

Origin of Circumpolar Deep Water intruding onto the Amundsen and Bellingshausen Sea continental shelves

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Melting of West Antarctic ice shelves is enhanced by Circumpolar Deep Water (CDW) intruding onto the Amundsen and Bellingshausen Seas (ABS) continental shelves. Despite existing studies of cross-shelf and on-shelf CDW transports, CDW pathways onto the ABS originating from further offshore have never been investigated. Here, we investigate CDW pathways onto the ABS using a regional ocean model. Simulated CDW tracers from a zonal section across 67°S (S04P) circulate along the Antarctic Circumpolar Current (ACC) and Ross Gyre (RG) and travel into ABS continental shelf after 3–5 years, but source locations are shifted westward by ~900 km along S04P in 2001–2006 compared to 2009–2014. We find that simulated on- and off-shelf CDW is ~0.1–0.2 °C warmer in the 2009–2014 case than in the 2001–2006 case together with changes in simulated ocean circulation. These differences are primarily caused by lateral, rather than surface, boundary conditions, implying that large-scale atmospheric and ocean circulations are able to control CDW pathways and thus off- and on-shelf CDW properties.

Keywords: Ice shelf-ocean interaction, Amundsen-Bellingshausen Sea, Circumpolar Deep Water (CDW)