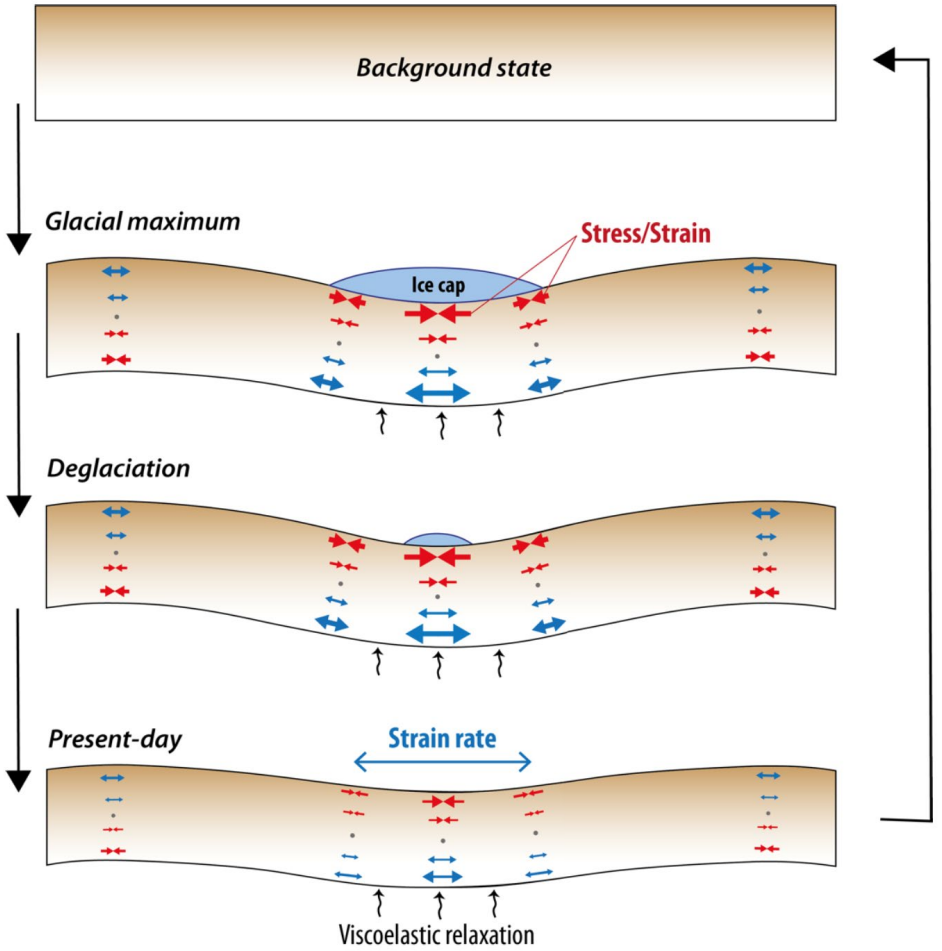
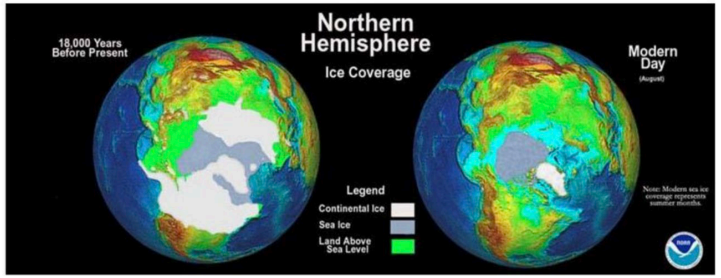
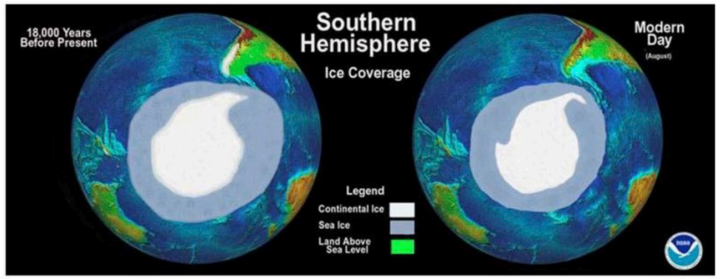
Kaixuan Kang

The Effect of Lateral Viscosity Variations on Local Sea Level and Bedrock Deformation in Antarctica

