

CLIVAR/CliC/SCAR Southern Ocean Region Panel SORP

National activities report

Country BELGIUM

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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))

Since decades, Belgium has been a primary contributor to Antarctic research. This national report for year 2018 highlights recent observing and modeling contributions from various institutions across the country. These range from monitoring the state of the atmospheric column to modelling small-scale coupled processes, through sampling ocean properties during dedicated field campaigns.

Acronyms:

RMI : Royal Meteorological Institute

UCLouvain: Université catholique de Louvain

VUB : Vrije Universiteit Brussel

ULiège : Université de Liège

KUL : Katholieke Universiteit Leuven

ULB : Université Libre de Bruxelles

UG : Universiteit Gent

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:

YES. This is the Belgian National Committee for Antarctic Research (BNCAR, <http://dev.ulb.ac.be/glaciol/BNCAR/index.htm>). The BNCAR is made of about 45 effective, associate or honorary members and is the direct link with the Scientific Committee on Antarctic Research (SCAR). The BNCAR is the national forum to share and discuss scientific results but also identify strategies for better coordination of resources.

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

RMI

Since February 2009 - continuous monitoring of total ozone, UV radiation and ambient aerosol physical and optical properties at Princess Elisabeth Station, Dronning Maud Land, East Antarctica

Weather balloon launches for radio soundings (T, rH, p, wind) during austral summer (Nov-Feb); since summer 2014/2015

Websites: <http://ozone.meteo.be/meteo/view/en/1550481-AEROCLLOUD.html> and www.aerocloud.be / <https://belatmos.blogspot.be>

Contact: alexander.mangold@meteo.be

ULiège, VUB, ULB

Involvement in the CHINARE 35th Antarctic cruise. Survey of N₂O and nitrogen related parameters in Antarctica coastal area (Prydz Bay) in sea ice and underlying water in the frame of the OCeANIC project

(<https://www.researchgate.net/project/OCeANIC-nitrous-Oxide-and-nitrogen-Cycling-in-ANTarctic-sea-Ice-Covered-zone>) a Chinese-Belgian bilateral

cooperation. People involved: Bruno Delille – ULiège, Frank Dehairs & Florian Deman - VUB, Jean-Louis Tison - ULB, Liyang Zhan - Third Institute of Oceanography – China)

Publications

Meiners, K.M., Vancoppenolle, M., Carnat, G., Castellani, G., Delille, B., Delille, D., Dieckmann, G.S., Flores, H., Fripiat, F., Grotti, M., Lange, B.A., Lannuzel, D., Martin, A., McMinn, A., Nomura, D., Peeken, I., Rivaro, P., Ryan, K.G., Stefels, J., Swadling, K.M., Thomas, D.N., Tison, J.-L., van der Merwe, P., van Leeuwe, M.A., Weldrick, C., Yang, E.J., 2018. Chlorophyll- a in Antarctic Landfast Sea Ice: A First Synthesis of Historical Ice Core Data. *Journal of Geophysical Research Ocean*. 123, 8444–8459. doi:10.1029/2018JC014245

Luhtanen, A.-M., Eronen-Rasimus, E., Oksanen, H.M., Tison, J.-L., Delille, B., Dieckmann, G.S., Rintala, J.-M., Bamford, D.H., 2018. The first known virus isolates from Antarctic sea ice have complex infection patterns. *FEMS Microbiol. Ecol.* 94. doi:10.1093/femsec/fiy028

ULB, UGent, KUL, ULg, VUB, ODN

Within the rECTO-vERSO projects, a marine research expedition named Belgica120 (www.belgica120.be) was planned and started in February 2018. Unfortunately due to technical issues the research vessel had to come back to the harbour and the campaign has been postponed to February 20th 2019. The expedition will investigate benthic biodiversity in relation to glacier retreat and climate change related-effects in the region of the Gerlache Strait.

