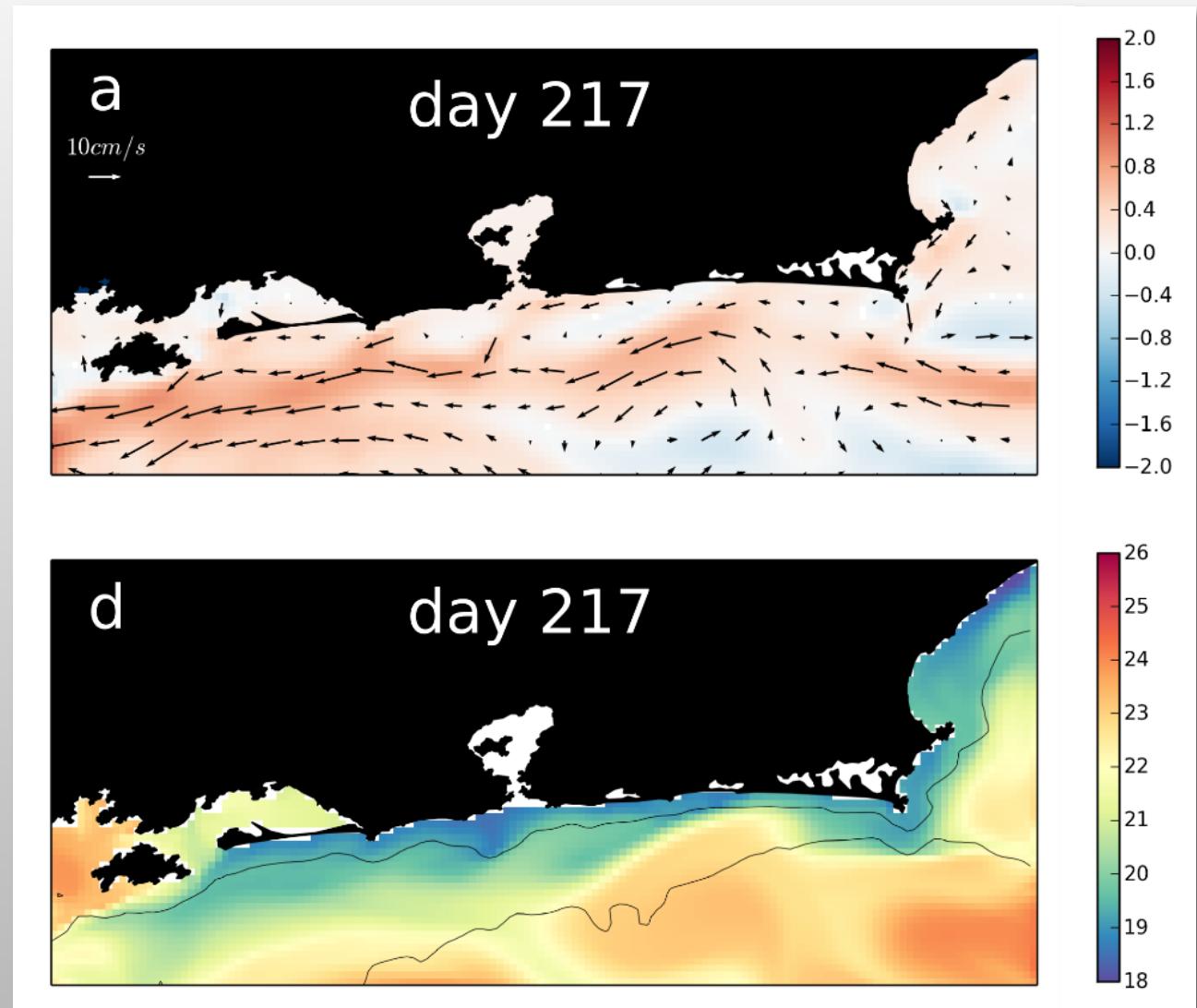
Results

Pressure gradient, velocity, and SST model 3-day moving averages

Cross-shelf barotropic
Pressure gradient: m/s^2

Barotropic velocity
Vectors

SST



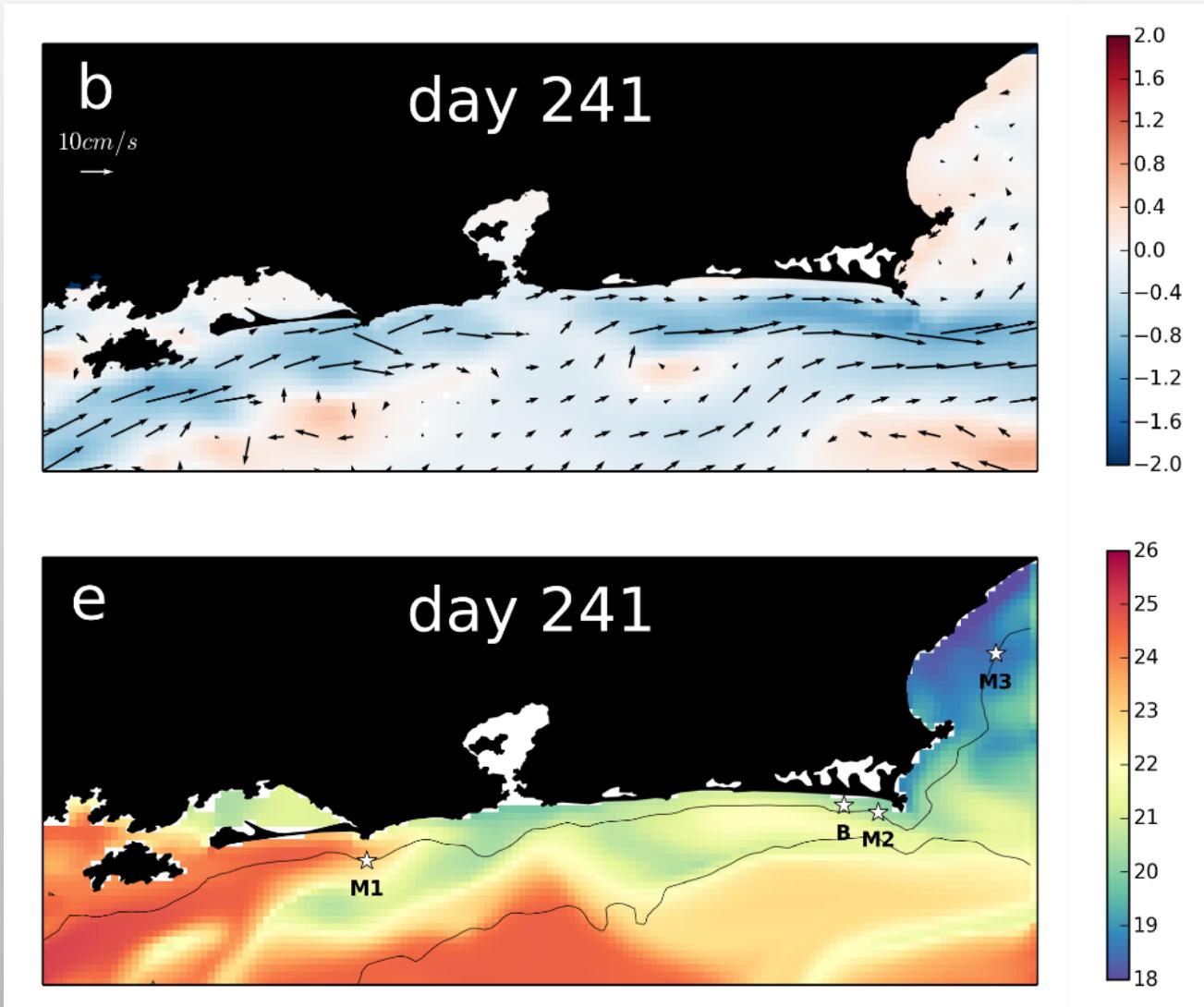
