

CLIVAR/CliC/SCAR Southern Ocean Region Panel SORP

National activities report

Country ITALY

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Receipt of material prior to 1 February 2019 will ensure inclusion discussions at the first SORP video conference for 2019. The reports contribute to future SORP discussions, as well as input to the SOOS and other CLIVAR/CliC/SCAR activities. All reports will be posted on the SORP website.

- Purpose of material gathered for the SORP:

To build an overview of observational, modeling, national projects and initiatives, ocean reanalysis and state estimation initiatives relevant to the SORP

(This can be detailed as a list of activities; maps showing where instruments have been or will be deployed; examples of modeling developments, experiments and set-ups; major national and international project involvement; etc.)

- Please refer to SORP's terms of reference (also given at the end of this template) for guidance on scope: <http://www.clivar.org/clivar-panels/southern>

Note: Biological topics such as marine ecology research, for example, are not within the scope of SORP's terms of reference and are therefore not required in these reports. However, SOOS has an interest in such research, so National Representatives are encouraged to include summaries of such research as separate sections.

Note: The Southern Ocean is not explicitly defined in SORP's terms of reference, so please note what the limit used for your national report is (e.g., research on regions only beyond an oceanographic boundary like "south of the Polar Front", or research contained within latitudinal limits like "south of 50 °S").

Summary of National Activities

(Half page max. This section should include a succinct list of the main annual activities and breakthroughs as well as future plans (including any possible future opportunities for international collaboration))

A. Recent and ongoing activities

If your country has a national committee tasked with oversight of Southern Ocean climate science (e.g., like US CLIVAR), please give the name of the committee here:

Describe which major activities have been carried out in the last year or are in progress now. For each activity/project, provide a contact information (e.g., Principal Investigators and Associate Investigators), a website if available and a list of relevant publications.

1. Observational Activities

MOMA Project funded by PNRA

P.I. Yuri Cotroneo, University of Naples Parthenope.
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Science Team: Isabelle Anserge; Pasquale Castagno; Antonio Celeste; Paola de Ruggiero; Nishendra Devanunthan; Henk A. Dijkstra; Pierpaolo Falco; Giannetta Fusco; Vittorio Gentile; Michael Ghil; Luigi Marziani; Milena Menna; Massimo Pacciaroni; Thierry Penduff; Stefano Pierini; Pierre Marie Poulain; Giovanni Sgubin; Marilisa Trani; Enrico Zambianchi;

In the framework of the MOMA project (Multiplatform Observations and Monitoring in a sector of the ACC) and in cooperation with the South African National Antarctic Programme, XBT launches as well as 13 floats deployment have been conducted from the R/V Agulhas II during the austral summer 2017/18. Float deployment map is shown in Figure 1.

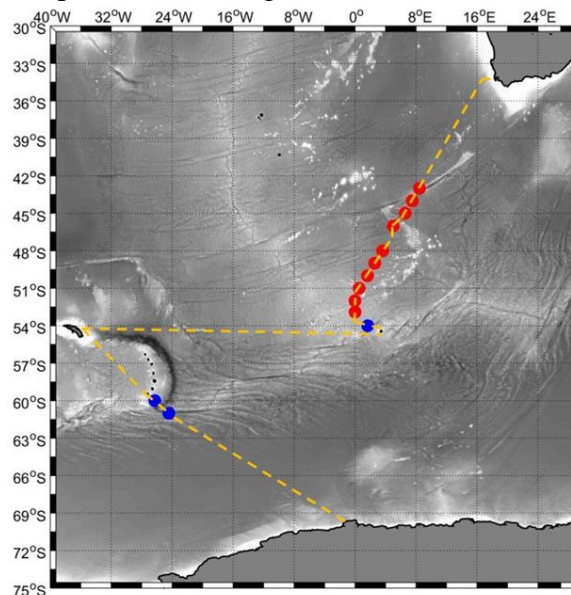


Figure 1 Map of the floats deployed in the framework of the MOMA project (blue dots) and of the floats deployed in cooperation with IFREMER (red dots)

Water temperature measurements were collected through 227 XBT casts along the Capet Town- Antarctica – Cape Town track, on the NOAA AX 25 high resolution XBT monitoring line, repeated since 2004. (http://www.aoml.noaa.gov/phod/hdenxibt/ax_home.php?ax=25).

