



A finite lifetime of poloidal Alfvén waves in the dipole model

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Poloidal Alfvén wave with high azimuthal wave number ($m \gg 1$) in the Earth's magnetosphere is one-dimensional waves that propagate along the magnetic field. To understand the dynamics of the high- m poloidal mode wave is of great importance since its polarization enables the waves to interact with the ring current particles and accelerate or decelerate them via drift-bounce resonances. We investigate the characteristics of the poloidal mode using MHD wave models with high grid resolution. Comparisons among a 3-D simple box model, 2-D, and 3-D dipole models advance our knowledge of the wave characteristics. We impose various standing poloidal Alfvén waves with different azimuthal wave numbers and harmonics, and examine how they evolve in time. Our results show that poloidal Alfvén waves are highly transient phenomena such that the initial poloidal wave energy is transferred to the toroidal mode energy, which is opposed to the toroidal field line resonance. The time scale of the brevity in dipolar geometry turns out to be much shorter than that in the box model. Our results indicate that the time-dependent behavior of the poloidal mode wave is

significantly affected by the geometry, therefore it should be incorporated into wave-particle interaction. It also suggests that prolonged poloidal mode oscillations could be observed only if there is continuous wave excitation via the wave-particle interaction.

References

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