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On the difficulties of modeling the Amundsen Sea embayment

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The ice shelves and glaciers of the West Antarctic Ice Sheet (WAIS) are rapidly thinning, especially in the Amundsen Sea. The melting of Pine Island Ice Shelf (PIIS) increased since 1994. Strong basal melting of this small ice shelf is caused by the relatively warm ($\sim 1°C$) Circumpolar Deep Water (CDW) that advances to the PIIS cavity through submarine glacial troughs located on the Amundsen Sea continental shelf. The basal melting may have a large impact on ice sheet dynamics, sea-level rise, and changes in water mass properties of the surrounding ocean. Thus, we simulate the melting of Amundsen Sea ice shelves using the global Finite-Element Sea-ice Ocean Model (FESOM) to investigate the impact of melting on changes in shelf water mass properties. In FESOM, the Amundsen Sea is represented much colder ($\sim$ -0.8°C at PIIS front) than in reality ($\sim 1°C$). While this was previously considered to be caused by intensive sea-ice formation due to a cold bias in the atmospheric forcing data, a suite of sensitivity studies indicates that even with different forcing and without the influence of sea-ice formation the model still shows an Amundsen Seas much colder than in reality. In this presentation, we discuss the reasons for the cold-biased Amundsen Sea in FESOM by means of several numerical experiments using different forcing, resolution, and model parameters.