Geophysical Research Abstracts
Vol. 19, EGU2017-7711, 2017
EGU General Assembly 2017

Variations of the Antarctic Ice Sheet in a coupled ice sheet-Earth-sea level model: sensitivity to viscoelastic Earth properties.

David Pollard (1), Natalya Gomez (2), and Robert DeConto (3)

(1) Earth and Environmental Systems Institute, Pennsylvania State University, University Park, Pennsylvania, United States (pollard@essc.psu.edu), (2) Department of Earth and Planetary Sciences, McGill University, Montreal, Canada (natalya.gomez@mcgill.ca), (3) Department of Geosciences, University of Massachusetts, Amherst, Massachusetts, USA (deconto@geo.umass.edu)

A coupled ice sheet-Earth-sea level model is applied to long-term variations of the Antarctic ice sheet. Five different viscoelastic profiles in the global Earth model are used to explore feedbacks on ice sheet variability, including one with a thin lithosphere and weak upper mantle (LVZ) representative of properties under West Antarctica. These profiles are globally homogeneous, with no lateral variations.

Simulations are performed for (1) the deglacial retreat of the last ~20,000 years, (2) the future 5000 years with greenhouse-gas scenario RCP8.5, and (3) the warm Pliocene ~3 Ma. For the deglacial period a large ensemble of 625 runs is analyzed, with overall scores computed vs. geologic and modern data. For each of the 5 Earth profiles, the top-scoring sets of the other model parameters in the ensemble are used to perform future and Pliocene simulations.

There is little difference in the last deglacial retreat between LVZ and the other Earth profiles. In contrast, the LVZ profile produces significantly more negative feedback and less ice retreat in the future and Pliocene runs. This is due to faster timescales of retreat and larger temporal lags of bedrock rebound in the latter runs, allowing the different Earth profiles to have greater influence on ice-sheet retreat. However, the reduced retreat with LVZ occurs primarily in East Antarctic basins, where the LVZ profile may not be realistic, emphasizing the need for lateral heterogeneity in the Earth model.