JOURNAL CLUB

MHDust: A three-fluid dusty plasma code

Simulation of ambipolar flux response to HF heating of the daytime F region ionosphere

by

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ABSTRACTS

MHDUST IS A next generation three-fluid magnetized dusty plasma code, treating the inertial dynamics of both the dust and ion components. Tests of wave-mode propagation (Acoustic and Electromagnetic) allow a comparison to linear wave mode theory. Additional nonlinear phenomena are presented including magnetic reconnection and shear-flow instabilities. Relevant parameters for the space environment are considered, allowing a comparison to be made with previous dusty plasma codes (DENISIS). The utility of the code is expanded through the possibility of small dust mass, allowing its use as a two-ion plasma code. MHDust considerably expands the range of numerical investigations into nonlinear phenomena in the field of astrophysical dusty plasmas.

MODIFICATIONS OF FIELD-ALIGNED ion flux caused by artificial heating of the daytime high-latitude F-region ionosphere have been observed in a self-consistent, one-dimensional numerical model. Time-dependent altitude profiles of ion fluxes, densities, temperature, and electron temperature are calculated by numerically solving coupled one-dimensional continuity and steady-state momentum equations for the individual ion species simultaneously with ion and electron energy equations. Heating the F-region electrons for minutes leads to ion heating, resulting in an overall increase of ion ambipolar diffusion that describes the bulk steady-state field-aligned motion of plasma. Simulation results are compared with bulk plasma motion inferred from bistatic HF sounder observations during a continuous wave O mode heating experiment in the high-latitude ionosphere.

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