

## Report for the year 2022 and future activities

### **SOLAS - Brasil**

**compiled by: Raquel Renó de Oliveira**

*This report has two parts:*

- **Part 1:** reporting of activities in the period of January 2022 - Jan/Feb 2023
- **Part 2:** reporting on planned activities for 2023 and 2024.

*The information provided will be used for reporting, fundraising, networking, strategic development and updating of the live web-based implementation plan. As much as possible, please indicate the specific SOLAS 2015-2025 Science Plan Themes addressed by each activity or specify an overlap between Themes or Cross-Cutting Themes.*

- 1 Greenhouse gases and the oceans;
  - 2 Air-sea interfaces and fluxes of mass and energy;
  - 3 Atmospheric deposition and ocean biogeochemistry;
  - 4 Interconnections between aerosols, clouds, and marine ecosystems;
  - 5 Ocean biogeochemical control on atmospheric chemistry;
- Integrated studies of high sensitivity systems;  
Environmental impacts of geoengineering;  
Science and society.

**IMPORTANT:** *This report should reflect the efforts of the SOLAS community in the entire country you are representing (all universities, institutes, lab, units, groups, cities).*

**First things first...Please tell us what the IPO may do to help you in your current and future SOLAS activities. ?**

As recently nominated national representative for SOLAS in Brazil, it will take some time to engage with the Brazilian researchers that work on the SOLAS topic (since just a few of them have answered the survey about SOLAS in the past month). However, it is already possible to have an idea of the status of the research in Brazil in 2022 and the prospects for 2023/2024, described in this report. In addition, what the researchers most expect from SOLAS in Brazil are increasing the partnership with international and national researchers, and outreach about opportunities in the field campaigns, open positions, events, etc. Therefore, I'm hopeful that with the help of IPO and the other national representatives, we can find the best and most effective strategies to achieve these demands and promote greater integration of Brazilian research into SOLAS.

**PART 1 - Activities from January 2022 to Jan/Feb 2023**

**1. Scientific highlight**

*Describe one scientific highlight with a title, text (max. 300 words), a figure with legend and full references. Please focus on a result that would not have happened without SOLAS, and we are most interested in results of international collaborations. (If you wish to include more than one highlight, feel free to do so).*

### **The southwestern South Atlantic continental shelf biogeochemical divide**

The structure of the phytoplankton community is strongly influenced by environmental variables linked with variations in sea–air CO<sub>2</sub> net fluxes (FCO<sub>2</sub>). The complex interplay between CO<sub>2</sub> uptake by the coastal ocean and the dominance of different phytoplankton groups was investigated in the southwestern South Atlantic Ocean (20°S–50°S), mostly during spring. We addressed this challenge by synoptically characterizing the study region for both FCO<sub>2</sub> and phytoplankton pigment composition. Thus, we discern the phytoplankton biomass in different groups by pigment composition information obtained through high-performance liquid chromatography (HPLC), with further determination of phytoplankton groups using the CHEMTAX approach. The effects of biology and temperature on sea surface CO<sub>2</sub> partial pressure were evaluated, and phytoplankton groups were linked to CO<sub>2</sub> exchanges. We delimited the southwestern South Atlantic continental shelf into distinct biogeochemical regions (Figure). North of 35°S, higher sea surface temperature and salinity, combined with lower phytoplankton biomass were associated with a domination of generally very small cyanobacteria and CO<sub>2</sub> outgassing behavior. In the transitional zone (35°S–40°S), changes in both salinity and temperature promoted a shift in dominant phytoplankton groups and, consequently, changed the ocean surface behavior from a CO<sub>2</sub> outgassing zone to an ingassing zone. Farther south, between 40°S and 50°S, the higher phytoplankton biomass produced by diatoms, associated with lower values of both sea surface temperature and salinity, was positively related to stronger CO<sub>2</sub> uptake rates. This link between the shifts in phytoplankton community structure and CO<sub>2</sub>-uptake rates is a potential target on long-term CO<sub>2</sub> flux modulation in the southwestern South Atlantic Ocean. Thus, the main findings here can be relevant for predicting the potential consequences of future climate-driven changes in ocean CO<sub>2</sub> uptake, especially considering the warming ocean conditions associated with a shift toward smaller phytoplankton cells.

