RINGS probing into the Antarctic Ice Sheet margin

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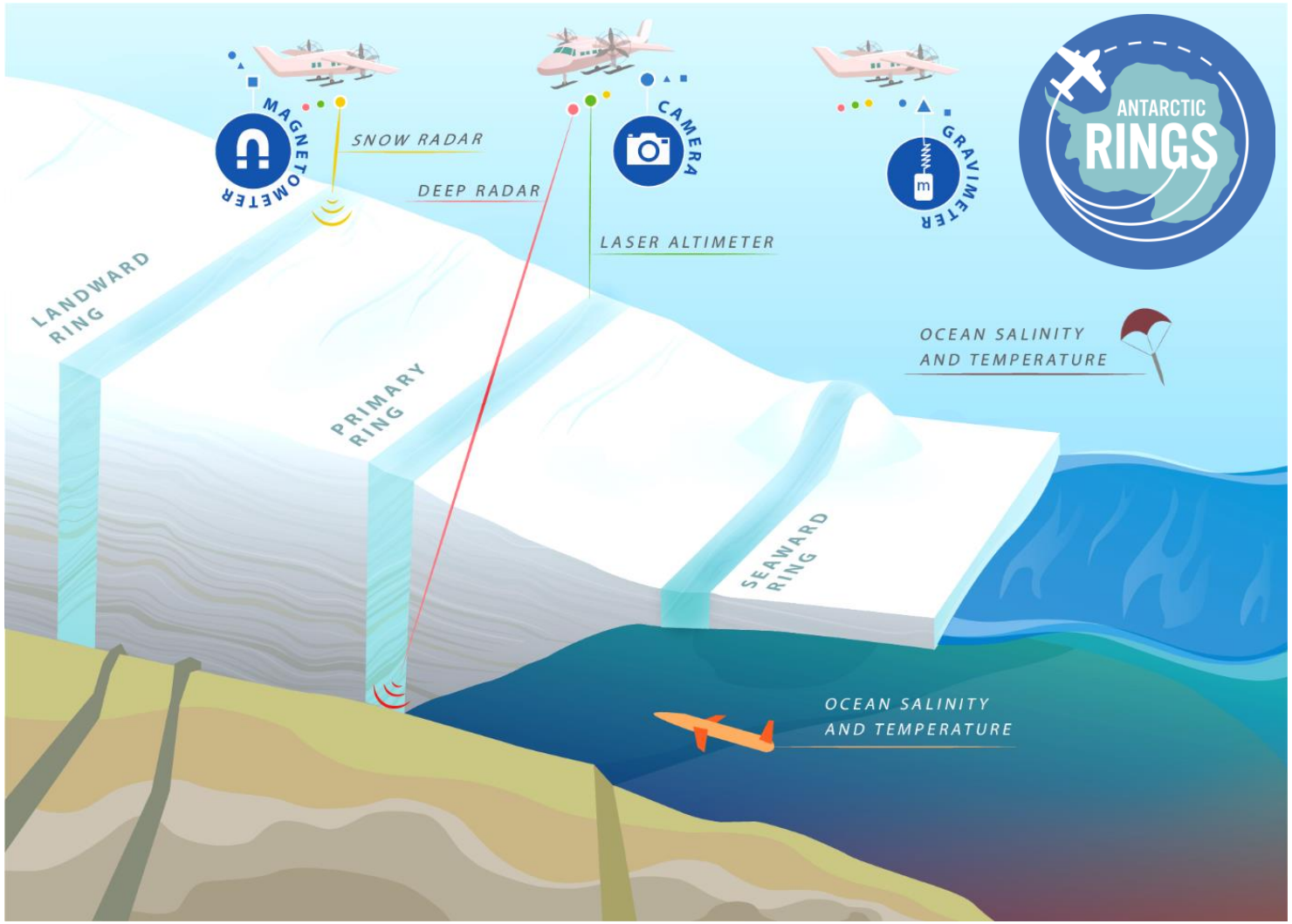
On behalf of
the SCAR Action Group Antarctic RINGS

RINGS surveys all around Antarctica

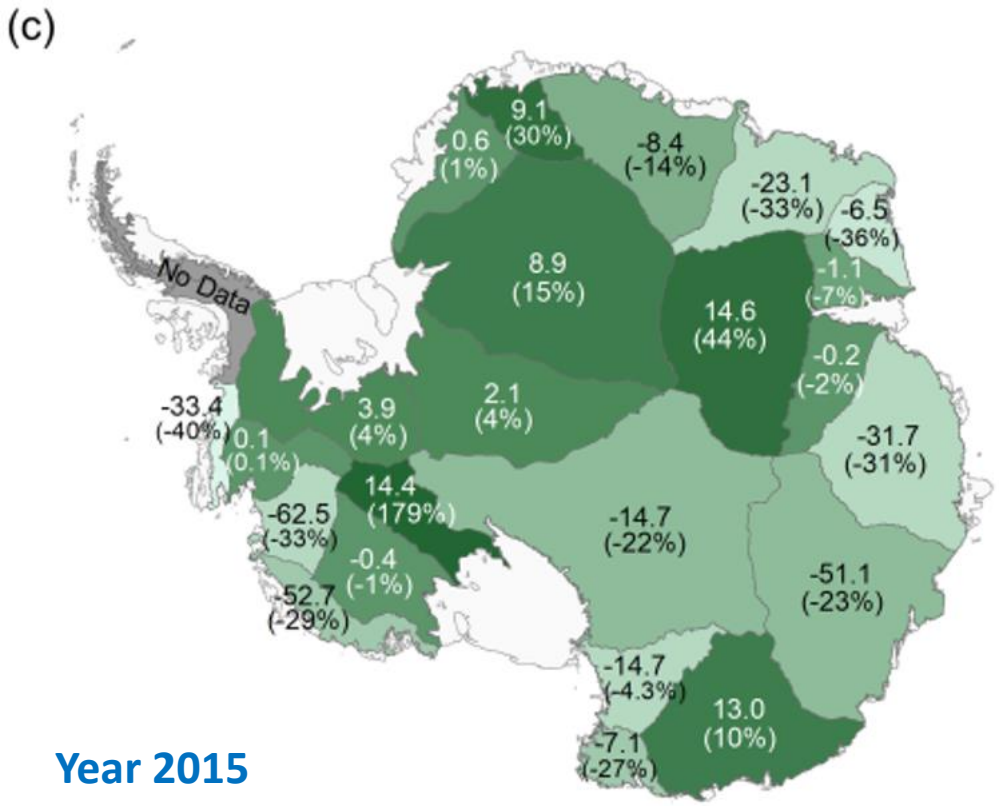


- **Primary RING**: at the current grounding line
- **Landward RING**: 10s km inland of the current grounding line
- **Seaward RING**: over ice shelves and ice rises
- **Deep sounding radar and gravimeter**
- **Shallow-sounding radar**
- **Magnetometer**:
- **Laser altimeter and camera**:
- **Ocean sensors**

