

Coordinated study on the electrodynamics around the most poleward arc system of the double oval configuration in a substorm (1)

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A campaign observation of the nightside high latitude aurora was carried out at Longyearbyen (LYR), Svalbard in March, 1999. In this campaign we aimed at an optical auroral conjugate observation between LYR and Zhongshan Station (ZHS) in Antarctica. A good auroral activity was observed in the 10 March night. During that time, very fortunately, EISCAT Svalbard Radar (ESR) was operating and the calculated footprints both of the FAST and GEOTAIL satellites passed within the field of view of LYR. POLAR UVI image data showed that an auroral brightening occurred over the IMAGE stations in Scandinavia around 19:42 UT, and then an auroral bulge expanded west-, east- and poleward. Around 19:57 UT, poleward edge of the bulge reached Svalbard island, and then intensity of the middle bulge gradually decreased to leave a discrete auroral activity at higher latitude side and more diffuse one at lower latitude side, forming so-called double oval configuration. We are especially interested in the electrodynamics around the most poleward arc system in the double oval configuration. Preliminary results of this study are as follows;

1. It was clearly shown that the most poleward arc is the discrete auroral activity appeared in the electromagnetic system around the PSBL region. The VDIS ions and downward field-aligned current (FAC) situated at the higher latitude side of the arc, and the upward FAC situated around the arc. The electric field distribution observed by the FAST

satellite implied that an equatorward ionospheric Pedersen current should flow to close this FAC circuit.

2. The GEOTAIL satellite observation showed that the sunward and tailward FAC pair existed around the PSBL region in the pre-midnight tail region of about 29 RE, corresponding to the downward and upward FAC at low altitudes. The electric field directed equatorward, i.e. inverse direction of the current flow, so this is a dynamo electric field. The VDIS ions appeared in the sunward (downward at low altitudes) FAC region. It should be noted that the VDIS structure appeared under the dawnward electric field condition, which implies that the source mechanism of this VDIS structure could be independent of the direction of the electric field.

3. Comparing with the low and high altitude observations, spatial relationship among the FACs, VDIS ions, and the electric field is qualitatively consistent with each other, except EY component, and the intensity of the FACs and the electric field is also consistent. As for the characteristic energy of the VDIS ions, the low altitude observation values are appreciably higher than the high altitude ones.