Geophysical Research Abstracts
Vol. 14, EGU2012-1228, 2012
EGU General Assembly 2012

Roosevelt Island – a good place for an ice core

H. Conway (1), N. Bertler (2), D. Dahl-Jensen (3), R.C.A. Hindmarsh (4), A. Pyne (2), E. Brook (5), E. Waddington (1), S Kipfstuhl (6), R. Hawley (7), J. Fitzpatrick (8), and the RICE Team

(1) University of Washington, Seattle, USA (conway@ess.washington.edu), (2) Victoria University, Wellington, New Zealand , (3) Niels Bohr Institute, University of Copenhagen, Denmark , (4) British Antarctic Survey, Cambridge, England , (5) Oregon State University, Corvallis, USA , (6) Alfred Wegener Institute, Bremerhaven, Germany, (7) Dartmouth College, Hanover, USA, (8) US Geological Survey, Denver, USA

Roosevelt Island, a coastal ice dome in the eastern Ross Sea of West Antarctica, is ideally situated for investigating histories of climate and deglaciation of the region. With ice thickness H=745m, accumulation rate b=0.18m/yr, the characteristic timescale at the divide H/b is $\sim$4kyr. Radar-detected layers (assumed to be isochrones) are arched upward beneath the divide; the pattern of the stack of bumps does not show evidence of divide migration. Matching the depth-profile of bump amplitudes using a 1-D transient ice-flow model indicates that the island has thinned about 300m since the onset of divide-type flow 3-4kyr BP (Conway et al., 1999). A coupled thermo-mechanical model yields similar results for the onset of divide flow and rate of thinning, and also shows that relatively high power rheology (n=4) is necessary to match the observed bump-amplitude distribution (Martin et al., 2006).

A depth-age relationship is needed to infer histories of climate and ice dynamics farther back in time (Waddington et al., 2005; Price et al., 2007; Parrenin et al, 2007). RICE (Roosevelt Island Climate Evolution) Project is an international partnership between scientists from New Zealand, USA, Denmark, United Kingdom, Germany, Australia, Italy and China. A primary goal is to drill and date a core from Roosevelt Island. Drilling at the south summit is underway and will be completed during the 2012-13 austral summer. Initial calculations indicate the glacial transition is at about 80% depth; we expect to be able to infer histories of climate and ice dynamics over the past 40kyr. A depth-age relationship will be established from depth profiles of stable isotopes, chemistry, electrical conductivity and gas (methane) chronology. Physical properties (grain size and fabric, dust and volcanic layers) will also be measured. Borehole temperature profiles will be measured after drilling is complete. The spatial pattern of the modern thinning rate is being determined directly from repeat measurements with phase-sensitive radar, and indirectly from continuity (the residual of the sum of the horizontal flux divergence and the accumulation rate). Geophysical inverse methods using ice-flow models of varying complexity will be used to fit all available data at their level of uncertainty to infer histories of ice thickness and climate.