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How do heat fluxes in the Southern Ocean depend on bottom pressure torque?

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Successfully describing ocean physics entails a correct interpretation of the fundamental underlying mechanisms. Ocean physics are an integral part of the climate, and being able to model them with confidence leads to reduced uncertainty and predictive power. Our theoretical understanding of ocean physics is largely based on a laminar view of the ocean, assuming the non-linear vorticity terms are small. Here we investigate the balance of forces in a coarse (1°), an eddy permitting (1/4°) and an eddy resolving (1/12°), version of the NEMO general circulation model. All three versions of the model use the same surface forcing for the period from 1978 to 2007. We find that in the 30-year mean the baroclinic contribution to ocean heat transport becomes increasingly important with higher resolution, especially in the Southern Ocean. This implies that resolving eddies leads to a shift in the balance of forces and to a different partitioning of the ocean heat transport. We investigate this shift using the depth integrated vorticity equation, demonstrating that changes in the bottom steering in terms of the bottom pressure torque in the instantaneous and 30-year mean are particularly evident in the Southern Ocean.