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Making the software package for analysis the statistical models of space observations

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Abstract

© SGEM2018. The object of research is making the statistical modeling software package for analysis space observations. In particular, the potential fields of the planets, the topography and gravitational fields are studded. It should be noted the fields of the terrestrial planets are still poorly understood. In the past decade data requiring precision machining have been accumulated for many planets of the Solar system. The purpose of research is improving the accuracy of the mathematical description and mapping of potential fields for large degrees of the expansion and data volumes on the basis of software package “Automated Software for Planetophysics Research+” (ASPR+). This software package provides the development of the mathematical models the potential fields of the planets. At the present time to describe the potential fields of the planets (for example, geometric shapes) the expansion in spherical harmonic functions is used. The expansion of altitude function can be represented by polynomials and associated Legendre functions of the arguments φ and λ as a function in the form of series. The work of ASPR+ program can be divided into three stages: a) obtaining of a regression matrix on the basis of points and the degree; b) estimation of the normalized harmonic amplitudes of mathematical model based on regression modeling approach; c) prediction of the relief of the planet over the entire surface or at a certain location on the basis of the model. The previous version program ASPR was limited to 85 order of the expansion which is associated with a hardware storage factorial. Because of the above described disadvantages of package ASPR it has been decided to develop a new version of the program which is analogous to the previous version only on the mathematical algorithm. The new ASPR+ software version is overcoming the limitations in the degree of 85 expansions in spherical harmonics in the modeling of potential fields of the planets which has been achieved by changing the compiler. This allowed to use of extended storage format of real numbers (80-bit extended precision). Also due to transition to an extended storage format of real numbers the accuracy has increased from 15 to 19 decimal digits in the coefficients of models obtained by the program.

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Keywords

Highly-precise models of potential fields, Regression matrix, Software package, Statistical modeling

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