PREDICTABILITY OF HOMOGENEOUS ISOTROPIC TURBULENCE

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We discuss the chaoticity and the predictability of a turbulent flow on the basis of high-resolution direct numerical simulations at different Reynolds numbers. The maximum Lyapunov exponent of turbulence, which measures the exponential separation of two initially close solutions of the Navier-Stokes equations, is found to grow with the Reynolds number of the flow, with an anomalous scaling exponent, larger than the one obtained on dimensional grounds. For large perturbations, the error is transferred to larger, slower scales, where it grows algebraically generating an *inverse cascade* of perturbations in the inertial range. In this regime, our simulations confirm the classical predictions based on closure models of turbulence [1]. We also discuss how to link chaoticity and predictability of a turbulent flow in terms of a finite size extension of the Lyapunov exponent.

References

[1] Boffetta, G. and Musacchio S., *Phys. Rev. Lett.* **119**, 054102 (2017).