

Ocean-Cryosphere Exchanges in ANtarctica: Impacts on Climate and the Earth System

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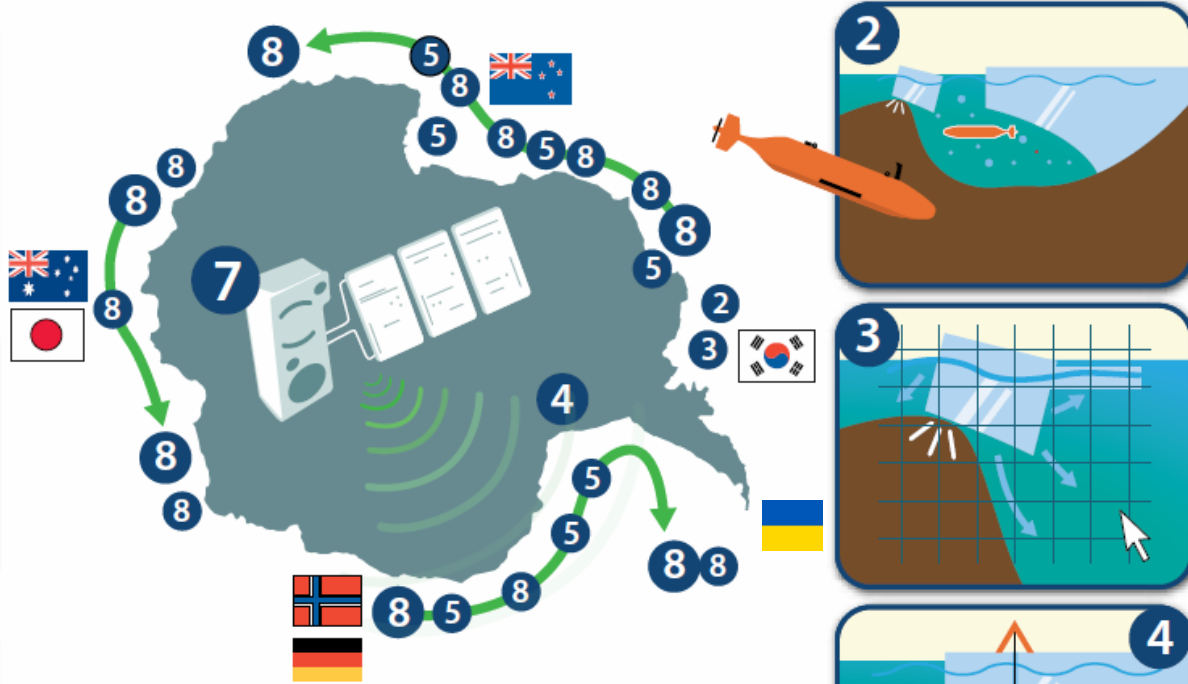
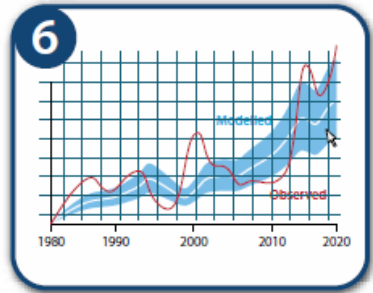
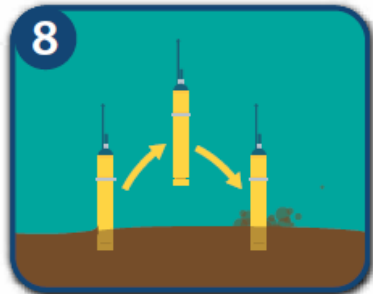
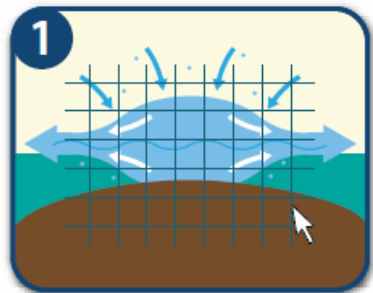
A 4 year (Nov 22) Horizon Europe programme involving 17 centres, ~€8M funding (inc. UKRI co-funding)



