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Variation of the plasma density distribution in low-L (L~1.3) region during magnetic storms

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The field line resonance (FLR below) in the Earth's magnetosphere is caused by hydromagnetic waves. In ground-based observations of FLR phenomena, it is known that the amplitude of the H-component perturbation reaches a maximum at the resonant point, and that its phase jumps by 180 degrees across the resonant point. The cross-phase method and the amplitude-ratio method are useful for identifying these properties and determining the resonant frequency.

The field line eigenfrequency is dependent upon the plasma density and the magnetic field intensity in the region of space threaded by the field line, and the length of the field line. When we observe the eigenfrequency of the field line and assume models for the latitude profiles of the magnetic field and the plasma density (with the equatorial density as a free parameter), we can estimate the plasma mass density. Therefore, FLR is useful for monitoring temporal and spatial variations in the plasmaspheric density. In ground-based observations, we can identify FLR phenomena and measure the fundamental field line eigenfrequency by applying the cross-phase method and the amplitude-ratio method.

We have installed three magnetmeters at L~1.3, and observed geomagnetic pulsations in the Pc3 range. Each adjacent stations are separated in latitude by 50~100 km. We have analyzed the magnetic field data from these stations by using the two methods, the amplitude-ratio method and the cross-phase method. As a result, we have identified FLR events and measured their frequencies; these data provide the plasma density at L~1.3 varying with time. By using these data, we will discuss the temporary variation of the plasma density at L~1.3 during magnetic storms.

In addition, we note that the observed FLR frequency decreased with decreasing latitude: We interpret this feature to be the result of heavy ion (for example O+-ion from the ionosphere) mass loading at low latitudes, which decreased the magnetic field line eigenfrequency there. It is possible that the plasma is mainly composed of heavy ions at L~1.3. It deserves to be studied if the activity of this mass loading effect seen in the ground data, depend on the storm activity.