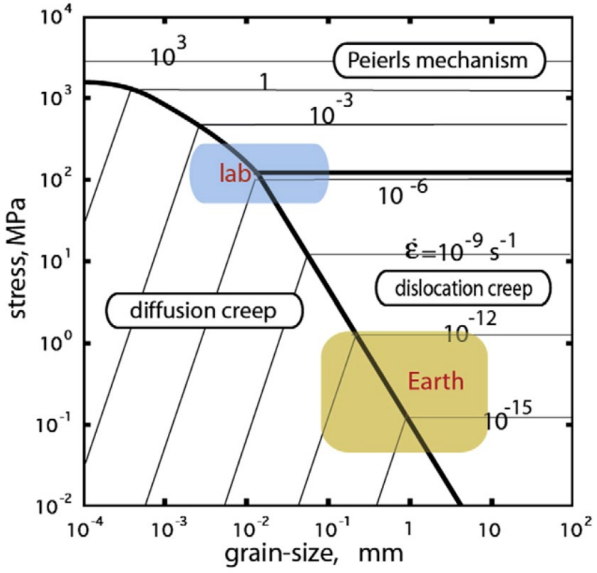


Ice Loading

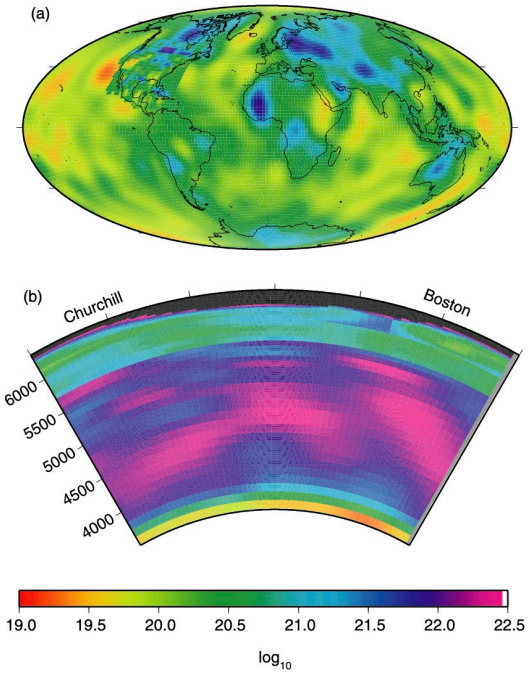




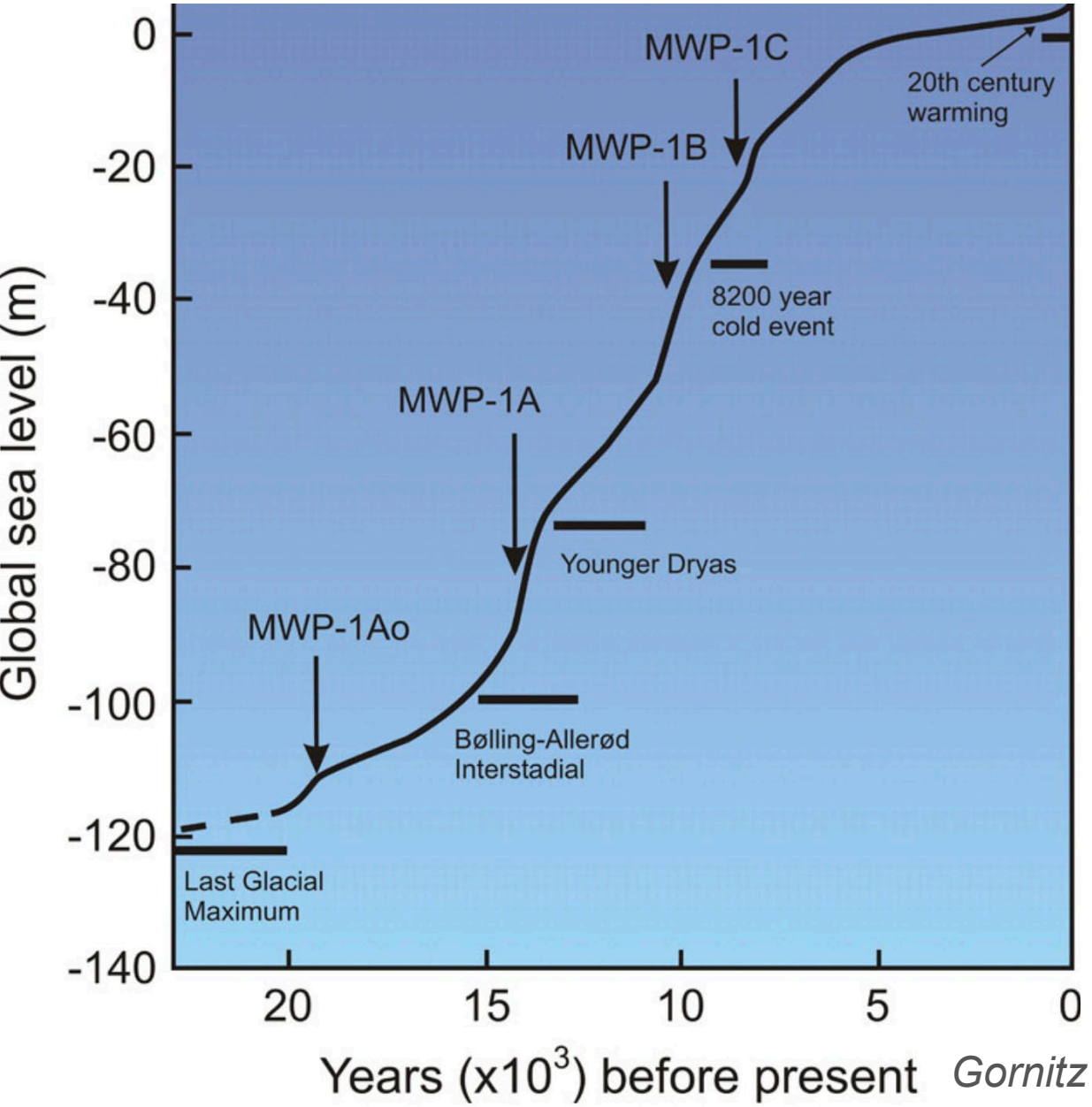
Earth Model



Karato et al., 2010

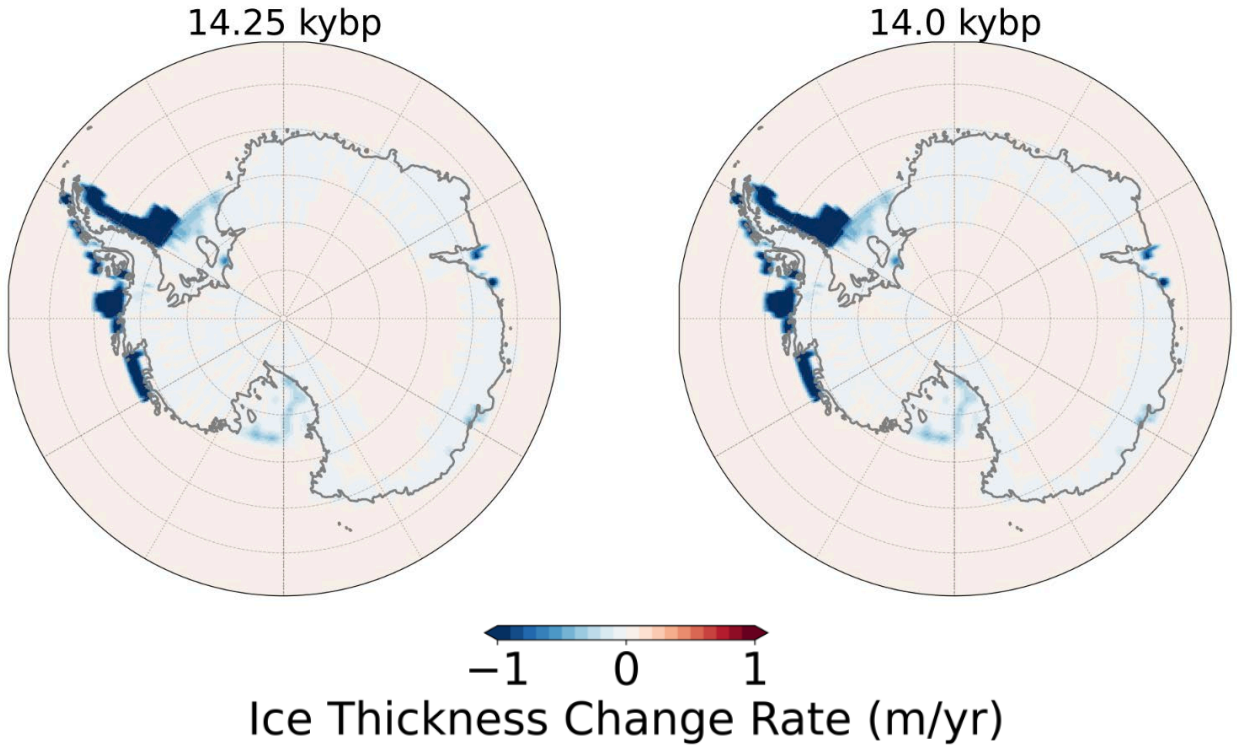


Antarctic ice sheet evolution since Last Glacial Maximum



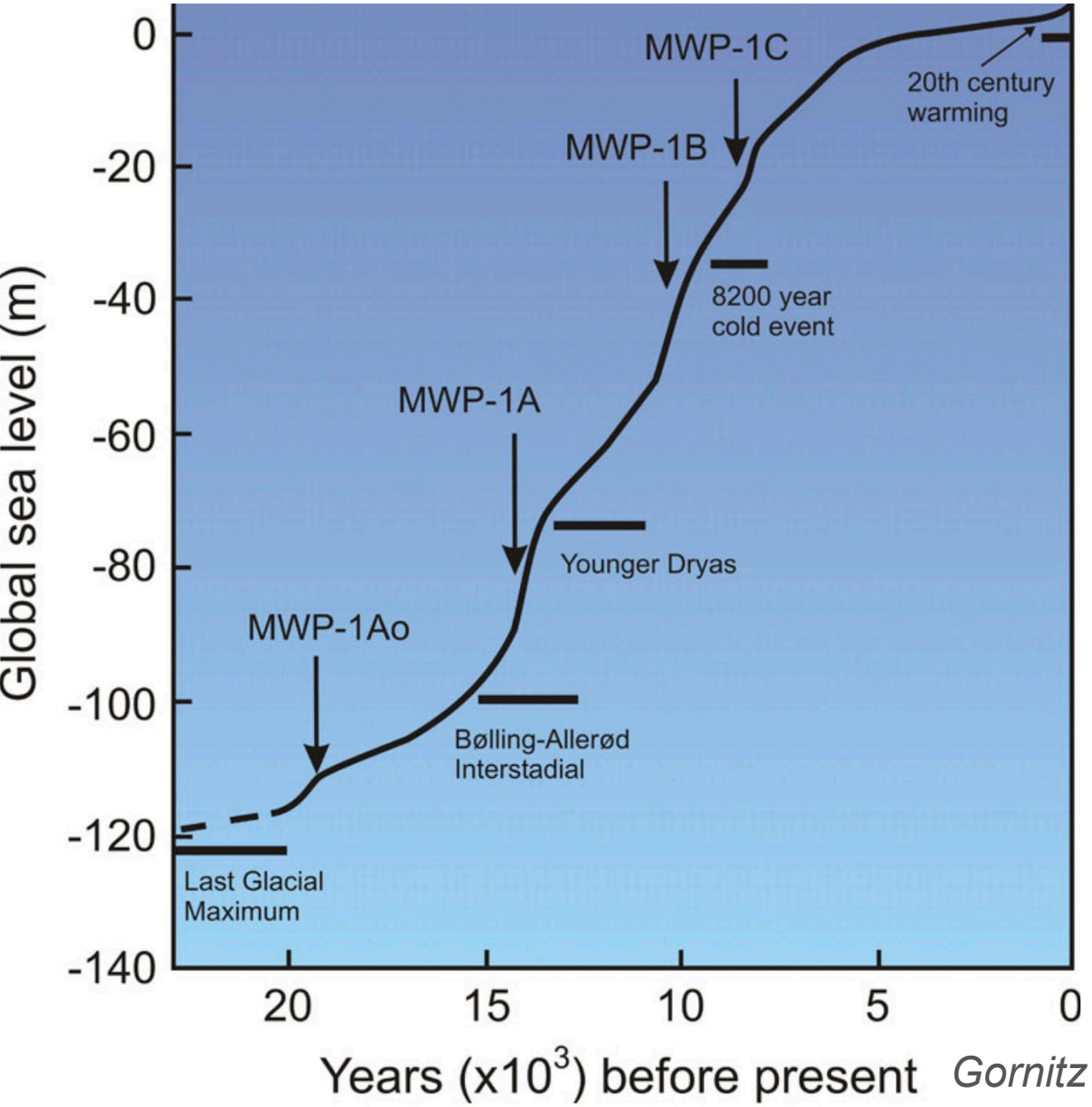
Gornitz 2012

MWP-1A (14.3 – 12.8 kybp):
Sea level rise ~16 m during this event at rates of 26-53 mm/yr



