Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The formation of grounding zone wedges KATARZYNA KOWAL[1], GRAE WORSTER, DAMTP, University of Cambridge — Ice sheets are generally lubricated by a layer of sub-glacial sediment, or till, which plays a central role in determining their large-scale dynamics. Sub-glacial till has been found to accumulate into distinctive sedimentary wedges at ice-sheet grounding zones, separating floating ice shelves from grounded ice sheets. These grounding-zone wedges have important implications for stabilizing ice sheets against grounding-zone retreat in response to rising sea levels. We develop a theoretical model of wedge formation in which we treat both ice and till as viscous fluids spreading under gravity into an inviscid ocean and present a fluid-mechanical explanation of the formation of these wedges in terms of the jump in hydrostatic loading and unloading of till across the grounding zone. We also conduct a series of fluid-mechanical experiments in a confined setting in which we find that the underlying layer of less viscous fluid accumulates spontaneously in a similar wedge-shaped region at the experimental grounding line. We also extend our theory to more natural, unconfined settings in two dynamical regimes in which the overlying ice is resisted dominantly either by vertical shear or by extensional stresses and compare our findings with available geophysical data.

[1]Currently at Northwestern University

Katarzyna Kowal
DAMTP, University of Cambridge

Date submitted: 01 Aug 2016 Electronic form version 1.4