Illustration: Hasan Abbas (GRID-Arendal) and RINGS Action Group

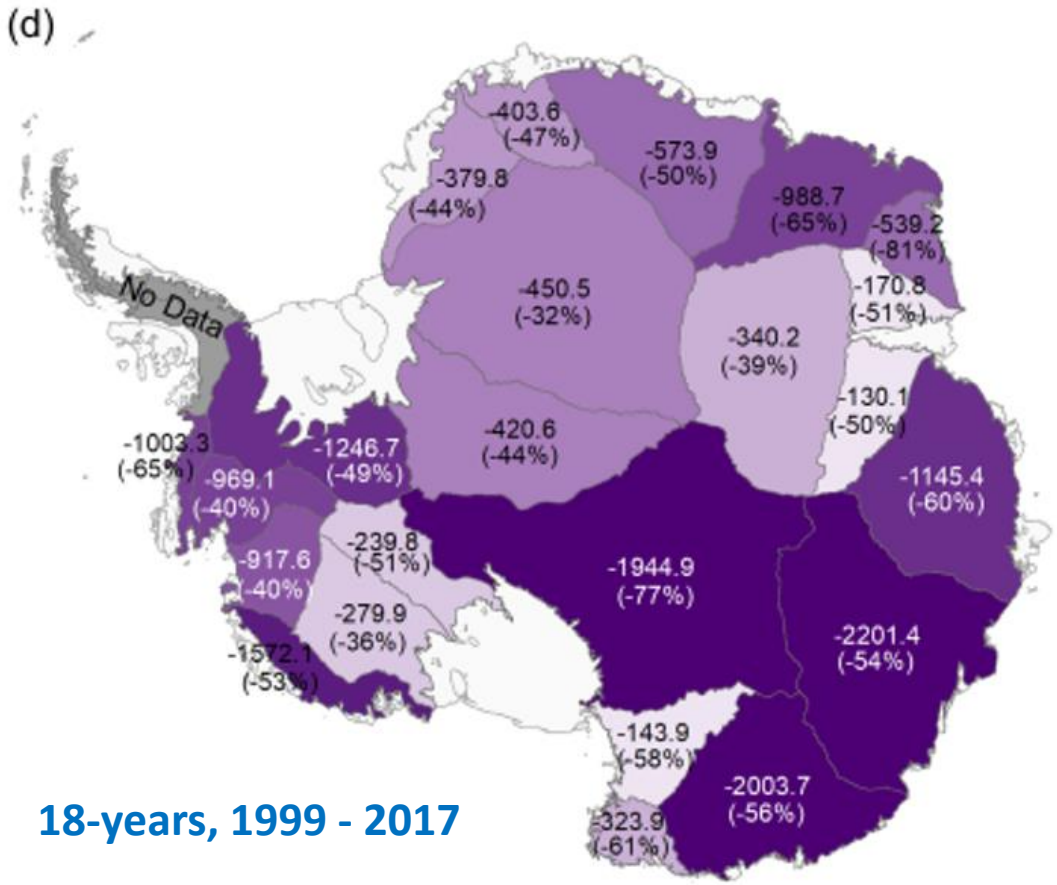
Discrepancies between ice-discharge estimates

Miles et al. (2022) - Gardner et al. (2018)



Year 2015

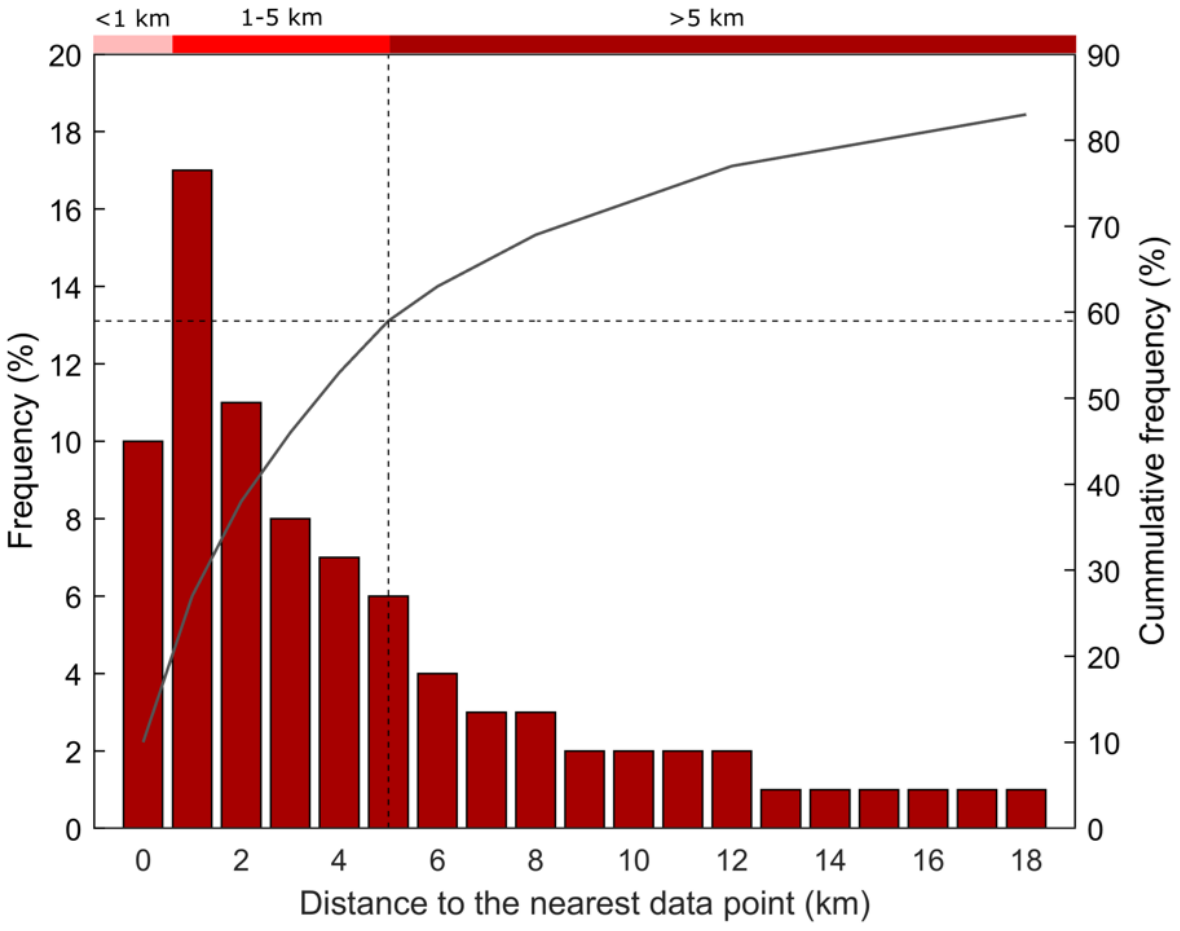
Miles et al. (2022) – Rignot et al. (2019)



18-years, 1999 - 2017

Fig. 4 of RINGS paper, Analysis: Anirudha Mahagaonkar (NPI) et al.

