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

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OCEAN:ICE

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

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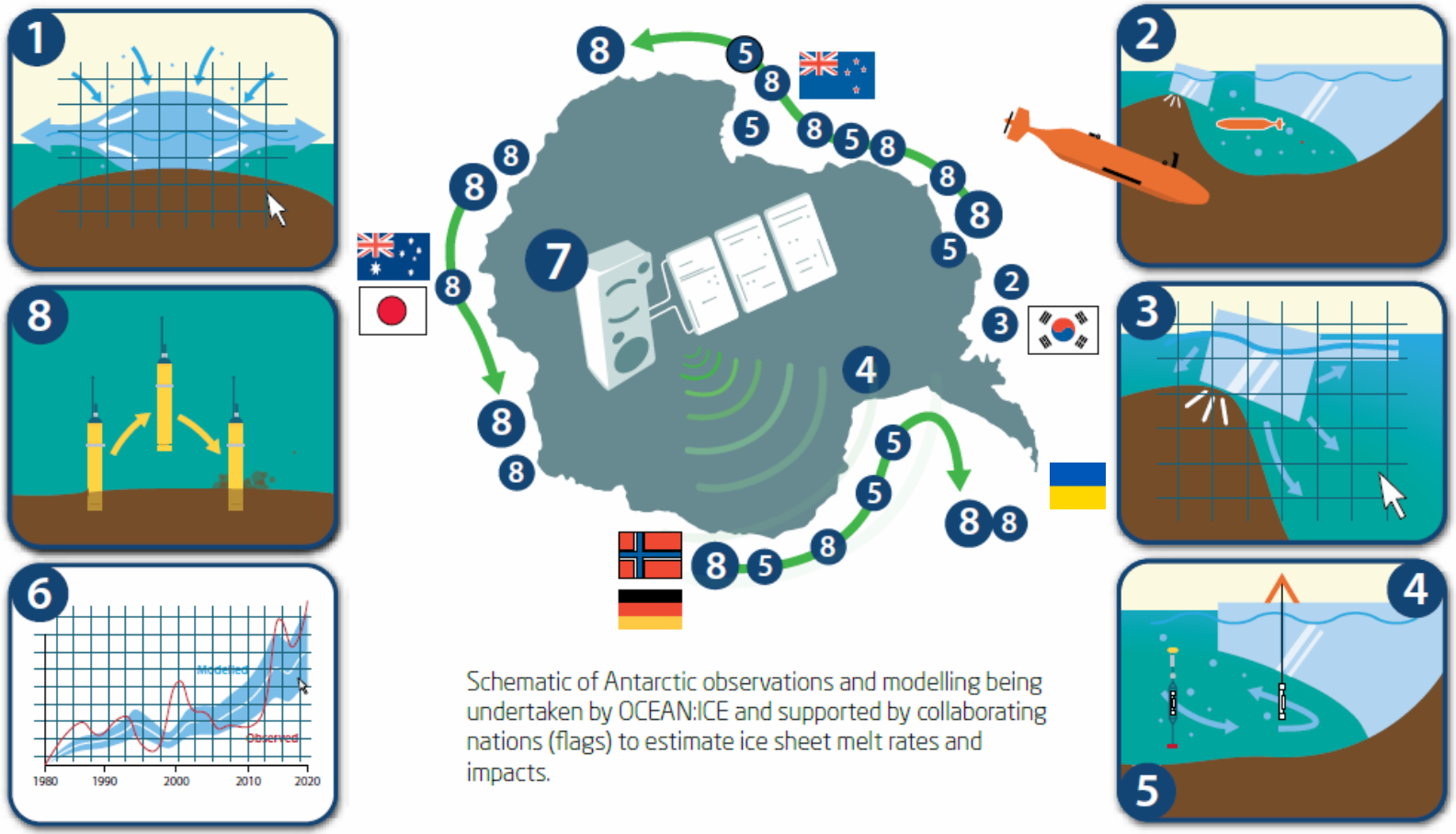
DMI

