Abstract Submitted
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Three-dimensional extraction and analysis of thermal plumes in turbulent Rayleigh-Bénard convection[1] MATTHIAS KACZOROWSKI, The Chinese University of Hong Kong, OLGA SHISHKINA, German Aerospace Center, KE-QING XIA, The Chinese University of Hong Kong — We report a new method for extracting the thermal plumes (TPs) in turbulent Rayleigh-Bénard convection (RBC) which allows us to analyze the properties of the TPs and the background fluid. The investigation is based on direct numerical simulations of RBC in a cube ($8 \times 10^6 \leq Ra \leq 5 \times 10^9$) filled with fluid of Prandtl number $Pr = 4.38$. The basis of our extraction method is the idea that plumes convectively transport heat through the fluid, so that a heat flux threshold can be employed to extract the TPs. It is shown that this method yields reliable results over a wide range of Ra and at any vertical wall distance z. Characteristic quantities of the flow are investigated on the boundaries of the TPs and the mean properties of the TPs and the background fluid are investigated as a function of the vertical coordinate. The Ra-scaling of a characteristic length scale of the TPs is examined and compared to taht of the thermal boundary layer thickness.

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