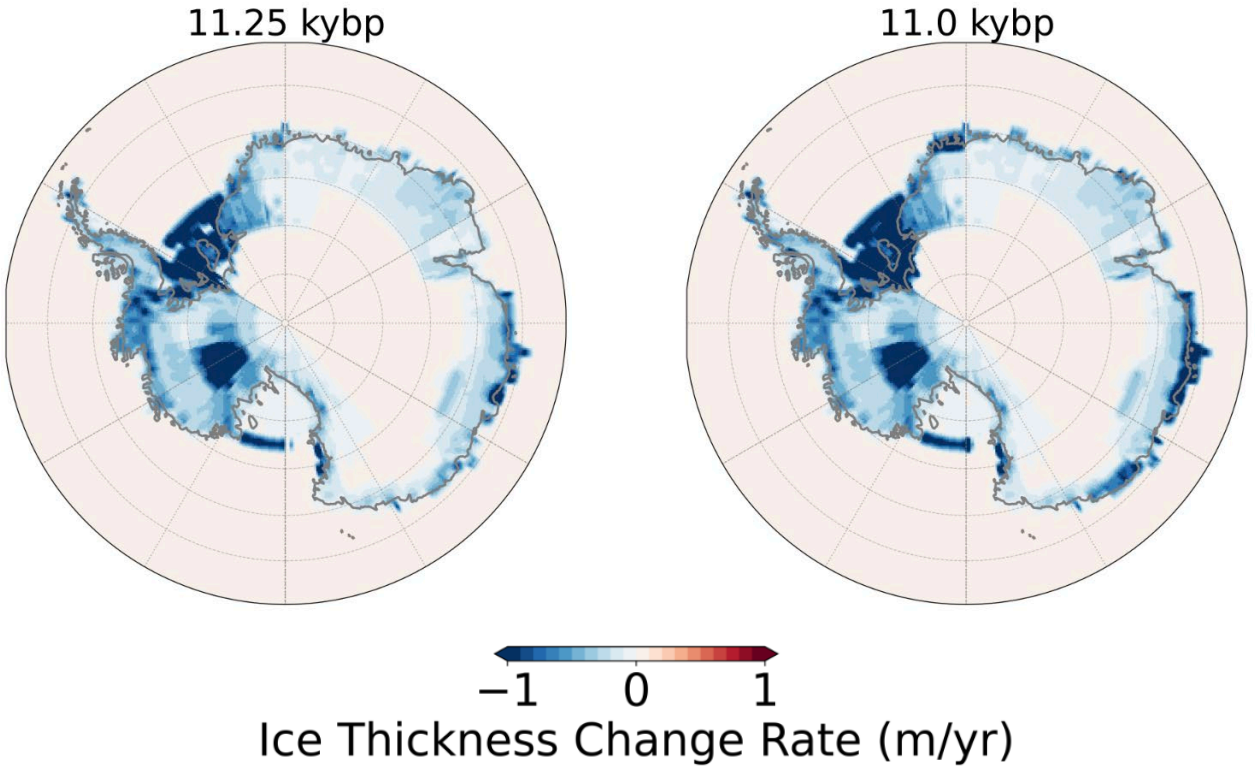
Argus, et al,. 2014

Antarctic ice sheet evolution since Last Glacial Maximum



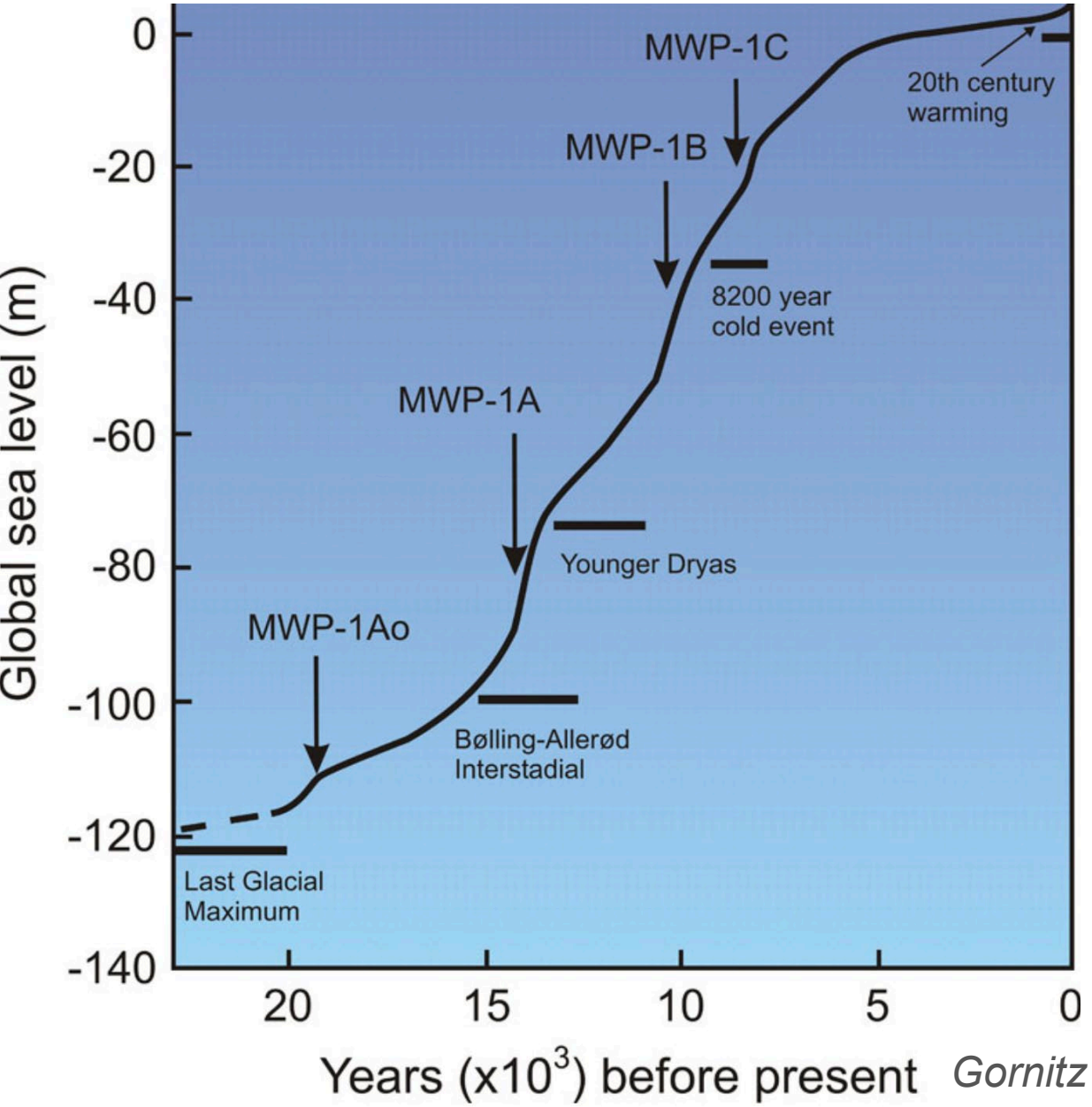
Gornitz 2012

MWP-1B (11.5 – 11 kybp):
Antarctica contribution to the global sea level rise ~5 m in ~300 years, at rates of 13-15 mm/yr



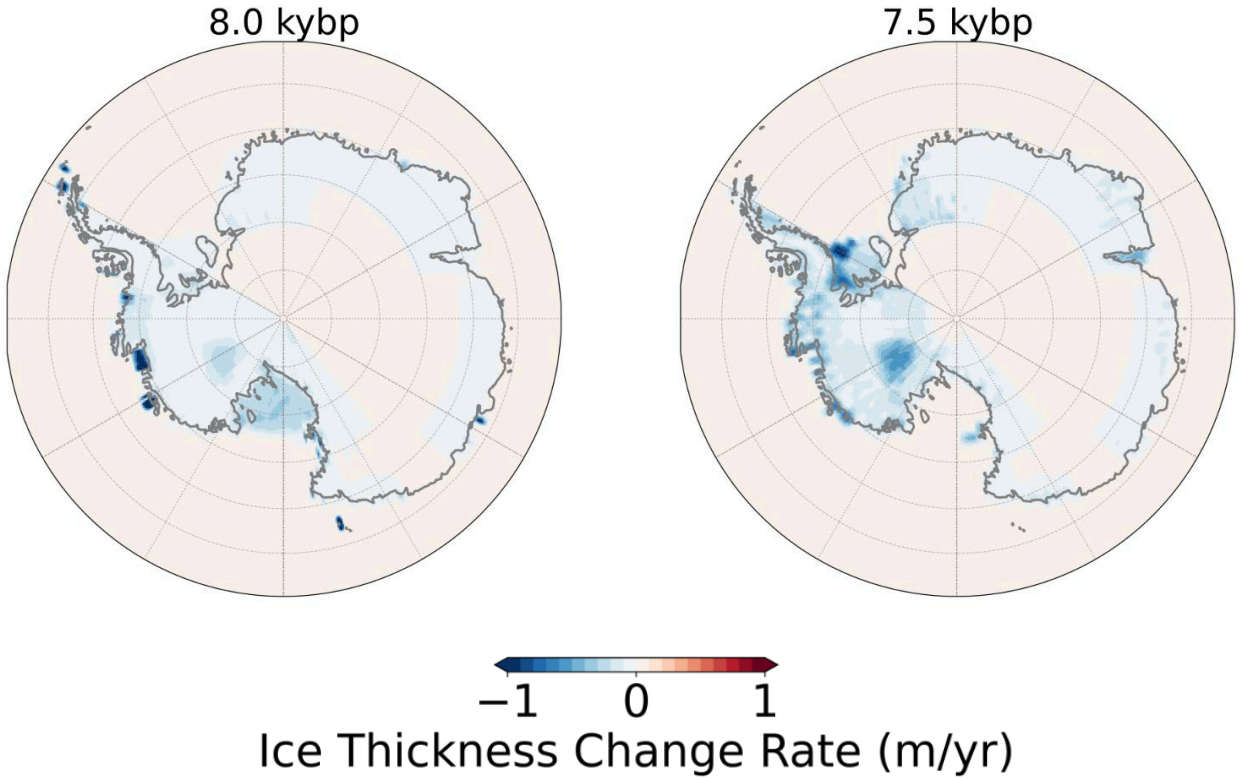
Argus, et al,. 2014

Antarctic ice sheet evolution since Last Glacial Maximum



Gornitz 2012