Results

Pressure gradient, velocity, and SST model 3-day moving averages

Cross-shelf barotropic
Pressure gradient: m/S^2

Barotropic velocity
Vectors

SST



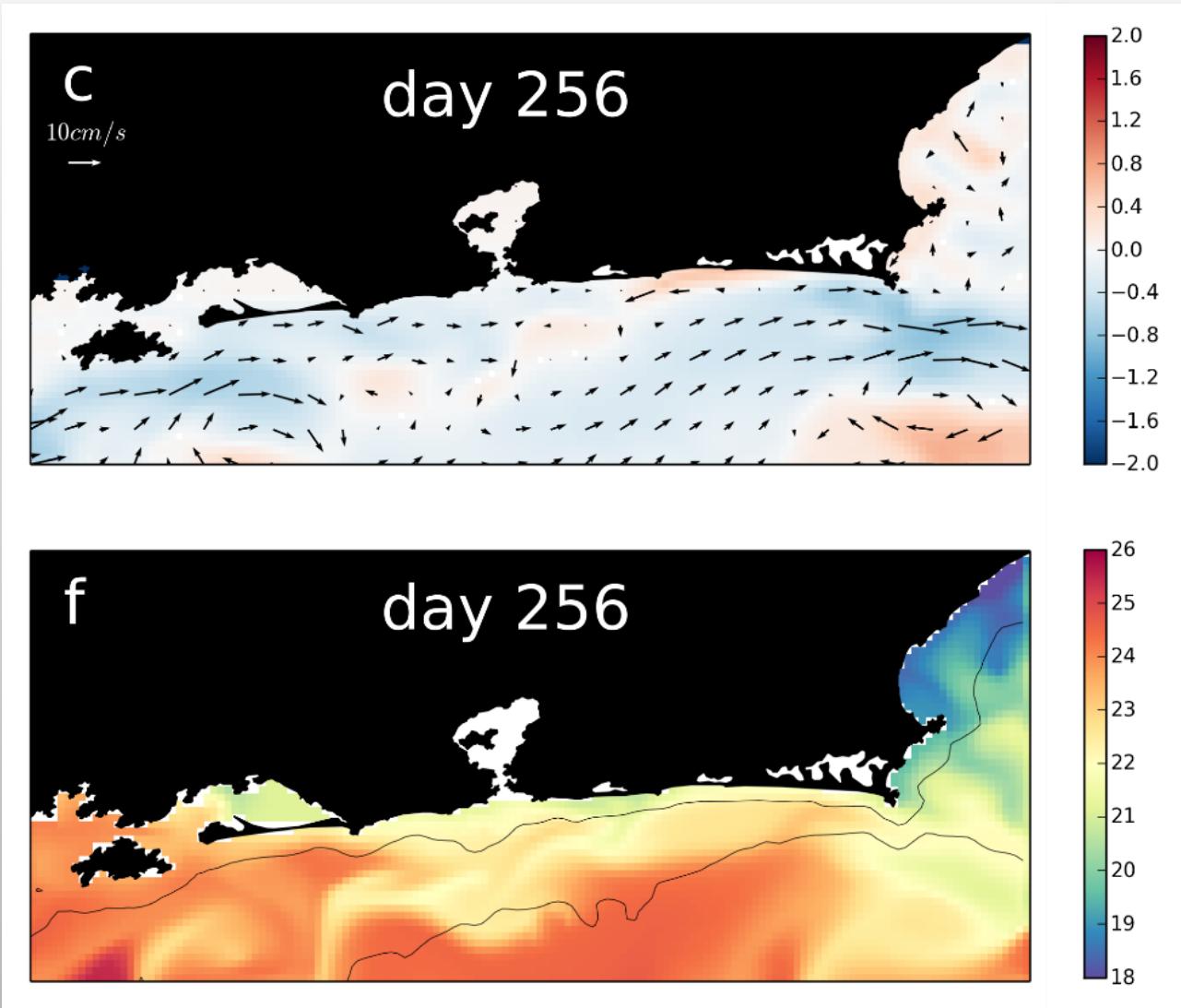
Results

