Histories of accumulation, ice thickness, and ice-divide position from Central West Antarctica

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In the vicinity of the WAIS Divide ice-core site we use radar-observed internal layers, an ice-temperature profile at the core site, accumulation-rate estimates, ice-surface velocities, and modern ice thickness to infer *histories* of accumulation rate, ice thickness, and ice-divide position. In this inverse problem we use available continuous layers that have been imaged by ground-based radar sounding, and these available layers can now be dated using the depth-age scale for the WAIS Divide ice core. Including additional layer data is an important new development because we rely on data and on applied constraints in order to stably find a unique solution. There are many solutions that may replicate the set of available internal layers, but there are few solutions that are physically reasonable and can satisfy other available data. The measured depth-age scale and the ice-temperature profile are valuable data that can help constrain this problem, and for the first time we use all currently available data together to solve our best construction of this inverse problem. We discuss the sensitivity of the solution to the data used, in particular the time separation of internal layers.

The WAIS Divide ice-core site is located on the flank of the modern ice divide in the interior of Central West Antarctica with a high accumulation rate and a strong accumulation gradient. In a span of ~45 km across the modern divide, the accumulation rate varies from ~33 cm/yr on the Amundsen Sea side to ~20 cm/yr on the Ross Sea side (e.g. Neumann et al., 2008). The high accumulation rate is an advantage for ice-core studies, but the constancy of the modern accumulation pattern and the stability of the ice divide are unknown. While transients in accumulation and in ice flow can drive ice-divide migration, 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. 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) reported that the modern ice divide here 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 decadal-, centennial- or millennial-scale forcing. We address: How long has the divide been migrating? How has ice thickness changed during the Holocene?

Conway, H. and L.A. Rasmussen (2009). *Geophys. Res. Letters* 36, doi:10.1029/2009GL038072.
Neumann, T.A. et al. (2008). *Journal of Geophys. Res.* 113, doi:10.1029/2007JF000764.