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Abrupt changes in drift trend of the earth's geocenter and rotational pole in 2012-2014

MATSUO, Koji[1*] ; OTSUBO, Toshimichi[2] ; MUNEKANE, Hiroshi[1] ; HEKI, Kosuke[3]

[1]GSI of Japan, [2]Hitotsubashi University, [3]Hokkaido University

Positions of the earth's geocenter and rotational pole are constantly moved by mass redistributions on/in the earth. Such movements can be estimated via low-degree gravity field measurement by Satellite Laser Ranging (SLR). In this study, we investigate recent trends in geocenter motion and polar motion based on SLR analysis. We compute their linear changes for the following three periods: 1994-2002, 2003-2011, and 2012-2014. Here annually-average drift rates and directions are described as (rates, azimuth angle, elevation angle) for geocenter motion and (rates, azimuth angle) for polar motion, respectively. In 1994-2002, the obtained drift trends are (0.5mm/yr, -26 ^{0} , 59 ^{0}) for geocenter motion and (1.3mm/yr, -73 ^{0}) for polar motion. Concerning polar motion, the good agreement with EOPs data by VLBI was confirmed. These trends are considered to be caused by Glacial Isostatic Adjustment (e.g. Wahr et al., 1993; Greff-Lefftz, 2000). In 2003-2011, the obtained drift trends are (0.8mm/yr, 111 ^{0} , -61 ^{0}) for geocenter motion and (5.4mm/yr, 14 ^{0}) for polar motion. These trend shifts from 1994-2002 can be well explained by large-scale ice mass depletion in polar region started in 2000s (e.g. Chen et al., 2013; Dong et al., 2014). In 2012-2014, the obtained drift trends are (3.4mm/yr, -84 ^{0} , 44 ^{0}) for geocenter motion and (8.9mm/yr, -62 ^{0}) for polar motion. We can see distinct departures in drift trends from 2003-2011. By analyzing other geodetic data and geophysical models, we have revealed that these trend shifts can be attributed to an abrupt stagnation of Greenland's ice loss after autumn of 2012.

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