

Middle and upper atmosphere profiling over Syowa station, Antarctic

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The polar middle atmosphere is located in the downward/upward stream of the meridional circulation in winter/summer, and shows a significant seasonal change of temperature in the upper region. The cold mesopause in summer and related phenomena such as PMC (polar mesospheric clouds), NLC (noctilucent clouds), and PMSE (polar mesospheric summer echo) are the most outstanding signals caused by such large amplitude seasonal variations. However, observations of the dynamics and chemistry in the Antarctic middle atmosphere are still very limited.

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). Active remote sensings such as a large atmospheric radar (PANSY) and a lidar, as well as profiling of minor constituents by a millimeter wave spectrometer are being installed in Syowa, Antarctica. In this paper, we overview the instrumentation of this project, and results from the first season will be reported. PANSY radar is an MST/IS radar with 47 MHz VHF frequency and 500 kW peak transmission power. The antenna array consists of 1045 crossed Yagi antennas. The lidar system installed in early 2011 is a Rayleigh/Raman lidar, at 355 nm transmission with 6 W average power. The receiver telescopes are with 82 cm and 35.5 cm diameters. A millimeter-wave spectroscopic radiometer for continuous profiling of minor constituents at Syowa Station has been developed as a low electric power consumption system. These new additional instruments for profiling the middle atmosphere are expected to provide valuable information on variabilities of the Antarctic and global atmosphere.

Keywords: middle atmosphere, upper atmosphere, Antarctic, radar, lidar, ground-based observation