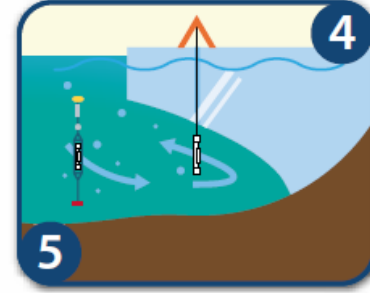
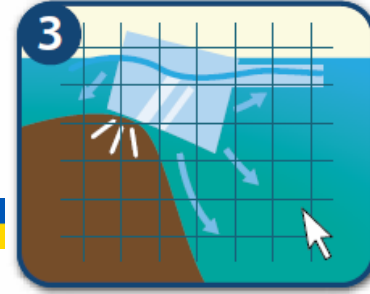
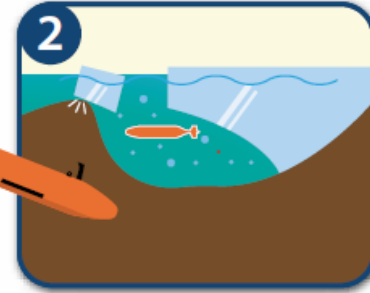
OCEAN:ICE is co-funded by the European Union, Horizon Europe Funding Programme for research and innovation under grant agreement Nr. 101060452 and by UK Research and Innovation



Objectives of Ocean:ICE

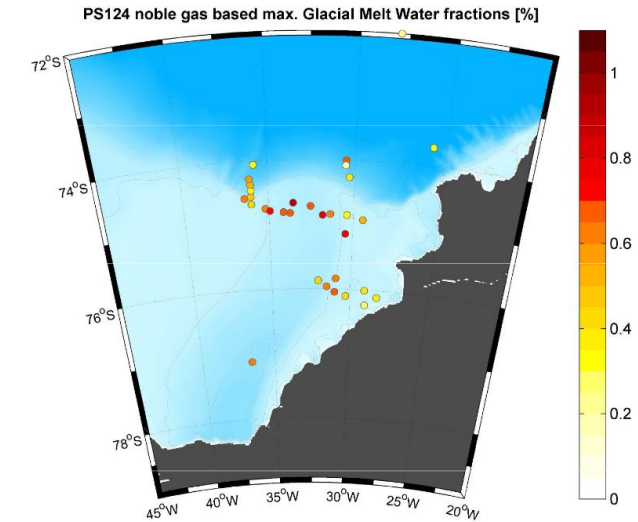
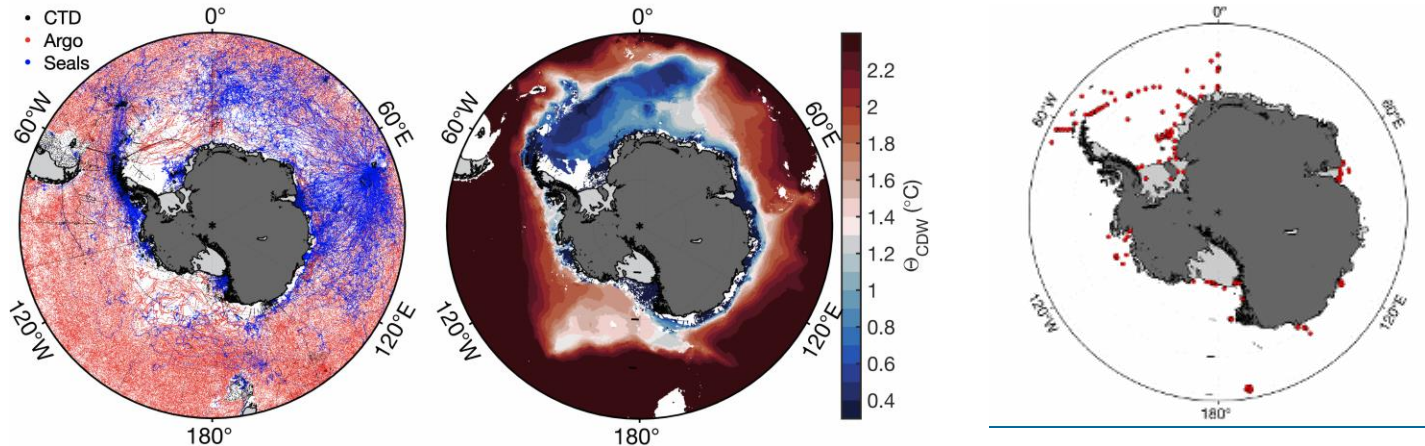


