surface ocean solas lower atmosphere study

Report for the year 2016 and future activities

SOLAS *Brazil*

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This report has two parts:

***- Part 1:** reporting of activities in the period of January 2016 – Jan-Feb 2017*
***- Part 2:** reporting on planned activities for 2017/2018 and 2019.*

The information provided will be used for reporting, fundraising, networking, strategic development and updating of the live web-based implementation plan.

***IMPORTANT**: May we remind you that this report should reflect the efforts of the SOLAS community in the **entire country** you are representing (all universities, institutes, lab, units, groups, cities)!*

PART 1 - Activities from January 2016 to Jan/Feb 2017

1. Scientific highlight

Carbonate system properties in the Gerlache Strait, Northern Antarctic Peninsula (February 2015): I. Sea–Air CO_2 fluxes

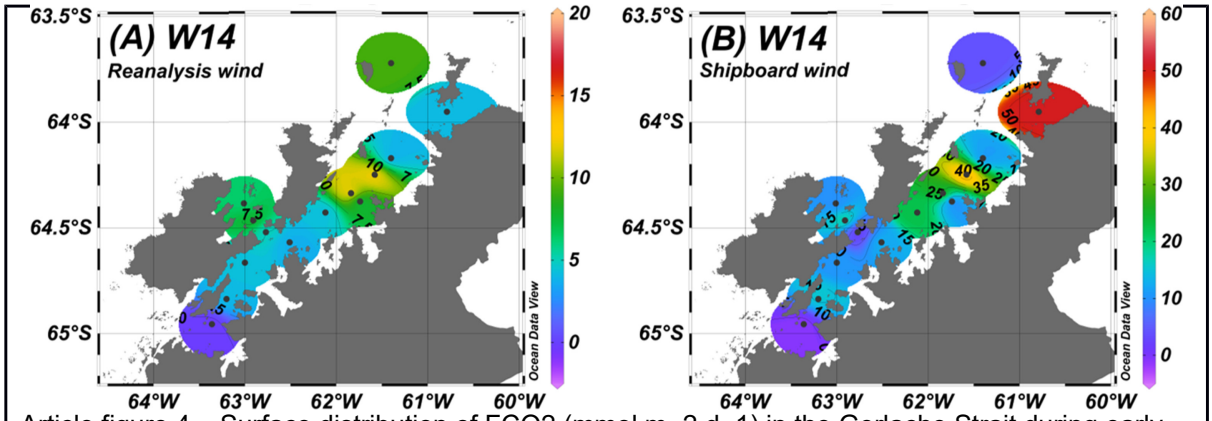
Rodrigo Kerr, Iole B.M. Orselli, Jannine M. Lencina-Avila, Renata T. Eidt, Carlos Rafael B. Mendes, Leticia C. da Cunha, Catherine Goyet, Mauricio M. Mata
http://dx.doi.org/10.1016/j.dsr2.2017.02.008 Deep-Sea Research II, in press

Highlights:

• We have measured the hydrographic, CO_2-carbonate system, and phytoplankton properties in waters of the Gerlache Strait.

• CO_2 flux was computed comparing eight distinct parameterizations for the gas transfer velocity coefficient depending upon wind speed.

• The Gerlache Strait was a CO_2 net source for the atmosphere in early February 2015.



Article figure 4 – Surface distribution of FCO2 (mmol m−2 d−1) in the Gerlache Strait during early February 2015. FCO2 was estimated considering the W14 gas transfer velocity relationship (see Table 1) and following two wind approaches: ECMWF reanalysis wind (a) and shipboard measured instantaneous wind (b). Note that the plots have different colour scales.

2. Activities/main accomplishments in 2016 (projects, field campaigns, events, model and data intercomparisons, capacity building, international collaborations, contributions to int. assessments such as IPCC, interactions with policy makers or socio-economics circles, etc.)

Research projects (Approved projects in 2016 and ongoing projects)

1) The ongoing project "New autonomous technologies investigation and monitoring of AABW transformations in the Weddell Sea and Antarctic Peninsula: a contribution to the study of those implications in ocean circulation and climate" (Portuguese acronym **NAUTILUS**) aims to contribute to international initiatives observing the ocean circulation and water masses properties. In this context, samples for C_T, A_T and pH were collected in the last summer, and surface pCO_2 was also sampled in the 2016 cruise – Figure 1. Reconstruction of the carbonate system in the Bransfield Strait is being executed through a PhD thesis.

