

An observation of sodium twilight airglow using a Fabry-Perot imager

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The mesosphere and lower thermosphere (MLT) region is thought as a key region to solve a mechanism of the global change in the Earth's atmospheric system. Atomic metal layers which are maintained by ablation of meteors in the MLT region are known as a precious tracer to investigate chemistry and dynamics of the upper atmosphere [Williams, 2002]. For example, resonance scatter lidars tuned for wavelengths of various metal species are widely used to infer the winds and temperature in the MLT region [Plane, 2003]. However, there are still many ambiguities in knowledge about a horizontal structure and a seasonal variability of the metal layers. Therefore, a twilight airglow is focused on as a tracer to investigate horizontal structures of the metal layers in the MLT region in this study. The twilight airglow is luminous phenomenon which is caused by a resonance scattering of the metallic atoms in the MLT region illuminated by solar irradiance. This emission is effectively detectable in twilight time under a suitable geometric condition among the Sun, the metal layers, and a ground-based observer [e.g. Chamberlein, 1961]. Unlike a resonance scattering lidar, an emission from a metallic atom layer occurs simultaneously in a horizontally spread area, because a light source of the emission is solar irradiance in a case of twilight airglow. Thus, it is possible to deduce a horizontal distribution of metallic atoms from twilight airglow observations by using a sensitive and narrow band imaging device with a wide field of view. The Fabry-Perot interferometric imager (FPI) of the National Institute of Polar Research (NIPR) is one of instruments which satisfy these requirements. In this study results of a test observation of sodium twilight airglow, which is one of the strongest emissions in twilight, using the FPI at NIPR are presented, and future possibilities for study of a horizontal structure of metallic atom distribution in the MLT region using the FPI are discussed.

Keywords: twilight airglow, mesosphere, thermosphere, metallic layer, Fabry-Perot