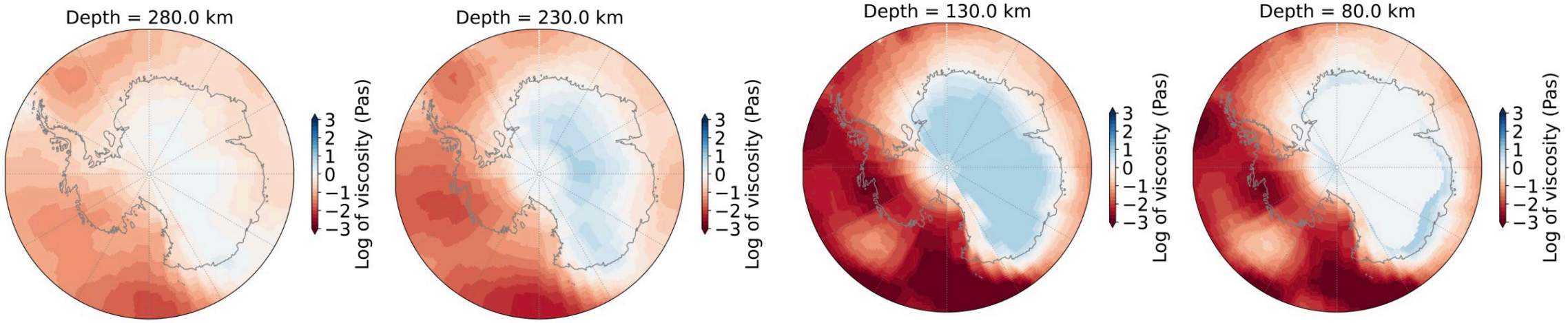
MWP-1C:
Sea level rise ~1 m



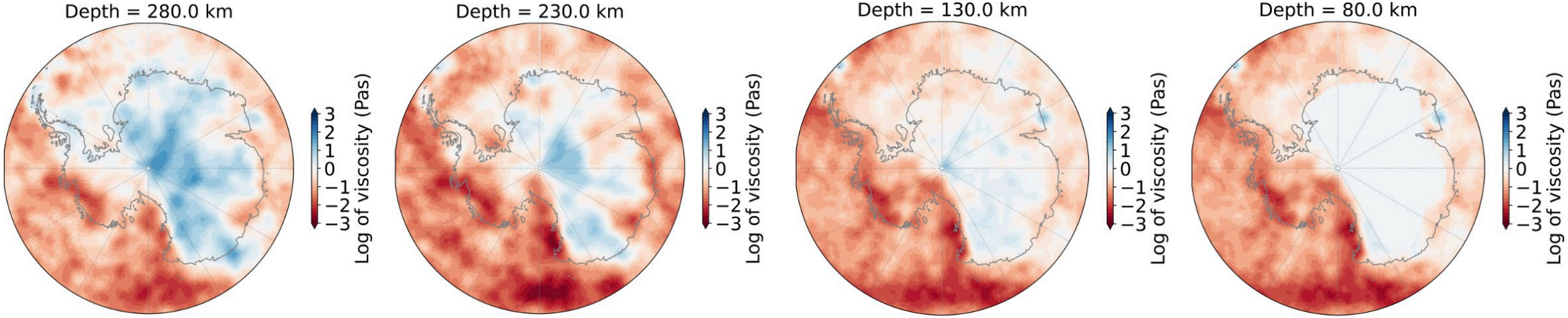
Argus, et al,. 2014

Lateral viscosity variations underneath Antarctic ice sheet

TX19

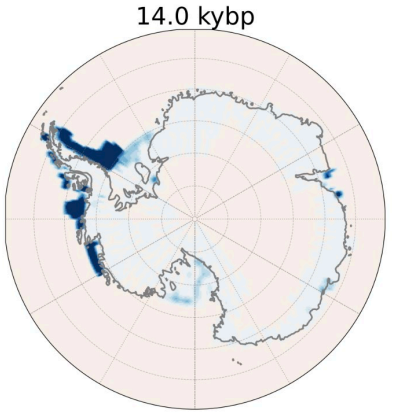


REVEAL



We use finite element modeling package **CitcomSVE** (Zhong et al,. 2008, 2022; Tao et al., 2024) to compute the bedrock motion and sea level change accounting for the horizontal gradients in viscosity.