Floats and XBT data contribute to the population of a high resolution observational dataset for the study of the variability and dynamics of the ACC and its fronts south of Africa.

Main publications:

Aulicino, G., Cotroneo, Y., Ansoerge, I., van den Berg, M., Cesarano, C., Belmonte Rivas, M., and Olmedo Casal, E.: Sea surface salinity and temperature in the southern Atlantic Ocean from South African icebreakers, 2010–2017, *Earth Syst. Sci. Data*, 10, 1227-1236, <https://doi.org/10.5194/essd-10-1227-2018>, 2018.

Menna et al.: “Experimental evidences of the eddy saturation regime in the Southern Pacific Ocean (1995-2017)” submitted to *JGR - Oceans*

Dataset publications:

Aulicino, Giuseppe; Cotroneo, Yuri; Ansoerge, Isabelle; Van Den Berg, Marcel. Sea surface temperature and salinity collected aboard the S.A. AGULHAS II and S.A. AGULHAS in the South Atlantic Ocean and Southern Ocean from 2010-12-08 to 2017-02-02 (NCEI Accession 0170743), 2018, 10.7289/v56m3545.

Main publications:

Menna et al.: “Experimental evidences of the eddy saturation regime in the Southern Pacific Ocean (1995-2017)” submitted to JGR - Oceans

Dataset publications:

1. Cotroneo, Yuri; Budillon, Giorgio; Fabio Conversano Ferrara, Claudia; Spezie, Giancarlo. Water temperature from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 1997-01-26 to 1997-02-19 (NCEI Accession 0172042), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v5kd1w6b, 2018.

2. Cotroneo, Yuri; Budillon, Giorgio; Castagno, Pasquale; De Alteris, Arturo; De Stefano, Massimo; Falco, Pierpaolo; Fusco, Giannetta; Zambardino, Giovanni; Spezie, Giancarlo. Water temperature from XBT taken from research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 2012-01-13 to 2012-01-19 (NCEI Accession 0167834). NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v54j0cbw, 2017.

3. Cotroneo, Yuri; Budillon, Giorgio; Meloni, Roberto; Aliani, Stefano; Zambardino, Giovanni; Spezie, Giancarlo. Water temperature data from XBT taken from research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 2010-01-25 to 2010-01-29 (NCEI Accession 0167835), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v50r9mmm, 2017.

4. Cotroneo, Yuri; Budillon, Giorgio; Artegiani, Antonio; Conversano, Fabio; Corbo, Carmine; Gallarato, Antonio; Giaquinto, Giuseppe; Russo, Aniello; Sala, Antonello; Testa, Gennaro; Spezie, Giancarlo. Water temperature data from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 1995-01-06 to 1995-03-02 (NCEI Accession 0170765), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v53r0r5z, 2018.

5. Cotroneo, Yuri; Budillon, Giorgio; Artegiani, Antonio; Conversano, Fabio; Corbo, Carmine; Gallarato, Antonio; Giaquinto, Giuseppe; Russo, Aniello; Sala, Antonello; Testa, Gennaro; Spezie, Giancarlo. Water temperature data from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 1994-11-03 to 1995-01-01 (NCEI Accession 0170608),

NOAA National Centers for Environmental Information. Dataset. doi:10.7289/v5rf5s9v, 2018.

6. Cotroneo, Yuri; Budillon, Giorgio; Bergamasco, Andrea; DE ALTERIS, Arturo; DE STEFANO, Massimo; Ferrara, Claudia; Manno, Clara; Paschini, Elio; Spezie, Giancarlo. Water temperature from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 2003-01-06 to 2003-01-11 (NCEI Accession 0173338), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v5qz289c. 2018.

7. Cotroneo, Yuri; Budillon, Giorgio; Ferrara, Claudia; Monteduro, Rocco; Russo, Aniello; Spezie, Giancarlo. Water temperature from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 2003-12-24 to 2003-12-28 (NCEI Accession 0173328), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v5vq3113, 2018.

8. Cotroneo, Yuri; Budillon, Giorgio; Bergamasco, Andrea; DE STEFANO, Massimo; Ferrara, Claudia; Paschini, Elio; Spezie, Giancarlo. Water temperature from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 2001-01-06 to 2001-02-26 (NCEI Accession 0173213), NOAA National Centers for Environmental Information. Dataset. doi:10.7289/v5s75dpg, 2018.

