



OCEAN:ICE



**Northumbria
University**
NEWCASTLE



**UNIVERSITÉ
LIBRE
DE BRUXELLES**

Ocean-Cryosphere Exchange in Antarctica: Impacts on Climate and the Earth System

Deep Uncertainty in Freshwater Fluxes (DUFF)

2024 Annual Meeting
24 September 2024



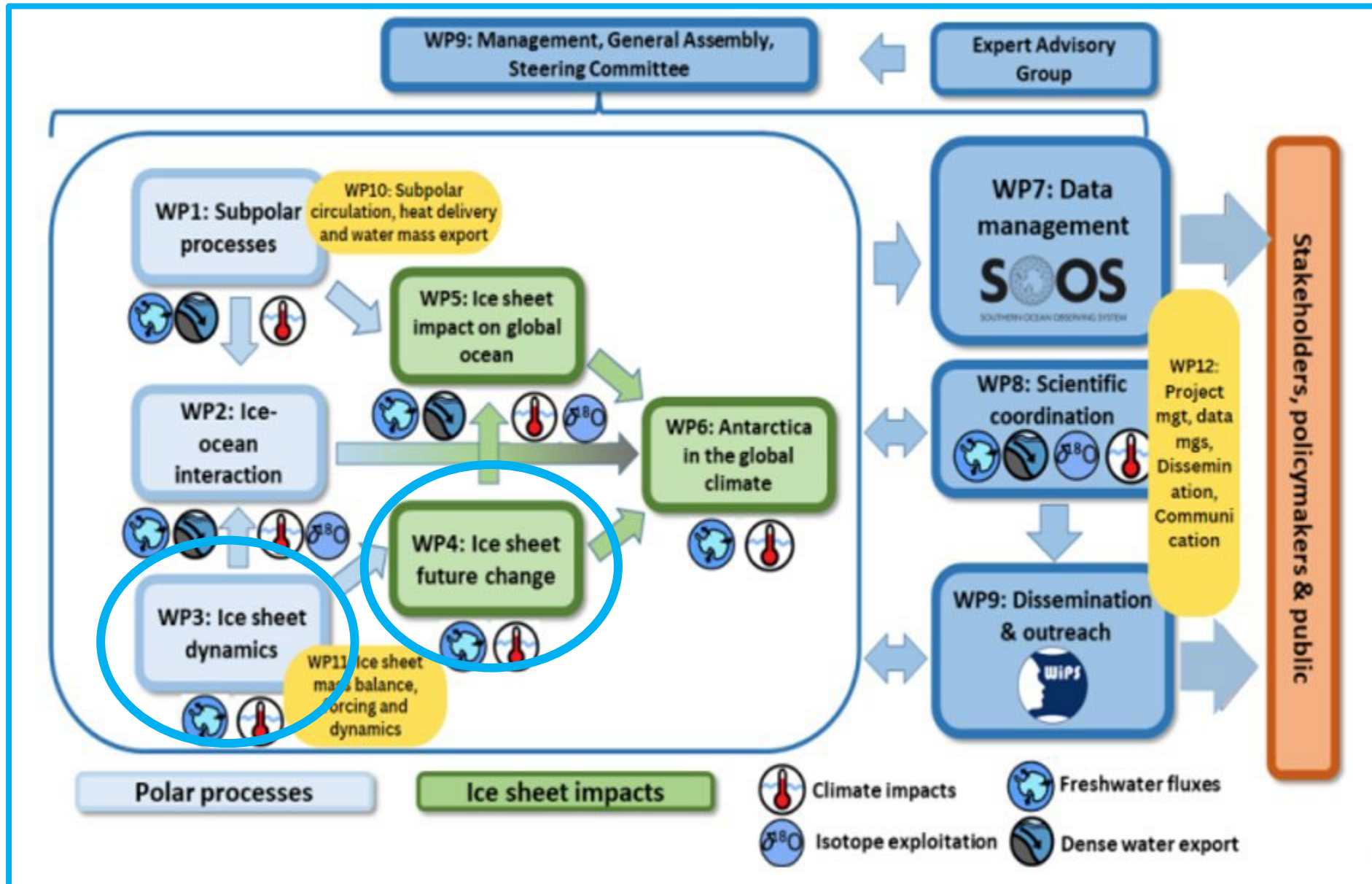
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Deep Uncertainty in Freshwater Fluxes

- **Freshwater fluxes:** The drivers, magnitude and variability of freshwater flux from the polar ice sheets to the ocean is a central theme in OCEAN:ICE.
 - Sub-shelf melt (basal ice shelf mass balance)
 - Calving (discrete or calving rate)
 - Surface melt runoff
 - ...
- **Deep uncertainty** (SROCC): exists when experts or stakeholders do not know or cannot agree on.

Dynamical ice loss (freshwater fluxes) from Antarctica provides an example of lack of knowledge about processes, and disagreement about appropriate models and probability distributions for representing uncertainty.