Pressure gradient, velocity, and SST model 3-day moving averages

Cross-shelf barotropic
Pressure gradient: m/s^2

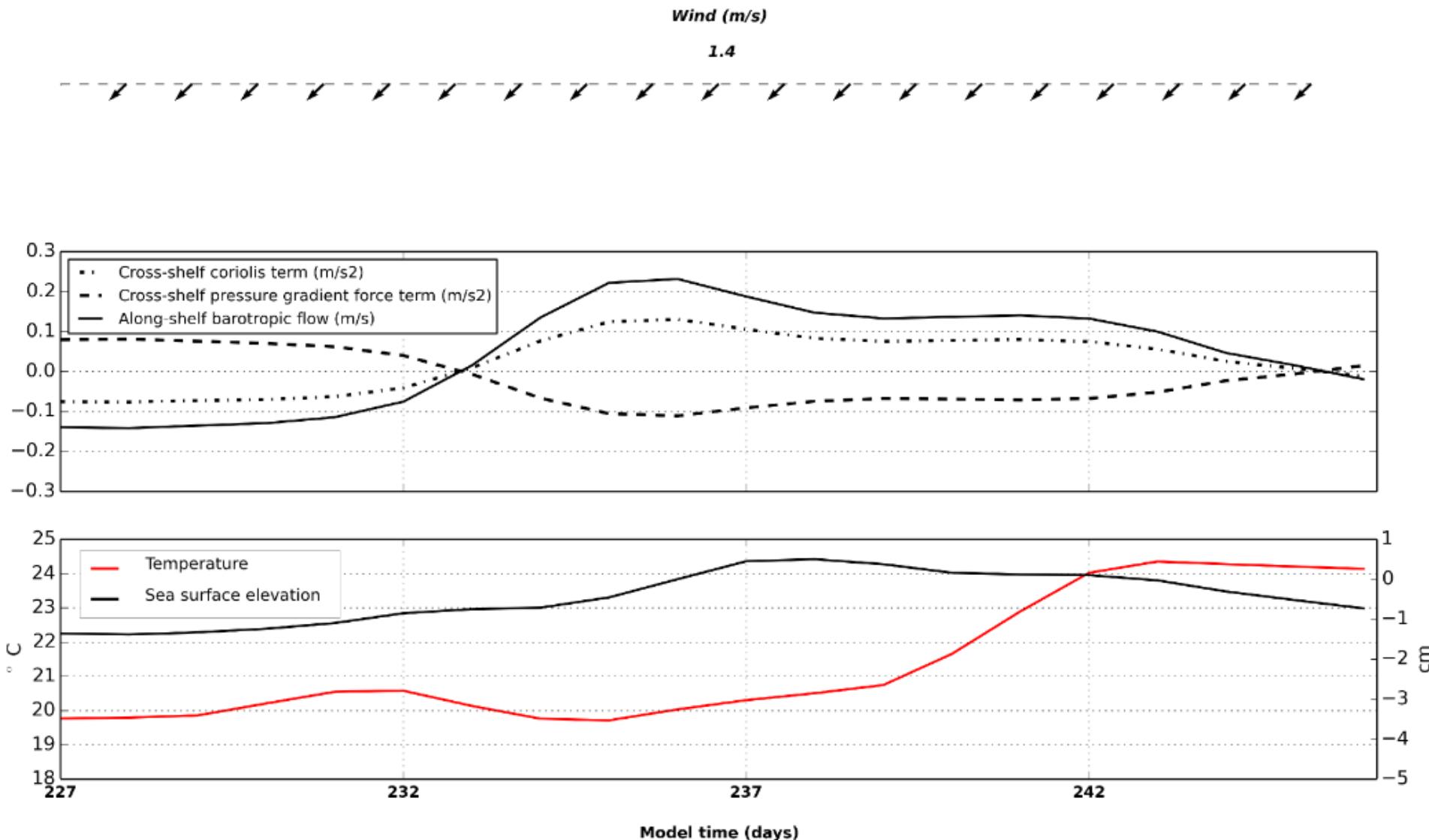
Barotropic velocity
Vectors

SST



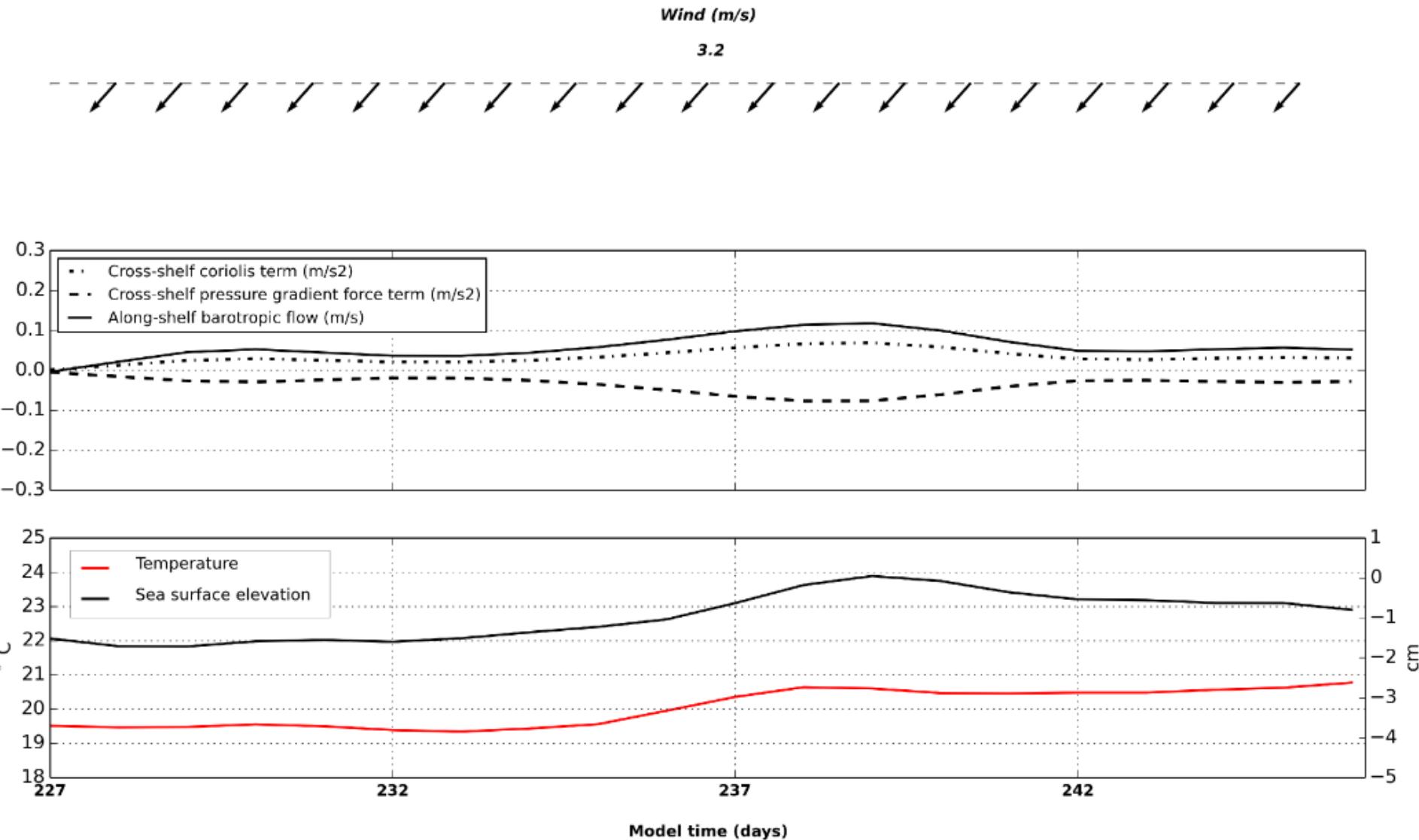
Results

