Brazilian Polar Research and the Atlantic: potential for scientific cooperation

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Interest of the Brazilian scientists on bipolar processes and Tropics-Polar teleconnections

Investigation of the role of the ice masses in the environmental system focused on Antarctica, our research consists of:

• Investigation of the impact of climate change on glaciers and the implications for the sea level

• Palaeoclimatic reconstruction using ice cores from the Antarctic and South America, exploring Pole-Tropics teleconnections

• The role of sea ice in the South America climatic variability (to include Antarctic cryospheric processes in climate/meteorological models for the South Atlantic)

New question: What are the implications of the fast Arctic sea ice retreat for the South Atlantic tropics?

Brazilian National Institute of S&T of the Cryosphere

INCT da CRIOSFERA

Possible themes for cooperation

Physical and Polar Oceanography

Ocean ventilation
Water mass formation, export and evolution

Ocean-Atmosphere-Cryosphere Interactions

Sea-air CO_2 fluxes
Physical and biogeochemical properties variability

Confluence of the Falklands/Malvinas current and Brazilian Current

Paleoclimatic evolution of the Southern Ocean - South Atlantic (since the LGM)

Impact of global changes on the cryosphere and consequences for the sea level

Marine Biogeochemistry and Ecosystems

Ocean Acidification
Anthropogenic carbon inventory
Response of the pelagic ecosystem to climate change

Arctic

Fast changes in the Arctic Ocean (sea ice extent) and consequences for the tropical Atlantic Ocean and South America climate (teleconnections)

GOAL

Grupo de Oceanografia de Altas Latitudes

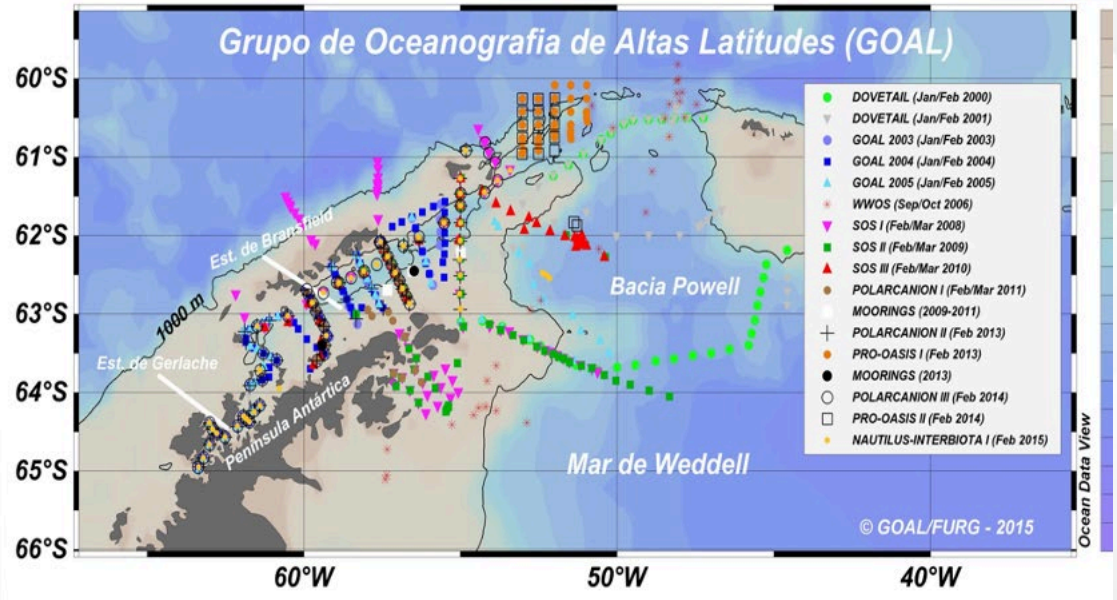
FURG

"High Latitude Oceanography Group" – GOAL is a multidisciplinary group focusing on research of the Northern Antarctic Peninsula marine environments for the last 20 years.

