

Role of the solid earth studies toward the future environmental monitoring

*Yoichi Fukuda¹, Koichiro Doi², Yuichi Aoyama², Jun'ichi Okuno², Yusuke Suganuma²

1. Department of Geophysics, Graduate School of Science, Kyoto University, 2. National Institute of Polar Research

The Antarctic ice sheet, which relates to the global climate changes through the sea level rise and ocean circulation, is an essential element of the Earth system for predicting the future environment changes. Actually ice-sheet melting directly causes sea level raise. Thus several in-site observations as well as satellite observations such as satellite gravimetry and satellite altimetry have been conducted for the precise monitoring of the ice-sheet mass changes.

In addition, geomorphological and/or geological surveys have been also conducted for investigating the relations between paleoenvironments and Antarctic Ice Sheet (AIS). In particular, AIS history is a key not only for studying the paleoenvironmental changes but also present day environmental changes, because ice sheet history causes the present day solid Earth deformations due to GIA (Glacial Isostatic Adjustment) effects, which is the interaction between the solid Earth and the ice sheet loading.

Recognizing the importance of these studies, Japanese Antarctic Research Expedition (JARE) have been conducting various geodetic, geomorphological and other surveys at Syowa station and the neighbouring areas in East Antarctica. There are continuous observation sites of three space geodetic techniques, namely, VLBI, GNSS and DORIS in Syowa station. These observations provide the basic data sets necessary to maintain the International Terrestrial Reference Frame (ITRF), which is the most basic reference of the positioning, and consequently contribute to the sea level monitoring. The tide gage data in Syowa station is one of the longest time records in Antarctica, and directly show the sea level changes. There are also the continuous gravity records of superconducting gravimeters and time-lapse data sets of absolute gravity measurements since the early 1990's. These long and high quality gravity data sets are unique in Antarctica and also provide the information about the ice-sheet mass changes as well as GIA effects.

JARE have been also conducting several geomorphological surveys around Lützow-Holm Bay, Sør Rondane Mountains, and other areas in Dronning Maud Land. These surveys data can be used to reveal the past crustal movements and ice-melting history from thousands to millions years ago, and consequently contribute to the paleoenvironmental and GIA related studies.

In this presentation, we first review these geoscientific observations related to the environmental issues so far made by JARE, and then discuss the role of the solid earth studies toward the future environmental monitoring.

Keywords: Ice sheet melting, Sea level rise, Glacial Isostatic Adjustment, geodetic observations, geomorphological surveys