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SLR 低次重力解でみる極域氷床の質量変化
Mass changes in polar ice sheets from low-degree gravity field by SLR

松尾 功二 [1], Benjamin Fong Chao[3], 大坪 俊通 [2], 日置 幸介 [1*]
Koji Matsuo[1], Benjamin Fong Chao[3], Toshimichi Otsubo[2], Kosuke Heki[1*]

[1] 北海道大学, [2] 一橋大学, [3] 台湾中央研究院
[1]Hokkaido University, [2]Hitotsubashi University, [3]Academia Sinica, Taiwan, ROC

The majority of the land ice on earth lies in Antarctica and Greenland as continental ice sheets. Recent climate changes have brought about the significant ice melting in these regions. The space mission of Gravity Recovery and Climate Experiment (GRACE), launched in 2002, enables direct measurements of such mass losses over extensive areas. According to the GRACE observation during 2003-2010, the polar ice sheets experienced mass loss at the rates ˜390 Gt/yr, amounting to ˜70% of the total ice loss globally in the same period (Jacob et al., 2012). These massive and extensive mass losses can also be detected by the Satellite Laser Ranging (SLR) technique. Although limited in spatial resolution, the SLR data have been available for a longer time span of 1991-2011. Here we calculated the changes in the earth's gravity field using the monthly Stokes coefficients up to degree and order 4 estimated from both SLR and GRACE. Then we corrected the results for the contributions of Glacial Isostatic Adjustment using the model of Paulson et al. (2007). Between 2003 and 2011, the linear trend map of the gravity field from SLR shows significant negative patterns in Greenland and Antarctica, agreeing well with that from GRACE. However, seen from SLR data, the gravity trend map between 1991 and 2011 shows different behaviors: near-balance in Greenland prior to 2002 and shifting to decreasing afterwards. The gravity in West Antarctica also shows similar trends as Greenland, but that in East Antarctica shows opposite trends. These results imply that the mass balances in the polar ice sheets might be affected by some decadal climate variability.

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