



## **Water pressure instabilities under glaciers.**

**R.C.A. Hindmarsh** (1)

(1) British Antarctic Survey, Cambridge, UK (rcah@bas.ac.uk)

Over long length scales water pressure under glaciers is controlled by the ice-overburden pressure, to which it is constrained to be very close. This is a consequence of the poor drainage under glaciers; water has to be close to ice pressure to establish drainage routes. Over shorter length-scales, the permeability of the bed allows water to drain through bedrock along paths with permeability independent of the water pressure. This permits the water pressure to be able to vary strongly underneath an ice-sheet over short length scales (Hindmarsh, 1998).

The length-scales over which the water pressure can vary strongly depend on the permeability of the rock, and can range from  $10^2$ m to  $10^4$ m. It is known that this property permits coupled small-amplitude instabilities in the water pressure and ice thickness for lubrication flows (Hindmarsh, 1998). In this paper the linear analysis is extended to the full system of momentum equations, where it is still shown to hold. Finite amplitude calculations are presented using a numerical model.

Hindmarsh, R.C.A. 1998, "Ice Stream Surface Texture, Sticky Spots, Waves and Breathers: The Coupled Flow of Ice, Till and Water." *J. Glaciol.*, 44(148), p.589-614.