Some glaciers have much better data coverage but there are no regions with adequate data



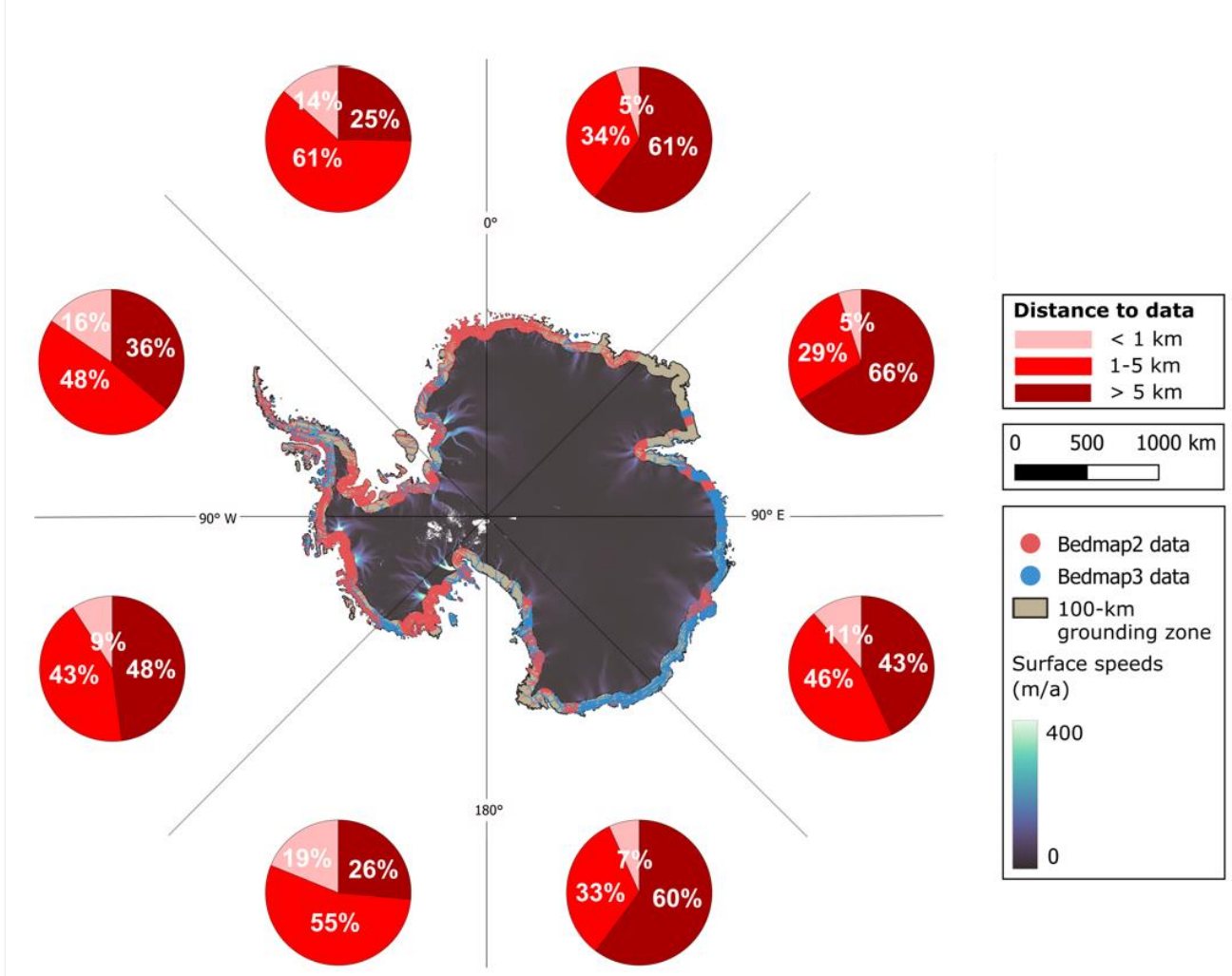
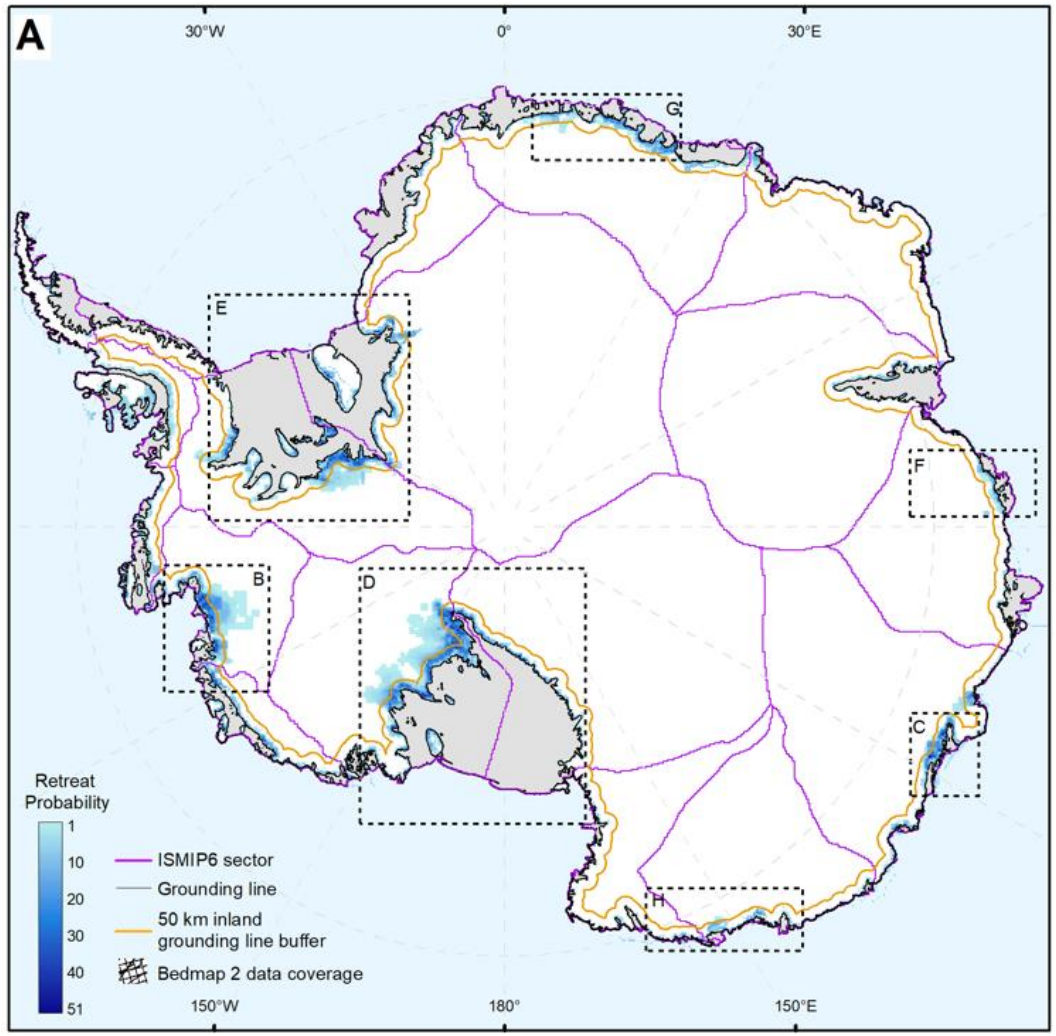
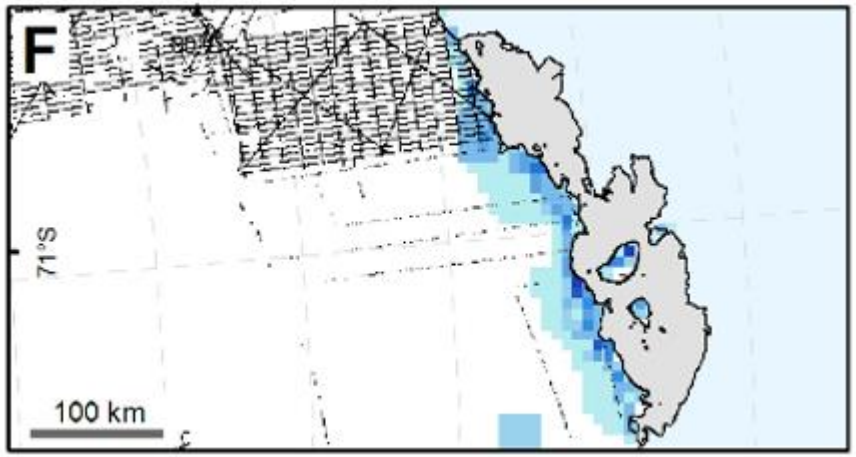
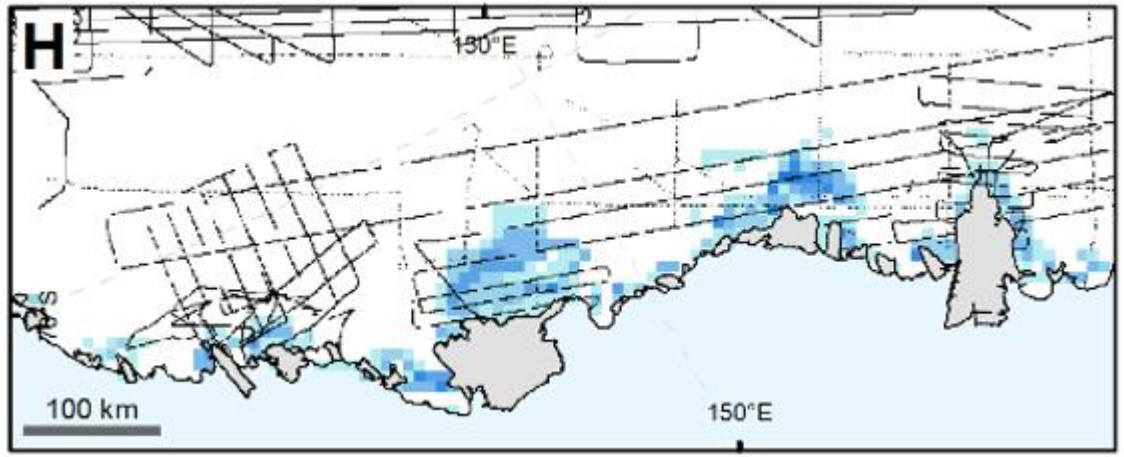