Contacts: francesca.pasotti@ugent.be and bdanis@ulb.ac.be

UGent

As part of the Larsen-C Benthos (JR17003a CRUISE) samples have been collected during the Larsen-C Benthos (JR17003a) expedition led by the British Antarctic Survey (BAS), which took place on board of the RRS James Clark Ross research ship between February and March 2018. The area of interest is the Antarctic Peninsula, particularly the Prince Gustav Channel (a narrow seaway enclosed between Trinity Peninsula and James Ross and Vega Islands). Samples were collected with a multicorer (MUC), type MARUM at different depths and locations. Three deep stations along the north-south gradient of the PGC at 800, 1000 and 1250m and three stations along a bathymetric transect in Duse Bay at 200, 500 and 1000m were sampled. At each station 1 to 4 cores from up to two different MUC samples were collected, each with a diameter of 10 cm. The undisturbed cores were sliced horizontally per 2cm up to 8cm. Objectives:

The samples will be used to investigate three distinct research hypotheses.

-Major changes in sediment conditions and community assemblages of associated meiofauna are expected to be intensely influenced by different ice condition in historical and present times. Indeed glacier impact, hydrological dynamics and surface productivity are supposed to play an important function in determining the community structure in three contiguous deep basins along Prince Gustav Channel.

-The Benthic diversity of PGC deep basins is more similar to populations inhabiting the adjacent shelf than to the bathyal fauna of the Weddell Sea.

-Evident differences in benthic communities are supposed to occur comparing the shallower, most likely impacted areas of Duse Bay with deeper protected basins. These are also expected to act as carbon sink, thus providing more nutrients to benthic assemblages and suggesting the presence of abundant populations. Each slice was then divided in two equal parts, of which one has been fixed in 4% formaldehyde and the other has been stored in plastic bags at -80°C. The fixed

samples are going to be sieved with both a 1mm and a 32 µm sieve, in order to separate the macro- and meiofauna fractions from the sediment. Meiofauna will be counted and identified, with a special attention to Nematodes, whilst the macrofauna fraction will be quantified and weighted in order to assess the abundance of bioturbators in the first centimeters of the seabed at each station. The frozen samples will be used for the analysis of environmental parameters and the metabarcoding of Nematodes, as to evaluate their genetic diversity and confirm the findings of binocular identification.

A thesis Master student is already working on these samples who will likely follow with a PhD project.

Contacts: francesca.pasotti@ugent.be , ann.vanreusel@ugent.be

Publications/References:

- Pasotti, F., Braeckman, U., Lefaible, N., Hoffmann, R. & Vanreusel, A. “Antarctic fjord soft sediment benthos: a snapshot at different scales.” (in prep.).
- Braeckman U., Pasotti F., et al. (in press) “Degradation of macroalgal detritus in shallow coastal Antarctic sediments”, *Limnology & Oceanography* doi: 10.1002/lno.11125
- Hoffmann R., Pasotti F., Vázquez S., Torstensson A., MacCormack W., Wenzhöfer F., Braeckman U. “Spatial variability of biogeochemistry in shallow coastal benthic communities of Potter Cove (Antarctica) and the impact of a melting glacier”, *PLoS One*, doi: 10.1371/journal.pone.0207917
- Braeckman U, Hoffmann R, Pasotti F, Vazquez S, Torstensson A, Vanreusel A, Wenzhöfer F, Abele D (in prep.) Spatio-temporal variability in biogeochemistry in Antarctic benthic communities influenced by glacier retreat.
- Pasotti, F., Braeckman, U., Lefaible, N., Hoffmann, R. & Vanreusel, A. “Antarctic fjord soft sediment benthos: a snapshot at different scales.” (in prep.).
- Pasotti F. “Impact of Climate-induced dynamics on a Coastal benthic ecosystem from the West Antarctic Peninsula”, PhD Thesis dissertation for the degree of Doctor in Science (Marine Sciences), Ghent University, Academic year 2014-2015.
- Pasotti, F. et al. “Benthic Trophic Interactions in an Antarctic Shallow Water Ecosystem Affected by Recent Glacier Retreat”, *PLoS One* 1–26 (2015). doi:10.1371/journal.pone.0141742
- Hauquier F., Verleyen E., Tytgat B., Vanreusel A. (2018) Regional-scale drivers of marine nematode distribution in Southern Ocean continental shelf sediments. *Progress in Oceanography*, 165: 1-10. doi:10.1016/j.pocean.2018.04.005
- Veit-Köhler G., Durst S., Schuckebrock J., Hauquier F., Durán Suja L., Dorschel B., Vanreusel A., Martínez Arbizu P. (2018) Oceanographic and topographic conditions structure benthic meiofauna communities in Weddell Sea, Bransfield Strait and Drake Passage (Antarctic). *Progress in Oceanography*, 162: 240-256. doi:10.1016/j.pocean.2018.03.005