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.**

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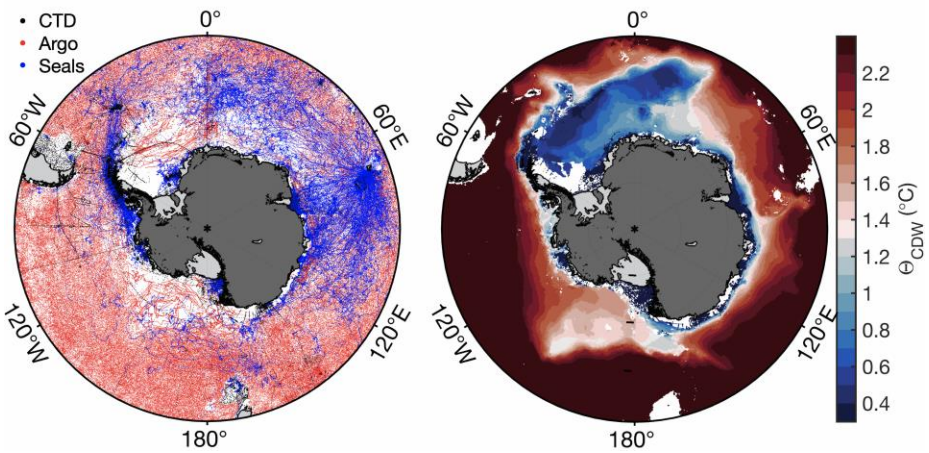
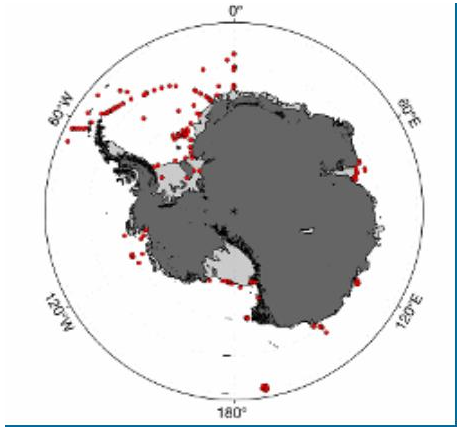
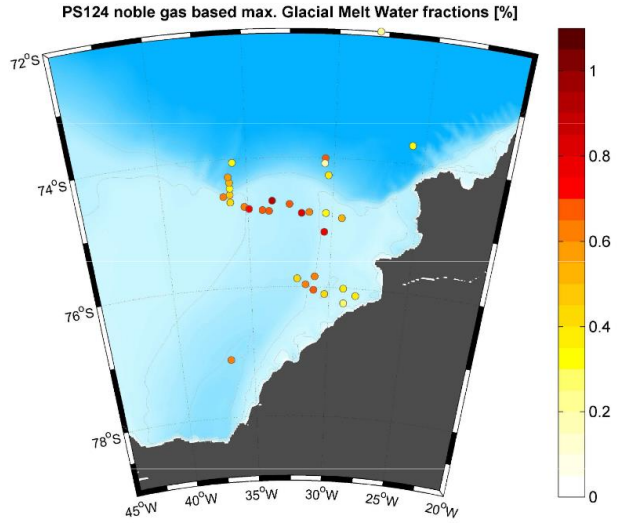
Antarctic research elements : Finding the old data, making new ocean observations

