

Simultaneous ground-satellite observations of meso-scale auroral arc undulations

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

¹*National Institute of Polar Research*

²*University of Electro-Communications*

We present simultaneous ground-based and in situ measurements of a train of meso-scale (about 100–300 km) auroral arc undulations, occurring in the postmidnight sector (~ 1 MLT) between 0040 UT and 0054 UT on September 21, 2009. The undulations appeared at the poleward edge of the preexisting diffuse aurora, and then moved eastward with a speed of 0.9–2.2 km s⁻¹. Dynamic behaviors of the associated meso-scale ionospheric plasma flows and current systems were also detected with the ground-based magnetometer and radar measurements within the all-sky camera field-of-view. During the interval of interest, simultaneous Cluster observations in the central near tail region (11–14 R_E down tail) were available, and especially the ionospheric footprint of Cluster 2 (CL2) was close to the optical auroral forms. Whenever a bright arc area (a trailing dark area adjacent to it) of the auroral undulations passed the CL2 footprint, CL2 observed strong perturbations in the in-situ B_y field with amplitude of 5–10 nT. The B_y field changes at CL2 could be considered as a manifestation of localized upward and downward field-aligned current sheets moving eastward at the central near-Earth tail boundary, linked to the drifting meso-scale auroral structures.