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Analysis of the Marine Ice Sheet-Ocean Model Intercomparison Project first phase (MISOMIP1)

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The Marine Ice Sheet-Ocean Model Intercomparison Project (MISOMIP) is a community effort sponsored by the Climate and Cryosphere (CliC) project. MISOMIP aims to design and coordinate a series of MIPs—some idealized and realistic—for model evaluation, verification with observations, and future projections for key regions of the West Antarctic Ice Sheet (WAIS). The first phase of the project, MISOMIP1, was an idealized, coupled set of experiments that combined elements from the MISMIP+ and ISOMIP+ standalone experiments for ice-sheet and ocean models, respectively. These MIPs had 3 main goals: 1) to provide simplified experiments that allow model developers to compare their results with those from other models; 2) to suggest a path for testing components in the process of developing a coupled ice sheet-ocean model; and 3) to enable a large variety of parameter and process studies that branch off from these basic experiments.

Here, we describe preliminary analysis of the MISOMIP1 results. Eight models in 14 configurations participated in the MIP. In keeping with analysis of the MISMIP+ experiment, we find that the choice of basal friction parameterizations in the ice-sheet component (Weertman vs. Coulomb limited) has a particularly significant impact on the rate of ice-sheet retreat but the choice of stress

approximation (SSA, SSA* or L1Lx) seems to have little impact. Models with Coulomb-limited basal friction also tend to be those with the highest melt rates, confirming a positive feedback between melt and retreat in the MISOMIP1 configuration seen in previous work. The ocean component's treatment of the boundary layer below the ice shelf also has a significant impact on melt rates and resulting retreat, consistent with findings based on ISOMIP+. Feedbacks between the components lead to localized features in the melt rates and the ice geometry not seen in standalone simulations, though the ~2-km horizontal and ~20-m vertical resolution of these simulations appears to be too coarse to produce long-lived, sub-ice-shelf channels seen at higher resolution.