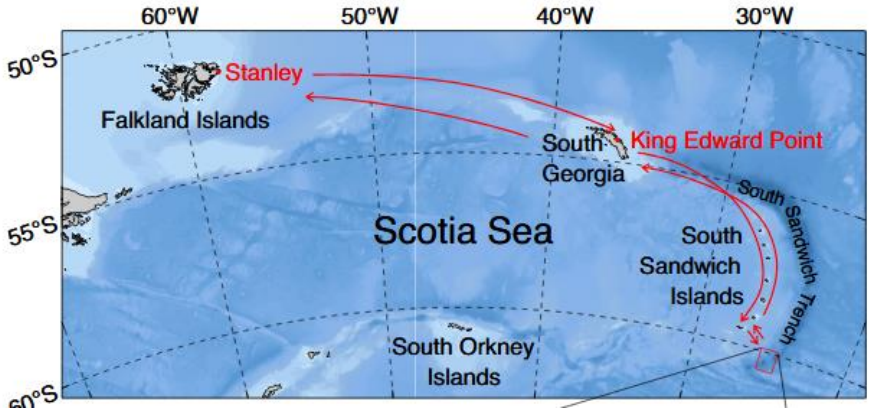






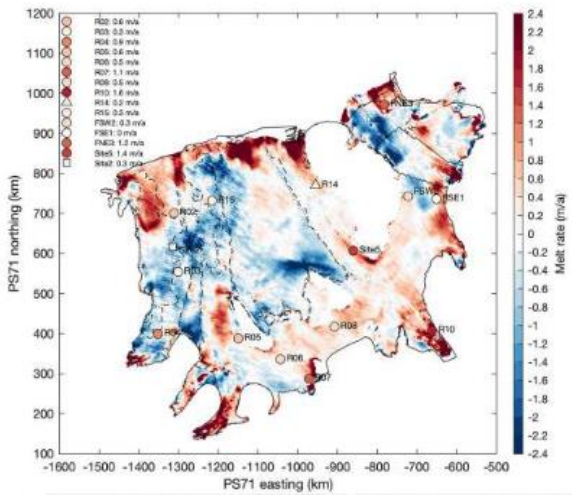
Water mass age and meltwater fraction, Weddell Sea, Janout, AWI

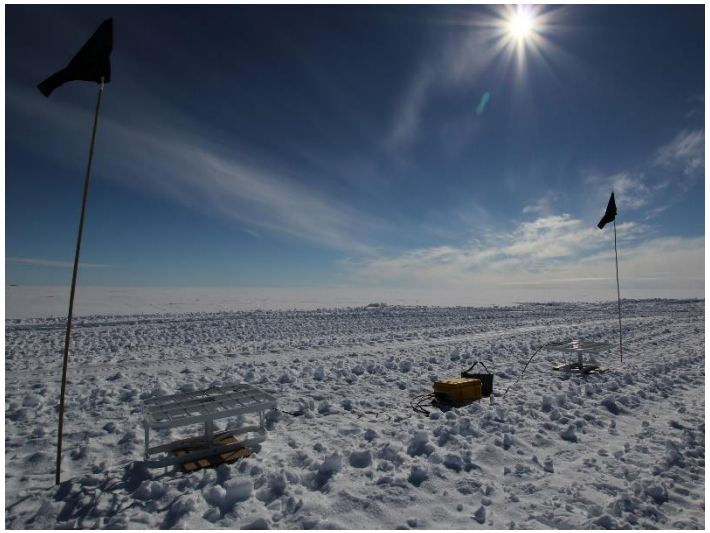
600,000 temperature/salinity profiles and time series observations of essential ocean variables and compilation of mooring data since 1975 (Zhou and Dutrieux, BAS) https://www.seanoe.org/data/00886/99787

