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Spatial-temporal dynamics of Newtonian and viscoelastic turbulence in channel flow SUNG-NING WANG, ASHWIN SHEKAR, MICHAEL GRAHAM, University of Wisconsin-Madison — Introducing a trace amount of polymer into liquid turbulent flows can result in substantial reduction of friction drag. This phenomenon has been widely used in fluid transport; however, the mechanism is not well understood. Past studies have found that in minimal domain turbulent simulations, there areoccasional time periods when flow exhibits features such as weaker vortices, lower friction drag and larger log-law slope; these have been denoted as "hibernatingturbulence". Here we address the question of whether similar behavior arises spatio-temporally in extended domains, focusing on turbulence at friction Reynolds numbers near transition and Weissenberg numbers resulting in low-medium drag reduction. By using image analysis and conditional sampling tools, we identify the hibernating states in extended domains and show that they display striking similarity as those in minimal domains. The hibernating states among different Weissenberg numbers exhibit similar flow statistics, suggesting they are unaltered by low to medium viscoelasticity. In addition, the polymer is much less stretched during hibernation. Finally, these hibernating states vanish as Reynolds number increases. However, they reoccur and gradually become dominant with increasing viscoelasticity.

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