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Modeling various effects of compressibility on the pressure Hessian tensor SAWAN SUMAN, Indian Institute of Technology Delhi, SHARATH GIRIMAJI, Texas A&M University — Modeling the role of the pressure Hessian tensor in the evolution of turbulent velocity gradients is critical for developing closed Lagrangian equations of velocity gradients. In incompressible flows, substantial success has been achieved in this regard (Chevillard et al. Phys. Fluids, 2008). However, these incompressible models strongly hinge on Poisson equation of pressure, and thus - despite their success in incompressible flows - are not useful for compressible flows, wherein pressure behaves as a bona-fide thermodynamic variable evolving via the state and energy equations. Some initial attempts at modeling the pressure Hessian tensor inclusive of essential compressible physics have recently been made (Suman & Girimaji, J. Fluid Mech. 2009, 2011). However several further improvements are still desirable. With this motivation, we present a novel strategy of including further compressibility physics in these models by directly parameterizing a local state of the pressure Hessian tensor in terms of (i) local dilatation and (ii) rate of change of local dilatation. The rationale behind this modeling strategy and an evaluation of the model performance will be presented.

Sawan Suman
Indian Institute of Technology Delhi

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