Fig. 20 of RINGS paper, Analysis: Julien Bodart (Univ. Bern) et al.

ISMIP6 ice-sheet-model comparisons show a large uncertainty in future Antarctic retreat

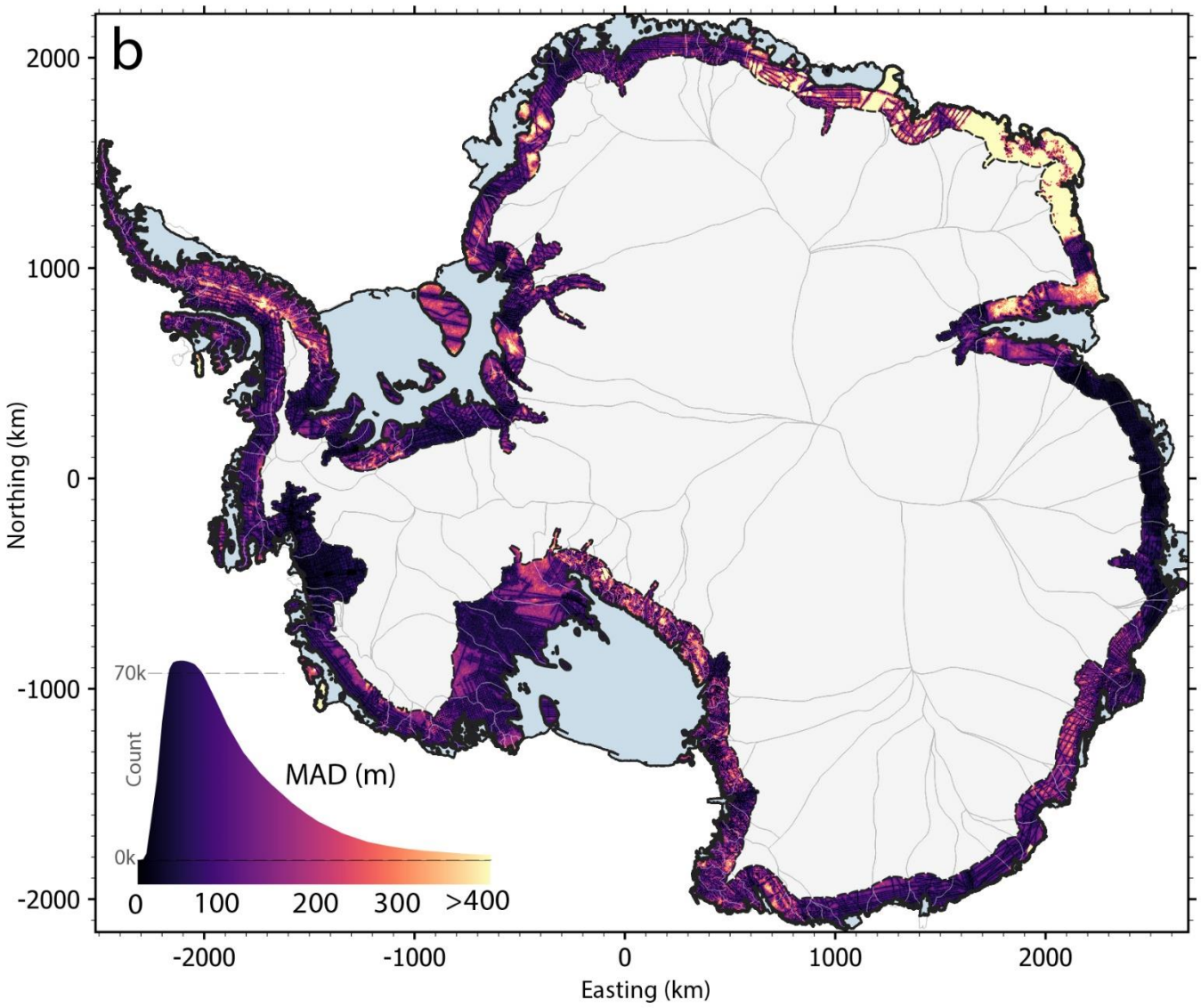


