Geophysical Research Abstracts
Vol. 19, EGU2017-17259, 2017
EGU General Assembly 2017

Sensitivity of simulated englacial isochrones to uncertain subglacial boundary conditions in central West Antarctica: Implications for detecting changes in ice dynamics

Gail Muldoon, Charles S. Jackson, Duncan A. Young, Enrica Quartini, Marie G.P. Cavitte, and Donald D. Blankenship

University of Texas Institute for Geophysics, University of Texas, Austin, USA (gail.muldoon@utexas.edu)

Information about the extent and dynamics of the West Antarctic Ice Sheet during past glaciations is preserved inside ice sheets themselves. Ice cores are capable of retrieving information about glacial history, but they are spatially sparse. Ice-penetrating radar, on the other hand, has been used to map large areas of the West Antarctic Ice Sheet and can be correlated to ice core chronologies.

Englacial isochronous layers observed in ice-penetrating radar are the result of variations in ice composition, fabric, temperature and other factors. The shape of these isochronous surfaces is expected to encode information about past and present boundary conditions and ice dynamics. Dipping of englacial layers, for example, may reveal the presence of rapid ice flow through paleo ice streams or high geothermal heat flux.

These layers therefore present a useful testbed for hypotheses about paleo ice sheet conditions. However, hypothesis testing requires careful consideration of the sensitivity of layer shape to the competing forces of ice sheet boundary conditions and ice dynamics over time. Controlled sensitivity tests are best completed using models, however ice sheet models generally do not have the capability of simulating layers in the presence of realistic boundary conditions. As such, modeling 3D englacial layers for comparison to observations is difficult and requires determination of a 3D ice velocity field.

We present a method of post-processing simulated 3D ice sheet velocities into englacial isochronous layers using an advection scheme. We then test the sensitivity of layer geometry to uncertain boundary conditions, including heterogeneous subglacial geothermal flux and bedrock topography. By identifying areas of the ice sheet strongly influenced by boundary conditions, it may be possible to isolate the signature of paleo ice dynamics in the West Antarctic ice sheet.