DYNAMICS OF MARINE ICE SHEETS

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Marine ice sheets, such as those in Western Antarctica comprise a grounded ice sheet coupled to a floating ice shelf. The position of the grounding line, where the sheet detaches from the bedrock to form the shelf, is determined dynamically by the forces acting on either side. On long, glacial timescales the sheet and shelf can be modelled using viscous fluid mechanics: the sheet is a shear-dominated viscous gravity current; the shelf is characterized by extensional flow with weak shear. On short timescales, including typical transit times for ice to pass through the grounding-line zone, the marine ice sheet behaves more elastically. I will present recent laboratory experiments and mathematical studies aimed at elucidating fundamental mechanisms controlling the evolution and stability of marine ice sheets and their grounding lines. Many aspects of the flow can be modelled using Newtonian fluids but interesting phenomena relate to Non-Newtonian rheology of large-scale ice flows.

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