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Determination of Earth gravity field spherical harmonic coefficients using SLR data

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ABSTRACT

Satellite orbital perturbations resulting from the disturbing-potential (difference between spherical gravitational potential and aspherical geopotential) are in addition to being one of the major sources of orbital perturbations, important indicators of geophysical signals. Determining accurate coefficient values of Earth gravity models is a complex process, usually achieved by combining satellite and terrestrial data, which allow models of high degree and order to be developed. Recently we have developed software that estimates zonal coefficients $J_{2,0} - J_{20,0}$ as well as C_{21} and S_{21}. These different coefficients have special applications within interesting scientific questions ranging from relativistic tests of post-Newtonian parameters to fixing the rotation axis of the reference frame. With the development of new models using satellite data (GRACE, GOCE etc.) higher levels of accuracy should be reached, allowing increased potential for more accurate estimates of solve-for parameters of interest, such as SLR station position, other orbital perturbations, geophysical processes and relativistic tests. The new models should still be validated utilising independent techniques such as Satellite Laser Ranging, where particularly the coefficients of lower degree and order affect geodetic satellite orbits. In addition, the ability to estimate gravity coefficients allows determination of trends in the coefficients and validates the software's force models. A brief description of the method used for the spherical harmonic expansion coefficient is given as well as some results using SLR data to LAGEOS 1 and LAGEOS 2.

Keywords: Geodesy and Gravity, gravity coefficient, gravity fields, satellite laser ranging, satellite orbits.