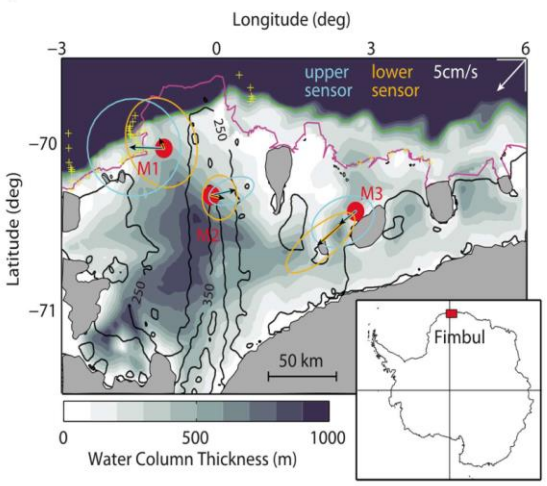


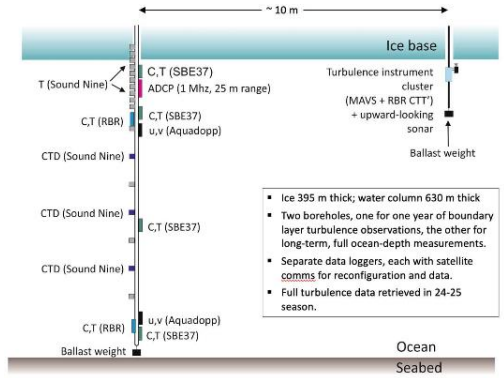
Deployment of new moorings in the Scotia Sea (Abrahamsen, BAS); Noosfera deployments planned for 2024-25

Antarctic research elements: Observing ice shelf processes



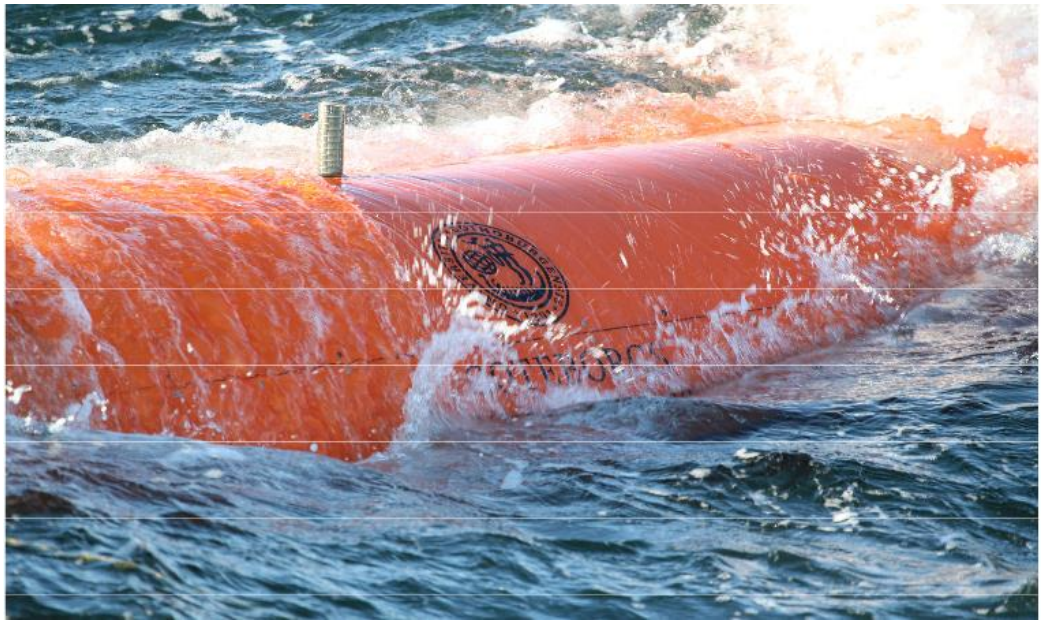






Deployments through Fimbul ice shelf borehole, Hattemann (NPI), and NECKLACE ApRES Nicholls (BAS).

