

West Antarctic ice shelf melting causes Ross Sea freshening and Circumpolar Deep Water warming.

*Yoshihiro Nakayama^{1,2}, Ralph Timmermann¹, Hartmut H Hellmer¹

1. Alfred Wegener Institute, 2. NASA Jet Propulsion Laboratory

Ross Sea (RS) freshening and Circumpolar Deep Water (CDW) warming have been unveiled from oceanographic observations, yet responsible mechanisms remain uncertain. Using a sea-ice/ice-shelf/ocean model, we show that enhanced ice shelf melting in West Antarctica explains the observed changes. The RS continental shelf freshening is caused by an increase in ice shelf meltwater from the Amundsen/Bellingshausen Sea. This weakens the Antarctic Bottom Water formation in the RS, which reduces the density of mid-depth and deep water, allowing CDW to shift further south and causing open ocean warming. The warming signal is transmitted onto the Amundsen/Bellingshausen Sea continental shelves including the ice shelf cavities, implying a positive feedback. Good agreement between simulations and observations suggests that the proposed mechanism is able to explain the ongoing RS freshening and CDW warming. Warmer water on the shelf likely enhances ice shelf melting and may amplify the rate of sea level rise.

Keywords: Ice shelf-ocean interaction, Amundsen-Bellingshausen Sea, Ross Sea, Circumpolar Deep Water