Geophysical Research Abstracts, Vol. 8, 04077, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04077

Methods for determining bed roughness beneath ice sheets; an assessment of roughness beneath Pine Island Glacier, East Antarctica

D.M. Rippin (1), D.G. Vaughan (2), H.F.J. Corr (2)

(1) Department of Geography, University of Hull, Cottingham Road, Hull, HU6 7RX, UK (d.rippin@hull.ac.uk / Phone: +44 1482 466 672)

(2) British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, UK

The degree of coupling between ice and bed is of fundamental importance in controlling the amount of basal motion experience by an ice body. This coupling is controlled by bed roughness and subglacial water pressure, however, bed roughness is often completely ignored, usually because of difficulties in measuring this quantity.

We have developed a number of methods for assessing and quantifying bed roughness from airborne radio-echo sounding data. These methods were employed on a recently-collected data-set from the Slessor Glacier complex in East Antarctica, and have shown that smooth beds are detectable beneath enhanced flow tributaries where there is substantial basal motion. Conversely, areas of slow flow, where there is no/minimal basal motion, are associated with very rough beds. Most significantly, these techniques also enabled us to identify areas of relict enhanced flow - i.e. areas of currently low flow rates, that exhibit a smooth bed, which we take to be a characteristic of past rapid flow.

Here we present our roughness-assessment methods, and also their application in a detailed analysis of basal roughness beneath Pine Island Glacier, from a new airborne radio-echo sounding data-set. These data were collected as part of a major aerogephysical survey of the Amunsden Sea Sector of West Antarctica, in the austral summer of 2004/05 by the British Antarctic Survey (BAS) and the University of Texas (supported by the National Science Foundation (NSF) of the United States). Our work demonstrates the usefulness of the methods for identifying smooth regions of bed

which either facilitate basal motion and/or are a consequence of past/present basal motion. Identifying regions of low roughness beyond the current limits of rapid flow may reveal important information about the maximum extent of basal motion at times in the past when the ice sheet was larger and/or more dynamic.