

Progress of the middle and upper atmosphere observations over Syowa station in the Antarctic

Takuji Nakamura^{1*}, Kaoru Sato², Masaki Tsutsumi¹, Takashi Yamanouchi¹

¹National Institute of Polar Research, ²Graduate School of Science, the University of Tokyo

The Japanese Antarctic Research Expedition (JARE) has started the VIII-th six-year mid-term project in 2010, and the 52nd JARE departed in November 2010 commenced observations of the six-year project. The middle and upper atmosphere study in the VIII-th term, named as 'Global environmental change revealed by observing the Antarctic middle and upper atmosphere', is one of the sub-projects of the prioritized research project entitled 'Global warming revealed from the Antarctic'. PANSY (Program of the Antarctic Syowa MST/IS) radar, and a Rayleigh/Raman lidar system have been newly installed besides the existing radio and optical instruments such as an MF radar, HF radar (Super DARN radar), ionosondes, an OH spectrometer and an all-sky airglow imager in Syowa station, in order to clarify variabilities on the atmosphere from the ground to the upper atmosphere. Also installed was a millimeter wave spectrometer for profiling minor constituents.

PANSY radar is the core instrument of this project, and is a 47 MHz VHF radar with 500 kW output power and 20,000 m² antenna array. The radar observes wind velocities from the troposphere to the mesosphere, as well as plasma parameters in the ionosphere. Three groups of antenna (1/18 of full system) was installed during summer operation of the 52nd JARE, and started observation of troposphere. Scientific observation with 12 groups of antenna (about 1/4) started since April 2012 and the tropospheric and lower stratospheric winds has been measured continuously. PMSE (Polar mesosphere summer echo) and PMWE (Polar mesosphere winter echo) have been monitored in detail by continuous observations. The Rayleigh/Raman lidar observes temperature and clouds in the mesosphere, the stratosphere and part of the troposphere, and providing data of gravity wave characteristics in the middle atmosphere, as well as high altitude clouds of PMC (polar mesospheric clouds) and PSC (polar stratospheric clouds). In order to extend the height coverage to include mesosphere and lower thermosphere region, and also to extend the parameters observed, an external laser system for multi-wavelength resonance scatter lidar measurement is being developed. The millimeter spectrometer measures density profiles of O₃ and other species. Since January 2012, NO density has been measured in order to observe day-to-day variation, in order to investigate NO variations due to high energy particles and electrons. Current status of the research and observations, as well as future plans will be presented in the presentation.

Keywords: Antarctic, Middle atmosphere, Upper atmosphere, radar observation, lidar observation, millimeter wave spectrometer