WP3: Main results achieved (M1-18)

Ice shelf basal melt from satellite data

Ice shelf calving fluxes: $dV = BMB + SMB + GLF - CF$

Freshwater fluxes from surface mass budget processes

Estimation of the basal freshwater discharge from the AIS

B A M S 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 Rodehacke,^{a,d}
Rebecca L. Dell,^e Anna E. Hogg,^f Benjamin J. Davison,^f Stef Lhermitte,^{g,h}
Nicolai Hansen,^{a,i} Jose Abraham Torres Alavez,^a and Martin Olesen^a

WP4

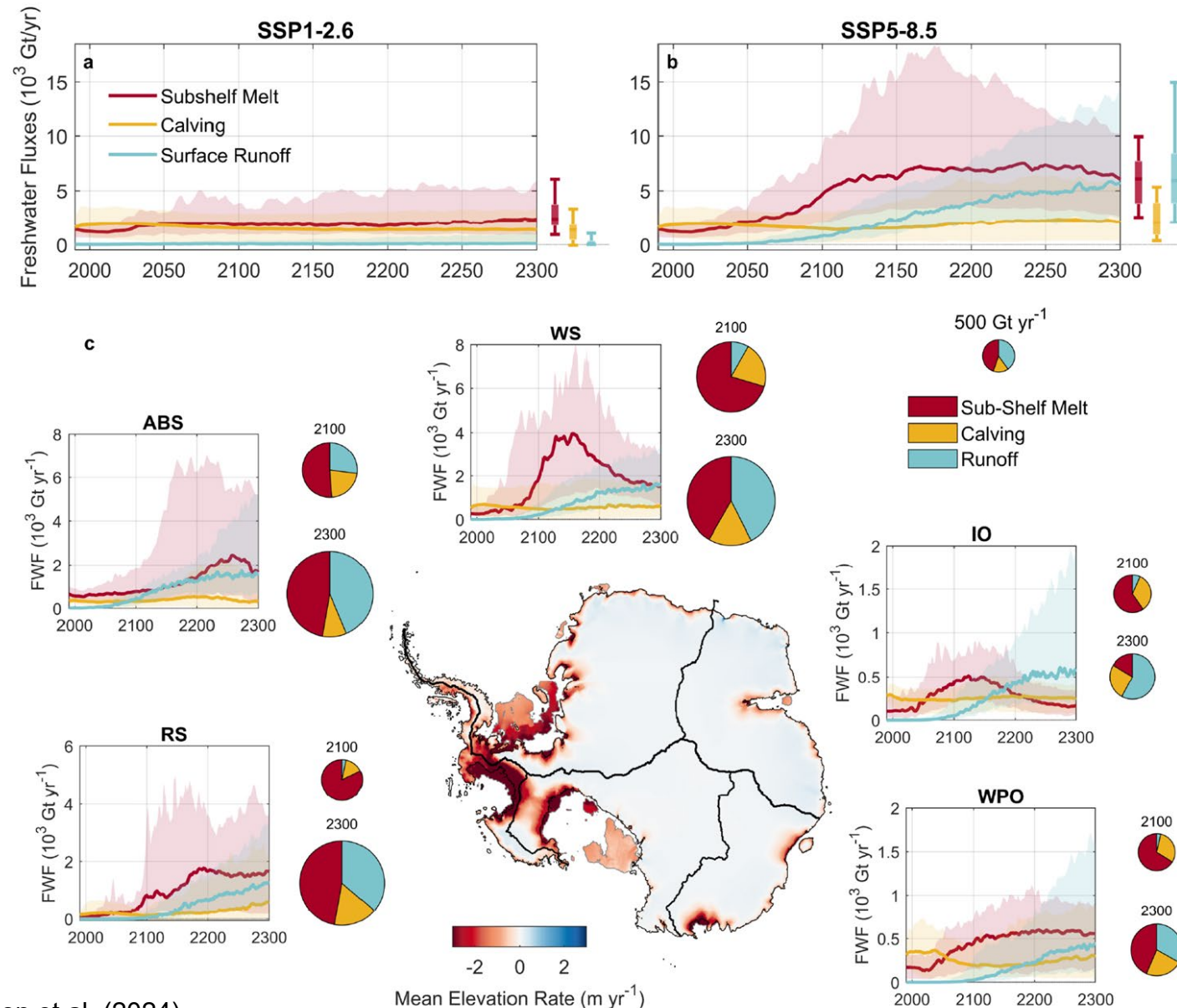
'Fast-track' sensitivity of freshwater fluxes to climate scenarios

Deliverable submitted 30 April 2024

Contributors:

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Dataset available



Coulon et al. (2024)