9. Cotroneo, Yuri; Budillon, Giorgio; Ferrara, Claudia; Orsi, Marco; Paschini, Elio; Rivaro, Paola; Spezie, Giancarlo. Water temperature from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 2001-12-24 to 2001-12-31 (NCEI Accession 0173214), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v5ng4nzs, 2018.

10. Cotroneo, Yuri; Budillon, Giorgio; Artegiani, Antonio; Ferrara, Claudia; Meloni, Roberto; Spezie, Giancarlo. Water temperature from XBT taken from research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 1996-01-07 to 1996-02-18 (NCEI Accession 0171481), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v5x065b9, 2018.

11. Cotroneo, Yuri; Budillon, Giorgio; Ferrara, Claudia; Paschini, Elio; Russo, Aniello; Spezie, Giancarlo. Water temperature from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 2000-01-07 to 2000-02-18 (NCEI Accession 0173212), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v56d5r8p. 2018.

12. Cotroneo, Yuri; Budillon, Giorgio; Ferrara, Claudia; Meloni, Roberto; Paschini, Elio; Spezie, Giancarlo. Water temperature from XBT taken from the research vessel *Italica* in the Southern Ocean and Southwest Pacific Ocean from 1999-01-05 to 1999-01-11 (NCEI Accession 0173211), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v5mg7mtc, 2018.

13. Cotroneo, Yuri; Budillon, Giorgio; Bergamasco, Andrea; Capello, Marco; DE STEFANO, Massimo; Ferrara, Claudia; Paschini, Elio; Russo, Aniello; Spezie, Giancarlo. Water temperature data from XBT collected from research vessel Italica in Southern Ocean and Southwest Pacific Ocean from 1997-11-23 to 1998-03-06 (NCEI Accession 0172859). NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v50863mf, 2018.

14. Cotroneo, Yuri; Budillon, Giorgio; Aliani, Stefano; Capello, Marco; Ferrara, Claudia; Paschini, Elio; Spezie, Giancarlo. Water temperature from XBT taken from the research vessel Italica in the Southern Ocean and Southwest Pacific Ocean from 2005-01-01 to 2005-01-06 (NCEI Accession 0173533), NOAA National Centers for Environmental Information. Dataset. doi: 10.7289/v5vh5m45,2018.

Lagrangian measurements:

Thanks to synergy with, and funding from, the ARGO-Italy programme, SVP near-surface drifters and ARGO floats have been regularly deployed on the route from New Zealand to the Ross Sea and back (A group) and from South Africa to Antarctica and back (B group).

Deployment activities, as well as data analysis are performed in the framework of the MOMA and MORSea projects.

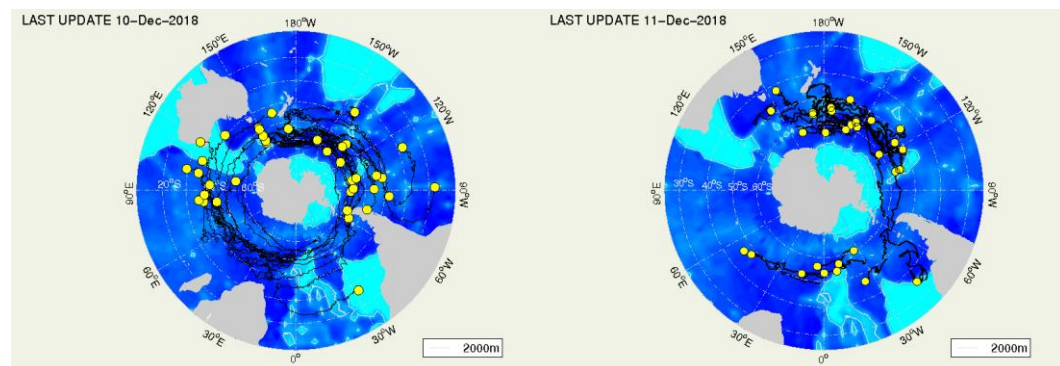


Figure 4: trajectories of floats (left) and drifters (right) alive in the Southern Ocean area and deployed by MOMA and MORSea projects. Update 10 Dec 2018

In the last few years, Lagrangian instrument deployments amounted to:

- A) 10 floats and 10 drifters in Summer 2014/15 from the R/V Araon
- A) 10 floats and 10 drifters in Summer 2015/16 from the R/V Italica
- B) 5 floats in Summer 2015/16 from the R/V Agulhas II

