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Overturning circulaton in an eddy-resolving model: the effect of the pole-to-pole temperature gradient.

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The effect of the pole-to-pole surface temperature difference on the deep stratification and the strength of the global meridional overturning circulation (MOC) is examined in an eddy-resolving ocean model configured in an idealized domain roughly representing the Atlantic sector. Mesoscale eddies lead to qualitative differences in the mean stratification and the MOC compared to laminar (i.e., eddy-free) models. For example, the spreading of fluid across the models representation of the Antarctic Circumpolar Current (ACC) no longer relies on the existence of a sill in the ACC. In addition, the deep and abyssal water masses, roughly representing Antarctic Bottom Water (ABW) and North Atlantic Deep Water (NADW), are eroded by the eddies so that their zonal and meridional extents are much smaller than in the laminar case. The present simulations confirm an important prediction of the laminar theory: namely, that the density at the northern hemisphere sinking site must lie in the range of surface densities found in the ACC for efficient formation of NADW and a vigorous northern hemisphere overturning circulation. In contrast to the laminar theory, realistically strong deep stratification is formed even if the temperature at the northern sinking site is warmer than any temperature found in the channel. Indeed, mid-depth stratification is actually stronger in the latter case than the former case.