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Estimation of ice-sheet trend over Antarctica using GRACE, ICESat, and EnviSat data

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Total ice sheet on Antarctica is said to consist of about 90 % of the earth's entire Ice sheet, which is equivalent to almost 60 meters of sea level rise. Nevertheless, because of the difficulties of in-situ observations, it has been difficult to estimate the mass change rate of the whole of Antarctic Ice mass. GRACE (Gravity Recovery and Climate Experiment) has been observing time-variable gravity fields, by conducting continuous measurements of the distance between the twin satellites. GRACE has succeeded to estimate the mass change rate for the whole of Antarctica, which was difficult to conduct by other means. However the GRACE observation is the total mass change of the earth including the Post Glacial Rebound (PGR) effect. Therefore, to estimate the actual ice-sheet mass trend in Antarctica from GRACE data, a precise PGR model is required. On the other hand, ICESat (Ice, Cloud, and land Elevation Satellite) is a satellite with GLAS (Geo-science Laser Altimeter System), which can observe ice-sheet elevation changes. By combining the elevation changes observed by ICESat with mass changes by GRACE, a better PGR model can be obtained. Although ICESat data has sufficient coverage of the higher latitudinal area, its data sets of 90 days have 180 days of interval time, and therefore, not appropriate to compare with monthly GRACE data. Equipped with RA2 radar system, EnviSat (Environmental Satellite) is useful to compensate ICESat data, because its data sets are available monthly from the same period as GRACE, and it has a better precision at East Antarctic coastlines. In this study, we present the data processing using ICESat and EnviSat altimeter data combined with GRACE data, and the result of the ice-sheet trend over Antarctica.

Keywords: Antarctica, ice-sheet change, altimeter, GRACE, ICESat, EnviSat