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Kolmogorov's dissipation number and the number of degrees of freedom for the 3D Navier-Stokes equations

Kolmogorov's theory of turbulence predicts that only wavenumbers below some critical value, called Kolmogorov's dissipation number, are essential to describe the evolution of a three-dimensional fluid flow. A determining wavenumber, first introduced by Foias and Prodi for the 2D Navier-Stokes equations, is a mathematical analog of Kolmogorov's number. The purpose of this paper is to prove the existence of a time-dependent determining wavenumber for the 3D Navier-Stokes equations whose time average is bounded by Kolmogorov's dissipation wavenumber for all solutions on the global attractor whose intermittency is not extreme.