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Global configuration and dynamics of Ganymede's magnetosphere: Three-dimensional MHD simulations

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Ganymede, the largest moon in the solar system, is the only one known to be strongly magnetized. Like magnetized planets (Earth, Jupiter, etc.), Ganymede is embedded in a flowing plasma, but the physical conditions of the incident flow at Ganymede and at the planets differ in an important way: the plasma flow onto Ganymede is sub-magnetosonic to trans-magnetosonic, and consequently produces a magnetosphere whose properties differ from those of planetary bodies in the super-magnetosonic solar wind. No bow shock stands upstream of the magnetosphere; the magnetospheric structure extends farthest along the dipole axis instead of transverse to the dipole axis. We have developed a global MHD model with a high-resolution grid and appropriate boundary conditions to understand the large-scale interaction between Ganymede's magnetosphere and Jupiter's magnetospheric plasma. In this talk, we will discuss the general properties of Ganymede's magnetosphere inferred from our global simulations, such as the global configuration and the convection pattern, and will compare them with Galileo observations. Ganymede's magnetosphere provides us with a good opportunity to investigate the reconnection process in a relatively stable external environment because the upstream conditions vary imperceptibly over time scales pertinent to plasma flow across the entire structure. Our time-dependent simulations reveal that even under steady external conditions, upstream reconnection is intermittent, a result that is consistent with the presence of magnetic fluctuations near the magnetopause encounters.