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Investigations of turbulent structures in the TORPEX device S.H. MUELLER, A. FASOLI, B. LABIT, M. MCGRATH, G. PLYUSHCHEV, M. PODESTA, F.M. POLI, CRPP EPFL, Switzerland, V. NAULIN, RISOE Nat. Lab., Denmark — Electrostatic turbulent structures are visualized on the TORPEX toroidal plasma experiment ($R = 1\,\mathrm{m}$, $a = 0.2\,\mathrm{m}$) using HEXTIP, an 86-tip, 2D Langmuir probe array covering the whole poloidal section. To characterize such turbulence imaging data statistically, thus providing a quantitative basis for comparison (theory-experiment, theory-theory, experiment-experiment), suitable observables like positions, shapes and velocities of structures must be defined. Several possible definitions are compared in terms of information content, discriminative power, robustness and computational requirements. The statistical distribution of these observables is experimentally measured on TORPEX as a function of control parameters, i.e. quantities set externally and not subject to the plasma feedback action. Among these, the magnetic field line pitch angle is shown to play a special role for the turbulence dynamics through its effect on parallel flows, important to oppose drift-induced charge separation. The TORPEX results thus provide a highly discriminative test environment for turbulence models. On the modeling side, a pseudo-3D variant of the two-fluid code ESEL has been developed, accounting for the effect of a non-zero field line pitch angle and permitting to replace formerly freely chosen dissipation parameters by a physical model of the parallel dynamics.

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