オーロラ降下粒子が起こす Na 層変動について

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On sodium layer variation by auroral particle precipitation

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The relationship between auroral particle precipitations and sodium atom layer variations is still an unresolved subject, although there are several previous studies. To examine this issue, it is important to distinguish auroral particle precipitation from ionospheric electric fields for evaluation of their actual effects on sodium atom density variations. However, the separation of these two effects has never been done in previous studies. In order to overcome this issue, we have performed a simultaneous and commonvolume observation via a European incoherent scatter (EISCAT) VHF radar and a sodium lidar at Tromsø, Norway (69.6ºN, 19.2ºE), and have determined, for the first time, the effect of pure particle precipitation, excluding that of the electric field, on sodium density variations. Our observation on 24-25 January 2012 showed that sodium atom density decreased when there was no ion temperature enhancement (indicating a weak electric field) and the electron density increased (indicating strong particle precipitation). From the results we have concluded that auroral particle precipitation induced sodium atom density decrease in this event. Furthermore, a discussion is provided regarding the time response of the decrease in sodium density.

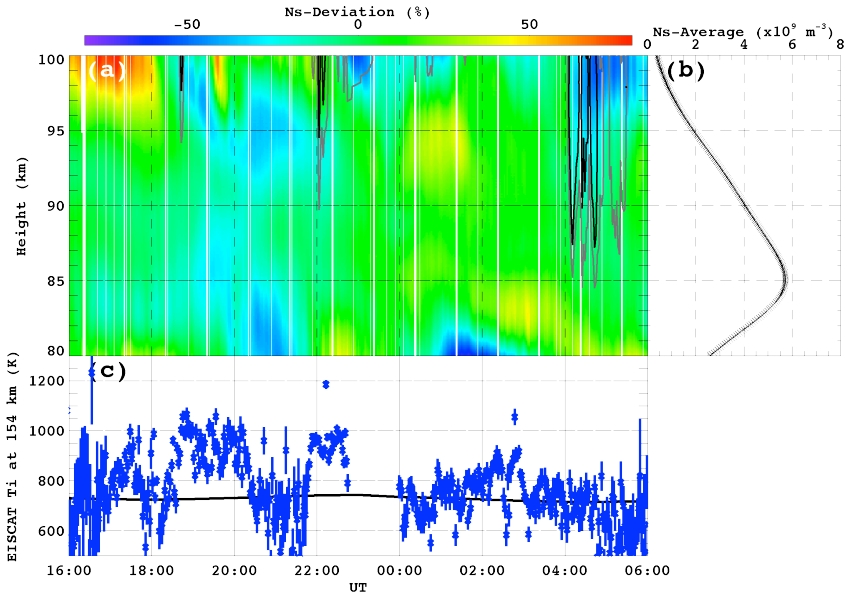

Figure 1. (a) Deviation from averaged sodium number density at each height (Ns-Deviation), (b) the averaged sodium number density (Ns-Average), and (c) the ion temperature (blue) at 154 km and the neutral temperature (black thick line) from the NRLMSISE-00 model. Black and gray lines overlaid on the Ns-deviation indicate the electron densities of 3×10^{11} m^{-3} and 2×10^{11} m^{-3}, respectively. At 04:00-05:00 UT, electron density enhancements were observed, suggesting auroral particle precipitations, and then no ion temperature enhancements were observed, suggesting no (or very weak) electric field injection. During the time, it was found a decrease in sodium density of several tens of percent at 90-100 km (down to -60% around 100 km).