Geophysical Research Abstracts,
Vol. 11, EGU2009-1954, 2009
EGU General Assembly 2009

Modelling the effects of ocean tides on ice stream motion

G..H. Gudmundsson
British Antarctic Survey, Cambridge, United Kingdom (ghg@bas.ac.uk, +41-(0)79-7063020)

On Rutford Ice Stream, West Antarctica, tidal modulation causes horizontal velocity to change by up to about 20% from its mean value. One of the peculiarities of the tides on Rutford is that the strongest modulation is at the Msf tidal frequency, or 14.76 days. This is despite the fact that the Msf tidal amplitude is almost absent in the vertical oceanic tides, and much smaller than the semi-diurnal and the diurnal tidal amplitudes.

Previously, a simple conceptual model has been proposed suggesting that the fortnightly tidal motion on Rutford Ice Stream arises through a strongly non-linear interaction between the main semidiurnal tidal components. Non-linear viscous till rheology is a potential source of the non-linearity in the system. This idea is tested using a visco-elastic flow model. Both the ice and the till is modelled as a non-linear visco-elastic medium. All terms of the momentum equations are kept in the momentum balance. In full agreement with the much simpler conceptual model it is found that the fortnightly tidal motion can be generated through strong non-linear interaction between two main semi-diurnal oceanic tidal components for non-linear till rheology. The implication is that the rheology of till underneath Rutford Ice Stream (as experienced by the overlying ice), must be non-linear and viscous.