

Jamming of Ice Melange: Modeling Ice Melange Dynamics with Particle Rafts

Chin-Chang Kuo, Michael Dennin (U. California, Irvine), Wendy Zhang, Justin Burton, Douglas MacAyeal (University of Chicago) and Jason Amundson (U. of Alaska Southeast)

Corresponding author: Michael Dennin, mdennin@uci.edu

Recent satellite imagery and oblique timelapse photographs indicate that dense packs of sea ice and icebergs may inhibit the calving of icebergs from tidewater glaciers. Such fjord ice-coverage, or ice mélangé, may therefore play an important role in determining seasonal and secular variations in glacier geometry. Ice mélangé consists of polyhedral ice blocks that span several orders of magnitude in size (horizontal and vertical dimensions), and as such, is the ultimate poly-disperse granular material. Therefore, even though on average the “back-forces” exerted on a glacier by ice mélangé are likely small compared to glaciological driving stresses, *jamming* of the ice mélangé could produce transient forces that are significant. Essentially, jamming is the formation of connections between particles in a sufficiently dense granular material that produce relatively large stresses. Particle rafts, plastic particles floating at the water surface, provide an ideal laboratory scale material for studying the dynamics relevant to ice mélangé. We report on studies of a particle raft that is driven through a narrow channel between two parallel walls. We measure both the force versus time on the driving plate and track the motion of the granular particles. We have identified a boundary-driven jamming mechanism that is the result of a buckling of chains of particles along the side walls of the system. Also, there is a pre-cursor density variation that occurs just before the onset of jamming. This signal will be important for direct comparisons between the model system and real fjord systems in Greenland.