EGU General Assembly 2020

EGU2020-174
https://doi.org/10.5194/egusphere-egu2020-174
EGU General Assembly 2020

Preliminary hydrological polar motion excitation estimates from the GRACE Follow-On mission

Justyna Śliwińska[1], Małgorzata Wińska[2], and Jolanta Nastula[1]
[1]Space Research Centre, Polish Academy of Sciences, Warsaw, Poland (jsliwinska@cbk.waw.pl, nastula@cbk.waw.pl)
[2]Institute of Roads and Bridges, Warsaw University of Technology, Warsaw, Poland (mwin@il.pw.edu.pl)

Over almost 20 last years, observations from the Gravity Recovery and Climate Experiment (GRACE) mission have become invaluable as means to examine Earth global mass change. Since 2002, the relative along track motions between two identical satellites have been used to derive Earth's time variable gravity field. The great success and scientific sound of the mission, which ended in 2017, contributed to the launch of its successor, GRACE Follow-On (GFO) in May 2018. Until now, monthly time series of GFO-based geopotential models have been made available to the users by official GRACE data centres at Center for Space Research (CSR), Jet Propulsion Laboratory (JPL) and GeoForschungsZentrum (GFZ). This data enables the continuation of many researches which started with the beginning of the GRACE mission. Such applications included monitoring of land water storage changes, drought event identification, flood prediction, ice mass loss detection, groundwater level change analysis, and more.

In geodesy, a crucial application of GRACE/GFO mission observations is the study of polar motion (PM) changes due to mass redistribution of the Earth's surficial fluids (atmosphere, ocean, land hydrosphere). PM represents two out of five Earth Orientation Parameters (EOP), that describe the rotation of our Planet and link the terrestrial reference frame with the corresponding celestial reference frame. The use of C_{21}, S_{21} coefficients of GRACE/GFO-based geopotential models is a common method for determining polar motion excitation.

In this study, we present the first estimates of hydrological polar motion excitation functions (Hydrological Angular Momentum, HAM) computed from GFO data which were provided by CSR, JPL and GFZ teams. The HAM are calculated using (1) C_{21}, S_{21} coefficients of geopotential (GFO Level-2 data) as well as (2) gridded terrestrial water storage (TWS) anomalies (GFO Level-3 data). We compare and evaluate the two methods of HAM estimation and examine the compatibility between CSR, JPL and GFZ solutions. We also validate different HAM estimations using precise geodetic measurements of the pole coordinates.

Our analyses show that the highest internal agreement between different GFO solutions can be obtained when comparing CSR and JPL. Notably, GFZ estimates differ slightly from the other GFO models. The highest agreement between different GFO-based HAM, and between GFO-based HAM and reference data is obtained when GFO Level-3 data are used. We also demonstrate that the current accuracy of HAM from GRACE Follow-On mission meets the expectations and is

comparable with the accuracy of HAM from GRACE Release-6 (RL06) data.