P.I.: Prof. Mauricio M. Mata (FURG)

Recent product: Special Issue in the Deep Sea Research II (Jan 2018):

"**Northern Antarctic Peninsula (NAP) Oceanography**"



Project: PROVOCCAR – NAP
Ocean ventilation and Carbon Cycle

Mauricio M. Mata (Co-PI), Rodrigo Kerr (Co-PI)

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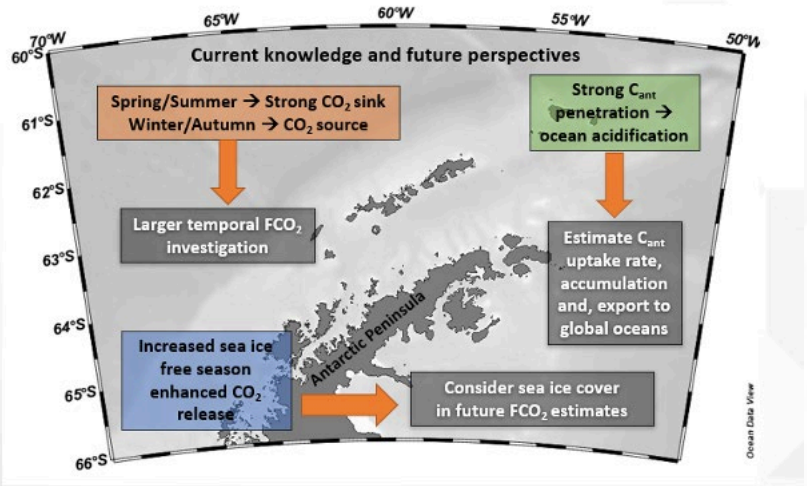
Motivation: NAP is a climate hotspot !

State of art and objectives:

- ✓ Improve understanding on the temporal variability
- ✓ Evaluate the role of mixing
- ✓ Understand the role of phytoplankton on regional CO_2 fluxes
- ✓ Estimate the regional absorption rate of Anthropogenic CO_2 and export to global ocean



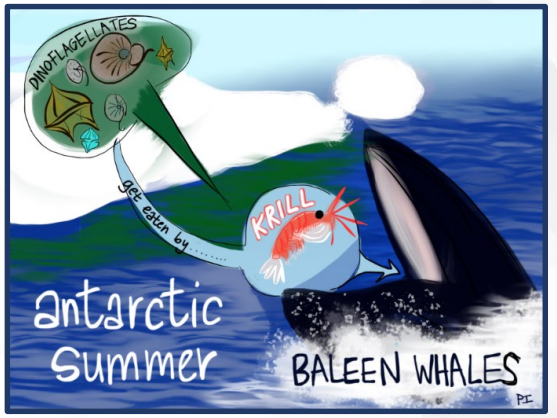
Main results: C_{ant} and ocean acidification (*Lencina-Ávila et al. 2018 - DSRII*):

- ✓ Reconstruction of the carbonate system (50 years)
- ✓ Increasing trend of inorganic carbon associated with increasing acidification
- ✓ Increase of Anthropogenic Carbon in deep Waters → becoming more acidic

Project: ECOPELAGOS – Response of the pelagic ecosystem to climate change in the Southern Ocean

Grupo de Oceanografia de Altas Latitudes

P.I. Eduardo Secchi, Carlos Rafael Mendes



1. How and at which temporal scales do the various biotic components of the Antarctic marine ecosystem respond to climate-driven changes in the abiotic environment?

2. What are the main biological-physic-chemical interactions that determine the structure and functioning of Antarctic marine ecosystems?

3. What is the degree of variability of Antarctic marine ecosystems at different spatiotemporal scales?

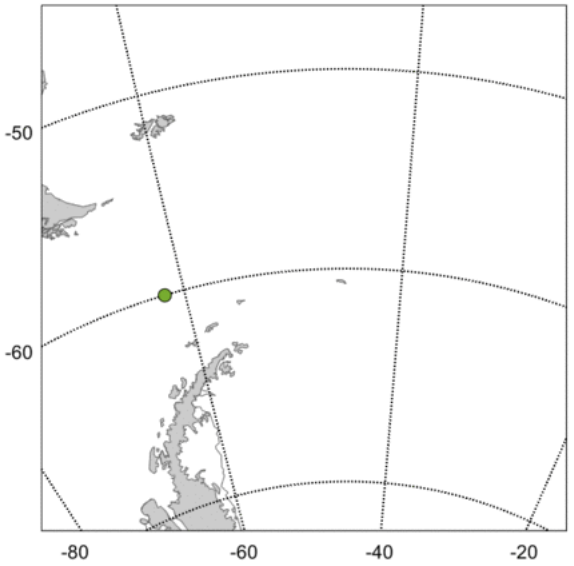
ATMOS - Antarctic Modeling Observation System

