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Initial Synthetic Diagnostics of Nonlinear Simulation of CSDX[1]

PAYAM VAEZI, CHRISTOPHER HOLLAND, SAIKAT THAKUR, GEORGE TYNAN, University of California, San Diego — The Controlled Shear Decorrelation Experiment (CSDX) linear plasma device provides a simple system for nonlinear studies of coupled drift-wave/zonal flow dynamics. We present numerical simulations of a minimal model of 3D collisional drift-wave physics in CSDX which evolves density, vorticity and electron temperature perturbations, implemented in the BOUndary Turbulence (BOUT++) framework [1]. Equilibrium electron density and temperature profiles are taken from experimental measurements [2]. We have verified the model with both linear analytical theory and nonlinear energy balance analysis. Results show that retaining the radial profile variation of plasma parameters has a significant impact on the simulation results. Application of synthetic Langmuir probes [3] to simulation results reveals that the effect of electron temperature fluctuations is significant for validation of model results against measurements of turbulence characteristics (e.g. fluctuation levels, flux, frequency spectra). Both of these effects are found to be needed for model predictions to be comparable to experimental observations.

[1] B. D. Dudson, et al., Comp. Phys. Comm. 180 (2009) 1467
[2] S. C. Thakur, et al., Physics of Plasmas 20, 012304 (2013)
[3] P. Ricci, et al., Physics of Plasmas 16, 055703 (2009)

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