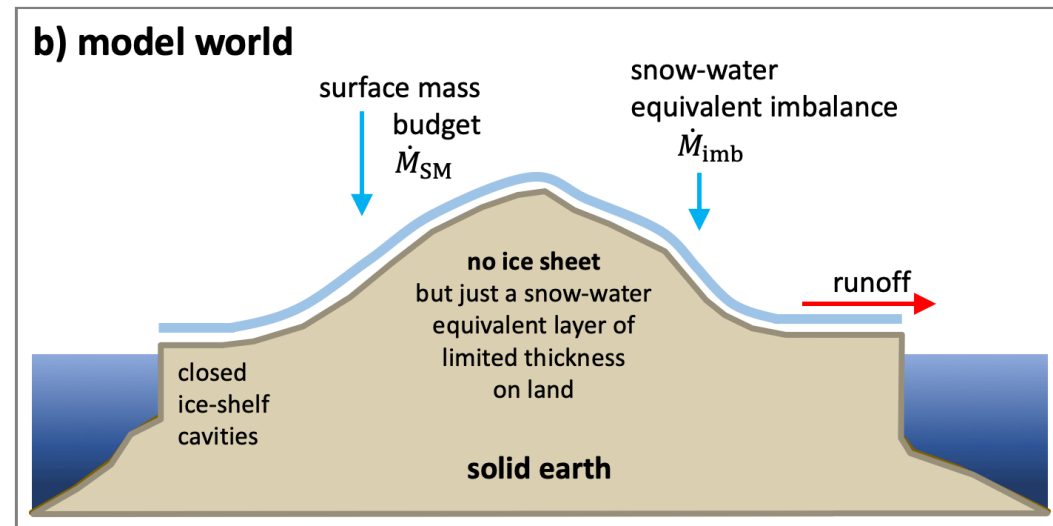
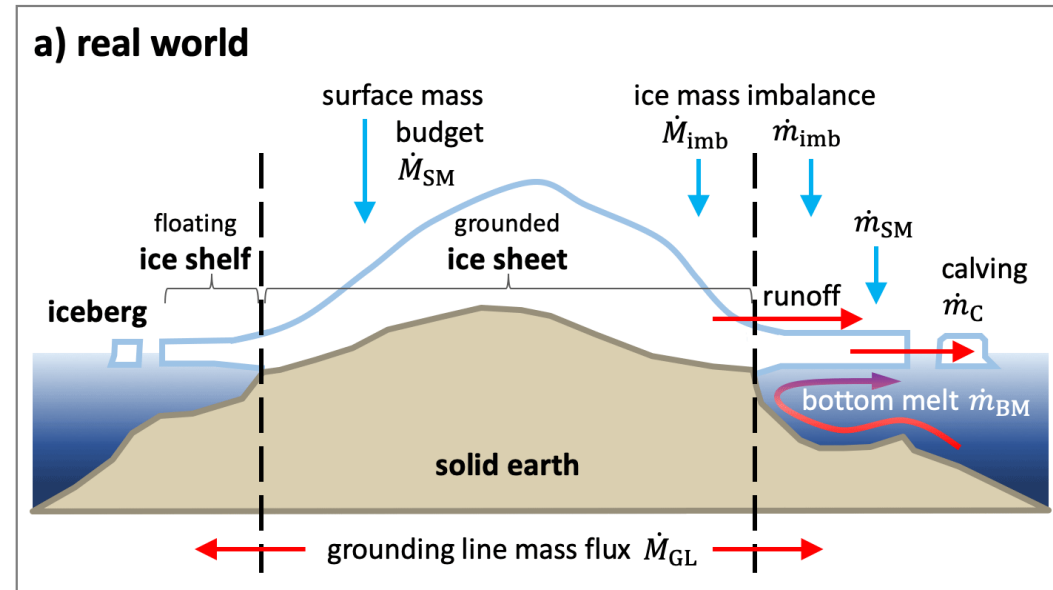
International initiatives

The Southern Ocean Freshwater Input from Antarctica (SOFIA) Initiative

Swart et al.: The Southern Ocean Freshwater Input from Antarctica (SOFIA) Initiative: scientific objectives and experimental design, Geosci. Model Dev., 16, 7289–7309, <https://doi.org/10.5194/gmd-16-7289-2023>, 2023

Online workshop organized by Gavin Schmidt in Feb 2024 (participation of several ocean:ice partners)

Paper in preparation: Datasets and protocols for including anomalous freshwater fluxes from melting ice sheets in climate simulations



Deep uncertainties and outlook

How to consider “unknown unknowns”?

To MICI or not to MICI

Coulomb friction + subglacial hydrology

Damage and link with hydrofracturing / visco-elastic processes

Timing of ice sheet collapse (WHERE and WHEN, less so HOW MUCH)

Integration with SOFIA

Fast track : exploit WP3/4 results in WP5/6

From fast track to full track: next steps towards integration of FF in OCEAN:ICE

Meetings: February (online FWF workshop) + May 2024

