

## **A study of global atmospheric circulation variability explored through comprehensive observations with the large atmospheric radar and complementary techniques**

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For the comprehensive understanding of the behavior of Antarctic atmosphere and also the global atmosphere we have been conducting integrated atmosphere observations at the Syowa station (69S, 39E) since the phase VIII of Japanese Antarctic Research Expedition (JARE) (JARE 52 to 57: 2011-2016) as one of the prioritized JARE projects, using a large aperture atmospheric radar (the PANSY radar) as the core facility together with various radio and optical instruments. The PANSY radar started continuous observations of mesosphere, stratosphere and troposphere (MST) using its quarter system in 2012, and after a few years of system adjustment the whole radar system consisting of over 1000 Yagi antennas has been fully operational since October 2015 through the whole phase IX.

In the phase X (JARE 64 to 69: 2023-2028) we will continue the comprehensive atmosphere observations in the Antarctic in a wide height range with complementary observation facilities such as the MF radar for mesosphere and lower thermosphere winds and the airglow radiometer for OH rotational temperature at the mesopause region. We will be able to successfully create a long time data base exceeding one solar cycle by the end of the JARE X, which is useful for the study of various atmospheric phenomena with a wide range of periodicities from several minutes to a solar cycle. In addition, advanced observation techniques are to be more often conducted during the phase X such as various spatial and range imaging measurements and ionosphere measurements by fully utilizing the high versatility of the PANSY system.

We are also planning to conduct super pressure balloon (SPB) observations of atmospheric gravity waves over the Antarctic continent in order to directly study the horizontal structure of Antarctic atmosphere. Its first test experiment was successfully conducted in the summer season of January –February 2022 prior to the phase X, and more intense operations throughout a year are scheduled during the phase X.

Interdisciplinary collaborations are also planned with other prioritized JARE projects. The importance of high quality Antarctic atmosphere data for weather forecasting is to be tested by incorporating PANSY data in a weather forecasting system. The influence of energetic particles precipitating from the ionosphere and magnetosphere on the polar atmosphere is studied, and the effects on the ionosphere by the atmospheric waves propagating from below are also studied.