

The altitude profile of TMA-induced optical emissions in the SEEK-2 campaign

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The SEEK-2 (Sporadic-E Experiment over Kyushu) campaign was carried out on August 3, 2002, to investigate the spatial structures and properties of the nighttime sporadic E layer in the midlatitude E region. The S-310-32 rocket released Trimethyl Aluminum (TMA) to measure neutral winds. Consequently, TMA-induced optical emissions appeared apart from the original TMA emissions.

During the SEEK-2 campaign, an II-CCD camera recording with a video frame rate recording, a film camera with an exposure time of 5 minutes, and an all-sky imager were set at Uchinoura, Tengu Plateau and Tanegashima, respectively. Altitude profile of electron density was measured by the instrument on board the same rocket. The results of the analysis are summarized as follows. (1) TMA-induced emissions appeared beneath the rocket orbit. The emissions were brightest in the altitude range of 86 - 100 km. The layer structures appeared around the altitudes of 86 - 93 km, 103 km, 107 km on upleg, and 86 - 87 km, 92 - 93 km, 96 - 98 km on downleg. (2) The emission layers occurred at the altitudes where the negative (westward) shear of the zonal wind component is observed. (3) The emission layer at 103 km altitude on upleg corresponds to the maximum of electron density with the characteristics of the sporadic E layer.

From the results described above, it is found that the TMA-induced optical emissions do not appear on the footprint of the magnetic field lines passing the rocket orbit. It is likely that induced emissions are concerned with the sporadic E layer and the ion layers formed by the shear of the zonal wind component.