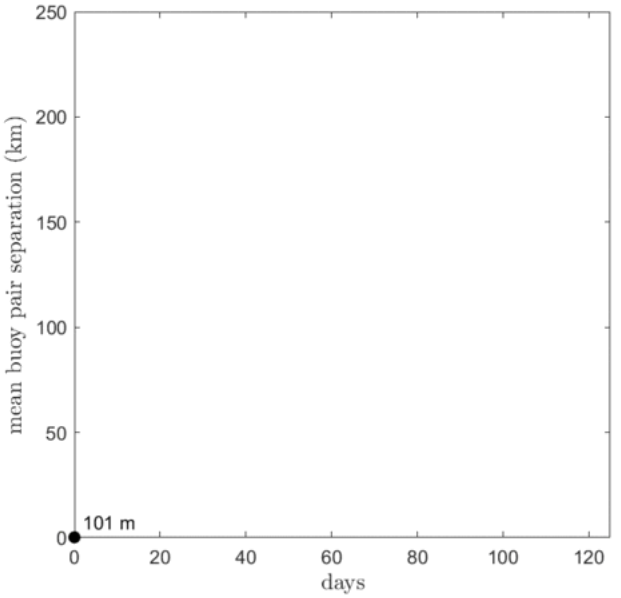
Brazilian National Institute for Space Research (INPE)

Deployment of Wave/Wind/SST mooring and drifting buoys
Partnership INPE/Brazilian Navy and SOFAR

Deployments:

5 in 2020/2021
41 in 2021/2022

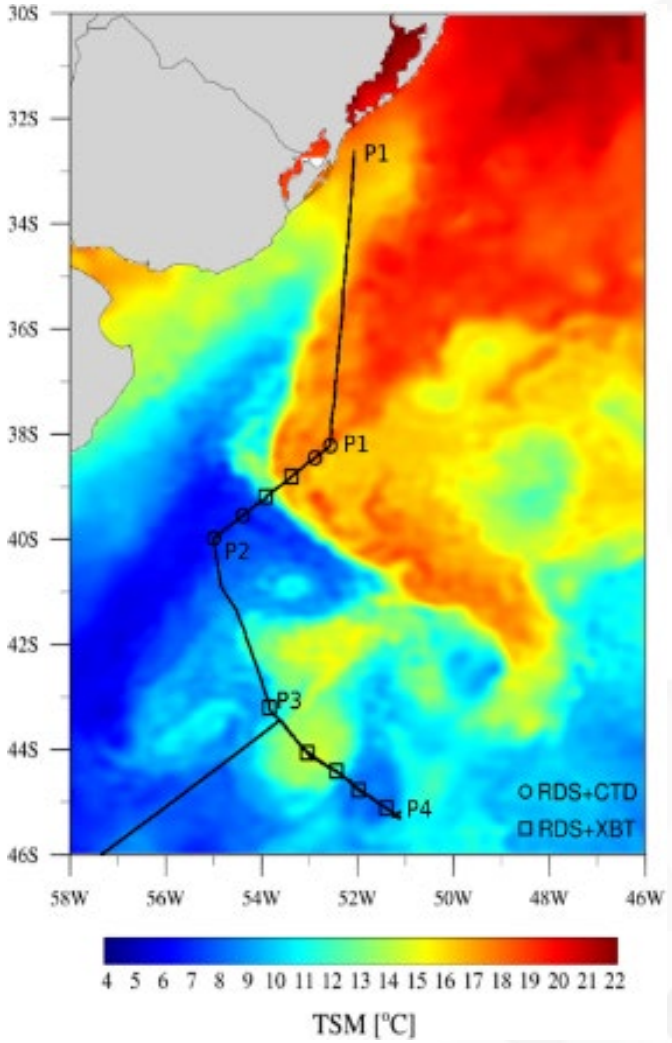




Ship based measurements, beaches (King George and Penguin Islands), Meteoceanographic buoys

Antarctic Modeling Observation System
ATMOS
INPE - PROANTAR

LOA Observational Activities –ATMOS Project
OPERANTAR 38 – October/November 2019



LOA's micro-meteorological tower
OPERANTAR 38 – October/November 2019

Brazilian National Institute for Space Research (INPE)

Leads the **implementation of the Oceans and Cryosphere components of the new, community Earth System model to be used in Brazil.**

Studies at the basin-scale processes linking the polar oceans with the South Atlantic, with an emphasis on the sea ice variability and the Polar Amplification phenomenon.

