Energetic particle impact on the Na layer

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The metallic atom and ion layers, its source is considered as ablation of meteoroids coming into the atmosphere, are generally distributed mainly height range of 80-110 km or higher in the upper atmosphere. An importance of the metallic ions, such as Na^+ and Fe^+, is their longer chemical lifetimes, i.e. slower recombination rates, compared with major ions, such as NO^+ and O_2^+. This can contribute to maintain dens electron concentration, which can influence radio propagation in the upper atmosphere, e.g., satellite communication between the ground and space. The metallic atoms, such as Na and Fe, are also important as a reservoir of the metallic ions through their chemical processes. Thus, it is socially important to investigate the metallic atom and ion layers for understanding or prediction of the radio propagation environment in the upper atmosphere.

In this presentation, we will introduce our recent investigation, which focuses on energetic particle impact on the Na layer. There are several previous studies on this issue. Of interest is that the previous studies reported conflicting results and/or suggestions in the response of Na density to auroral activity. In some cases the Na density increased, and in others it decreased. Thus, the Na density response to auroral activity is still unclear. We have been working on this issue using ground-based observations, such as Na resonance scattering lidar and European incoherent scatter (EISCAT) radar, as well as Na dayglow measurements from space, such as Optical Spectrograph and InfraRed Imager System (OSIRIS) onboard the Odin satellite. As the results of our investigation, we conclude that the basic auroral effect to the Na density is a decrease not an increase and the decrease is probably induced through Na ion chemistry triggered by ionization due to energetic particle precipitation related with the auroral activity.

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