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Modelling ice flow around the EPICA-Dome C drilling site

F. Gillet-Chaulet (1), O. Gagliardini (1), J. Ruokolainen (2), T. Zwinger (2) and J. Meyssonnier (1)

(1) LGGE CNRS UJF-Grenoble I, France, (2) CSC-Scientific Computing Ltd., Finland, (Contact gagliar@lgge.obs.ujf-grenoble.fr/Fax: 33 4 76 82 42 01)

The knowledge of how ice flows in the vicinity of ice-core drilling sites is essential to the interpretation of the climatic records preserved in the ice. In that regard, the most important expectation from an ice flow model is to provide the age and the origin of ice as a function of depth.
A large number of geophysical measurements are performed in the vicinity of drilling sites: bedrock and accurate surface topography, surface velocities and snow accumulation, temperature in the borehole, texture and microstructure of ice along the ice core, etc. However these measurements cannot be fully assimilated by global ice sheets flow models (e.g. that deal with the whole Antarctica ice sheet) whose grid resolution is about 20 km. Accurate interpretation of deep ice cores requires to develop local flow models with smaller grid resolution.
An efficient and easy-to-use method which allows to take into account the strain induced fabric development in polar ice sheets has been developed. The resulting Stokes-equation for incompressible ice with anisotropic behaviour, as well as a convection dominated evolution equation for ice fabric strengthening, have been implemented into the finite-element package ELMER.
Preliminary results of a local three dimensional simulation of the flow of ice around the EPICA Dome C drilling site are presented. The results are compared to those obtained with the 1D model usually used in the vicinity of a dome location. Effects of the observed actual accumulation gradient on the dome stability are studied. Recent microstructure measurements of the Dome C core showing that some ice layers have experienced a larger deformation than the adjacent layers (which implies that the deformation is not homogeneous but localized in these particular layers), are discussed.