Oceanic eddy-induced modifications to air–sea heat and CO_2 fluxes in the Brazil-Malvinas Confluence

Dr. Luciano Ponzi Pezzi
Laboratory of Ocean and Atmosphere Studies (**LOA**)
Earth Observation and Geoinformatics Division (**OBT**)
National Institute for Space Research (**INPE**)

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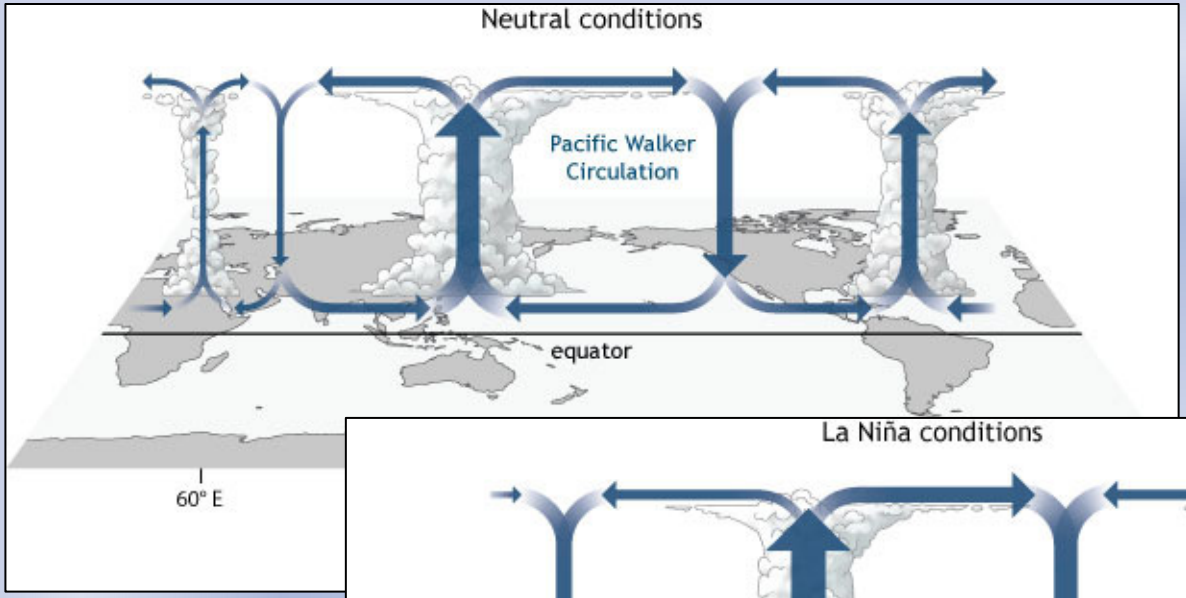
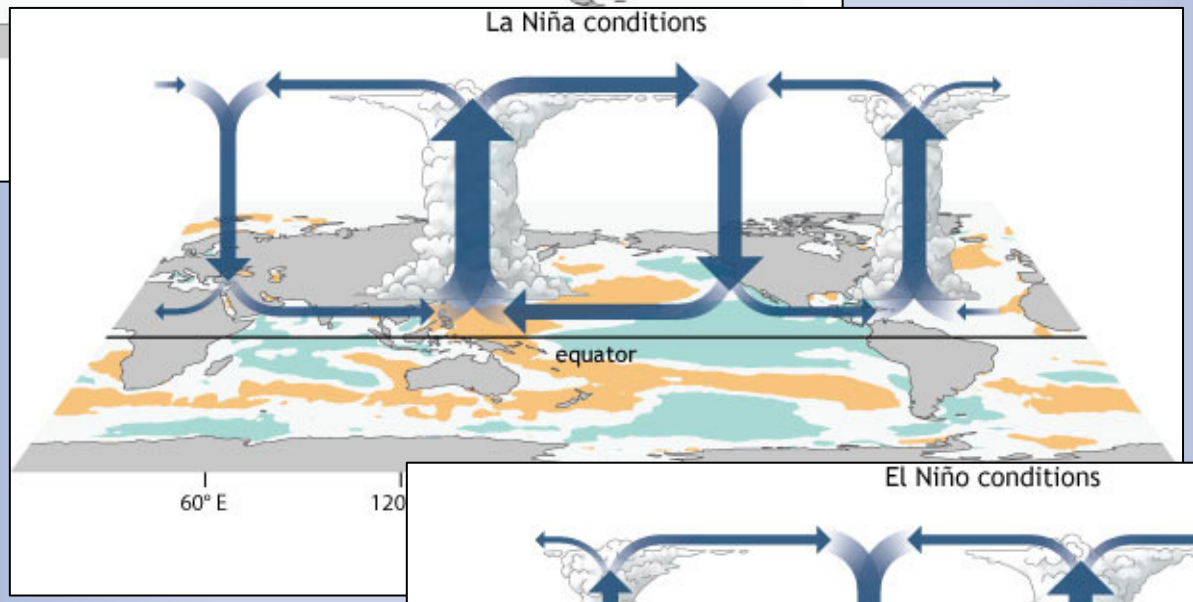
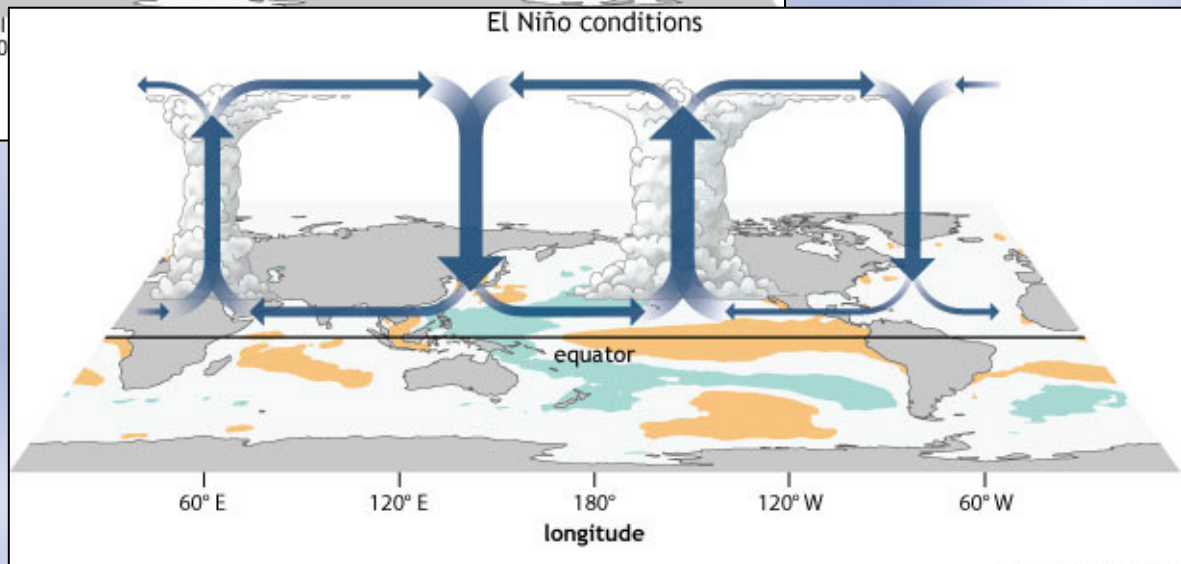
When it comes to O-A interaction
Then one thinks about basin scale phenomena with global impacts, teleconnections, monthly, seasonal, decennial scales, etc..

