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Analysis gps and doris geocenter oscillation measurements using software package asdrm

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Abstract

© SGEM 2018. The aim of this study is to determine the geocenter dynamics described by dynamic adaptive regression and the general laws of DORIS and GPS navigation systems. A spatial geocenter dynamics can be represented as coordinate and time series. Mathematical description of the time series allows for determination of systematic change in the geocenter dynamics. To improve the accuracy of modeling and forecasting of the geocenter dynamics and to identify the regular effects, the dynamic regression modeling approach is used. On the basis of this, an “Automatized system of the dynamic regression modeling” (ASDRM) and its modifications: ASDRM-G (for geophysical data processing) and ASDRM-T (for analyzing technogenic characteristics) are developed. The results are studied in terms of models’ structure, forecasting accuracy, stability of the polyharmonic structure models, cross-spectral analysis. The modeling of the geocenter coordinates dynamics provides a higher approximation and forecasting accuracy compared to the results by other authors. The common components of these models are revealed. As a result, statistical models of the geocenter dynamics, obtained by in three coordinates x, y, z, were considered. The forecast "horizons" were estimated from these models using a few criteria. The analysis of the obtained models on harmonics stability was carried out, the cross-spectral analysis of time series of geocenter movement coordinates received by two space systems was performed. In order to test the stability, the time series were studied according to two satellite systems. The harmonics with periods of 1, 2, 4, and 6 months and a year were the most stable; they are shown in all three coordinates. The "flickering" structure of time series periodic components is revealed: their spectral density changes over the studied period. The period of the most reliable forecast ("forecast horizon") is determined to be between 10 and 25 weeks for DORIS data and between 6 and 25 weeks for GPS. The accuracy of GPS models approximation and prediction was from 2 to 10 times higher compared to the models by DORIS. The interaction between the periodic components of the series obtained by the two systems is discovered, which allows emphasizing the most significant and influential for the geocenter coordinates change harmonics, in particular, the ones with the periods of six months and 1 year.

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Keywords

Cross-spectral analysis, Geocenter dynamics, Geoinformatics, Navigation systems DORIS and GPS, Regression modeling

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