Bedrock motion evolution during MWP-1A

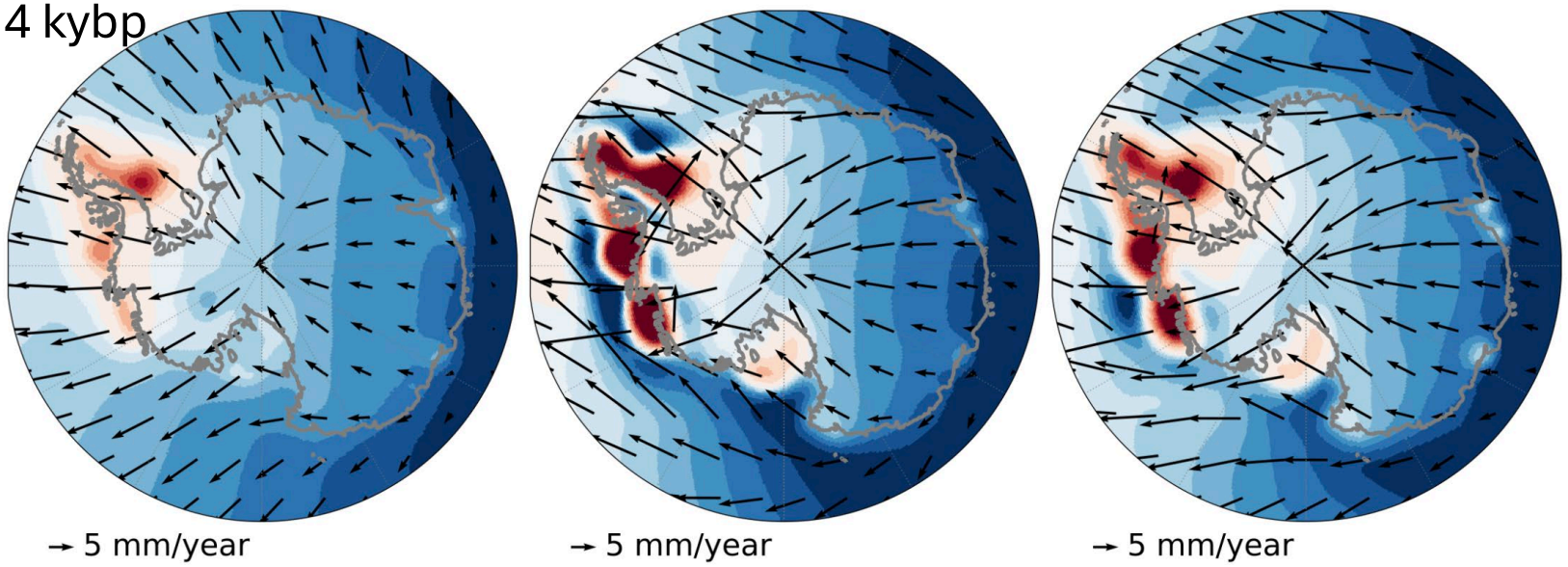


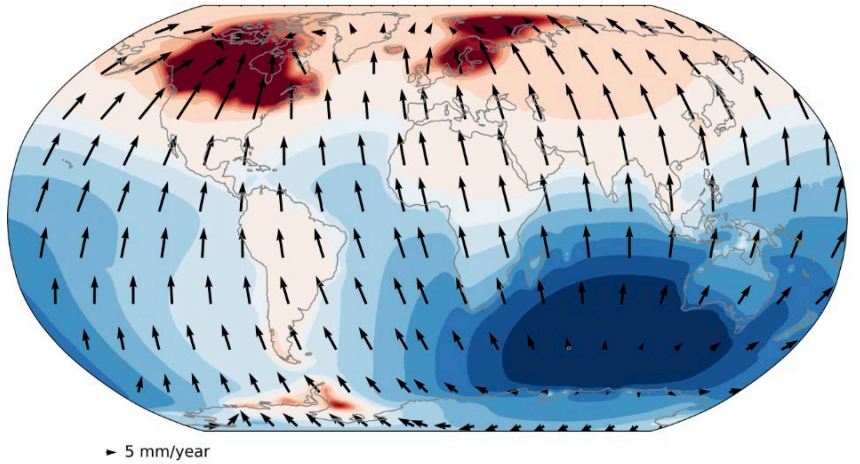
1D

3D_TX19

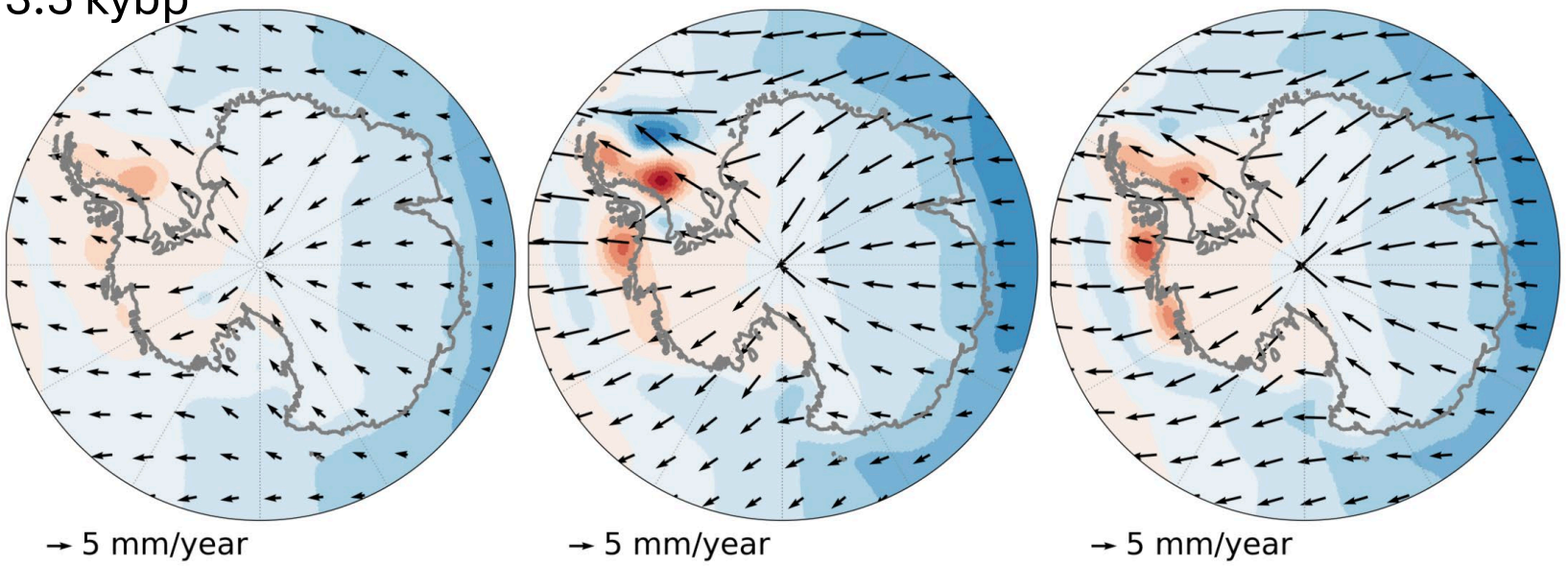
3D_REVEAL

14 kybp





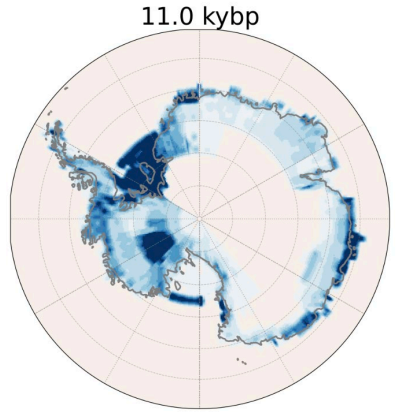
13.5 kybp



Northern Hemisphere glacial forcing

