Geomagnetic activity-related Na layer and CNA variations observed over Syowa, Antarctic

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Metallic layers, such as Na, Fe, Mg, K, and Ca layers, exist in the mesosphere and lower thermosphere (MLT). The height range of the MLT region corresponds to the ionospheric D and E regions, and in the polar region energetic particles precipitating from the magnetosphere can often penetrate into the E region and even into the D region. Therefore, the influence of energetic particles on the metallic layers is of interest regarding changes in atmospheric composition accompanied by auroral activity or geomagnetic activity.

In the present study, we have performed a statistical analysis on geomagnetic activity-related Na layer responses using Na density data, together with cosmic noise absorption (CNA) data. Those data were obtained from simultaneous observations at Syowa, Antarctic (69.0S, 39.6E) in 2000-2002. Utilizing the ground-based observational data, we can investigate local-time characteristics in the geomagnetic-related Na layer response, while it was difficult to see local-time variations in such Na layer responses from the statistical investigation by our previous work because of its dataset obtained from the polar orbit satellite.

As the results, it is found that the Na densities around the topside of Na layers tended to decrease but the CNA tended to increase during geomagnetic active days. The amounts of Na density responses, i.e., Na density decrease or Na loss, were increasing with magnetic local time (MLT) from dusk hours to dawn hours, and those of CNA responses, i.e., CNA increase, were also increasing with MLT. Thus, there were clear negative correlations between the Na density and the CNA variations. These MLT characteristics would be observational evidences for the the Na loss induced by the energetic particle precipitation during geomagnetic active days.