Momentum Balance analysis: Sepetiba, inner to mid shelf



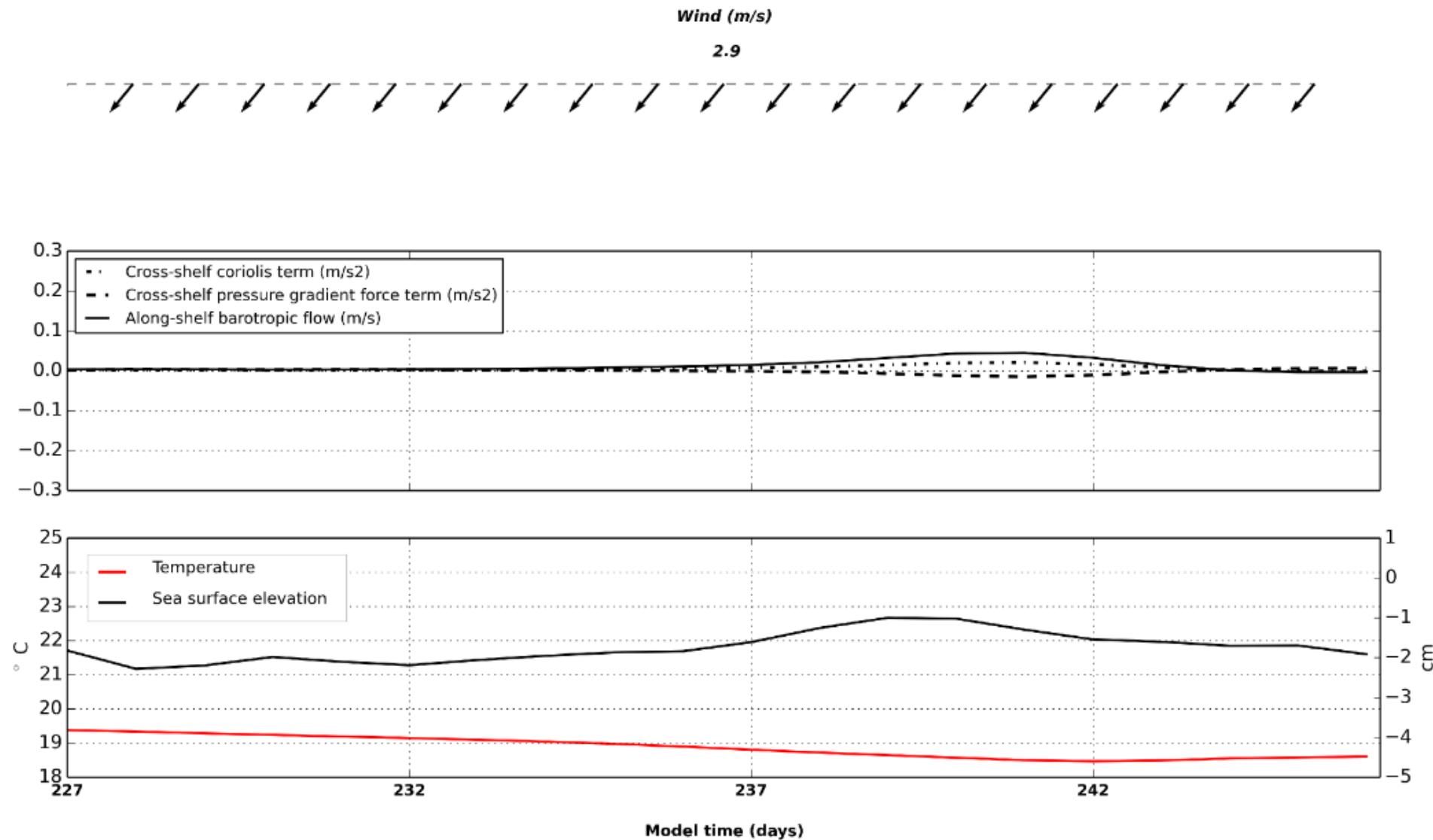
Results

Momentum Balance Analysis: Cabo Frio, inner to mid shelf



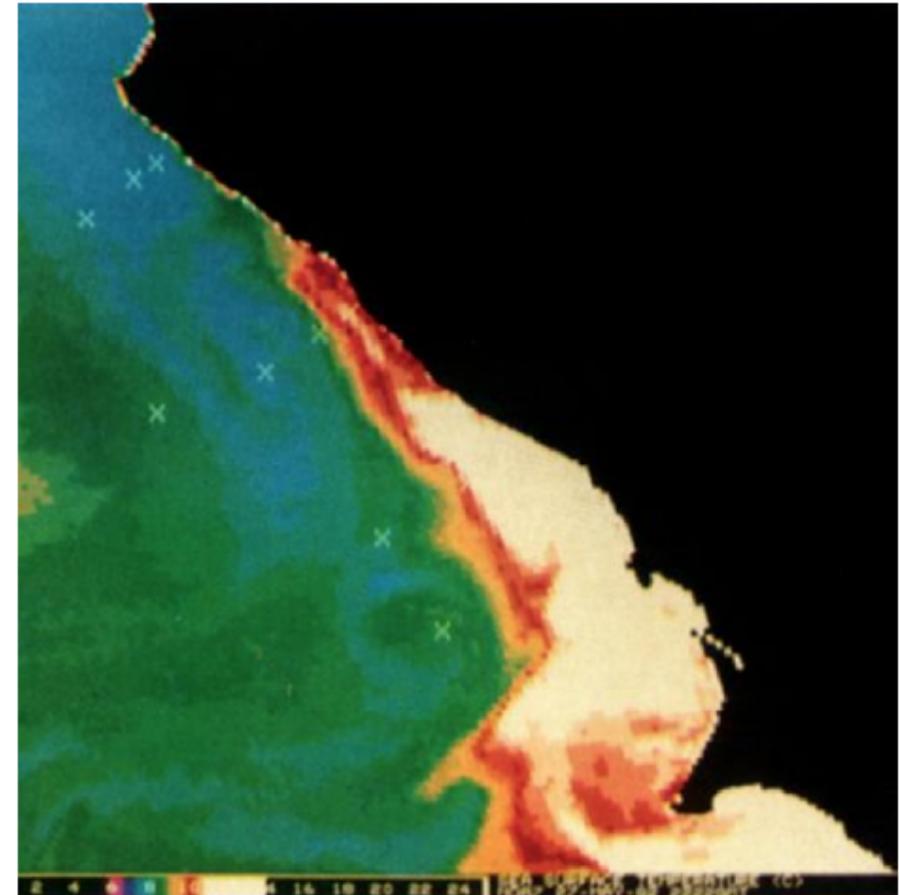
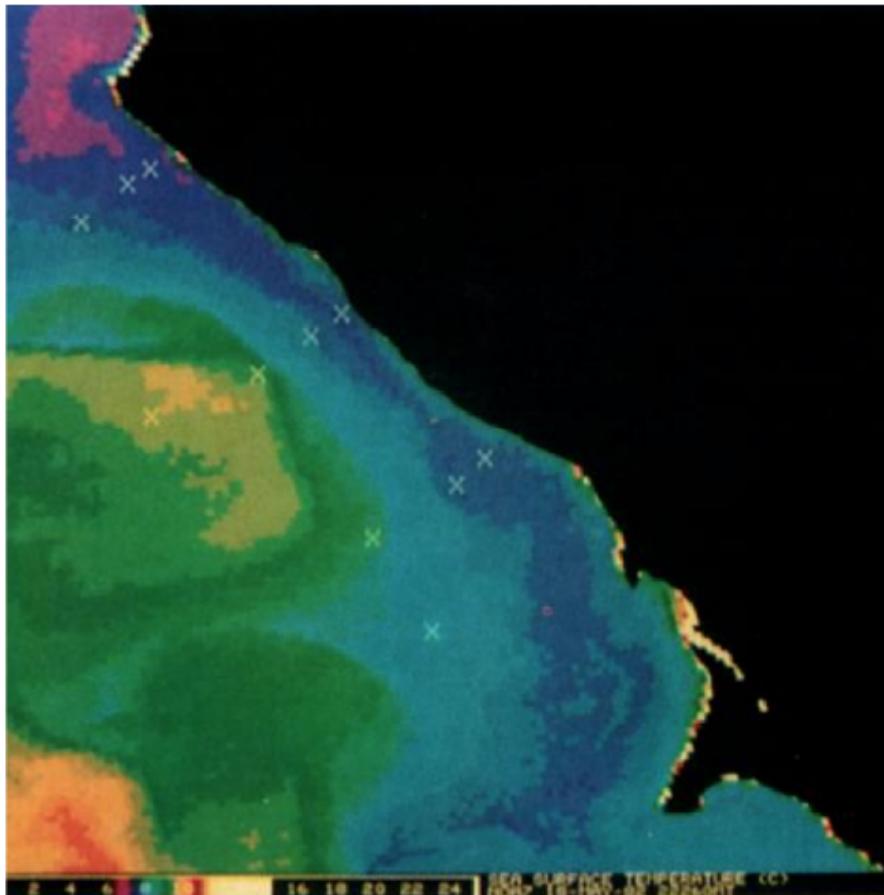
Results

