

両極での大型レーダー観測による地球大気システム変動の研究

Bipolar large radar observations for the study of variability of the Earth and geospace systems

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Radar stands for RAdio Detection And Ranging. When it is applied to soft targets such as atmosphere and ionosphere, physical parameters of the targets can be measured as a function of range or height, by sampling and processing received signal according to the delay time from the radar transmission pulse. This characteristic enables us to profile atmospheric parameters, such as wind velocities and plasma parameters, with very good height resolutions which cannot be obtained by passive remote sensings such as most of satellite observations. Japan is one of the leading countries in radar atmospheric remote sensings.

In the Antarctic, a large VHF radar, Program of ANtarctic SYowa MST/IS (PANSY) radar, was granted in 2009 and started observation in Syowa station in 2011. The radar is designed to observe wind velocities and plasma parameters from near the ground up to 500 km in the upper atmosphere. Research observations by 1/4 of the full system have been carried out and observational data in the troposphere, stratosphere and mesosphere have been obtained. Currently, 85 % (49 groups out of 55) of the antenna array and transmitter/receivers have been equipped. Full system operation is expected to start in 2015. The radar is a key instrument of the Syowa station in the current VIII-th term prioritized project of JARE (Japan Antarctic Research Expedition), and will also be the core facility in the IX'th term project. The observational data will contribute to understand the atmospheric dynamics and vertical couplings over the Antarctic region which is important to improve the climate models.

In the Arctic region, EISCAT (European Incoherent Scatter) radar system located in Scandinavian countries has been observing mainly the upper atmosphere/ionosphere. Large VHF and UHF radars have been used to observe plasma parameters in the polar region since 1980s. Japan joined the EISCAT association in 1996, and acting as an active member. The main focus of the radar system is the study of the energy flow from the solar activity into the earth system through the arctic upper atmosphere. The current associate countries of EISCAT are Norway, Sweden, Finland, Japan, UK and China. The EISCAT association is now proposing a new state-of-the-art incoherent scatter radar system, named EISCAT_3D, which is a multistatic active phased array radar system to observe three dimensional plasma parameters over the Northern Scandinavia, aiming the start of its observation in 2017. The proposal is on the ESFRI roadmap already in 2008 and has recently been listed in Japanese Roadmap in 2014 for large scientific projects as one of ten selected projects. (The EISCAT_3D is included in the project named 'Study of Coupling Process in the Solar-Terrestrial Systems (PI: Prof. Toshitaka Tsuda, Kyoto University)').

The two radars will play an important role in understanding variability of the Earth's system due to the perturbations originated from the ground and the solar energy input.