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Fully synchronous ice-ocean coupling

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Very little of the Antarctic ice sheet experiences surface melting; much of its ablation takes place under the floating extensions of the sheet (ice shelves), which are exposed to ocean warming. Ice-shelf thinning due to submarine melting has the potential to cause significant ice loss from portions of the ice sheet, and hence sea-level rise. Oceanographic and remote-sensing observations of this region in recent years have shown a pattern of high ice-shelf melt rates coincident with widespread thinning of grounded ice and therefore sea-level rise. However, the processes by which ocean warming leads to ice-sheet loss are poorly understood. The gap in knowledge is in part due to a lack of coupled numerical ice–ocean models capable of representing the key feedbacks between the ocean and ice shelves. To change this, a fully synchronous, coupled ice–ocean model of the ice-shelf/ocean system has been developed using MITgcm (Massachusetts Institute of Technology general circulation model) to investigate these processes. Unlike previous asynchronous coupled models, the position of the ice–ocean interface evolves every time step with no need for dump and restart methods. We present here work showing the coupled evolution of the ice ocean-system and the effect of melting upon buttressing strength.