Momentum Balance analysis: Macaé, inner to mid shelf



Results

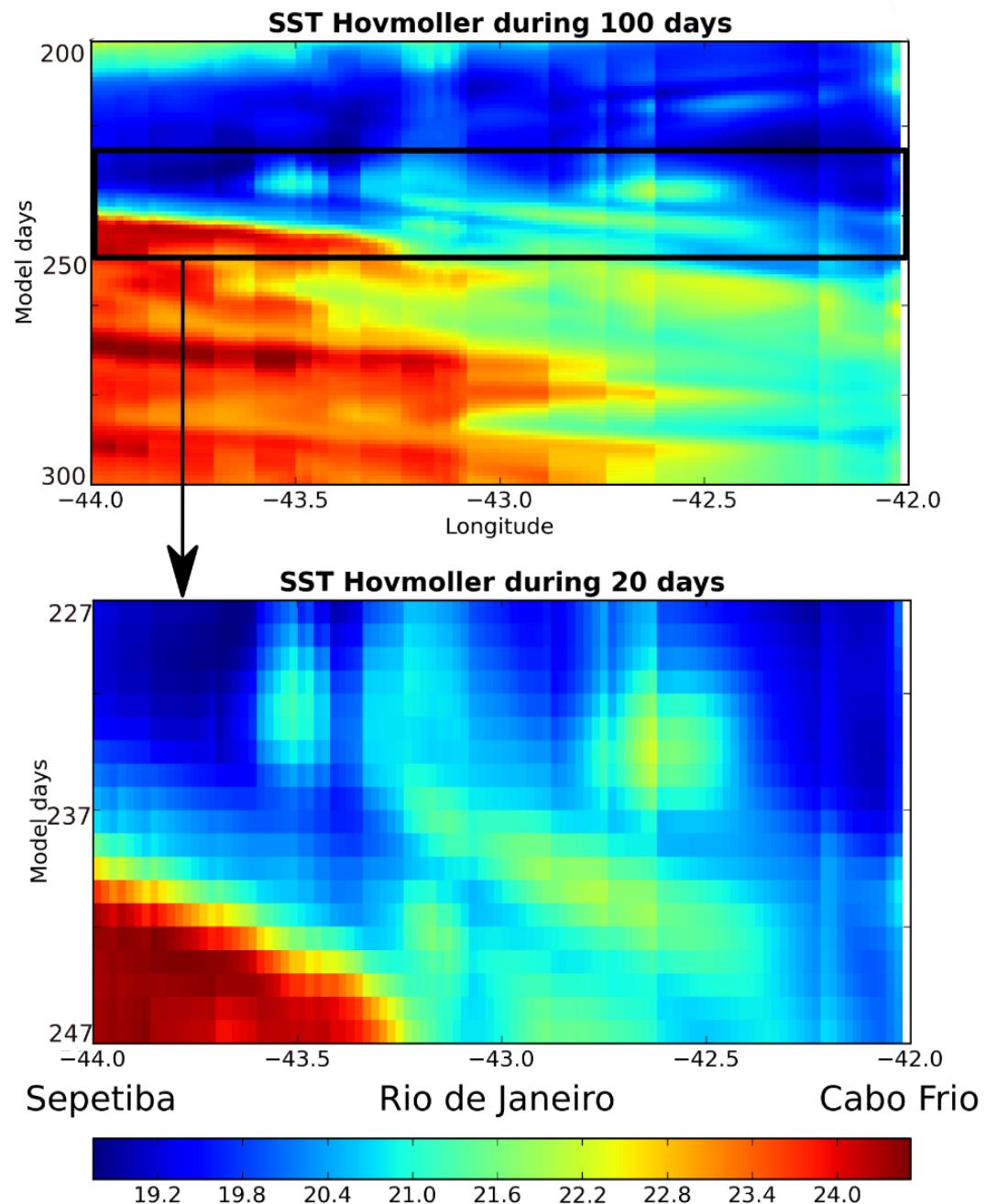
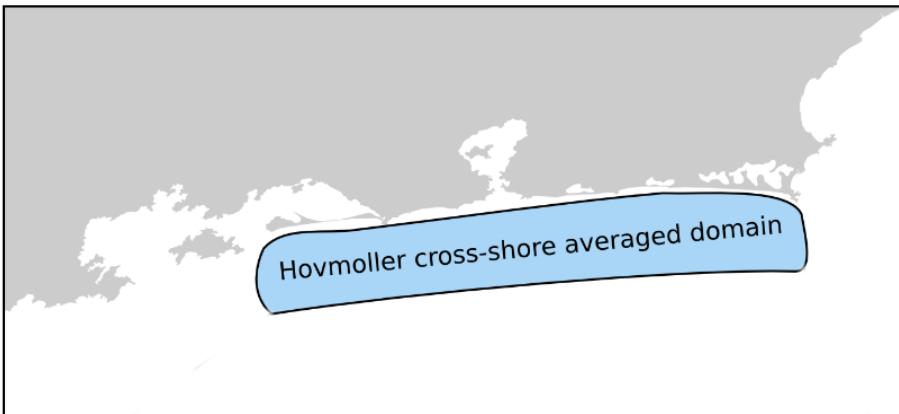
Literature comparison



Send et al. (1987)

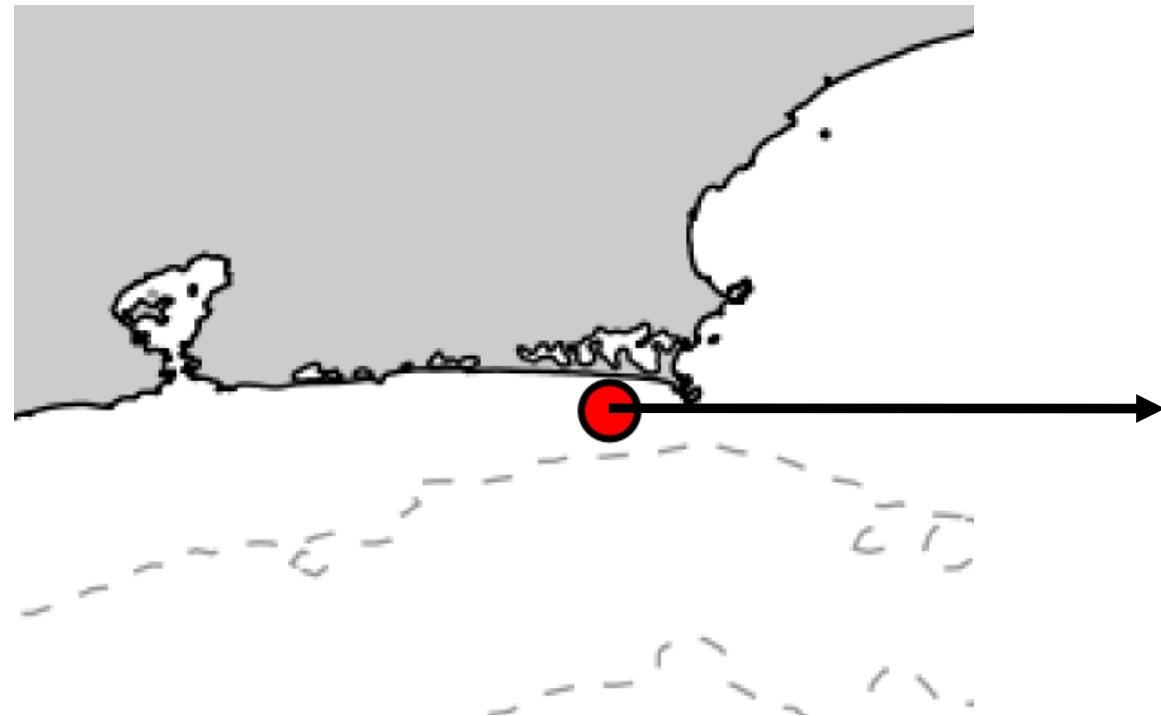
Results

Periodicity?



