Na layer observations by lidar and spectrograph in the EISCAT Tromsø site

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We have been operating a Na lidar system in the European incoherent scatter (EISCAT) radar site, Tromsø, Norway (69.6N, 19.2E) since October 2010. The lidar, which is capable of measuring range-resolved Na density, temperature and wind velocity, is a powerful tool for research in the polar upper atmosphere. The accumulated datasets during 6 years and more (from October 2010 to date) can be useful for studies on, for example, atmospheric waves, sporadic Na layers, and auroral particle effects to Na layers, and so on. On the other hand, since the lidar operation is not automatic, availability of operators limits its observation periods. Thus, it is not easy to monitor Na layer variations continuously.

Recently, we have developed a compact spectrograph, which is capable of measuring optical emission intensity in visible range from ~480 nm to ~880 nm with a resolution of ~1.6 nm. The aperture, i.e. F-number, is ~4, and the data-sampling rate is normally 1 Hz. We installed the spectrograph in the EISCAT Tromsø site, and started unmanned night-time operation on 4 October 2016. The field-of-view (FOV) of the spectrograph is pointed at magnetic field-aligned direction. Since then, aurora observations have been done continuously during this winter. While the main purpose of spectrograph is to observe aurora and/or artificial aurora, it has been detecting also Na D line emission (589 nm) in Na layers. Thus, if it is possible to derive Na (column) density from the spectrograph data, we can improve data coverage for more continuous monitoring in Na layer variations.

In this presentation, we will introduce Na layer observations by the lidar as well as Na D line emissions detected by the spectrograph, and then discuss a possibility to derive Na (column) density from the spectrograph data.