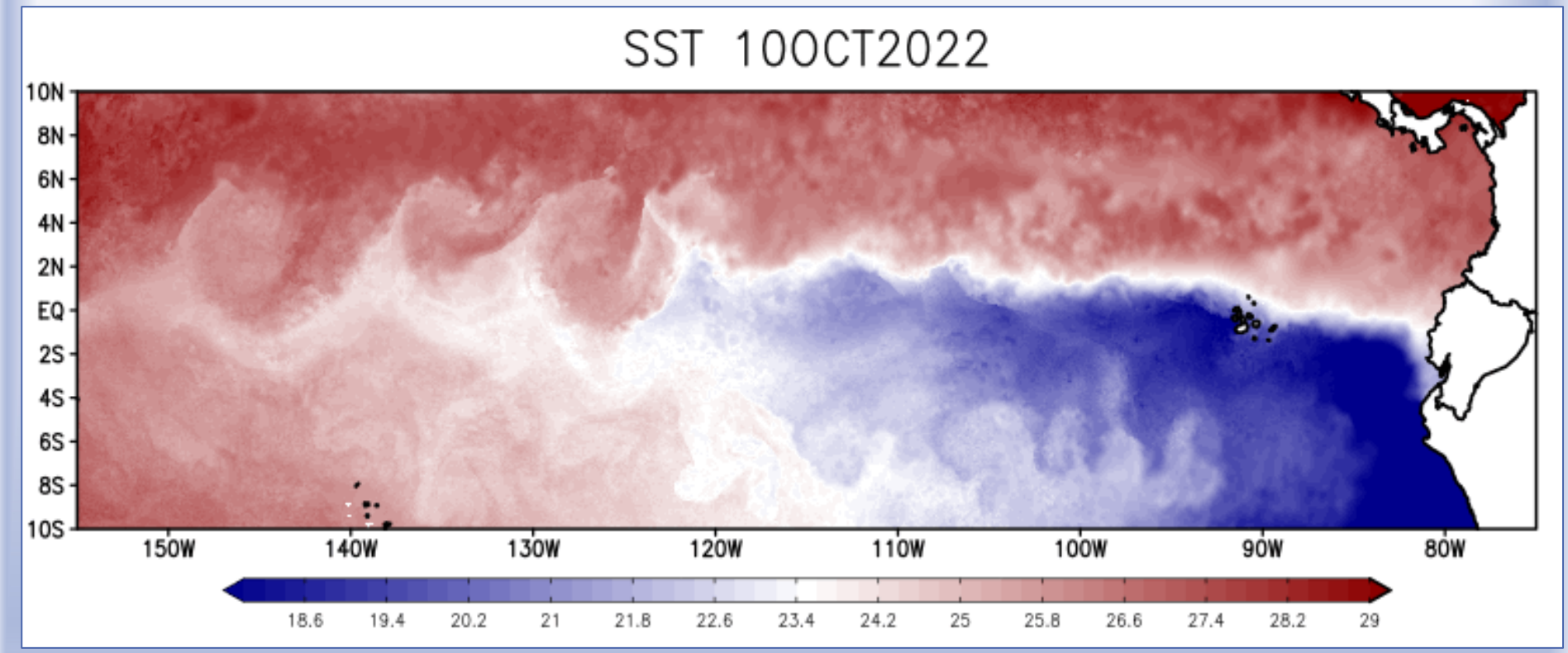






ENSO - (El Niño, La Niña)
Atlantic Dipole (or Variability) (TAV)
Pacific Decadal Oscillation (PDO)
and many
others
large scale variability phenomena

When the oceanic mesoscale plays a role…
Tropical Instability Waves (TIWs)
in the Pacific Equatorial



Group for High Resolution Sea Surface Temperature (GHRSST)

A merged, multi-sensor L4 Foundation SST analysis

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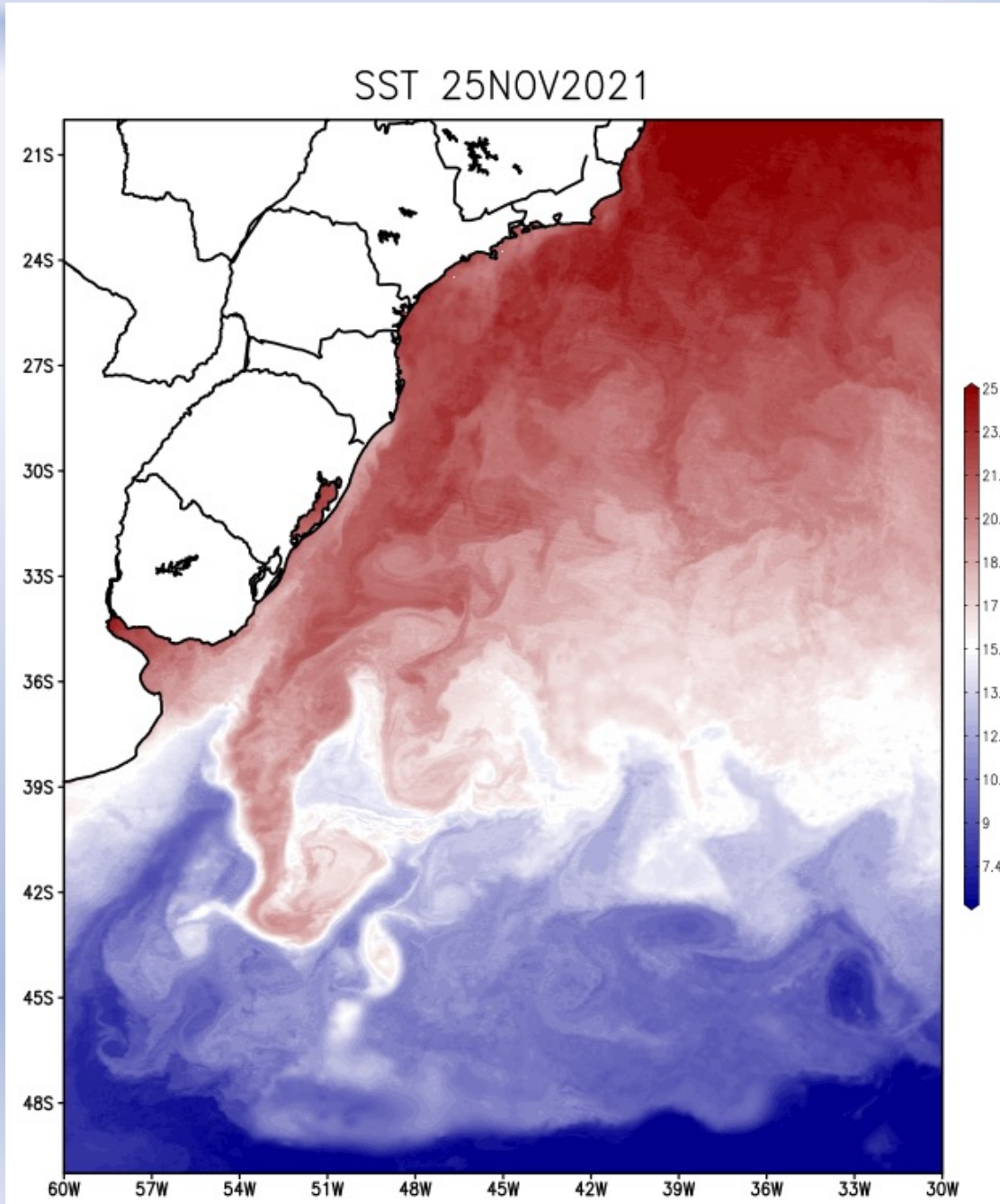
When the oceanic mesoscale plays a role…

Brazil-Malvinas Confluence (BMC) at Southwest Atlantic

and

intense oceanic eddy activity

warm core eddy (WCE)
cold core eddy (CCE)



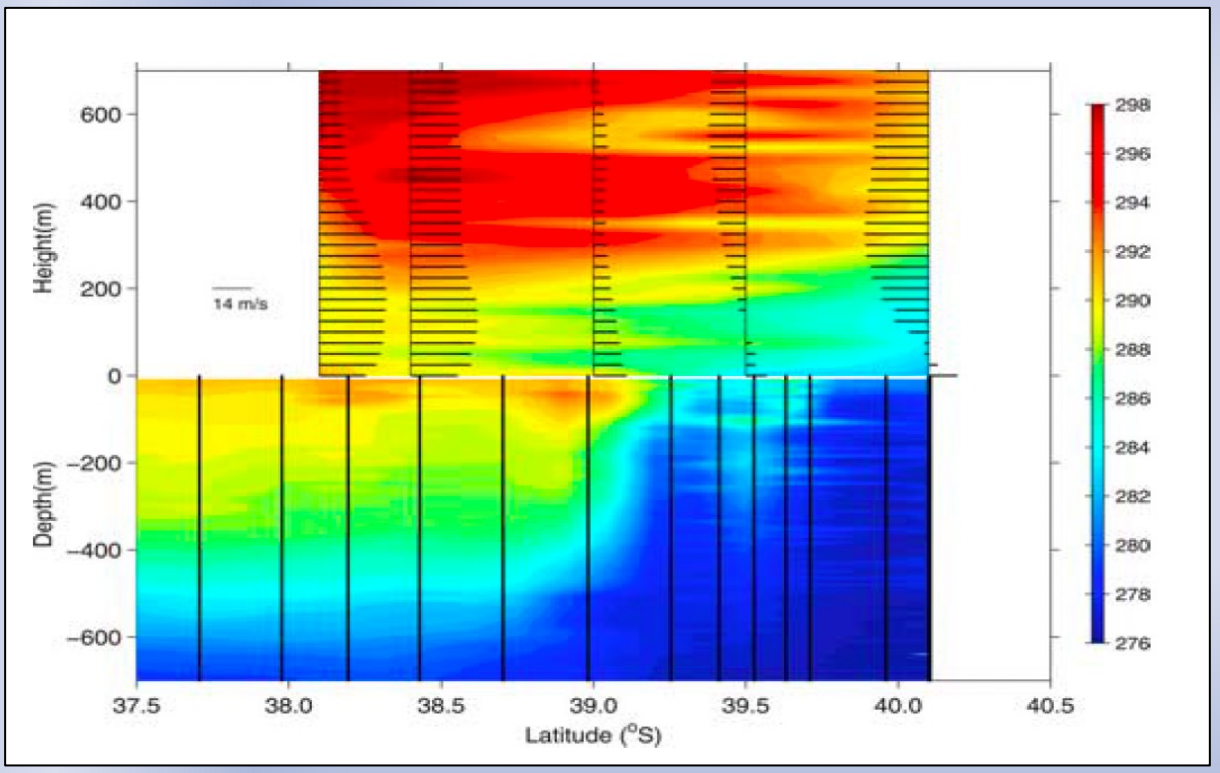
Group for High Resolution Sea Surface Temperature (GHRSST)

