Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

PEM29-P30 Room:Convention Hall Time:May 22 18:15-19:30

Primary observation results of potassium layer by a tunable resonance scattering lidar

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The National Institute of Polar Research (NIPR) is leading a six year prioritized project of the Antarctic research observations since 2010. One of the sub-project is entitled ”the global environmental change revealed through the Antarctic middle and upper atmosphere”. Profiling dynamical parameters such as temperature and wind, as well as minor constituents is the key component of observations in this project, together with a long term observations using existent various instruments in Syowa, the Antarctic (39E, 69S). As one of insturuments in this project, we are developing a new resonance scattering lidar system with multiple wavelengths and plan to install and operate it at Syowa (69S), Antarctica. The lidar transmitter is based on injection-seeded, pulsed alexandrite laser for 768-788 nm (fundamental wavelength) and a second-harmonic generation (SHG) unit for 384-394 nm (second harmonic wavelegth). The laser wavelengths are tuned in to the resonance wavelengths by a wavemeter that is well calibrated using a wavelength-stabilized laser. The lidar will measure temperature profiles using resonance scatter of atomic potassium (K, 770 nm) and density variations of minor constituents such as atomic iron (Fe, 386 nm) and K, calcium ion (Ca^+, 393 nm), and aurorally excited nitrogen ion ($N_2{}^+$, 390-391 nm). Currently, the laser pulses are transmitted with approximately 120 mJ/pulse at 25 Hz and the backscattered signal is received with a 35 cm diameter telescope. We got the first light from the K layer on January 28, 2013 and have started test operation to measure K density profiles at National Institute of Polar Research in Tachikawa. We will show the primary observation results and discuss nightly variations of K densities.

Keywords: resonance scattering lidar, mesosphere lower thermosphere, tunable, Potassium