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Micro-scale sea ice processes in Arctic Ocean dynamic

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Realistic models of sea ice processes and properties are needed to assess sea ice thickness, extent and concentration and, when run within GCMs, provide prediction of climate change. Presently, ad hoc tuning of model parameters such as ice strength and drag ratios are employed in order to reproduce data sets of sea ice extent, concentration and ice motion (measured by buoys). Parameter tuning is required because current sea ice models, up till recently, have not resolved physical processes below grid sizes of 100km. As ice floes are of typical dimension of 0.1-10km, the continuity assumption breaks down below 100km so that discontinuities in, e.g., ice velocity, thickness and motion, cannot be modelled. I present experimental results in sea ice mechanics and physics from mid-scale experiments simulating sea ice floe motion and interaction. I examine the scaling relations of the slip of sea ice floes, the micro-mechanics of sea ice friction and how a simple two-parameter model, describing the mechanical state and slip rate of the floes, can capture key elements of sea ice rheology. I then discuss the elements of heat flow, melting and re-freezing at a micro-scale that are necessary to be modelled so that they may be incorporated into mid and ocean-basin scale models.