Schematic of Antarctic observations and modelling being undertaken by OCEAN:ICE and supported by collaborating nations (flags) to estimate ice sheet melt rates and impacts.



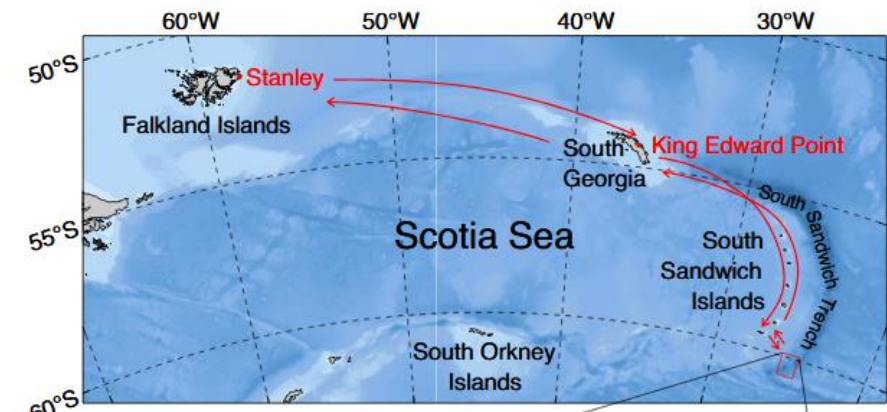
- **O1:** Reduce the spatial and knowledge gaps in ocean observations around Antarctica.
- **O2:** Improve critical ice sheet-ocean processes in numerical models.
- **O3:** Improve representation of AIS dynamics and integrate this knowledge into ice sheet-climate models.
- **O4:** Quantify AIS melt sensitivity to climate forcing and reduce the ‘deep uncertainty’ in freshwater flux and SLR projections to 2300.
- **O5:** Assess how global ocean circulation is impacted by freshwater discharge from the northern and southern ice sheets.
- **O6:** Assess the ocean impact on key global climate metrics from polar ice sheet melt to 2300 and beyond.
- **O7:** Deliver free and open data access and contribute to international assessments, climate model development, observing initiatives and policymakers.

Antarctic research elements : Finding the old data, making new ocean observations



Water mass age and meltwater fraction, Weddell Sea, Janout, AWI

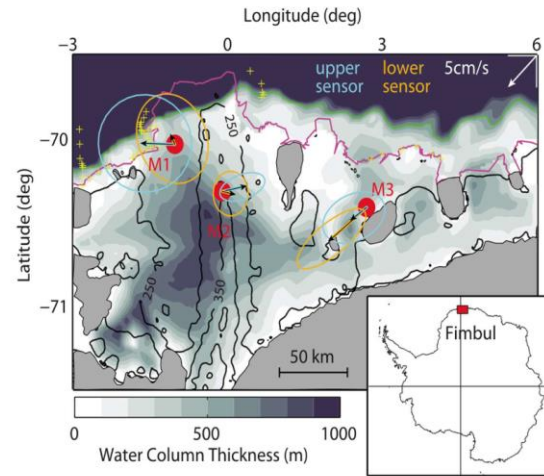
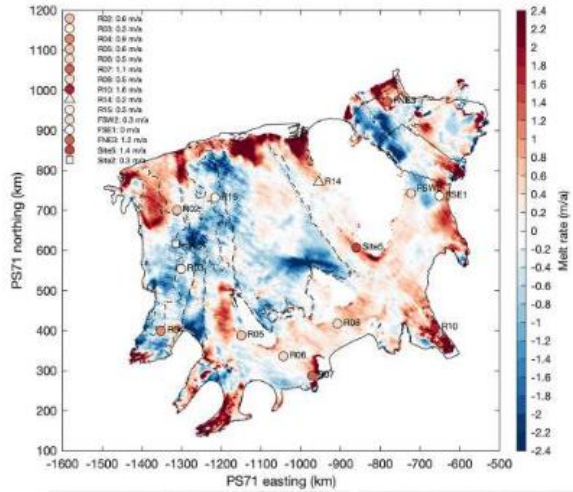
600,000 temperature/salinity profiles and time series observations of essential ocean variables and compilation of mooring data since 1975 (Zhou and Dutrieux, BAS) <https://www.seanoe.org/data/00886/99787>



