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Frequency Response of a Synchronously Coupled Ice-Ocean Model

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Dramatic changes at the West Antarctic ice-ocean boundary in recent decades has triggered significant increases in the regions contribution to global sea-level rise, coincident with large scale, and in some cases potentially unstable, grounding line retreat. Much of the induced change is thought to be primarily driven by fluctuations in the oceanic heat available at the ice-ocean boundary, transported on-shelf via warm Circumpolar Deep Water (CDW). However, the processes in which ocean heat drives ice-sheet loss remains poorly understood, with observational studies routinely hindered by the extreme environment notorious to the Antarctic region. Current generation coupled ice-ocean models calculate ice-ocean evolution asynchronously – that is, the ocean model is run for a period of time (months to a year) before the ice geometry is adjusted. While these models provide some insight into the dynamical processes at play at the ice-ocean interface, asynchronous coupling means correct attribution of the short-scale transient response and feedbacks is difficult. In this study we apply a novel synchronous coupled ice-ocean model, developed within the MITgcm, and are thus able to provide detailed insight into the impacts of short time scale (seasonal to centennial) climate variability and feedbacks within the ice-ocean system. Feedbacks and response are assessed in an idealised ice-sheet/ocean-cavity configuration in which the far field ocean state is adjusted to emulate climate variability patterns, and preliminary results are presented.