

Selected GRACE Gravity Models in the GOCE Orbit Determination – Relative Performance and Solution Efficiency

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In this work eight chosen gravity fields taken from the International Center for Global Earth Models (ICGEM) were applied in a dynamic orbit determination of the satellite of the Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) mission. The following gravity models were taken into account: HUST-GRACE2016S, ITU_GRACE16, ITSG-GRACE2014S, ITSG-GRACE2014K, TONGJI-GRACE01, EIGEN-51C, EIGEN5S, EGM2008. In order to obtain the relative performance of given gravity fields, the Precise Science Orbit (PSO) of the GOCE satellite given by the European Space Agency (ESA) was adopted as the reference orbit. Cartesian coordinates of the GOCE satellite in both types of PSO orbit, i.e. in the kinematic and reduced-dynamic orbits were treated as observations in the estimation process. In this process, the Cowell 8th order numerical integration in the frame of the least-squares method was used. The estimated orbital arcs were fitted to the corresponding arcs of the kinematic and reduced-dynamic arcs. The mean values of 3D root-mean-square (RMS) of distance between the estimated and reference arcs were computed and thus it was possible to compare the performance of selected gravity models in an orbital aspect. Additionally, the fit to both types of the GOCE PSO orbit made it possible to compare their quality in a regarded time span. Moreover, the research of the relative performance of the selected gravity models made it possible to describe the efficiency of determined solutions depending on the three lengths of estimated orbital arcs, type of PSO orbit and modeling or not of additional perturbing forces represented by the so-called background models.