Two types of global poloidal waves in the inner magnetosphere: Satellite observations and implications on wave-particle interaction

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Poloidal waves in the magnetosphere are a unique type of ultra-low-frequency (ULF) waves that can exchange energy with ring current particles. These waves usually come with large azimuthal wavenumbers (*m*), making them difficult to detect from the ground. Here we summarize the recent satellite observations of two types of global poloidal waves that can potentially modulate energetic particles in the inner magnetosphere. The first type is known as the “global poloidal mode” that has a wave frequency independent of *L*. It has recently been found that, by rapidly sweeping through different longitudinal sectors in the low Earth orbit, the ST-5 satellites frequently observed this type of global poloidal waves as the Doppler-shifted high-*m* waves. Furthermore, it is found that this global poloidal mode can last many hours during geomagnetically quiet times. The second type of global poloidal waves is associated with the storm recovery phase. Evidence is demonstrated by an unprecedented combination of satellite observations, including those by five missions with 15 different probes, during the recovery phase of a major magnetic storm in June 2015. The poloidal waves were found at *L*-values between 5 and 10 as well as at all local times covered by these satellites. Observations of *L*-dependent frequencies support the concept of a discrete number of drift-bounce resonance regions across *L*-shells associated with this type of global poloidal waves. We conclude with possible wave excitation mechanisms for these two types of global poloidal waves, as well as their impact on particle energies in the inner magnetosphere.

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