Finite-element modeling of subglacial cavities and related sliding law

O. Gagliardini (1,3), D. Cohen (2), P. Råback (3) and T. Zwinger (3)

(1) LGGE CNRS UJF-Grenoble I, France, (2) Department of Geological and Atmospheric Sciences, Iowa State University, Ames, U.S.A., (3) CSC-Scientific Computing Ltd., Finland. (gagliardini@lgge.obs.ujf-grenoble.fr/Fax: (33) 4 76 82 42 01)

Sliding velocity is the least predictable component of glacier velocity, and meaningful treatment of sliding is one of the biggest challenges in modeling wet-based ice masses. Changes in subglacial water pressure or subglacial water storage arising from opening and closing of subglacial water cavities in the lee of bedrock obstacles strongly influences the sliding velocity. In order to get a better understanding of this influence, finite-element simulations have been carried out for different synthetic and periodic bedrock shapes (saw, sinus, half-circle, . . .). In the proposed method, the cavity roof is treated as a free surface, for which both the starting and ending points are unknowns of the problem. The sliding law is calculated as a function of the water pressure inside the cavity and the bedrock shape, for different values of the Glen's law exponent.