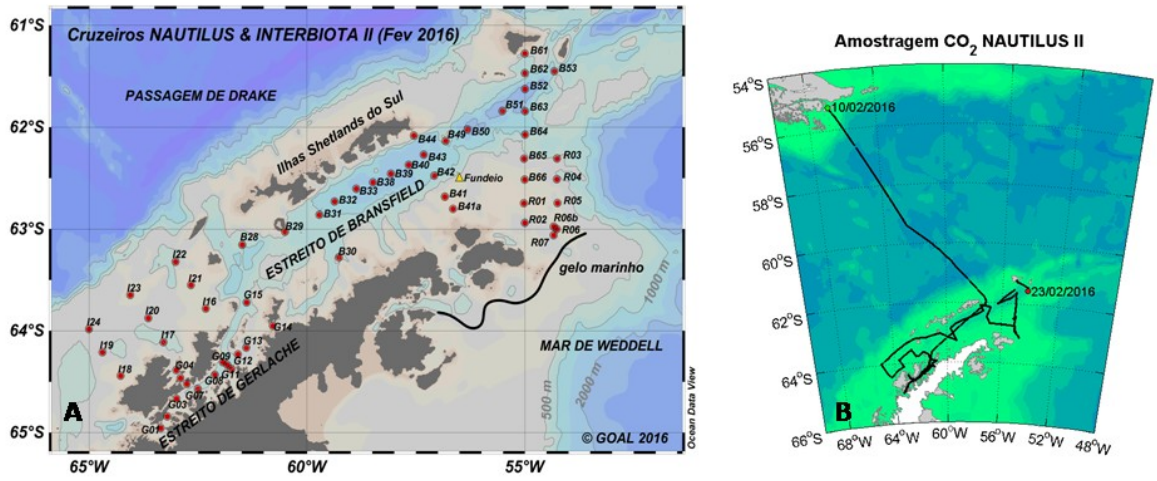


Figure 1. The working area of the NAUTILUS 2 cruise. **(A)** Sampled stations (red dots). **(B)** underway CO2 system track.

2) The ongoing project "Long term ecological research" (Portuguese acronym PELD) aims to understand natural phenomena influence and human impacts on biota and ecological processes in the Patos Lagoon Estuary. This project is being developed since 1998, and in 2015 monthly samples for C_T and A_T started to be collected – Figure 2 – and will be used to reconstruct the carbonate system in this ecosystem.

Figure 2. PELD oceanographic stations (yellow pins; Barra and museu) where C_T and A_T samples are monthly collected since 2015.

3) The **LTER/PELD Baía de Guanabara** – Rio de Janeiro, SE Brazil has been renewed in 2016. It aims at understanding the ecosystem structure at the heavily polluted Guanabara Bay, and its response to climate and anthropogenic stress. In its new phase, PELD-Guanabara now includes volatile organic carbon (VOC) measurements, as well as carbonate-system measurements (pH and alkalinity). Coordination: UFRJ, with participation of UERJ (Prof. Luana Pinho, Prof. Gleyci Moser, Prof. Leticia Cotrim da Cunha)

4) The **CAPES Ciências do Mar Baía de Guanabara** – Rio de Janeiro, SE Brazil has had its final campaign in 2016. It aims at understanding the exchange of water, particulate organic matter, nutrients, plankton and dissolved carbon between the Guanabara Bay and the inner shelf. It has included organic carbon, nutrients, and carbonate-system measurements (pH and alkalinity). Coordination: UERJ and UFRJ.

Research cruises:

1) NAUTILUS 2 - 2016 (Biogeochemistry, Acidification and Anthropogenic Carbon at the North Antarctic Peninsula)
R/V: NPo Almirante Maximiano (H41), Brazilian Navy
Period: 06 to 28 February 2016 (Figure 1)
Chief Scientist: Rodrigo Kerr, with a team of 16 FURG and UERJ researchers.
Measurements/samplings: u-ADCP, vertical CTD+Rosette profiles at 66 stations; underway pCO2 measurements along cruise track with the General Oceanics "ferry box" system, dissolved oxygen, pH, A_T, C_T, DOC, POC/PN, nutrients, pigments, cetacean survey (sight).
Goals:
i) Antarctic Bottom Water variability and implications for oceans and climate.
ii) Improve current knowledge on physical and biogeochemical processes controlling the carbon fluxes in the region;
iii) Quantify and characterize the distribution of anthropogenic carbon (Cant) in the region;
iv) Monitor CO2 system parameters in the region in order to understand ocean acidification effects;
v) Capacity building for marine carbon fluxes, and ocean acidification in Brazil.

