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**Exploring the dynamics of the velocity gradient tensor** MARCO MARTINS AFONSO, CHARLES MENEVEAU, Dept. of Mech. Engineering - Johns Hopkins University - Baltimore, MD — The dynamics of the velocity gradient tensor is investigated by means of analytical and numerical computations. Our starting point is the Lagrangian evolution equation of this tensor and a model for the pressure Hessian and viscous term proposed in Chevillard and Meneveau (*Phys. Rev. Lett.* **97**, 174501, 2006). The model is based on the Recent Fluid Deformation (RFD) closure, which was introduced in order to overcome the unphysical finite-time blowup of the Restricted Euler model that neglects anisotropic pressure Hessian effects. Using matrix exponentials, the RFD closure takes into account both the geometry and the dynamics of the recent history of the deformation of a fluid particle, and requires the specification of a decorrelation time scale $\tau$. When this time scale is chosen too short (or, equivalently, the Reynolds number is too high), unphysical statistics are observed in the model. In order to understand this model in greater detail, the original, full matrix-exponential-based model is compared with its power- series expansion for small $\tau$. In particular, the time evolution in the so-called $R$-$Q$ plane is studied for the two approaches, and also, the effects of adding a Gaussian white noise are examined.

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