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An analysis of the energy transfer and the locality of nonlinear interactions in turbulence JULIAN DOMARADZKI[1], University of Southern California, DANIELE CARATI, Universite Libre Bruxelles — Using results of direct numerical simulations of isotropic turbulence we compute detailed energy exchanges among different scales of motion, defined by decomposing velocity fields using sharp spectral and smooth, tangent hyperbolic filters. The elementary energy exchange event involves two scales interacting nonlinearly and producing an effect in the third scale. In Fourier decomposition wavevectors representing all three interacting scales form a triangle. The analysis of such detailed interactions reveals that individual nonlocal contributions are large, in agreement with results of other investigators. The global energy quantities such as the energy transfer, the spectral energy flux, and the subgrid-scale dissipation reflect an integrated effect of many individual triad interactions. We investigate how the detailed, triadic energy exchanges contribute to the global, integrated quantities. We find that while individual nonlocal contributions are large, significant cancellations lead to the global quantities asymptotically dominated by the local interactions. The conclusions are expressed quantitatively in terms of infrared and ultraviolet Kraichnan's locality functions. Implications of these results for turbulence modeling are discussed.

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