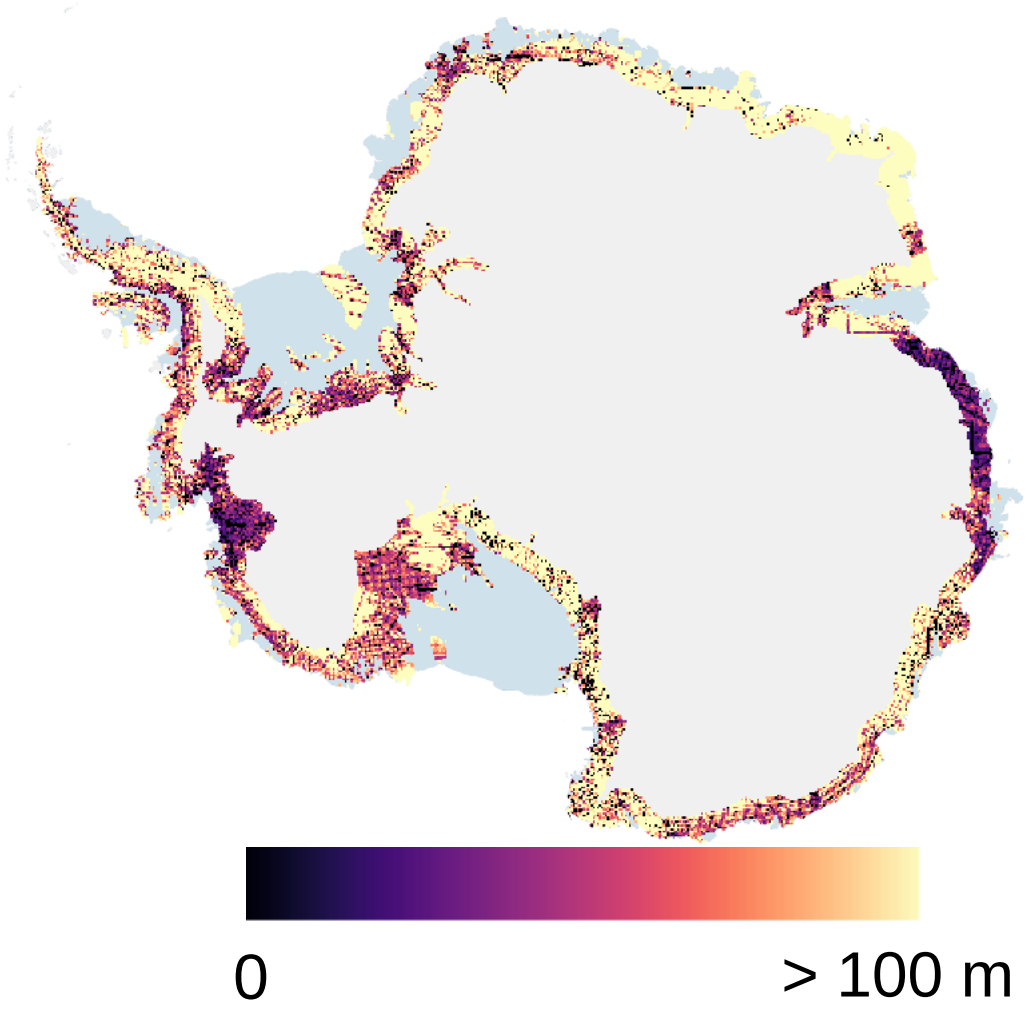




Data source: Seroussi et al. (2020; TC). Analysis: Jenny Arthur (NPI)

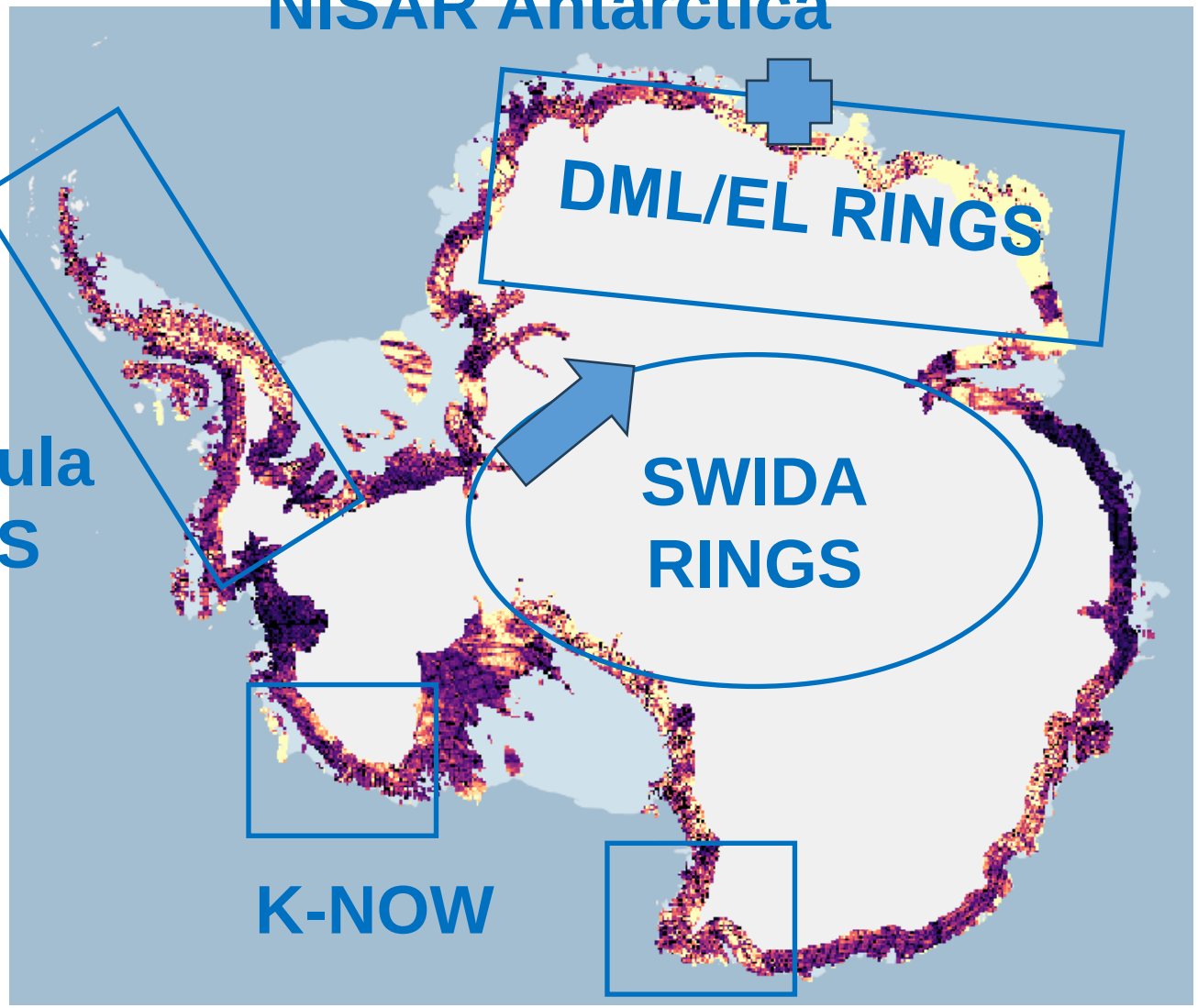
Quantifying bed elevation uncertainties in the ice-sheet margin