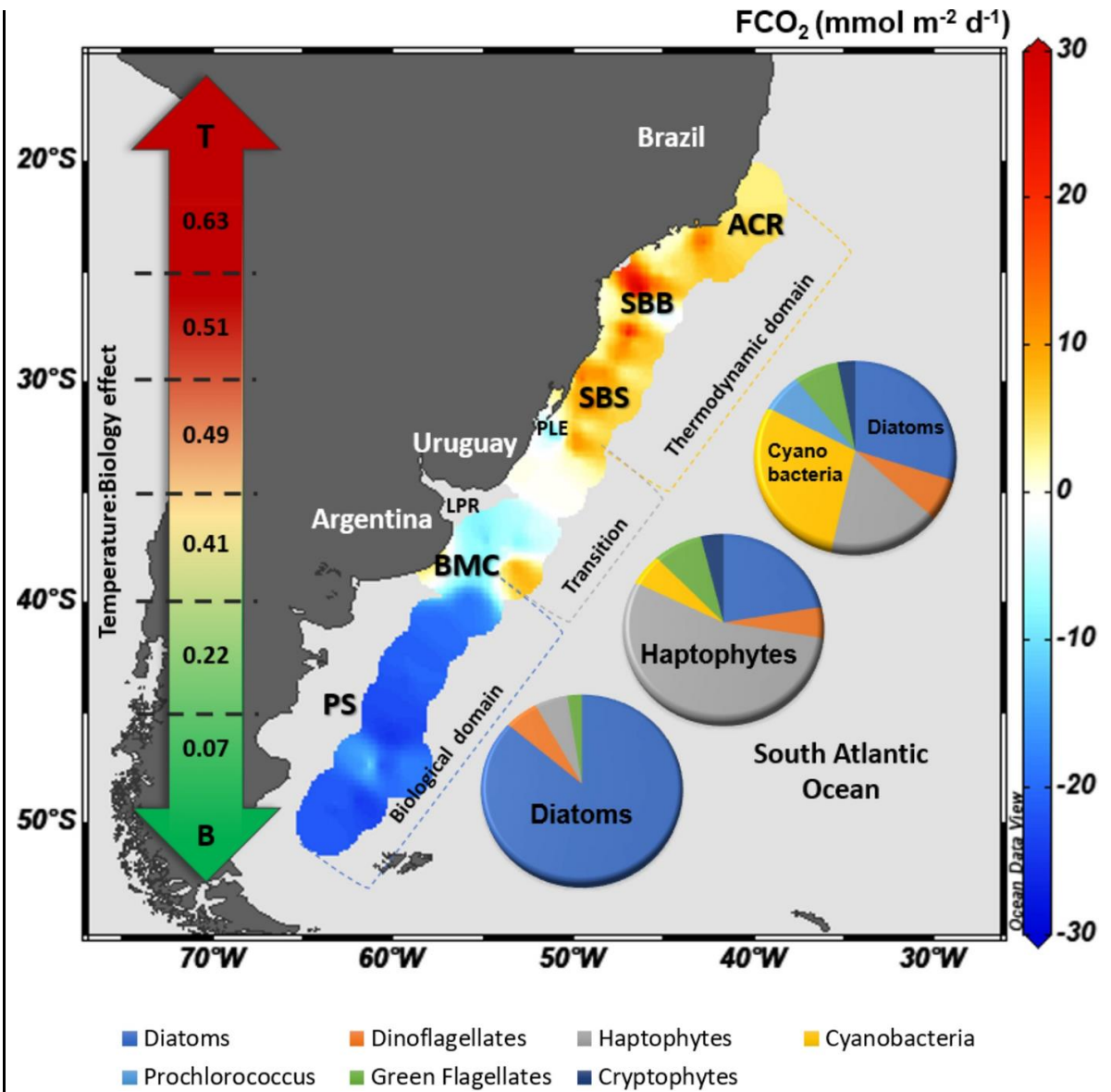


Figure: Spring–summer contrasting biogeochemical domains proposed for the study region, based on FCO<sub>2</sub>; mmol m<sup>-2</sup> d<sup>-1</sup> and dominance of main phytoplankton groups (inset pie graphs). The blue–red scale represents FCO<sub>2</sub> values according to the legend on the right side. The red–green arrow represents the T:B ratio, indicating the thermal (T) and nonthermal (B) effect index. The pie charts for each proposed domain comprise the main phytoplankton groups (diatoms, haptophytes, cyanobacteria, green flagellates, dinoflagellates, cryptophytes, and *Prochlorococcus*) according to the legend. The main areas in the study region are represented: ACR Abrolhos–Campos region (20°S–23°S), SBB South Brazil Bight (23°S–28°S), SBS southern Brazilian shelf (28.5°S–35°S), BMC Brazil–Malvinas Confluence region (~ 38°S), PS Patagonian shelf (40°S–50°S).

