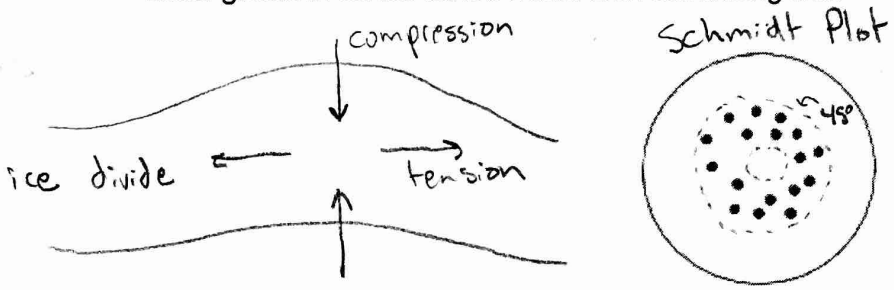
4/9/2018 Review of Ice Dynamics

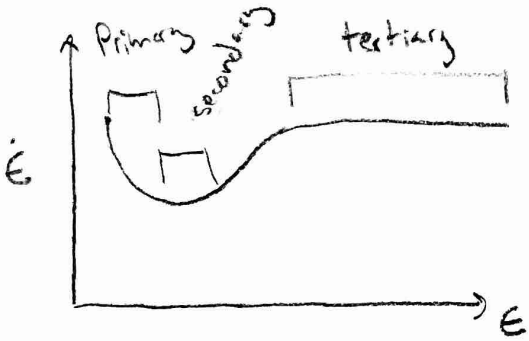
C-axis orientation at ice divides

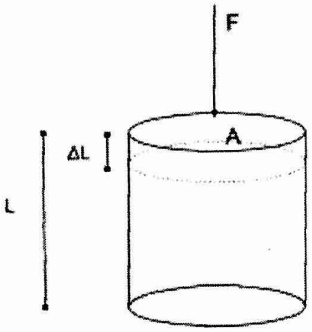
At an ice divide, the high vertical compressive stresses encourages recrystallization of grains with c-axis oriented ~45° from the vertical. The vertical compression causes rotation of c-axis towards the vertical. Crystals with c-axis oriented in the vertical are "consumed" by neighboring snow grains. The Schmidt plot (projection of a hemisphere onto a plane) of c-axis orientations of snow grains in an ice divide would look something like:



Creep tests

People put masses on ice to see how it deforms

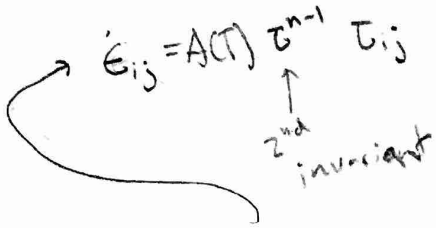




People found 3 types of creep: Primary, secondary (happens at 1% strain), and tertiary (happens at 10% strain).

Glen's Flow Law

Glen did creep tests and came up with Glen's flow law



$$d\varepsilon/dt = A(T)\tau^n$$

τ is deviatoric stress, and dε/dt is strain rate. You can reformulate Glen's law in terms of the 2nd invariant of the the stress tensor if you want. Finding constants in A(T) and n are done experimentally by doing many creep tests while varying Temperature and deviatoric stress. Plots of the natural log of the results yield lines which give values of the constants Q, A0, and n.

$$ln(d\varepsilon/dt) = ln(A(T)) + n\,ln(\tau)$$
$$ln(A(T)) = ln(A0) - Q/(RT)$$