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Future Freshwater Fluxes From the Antarctic Ice Sheet

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Surface freshening of the Southern Ocean driven by meltwater discharge from the Antarctic ice sheet has been shown to influence global climate dynamics. However, most climate models fail to account for spatially and temporally varying freshwater inputs from ice sheets, introducing significant uncertainty into climate projections. We present the first historically calibrated projections of Antarctic freshwater fluxes (sub-shelf melting, calving, and surface meltwater runoff) to 2300 that can be used to force climate models lacking interactive ice sheets. Our findings indicate substantial changes in the magnitude and partitioning of Antarctic freshwater discharge over the coming decades and centuries, particularly under very-high warming scenarios, driven by the progressive collapse of the West Antarctic ice shelves. We project a shift in the form and location of Antarctic freshwater sources, as liquid sub-shelf melting increases under the two climate scenarios considered, and surface meltwater runoff could potentially become a dominant contributor under extreme atmospheric warming.