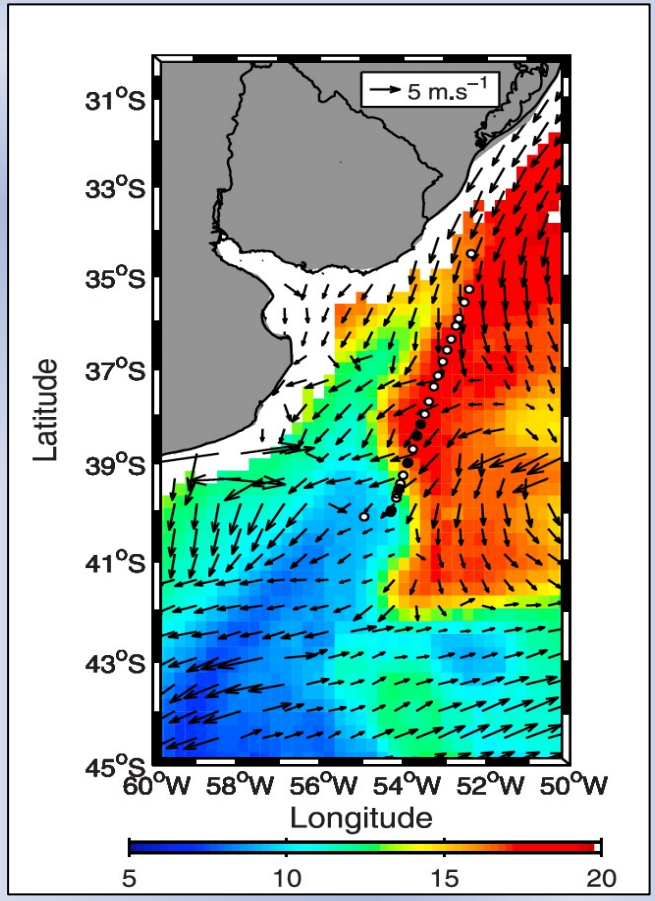
A merged, multi-sensor L4 Foundation SST analysis

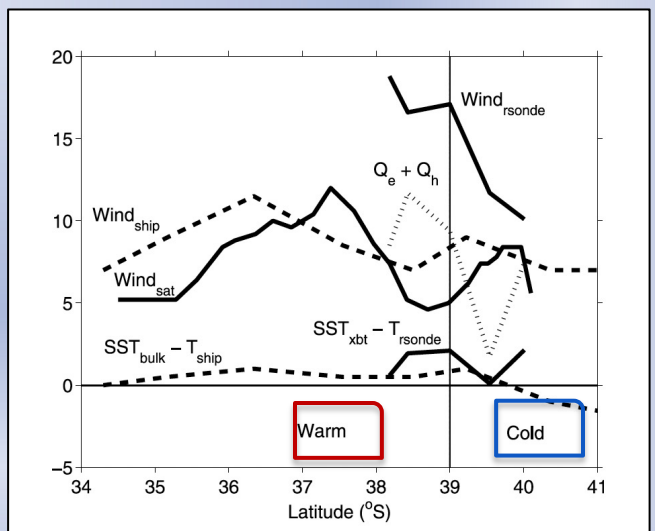
GEOPHYSICAL RESEARCH LETTERS, VOL. 32, L22603, doi:10.1029/2005GL023866, 2005

Ocean-atmosphere in situ observations at the Brazil-Malvinas Confluence region

L. P. Pezzi,[1] R. B. Souza,[2] M. S. Dourado,[2] C. A. E. Garcia,[3] M. M. Mata,[3] and M. A. F. Silva-Dias[1]







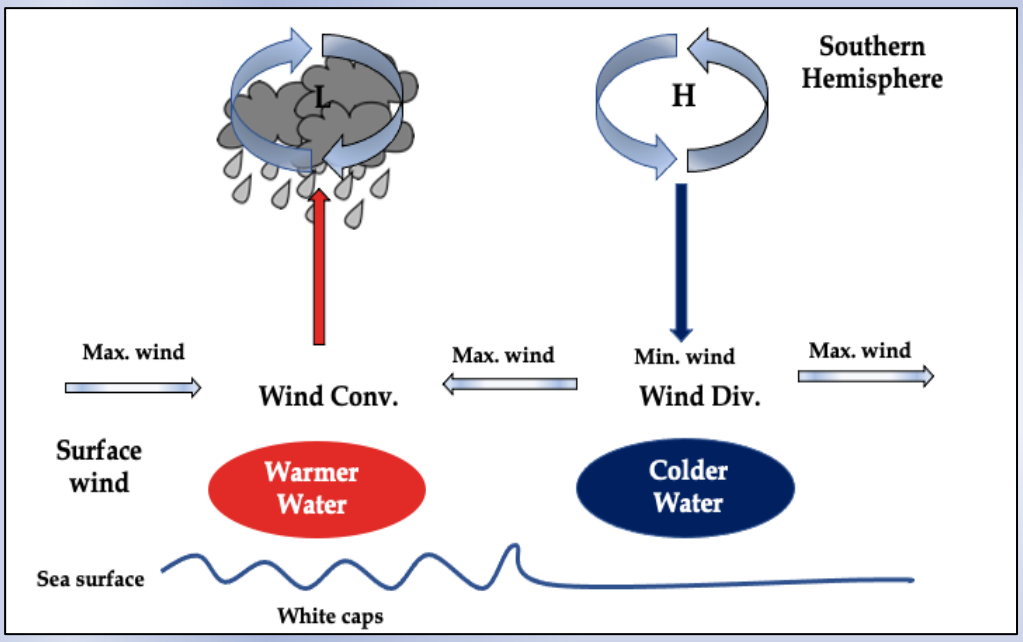
This was our first O-A cruise and we got a “textbook case”

In situ observations

O-A interactions in strong SST gradient regions

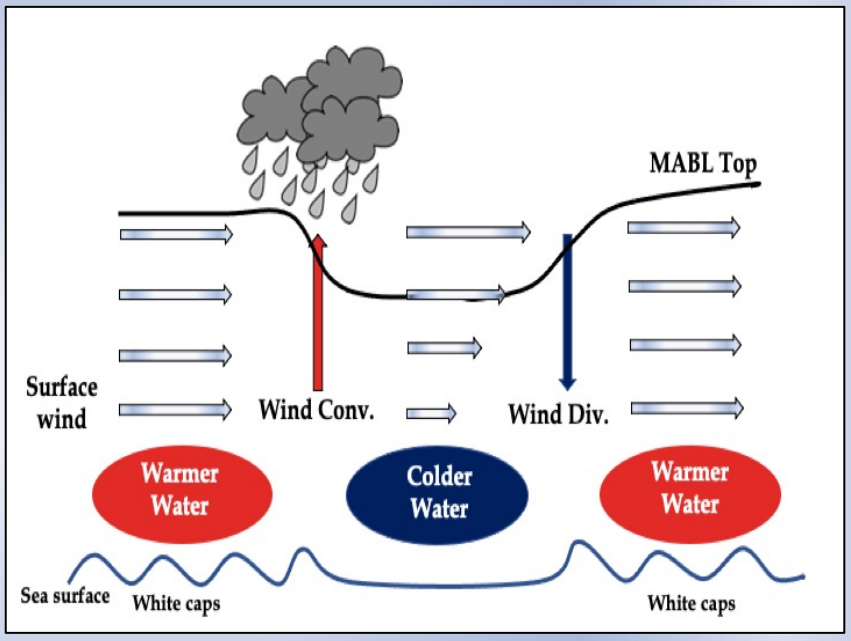
TWO POSSIBLE PHYSICAL STABILITY MECHANISMS OF MABL:

Hydrostatic Stability



Lindzen and Nigan (1987), Wallace *et al.* (1989) surface wind is affected by pressure gradient at sea level (SLP). Hydrostatic stability.

Static Stability



Hayes *et al* (1989) - surface wind is affected by the turbulence of the atmospheric boundary layer. Static stability

Courtesy: Mylene Jaen Cabrera

How do we study air-sea interaction processes?