- Sea-level fingerprint
- Polar wander feedback

Bedrock motion evolution during MWP-1B

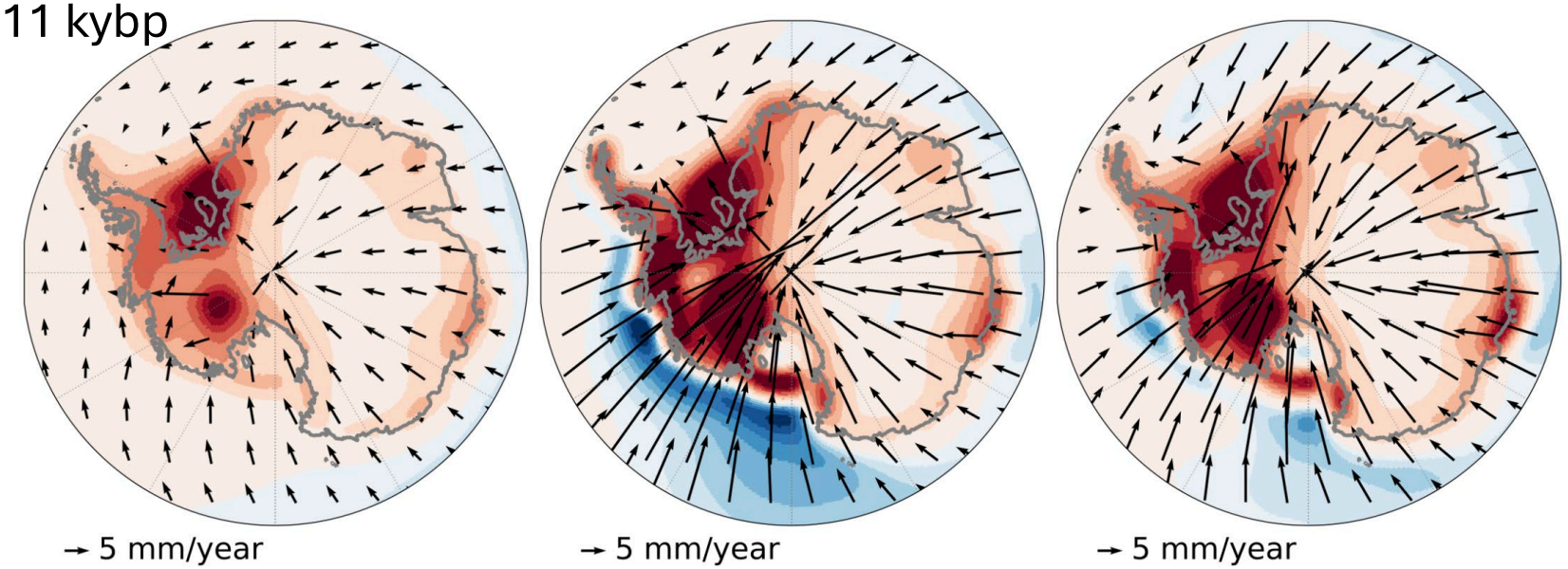


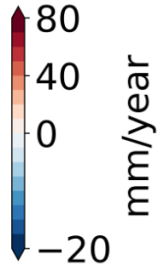
1D

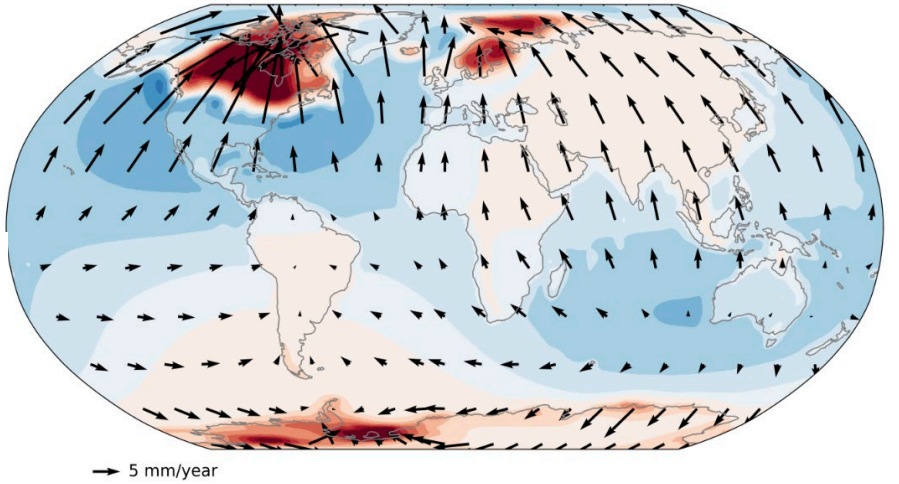
3D_TX19

3D_REVEAL

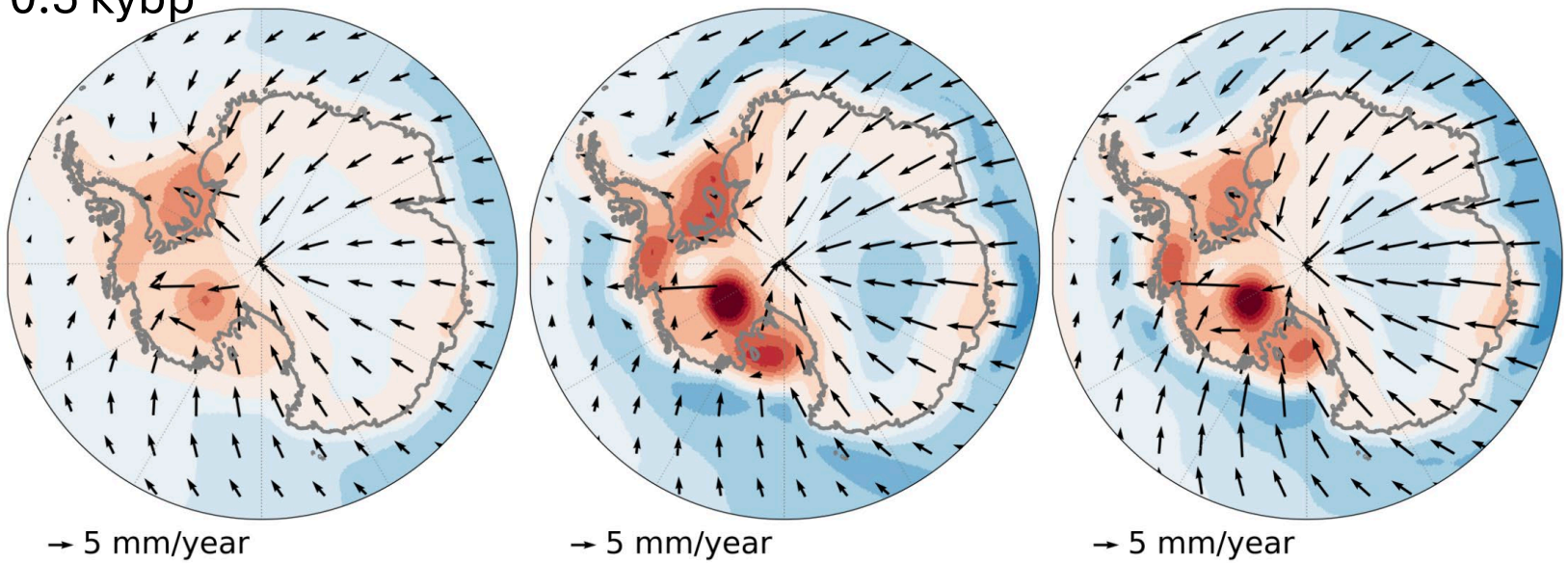
