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The effect of changing wind forcing on Antarctic ice shelf melting in high-resolution, global sea ice-ocean simulations with the Accelerated Climate Model for Energy (ACME)

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The capability for simulating sub-ice shelf circulation and submarine melting and freezing has recently been added to the U.S. Department of Energy's Accelerated Climate Model for Energy (ACME). With this new capability, we use an eddy permitting ocean model to conduct two sets of simulations in the spirit of Spence et al. (GRL, 41, 2014), who demonstrate increased warm water upwelling along the Antarctic coast in response to poleward shifting and strengthening of Southern Ocean westerly winds. These characteristics, symptomatic of a positive Southern Annular Mode (SAM), are projected to continue into the 21st century under anthropogenic climate change (Fyfe et al., J. Clim., 20, 2007). In our first simulation, we force the climate model using the standard CORE interannual forcing dataset (Large and Yeager; Clim. Dyn., 33, 2009). In our second simulation, we force our climate model using an altered version of CORE interannual forcing, based on the latter half of the full time series, which we take as a proxy for a future climate state biased towards a positive SAM. We compare ocean model states and sub-ice shelf melt rates with observations, exploring sources of model biases as well as the effects of the two forcing scenarios.