- *In situ* observations (opportunity x permanent)
- Satellite data
- Numerical Modeling (global, regional, coupled)

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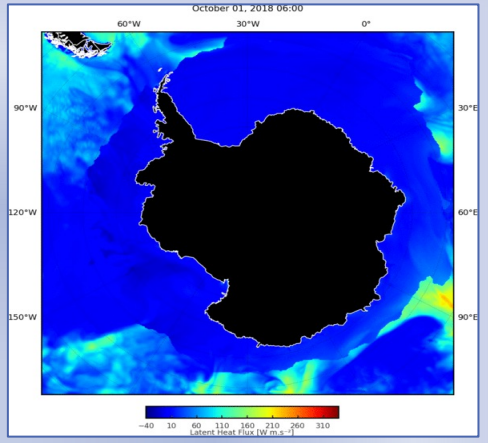

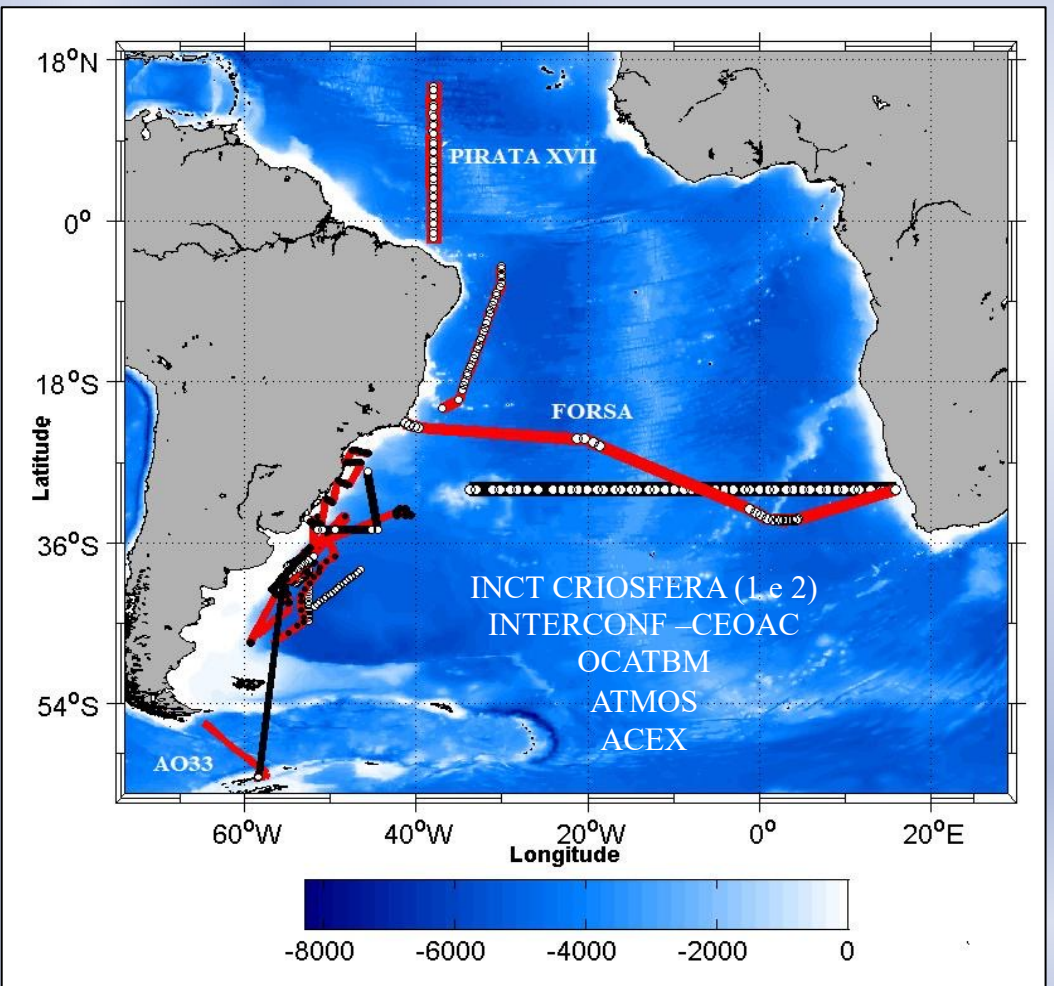

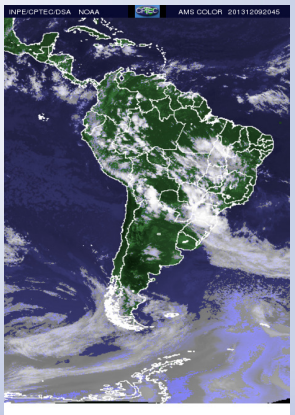

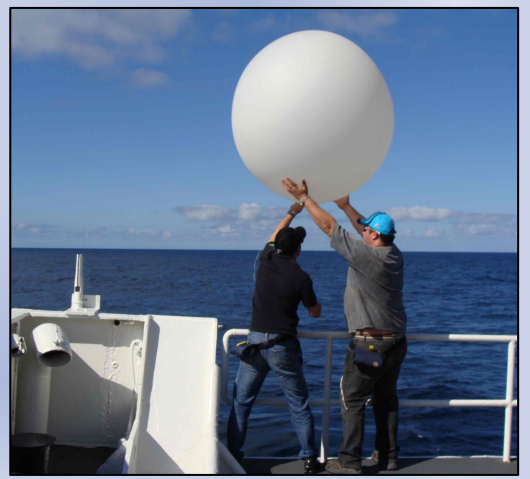

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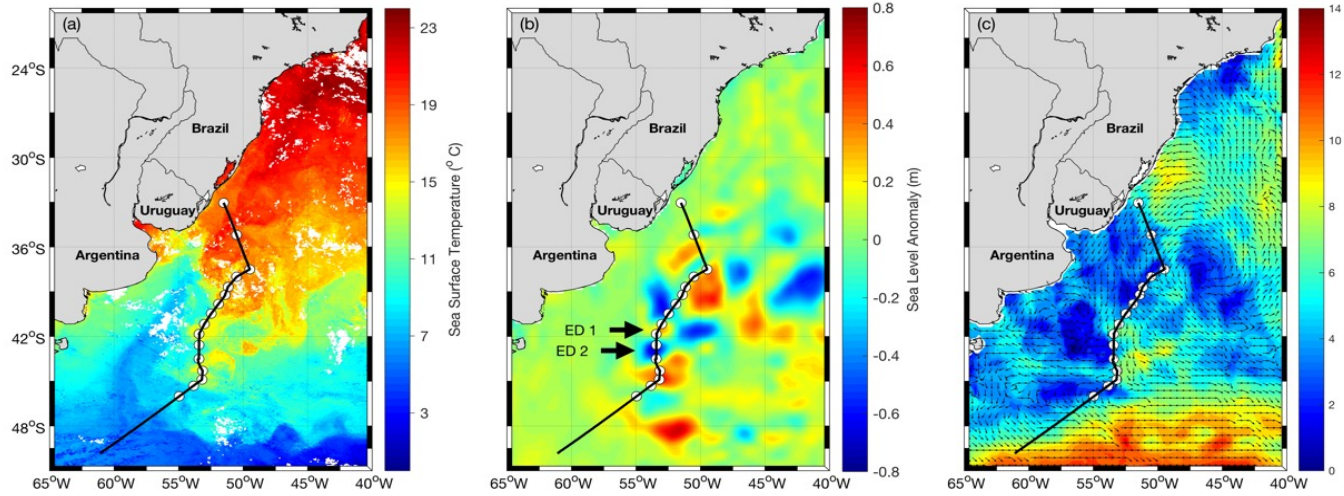
INTERCONF
OPERANTAR 32
14 to 20 October 2013

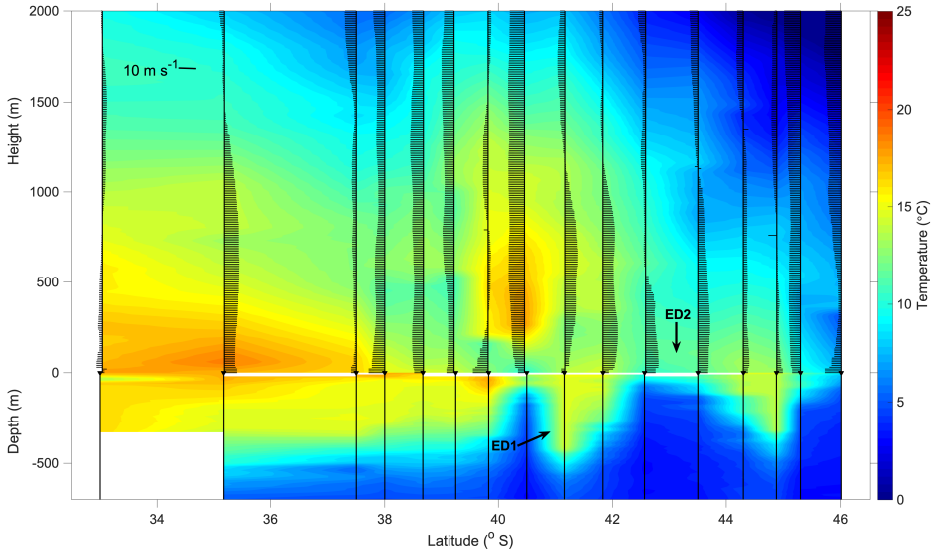


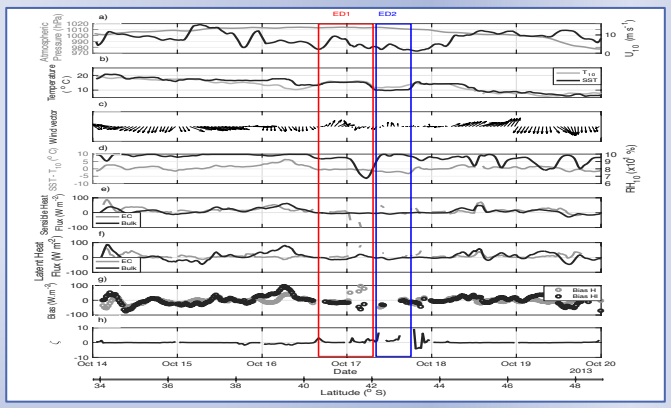
remote sensing
https://www.mdpi.com/journal/remotesensing
MDPI

