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Energetic dynamics of a rotating horizontal convection model with wind forcing[1] VARVARA ZEMSKOVA, BRIAN WHITE, ALBERTO SCOTTI, University of North Carolina at Chapel Hill — We present a new test case for rotating horizontal convection, where the flow is driven by differential buoyancy forcing along a horizontal surface. This simple model is used to understand and quantify the influence of surface heating and cooling and wind stress on the Meridional Overturning Circulation. The domain is a rectangular basin with surface cooling at both ends (the poles) and surface warming in the middle (equatorial) region. To model the effect of the Antarctic Circumpolar Current, reentrant channel is placed near the Southern pole. Free-slip boundary conditions are imposed in the closed box, while zonally periodic boundary conditions are enforced in the channel. The problem is solved numerically using a 3D DNS model based on a finite-volume AMR solver for the Boussinesq Navier-Stokes equations with rotation. The relative contributions of surface buoyancy and wind forcing and the energetic balance are analyzed at a Rayleigh number of 10^8 and a relatively high aspect ratio of [5, 10, 1] in zonal, meridional and vertical directions, respectively. The overall dynamics, including large-scale overturning, baroclinic eddying, and turbulent mixing are investigated using the local Available Potential Energy framework introduced in [Scotti and White, J. Fluid Mech., 2014].

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