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# Nonlocal Transport from Edge to Core in Tokamak Plasmas

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A nonlocal response of plasma to edge density sources, which has been sometimes observed in toroidally magnetic confinement plasmas, is found in global fluid simulations. In the 4-field reduced MHD model, a toroidally-elongated particle source is applied in the edge region after saturation of the resistive ballooning mode turbulence is attained. The nonlocal transport appears at the location far from the edge source. The detailed process of the nonlocal transport is revealed for the first time. Both nonlinear and toroidal couplings between axisymmetric Fourier modes are responsible for the nonlocal transport. Especially (m,n)=(1,0) and (-1,0) modes play an essential role to produce the nonlocal transport, where m and n are poloidal and toroidal mode numbers, respectively. In the RMHD simulation only the resistive ballooning modes are unstable at the edge and no turbulence exists in the core region where the nonlocal response appears. The (1,0) pressure perturbation is an ingredient of the geodesic acoustic mode (GAM) oscillation of zonal flows (ZFs) and can be driven by drift wave turbulence such as ion temperature gradient (ITG) driven turbulence in toroidal plasmas. Therefore, it is interesting to investigate what happens in the nonlocal transport observed in the RMHD simulation if the ITG turbulence exists in the core. In order to study effects of edge density source on the ITG-ZF/GAM behavior, the global ITG turbulence code has been modified, in which the edge density source is implemented as a sink or cold pulse in the temperature equation. It is found in electrostatic ITG turbulence simulations that strong GAM oscillation is excited in an inner region than the sink location when the sink is imposed to simulate the cold pulse propagation. After investigating the above simulations in detail, we will perform simulations including both density source and temperature sink by extending the codes further.

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