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BOUT Simulations of Drift Resistive Ballooning L-mode Turbulence in the Edge of the DIII-D Tokamak[1]

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Progress is reported on simulations of electromagnetic drift-resistive ballooning turbulence in realistic single-null tokamak geometry using the BOUT three-dimensional fluid code [1] that solves Braginskii-based fluid equations [2]. The simulation domain models the actual magnetic geometry of the DIII-D tokamak. The simulations follow unstable drift resistive ballooning turbulence in the edge region to saturation. Fluctuation amplitudes, fluctuation spectra, and particle and thermal fluxes are compared to experimental probe and beam-emission-spectroscopy data for a well-characterized L-mode discharges in DIII-D. Post-processing of the simulation data using synthetic diagnostics facilitates the comparisons. The simulations are comprised of a suite of runs in which the physics model is extended to include more fluid fields and physics terms. The relative agreement of the simulation results with the experimental data improves as more physics is included in the model. The simulations yield results for fluctuation amplitudes, correlation lengths, particle and energy fluxes and diffusivities in reasonable agreement with measurements near the outer midplane of the discharge. The effects of sheared ExB poloidal rotation are included, and a density scan is presented.

[1] X. Q. Xu, and R. H. Cohen, Contrib. Plasma Phys. 36 (1998) 158.
[2] S. Braginskii, "Transport Processes in a Plasma," in Reviews of Plasma Physics, Vol. 1, ed. M. A. Leontovich (Consultants Bureau, New York, 1965), p. 205.

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