

Responses of mesospheric sodium layer to the Geminid meteor shower activities observed with a resonance scattering lidar located in Japan in 2007 and 2008

Mitsumu K. Ejiri, Takuji Nakamura, *Yasunori Fujiwara, and Takuya D. Kawahara

The impact that the Geminid meteor shower has on the sodium (Na) layer density at an altitude range of 90–100 km between 262.0° and 263.0° solar longitude was observed with a resonance scattering lidar at Uji, Japan (35°N, 136°E) in 2007 and 2008. The Na resonance scattering lidar was composed a transmitter with injection-seeded, pulsed Nd:YAG laser and a receiver with a 50-cm diameter telescope. The irradiated area by transmit laser of the Na lidar was smaller than 100 m diameter around the zenith at 100 km altitude. The Na lidar could measure Na density profiles and the mesosphere and lower-thermosphere temperature profiles, which were derived every hour with a vertical resolution of 2.0 km. With an increase in the elevation angle of the Geminid radiant point, the altitude of the maximum Na density descended from 97 km to 90 km and the maximum density quadrupled for ~6 hours. Nightly variation of the Na column density that was calculated as an integration of the Na densities in an altitude range from 70 km up to 120 km showed an exceptional increase over five hours when the elevation angle of the Geminid radiant point was larger than ~60° on December 14, 2007 and 2008. The large elevation angle was likely to be required for a prominent increase in the Na column density although a physical meaning for the threshold is still under investigation. In addition, the Na column density variation as a function of the solar longitude clearly showed that the meteoric Na flux is greater after the peak of the Geminid meteor shower activity determined by visual and radio meteor observations.