Shackleton and Matsuoka (in prep)

Ongoing/emerging regional RINGS efforts



RINGS-endorsed projects

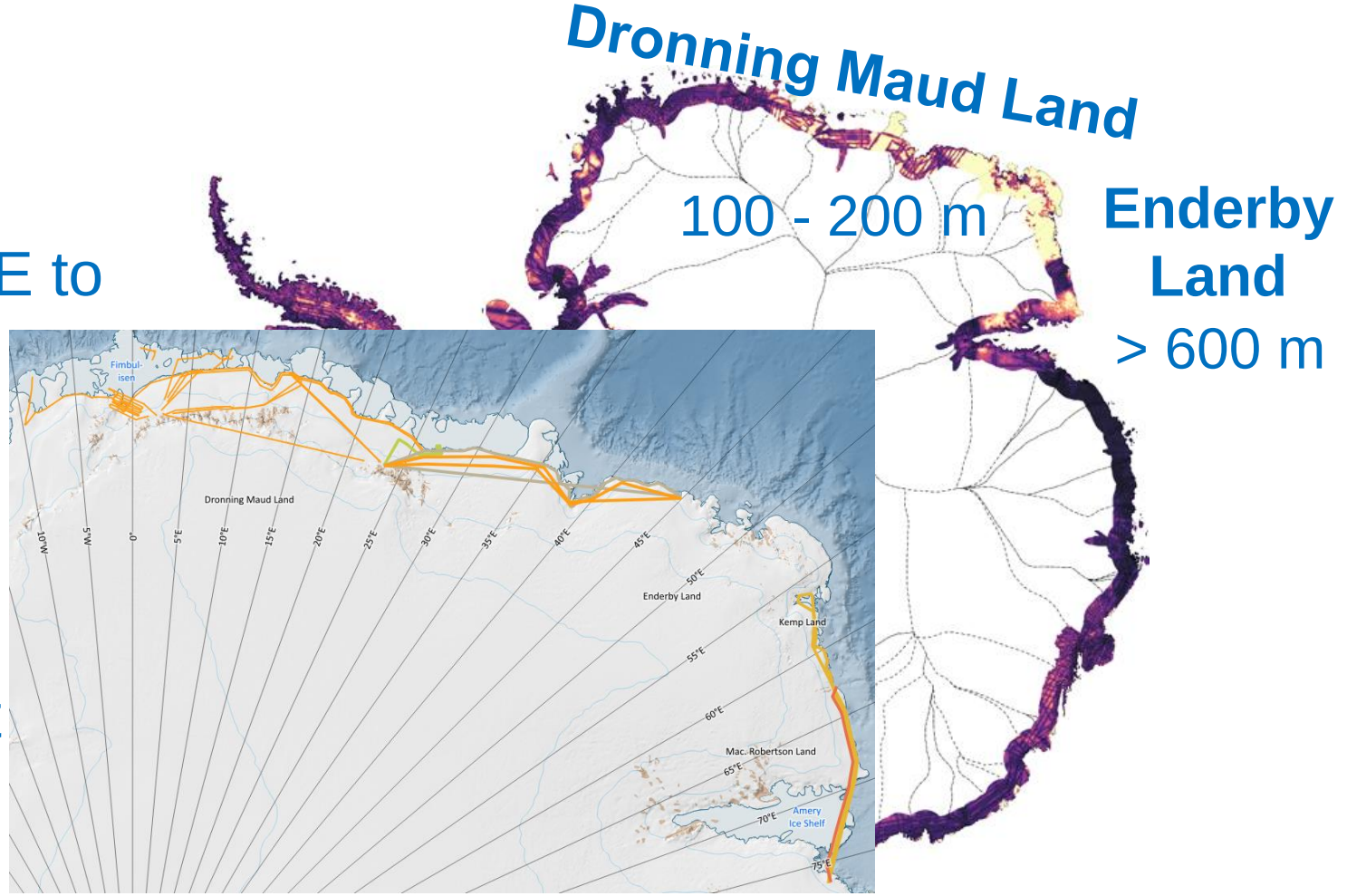
- **DML/EL RINGS**: led by NPI and AWI
- **SWIDA RINGS**: led by DTU
- **NISAR Antarctica**: led by UC Irvine
- **K-NOW**: led by KOPRI

Ongoing regional project development

- **Peninsula RINGS**: led by CECs, Chile

First RINGS surveys in the last 23-24 season

- In Dronning Maud Land and Enderby Land.
- Collaboration of 10 nations.
- The Primary RING is compelte from 10W to 45E, and from 56E to 75E.
- The first landward RING is establsihed from 4E to 26E.
- Local seaward RINGS is established at Jutulstraumen Glacier with steep sidewalls.
- Enderby Land was probed first time from 75E to 56E.

