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Modelling the ocean circulation and the basal melting in the Prydz Bay-Amery Ice Shelf system

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The basal melting of the Amery Ice Shelf (AIS) in East Antarctica and its connections with the oceanic circulation are investigated by a regional ocean model. The simulated estimations of net melt rate over AIS from 1976 to 2005 vary from 1 to 2 m/yr depending primarily due to inflow of modified Circumpolar Deep Water (mCDW). Prydz Bay Eastern Costal Current (PBECC) and the eastern branch of Prydz Bay Gyre (PBG) are identified as two main mCDW intrusion pathways. The oceanic heat transport from both PBECC and PBG has significant seasonal variability, which is associated with the Antarctic Slope Current. The onshore heat transport has a long-lasting effect on basal melting. The basal melting is primarily driven by the inflowing water masses though a positive feedback mechanism. The intruding warm water masses destabilize the thermodynamic structure in the sub-ice shelf cavity therefore enhancing the overturning circulations, leading to further melting due to increasing heat transport. However, the inflowing saltier water masses due to sea-ice formation could offset the effect of temperature through stratifying the thermodynamic structure, then suppressing the overturning circulation and reducing the basal melting.