Spatial Sensitivities of the Antarctic Ice Sheet to Environmental Changes (The SeaRISE Project).

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Abstract.

Atmospheric, oceanic, and subglacial forcing scenarios from the Sea-level Response to Ice Sheet Evolution (SeaRISE) project are applied to six three-dimensional thermomechanical ice-sheet models to assess Antarctic ice sheet sensitivity over a 500-year timescale and to inform future modeling and field studies. Results indicate: i) growth with warming, except within low-latitude basins (where inland thickening is outpaced by marginal thinning); ii) mass loss with enhanced sliding (with basins dominated by high driving stresses affected more than basins with low-surface-slope streaming ice); and iii) mass loss with enhanced ice-shelf melting (with changes in West Antarctica dominating the signal due to its marine setting and extensive ice shelves; cf. minimal impact in the Terre Adelie, George V, Oates, and Victoria Land region of East Antarctica). Ice loss due to dynamic changes associated with enhanced sliding and/or sub-shelf melting exceed the gain due to increased precipitation. Furthermore, differences in results between and within basins as well as the controlling impact of sub-shelf melting on ice dynamics highlight the need for improved understanding of basal conditions, grounding-zone processes, ocean-ice interactions, and the numerical representation of all three.

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