Article

Air-Sea Interactions over Eddies in the Brazil-Malvinas Confluence

Ronald Souza [1,*], Luciano Pezzi [2], Sebastiaan Swart [3,4], Fabrício Oliveira [5] and Marcelo Santini [2]





Increase – ED1 (WCE):
78% sensible and 55% in latent heat fluxes

Decrease – ED2 (CCE):
49% sensible and 25% in latent heat fluxes

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scientific reports

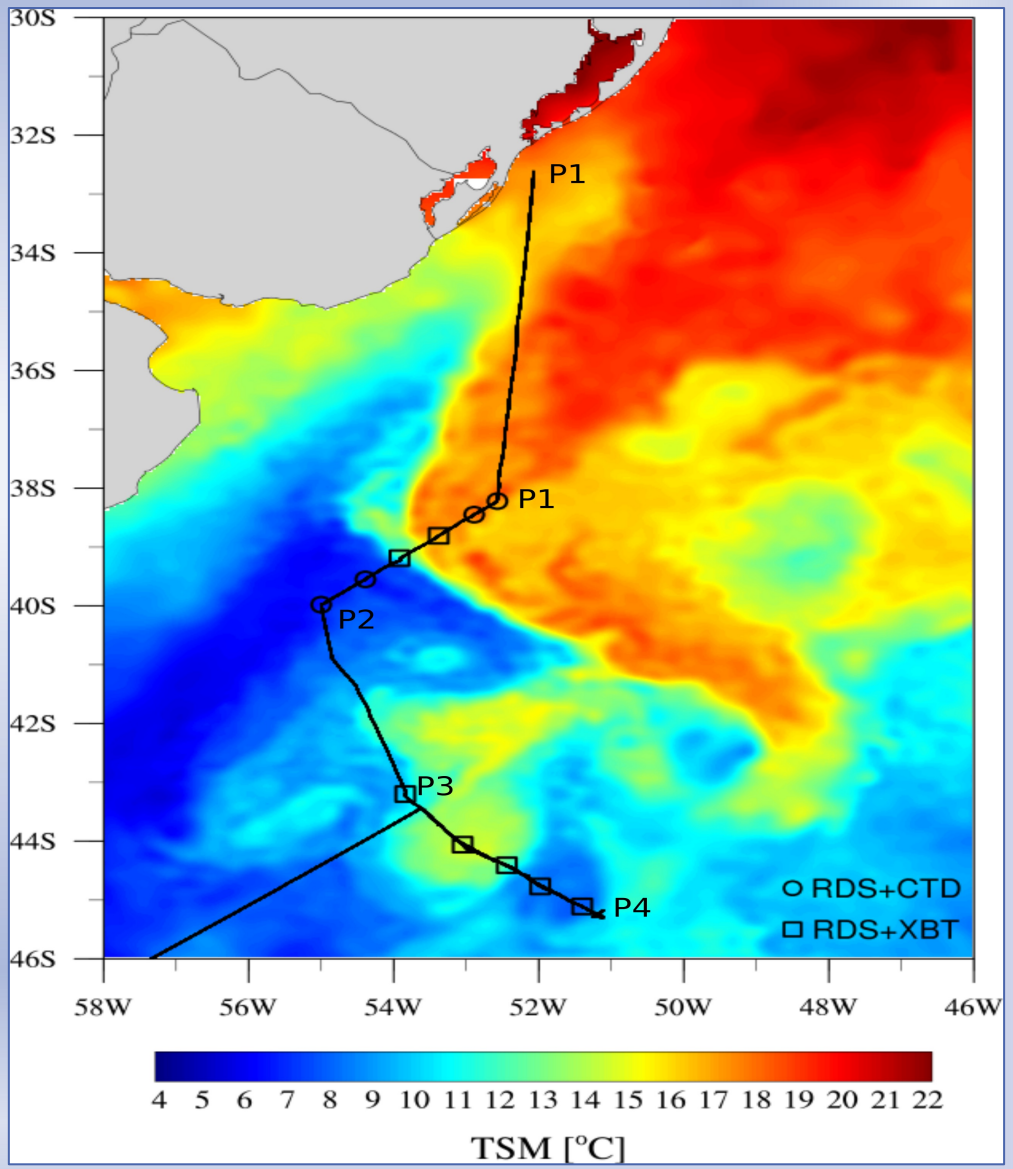
Oceanic eddy-induced modifications to air–sea heat and CO_2 fluxes in the Brazil-Malvinas Confluence

Luciano P. Pezzi[1]✉, Ronald B. de Souza[2], Marcelo F. Santini[1], Arthur J. Miller[3], Jonas T. Carvalho[1], Claudia K. Parise[4], Mario F. Quadro[5], Eliana B. Rosa[1], Flavio Justino[6], Ueslei A. Sutil[1], Mylene J. Cabrera[1], Alexander V. Babanin[7], Joey Voermans[7], Ernani L. Nascimento[8], Rita C. M. Alves[9], Gabriel B. Munchow[9] & Joel Rubert[10]

https://doi.org/10.1038/s41598-021-89985-9

ATMOS Project

OPERANTAR 38 Nov 2019



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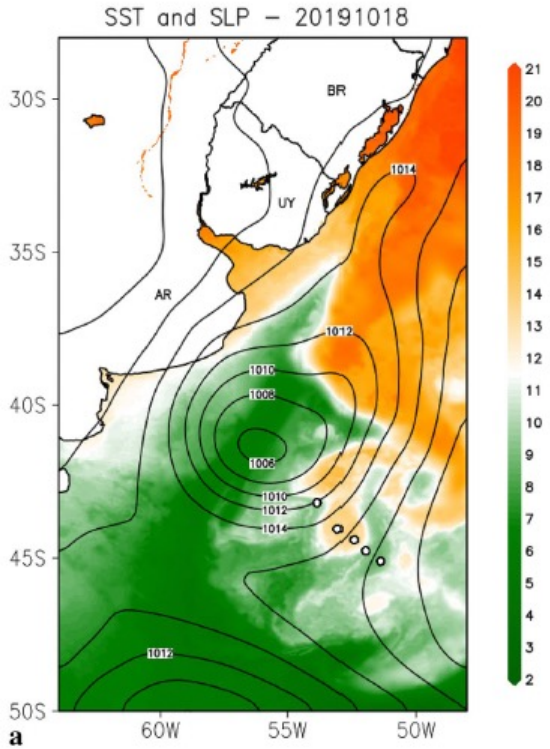
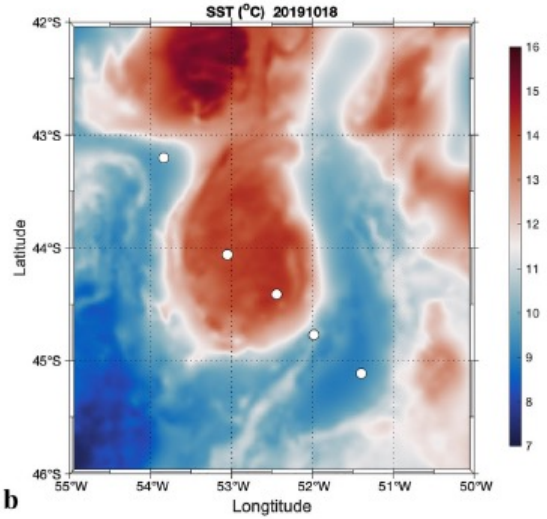
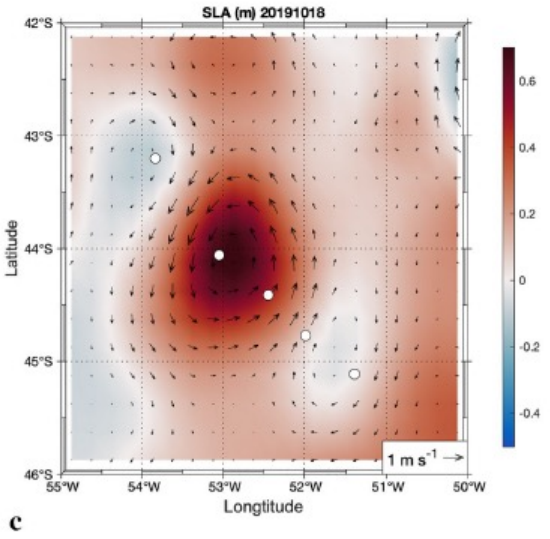
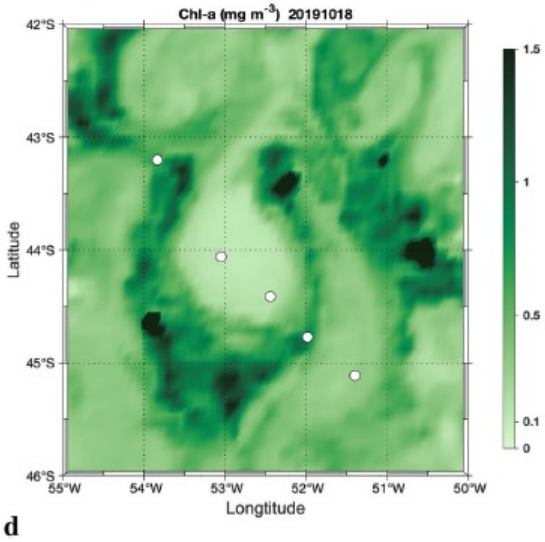
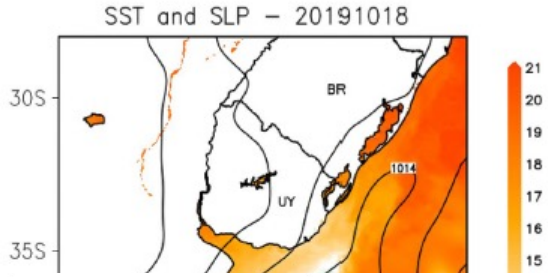


