Using radar layers to infer migration of WAIS Divide

M.R. Koutnik[1], E.D. Waddington[2], T.A. Neumann[3], H. Conway[2], T.J. Fudge[2]

[1]Centre for Ice and Climate, University of Copenhagen, Copenhagen, Denmark
[2]Earth and Space Sciences, University of Washington, Seattle, WA, USA
[3]NASA Goddard Space Flight Center, Greenbelt, MA, USA

Transients in accumulation and in ice flow can drive ice-divide migration. However, it is likely that dynamical changes initiated near the ice-sheet margin control ice-divide position. Margin changes can rapidly affect interior ice, and in Central West Antarctica this has been observed upstream of outlet-glacier systems draining to the Amundsen Sea and to the Ross Sea (e.g. Rignot et al., 2008; Pritchard et al., 2009). In addition to rapid and recent changes in ice flow, the interior ice-sheet geometry may still be adjusting to changes in sea level and accumulation from the end of the last glacial.

Conway and Rasmussen (2009) report that the Western Divide, Central West Antarctic Ice Sheet (WAIS) is thinning by ~8 cm/yr and is migrating toward the Ross Sea at 10 m/yr. While this is a significant modern signal, it is unknown whether these changes are a response to centennial-scale or to millennial-scale forcing. How long has the WAIS Divide been migrating? If this magnitude of change is sustained for 100-1000 years, the interior ice may thin by 8-80 meters and the divide may migrate by 1-10 km. It is likely that changes of this magnitude have occurred in the past, which would have also affected the shape and depth of internal layers. Therefore, internal layers inform about and ice-flow changes and ice-sheet response.

We use radar layers, accumulation-rate estimates, ice-surface velocities, and modern ice thickness to infer *histories* of accumulation rate, ice thickness, and ice-divide position. The layers used in this study span 9-2 ka, and have been dated using a preliminary depth-age scale for the WAIS Divide ice core (WDC06A-4). Using our ice-flow model we assess how the signal we want to recover is represented in realizations of the available data. Using the available data we solve a suite of inverse problems to bracket the most likely history of the WAIS Divide. Understanding the history of the ice divide is necessary to interpret ice-core records and to estimate future behavior of the WAIS.