Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07883, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07883
EGU General Assembly 2008

Ice flow and crystal fabric near ice divides

C. Martín (1), G. H. Gudmundsson (1), H. Pritchard (1) and O. Gagliardini (2)

(1) British Antarctic Survey, Natural Environment Research Council, Cambridge, UK, (2) Laboratoire de Glaciologie et Géophysique de l'Environnement, CNRS and Joseph Fourier University, Grenoble, France, (cama@bas.ac.uk).

Polycrystalline ice within an ice sheet develops a crystal orientation fabric that leads to macroscopically anisotropic behaviour. This has been observed in several ice cores located at divides and is known to affect ice flow and therefore the shape of both ice stratigraphy and surface topography. Radar stratigraphy near ice divides provides an indirect but spatially-continuous and stationary record of ice flow, it therefore provides both a means to validate the ice flow and crystal fabric assumptions made in ice sheet modelling and a way of reconstruct past changes in the cryosphere: accumulation, local thinning and age of formation of the divide.

Employing a time-dependent full-Stokes model that considers a nonlinear extension of an orthotropic flow law and strain-induced anisotropy, we study ice flow and crystal fabric evolution near the divide and their effects on the radar stratigraphy. We show that anisotropy amplifies the Raymond effect and changes the shape of the ice stratigraphy near the divide; under certain circumstances, dips appear in the radar layers and in the surface topography, and Raymond bumps develop into double-rooted bumps. These features are compared with field examples from Fuchs Ice Piedmont and Kealy Ice Rise, Antarctica. We also investigate the different stages and time scales in divide development; explaining why divides may exhibit single or double-rooted Raymond bumps, or neither. Finally, we assess the importance of considering ice anisotropy near the divide.