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Snow and Ice Dynamics

4/30/18 Class Review

Review of HW 2:

HW 2 involved writing down the momentum conservation equations, and from them, deriving the stress state of the ice sheet. Problem 2 involved some difficult algebra that could be avoided by numerically solving the cubic equation.

Tracking Particles in an Ice Sheet:

There are range of glaciological questions (ex. ice cores, radar, and fabric evolution) that required tracking ice particles from the surface of an ice sheet to some layer deep within the ice. We can track particles in an ice sheet by considering a “flow band” of an ice sheet (illustrated below.)

The goal here is to find expressions for velocity in the x direction, u(x,z,t), and the z direction, w(x,z,t). We start this derivation with the mass conservation equation

$$\frac{\partial S}{\partial t} + \frac{1}{W(x)}\frac{\partial Q}{\partial x} = \dot{b}(x,t) - \dot{m}(x,t)$$

Some clever math is done (see ed’s notes) to get at u(x,z,t) and w(x,z,t). The expressions for u and w can be solved numerically to get particle paths.