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Analysis of divergence and rotation of the intertial particle velocity in high Reynolds number turbulence[1] THIBAULT OUJIA, Institut de Mathématiques de Marseille (I2M), Aix-Marseille Université, CNRS and Centrale Marseille, France, KEIGO MATSUDA, Research Institute for Value-Added-Information Generation (VAiG), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama, Japan, KAI SCHNEIDER, Institut de Mathématiques de Marseille (I2M), Aix-Marseille Université, CNRS and Centrale Marseille, France — Inertial particle data from three-dimensional direct numerical simulations of particle-laden homogeneous isotropic turbulence at high Reynolds number are analyzed using Voronoi tessellation of the particle positions and considering different Stokes numbers. A finite-time measure to quantify divergence and the rotation of the particle velocity by determining respectively the volume change rate of the Voronoi cells and their rotation is proposed. For inertial particles the probability distribution functions (PDF) of the divergence and of the curl deviate from that for fluid particles. Joint PDFs of the divergence and the Voronoi volume illustrate that the divergence is most prominent in cluster regions and less pronounced in void regions. For larger volumes the results show negative divergence values which represent cluster formation and for small volumes the results show positive divergence values which represents cluster destruction/void formation. Moreover, when the Stokes number increases the divergence takes larger values, which gives some evidence why fine clusters are less observed for large Stokes numbers. Finally, the PDFs of the particle vorticity have much heavier tails compared to the fluid vorticity, and the extreme values increase significantly with the Stokes number.

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