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Multiscale Characterisation of Helical Properties in Homogeneous Turbulence WOUTER BOS, Ecole Centrale de Lyon, FRANK JACOBITZ, University of San Diego, KAI SCHNEIDER, Aix-Marseille Université, MARIE FARGE, Ecole Normale Supérieure — This study investigates the helical properties of five prototypical homogeneous turbulent flows: statistically steady forced isotropic turbulence, decaying isotropic turbulence, decaying rotating turbulence, growing sheared turbulence, and growing rotating sheared turbulence. A solenoidal uncorrelated Gaussian random field is included in the analysis as a sixth comparison case. The scale-dependent helical properties of the cases are studied using an orthogonal wavelet decomposition. It was observed that flows with growing turbulent kinetic energy and turbulent motion at large scales show a maximum in the velocity helicity probability distribution functions (PDFs) at zero, corresponding to a trend to local two-dimensionalization of the flow with vorticity and velocity being perpendicular. Flows with decaying turbulent kinetic energy and turbulent motion at small scales, however, show maxima of the velocity helicity PDFs at plus and minus one, indicating a preference for helical motion with alignment or anti-alignment of vorticity and velocity. Joint PDFs of relative velocity helicity and relative vorticity helicity show that the quantities tend to have the same sign for all flows including the random field, indicating that vorticity helicity dissipates velocity helicity.

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