

Study on geomagnetic responses of Na, Mg, and Mg⁺ layers based on Envisat/SCIAMACHY observations

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

In this study, we investigated the geomagnetic responses in the Na, Mg, and Mg⁺ layers using the SCanning Imaging Absorption spectroMeter for Atmospheric CHartographY (SCIAMACHY) onboard the Envisat. The results showed a significant decrease in the Na density at heights above 95 km at latitudes above 50°S during geomagnetically active periods. In contrast, a significant increase in the Mg⁺ density was found at heights above 105 km at latitudes above 40°S during geomagnetically active periods. The most probable explanation for the Na and Mg⁺ responses is the charge-transfer reactions triggered by ionization due to energetic particle precipitation during geomagnetically active periods.

Keywords: Metallic atom layers, Metallic ion layers, Auroral activity, Envisat/SCIAMACHY