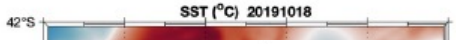
Three different satellite products

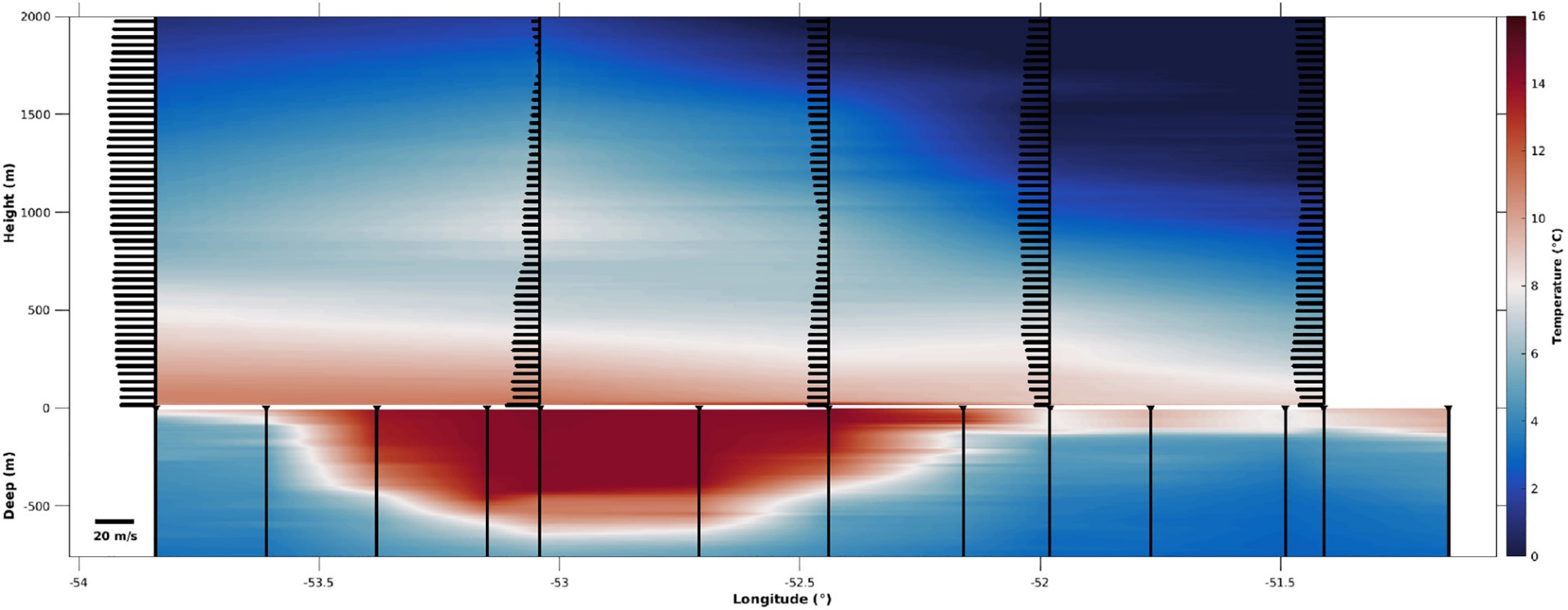


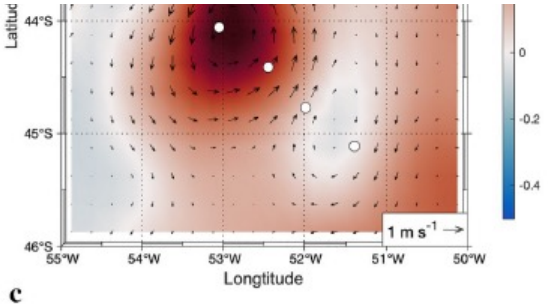


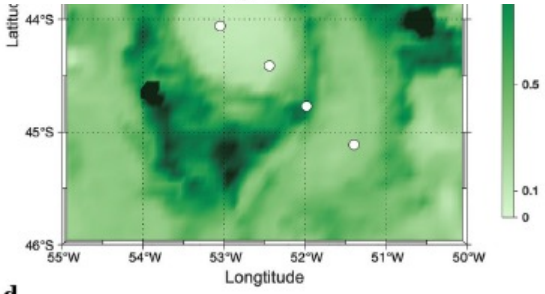












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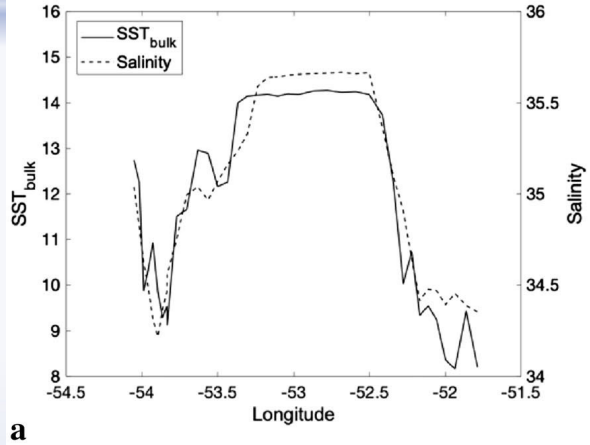
Look at the power of the warm core eddy in OP38



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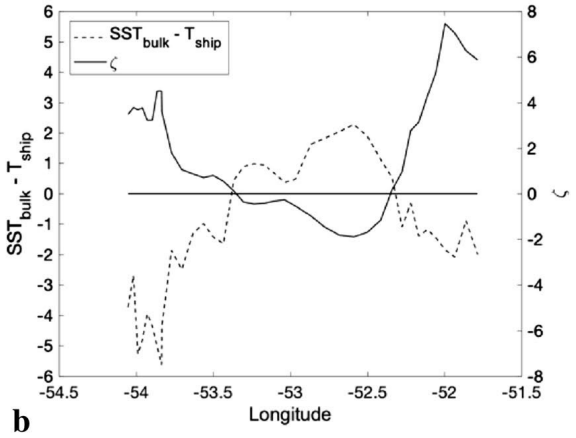

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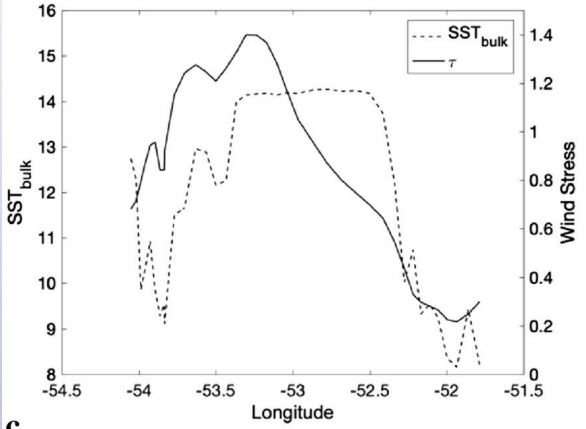
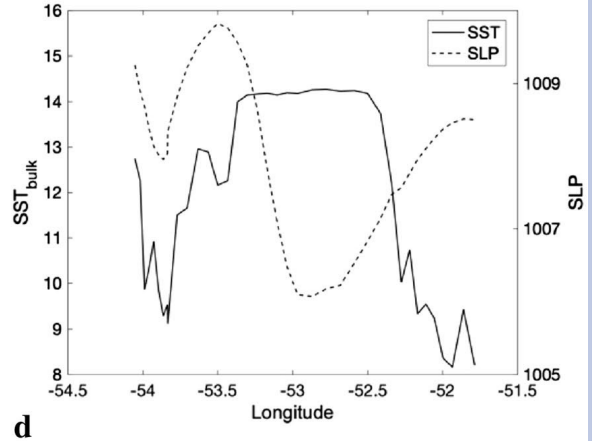


c



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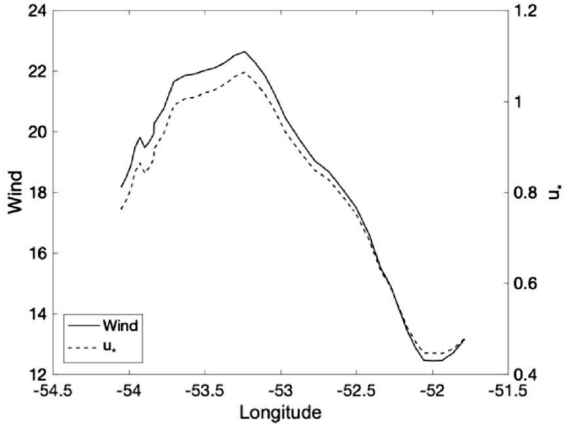

