Turbulent Rotating Convection

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Abstract:
Rayleigh-Bénard convection is a classical problem in which a fluid layer enclosed between two parallel horizontal walls is heated from below and cooled at the top. In a rotating frame of reference the dynamics can change considerably through the fundamental involvement of a combination of buoyancy and Coriolis forces. The rotating Rayleigh-Bénard (RRB) setting is important for many applications, e.g., in engineering and climate modelling.
Direct numerical simulation (DNS) is used to calculate the heat transfer, flow structuring and small-scale turbulent properties at systematically varied rotation rates. The DNS code solves the incompressible Navier-Stokes equations in a cylinder in a rotating frame of reference, coupled to the heat equation within the Boussinesq approximation. The results from the DNS will be compared to data from SPIV measurements in a water-filled cylindrical convection cell.
In particular, the fate of the Large Scale Circulation, present in non-rotating RB convection, and enhanced heat transfer under influence of increasing rotation rate will be discussed in this talk.