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



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

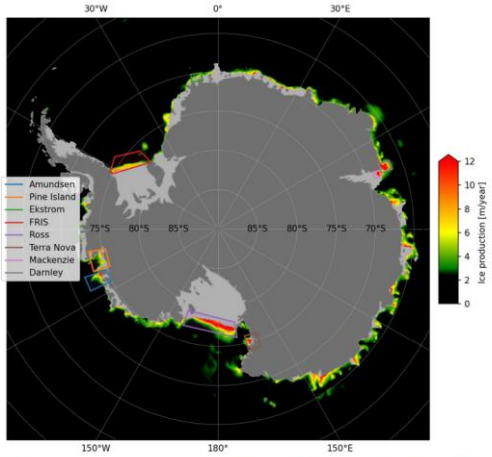
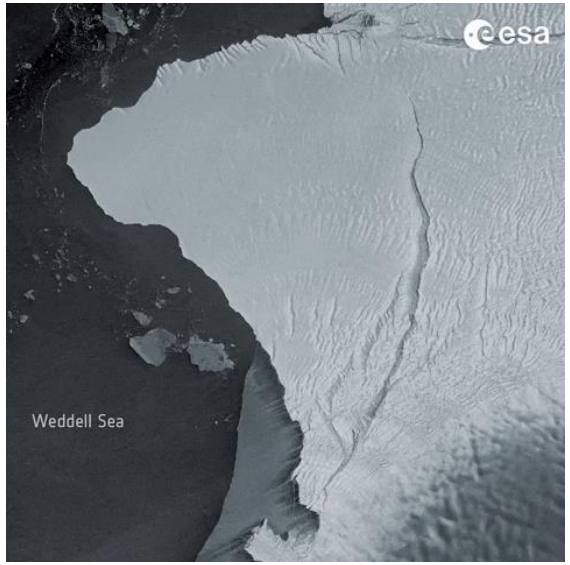


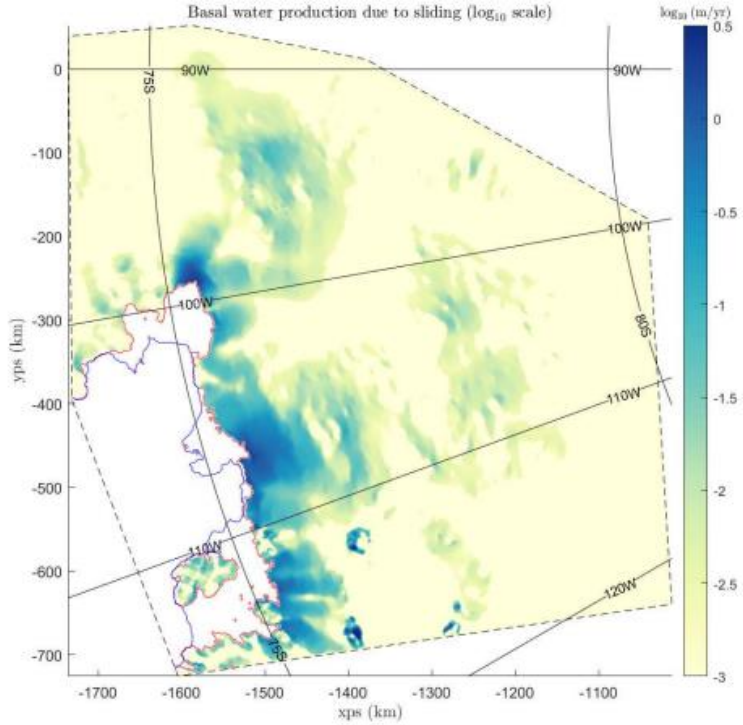
Fig. 2: Map of annual SIP, averaged over 1992-2023, based on the SSMI ASI ice concentration and ERA5 wind speed and surface air temperature. Some selected polynyas are shown with their corresponding colour-coded polygons (own approximations). The SIP colour scale was designed to match Fig 3 in Oshima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

