Abstract Submitted
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A closed grid turbulence experiment under rotation: Anisotropic energy transfer and inertial modes inhibition CYRIL LAMRIBEN, PIERRE-PHILIPPE CORTET, FREDERIC MOISY, Laboratoire FAST, CNRS UMR 7608, Universite Paris-Sud, Universite Pierre-et-Marie-Curie, ROTATING TURBULENCE TEAM — We report an experimental study of the free decay of an initially 3D homogeneous and isotropic grid turbulence submitted to a global rotation. Turbulence is generated by rapidly towing a grid in a rotating water tank and velocity fields are measured in a vertical plane parallel to the rotation axis using a corotating Particle Image Velocimetry (PIV) system. We first show that, when a simple grid is used, a significant amount of the kinetic energy is stored in a reproducible mean flow composed of resonant inertial modes and whose spatial structures are extracted. The possible coupling between these modes and turbulence suggests that turbulence cannot be considered as freely decaying. We demonstrate that these inertial modes may be considerably inhibited by adding inner tanks to the grid, yielding, for the first time, an effectively freely decaying rotating turbulence in a confined geometry. We also provide a thorough analysis of the anisotropic energy transfers from the anisotropic third order moment of the velocity increments obtained by PIV. We show that the departure from 3D isotropic energy transfers is stronger for horizontal increments. We also show a direct evidence of an inverse energy cascade of horizontal motions at large scales.

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