Gravity survey on the Ross Ice Shelf at the mouth of Whillans Ice Stream, West Antarctica

Atsuhiro Muto[1], Knut Christianson[2], Huw J. Horgan[3], Sridhar Anandakrishnan[1] and Richard B. Alley[1]

1: Department of Geosciences and the Earth and Environmental Systems Institute, The Pennsylvania State University

2: Department of Physics, St. Olaf College

3: Antarctic Research Centre, Victoria University in Wellington, New Zealand

Grounding zones of ice sheets and contiguous ice shelves are important in understanding ice sheet dynamics, as key processes that influence the grounded ice and its discharge into the ocean occur in these regions. Ice-ocean interactions are controlled by the relatively poorly known bathymetry and the configuration of the cavity beneath ice shelves. In addition, knowledge of submarine geological structures and their distributions contributes to understanding the dynamic history of the glaciers and ice streams feeding the ice shelves. However, detailed geophysical surveys of these areas remain scarce due largely to the logistic difficulties of obtaining observational data about the subglacial environment beneath an ice shelf. In the austral summer of 2011-12, we conducted a ground-based gravity survey over the Ross Ice Shelf in an embayment at the mouth of Whillans Ice Stream with the aim of modeling the subglacial bathymetry and geological structures. The survey consisted of 82 sites scattered at 3 km spacing within a ~500 km^2 embayment that is roughly triangular in shape. We present preliminary results of 2-D modeling of bathymetry and geological structures along a few lines coincident with high-resolution active-source seismic and ice-penetrating radar data. The active-source seismic survey revealed a shallow water column (<15 m) and soft sediments approximately 15 km seaward of the grounding zone. We explore the extent of such water and sedimentary columns, and the density of the sediment in this embayment and discuss uncertainties in the presented models.