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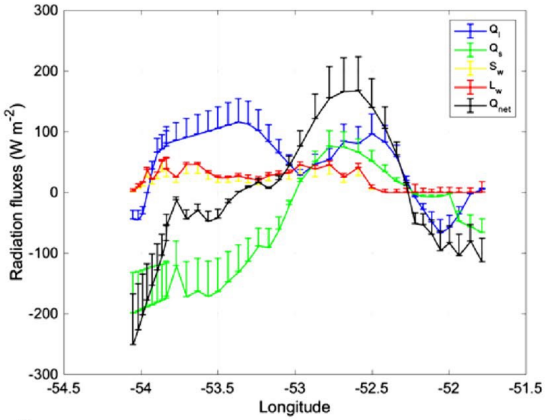

f

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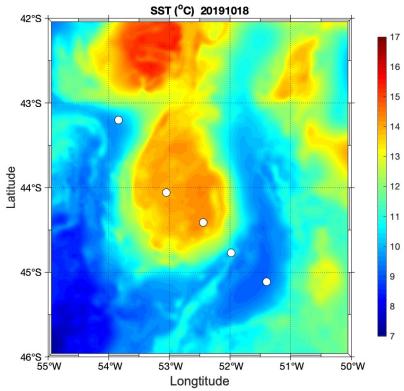
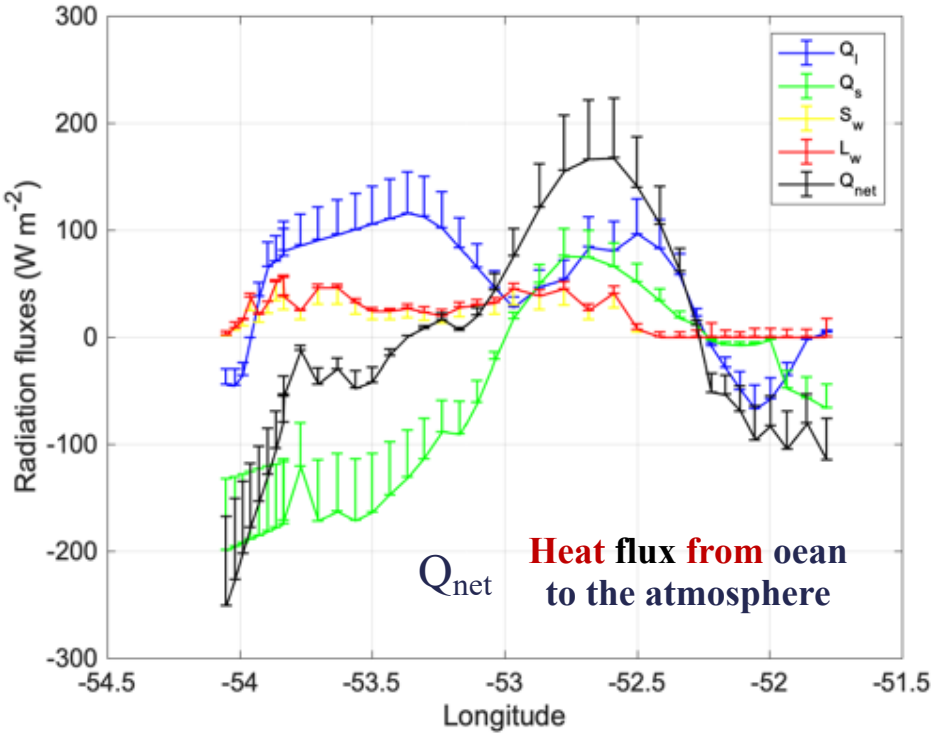
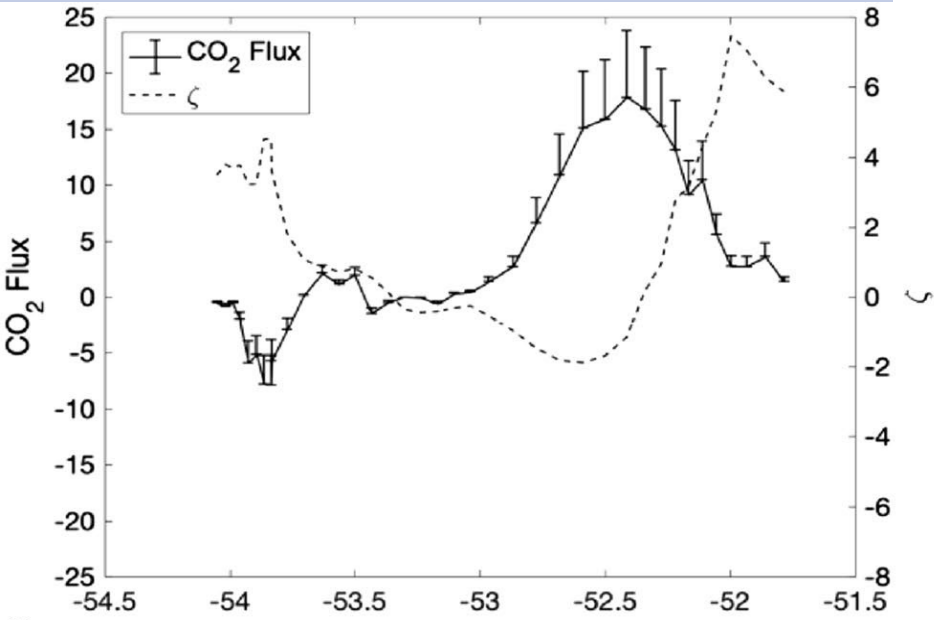
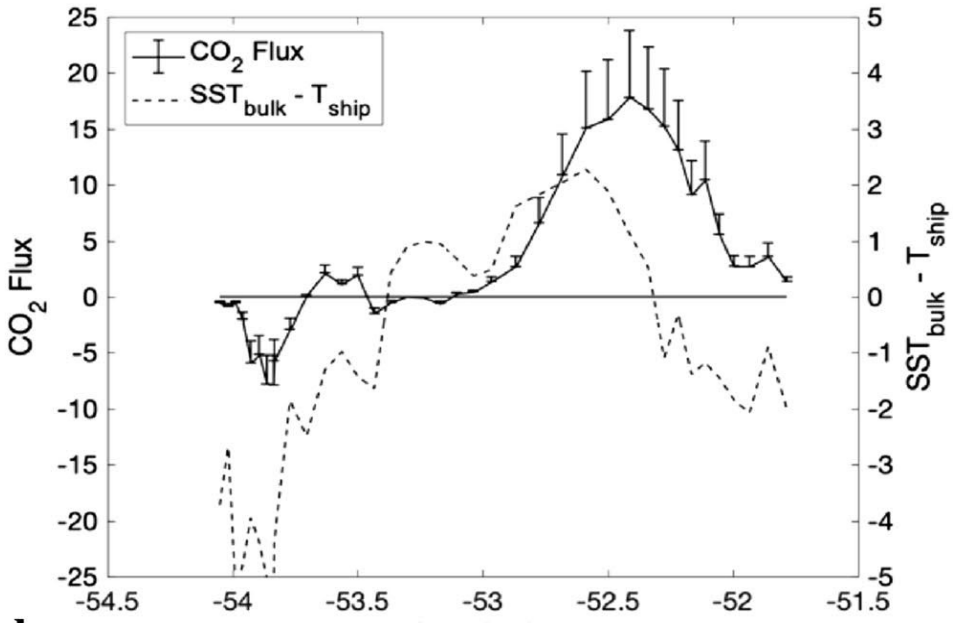
Look at the power of the warm core eddy in OP38









In addition to getting turbulent fluxes observations...

we want to try our own parameterizations...

$$FCO_{2BK} = s.k.\Delta pCO_{2(mar-ar)}$$

CO_2 fluxes

$$\frac{\tau}{\rho} = \overline{u'w'} = u_*^2 = C_{D10}\overline{u_{10}}^2.$$

Momentum fluxes

analogue

$$C_{DN10} = (0.75 + 0.067\overline{u_{N10}}) \times 10^{-3}.$$

Heat fluxes

both the **transfer velocity coefficient**
and **drag coefficient** ...
are bulk "**physical-statistical**" parameterizations

