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Cross-Scale Interactions in Multi-scale Turbulence Explored Through a Reduced Model[1] MANAURE FRANCISQUEZ, DARIN R. ERNST, MIT Plasma Science and Fusion Center, Cambridge, MA 02139 USA, DANIEL REYNOLDS, Southern Methodist University, Dallas, TX 750235 USA, CODY BALOS, Lawrence Livermore National Laboratory, Livermore, CA 94550 USA — Multiscale gyrokinetic simulations using kinetic ions and electrons while resolving both ion- and electron-scale turbulence require tens of millions of CPU-hours[2,3]. This cost is prohibitive for physics studies and parameter scans, and severely limits box sizes for ion scales. We have developed a 2D reduced fluid model based on the gyrokinetic equations for multiscale turbulence, including Bessel functions and featuring nonlinear terms of the same Poisson bracket form as large gyrokinetic codes. We have implemented several versions of the model in a new 2D pseudo-spectral turbulence code with periodic boundary conditions, and verified it against earlier ion-scale fluid simulations.[4] The new code is serving as a test-bed for multi-scale and multi-rate algorithms that exploit the scale separation between ion and electron scales. Using the reduced model, we are presently exploring cross-scale interactions including the previously reported impact of electron scale turbulence on ion scale zonal flows.

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