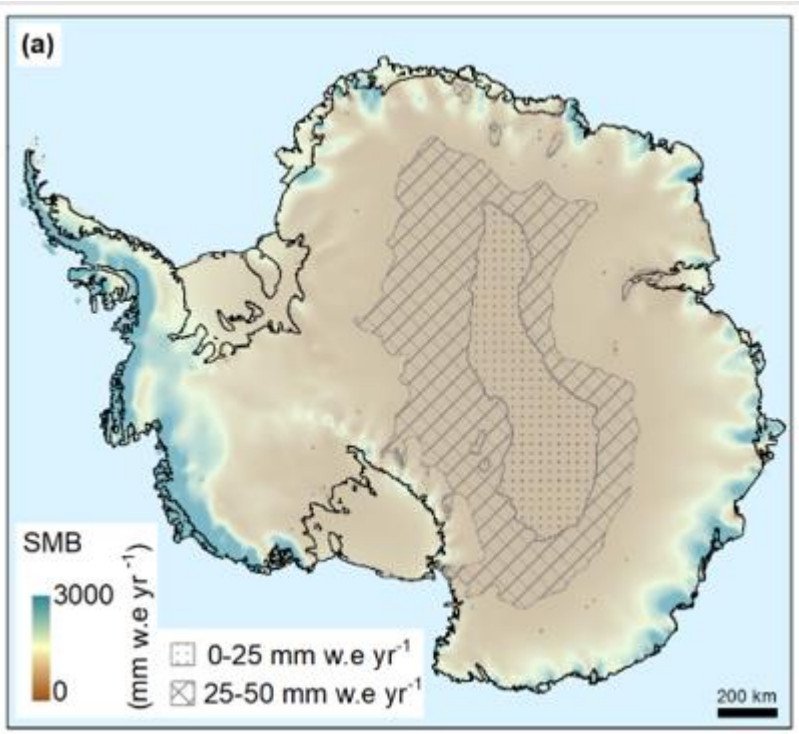


(non-exclusive) RINGS's key science questions

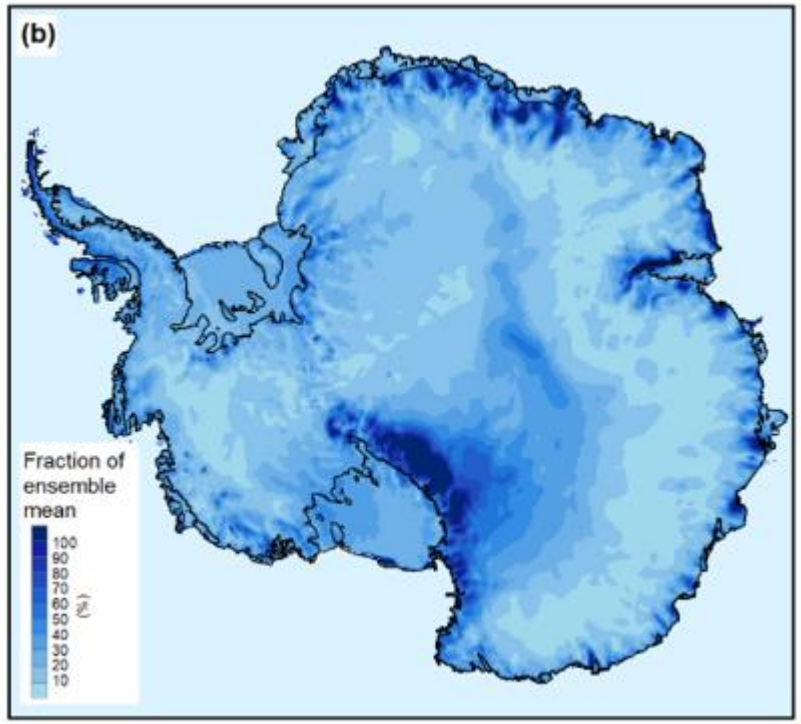
	First priority	Second priority	Third priority
Primary RING	Ice-flow discharge	Small-scale bed structure	Subglacial water discharge
Seaward RING	Oceanic melt/refreeze	Ocean heat transport	Ice-shelf stability
Landward RING	Basal friction	Surface mass balance	Long-term ice-sheet evolution

Large discrepancies between modeled SMB

Ensemble mean 1987 - 2015 (COSMO-CLM, HIRHAM5, MetUM, MAR v.3.10, RACMO2.3p2)

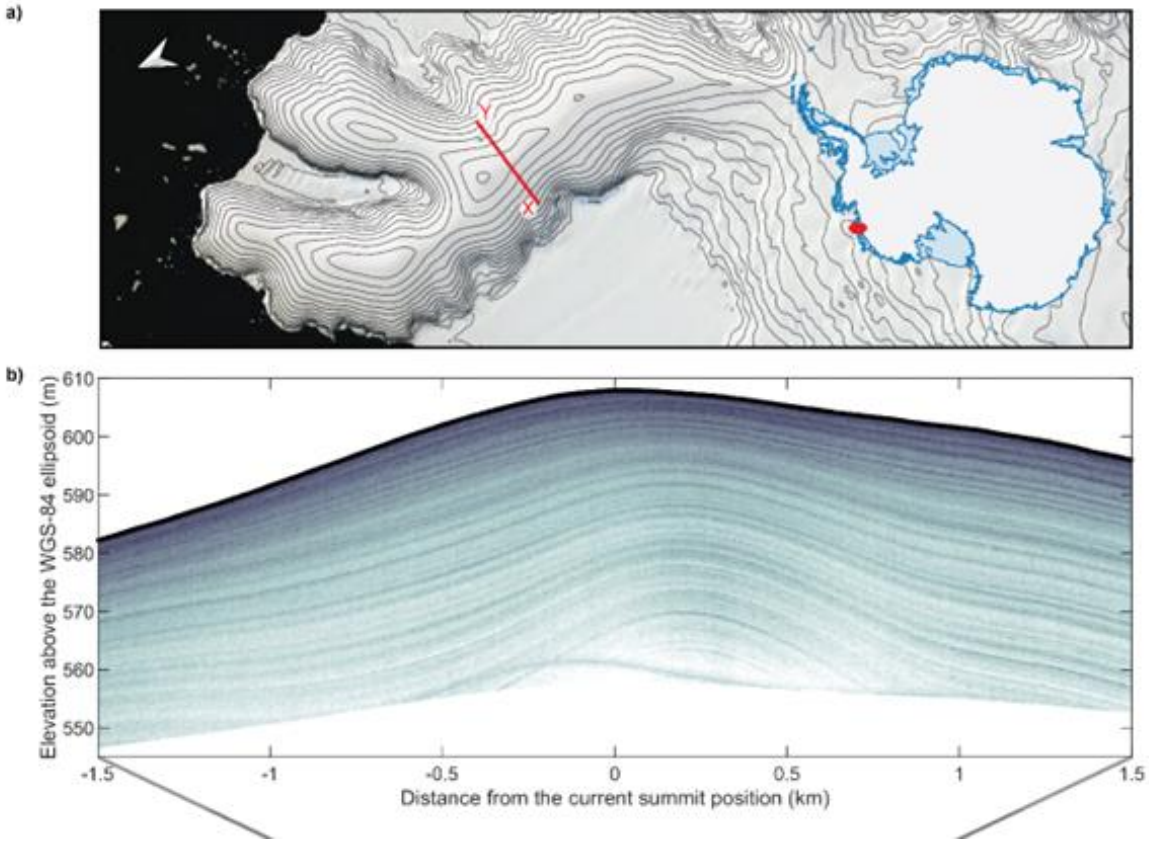


Ensemble standard deviation



Model data compiled by Mottram et al. (2021, TC), Analysis: Jenny Arthur (NPI) et al.