11 kybp





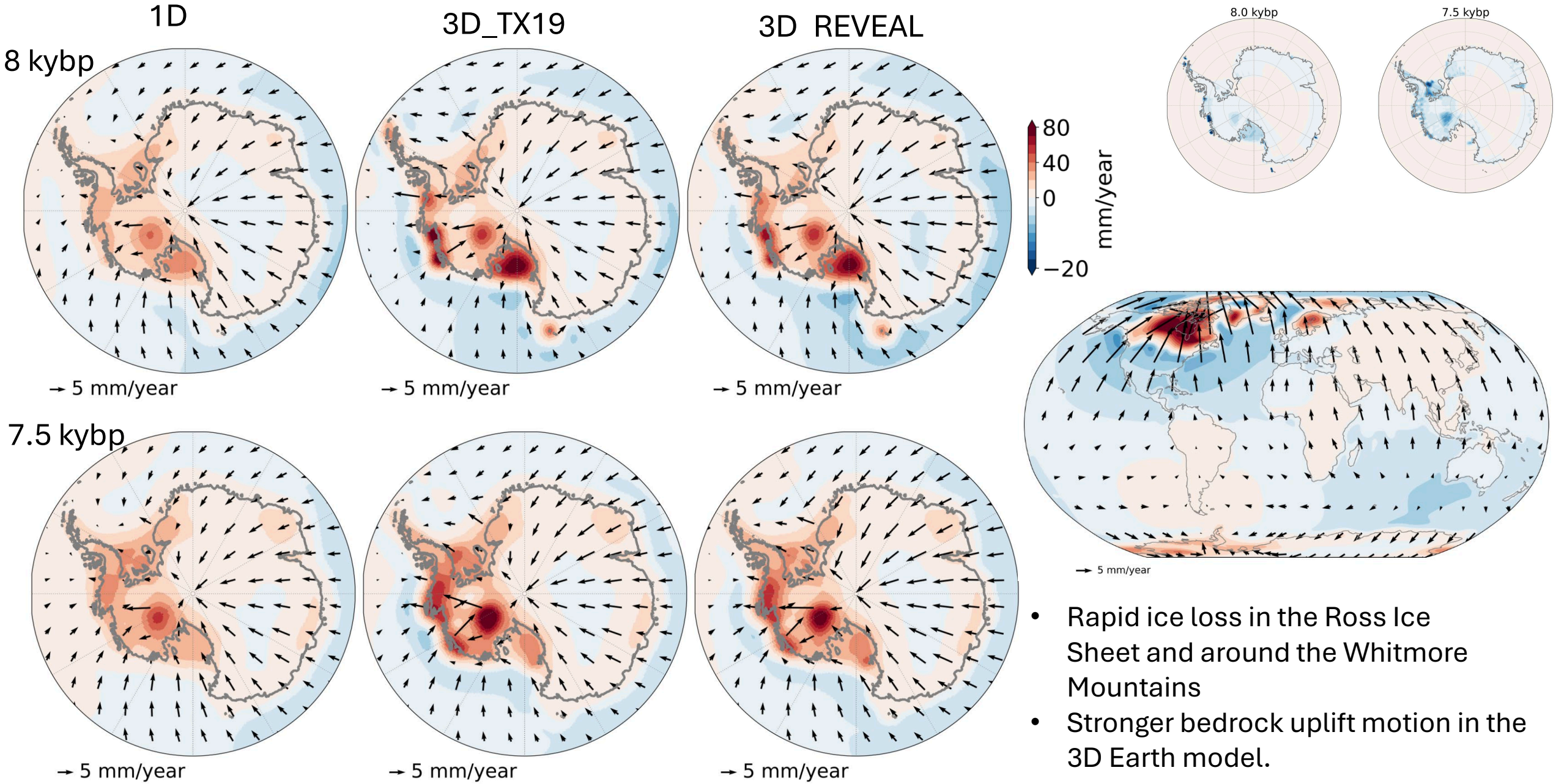


10.5 kybp



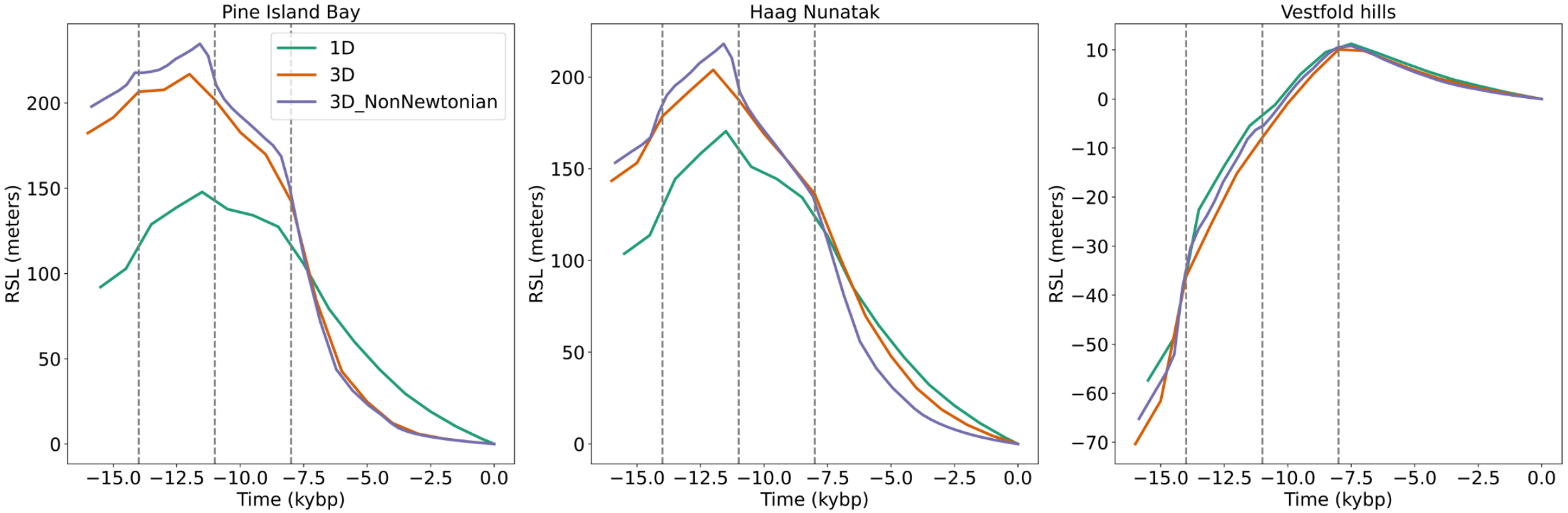
- Rapid ice loss in the Ronne Ice Sheet and around the Whitmore Mountains
- Stronger bedrock uplift and horizontal motion in the 3D Earth model.

