

Varying IMF B_y effects on interhemispheric conjugate auroral features during a weak substorm

Tetsuo Motoba¹, Keisuke Hosokawa², Natsuo Sato¹, Akira Kadokura¹, Yasunobu Ogawa¹, and Gunnlaugur Bjornsson³

¹*National Institute of Polar Research*

²*University of Electro-Communications*

³*University of Iceland*

Interhemispheric conjugate auroral features during a weak substorm on September 21, 2009, were investigated using simultaneous all-sky camera (ASC) measurements at the northern and southern geomagnetic conjugate points: Tjornes (TJO, 66.2N, 342.9E) in Iceland and Syowa Station (SYO, 69.0S, 39.6E) in Antarctica. The time sequence of the interhemispheric conjugate auroral features was well reflected in the geomagnetic field variations at both stations. Based on a detailed comparison of both ASC images, we identified that the northern geomagnetic footprint of SYO was displaced poleward of TJO by up to 3.0 deg or more in the initial stage of substorm development, whereas in the late stage it was displaced eastward by up to ~ 1 h relative to TJO and then it moved closer to TJO. In addition, we analyzed the magnetic field data observed at four Cluster satellites in the 11-14 R_E near-Earth tail, in close conjunction with the TJO-SYO conjugate optical auroras. Interestingly, we found that the variations in the magnetic field y-component (B_y) at all satellites correlated moderately well with the variations in the time-shifted IMF clock angle (θ_{CA}). The correlation coefficients (0.56-0.61) between the B_y field at Cluster and IMF θ_{CA} peaked at a time delay of 52 ± 1 min from the dayside magnetopause, probably corresponding to the timescale for the reconfiguration of the IMF θ_{CA} -related B_y field in the near-Earth tail. The IMF θ_{CA} -related B_y variation at Cluster, regarded as a manifestation of the twisting magnetotail configuration, also roughly coincided with the relative magnetic local time displacement of nightside conjugate auroral forms. Simultaneous ground and satellite observations allow us to conclude that the dynamic motion of the conjugate points are a consequence of the time-dependent magnetotail field reconfiguration (twisting) process, controlled by the varying IMF B_y polarity.