Shallow radar reflectors can constrain SMB



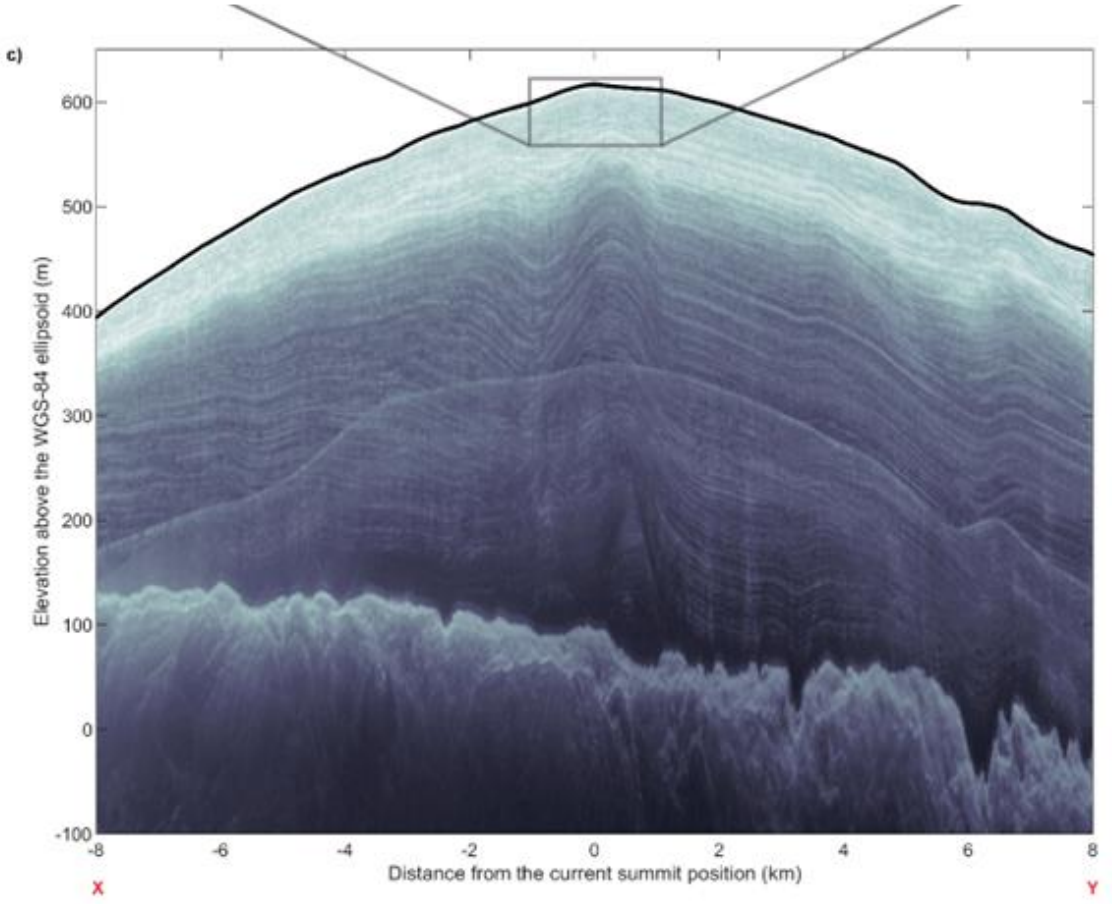
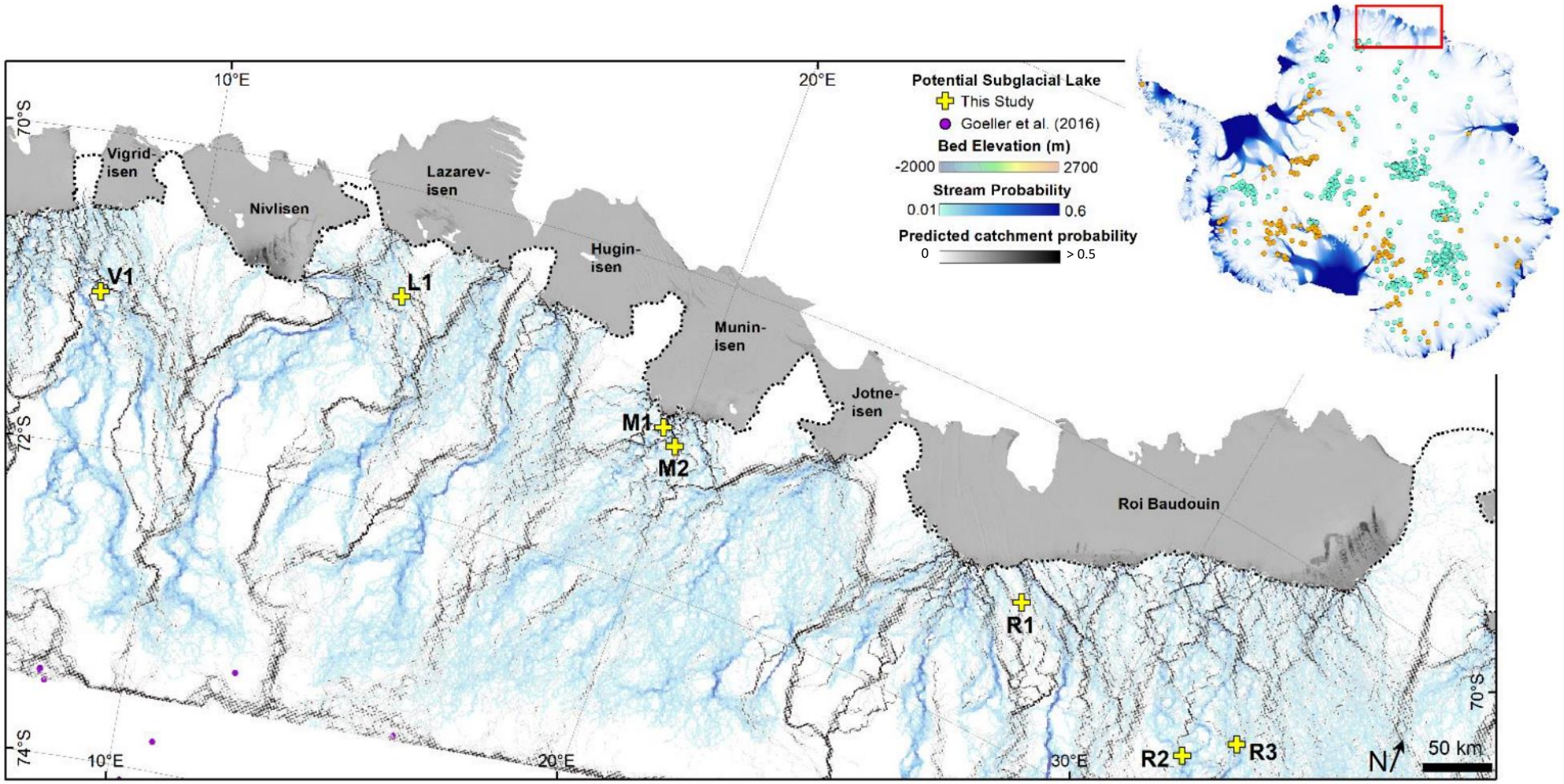


Fig. 15 of RINGS paper, NASA OIB Data, Re-processing: Jilu Li (Univ. Kansas)

New topography knowlege can deliver more precise locations of sugblacial water outlets



Arthur, Shackleton, … Matsuoka et al. (in review, TCD)

Take Home Messages

- Antarctic RINGS is filling data gaps in the Antarctic Ice Sheet margin primarily using airborne geophysics and eventually improves estiamtes of the current and future ice-sheet mass balance.
- RINGS is **not** a club of radar nuts. It is an open community of ~100 members, incldуing EO and model specialsits, with various expertise including atmospheric sciences and oceanography.
- RINGS membership is individual and open for all interested professionals.
- RINGS endorses proposals and funded projects to reach our goals.
- RINGS shares data openly and follows our own EDI policy.

RINGS Shared Values