2) SACROSS - M133 (Physical and chemical sampling of oceanographic and meteorological underway data at the South Atlantic Ocean in the framework of AtlantOS WP5)
R/V: Meteor, Germany
Period: December 15th 2016 to January 13th 2017 (Figure 3)
Chief Scientist: Martin Visbeck, with a team of 26 researchers and students including 1 FURG researcher.
Measurements/samplings: u-ADCP, underway-CTD, RapidCast CTD, vertical CTD+Rosette stations, XBT, underway pCO2 measurements along cruise track with the General Oceanics "ferry box" system, dissolved oxygen and salinity samples.

Goals:
i) The South Atlantic crossing will focus on a multidisciplinary ocean survey of the South Atlantic gyre roughly along 34.5°S a region also covered by the SAMOC moored array and also the path of the X18 XBT line;
ii) a practical sea going training opportunity covering mainly the field of physical oceanography with limited additional experiences in marine meteorology, surface layer biogeochemistry and plankton ecology to Masters and PhD students from countries bordering the South Atlantic Ocean.

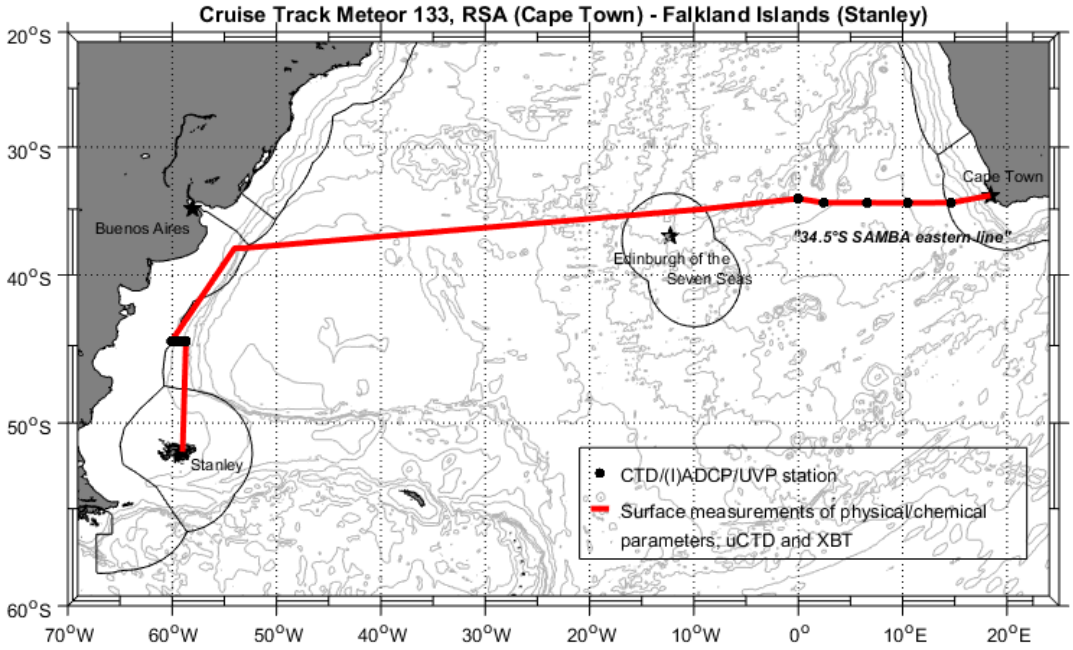


Figure 3. The working area of the M133 cruise.