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

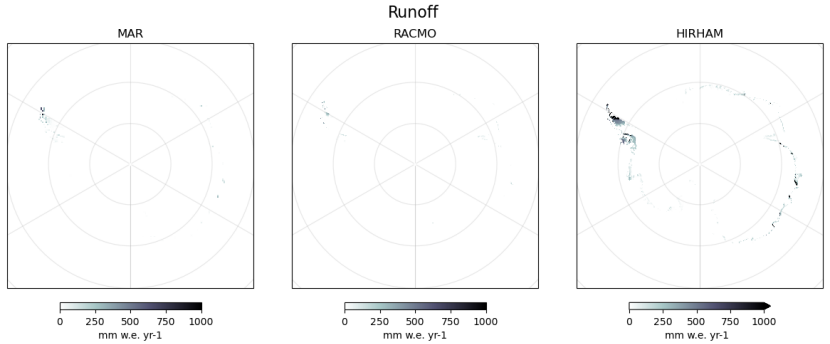
Ice shelf calving, melt and damage from EO data Millan, IGE



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



Gudmundsson, UNorthumbria



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

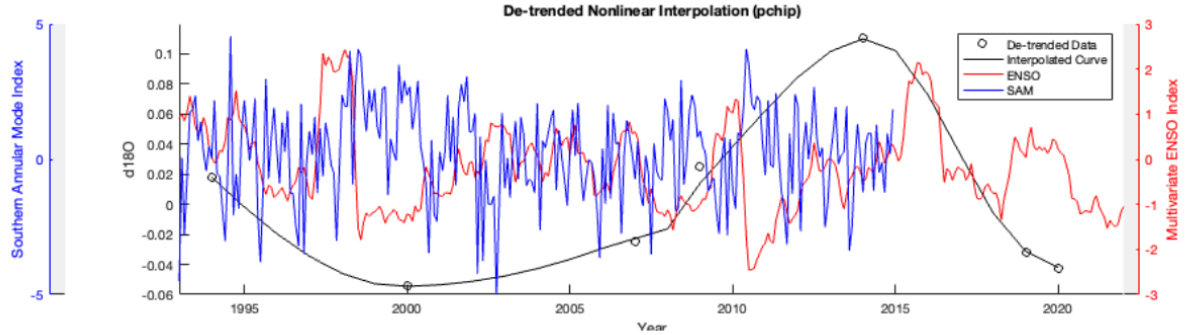
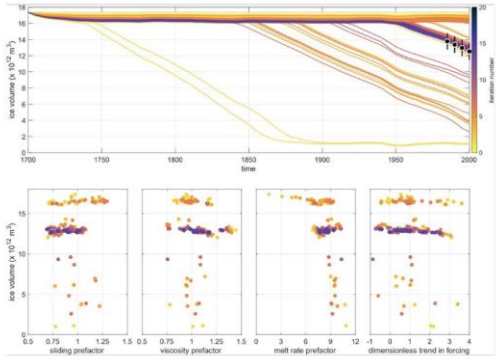


Fig.7: De-trended and interpolated $\delta^{18}O$ time series from the south-eastern Amundsen Sea (73.5°S – 75.5°S; 108°W - 100°W) (in black), overlapped with the El Niño-Southern Oscillation (ENSO; in red) and Southern Annular Mode (SAM; in blue) climatic indexes.