Citation: de Oliveira Carvalho, A., Kerr, R., Tavano, V.M. et al. "The southwestern South Atlantic continental shelf biogeochemical divide". *Biogeochemistry* 159, 139–158 (2022). <https://doi.org/10.1007/s10533-022-00918-8>

2. Activities/main accomplishments in 2022 (e.g., projects; field campaigns; workshops and conferences; model and data intercomparisons; capacity building; international

collaborations; contributions to int. assessments such as IPCC; collaborations with social sciences, humanities, medicine, economics and/or arts; interactions with policy makers, companies, and/or journalists and media).

### **Projects underway:**

- Estudo multiescala do sistema acoplado oceano-atmosfera-criosfera (SOAC Multiescala) (CNPq; MONAN, Finep).
- TRIATLAS Horizon 2020 (União Europeia).
- Desenvolvimento de um sistema de modelagem acoplada oceano-atmosfera-ondas para análise dos impactos às mudanças climáticas e áreas vulneráveis à inundação e agitação marítima no Complexo Portuário do Itaqui (UFMA).
- ReNOMO - Rede Nacional de Observação e Monitoramento Oceânico (FURG).
- Mid-Holocene ocean controls on Green Sahara and Northeast Brazil (FAPESP).
- Monitoramento hidro meteorológico da Lagoa da Conceição (UFSC).
- Sentinelas do Mar Fluminense (UERJ/FAPERJ).
- Alterações dinâmicas e termohalinas decorrentes das mudanças climáticas sobre o banco dos Abrolhos e Royal-Charlotte e seus impactos sobre os recifes de corais (CNPq).
- Um estudo climatológico do efeito das gotículas espumas nas trocas de gás CO<sub>2</sub> na interface oceano-atmosfera. Modelagem da difusão de gás (CO<sub>2</sub>) na superfície de spume droplets (CNPq).
- Movendo o Conhecimento da Antártica e dos Oceanos: da Revisão Acadêmica para o Ensino e Sociedade (MARES) (FURG, CNPq/MCTI).
- Processos de Ventilação Oceânica e Ciclo do Carbono no Norte da Península Antártica (PROVOCCAR) (FURG, CNPq/CAPES/MCTI).
- Comparison of climate change scenarios using inter-annual simulations on the Southwest Atlantic Ocean with focus on the Brazil-Malvinas Confluence and the South-Southeast coast of Brazil (USP).
- Programa Antartico Brasileiro (PROANTAR) (Brazilian Navy).
- Investigação dos processos controladores dos parâmetros do sistema CARBONato e dos FLUXos líquidos de CO<sub>2</sub> no estuário da Lagoa dos Patos, RS: uma contribuição regional para o balanço global de carbono (CARBON-FLUX) (CNPq).
- PROBIOMA.
- PROTRINDADE.
- ATMOS (CNPq).
- INCT Criosfera (CNPq).

### **Field campaigns:**

- Operação Antártica XLI, October to December/2022.
- Island Impact (AWI – Polarstern), October to November/2022.

- PIRATA 2022, June to July/2022.

#### **International Collaboration with:**

- University of Gothenburg (Sweden).
- Technical University of Denmark (Denmark).
- TRIATLAS Horizon 2020 - União Europeia (UE).
- LOCEAN/Sorbonne University (France).
- CGD/NCAR-National Center for Atmospheric Research (USA).
- UQAM - University of Montreal in Quebec (Canadá).
- LOCEAN-IRD (France).
- CCRC, UNSW (Australia).
- Regional Oceanic and Atmospheric Downscaling, Universidad de Cantabria (Spain).
- Virginia Institute of Marine Science (USA).
- GEOMAR Helmholtz Zentrum für Ozeanforschung Kiel (Germany).
- University of Edinburgh (UK).
- LOPS (France).
- University of Kansas (USA).

#### **Scientific events:**

- 8th SOLAS Open Science Conference, 25 - 29 September, 2022.
- EGU Assembly, 23-27 May, 2022.
- Meeting "Heat and carbon uptake in the Southern Ocean: the state of the art and future priorities", 09-10 May de 2022.
- TRIATLAS Summer School – 2022, 25 September – 01 October, 2022.
- 5th Symposium on the Ocean in a High-CO<sub>2</sub> World, 13-16 September, 2022.
- Symposium on Advances in Ocean Observation, 13-17 July, 2022.
- 10th SCAR Open Science Conference, 1 - 10 August, 2022.
- The 8th International Symposium on Gas Transfer at Water Surfaces 17-20 May, 2022.