3) SACROSS - MSM60 (Physical and biogeochemical sampling of oceanographic and meteorological underway data at the South Atlantic Ocean in the framework of AtlantOS)
R/V: Meteor, Germany
Period: 04 January to 01 February 2017 (Figure 4)
Chief Scientist: Johannes Karstensen, with a team of 22 researchers and students including 1 FURG, 1 UERJ and 3 USP researchers.
Measurements/samplings: u-ADCP, underway-CTD, vertical CTD+Rosette stations, XBT, dissolved oxygen, salinity, A_T, C_T, CFC, SF_6, fluorescence, DOC, POC/PN and nutrients samples.
Goals:
i) For the first time get a (nearly) synoptic picture of physical, biogeochemical and ecosystem parameter distribution along the SAMOC (34.5°S) line in the South Atlantic Ocean;
ii) Estimate the meridional heat- and freshwater transport across the SAMOC line;
iii) Determine circulation and ventilation pathways using physical and chemical data;
iv) Fill existing gaps in the knowledge of the carbonate system of the South Atlantic, including an estimate of anthropogenic carbon content;
v) Estimate the functional composition of Chlorophyll and particle composition along the 34.5°S section.

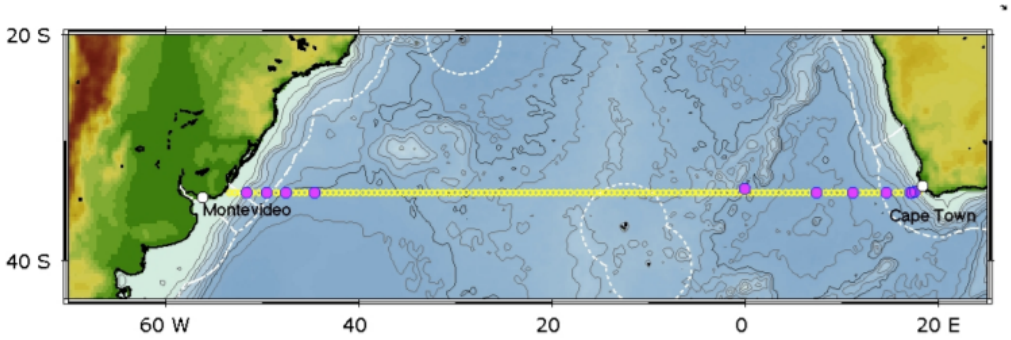


Figure 4. The working area of the M133 cruise.

Events:

1) 4TH INTERNATIONAL SYMPOSIUM ON THE OCEAN IN A HIGH-CO2 WORLD. 03 to 06 May 2016, Hobart, Australia.
Main contributions from SOLAS-BR community:
i) Anthropogenic carbon distribution and ocean acidification state in the Patagonian shelf break region; Iole B. M. Orselli, Rodrigo Kerr, Rosane G. Ito, Virgínia M. Tavano and Carlos A. E. Garcia.
ii) CO2 net fluxes along south and southeast Brazilian continental shelf and slope; Ana G. Correa, Iole B. M. Orselli, Rodrigo Kerr
iii) Spatial variability of CO2 fluxes in the Gerlache Strait, Antarctica, during austral summer 2015; Eidt, Renata T., Kerr, Rodrigo, Orselli, Iole B. M.
iv) Spatial variation of total alkalinity and total dissolved inorganic carbon along the Brazilian continental shelf-break and slope: preliminary results; Mariah Borges, Iole Orselli, Rodrigo Kerr
v) Surface total alkalinity, salinity and temperature: a study case in the Southwestern Atlantic Ocean; Leticia COTRIM DA CUNHA, Cintia ALBUQUERQUE, Rodrigo KERR, Iole ORSELLI

2) XXXIV SCAR 2016 Open Science Conference. 20 to 30 August 2016, Kuala Lumpur, Malasia.
i) CO2 fluxes in the Gerlache Strait (Antarctica) during austral summer 2015; Kerr, Rodrigo, Eidt, Renata T., Orselli, Iole B. M.
ii) Distribution of anthropogenic carbon in the Bransfield and Gerlache Straits (Antarctic) waters during austral summer 2015; Orselli, Iole B. M.**,** Lencina-Avila, Jannine M., Kerr, Rodrigo.

3. Top 5 publications in 2016 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

1) Santos, G. C., Kerr, R., Azevedo, J. L. L., Mendes, C. R. B. and da Cunha, L. C.: Influence of Antarctic Intermediate Water on the deoxygenation of the Atlantic Ocean, Dyn. Atmos. Ocean., 76, 72–82, doi:10.1016/j.dynatmoce.2016.09.002, 2016.