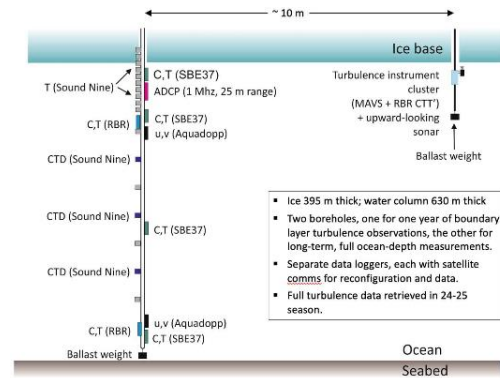
Deployment of new moorings in the Scotia Sea (Abrahamsen, BAS); Noosfera deployments planned for 2024-25



Antarctic research elements: Observing ice shelf processes



Deployment of AUV in the Amundsen Sea (Wåhlin and Wahlgren, Gothenburg University)



Deployments through Fimbul ice shelf borehole, Hattemann (NPI), and NECKLACE ApRES Nicholls (BAS).

Antarctic research elements: Freshwater fluxes from Earth Observation, in-situ and models

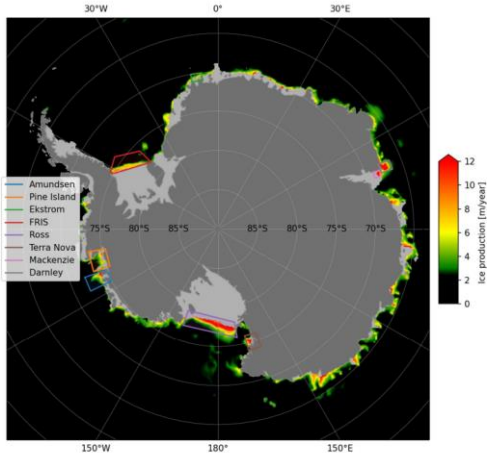
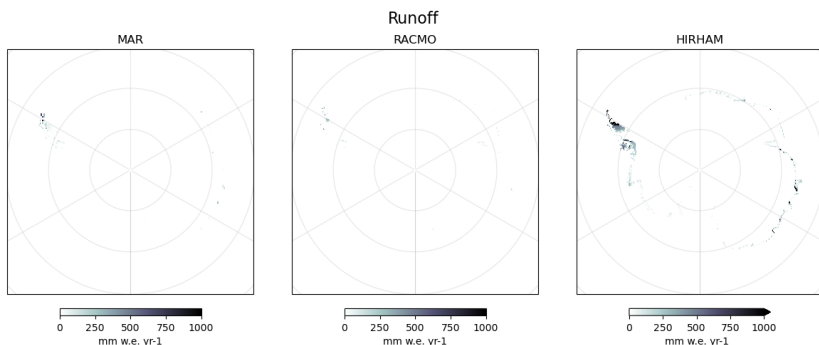
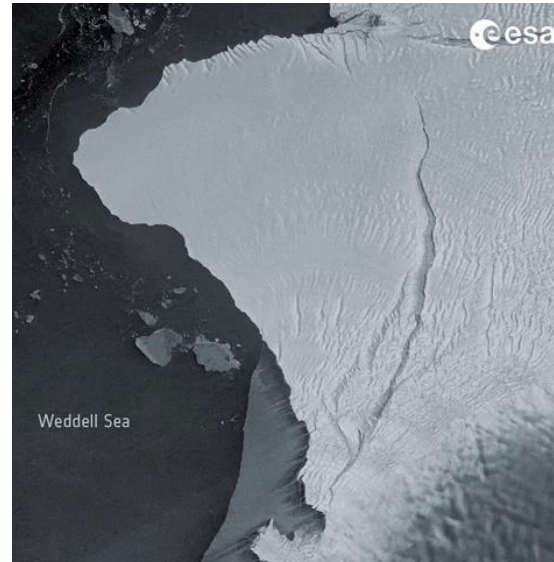


