Abstract Submitted
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DNS of Horizontal Convection[1] BRIAN WHITE, ALBERTO SCOTTI, Dept. of Marine Sciences, UNC Chapel Hill — We perform three-dimensional DNS of Horizontal Convection in a rectangular tank with idealized boundary conditions. The flow is driven by imposing the profile for the buoyancy b at the surface, where it ranges from b_0 to $b_0 + \Delta b$ and the transition region is confined to a very small area. The Rayleigh based on the domain depth ranges from 10^5 to 10^{12}. The scaling observed for the Nusselt number and the strength of the circulation is consistent with Rossby's scaling across the range of Rayleigh numbers considered, indicating that the dynamics in the boundary layer under the "warming" side throttles the flow. Energetically, we find that Available Potential Energy (APE) is generated along the surface, and converted to Kinetic Energy (KE). Along the descending plume energy goes from APE to KE up to Ra $\sim 10^{11}$. For higher Rayleigh numbers the plume becomes a net sink of APE. When the switch occurs, a stagnant layer develops near the bottom, and the overall circulation becomes characterized by a narrow plume which retroflects rapidly towards the surface, with a shallow recirculation to close the flow. This may indicate the beginning of a Sandström regime characterized by a stagnant abyssal region and a shallow circulation.

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Alberto Scotti
Dept. of Marine Sciences, UNC Chapel Hill

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