2) Ito, R. G., Garcia, C. A. E. and Tavano, V. M.: Net sea-air CO2 fluxes and modelled pCO2 in the southwestern subtropical Atlantic continental shelf during spring 2010 and summer 2011, Cont. Shelf Res., 119, 68–84, doi:10.1016/j.csr.2016.03.013, 2016.

3) Cotovicz, L. C., Knoppers, B. A., Brandini, N., Poirier, D., Costa Santos, S. J. and Abril, G.: Spatio-temporal variability of methane (CH 4) concentrations and diffusive fluxes from a tropical coastal embayment surrounded by a large urban area (Guanabara Bay, Rio de Janeiro, Brazil), Limnol. Oceanogr., 61(S1), S238–S252, doi:10.1002/lno.10298, 2016.

4) Pezzi, L. P., R. B. Souza, P. C. Farias, O. Acevedo, and A. J. Miller (2016), Airsea interaction at the Southern Brazilian Continental Shelf: In situ observations, J. Geophys. Res. Oceans, 121, doi:10.1002/2016JC011774.

5) Lencina-Avila, J. M., Ito, R. G., Garcia, C. A. E. and Tavano, V. M.: Sea-air carbon dioxide fluxes along 35°S in the South Atlantic Ocean, Deep Sea Res. Part I Oceanogr. Res. Pap., 115, 175–187, doi:10.1016/j.dsr.2016.06.004, 2016.

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2016? If yes, who? How did you engage?

a) In February 2017, the Chemical Oceanography Laboratory has established an informal partnership with ProOceano, a technology-based Brazilian company focused on offshore and coastal oceanography, water bodies and environment (http://www.prooceano.com.br/site/en/), in order to collect surface seawater samples daily at Guanabara Bay – Rio de Janeiro. Here we aim at training undergraduate students in sampling and analysing salinity (SSS) and total alkalinity (TA), to further construct a solid regression model of TA vs. SSS for this coastal area. We are looking forward to including these daily (Monday to Friday) results in the concerned project web-page.

PART 2 - Planned activities from 2017/2018 and 2019

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

1) NAUTILUS 3 - 2017 (Biogeochemistry, Acidification and Anthropogenic Carbon at the North Antarctic Peninsula)
R/V: NPo Almirante Maximiano (H41), Brazilian Navy
Period: February 2017
Chief Scientist: José Luiz Lima de Azevedo, with a team of 11 FURG and UERJ researchers.

2) NAUTILUS 4 - 2018 (Biogeochemistry, Acidification and Anthropogenic Carbon at the North Antarctic Peninsula)
R/V: NPo Almirante Maximiano (H41), Brazilian Navy
Period: February 2017
Chief Scientist: Rodrigo Kerr, with a team of 11 FURG and UERJ researchers.

3) PIRATA XVII – 2017 (Ocean – atmosphere interactions → heat, momentum budgets, micrometeorology, eddy-covariance CO2 measurements; Biogeochemistry (dissolved oxygen, pH, underway pCO2, nutrients, dissolved Rare Earth elements (REE – Brazil GEOTRACES), physical oceanography
R/V: Nho Vital de Oliveira (H39), Brazilian Navy
Period: June/July 2017
Chief Scientist: Paulo Arlino, with a team of researchers from UERJ, UFBA, INPE, UFSM and UFPE distributed in 3 legs

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

MSc. Dissertation: Mariah de Carvalho Borges. *"Distribuição de Carbono Antropogênico na Região de Plataforma e Quebra de Plataforma Continental do Oceano Atlântico Sudoeste (Anthropogenic Carbon distribution in the shelf and shelf-breake region of the Western South Atlantic)"*. 2017. MSc in Physical, Chemical and Geological Oceanography - Universidade Federal do Rio Grande (FURG). ***Advisor: Rodrigo Kerr.***

MSc. Dissertation: **Thiago Monteiro da Silva.** "Variabilidade dos Fluxos Líquidos de CO2 no Estreito de Gerlache entre 2004-2016 (CO2 net fluxes variability in the Gerlache Strait between 2014-2016)" 2018. MSc in Physical, Chemical and Geological Oceanography - Universidade Federal do Rio Grande (FURG). ***Advisor: Rodrigo Kerr.***