Fig. 2: Map of annual SIP, averaged over 1992-2023, based on the SSM/I ASI ice concentration and ERA5 wind speed and surface air temperature. Some selected polynyas are shown with their corresponding colour-coded polygons (own approximations). The SIP colour scale was designed to match Fig 3 in Oshima et al. (2016) for a direct comparison.

Sea ice production (SIP) in Antarctic coastal polynyas with ESA CCI sea ice data. Janout and Kaleschke, AWI

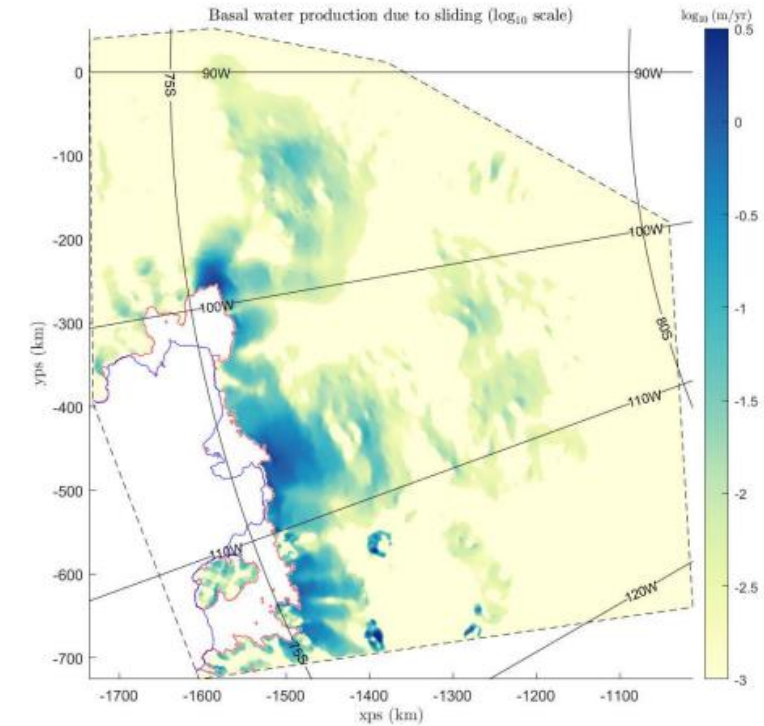


Ice shelf calving, melt and damage from EO data
Millan, IGE



A81 iceberg breaking away from the Brunt Ice Shelf. January 2023 - Copernicus Sentinel data (2021-23), processed by ESA

SMB: Case, van den Broeke, van de Berg, U Utrecht; Hansen, Olesen Boberg + Mottram, DMI



