Study on the plasmaspheric oscillations by using ETS-6 and a ground station

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It was recently reported that Pc 3 pulsations observed on the ground are often coherent over a wide region of the sunlit hemisphere. The two-dimensional spatial structure of the amplitude and phase of these coherent Pc 3 pulsations on the ground were also investigated, and by mapping them onto the equatorial plane of the magnetosphere, a twin-vortex structure of the magnetic perturbations in the magnetosphere was obtained. However, it was not possible to identify the wave modes in the magnetosphere only by the ground-based observations. On the other hand, statistical analyses of the satellite data have clarified the energy distribution of Pc 3 pulsations in the magnetosphere for various wave modes. Only by the satellite data, however, it is impossible to understand the spatial phase structure of Pc 3 pulsations, because of a lack of simultaneous multipoint observations. In order to complement each other, it is important to combine the magnetic field data from satellites in the magnetosphere with those from ground stations.

In this study, we have attempted to investigate the spatial phase structure of Pc 3 pulsations in the magnetosphere by using the magnetic field data from ETS-6 satellite and GUA on the ground near the magnetic equator. We have performed the coherence and cross-phase analysis between the compressional component at ETS-6 and the H component at GUA. The results are summarized as follows. (1) With a small local time separation between ETS-6 and GUA (within 1hour), the ratio of high coherence events (larger than 0.6) to all events is about 30%. The ratio becomes smaller with increasing local time separation. (2) The occurrence ratio of high coherence events is almost constant in the range of L=4.5-7.1, independent of the radial distance. (3) The phase differences are –178 degrees in the 0700-1100 LT sector and –23 degrees in the 1100-1800 LT sector, where the minus sign means that the signals at ETS-6 lag behind those at GUA. These results are similar to those reported by Kim et al. [1998], who demonstrated the high coherence and out-of-phase relation between the compressional component at L=3-6 in space and the H component at L=1.25 on the ground in the morning sector. Furthermore, our result indicates that the cavity mode oscillations may have a non-zero azimuthal wave number.