Spatial variation in E-ring neutral cloud erosion

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Ionization–whether through solar photons, impacting particles, or charge exchange–is a significant loss process in the E-ring neutral cloud. When these particles are ionized, they are energized by the electric field associated with the corotating magnetized plasma. When the pick-up energy is great enough, the particles generate ion cyclotron waves with a magnetic field amplitude that is determined by the energy of the pick-up ions. These waves, with frequencies near the local water-group gyrofrequencies, were first seen in the E ring by the Pioneer 11 and Voyager 1 magnetometers, but Cassini's large coverage of radial distance, local time, and latitude within the E ring allows us to use this spacecraft's magnetometer to conduct a more comprehensive study of these waves. These waves are consistently seen between 3.5 and 6.5 Rs at low to moderate latitudes. We use these measurements, and a simple model of the plasma cloud, to calculate erosion rates of the E-ring exosphere. We find that this structure loses, on average, about 7 kilograms of water-group neutrals per second to the magnetospheric plasma and has peaks in the erosion rate near the orbital distances of Enceladus, Tethys, and Dione. We further analyze the variation in the wave observations, focusing on the difference with local time and the effect of proximity to the icy moons.