Gudmundsson, UNorthumbria

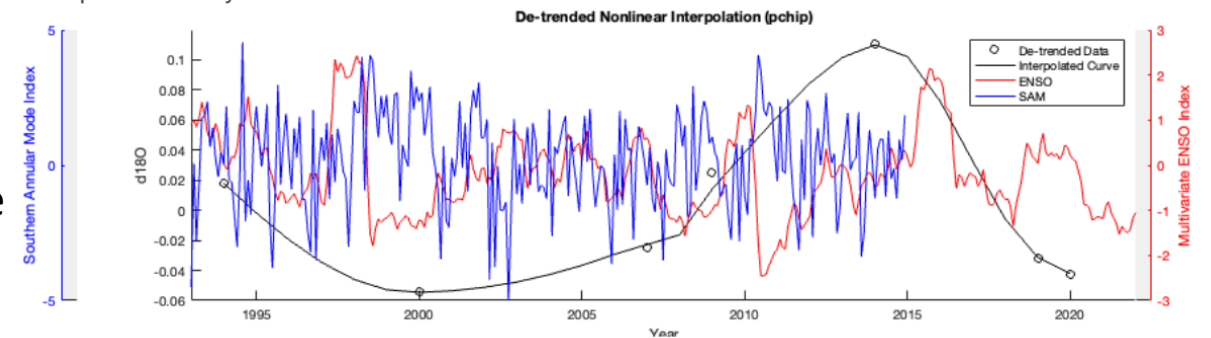
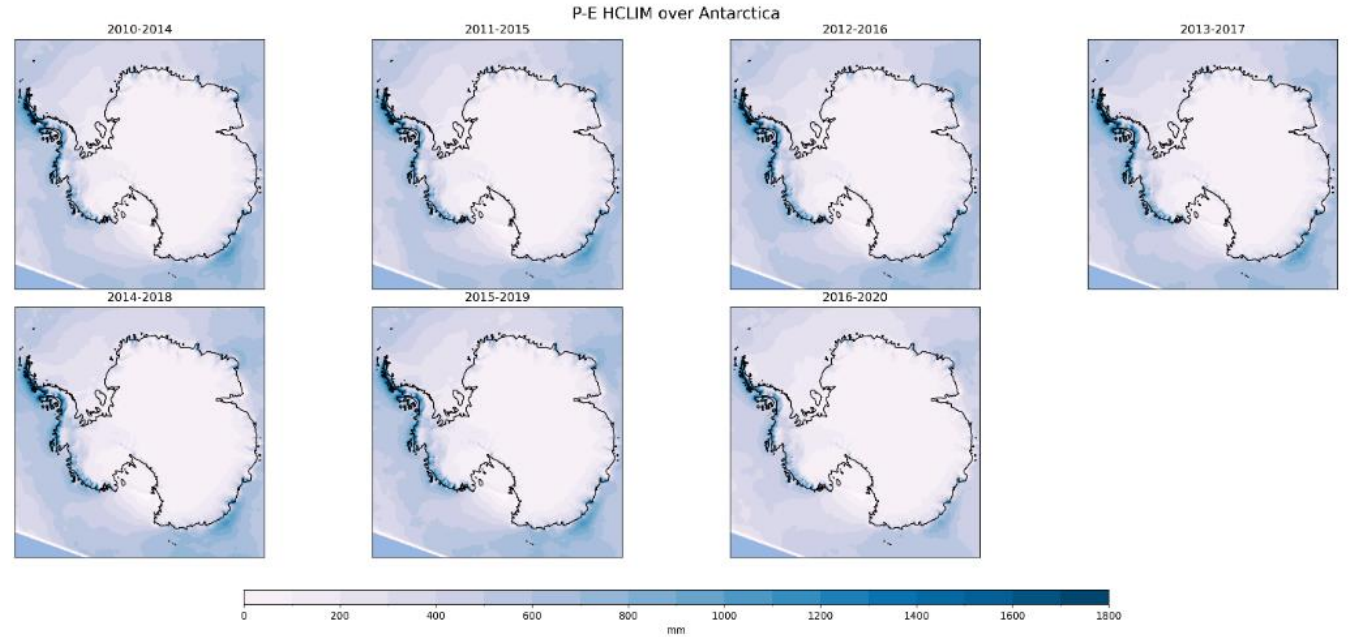
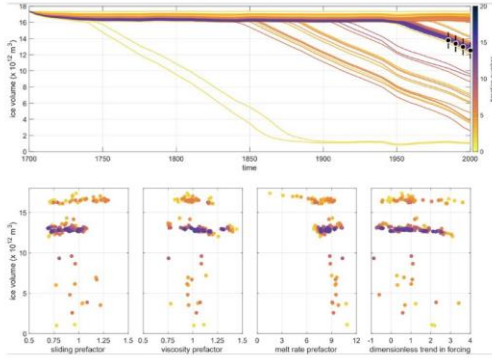


