Dynamics of MHD Wave Propagation in the Inner Magnetosphere

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It is analytically and numerically investigated how MHD waves propagate in the plasmasphere and magnetosphere by using a dipole model. MHD approximation is used to determine the cutoff boundaries in the inner magnetosphere. It is found that most wave energy may be significantly transmitted into the deep magnetosphere through the low-latitude region. It is also examined how the transmission from the outer magnetosphere to the inner magnetosphere depends on wave frequencies and azimuthal wavenumbers. We quantitatively determine the cutoff boundaries of wave propagation for each mode and wavenumber by applying the WKB calculations, which show various mode structures on the meridian. The results suggest that the propagation region may consist of two separable domains of the inner and outer magnetosphere for a relatively low frequency wave. Such spatial separation of the two regions becomes weak and gradually interconnected as the frequency increases and the azimuthal wavenumber becomes relatively small. It is shown that the cavity modes may exist in the plasmasphere as well as in the magnetosphere, which are found to be strongly associated with the characteristics of wave parameters.