“Quantifying the role of coherent structures in the cross-scale energy transfer: a space-filter approach”

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The dissipation of turbulent energy at small scales in space plasmas remains an open and challenging problem. Two main channels for energy dissipation have been intensively investigated in recent years: linear wave damping and non-linear interactions within coherent structures. However, a general consensus has not yet been reached on what is the relative importance of these two processes. It is now well established that coherent structures in the form of current sheets are associated with localized particle heating, and are generally responsible for the observed intermittent nature of plasma turbulence. Still, the contribution of such structures to the turbulence cascade, and the local energy spectrum is not well understood. Here, for the first time, we apply a 'space-filter' technique, well-known in the hydrodynamics and Large-Eddy-Simulation communities, to two-fluid plasma simulations of Kelvin-Helmholtz turbulence. This technique allows to obtain a local measure of the inter-scale transfer and to characterize the contribution of coherent structures to the energy spectrum. Specifically, we study in detail the current sheets identified in turbulent Kelvin-Helmoltz vortexes by the Partial Variance of Increments (PVI) technique, and we discuss the correlation between the inter-scale transfer and high values of the PVI index.