- A) 10 floats and 10 drifters in Summer 2016/17 from the R/V Italica
- B) 5 floats and 16 drifters in Summer 2016/17 from the R/V Agulhas II

- A) 5 floats and 9 drifters in Summer 2017/18 from the R/V Italice
- B) 13 floats in Summer 2017/18 from the R/V Agulhas II

2. Modeling Activities

3. Ocean reanalysis and state estimation Activities

4. National and International Projects/Initiatives

Since 2017 the MOMA project funded by the Italian National Antarctic Programme (PNRA), with the collaboration of the South African National Antarctic Programme (SANAP) aims at describing the Antarctic Circumpolar Current (ACC) and its variability, in space and time south of Africa on the basis of an up-to-date high-resolution observational dataset complemented with a modelling activity based on an ocean circulation model to be developed for the project.

Since 2016 the Plankton biodiversity and functioning of the ROSS Sea Ecosystems in a changing Southern Ocean (P-Rose) project (P.I. Olga Mangoni Local Research Unit CoNISMa - Department of Biology, University of Naples Federico II (UNINA) funded by the PNRA aims to identify the ongoing variations in the structure and functioning of the pelagic food web as related to climate changes. In the framework of P-Rose the Research Unit Parthenope (Coordinator Giannetta Fusco – University of Naples Parthenope) coordinate the acquisition and analysis of the data from CTD, lowered ADCP (current velocity) and continuous underway measurements and of the satellite observations. A continuous and synoptic monitoring of sea-ice presence, sea surface temperature and chlorophyll-a concentration will realize to detect the marginal ice zone position/variability. In this contest the following manuscripts are published.

“A New Approach for Monitoring the Terra Nova Bay Polynya through MODIS Ice Surface Temperature Imagery and Its Validation during 2010 and 2011 Winter Seasons” by Giuseppe Aulicino, Manuela Sansiviero, Stephan Paul, Cinzia Cesarano, Giannetta Fusco, Peter Wadhams and Giorgio Budillon (2018). Remote Sensing, 10, 366; doi:10.3390/rs10030366.

“Low-Frequency Climate Modes and Antarctic Sea Ice Variations, 1982–2013” by Dario Cerrone and Giannetta Fusco (2018). Journal of Climate, 31, 1; doi: 10.1175/JCLI-D-17-0184.1.

“Different Behaviours of the Ross and Weddell Seas Surface Heat Fluxes in the Period 1972–2015” by Giannetta Fusco, Yuri Cotroneo and Giuseppe Aulicino (2018). Climate 2018, 6, 17; doi:10.3390/cli6010017.

B. Planned activities

List which major activities are planned or likely to occur during the next several years, together with a contact information (e.g., Principal Investigators and Associate Investigators).

1. Observational
2. Modeling

Investigating the predictability of the Southern Ocean dynamics through ensemble simulation hindcasts (IPSODES) project,
funded by the Italian National Programme for Antarctic Research as a contribution to YOPP

P.I.: D. ZANCHETTIN (DAIS, Dip. di Scienze Ambientali, Informatica e Statistica – Univ. Ca' Foscari di Venezia)

Objectives:

The overarching objective of IPSODES is to substantially advance our knowledge of Intrinsic Ocean Variability (IOV) of the Southern Ocean (SO), of its underlying dynamics, of its implications for short- and mid-term predictability, and of its potential environmental repercussions. To achieve its main goal, IPSODES pursues the following specific objectives:

- (i) disentangle the IOV from the global variability of the Antarctic Circumpolar Current (ACC) and improve process understanding concerning the dynamical mechanisms that produce the IOV through the analysis of global as well as regional high-resolution (i.e., eddy permitting and resolving) oceanic simulations;
- (ii) evaluate the simulated representation of SO IOV in coupled climate models used in state-of-the-art systems for seasonal and decadal climate predictions, and understand the physical local as well as remote simulated mechanisms that determine predictability (or lack thereof) in the SO;
- (iii) determine how IOV can potentially affect the propagation and dispersion of plastic debris in the ocean surface layers, particularly across the ACC fronts, through the characterization (e.g., identification of systematic or preferential dispersion patterns) of Lagrangian trajectories extracted from numerical simulations;
- (iv) estimate, together with an improved view of the mere physical transport, broad aspects of the biologically-mediated transport (e.g., sequestration of microplastic through feeding by migrating biota or inputs from ships), implying the inclusion of non-Lagrangian transport properties;
- (v) produce, analyze and share new high-resolution regional ocean model simulations, and develop, test, apply and disseminate innovative statistical and mathematical methods for the study of IOV.

