A plan for studying the interaction of the solid Earth and the Antarctic ice sheet

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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. Thus many studies of the ice sheet changes have been conducted by means of geomorphological, geological, geodetic surveys, as well as satellite gravimetry and satellite altimetry. For these studies, one of the largest uncertainties is the effects of GIA, which, on the other hand, includes valuable information about the rheological properties of the solid Earth, because GIA is the rheological response of the solid Earth to the ice mass loading. The observational studies of the GIA effects should greatly contribute to investigate the inner structure of the Earth.
GIA as a keyword to investigate the interaction between the solid Earth and the ice sheet changes is an urgent and important research target not only for a practical requirement of predicting global changes but also for a more pure scientific interest to know the structures of the deep Earth's interior.
In view of these points, in addition to the several precise observations at Syowa station and surounding areas, we plan to conduct geomorphological, geological and geodetic surveys in the inland mountain areas and the coastal areas in East Antarctica, where the in-situ data for constraining GIA models are very few.
Combining these new observations with other in-site data, various satellite data and numerical modeling, we aim to estimating a precise GIA model, constructing a reliable ice melting history after LGM (the Last Glacial Maximum) and obtaining the viscoelastic structure of the Earth's interior.
To achieve the goal, we are planing to conduct the following studies;
(1) conducting glacial topographic surveys, geological surveys, gravity measurements, and GNSS measurements at the in-land areas of the East Antarctica, where very few observations were conducted so far, and reevaluating the glacial topography using the in-situ observations and recent precise DEM (Digital Elevation Model),
(2) improving the accuracies of the retreat ages of the ice sheets using the micro glacier topography from the detailed airborne photographic data obtained by unmanned aerial vehicles, the cosmogenic nuclide exposure ages of the basement bowling samples and the moraine rocks,
(3) monitoring the present day ice sheet movements and sea level changes by combining satellite data and in-situ geodetic and other observations in and around Syowa Station, and
(4) finally aiming at the quantitative reconstruction of the ice melting history over the last millions years, and the improvement of the models for predicting the future global changes.

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