Msc. Dissertation: **Cintia Albuquerque.** "Alcalinidade e salinidade na região de quebra da plataforma continental S-SE brasileira". June 2017. Msc in Oceanography – Universidade do Estado do Rio de Janeiro (UERJ). ***Advisor: Leticia Cotrim da Cunha***

Msc. Dissertation: Ludmila Caetano. "Controles sinérgicos da temperatura sobreo CO2 em mares do sul: heterogeneidade em uma Baía Antártica". March 2017. Msc. In Geochemistry – Universidade Federal Fluminense (UFF). ***Advisor: Humberto Marotta***

Msc. Dissertation: Rafael Afonso do Nascimento Reis. "Fugacidade de CO2, Massas d´Água e Bombeamento de Ekman no Oceano Atlântico Sudoeste". December 2016. Msc. In Remote Sensing and Meteorology – Universidade Federal do Rio Grande do sul (UFRGS). ***Advisor: Ronald Buss de Souza***

PhD. Thesis: Luiz Cotovicz Junior. "CONCENTRAÇÕES E TROCAS ATMOSFÉRICAS DE DIÓXIDO DE CARBONO (CO2) E METANO (CH4) EM UM ESTUÁRIO TROPICAL EUTROFIZADO, BAÍA DE GUANABARA, RJ, BRASIL". March 2016. PhD in Geochemistry – Universidade Federal Fluminense (UFF). ***Advisors: Bastiaan Knoppers & Gwenäel Abril***

3. Funded national and international projects / activities underway (if possible please list in order of importance and indicate to which part(s) of the SOLAS 2015-2025 Science Plan and Organisation (downloadable from the SOLAS website) the activity topics relate – including the core themes and the cross cutting ones)

2016 – PELD Baía de Guanabara (Long-Term Ecological Research Baía de Guanabara)
CNPq funding
SOLAS-related activities:
a) Ocean biogeochemical control on atmospheric chemistry (Coastal zone – Measurements of Volatile Organic Carbon – VOC – Researchers from UERJ and UFRJ)
b) Atmospheric deposition and ocean biogeochemistry (Coastal zone – Measurements of nutrients and carbonate-systems parameters – Researchers from UERJ and UFRJ)

since 2015 – PELD Lagoa dos Patos (Long-Term Ecological Research)
CNPq funding
SOLAS-related activities:
a) Atmospheric deposition and ocean biogeochemistry (Coastal zone – Measurements of carbonate-systems parameters – Researchers from FURG)

since 2014 – NAUTILUS
CNPq funding
SOLAS-related activities:
a) Ocean biogeochemical control on atmospheric chemistry (Southern Ocean – underway pCO2 measurements, phytoplankton, ocean biogeochemistry – Researchers from FURG and UERJ)

since 1998 – PIRATA
Ministry of Science and Technology funding (Brazil), in cooperation with USA and France
Tropical Atlantic moored buoy array
SOLAS-related activities:
a) Air-sea interface and fluxes of mass and energy

4. Plans / ideas for future projects, programmes, proposals national or international etc. (please precise to which funding agencies and a timing for submission is any)

Submitted in July 2016 to CAPES (waiting for response):
Application of the Brazilian Earth System Model to assess the effects of anthropogenic CO2 emissions in the Atlantic Ocean biogeochemistry (Aplicação do BESM para estudo de processos biogeoquímicos marinhos sob efeito de emissões antropogênicas de CO2)
Possible PI: L. Cotrim da Cunha (UERJ), with participation of INPE and FURG

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

Brazil-SOLAS community, especially the researchers actively working on ocean carbon biogeochemistry, is actively cooperating with:
a) Latin American Ocean Acidification Network – LAOCA (http://www.eula.cl/musels/laoca/)

b) Global Ocean Acidification Observing Network – GOA-ON (http://goa-on.org/)

c) GEOMAR (Kiel, Germany – Prof. Arne Körtzinger and Dr. Tobias Steinhoff) – Partnership with UERJ through a DFG-FAPERJ (Brazil call) and a BMBF call (Germany)

d) University of Exeter (Dr. Ute Schuster) – Partnership with FURG and UERJ during the MSM60 Cruise – ocean carbon biogeochemistry measurements

Comments