Time series analysis applied to generation of external transport barrier in non-linear plasma edge simulations

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Tokamak experiments show that under certain conditions, the plasma self-organizes into a state characterized by large, localized velocity shear flows that quench turbulence, creating a transport barrier. Such transport barriers, which develop near the edge of the plasma (external transport barrier, ETB) provide an important gain in confinement (called H-mode). Here, generation and dynamics of this ETB is reproduced using three-dimensional first-principles plasma edge turbulence simulations. A transport barrier is observed to form spontaneously above a threshold of the input power. The physical mechanism relies on the coupling between the equilibrium pressure gradient and the poloidal flow, through the radial force balance including the neoclassical friction.

In the rich self-consistent dynamics between turbulence, turbulence-driven flows and the equilibrium flow governed by force balance, these neoclassical effects play a major role and lead to the barrier formation. In previous works, it has been found that neoclassical friction acts as an energy source for the flow, which largely overcomes the sink due to the turbulent Reynolds stress during the whole barrier lifetime [1]. In the work presented here, preliminary analysis for the characterization of the simulated turbulence using statistical tools will be presented.

References:

1. L. Chône *et al.*, Nucl. Fusion, **55**, 073010, (2015).