Bedrock motion evolution during MWP-1C



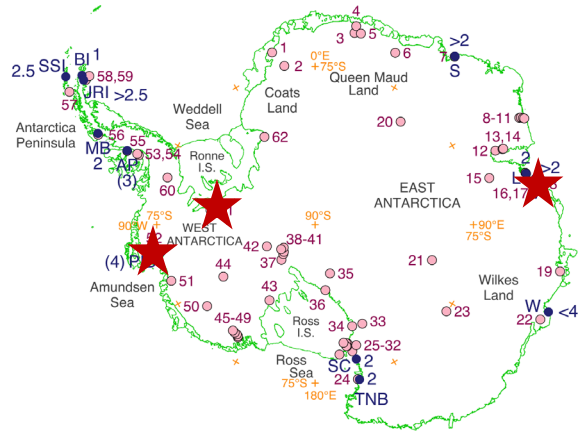
- Rapid ice loss in the Ross Ice Sheet and around the Whitmore Mountains
- Stronger bedrock uplift motion in the 3D Earth model.

Relative sea level evolution



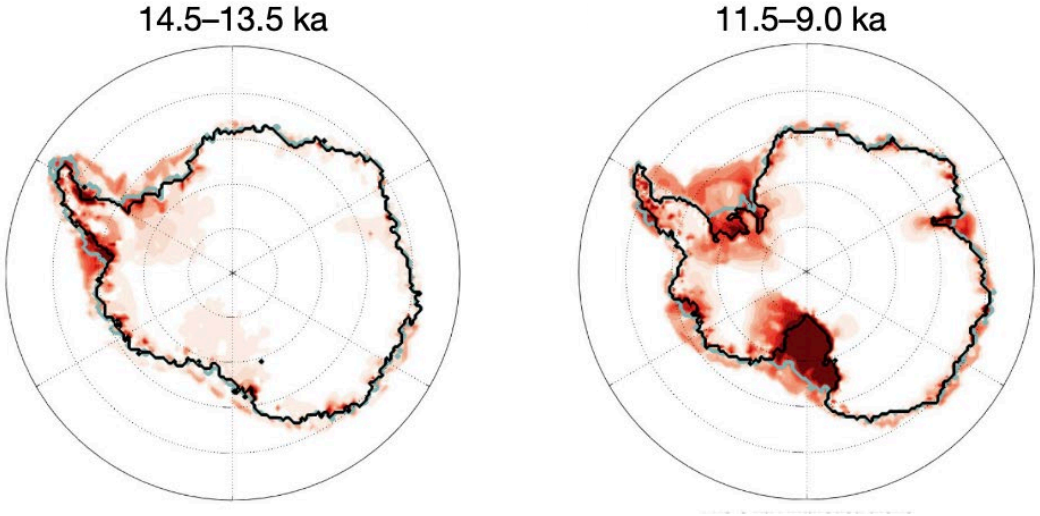
Sea Level Change Patterns: Antarctica

- **West Antarctica**
  - Sea level **rise before ~11 kyBP**
  - Followed by **local sea level fall** due to rapid ice loss during **MWP-1B** and after
  - **3D low-viscosity models** show a **faster sea-level fall** between **11–8 kyBP**
- **East Antarctica**
  - Sea level **rises until ~8 kyBP**
  - Results from **3D and 1D models** are **similar**, with only slight differences

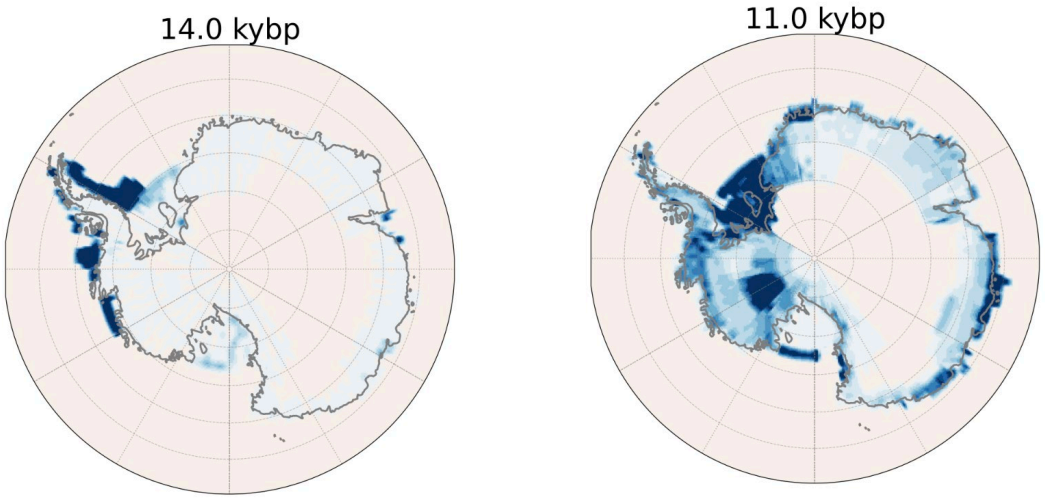


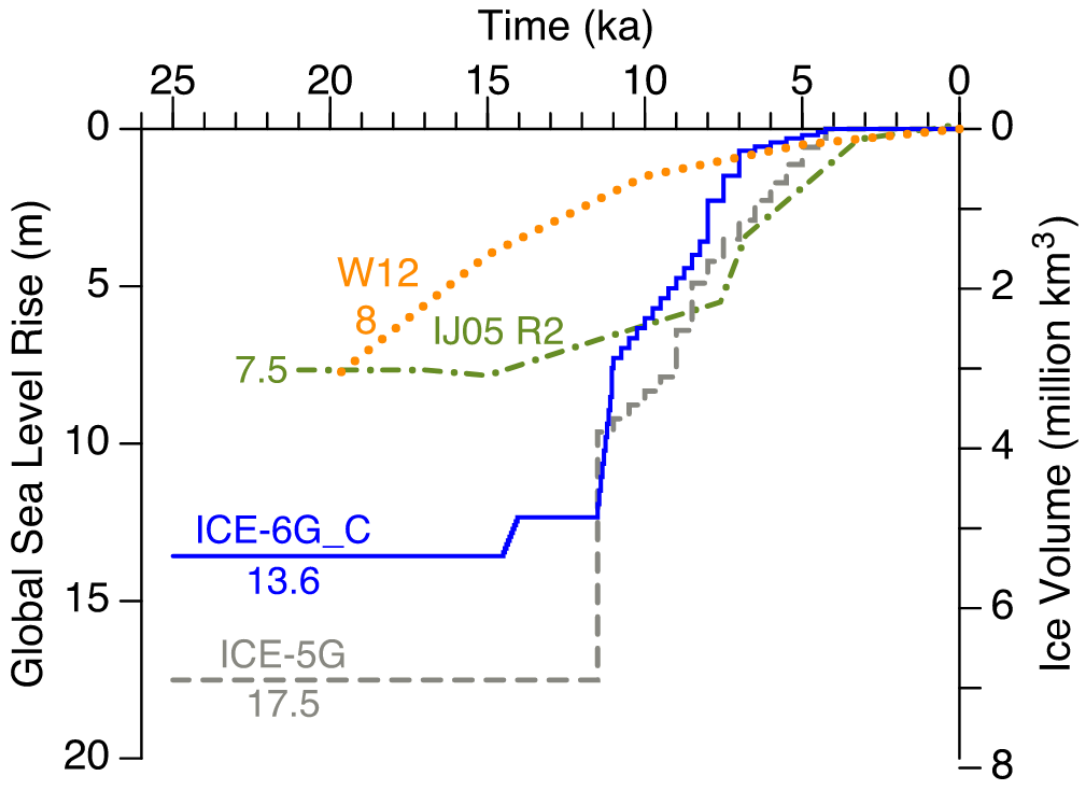
Further Plan

Ice dynamics-GIA coupled model, Gomez et al., 2020



Ice model reconstruction by GIA with data constraints (e.g., RSL, GPS and Ice thickness change), Argus et al., 2014





Explore how to reconstruct Antarctica deglaciation model that both follows the ice dynamic physics and can fit to the geological & geodetic data observations.