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A new MHD model for Io's and Europa's plasma interaction

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Io and Europa are embedded in Jupiter's magnetosphere and the moons' surfaces and atmospheres interact with the surrounding moving magnetized plasma forming a complex plasma interaction. The interaction scenarios for both moons are characterized by inhomogeneities in the atmospheres from local outgassing. These inhomogeneities affect the electromagnetic environment but can also lead to localized features in the moons' auroral emissions. The moons' aurora in turn is sensitive to the energy or temperature of the exciting electrons in the plasma. To simulate the interaction scenarios including atmospheric inhomogeneities and aurora generation, we expand the magnetohydrodynamic code MPI-AMRVAC by implementing a self-consistent description of the electron temperature and the electron density where the cooling by inelastic collisions between the magnetospheric electrons and the atmosphere, and the electron heat flux from the magnetospheric plasma to the moons' ionosphere are included. Furthermore, the numerical schemes of MPI-AMRVAC are able to handle discontinuities that arise from the atmospheric inhomogeneities. Here, we demonstrate the implementation of the physical effects and first modeling results of Io's and Europa's plasma interaction with the advanced MHD code.