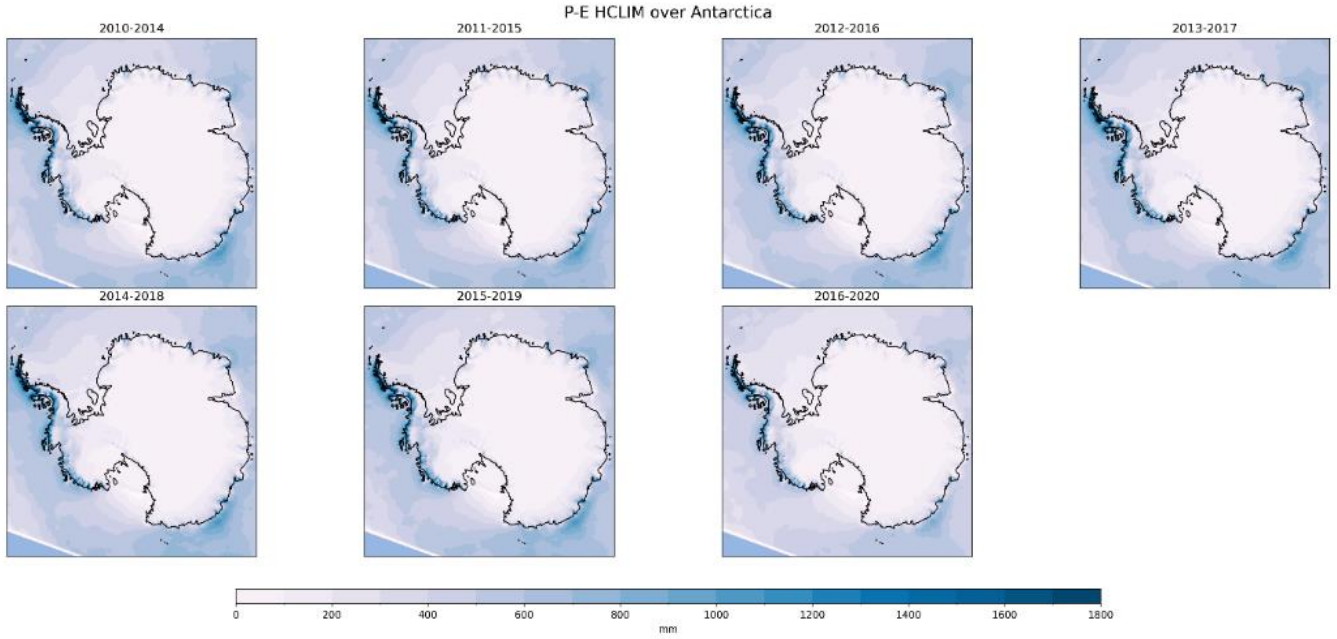
d18O analysis Dabila and Mcdonagh, NORCE

DMI

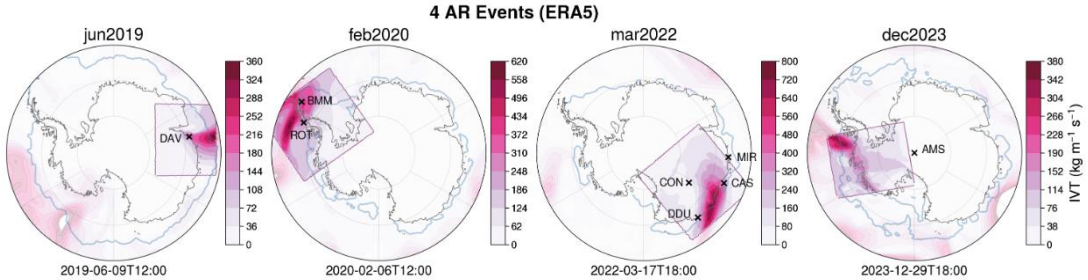
Antarctic research elements: Development of ice sheet models, regional climate models, ice-ocean coupled models, earth system models and data assimilation schemes

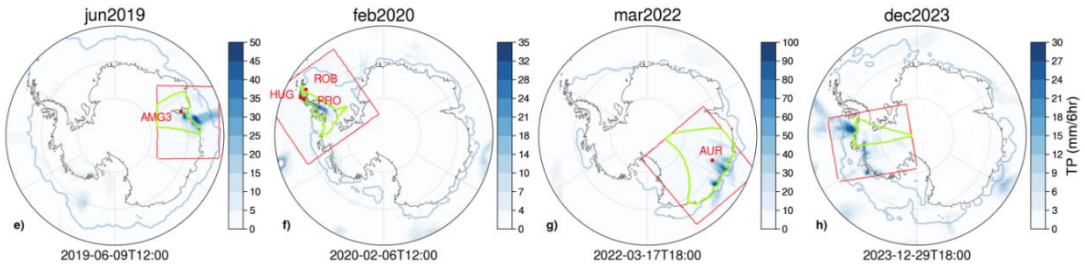


IEnKS for initialising coupled ice - ocean models. Arthern, BAS



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)