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Equatorial Electrojet Instabilities - New Fluid Model Approach

EHAB HASSAN, WENDELL HORTON, University of Texas at Austin, ANDREI SMOLYAKOV, University of Saskatchewan, DAVID HATCH, University of Texas at Austin — A fluid model combines both Farley-Buneman (Type-I) and Gradient-Drift (Type-II) plasma instabilities in the equatorial electrojet. The ion viscosity and electron inertia are considered in the ion and electron equations of motion, respectively. These two terms play an important role in stabilizing the growing modes in the linear regime and in driving Farley-Buneman instability into the saturation state. The simulation is stable in the saturated state and the results show good agreements with a number of rocket measurements and radar observations, where we find (1) a saturation of the plasma density around 7% relative to the ionosphere background, (2) the horizontal secondary electric field stabilizes at 8.7 (mV/m), (3) the phase velocity of the perturbed density wave has a value close to the ion-acoustic speed inside the electrojet, (5) an up-down asymmetry in the vertical particle fluxes of plasma density, (5) an east-west asymmetry in the plasma drifts in the zonal direction, and (6) a generation of the small-scale; of the order of 3 meter scale length and less, irregularities embedded in the large-scale structures in the vertical direction. The break-up of the large-scale structures into small-scale structures explains the disappearance of Type-II echoes in the presence of Ty

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