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GRAVIMETRIC SATELLITE MEASUREMENT CORRECTIONS WITH EOT20 TIDAL MODEL

Abstract

The need to better quantify and monitor Climate Change (CC) is crucial for scientist and decision-makers alike to take timely actions and prevent irreversible damage. Space-based Earth Observation (EO) missions, such as the GRACE Follow-On (GRACE-FO) Mission, play an irreplaceable role in understanding Climate Change. Observational data on environmental damages, such as the drastic changes in terrestrial water cycles, sea-level, and mass balance of ice sheets and glaciers, require higher temporal and spatial resolution in gravimetric measurements.

To achieve this, the Relativistic Modelling Department at the DLR Institute of Satellite Geodesy and Inertial Sensing, aims to provide a Digital Twin for future EO Missions with higher resolution satellite simulations. Therefore, DLR and ZARM (University of Bremen) have developed the Hybrid Simulation Platform for Space Systems (HPS) to analyse emerging space technologies. This software includes disturbance forces on the satellite such as solar, albedo, and infrared radiation, as well as aerodynamic drag and tidal effects of the ocean, poles, and solid earth.

This paper focuses on implementing the latest empirical tidal model by DGFI-TUM, EOT20 (Empirical Ocean Tide 2020) to simulate ocean tide effects on the satellite attitude and orbit. EOT20 provides 17 tidal coefficients in a spatial resolution of a 0.125 degree grid using multi-satellite missions data from 1992 to 2018 and the FES2014 (Finite Element Solution 2014) as the reference oceanic tide model. The simulated satellite acceleration applying EOT20 is compared to those that were previously calculated incorporating EOT11a and measurement data such as from GRACE-FO. Furthermore, this paper presents our current research status on the investigation of tidal spatial pattern evolution and tidal effects under the Antarctic ice sheets due to global warming during the last decades. Thus, Digital Twins of space-based technology provide data that helps to generate a more calculated and lower-risk solution to tackle Climate Change.