

Modelling ice-divide dynamics by perturbation methods

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Abstract

Two-dimensional, isothermal, non-stationary, cold-glacier dynamics are analysed by perturbation methods, when the ice creep is described by Glen's flow law. This approach allows us to model the ice-divide dynamics separately from that of the glacier and to pose a simplified problem for the ice divide. To order of the glacier-aspect ratio, all unknown characteristics near the ice divide can be searched for in an infinite layer with parallel boundaries, whose thickness coincides with that found by the shallow-ice approximation. The problem for the ice divide is stationary and does not depend on the ice and glacier characteristics, such as a flow-law constant, ice thickness and accumulation rate. At the ice divide, the ice upper surface curvature is finite and the shallow-ice approximation is inadequate.
