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Testing of Selected Geopotential Models in Terms of GOCE Satellite Orbit Determination Using Simulated GPS Observations

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This work contains a comparative study of performance of twenty geopotential models in an orbit estimation process of the satellite of the Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) mission. For testing, among others, such models as JYY_GOCE02S, ITG-GOCE02, ULUX_CHAMP2013S, GOGRA02S, ITG-GRACE2010S, EIGEN-51C, EGM2008, EGM96, JGM3, OSU91a, OSU86F were adopted. A special software package, called the Orbital Computation System (OCS), based on the classical method of least squares was used. In the frame of OCS, initial satellite state vector components are corrected in an iterative process, using the given geopotential model and the models describing the remaining gravitational perturbations. An important part of the OCS package is the 8th order Cowell numerical integration procedure, which enables a satellite orbit computation. Different sets of pseudorange simulations along reference GOCE satellite orbital arcs were obtained using real orbits of the Global Positioning System (GPS) satellites. These sets were the basic observation data used in the adjustment. The centimeter-accuracy Precise Science Orbit (PSO) for the GOCE satellite provided by the European Space Agency (ESA) was adopted as the GOCE reference orbit. Comparing various variants of the orbital solutions, the relative accuracy of geopotential models in an orbital aspect is determined. Full geopotential models were used in the adjustment process. However, the solutions were also determined taking into account truncated geopotential models. In such case, an accuracy of the orbit estimated was slightly enhanced. The obtained solutions refer to the orbital arcs with the lengths of 90-minute and 1-day.