Hauquier F., Leliaert F., Rigaux A., Derycke S., Vanreusel A. (2017) Distinct genetic differentiation and species diversification within two marine nematodes with different habitat preference in Antarctic sediments. *BMC Evolutionary Biology*, 17: 120. doi:10.1186/s12862-017-0968-1

Hauquier F., Ballesteros-Redondo .L, Gutt J., Vanreusel A. (2016) Community dynamics of nematodes after Larsen ice-shelf collapse in the Eastern Antarctic Peninsula. *Ecology and Evolution*, 6(1): 305–317. doi:10.1002/ece3.1869

Hauquier F., Durán Suja L., Gutt J., Veit-Köhler G., Vanreusel A. (2015) Different oceanographic regimes in the vicinity of the Antarctic Peninsula reflected in benthic nematode communities. *PLOS ONE*, 10(9). doi:10.1371/journal.pone.0137527

Lins L., da Silva M.C., Hauquier F., Esteves A.M., Vanreusel A. (2015) Nematode community composition and feeding shaped by contrasting productivity regimes in the Southern Ocean. *Progress in Oceanography*, 134: 356–369

Lins L., Guilini K., Veit-Köhler G., Hauquier F., Alves R.M.S., Esteves A.M., Vanreusel A. (2014) The link between meiofauna and surface productivity in the Southern Ocean. *Deep-Sea Research II*, 108: 60–68. <http://dx.doi.org/10.1016/j.dsr2.2014.05.003>

2. Modeling Activities

UCLouvain

- The project PARAMOUR (Decadal Predictability and vAriability of polar climate: the Role of AtMosphere- Ocean-cryosphere mUltiscale inteRactions; <http://www.climate.be/php/users/klein/PARAMOUR/>) funded in the framework of the program EOS –The excellence of Science has started in 2019. It aims at revealing fundamental drivers of climate variability and assessing the predictability in high-latitudes by using coupled regional climate models in both hemispheres. Achieving our goals requires the development of coupled regional models including the atmosphere, ocean, sea ice and ice sheets. Three configuration are proposed, covering 1/ Greenland, the Arctic and the North Atlantic sector, 2/ Antarctica and the Southern Ocean, 3/ The Totten glacier region. We are in the development phase and expect that each configuration will be operational in 2019.
- The ongoing project AdelieHRM aims at providing a better understanding of the role of small scale processes - ranging from few to few tens of kilometers - on the dynamics of the atmosphere-ocean-ice system in east Antarctica. A regional high-resolution configuration of the ocean and sea ice model NEMO/LIM has been developed and is currently used to evaluate the impact of small scale processes - such as tides, interactions with ice shelves, sea ice rheology - on air-sea-ice fluxes. A second panel of the project will focus on the coupling with the atmospheric model MAR, to

evaluate the role of air-sea interactions at the mesoscale on regional Antarctic climate and surface mass balance.