Expected outputs:

- synthesis data and metrics to assess variability and predictability of the SO from seasonal (S2S) and decadal (MPI-ESM/MiKlip) ensemble climate predictions, including strength and variability of ACC, eddy kinetic energy, and sea ice parameters.
- testing hypotheses about the sources of predictability and of systematic errors in seasonal and decadal climate predictions.
- ensemble simulations with a sigma-coordinate ocean model encompassing the SO
- Lagrangian trajectories obtained from the Eulerian velocity fields of the ocean model to investigate the distribution of marine debris in the SO
- Synthesis data and metrics to assess variability and predictability of the SO from the ensemble OCCIPUT-NEMO simulations
- pathways of transports of floating items across ACC fronts, with parameterizations focused on plastic debris

3. Ocean reanalysis and state estimation

INterannual Variability of the Antarctic Sea Ice/ocean system from ocean reanalyses (INVASI) project,
funded by the Italian National Programme for Antarctic Research as a contribution to YOPP

P.I.: D. IOVINO (Dept. of Ocean modeling and Data Assimilation, CMCC, Euro-Mediterranean Center on Climate Change, BOLOGNA)

Sea ice is undoubtedly a sensitive indicator of climate changes. In spite of its relevance, Antarctic sea ice region is among the least understood of the *climate* system, and its response to a warming climate continues to confound expectations. Antarctic sea ice cover has increased in recent decades to sharply decline in 2016 and shrank to a historic low in 2017. How this puzzling behaviour links to climate change needs further investigation.

Ocean reanalyses (ORAs, combining ocean/sea ice models, atmospheric forcing fluxes and observations) provide the most complete description and accurate estimation of time evolution of ocean/sea ice in polar regions where observations are sparse and models are affected by large biases. Within the Polar Ocean ReAnalyses Intercomparison Project, INVASI plans a coordinated evaluation of ORAs to assess the variability and recent trends in the Antarctic region. A set of global ORAs at eddy-permitting resolution will be analysed. In addition to a comparison of each individual product to

observations, we will assess the accuracy of the ORAs ensemble contributing to the requirement of uncertainty estimates for climatic datasets.

Breakdown of activities:

Task 1 will contribute to quantify crucial sea ice properties (thickness and drift), examine processes and interactions with other climate components in order to advance the understanding and prediction of climate change, and will provide recommendations to reduce uncertainties in future reanalyses.

Advances in the explicit simulation of key processes are essential for improving our knowledge of mechanisms of Antarctic sea ice variability. High-resolution has been identified as an essential element to reproduce relevant features, as oceanic eddies, polynya/ice formation, with high fidelity. Task 2 will develop and implement a global ORA at eddy resolution (3km around Antarctica) to advance understanding of drivers of variability and changes.

4. National and International Projects/Initiatives
5. Opportunities for future international collaborations

CLIVAR/CliC/SCAR SORP terms of reference

(<http://www.clivar.org/clivar-panels/southern>)

"To serve as a forum for the discussion and communication of scientific advances in the understanding of climate variability and change in the Southern Ocean. To advise CLIVAR, [CliC](#), and [SCAR](#) on progress, achievements, new opportunities and impediments in internationally-coordinated Southern Ocean research."

Specific Activities:

1. Facilitate progress in the development of tools and methods required to assess climate variability, climate change and climate predictability of the ocean-atmosphere-ice system in the Southern Ocean.
2. Identify opportunities and coordinated strategies to implement these methods, spanning observations, models, experiments, and process studies.
3. Provide scientific and technical input into international research coordination, collaborating as required with other relevant programs, including the [Southern Ocean Observing System \(SOOS\)](#).
4. Monitor and evaluate progress in Southern Ocean research, and identify gaps.
5. Enhance interaction between the meteorology, oceanography, cryosphere, geology, biogeochemistry and paleoclimate communities with an interest in the climate of the Southern Ocean.
6. Work with relevant agencies on the standardization, distribution and archiving of Southern Ocean observations.