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Snow & Ice Dynamics
Class highlights for 4/16/18

We spent the first half of class going over homework #1. For problem 1, designing an experiment to find A_0, Q, and n for Glen's flow law, we discussed how to make isotropic ice from crushing ice cubes and refreezing with more water, how to calculate the deviatoric stress given the measured stress, and how to nondimensonalize Glen's flow law before taking the natural log. For problem 2, we reminded ourselves that, to get a linear relationship between A(T) and T, we need to relate ln(A(T)) to 1/T, which becomes apparent when you look at the Arrhenius equation. For problem 3, we reminded ourselves that the purpose of the problem was to emphasize the strain rate and stress relationship by noting that if stress drops by two orders of magnitude, then strain rate drops by six orders of magnitude (if n=3).

In the second half of class we looked more closely at Glen's flow law and went through some examples of how to derive the law for simple examples. Glen's flow law can be written in a similar form as the flow law for a Newtonian linear viscous fluid, such that, if n=1, Glen's flow law becomes the flow law for the Newtonian linear viscous fluid. A Newtonian linear viscous fluid is defined by a viscosity that is dependent on temperature but not on the applied stress. A Glen fluid is dependent on both temperature and the applied stress with the added complexity that, as n increases, the dependency is greater. As n approaches infinity, the fluid increasingly becomes plastic. With a better understanding of Glen's flow law, we went through two examples of how to take a known stress state and find the prefactors for Glen's flow law. We saw that the type of stress (normal, shear, or a combination) makes a difference.

Last, we rushed through a brief explanation of how to derive the conservation of momentum equations, but I expect we'll talk more about this next class.