Production of turbulent energy flux in inertial-range cascades[1]

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— We study the exact dynamical equation for the production of turbulent energy flux in the inertial-range, obtained by spatial filtering of the Navier-Stokes equation (Germano, 1992). We report here on the results from direct numerical simulations of both the 2D inverse-energy cascade and the 3D forward-energy cascade. Conditional averages of the various production and destruction terms in the equation are calculated, given the values of the energy flux at later times in a Lagrangian frame, using a backward particle-tracking method. In the 3D forward cascade, the dominant term is the production of subscale stress by the large-scale strain. However, in the 2D inverse cascade the dominant term is the production of subscale stress by the pressure-strain correlation. The physical mechanisms associated with these various terms will be discussed.

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