Gemma O'Connor
Class Summary for 4/11/18

First, we explored a test of uniaxial compression in which a stress was exerted downward on a block of ice (in the z direction). This stress is equal to some force F divided by the area of the top of the block of ice A. Over time, this normal stress translates to a deviatoric stress in both the z and x directions. To model this deviatoric stress system, we rotated the coordinate system by 45°. Our new area A' is now larger than our original area by a factor of root 2 and our new force is reduced by a factor of root 2, so our new stresses on the system are equal to the original force divided by twice the original area, and the stresses on the system are now shear stresses (not normal).

Next, we reviewed several different ways to model crystal deformation in response to stresses and strains. This is difficult to accurately model because when adjacent crystals undergo some strain, they must be modeled in a way such that they don't overlap each other. The Sachs homogeneous stress assumption models the system as the crystals undergoing the same stress, and the average response of all the crystals is analyzed. In the Taylor-Bishop hill approximation, the reverse idea is modeled. The strain of all the crystals is modeled homogeneously, so the stresses applied on each crystal must be different. With viscoplastic self consistent modelling, we treat the system as a homogeneous equivalent medium, in which you analyze the deformation of one crystal by modeling the bulk properties of the crystals surrounding the individual crystal. The nearest neighbors interaction model is similar to this, but the system is treated as blocks. Thus, you model the deformation of one crystal by accounting for its 6 nearest neighbor crystals as well. None of these modelling techniques is completely accurate, but each has its own strengths and weaknesses making some better than others depending on the application.