Geophysical Research Abstracts, Vol. 9, 05218, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05218

The effect of a non-uniform velocity field upon isochrone geometry in a steady ice sheet

F. Parrenin (1) and R. Hindmarsh (2)

(1) Laboratoire de Glaciologie et Géophysique de l'Environnement, Grenoble, France, (2) British Antarctic Survey, Cambridge, UK.

The effect of spatial variations in velocity profiles on isochrone ge ometry are examined using an analytical method. We define the flux shape function ω at a given depth as the proportion of the total horizontal flux passing below this depth and we show that the slope of the isochrones is equal to the slope of the iso-ω lines, plus a 'history term'. This term is the cumulative result of the past trajectory of the ice particles and it is the product of a principal term (which determines the sign of the slope) and a positive scale factor. With this new point of view, we show that downstream of a Raymond bump or a no-sliding-sliding transition, the history effect rotates slopes towards the bed in the bottom part and towards the surface in the upper part. This effect counteracts the classical Raymond effect, and can even lead to depressions surrounding the bumps if the transition from dome to flank velocity profile is sufficiently abrupt. Moreover, we show application of the ω coordinate for numerical transport schemes. Finally, we show how isochronal layers may be used to invert the velocity field in a steady ice sheet with known surface accumulation rate and known velocity profile at the divide.