MERIDIAN OBSERVATIONS OF SOLAR SYSTEM BODIES WITH THE STRUVE-ERTEL INSTRUMENTS OF THE PULKOVO OBSERVATORY

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ABSTRACT. Two Struve-Ertel instruments were used for the daytime observations of the Sun, Mercury, Venus and Mars at Pulkovo from 1956 to 1976. The FK4 equinox and equator corrections were derived. Both the instruments were installed in 1983-1986 at the Kislovodsk Station of the Pulkovo Observatory. The atmospheric dispersion and lateral refraction have been estimated at the Station.

The Meridian observations of the solar system bodies were resumed with two Struve-Ertel instruments - the large transit instrument (LTI) and the vertical circle (VC), at Pulkovo in 1956. The traditional visual method was used. The mean epoch of the series is 1971.0

The table gives the number of observations of four objects and the error of one observation which was derived by the least squares method with the determination of the corrections for the zero-points of the FK4, ΔA and ΔD, and of the corrections for the orbital elements (not listed in the table) using two theories of the planets' motion.

Table

Instru-ment	Number of observations standard deviation				ΔA and ΔD, 1971.0 theories used		comparison	
	Sun	Merc.	Venus	Mars	VSOP-82	Newcomb	F	S
LTI	1033	121	593		0^s074	0^s064	0^s052	0^s038
	0^s0097	0^s105	0^s106		0^s003	0^s003	0^s004	0^s012
VC	922	135	511	72	-0"036	-0"022		0"00
	0"92	0"84	0"95	0"71	0"027	0"026		0"02

For comparison, the results by Fricke (1982) and by Svechnikov (1985) are listed in the table being reduced to the epoch 1971.0.

The equinox correction ΔA derived from our observation series - being greater than both cited values - does not rule out the presence of the centennial drift of the FK4 equinox. The value ΔD - being the correction to the declination system in the wide

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equatorial zone - is in accordance with the fact that the declination system is well determined. The observations with the VC are more exact those on the LTI. We explain that property of the RA-observations in our series by the significant difficulties in observing a sufficient number of day stars and as a consequence, by the necessity of determining the reduction elements from level reading and air meridian mark readings only, one day of every three. The LTI was equipped with air mires 170 meters distant. The standard deviation for one reading is plotted for the south mire readings averaged for four observers and for four intervals of image estimation Q:Q is equal to 5 for the best image with the presence of diffractional rings. The plot gives the best estimation for the accuracy of a single reading of the air mire in our case. A standard deviation 0"04 may be achieved for visual reading.

The orbital distribution of the observations in our series was not optimal for excluding correlations, and, generally, the productivity of meridian observations of the solar system bodies was low in the Leningrad weather. All these obstacles encouraged us to install the two above mentioned instruments at the Kislovodsk astronomical station of the Pulkovo Observatory. The state is located in the North Caucasus at a latitude of 44 degrees N and an elevation of 2100 meters. The seeing there provides for regular observation all year round.

The first observations of the Sun and major planets and stars in the daytime were made from June 1981 to September 1982 by the astronomers of the Nicolaev Branch of the Pulkovo Observatory at Koslovodsk station. The reversable transit instrument with an objective of 10 cm and focal length 100 cm was used. The horizontal axis inclination was determined for every object. The collimation and azimuth relative to the middle line of air mires were determined every hour.

Studies of atmospheric dispersion and lateral refraction were made. According to visual micrometer data estimations the atmospheric dispersion h can be approximated by the expression h = 0"39 + 0"16 tanZ. The expression h = 0"16 + 0"13 tanZ is valid for nighttime.

On the basis of direct measurements of the temperature distribution along the nearest 10 meters of the instrument's sight line, the lateral refraction estimations were 0^s010 to 0^s015 under the dispersion 0^s006. The lateral refraction at Nicolaev was estimated at 0^s050. The accuracy of RA-observations derived from analysis of (0-C) α was characterized by the standard deviation 0^s036 at the station (Glebova).

The vertical circle was installed at the station in 1983. Regular differential determinations of the declinations have been in progress since 1984 for the planets observable in daytime. As a rule the day time observations continue for 6-8 hours (3-4 hours befroe and after noon). The average daily number of observations for the reference stars is 6, being 30 on the particular days when stars of 4^m0 could be observed. The quality of the planets' images as a rule is sufficient, there were even cases when Mercury and Venus could be observed within 5 degrees of the Sun's center. The preliminary $(O-C)_\delta$-estimation gives a standard deviation which does not exceed 0"6 for planets, being 0"4 for 1986. More than 1000 determinations of declinations of the solar system bodies have been made since 1984.

The large transit instrument was installed at the station in 1986. The vacuum mires are being built for that instrument. The night observations of major and minor planets were started in 1987 with both instruments.

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