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Geothermal Heat Flux and Enhanced Abyssal Mixing: Implications for the Antarctic Bottom Water Circulation

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We use a combination of theory and ocean data set to show that the geothermal heat flux (GHF) plays a non-negligible role in determining the abyssal stratification and circulation strength. We find that the observed buoyancy flux above the ocean floor erodes the abyssal stratification and thereby enhances the strength of the abyssal circulation, consistent with previous work. Idealized numerical simulations are used to quantify the impact of the GHF as a function of the depth dependence of the diapycnal diffusivity that is assumed to characterize mixing in the ocean interior. In particular we show that ignoring the vertical variation of abyssal mixing leads to an underprediction of the influence of the GHF on the abyssal circulation. We conclude by showing that the GHF leads to a steepening of density surfaces in the Southern Ocean, leading to a strengthening of the eddy-induced circulation and thereby of the Antarctic bottom water circulation. The enhanced circulation acts so as to ventilate the basal heat provided to the ocean over the entire basin floor to shallow depths primarily in the Southern Ocean.