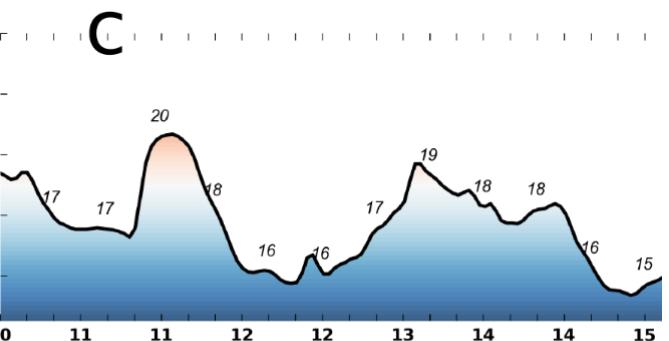
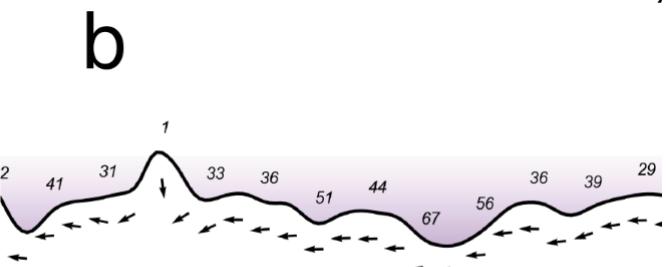
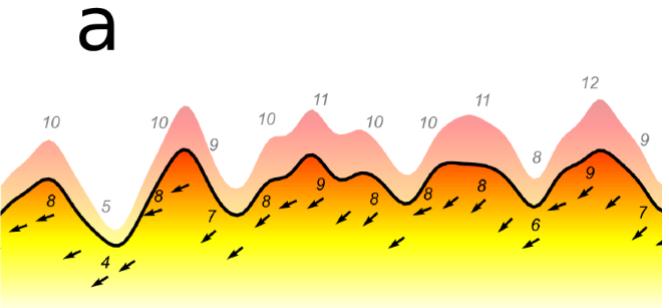
Results

Latest observed scenario – SIODOC Meteoceanographic Mooring



Meteoceanographic Buoy (SIODOC/IEAPM)
(lon : -42.18 - lat : -22.99)

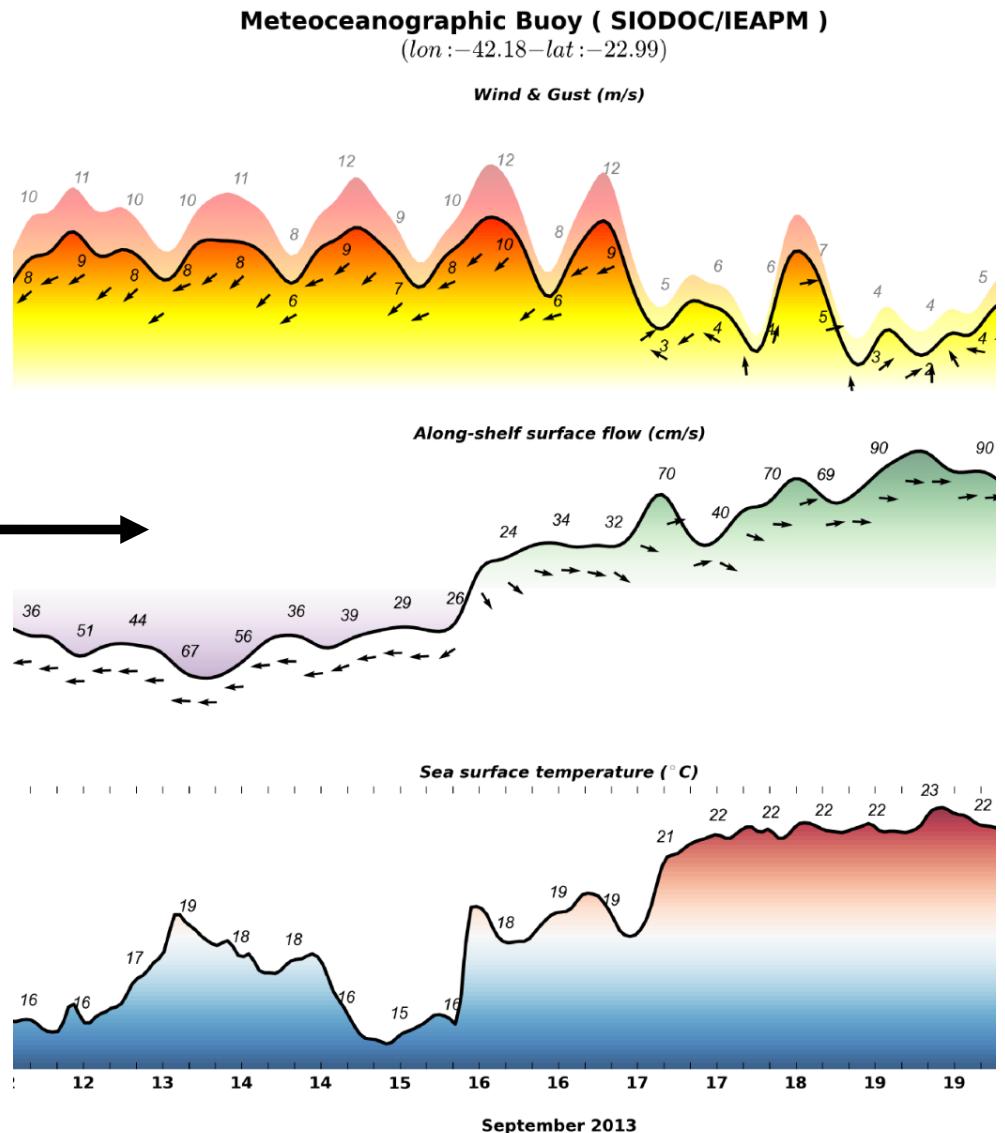
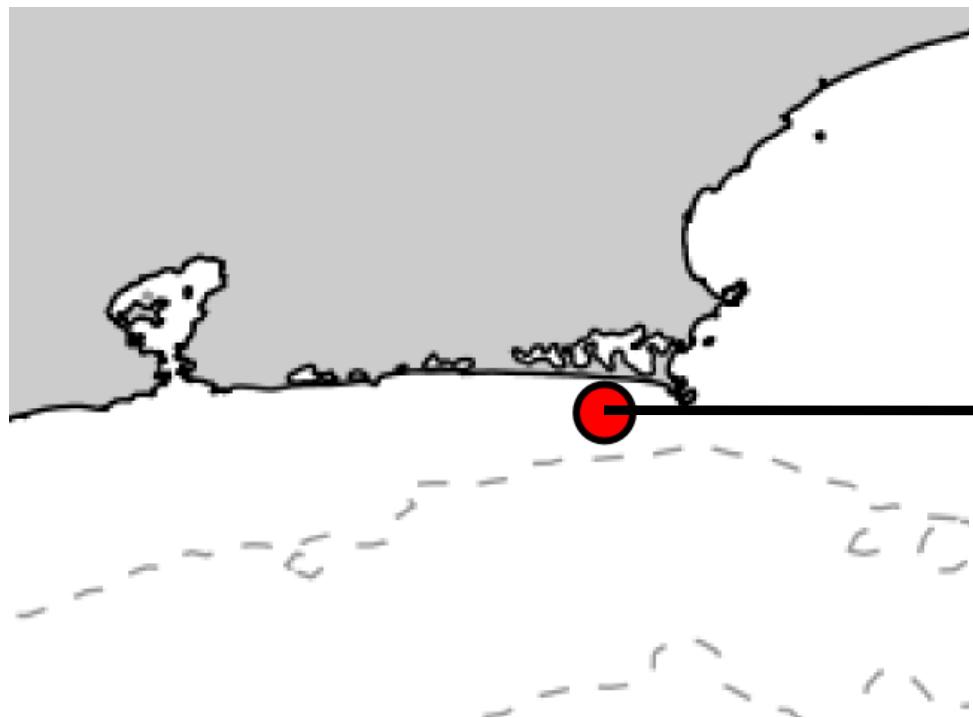
Wind & Gust (m/s)



