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Dynamics of Pure Ice Streams and Surges ROIY SAYAG, Department of Earth and Planetary Science, Harvard University, ELI TZIPERMAN, Department of Earth and Planetary Science and School of Engineering and applied sciences, Harvard University — We examine a bottom sliding law that is capable of explaining pure ice streams and glacier surges within a simple model of ice flow over a homogeneous bed. The model resolves longitudinal stresses, and assumes a plug flow as supported by ice stream observations. The flow law is Newtonian and hence we neglect thermo-viscous and shear-thinning effects. The bottom sliding law is a multivalued relation between the bottom stress and the ice velocity, similar to that suggested by previous work (e.g. Fowler & Johnson, 1996). The multivaluedness can be heuristically justified by variations in bed lubrication caused by changes in water formation rate and rearrangement of the drainage system. This sliding law accounts for two fundamental modes of flow, depending on the magnitude of the mass accumulation forcing: (i) a steady stream pattern, due to the coexistence of two stable velocities for a given bottom stress, the faster corresponds to an ice stream region and the slower to an inter-stream region. (ii) a relaxation oscillation mode (a surge).

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