

Resonance Lidar Observations for Polar Ionospheric Studies

Takuji NAKAMURA^(1,2), Mitsumu K. EJIRI^(1,2), Takanori NISHIYAMA^(1,2), Takuo T. TSUDA⁽³⁾, Makoto ABO⁽⁴⁾, Takuya D. Kawahara⁽⁵⁾, and Katsuhiko TSUNO⁽⁶⁾

(1) National Institute of Polar Research, 10-3 Midoricho, Tachikawa, 190-8518 Tokyo, Japan

(2) Dept. of Polar Science, SOKENDAI (The Graduate University for Advanced Studies), Tachikawa, 190-8518 Tokyo, Japan

(3) The University of Electro-Communications (Chofu, Tokyo 182-8585, Japan)

(4) Tokyo Metropolitan University (Hino, Tokyo 191-0065, Japan)

(5) Shinshu University (Nagano, Nagano 380-0928, Japan)

(6) RIKEN (Wako, Saitama 351-0198, Japan)

Polar Ionosphere shows significant variabilities due to high energy particle precipitations associated with solar winds and auroral activities. An Incoherent Scatter Radar such as EISCAT is a powerful tool to study the polar ionosphere, which is sensitive to the electrons in the ionosphere. On the other hand, the resonance scatter lidars are sensitive to the atoms and the positive ions in the ionosphere, which also provides important information on the ionospheric plasmas in the upper atmosphere.

The resonance scatter lidar is tuned to the resonance scatter line of the atoms in the mesosphere and the upper atmosphere. The most prevailing resonance scatter lidar is a sodium lidar, which can observe atomic sodium density, temperature and wind velocities in the mesosphere and lower thermosphere. Other atoms observed lidars are K, Fe, Ca etc. We have developed a frequency tuneable resonance scatter lidar using an alexandrite laser for the observation at Syowa station, the Antarctic (69S, 40E). The target atoms of the lidar are K and Fe. Furthermore, it observes the positive ions such as Ca⁺ and N₂⁺ in the lower ionosphere. The former reflects variations of the electron density in the ionosphere. The measurement in Tachikawa, Tokyo, has demonstrated the capability to capture plasma instabilities in the sporadic E layers. The latter is aiming at the effect of particle precipitation and aurora activities. In this paper, the development of the frequency tuneable lidar and initial results will be presented.