COMPARISON OF KYIV DATABASE OF LUNAR OCCULTATION

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ABSTRACT. Description of computer database of the results of lunar occultation observations collected at the Astronomical Observatory of the Kyiv National University is given. The results of processing the database materials as well as the same results taken from other databases were investigated by means of spectral and correlation analysis of uniform temporal series. Dependence of findings from change of the input parameters (system of astronomical constants, lunar ephemeris, reference star catalogue) were analyzed. When analyzing the Kyiv database the presence of some periodicities in O-C values that were found out by other investigators have been confirmed.

1. INTRODUCTION

The Kiev Database of Lunar Occultations (KDLO) includes complete data for more than 25000 observations of these phenomena observed during 1963-2003[1]. Almost 2/3 of these data have not been processed before and they have not been included yet to the world banks. Besides total occultations KDLO consits of data concerning 59 observations of grazing occultations (411 times) and 33 occultations of planets by the Moon (316 times). Majority of observations were made visually. Only approximately 2% of all observations were obtained using photoelectric and CCD equipments. Mean timing accuracy of them lies between 0.06 and 0.09 s. Almost 70 % of observations of occultations were made with dark limb of the Moon. 590 observers from 78 sites of Ukraine, Russia, Georgia, Belorus', Moldova, Lithuania, and Uzbekistan took part in observations. There are the following advantages of the KDLO: using the same type of time recording devices; reducing the occultation timings to the UTC scale through the uniform Time Service; positions of observers are given in the same Geodetic System.

2. ANALYSYS OF THE OBSERVATIONAL DATA AND REZULTS OF PROCESSING

On the level of input data the results of observations from KDLO are compatible with the similar data of the world banks [2,4,6]. Processing of the observational data were made by means of conventional 3-stage methods [3,6]. On each stage the results of processing were compared to the results of another authors which differ from one another with using different input data (system of astronomical constants, Lunar Ephemeris and charts of lunar profile as well as the

reference star catalogue). At the first stage for each observation the difference between the observed and calculated angular distance from the star to the lunar limb, $(O-C) \equiv \Delta\sigma$, were obtained. These values were compared with the analogues data from different series of lunar occultation data. All the data have practically normal distribution of values and similar standard deviations. At the second stage equations being formed for each observation were combined into systems on lunations and years. As a result of solving these equations series of values of (O-C) corrections to ecliptical coordinates of the Moon $(\Delta L, \Delta B)$ were obtained which were analysed by means of spectral and correlation analysis as the uniform temporal series. We found out some periodical terms in (O-C) values. The same periodicities are present in other considered series of lunation solutions. The greatest amplitude have the terms which correspond to periods of changing the Delaunay arguments (F, d, l_M, l_S) and longitude of node of the Moon's orbit,Ω. Earlier many investigators (E.Brown, 1923; L.V.Morrison and F.McBain Sadler, 1969; M.Soma, 1985; C.Jordi and G.Rossello, 1990) noted to presence of these periodicities. It was considered that the most of the periodic terms are caused with inaccuracies of astronomical constants, star positions, the Moon's motion theory and the Moon's profile charts. However it is impossible to understand why these periodicities are remained (true, with lesser amplitude) when we use modern high-precision mentioned input parameters. At the third stage main corrections were obtained solving the equation system for the whole set of data. Results obtained for the KDLO data as well as the [5] results are given in table 2 for comparison. They are practically the same within the errors of determination.

Comparison of two series of solutions of equation systems

Corrections	Soma 2000	KDLO
To the lunar ecliptic longitude	$-83.5 \pm 3mas$	$-101 \pm 27mas$
To the right ascension system of the stars	$-32.8 \pm 19mas$	$+9 \pm 34mas$
Rotation of the star's coordinates		
around the equinox	$-3.6 \pm 6mas$	$-12 \pm 11mas$
Rotation of the Hipparcos reference frame	$+0.67 \pm 0.42mas/yr$	$+1.2 \pm 0.65mas/yr$
	$+0.22 \pm 0.09mas/yr$	$+0.11 \pm 0.15mas/yr$
	$-4.57 \pm 1.29mas/yr$	$-3.2 \pm 2.2mas/yr$

We conclude that the KDLO is compatible with the similar data of the world bank from the point of view of its accuracy and duration of observation time period.

3. REFERENCES

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