3. Ocean reanalysis and state estimation Activities
4. National and International Projects/Initiatives

AEROCLOUD project

Belgian project, financed by BELSPO, Belgian Science Policy Office
Partners: RMI, KUL (KU Leuven), BIRA (Royal Belgian Institute of Space Aeronomy)

Contact: alexander.mangold@meteo.be / Nicole.vanlipzig@kuleuven.be

Website: www.aerocloud.be

Period: 2015-2019

The objective of the AEROCLOUD project are (i) to build up an extensive database on cloud, precipitation and aerosol properties derived from measurements performed at the Belgian station Princess Elisabeth in Dronning Maud Land, East Antarctica, (ii) to evaluate and improve a regional climate model for Dronning Maud Land, (iii) to assess the role of aerosols and clouds in the East-Antarctic climate system, with focus on precipitation, surface energy balance and the relation between aerosols and clouds in East Antarctica.

Excerpt of publications:

Herenz, P. H. Wex, A. Mangold, Q. Laffineur, Gorodetskaya, I. V., Z. Fleming, M. Panagi and F. Stratmann, CCN measurements at the Princess Elisabeth Antarctica Research station during three austral summers, *Atmos. Chem. Phys.* 19, 275-294, doi.org/10.5194/acp-19-275-2019, 2019.

Souwerijns, N., A. Gossart, I. V. Gorodetskaya, S. Lhermitte, A. Mangold, Q. Laffineur, A. Delcloo and N. P. M. Van Lipzig, How does the ice sheet surface mass balance relate to snowfall? Insights from a ground-based precipitation radar in East Antarctica, *The Cryosphere* 12, 1987-2003, 2018.

Gossart, A., N. Souwerijns, I. V. Gorodetskaya, S. Lhermitte, J. T. M. Lenaerts, J. H. Schween, A. Mangold, Q. Laffineur, N. P. M. Van Lipzig, Blowing snow detection from ground-based ceilometers: application to East Antarctica, *The Cryosphere* 11, 2755-2772, doi.org/10.5194/tc-11-2755-2017, 2017.

CHASE project

Belgian project, financed by BELSPO, Belgian Science Policy Office
Partners: RMI, UGent (University of Ghent), ULB (Universite Libre de Bruxelles), VUB (Vrije Universiteit Brussel)

Contact: alexander.mangold@meteo.be // nmattiel@ulb.ac.be

Period: 2017-2021

The objectives of CHASE are: (i) CHASE will build up a unique database of organic and inorganic composition of both atmospheric and surface snow particles

as well as of volatile organic compounds in Dronning Maud Land, East Antarctica; (ii) CHASE will assess comprehensively source regions, atmospheric transport pathways, seasonal variations and relative importance of trace elements, micronutrients and atmospheric pollutants and of natural and anthropogenic compounds in Dronning Maud Land, East Antarctica. Passive sampling systems have been installed along a transect from the plateau near Princess Elisabeth station to the coast (in total 7 locations). At Princess Elisabeth station, active sampling with high volume pumps is done during austral summer.

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

RMI

Existing activities (see section A) will continue at least until austral summer 2020/2021.

ULB, UGent, KUL, ULg, VUB, ODN

Within the rECTO-vERSO projects a marine research expedition named Belgica121 (www.belgica120.be) will depart from Ushuaia on February 25th 2019 with the research vessel Australis faring towards the Antarctic. The expedition aims at investigating benthic biodiversity and food web dynamics in relation to glacier retreat and climate change related-effects in the region of De Gerlache Strait. Onboard, ROV underwater imaging, quantitative and qualitative sampling (by small dredges or via diving) will be carried out to investigate biodiversity distribution, functional and evolutionary aspects of key benthic species. Fish and phytoplankton will also be target of this study.

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2. Modeling

3. Ocean reanalysis and state estimation

4. National and International Projects/Initiatives

The CHASE project (see section A) will continue until austral summer 2020/2021

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.