Comparison of experimental fluctuation and turbulence measurements with theory and simulation at DIII-D

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Abstract. Considerable research at DIII-D has been aimed at detailed comparisons of a variety of experimental fluctuation and turbulence measurements to turbulence simulations and theory. The goals of such comparisons are to improve the understanding of turbulence and transport as well as to test and provide feedback to the theory and simulations. Progress in this area will lead to confidence in the extrapolation of predictions to next-step fusion devices and, potentially, to improved control of transport. In this paper are summarized some of the more recent and significant results of comparisons of experiment to theory and simulation which have been performed at DIII-D. These comparisons cover a range of plasmas conditions (Ohmic, L-mode, impurity enhanced confinement), physical phenomena (transport, avalanches, zonal flows and geodesic acoustic modes) and measurements (fluctuation levels, fluctuation spectra, radial correlation lengths, heat transport, and poloidal fluctuation velocity). Results reviewed here include comparisons between experimental turbulent radial correlation

lengths and nonlinear turbulence simulations, measurements showing geodesic acoustic mode activity (a type of zonal flow) similar to predictions, long range or avalanche type behavior with significant heat transport similar to that seen in nonlinear simulations, and reduction of turbulence with an enhancement of confinement during impurity injection similar to theory and simulation.

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