Partners such as the ECMWF, NOAA and NCAR.

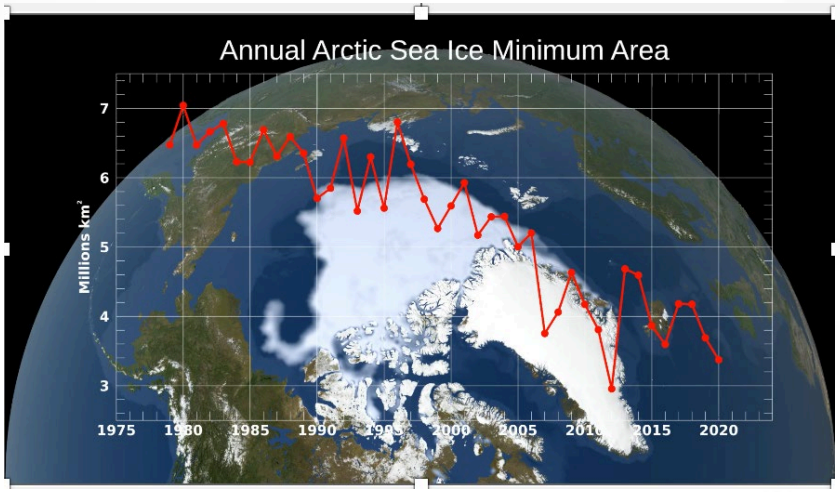
SCAR Scan Question: How are climate change and variability in the high southern latitudes connected to lower latitudes including the Tropical Ocean and monsoon systems?

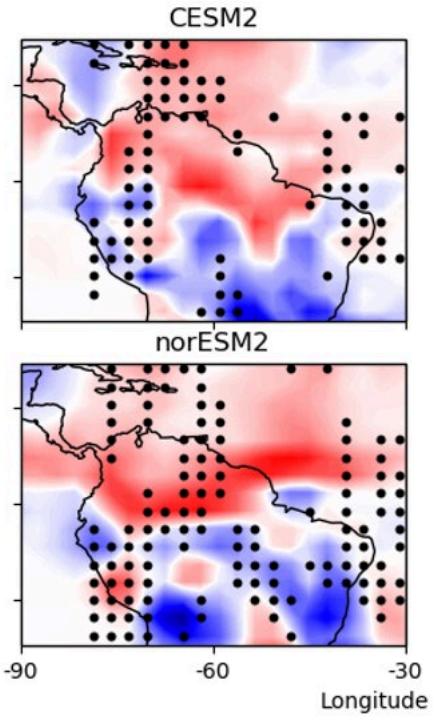
Tropical Antarctic Teleconnections Action Group (TATE AG)

P.I. Francisco E. Aquino and Jefferson C. Simões (Polar and Climate Centre, Federal University of Rio Grande do Sul, Porto Alegre)

- increase discussion and collaboration to explore tropical and polar weather and climate interactions;
- investigate the tropical forcing of the atmospheric circulation in the present and in the recent past (the last 200 years based on proxy records such as shallow ice core studies);
- explore the air-sea ice coupled systems and their relation to weather and climate of the tropics and subtropics, including interactions with the monsoons systems;
- conduct case studies on the relationship between complex weather and climate patterns in the South Atlantic, Indian and Pacific regions and the Southern Ocean sea ice cover, and how they are connected to natural modes of climatic variability (e.g., ENSO, SAM, PSA, PDO) or anthropogenic-induced changes.

Brazil and the Arctic





How sea ice extent changes are affecting the northern hemisphere climate and what are the consequences for the South American tropics?