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National Report to SCAR for year: 2011-12

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A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS:

Selected Highlights of the Japanese Antarctic Research Expedition, 2011-12
JARE 52 Winter

1. A development of the PANSY large-scale atmospheric radar project at Syowa

A large atmospheric radar system named PANSY (Program of ANtarctic SYowa Mesosphere, Stratosphere, and Troposphere/Incoherent Scatter [MST/IS] Radar, cf. IP63/XXXIII ATCM) installed at Syowa Station during the 2010–2011 austral summer has been put into operation. This program has been endorsed by several international academic associations such as the IUGG (International Union of Geodesy and Geophysics), SCAR (Scientific Committee on Antarctic Research), and SCOSTEP (Scientific Committee on Solar-Terrestrial Physics). The system was designed to obtain dynamic information for understanding how the atmospheric system works from the surface up to 500 km, with precise measurement of winds and plasma parameters, and to contribute to improving the global atmospheric model for better forecasting the future global climate. Additional installation and adjustment work was conducted during the 2011–2012 austral summer toward achieving a fully operational radar system in the near future, as well as the relocation of some parts of the antenna array to avoid heavy snow accumulation. The first observation of polar mesospheric summer echoes (PMSEs) was continuously conducted using a sub-array system during January and February 2012, and time evolution of PMSEs was successfully detected.

Currently, three-dimensional wind velocity measurements in the troposphere and lower stratosphere are being carried out (Fig. 1), which has already displayed PANSY's abilities as the most sensitive atmospheric radar system in the Antarctic. The development of new applications, including various interferometer observation techniques, is also under consideration.

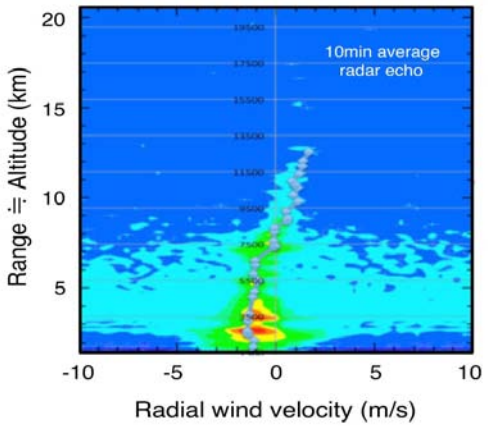

Figure 1. An example of PANSY data for the troposphere and the stratosphere over Syowa on April 24, 2012, together with a radio sonde observation profile (gray line) for comparison. Warmer colors indicate stronger radar echoes. Six times the observed radial wind velocities are roughly equal to eastward wind velocities.

JARE 53 Summer

1. Geological Survey in the Sør Rondane Mountains

A geological survey in the Sør Rondane Mountains was conducted from mid-November 2011 to late February 2012 by five members of the 53rd Japanese Antarctic Research Expedition (JARE-53) in collaboration with the Belgian Antarctic Research Expedition (BELARE). The members flew from Cape Town to the Russian Novolazarevskaya runway and to Belgium's Princess Elisabeth Station (71º 57' S, 23º 20' E) via DROMLAN (Dronning Maud Land Air Networks) to reach the survey area.

The objectives of this survey are to reconstruct temporal variability in the height of the East Antarctic Ice Sheet (EAIS) for several million years and to examine possibilities of ice-sheet melting after the Last Glacial Maximum. For these objectives, a detailed geo-morphological survey in the middle and western parts of the Sør Rondane Mountains was carried out, and rock specimens for surface exposure dating were collected at 259 sites to study when the height and volume of the EAIS changed (Fig. 2). GPS surveys were conducted at 17 sites to get precise three-dimensional topographical information on the Sør Rondane Mountains. The results of the survey will give us basic information for precise prediction of global environmental changes associated with future global warming.

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Figure 2. Acquisition of ice thickness profiles of a frozen lake in the Sør Rondane Mountains, using an ice radar.

3. Ecological Observations of Antarctic Lakes near Syowa Station

Ecological fieldwork was carried out to study material recycling processes in Antarctic lake ecosystems in bare-rock areas of Langhovde, Skarvsnes, Breidvågnippa, and Skallen near Syowa from December 2011 to February 2012. Collection of sediment cores from lake bottoms and on-site measurements of H_2S gas concentration and photosynthetic activity of the lake-bottom vegetation and sediments were carried out. Preparation of specimens for analyses of nutrients in lake water and stable isotope ratios in the sediments were conducted as well. Underwater video cameras to monitor growth of the lake-bottom vegetation and data loggers for temperatures of lake-bottom layers down to 200 cm were installed on and in the bottom of lakes with SCUBA diving operations (Fig. 3).

Collection of copepods inhabiting the bottom of a specific brackish lake, the only one in the region, was also carried out with an NIPR-I type plankton net and a hand net. The specimens will give us taxonomical and life-cycle information of the copepod species inhabiting the Antarctic lake.

Figure 3. Installing an interval video camera on the bottom of an Antarctic lake in a SCUBA diving operation to monitor growth of lake-bottom vegetation.