IRREGULAR PHENOMENA IN THE EARTH POLE OSCILLATION PROCESS AND TEMPORAL VARIATIONS OF GEOPOTENTIAL

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ABSTRACT. The observed irregular effects in the oscillatory process of the Earth Pole are of significant variability. They may be caused by the hydrosphere oscillations as well as the perturbations associated with the process of excitation and maintenance of the main oscillations components. Previously while carrying out the modeling of the Earth orientation parameters (EOP) in short time intervals (interyear periods) the tidal coefficients correction procedure, which took into account high-frequency unstable fluctuations with small amplitudes, was considered alongside with the regular model components. Such a short-period variations caused by geophysical processes don't make a significant influence on the quasi-periodical Earth motion and can be presented in the model as the additional components - residuals. According to the modeling results and the processing of the high-precise series of the IERS observations in the oscillation process of the Earth Pole "irregular effects" can be defined, that are associated with intrayear variation of the main oscillation components. That sort of effects that are registered by IERS, are significantly different than the ones in earlier researches. They are presented as "anomalous" fluctuations of the Earth Pole coordinates, which have a negative impact on the interpolation and prognosis of the mathematical model.

1. INTRODUCTION

It is well known that the observed irregular phenomena in the Earth Pole oscillation process are very variety. Based on the results of simulation and the processing of high-precise series of the IERS observations "irregular effects" in the Earth Pole oscillation process are extracted that are connected with within-annual variability of parameters of the main oscillation components. The abrupt changes in the oscillation phase in the middle of 1974 and in the end of 2005 – beginning of 2006 non-forecasting in the frames of the first approximation model are of significant interest. The trajectory of the Pole motion according to the IERS observation data and the theoretic interpolation curves on time interval of the Pole abnormal behavior in 2005–2006 are presented on Fig. 1.

These indicated in the IERS data phenomena are the "abnormal" fluctuations of the Earth Pole coordinates which are connected with the variation of the geodynamical parameters and they make a negative impact on the interpolation and forecast precision of the first approximation mathematical model. A numerical-analytical modeling of the Earth Pole motion shows that root-mean-square deviation of main model extrapolation of the Pole motion on the time intervals after the abnormal phenomena of 2006 year is increased considerably that corresponds to essential decreasing of the model precision.

2. MODELLING OF THE EARTH POLE MOTION

The construction of numerical-analytical model of the Earth Pole oscillation that allows to increase the precision of trajectory forecast in periods of considerable abnormalities is based on analysis of variations of the Earth gravitational field and the Earth rotation parameters (Markov et al., 2014). Figure 1 shows the plot of phase variation $\psi^{var}(\tau)$ of the Earth Pole motion that constructed on the IERS observation data on time interval from 1970 till 2011 years in the comparison with the variations of the Pole motion phase according to interpolations of two models (the main one and the refined one) on time intervals from 1990 till 2011 years. The residuals between the observed and calculated values of the phase are shown in the bottom of the plot.

The parameters of main component of the Pole oscillations on the forecast interval are assumed to be equal to its fixed values in the end of interpolation interval. The precision of annual forecast of the

refined model is higher than the forecast precision of main model during the abnormal fluctuations in the Pole oscillation process. But the precision of main model is higher when Chandler and annual oscillation characteristics are stable. The comparable short period of the Pole stable behavior was observed from 2004 till the middle of 2005. The average precisions of annual forecast of the Pole motion that is calculated by main and refined models are 1.66 m and 1.50 m correspondingly.

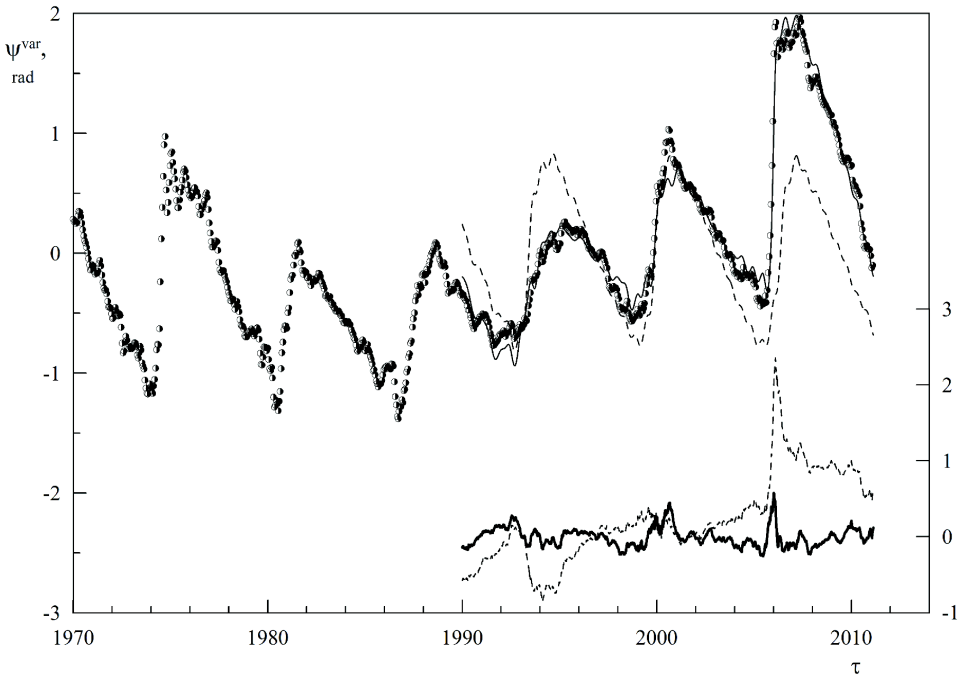

Figure 1: Variations in the phase $\psi^{var}(\tau)$ of the Earth's pole motion (upper plot) according to IERS observation data on pole coordinates on the time interval from 1970 to 2011 (discrete points) in comparison with phase variations in the pole motion according to two compared models: basic (dashed line) and refined (solid curve) models on a 23-year time interval (from 1990 to 2011). Residuals (lower plot), differences between the observed and calculated values of the phase according to the basic (dashed line) and refined (solid curve) models.

3. REFERENCES

Markov, Yu.G., Perepelkin, V.V., Krylov, S.S., 2014, "Time variations of geopotential coefficients in the structure of the oscillatory process of the Earth's pole", Doklady Physics, 59(11), pp. 544–549.