Dependences of GIA model parameters on the geodetic data in East Antarctica

*Jun'ichi Okuno[1,2], Koichiro Doi[1,2], Akihisa Hattori[2], Yoichi Fukuda[3]

1. National Institute of Polar Research, 2. The Graduate University for Advanced Studies, 3. Kyoto Univ.

Recent global warming has accelerated the melting of both the Greenland and Antarctic ice sheets and has resulted in global sea-level rise, which has become a social concern. The recent melting of the Antarctic Ice Sheet (AIS), the largest freshwater reservoir on Earth, has been detected by various observations. In particular, time series of gravity changes by GRACE, which launched in 2002, described in detail the movement and change of mass in Antarctica. However, the observation of gravity fields such as GRACE includes not only the change of ice mass but also the change of mass caused by the deformation of the solid Earth called Glacial Isostatic Adjustment (GIA). For this reason, an accurate estimate of the solid Earth deformation is required to prescribe the recent ice mass balance by gravity observations.
Furthermore, the current deformation rate of the solid Earth also includes the component induced by the melting of the AIS since the Last Glacial Maximum (ca. 20kyr before present). Therefore, the estimates of the deglaciation history of the AIS on a time scale over 10,000 years derived from geomorphic and geological observations are also required. In the GIA modeling study, the development of numerical methods simulating the Earth's response due to surface load has been continued with the inference of the melting history of the continental ice sheets simultaneously. At present, several scenarios of the AIS deglaciation history based on geomorphic and geological data have been proposed and are still being debated. In this study, we discuss the GIA-derived gravity change and crustal deformation in the East Antarctic region using the previously published AIS deglaciation models and the GIA modeling code currently under development. GIA is highly dependent not only on surface load variations such as the changes of ice and seawater volume but also on the structure of the Earth's interior (mainly viscosity structure of the mantle). Therefore, to discuss the recent ice mass change in detail, we will conduct the numerical experiments with the extensive GIA model parameters and show the effects of the GIA-induced geodetic signals on the estimates of current ice mass fluctuations quantitatively.

Keywords: Glacial Isostatic Adjustment, Antarctic Ice Sheet, gravity change, viscosity structure of the Earth's mantle