#### **Media:**

- Carbon Team News, [www.carbonteam.furg.br](http://www.carbonteam.furg.br)
- @inpe\_oceanography
- <https://blog.ufes.br/iurygoncalves/author/iury-goncalves/>

**3. List SOLAS-related publications published in 2022 (only PUBLISHED articles) and if any, web links to models, datasets, products, etc.**

- Albuquerque, Cíntia, Rodrigo Kerr, Thiago Monteiro, Iole Beatriz Marques Orselli, Mariah de Carvalho-Borges, Andréa da Consolação de Oliveira Carvalho, Eunice da Costa Machado, Júlia Kalid Mansur, Margareth da Silva Copertino, and Carlos Rafael Borges Mendes. "Seasonal variability of carbonate chemistry and its controls in a subtropical estuary." *Estuarine, Coastal and Shelf Science* 276 (2022). <https://doi.org/10.1016/j.ecss.2022.108020>
- Bose, Nicolás de A., Marília S. Ramos, Gustavo S. Correia, Claus W. Saidelles, Leandro Farina, Claudia K. Parise, and João L. Nicolodi. "Assessing wind datasets and boundary conditions for wave hindcasting in the southern Brazil nearshore." *Computers & Geosciences* 159 (2022). <https://doi.org/10.1016/j.cageo.2021.104972>
- Damini, Brendon Yuri, Rodrigo Kerr, Tiago S. Dotto, and Mauricio M. Mata. "Long-term changes on the Bransfield Strait deep water masses: Variability, drivers and connections with the northwestern Weddell Sea." *Deep Sea Research Part I: Oceanographic Research Papers* 179 (2022). <https://doi.org/10.1016/j.dsr.2021.103667>
- de Oliveira Carvalho, A., Kerr, R., Tavano, V.M. et al. "The southwestern South Atlantic continental shelf biogeochemical divide". *Biogeochemistry* 159, 139–158 (2022). <https://doi.org/10.1007/s10533-022-00918-8>
- de Souza, Danilo Couto, Renato Ramos da Silva, Paula Gomes da Silva, Antonio Fernando Härter Fetter Filho, Fernando Javier Mendez, and David Werth. "A hybrid regional climate downscaling for the southern Brazil coastal region." *International Journal of Climatology* 42, no. 13 (2022). <https://doi.org/10.1002/joc.7607>
- Gorenstein, Iuri, Luciana F. Prado, Paula R. Bianchini, Ilana Wainer, Michael L. Griffiths, Francesco SR Pausata, and Elder Yokoyama. "A fully calibrated and updated mid-Holocene climate reconstruction for Eastern South America." *Quaternary Science Reviews* 292 (2022). <https://doi.org/10.1016/j.quascirev.2022.107646>
- Monteiro, Thiago, Matheus Batista, Sian Henley, Eunice da Costa Machado, Moacyr Araujo, and Rodrigo Kerr. "Contrasting Sea-Air CO<sub>2</sub> Exchanges in the Western Tropical Atlantic Ocean." *Global Biogeochemical Cycles* 36, no. 8 (2022). <https://doi.org/10.1029/2022GB007385>
- Oliveira, Raquel R., Helen MJ Affe, Raquel Avelina, Luana Q. Pinho, Thiago V. Franklin, Gizyelle Miguel, and Leticia C. da Cunha. "Fonte ou Sumidouro? Uma revisão sobre os fluxos de CO<sub>2</sub> na Plataforma Continental Brasileira." *Química Nova* (2022). <http://dx.doi.org/10.21577/0100-4042.20170970>
- Orselli, Iole, Andrea CO Carvalho, Thiago Monteiro, Brendon Y. Damini, Mariah DE Carvalho-Borges, Cíntia Albuquerque, and Rodrigo Kerr. "The marine carbonate system along the northern Antarctic Peninsula: current knowledge and future perspectives." *Anais da Academia Brasileira de Ciências* 94 (2022). <https://doi.org/10.1590/0001-376520220210825>
- Parise, Cláudia K., Luciano P. Pezzi, Camila B. Carpenedo, Fernanda C. Vasconcellos, Wesley L. Barbosa, and Leonardo G. Lima. "Sensitivity of South America Climate to Positive Extremes of Antarctic Sea Ice." *Anais da*

Academia Brasileira de Ciências 94 (2022). <https://doi.org/10.1590/0001-3765202220210706>