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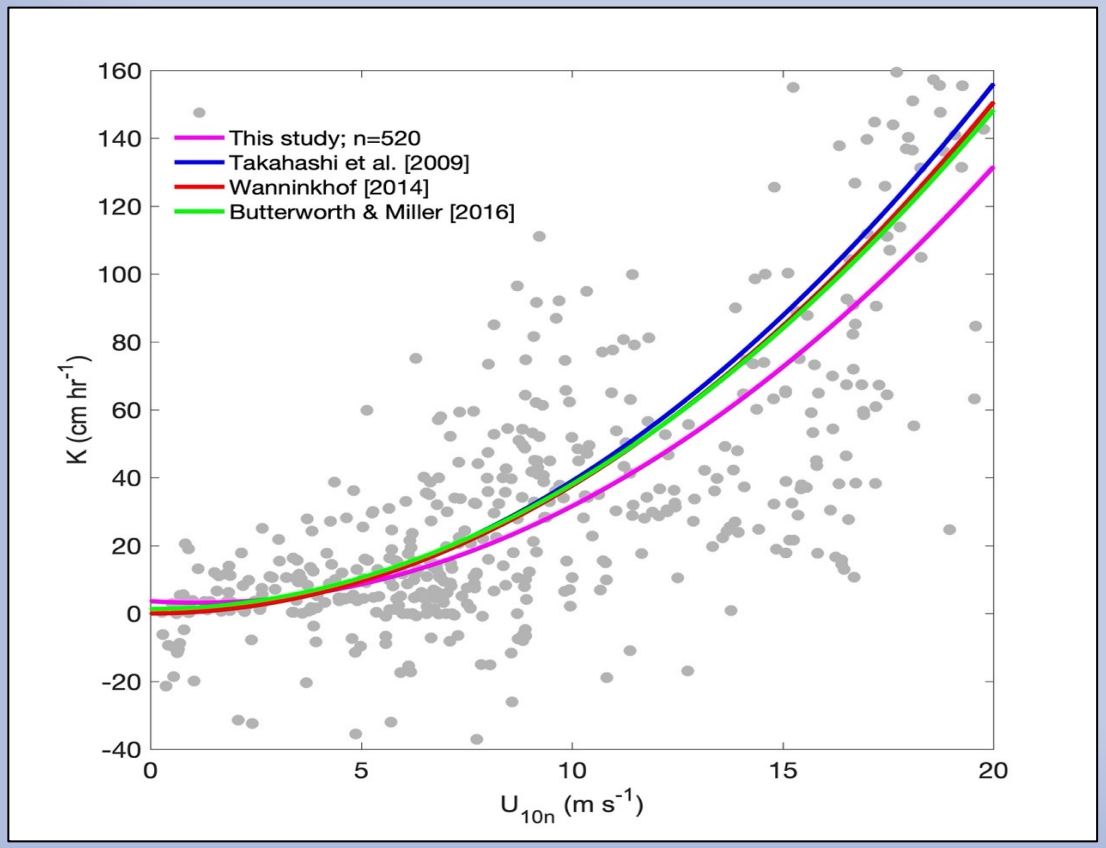
In addition to getting observational turbulent fluxes ... **we want to try our own parameterizations...**



"transfer velocity coefficient (K)" ... is a bulk "physical-statistical" parameterization

$$FCO_{2BK} = s.k.\Delta pCO_{2(\mathrm{sea}-air)}$$

This is our first try on parameterization to SWA

$$K = 0.36.U_{10m}^{2} - 0.8\ U_{10m} + 3.6$$

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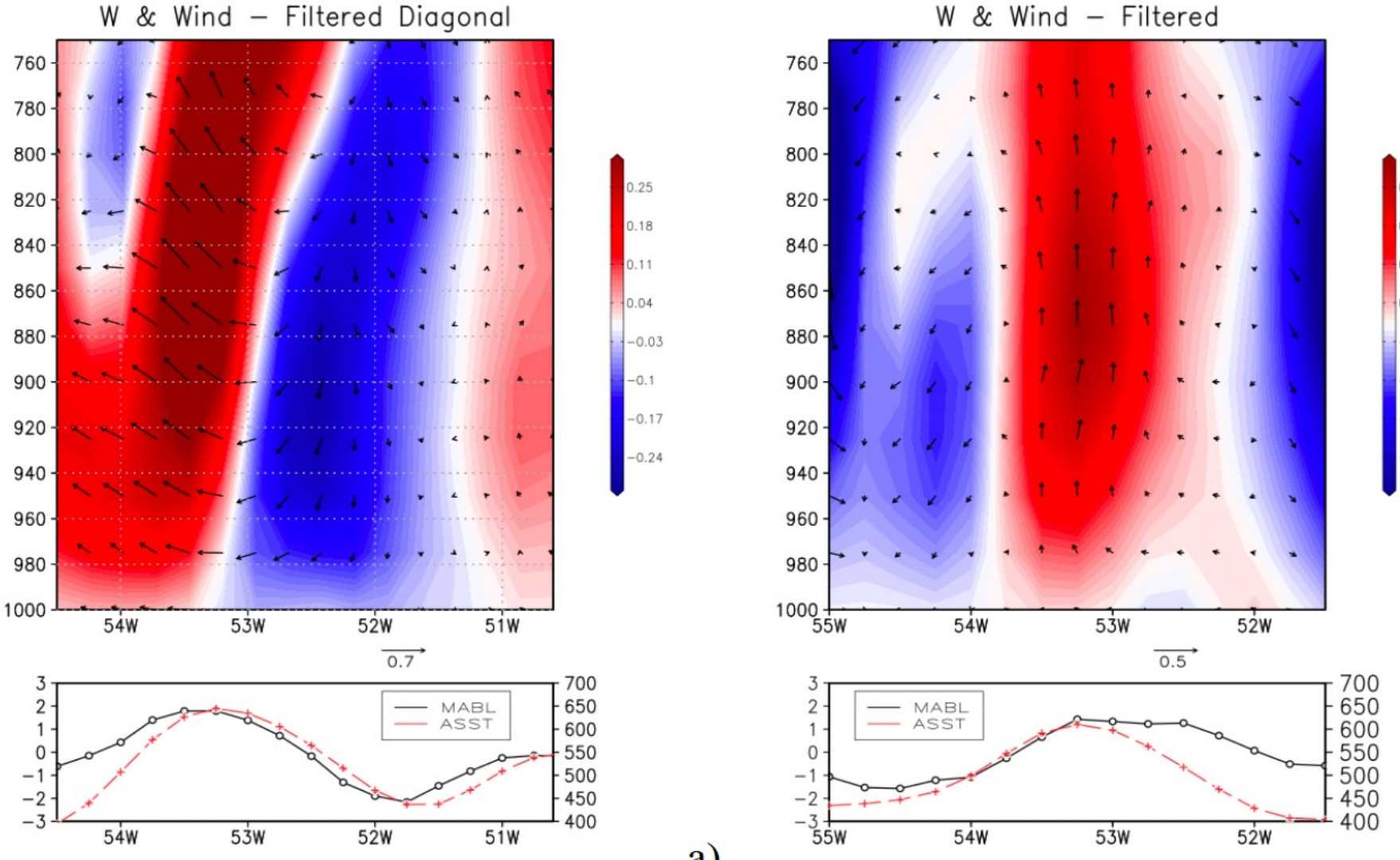
The **Warm Core Eddy** impact is perceived above the top of the Marine Atmospheric Boundary Layer (**MABL**) ...



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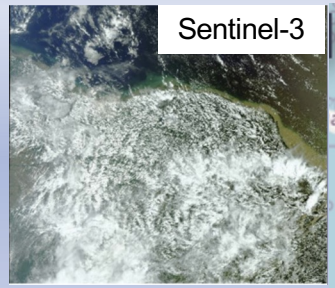


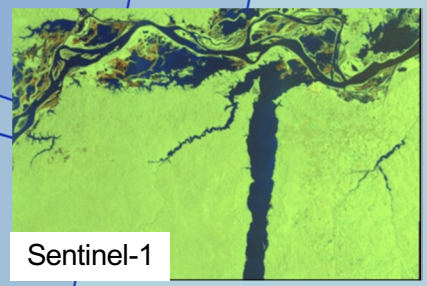
INPE Sentinel Mirror Site

www.sentinel-hub.inpe.br

Since January 2022, INPE has transferred over 200 TB of Sentinel data from the International Hub.

- Deforestation and forest degradation alerts
- Land use and land cover mapping
- Ocean monitoring
- International Charter Space and Major Disasters

Contact: Dr. Lubia Vinhas
lubia.vinhas@inpe.br



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Thank you very much for the opportunity and your attention!!!

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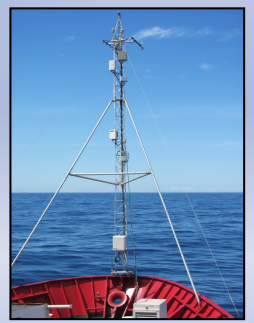
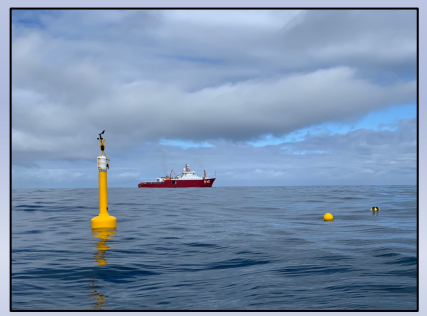
Copernicus · Copernicus Relays · JNCC Joint Nature Conservation Committee · CMM Center for Mathematical Modeling

fcfm Facultad de Ciencias Físicas y Matemáticas Universidad de Chile · Universidad de Playa Ancha Facultad de Ciencias Naturales y Exactas · TeleAmb





Atlantic Carbon Experiment ACEx

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