

INFLUENCE OF UNACCOUNTED EFFECTS OF FLEXURE AND REFRACTION ON THE VALUES $O - C$ FOR OUTER PLANETS DETERMINED WITH THE BELGRADE VERTICAL CIRCLE

Trajkovska, V., Mijatov, M.

Astronomical Observatory, Volgina 7, 11050 Belgrade, Yugoslavia

ABSTRACT. In this paper we show that the values $O - C$ for outer planets determined with the Belgrade Vertical Circle have to be corrected for remaining effects of flexure and refraction. The method for determination of corrections is given.

For reduction of observed declination of the planets determined with the Belgrade Vertical Circle (BVC) mean latitude $\bar{\varphi}$ was used which obtained from observations of selected southern stars with coordinates close to coordinates of the planets.

If there are unaccounted remaining of flexure and refraction, then for the latitude φ_i of a star the following formula have been used:

$$\varphi_i = \varphi_0 + b \sin z_i + \Delta\rho \tan z_i \quad (1)$$

where

φ_0 - latitude of BVC for the observational night;

b - coefficient of the horizontal flexure (for derivation z , measurements of the flexure are not included in calculation);

$\Delta\rho$ - correction for the refraction.

The mean value $\bar{\varphi}$ according to equation (1) is:

$$\bar{\varphi} = \varphi_0 + \overline{b \sin z_i} + \overline{\Delta\rho \tan z_i},$$

and the latitudes for calculation of declinations of the planets are:

$$\varphi_p = \varphi_0 + b \sin z_p + \Delta\rho \tan z_p.$$

The difference between the latitudes φ_p and $\bar{\varphi}$ is:

$$\varphi_p - \bar{\varphi} = b(\sin z_p - \overline{\sin z_i}) + \Delta\rho(\tan z_p - \overline{\tan z_i}) \quad (2)$$

The difference $\Delta(O - C) = (O - C)_{\varphi_p} - (O - C)_{\bar{\varphi}}$, where $O - C$ is calculated by φ_p and $\bar{\varphi}$ is:

$$\Delta(O - C) = \varphi_p - \bar{\varphi}$$

The unaccounted effects produce a systematic difference $\varphi_p - \bar{\varphi}$, in order to compute this difference it is necessary to derive from equation (1) the unknowns φ_0 , b and $\Delta\rho$. These unknowns cannot be determined by the method of least squares because the coefficients of unknowns φ_0 and b are approximately equal, but the total

effect $b \sin z + \Delta\rho \tan z$ on the quantity $\Delta(O - C)$ is anyway practically the same for different values of φ_0 .

In Table 1 using for φ_0 the value of the mean latitude of BVC, $\varphi_0 = +44^\circ 48' 07'' . 60$, the values $\Delta(O - C)$ for observations made in July 1984 are given.

Table 1. The values $\Delta(O - C)$ of planets

<i>Data</i>	<i>Mars</i>	<i>Jupiter</i>	<i>Saturn</i>	<i>Uranus</i>	<i>Neptune</i>
02.07.1984	-	-	-0'' . 21	+0'' . 02	-
10.07.1984	-0'' . 24	+0'' . 05	-	-0.04	-0'' . 02
11.07.1984	+0.16	-0.05	-	+0.02	-
12.07.1984	-0.26	+0.05	-	-0.05	-0.03
13.07.1984	-0.09	-	-	+0.00	+0.00
14.07.1984	-0.04	+0.02	-	+0.00	+0.01
15.07.1984	-0.29	-	-	-0.10	-0.08
19.07.1984	-0.28	+0.13	-	-0.03	+0.00
20.07.1984	-0.06	+0.03	-	-	+0.00
21.07.1984	-	+0.18	-	-0.12	-0.06
22.07.1984	-0.28	+0.16	-	-0.02	+0.02
<i>M. value</i>	-0'' . 15	+0'' . 07	-0'' . 21	-0'' . 04	-0'' . 02

According to equation (2) the values of coefficients of unknown b and $\Delta\rho$ are dependent of differences of zenith distance of planets, and some approximately mean zenith distance obtained from observations of stars. It means that the values $\Delta(O - C)$ are dependent of differences of declinations of planets and of some mean declination. During July 1984 declinations of Mars were higher than those of observational stars, and declinations of Uranus and Neptune were close to the mean one.

As seen from Table 1 the values $\Delta(O - C)$ for Mars are considerable and those for Uranus and Neptune negligible.

Our investigation showed that using of the mean latitude $\bar{\varphi}$ obtained from observations of selected southern stars does not entirely eliminate the effects of flexure and refraction.

In order to get the true values of $O - C$ from existing observations with BVC it is necessary to find the corrections $\Delta(O - C)$ by method which we applied for reduction of observations from July 1984.

In future, it should be, beside southern stars, to observe zenith ones as well as stars in lower culmination, in order to determine more realistically the unknowns φ_0 , b and $\Delta\rho$.