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Multiscale statistics of trajectories with applications to fluid particles in turbulence and football players KAI SCHNEIDER, Institut de Mathematiques de Marseille, I2M-CNRS, Aix-Marseille University, 39 rue Joliot-Curie, 13453 Marseille Cedex 13, France, BENJAMIN KADOCH, IUSTI-CNRS, Aix-Marseille University, Marseille, France, WOUTER BOS, LMFA-CNRS Ecole Centrale de Lyon, Universite de Lyon, Ecully, France — The angle between two subsequent particle displacement increments is evaluated as a function of the time lag. The directional change of particles can thus be quantified at different scales and multiscale statistics can be performed. Flow dependent and geometry dependent features can be distinguished. The mean angle satisfies scaling behaviors for short time lags based on the smoothness of the trajectories. For intermediate time lags a power law behavior can be observed for some turbulent flows, which can be related to Kolmogorov scaling. The long time behavior depends on the confinement geometry of the flow. We show that the shape of the probability distribution function of the directional change can be well described by a Fischer distribution. Results for two-dimensional (direct and inverse cascade) and three-dimensional turbulence with and without confinement, illustrate the properties of the proposed multiscale statistics. The presented Monte-Carlo simulations allow disentangling geometry dependent and flow independent features. Finally, we also analyze trajectories of football players, which are, in general, not randomly spaced on a field.
B.Kadoch, W.Bos, K.Schneider. Phys. Rev. Fluids, 2, 064604, 2017.
W.Bos, B.Kadoch, K.Schneider. Phys. Rev. Lett., 114, 214502, 2015.

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