Selected Gravity Models in Terms of the fit to the GOCE Kinematic Orbit in the Dynamic Orbit Determination Process

Andrzej Bobojć (1), Andrzej Drożyner (2), and Zofia Rzepecka (1)

(1) University of Warmia and Mazury in Olsztyn, Institute of Geodesy, Olsztyn, Poland (andrzej.bobojc@gmail.com, zofia.rzepecka@uwm.edu.pl), (2) Kujawy and Pomorze University in Bydgoszcz, Poland (drozyner@uwm.edu.pl)

The work includes the comparison of performance of selected geopotential models in the dynamic orbit estimation of the satellite of the Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) mission. This was realized by fitting estimated orbital arcs to the official centimeter-accuracy GOCE kinematic orbit which is provided by the European Space Agency. The Cartesian coordinates of kinematic orbit were treated as observations in the orbit estimation. The initial satellite state vector components were corrected in an iterative process with respect to the J2000.0 inertial reference frame using the given geopotential model, the models describing the remaining gravitational perturbations and the solar radiation pressure. Taking the obtained solutions into account, the RMS values of orbital residuals were computed. These residuals result from the difference between the determined orbit and the reference one – the GOCE kinematic orbit. The performance of selected gravity models was also determined using various orbital arc lengths. Additionally, the RMS fit values were obtained for some gravity models truncated at given degree and order of spherical harmonic coefficients. The advantage of using the kinematic orbit is its independence from any a priori dynamical models. For the research such GOCE-independent gravity models as HUST-Grace2016s, ITU_GRACE16, ITSG-Grace2014s, ITSG-Grace2014k, GGM05S, Tongji-GRACE01, ULUX_CHAMP2013S, ITG-GRACE2010S, EIGEN-51C, EIGEN5S, EGM2008 and EGM96 were adopted.