- Piñango, Andrés, Rodrigo Kerr, Iole Beatriz Marques Orselli, Andréa da Consolação Oliveira Carvalho, Elias Azar, Johannes Karstensen, and Carlos Alberto Eiras Garcia. "Ocean Acidification and Long-Term Changes in the Carbonate System Properties of the South Atlantic Ocean." *Global Biogeochemical Cycles* 36, no. 9 (2022). <https://doi.org/10.1029/2021GB007196>
- Pinheiro, Henri R., Tercio Ambrizzi, Kevin I. Hodges, and Manoel A. Gan. "Understanding the El Niño Southern Oscillation Effect on Cut-Off Lows as Simulated in Forced SST and Fully Coupled Experiments." *Atmosphere* 13, no. 8 (2022). <https://doi.org/10.3390/atmos13081167>
- Pontes, G.M., Taschetto, A.S., Sen Gupta, A. et al. "Mid-Pliocene El Niño/Southern Oscillation suppressed by Pacific intertropical convergence zone shift". *Nat. Geosci.* 15, 726–734 (2022). <https://doi.org/10.1038/s41561-022-00999-y>
- Prado, Luciana F., Ilana Wainer, and Ronald B. Souza. "Positive SAM trend as seen in the Brazilian Earth System Model (BESM) future scenarios." *Anais da Academia Brasileira de Ciências* 94 (2022). <https://doi.org/10.1590/0001-3765202220210667>
- Queiroz, Michelly GS, Cláudia K. Parise, Luciano P. Pezzi, Camila B. Carpenedo, Fernanda C. Vasconcellos, Ana Laura R. Torres, Wesley L. Barbosa, and Leonardo G. Lima. "Response of southern troposphere meridional circulation to historical maxima of Antarctic sea ice." *Anais da Academia Brasileira de Ciências* 94 (2022). <https://doi.org/10.1590/0001-3765202220210795>
- Torres, Ana Laura R., Claudia K. Parise, Luciano P. Pezzi, Michelly G. Queiroz, Adilson Machado, Gabriel S. Cerveira, Gustavo S. Correia, Wesley L. Barbosa, Leonardo G. Lima, and Ueslei A. Sutil. "Lagged response of Tropical Atlantic Ocean to cold and fresh water pulse from Antarctic sea ice melting." *Anais da Academia Brasileira de Ciências* 94 (2022). <https://doi.org/10.1590/0001-3765202220210800>
- Vasconcellos, Fernanda C., Renan M. Pizzochero, Telma M. Silva, Cláudia K. Parise, And Catharine F. Caldas. "Combined performance of September's Weddell sea ice extent, Southern Annular Mode, and Atlantic SST anomalies over the South American temperature and precipitation." *Anais da Academia Brasileira de Ciências* 94 (2022). <https://doi.org/10.1590/0001-3765202220210803>

**4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2022? If yes, who? How did you engage?**



## **PART 2 - Planned activities for 2023 and 2024**

### **1. Planned major national and international field studies and collaborative laboratory and modelling studies (incl. all information possible, dates, locations, teams, work, etc.).**

- OPERANTAR XLII 2022/2023.
- OPERANTAR XLII 2023/2024.
- PIRATA 2023/2024.

### **2. Events like conferences, workshops, meetings, summer schools, capacity building etc. (incl. all information possible).**

- Sea Ice Data Assimilation Workshop (IICWG-DA-11), 21-13 March, 2023.
- EGU2023, 23-28 April, 2023.
- IUGG2023, 11-20 July, 2023.
- 2nd CROCO Users' Meeting, 13-15 September, 2023.
- International Workshop on Western Boundary Current – Subtropical Continental Shelf Interactions, 22-24 May, 2023.
- SOLAS Summer School, 05-15 June, 2023.
- 1º Simpósio do Southern Ocean Observing System (SOOS), 14-18 August, 2023.

### **3. Funded national and international projects/activities underway.**

- Projeções de eventos extremos de precipitação em vórtices ciclônicos de altos níveis na América do Sul (CNPq, 2023-2024).
- Sistema de modelagem acoplada oceano-atmosfera para o monitoramento e previsão de extremos climáticos na Zona costeira do Leste do Nordeste do Brasil (CNPq, 2023).

### **4. Plans / ideas for future national or international projects, programmes, proposals, etc. (please indicate the funding agencies and potential submission dates).**

### **5. Engagements with other international projects, organisations, programmes, etc.**

### **Comments**

In late 2022 the Brazilian Government approved the creation of the Instituto Nacional das Pesquisas Oceânicas (INPO) that hopefully will increase the visibility and investments in ocean science in Brazil.