September 2013

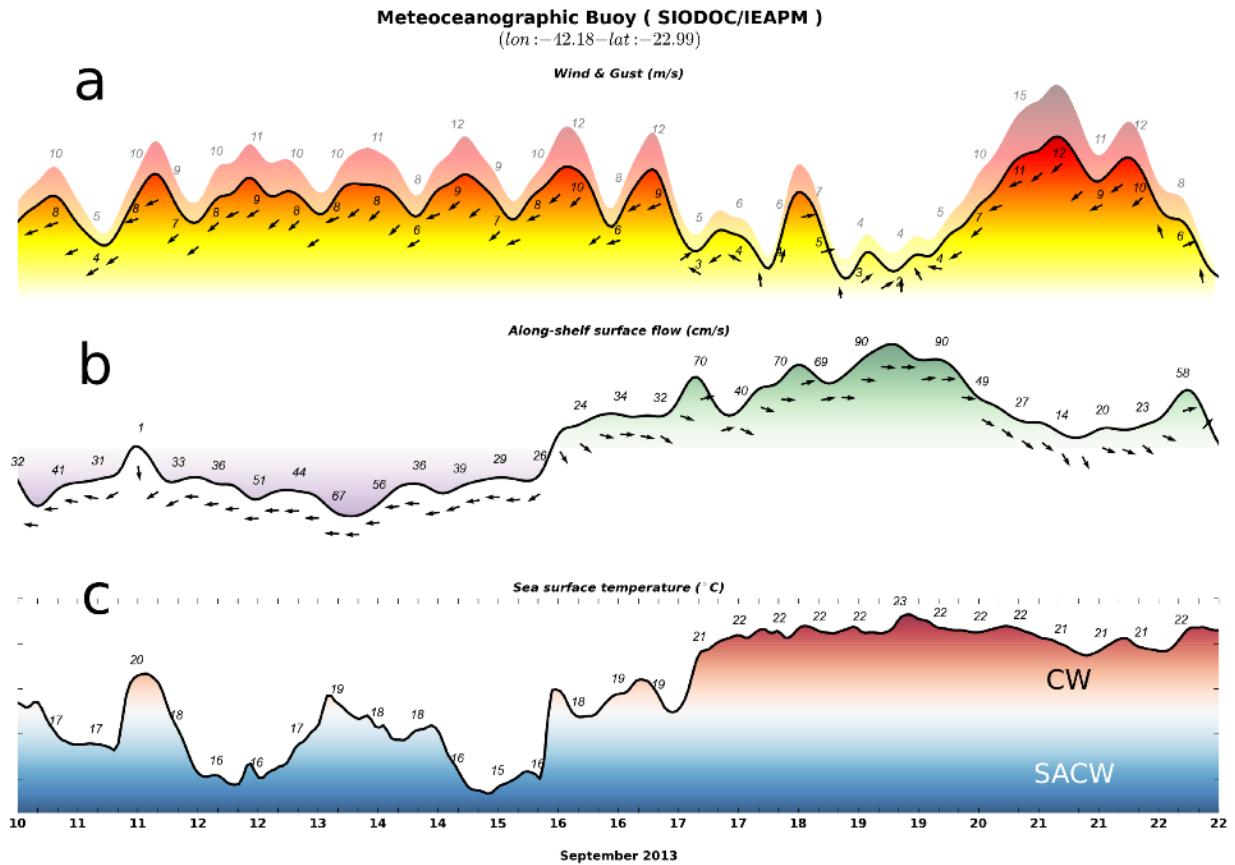
Results

Latest observed scenario – SIODOC Meteoceanographic Mooring

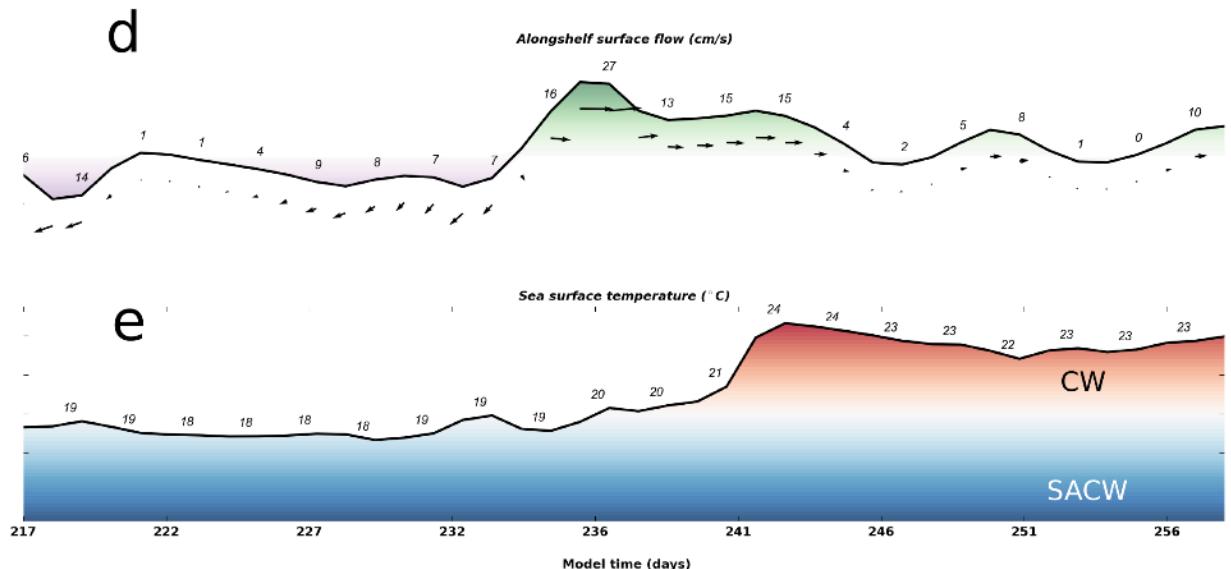


Results

Comparing with ROMS

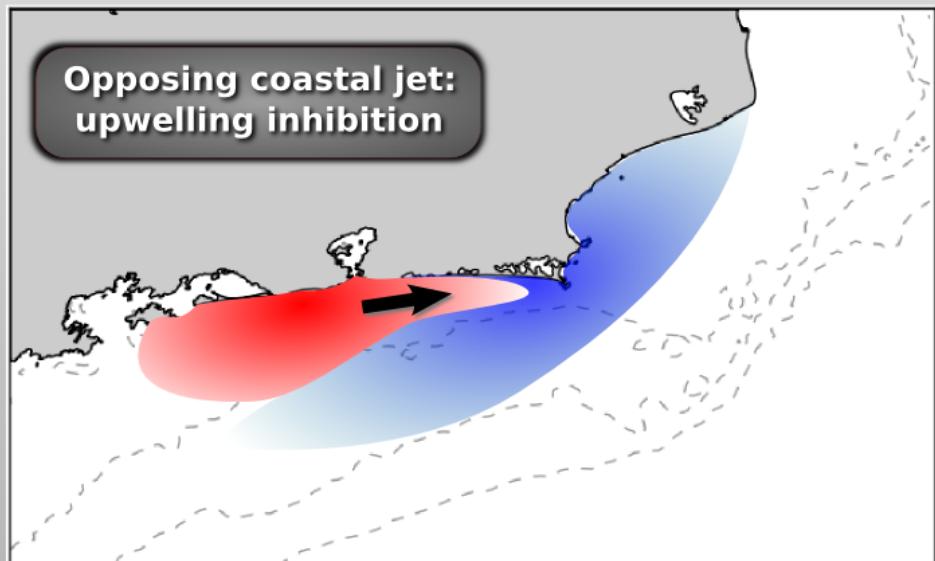
