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The energetics of rotating wind-forced horizontal convection¹ VARVARA ZEMSKOVA, BRIAN WHITE, ALBERTO SCOTTI, University of North Carolina at Chapel Hill — We present numerical results for rotating, windforced horizontal convection as a simple model for the Southern Ocean branch of the Meridional Overturning Circulation. The flow is driven by differential buoyancy forcing applied at the top surface, with cooling at one end (to represent the pole) and warming at the other (the equatorial region) and a zonally re-entrant channel to represent the Antarctic Circumpolar Current. Zonal wind forcing is applied with a similar pattern to the westerlies and with varying magnitude relative to the buoyancy forcing. The problem is solved numerically using a 3D DNS model based on a finite-volume solver for the Boussinesq Navier-Stokes equations with rotation. The overall dynamics, such as large-scale overturning, baroclinic eddying, turbulent mixing, and energy cascades are investigated using the local Available Potential Energy framework introduced in [Scotti and White, JFM, 2014]. We find that the magnitude and shape of the zonal wind stress profile are important to the spatial pattern of the overturning circulation. However, the essential circulation and the energetics in cases with wind are similar to the base case with buoyancy forcing alone, suggesting that surface APE generation by buoyancy forcing is dominant in setting the circulation.

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