Program of the Antarctic Syowa MST/IS radar (PANSY) toward JARE Phase IX

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The PANSY radar is the first Mesosphere-Stratosphere-Troposphere/Incoherent Scatter (MST/IS) radar in the Antarctic region. It is a large VHF monostatic pulse Doppler radar operating at 47 MHz, consisting of an active phased array of 1,045 Yagi antennas and an equivalent number of transmit-receive (TR) modules with a total peak output power of 500 kW. The first stage of the radar was installed at Syowa Station (69°00'S, 40°35'E) in early 2011, and is currently operating with 228 antennas and modules. This paper reports the project's scientific objectives, technical descriptions, and the preliminary results of observations made to date. The radar is designed to clarify the role of atmospheric gravity waves at high latitudes in the momentum budget of the global circulation in the troposphere, stratosphere and mesosphere, and to explore the dynamical aspects of unique polar phenomena such as polar mesospheric clouds (PMC) and polar stratospheric clouds (PSC). The katabatic winds as a branch of Antarctic tropospheric circulation and as an important source of gravity waves are also of special interest. Moreover, strong and sporadic energy inputs from the magnetosphere by energetic particles and field-aligned currents can be quantitatively assessed by the broad height coverage of the radar which extends from the lower troposphere to the upper ionosphere. From engineering points of view, the radar had to overcome restrictions related to the severe environments of Antarctic research, such as very strong winds, limited power availability, short construction periods, and limited manpower availability. We resolved these problems through the adoption of specially designed class-E amplifiers, lightweight and tough antenna elements, and versatile antenna arrangements. Although the radar is currently operating with only about a quarter of its full designed system components, we have already obtained interesting results on the Antarctic troposphere, stratosphere and mesosphere, such as gravity waves, multiple tropopauses associated with a severe snow storm in the troposphere and stratosphere, and polar mesosphere summer echoes (PMSE). In Phase IX of JARE, various scientific goals of the PANSY radar will be further pursued with a wider height coverage, which becomes available with the full system.

Reference

Sato, K., M. Tsutsumi, T. Sato, T. Nakamura, A. Saito, Y. Tomikawa, K. Nishimura, H. Yamagishi, and T. Yamanouchi, Program of the Antarctic Syowa MST/IS Radar (PANSY), *SPARC Newsletter*, No.36, 23-26, January, 2011

Sato, K., M. Tsutsumi, T. Sato, T. Nakamura, A. Saito, Y. Tomikawa, K. Nishimura, M. Kohma, H. Yamagishi and T. Yamanouchi, Program of the Antarctic Syowa MST/IS Radar (PANSY), *J. Atmos. Solar-Terr. Phys.*, in press.