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Response of the Antarctic Ice Sheet to increased ice-shelf oceanic melting

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A numerical ice sheet-shelf model is used to simulate the large-scale response of the Antarctic Ice Sheet to prescribed future increases in oceanic melting at the base of floating ice shelves. The model is driven forward in time starting from modern conditions, with step-function perturbations in parameterized sub-ice oceanic melt rates that crudely represent possible ranges due to future anthropogenic warming. It is found that with melt rates under the interiors of large shelves increased to $\sim$2 m/y or more (from modern 0.1 m/y), drastic grounding line retreat in the Ross, Filchner-Ronne and Pine Island/Thwaites embayments leads to collapse of nearly all marine West Antarctic ice. The time scale of collapse depends on the magnitude of oceanic melt: $\sim$1500 years for 2 m/y, and $\sim$300 years for "infinite" melt (no floating ice). The WAIS collapse causes $\sim$3 m of global sea-level rise. Further results are presented which include surface mass-balance changes, time-dependent future forcing, and spatial differences in ocean melting between embayments.