# **WilkesMIP**: an ice-sheet model intercomparison project for the Wilkes Subglacial Basin, Antarctica

Motivation

The Wilkes Subglacial Basin (WSB) is considered to be one of the most likely sectors of East Antarctica to retreat under future warming. It holds approximately 3-4 m sea-level-equivalent ice volume (Rignot et al., 2019; Crotti et al., 2022), meaning that even a relatively small amount of ice loss from this region could have significant global consequences.

We propose a regional-scale ice sheet modelling intercomparison project - **WilkesMIP** - with which to better understand the sensitivity of this critical area. This MIP is open to all ice-sheet modellers, and adopts a 'come-as-you-are' approach to enable groups to contribute easily using their existing model configurations. Groups who have participated in ISMIP6 or ISMIP2300 for Antarctica could for example use their ISMIP setup as their initial conditions.

Aims

Specifically, the MIP will address two primary questions:

1) What are the ocean and atmospheric temperature thresholds for WSB grounding line retreat?
2) What are the early-warning indicators of this retreat?

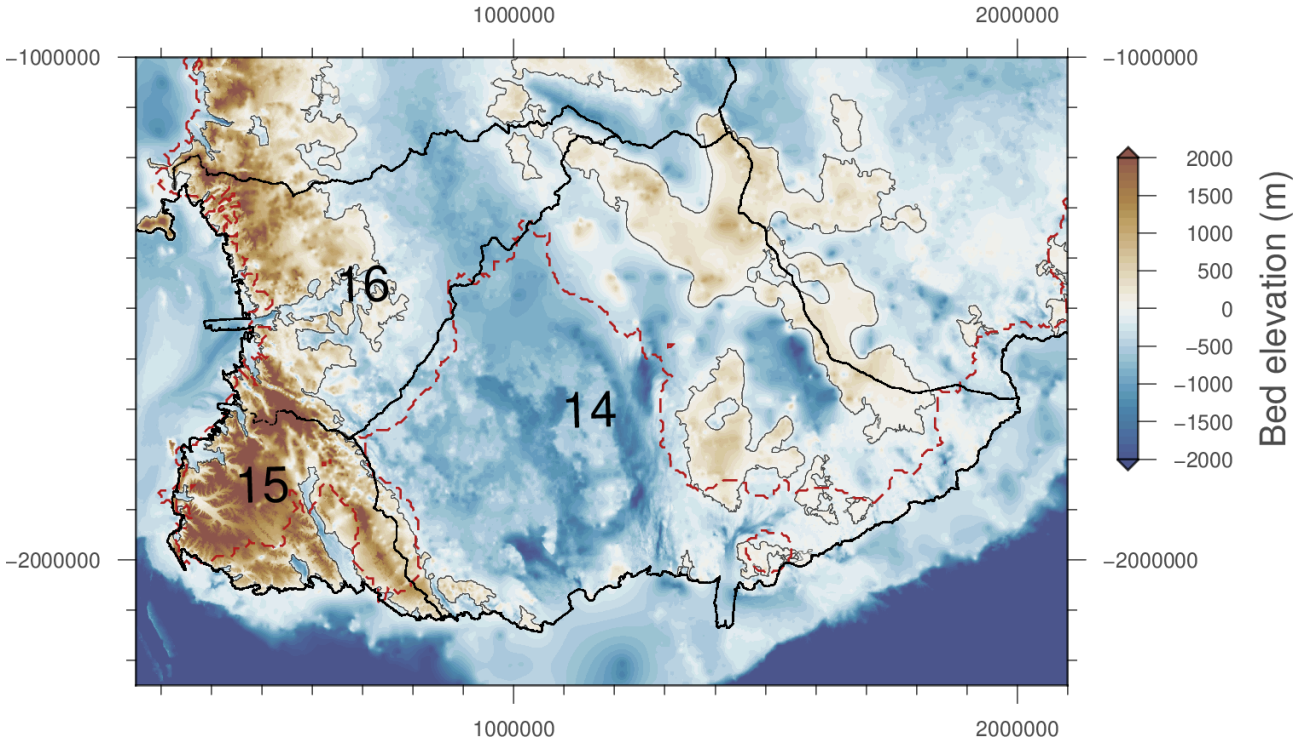


**Figure 1:** *Map of Wilkes Subglacial Basin, East Antarctica, showing IMBIE catchment boundaries (black lines) and modelled grounding line during retreated Pliocene extent (red dashed line).*

Approach

- All experiments should start from a present-day state

- Key input fields can be provided if required, but groups are free to use their own
- Experiments should be run for 100, 500, 1000 or 5000 years depending on resources available. The longer timeframes will be useful for quantifying the slow retreat into the inner basin.
- Submissions can be made for any domain that includes the full extent of IMBIE catchment 14, and ideally 15 & 16 as well (Figure 1, above). This could be a regional simulation, or data can simply be extracted from whole continent simulations if preferred.
- Preference is for high-resolution (< 5 km) simulations (ideally < 2km if possible)
- The preferred experimental ensemble consists of 16 instantaneous and time-invariant climate anomalies: 4 air temperature anomalies (1, 2, 4, 8 K) combined with each of 4 ocean temperature anomalies (0.5, 1, 2, 3 K)
- Anomalies should be imposed as spatially uniform deviations from each model group's preferred present-day state
- Precipitation anomalies should also be imposed if possible, based on a local Clausius-Clapeyron relationship of 6.8% / K (based on ice core-derived relationship at nearby Talos Dome, Frieler et al., 2015). i.e ppt(T) = ppt(PD) x 1.068^(T)
- A single control experiment of the same duration as the perturbation runs should also be included. This would simply be a time-evolving simulation under constant present-day climate.
- We hope to bring the results together to train a statistical emulator and use this to simulate unexplored temperature combinations
- Model sensitivity may also be explored if sufficient comparable submissions are available - for example, role of different ice flow or mass balance parameterisations, inclusion of isostasy etc

<u>Requirements</u>
To ensure that results from participating models are comparable, it would be useful if contributing models are able to:

- simulate floating and grounded ice, and the transition between them
- compute surface mass balance from temperature and precipitation
- compute ice-shelf basal melt from ocean temperature, or impose pre-computed basal melt rate anomalies using an established conversion (eg 10 m yr-1 K-1; Rignot & Jacobs, 2002)
- calculate isostatic adjustment of bedrock (desirable but not essential - mainly relevant for the longer runs, i.e. 1000, 5000 yrs)
- output timeseries and spatial fields for key variables in netCDF format, with spatial fields using rectangular polar stereographic coordinates where (0,0) represents the

pole and distances are in metres. For consistency, we suggest adopting the ISMIP6 / ISMIP2300 naming convention for variables and file names.

Timeline and outputs

Once model outputs are ready, please email nicholas.golledge@vuw.ac.nz for details on data transfer. We hope to have enough initial results to present at CliC (Wellington, February 2026), with a more detailed / final compilation for SCAR (Oslo, August 2026). A manuscript detailing the results will be prepared during 2026, and will include all participating individuals as co-authors.

Project coordination

WilkesMIP will be led by Nick Golledge (Victoria University of Wellington, NZ), with assistance from Dan Lowry (University of South Florida, USA), Chen Zhao, Yu Wang, and Poul Christoffersen (University of Tasmania, Australia).