

Solar Wind Dynamic Pressure during Magnetic Storms and its implications on the Dayside Ring Current Particle Loss

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It has been known that ring current particles can be lost through dayside MP(magnetopause). However, details of the loss mechanism of this process has not received much attention. In this study, we show that the solar wind dynamic pressure P_D can play a significant role in the dayside loss. In order to show that, we have first conducted superposed epoch analysis using 95 geomagnetic storm events selected from the period 1997 to 2002. We find that P_D overall enhances during the magnetic storm. The enhancement is most significant during the storm main phase and for stronger storms. Using the most recent Tsyganenko code, T01_s, we show that this enhanced P_D not only pushes MP to move inward but also sets an enhanced gradient of magnetic field intensity along the MP. On the basis of the test particle calculation, we explicitly show that the increased gradient of the magnetic field intensity along the MP can be a significant factor for the particles to drift across the MP. Our result applies to those of the particles that are adiabatic at and near the MP. We however argue that as the solar pressure increases, the particle's energy range in which the particles can be considered to be adiabatic at the MP becomes wider. Then, the rest of the particles having higher energy that are therefore not adiabatic near MP are lost by a large gyroradius motion crossing the MP.