Fig.7: De-trended and interpolated $\delta^{18}\text{O}$ time series from the south-eastern Amundsen Sea (73.5°S – 75.5°S; 108°W - 100°W) (in black), overlapped with the El Niño-Southern Oscillation (ENSO; in red) and Southern Annular Mode (SAM; in blue) climatic indexes.

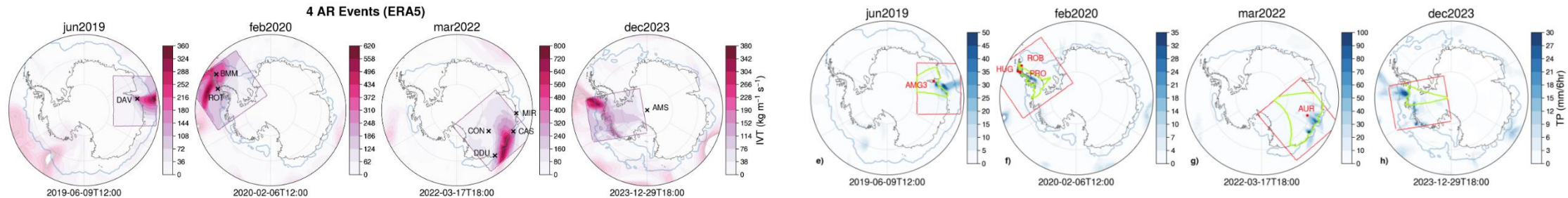
d18O analysis Dabila and Mcdonagh, NORCE

Antarctic research elements: Development of ice sheet models, regional climate models, ice-ocean coupled models, earth system models and data assimilation schemes



IEnKS for initialising coupled ice - ocean models. Arthern, BAS

New processes in regional SMB models and high impact extreme events in km scale models, Torres Alavez, Kolbe, Mottram DMI



Cross-cutting Themes, policy briefings and (a few) publications

Antarctic Bottom Water theme, led by Povl Abrahamsen (UKRI -BAS).

Deep Uncertainty in Freshwater Fluxes (DUFF) theme, led by Frank Pattyn (ULB) and Jan de Rydt (UNN).

Role of the Poles' them, led by Robin Smith (U Reading)

Oxygen isotope theme, led by Casimir de Lavergne (CNRS)

FROM CHANGING POLAR REGIONS TO
POLICY RESPONSES -
STRENGTHENING EU AND GLOBAL
CLIMATE PREPAREDNESS

BAMS
Meeting Summary

Determining the Freshwater Fluxes from Antarctica with Earth Observation Data, Models, and In Situ Measurements: Uncertainties, Knowledge Gaps, and Prospects for New Advances

Ruth Mottram,^a Michiel van den Broeke,^b Andrew Meijers,^c Christian Rodehacker,^{a,d} Rebecca L. Dell,^e Anna E. Hogg,^f Benjamin J. Davison,^f Stef Lhermitte,^{g,h} Nicolaj Hansen,^{aj} Jose Abraham Torres Alavez,^a and Martin Olesen^a



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A heat wave in Greenland and a storm in Antarctica. These kinds of individual weather “events” are increasingly being supercharged by a warming climate. But despite being short-term events they can also have a much longer-term effect on the world’s largest ice sheets, and may even lead to tipping points being crossed in the polar regions.

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Observing Antarctic Bottom Water in the Southern Ocean

Alessandro Silvano^{1k}, Sarah Purkey², Arnold L. Gordon³, Pasquale Castagno⁴, Andrew L. Stewart⁵, Stephen R. Rintoul^{6,7,8}, Annie Foppert^{8,9}, Kathryn L. Gunn¹, Laura Herráiz-Berreguero^{6,7}, Shigeru Aoki¹⁰

