Extreme Events in Turbulent Rotating Flows: Lagrangian and Eulerian Statistics

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Abstract

Rotating turbulent flows at different Reynolds and Rossby numbers and seeded with millions of particles of different inertia are investigated by direct simulations. We quantitatively show that the deviations from a normal-distribed Eulerian statistics result from the entangled interactions among the structures oriented along the rotation axis and the turbulent background. This happens at rotation rates of practical interest for typical industrial or geophysical application. Concerning inertial particles, we measure the relative importance of Stokes' drag with respect to the Coriolis and Centrifugal forces at different rotation rates and we assess the singular role played by the slow vortical structures to preferentially concentrate (expel) light (heavy) particles, leading to unexpected diffusion properties in the direction parallel (perpendicular) to the rotation axis.

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