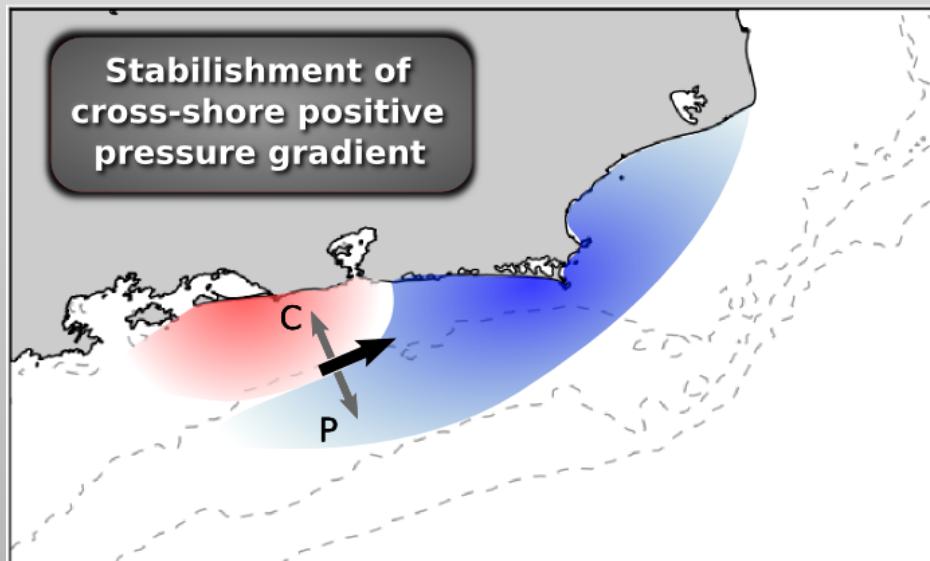
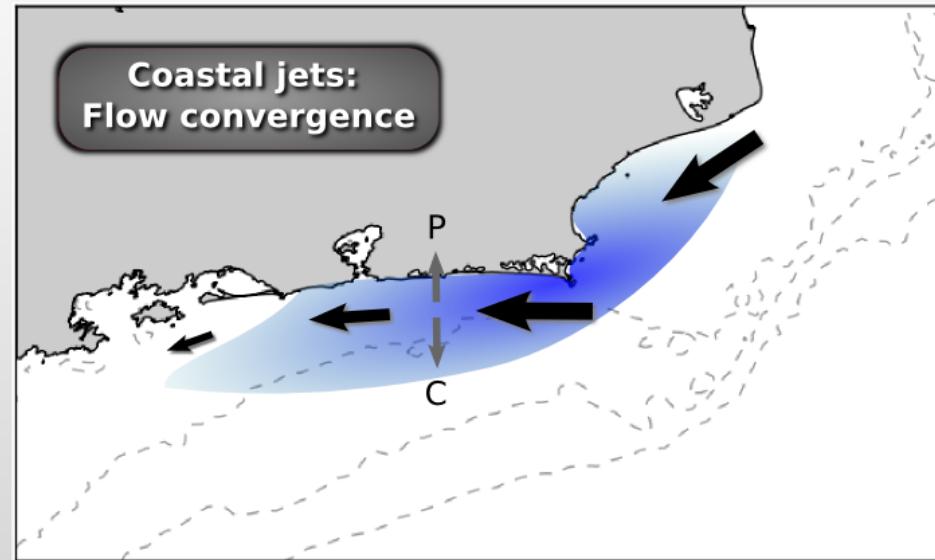
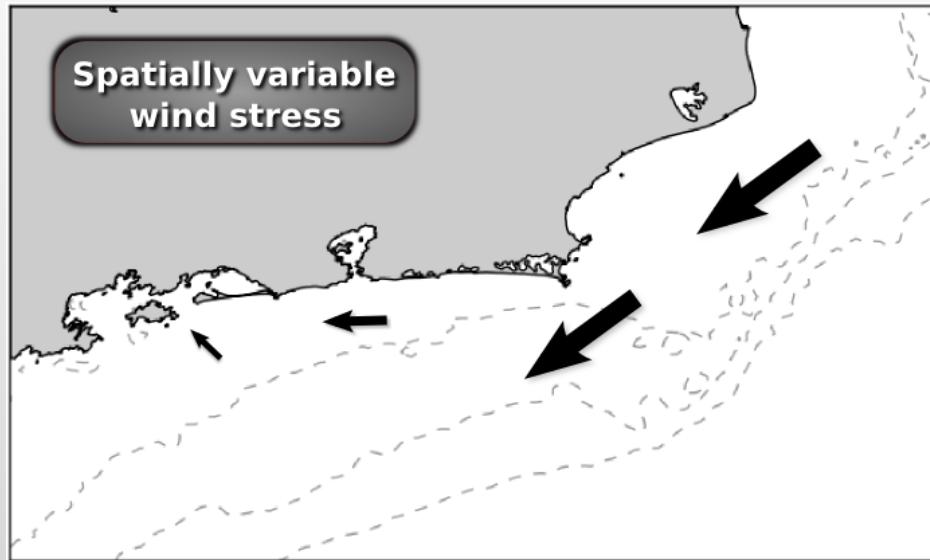


ROMS Results



Summary

Suggested mechanism



Obrigado !

Thank you !

Questions ?

phellipe.couto@gmail.com

rsoutelino@ieapm.mar.mil.br