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Sea-level and solid-Earth deformation feedbacks in ice sheet modelling

Hannes Konrad (1), Ingo Sasgen (1,2), Volker Klemann (1), Malte Thoma (3), Klaus Grosfeld (3), Zdeněk Martinec (4,5)

(1) GFZ German Research Centre for Geosciences, Department of Geodesy and Remote Sensing, Germany (hkonrad@gfz-potsdam.de), (2) Department of Geosciences, The Pennsylvania State University, State College, PA, United States, (3) Alfred Wegener Institut, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany, (4) Department of Geophysics, Charles University, Prague, Czech Republic, (5) School of Cosmic Physics, Dublin Institute for Advanced Studies, Dublin, Ireland

The interactions of ice sheets with the sea level and the solid Earth are important factors for the stability of the ice shelves and the tributary inland ice (e.g. Thomas and Bentley, 1978; Gomez et al, 2012). First, changes in ice extent and ice thickness induce viscoelastic deformation of the Earth surface and Earth's gravity field. In turn, global and local changes in sea level and bathymetry affect the grounding line and, subsequently, alter the ice dynamic behaviour. Here, we investigate these feedbacks for a synthetic ice sheet configuration as well as for the Antarctic ice sheet using a three-dimensional thermomechanical ice sheet and shelf model, coupled to a viscoelastic solid-Earth and gravitationally self-consistent sea-level model. The respective ice sheet undergoes a forcing from rising sea level, warming ocean, and/or changing surface mass balance. The coupling is realized by exchanging ice thickness, Earth surface deformation and sea level periodically. We apply several sets of viscoelastic Earth parameters to our coupled model, e.g. simulating a low-viscous upper mantle present at the Antarctic Peninsula (Ivins et al., 2011). Special focus of our study lies on the evolution of Earth surface deformation and local sea level changes, as well as on the accompanying grounding line evolution.

N. Gomez, D. Pollard, J. X. Mitrovica, P. Huybers, and P. U. Clark 2012. Evolution of a coupled marine ice sheet–sea level model, J. Geophys. Res., 117, F01013, doi:10.1029/2011JF002128.

E. R. Ivins, M. M. Watkins, D.-N. Yuan, R. Dietrich, G. Casassa, and A. Rülke 2011. On-land ice loss and glacial isostatic adjustment at the Drake Passage: 2003–2009, J. Geophys. Res. 116, B02403, doi: 10.1029/2010JB007607

R. H. Thomas and C. R. Bentley 1978. A model for Holocene retreat of the West Antarctic Ice Sheet, Quaternary Research, 10 (2), pages 150-170, doi: 10.1016/0033-5894(78)90098-4.