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OBSERVATORY CORRECTION FOR ASTRONOMICAL
LONGITUDES REFERRING TO POTSDAM

by
C. C. Tscherning

Abstract

Astronomical longitude determinations have frequently been determined through the determination of the longitude differences with respect to one main observatory. When the longitude of the observatory is changed, all longitudes referring to the observatory must be changed as well. The correction has been determined for longitudes referring to Potsdam for stations in the Baltic system of longitudes to - 0°165.

1. Introduction

Earlier determinations of longitudes were determined by determining the difference in longitude with respect to a main observatory, see e.g. (Baltische Geodätische Kommission, 1934). However, the longitudes of the main observatory may also change due to new adjusted values or change in reference system, see eg. (Stoyko and Stoyko, 1961, 1964) and (Guinot and Feissel, 1969).

In this short report we consider the changes in longitudes due to the changes in the main observatory in Potsdam, DDR.

2. Astronomical longitude determinations in Potsdam

The main geodetic reference station in Potsdam is since 1923 the so-called "Helmert Turm" (HT). (Albrecht, 1905, p. 157) quotes the longitude

$$\lambda_{HT}^0 = 52^m 16^s .115 (= 13^{\circ} 04' 01'' .725). \quad (1)$$

He also quotes a value for the "Östl. Meridian Haus", (ÖMH), which enables us to determine the longitude difference between the ÖMH and the HT to

$$\lambda_{HT}^0 - \lambda_{\text{ÖMH}}^0 = 0^s .053 (= 0'' .795). \quad (2)$$

The Baltic Geodetic Commission has fixed the value for ÖMH to

$$\lambda_{\text{ÖMH}}^1 = 52^m 16^s .059 (= 13^{\circ} 04' 00'' .885),$$

hence

$$\lambda_{HT}^1 = 52^m 16^s .112 (= 13^{\circ} 04' 01'' .680), \quad (3)$$

which is the value quoted by (Ölander, 1949).

The astronomical longitude used for the European Datum 1950 can be found in (Wolf, 1949, p. 98)

$$\lambda_{HT}^2 = 13^{\circ} 04' 01'' .665 \quad (4)$$

This corresponds to the adopted values for the prime vertical component of the deflection of the vertical fixed for ED 1950,

$$d\lambda = + 2'' .92,$$

giving

$$\lambda_g(\text{ED 1950}) = 13^{\circ} 03' 58'' .745. \quad (5)$$

Using (2) we have the ED 1950 value for ÖMH

$$\lambda_{\text{ÖMH}}^2 = 13^{\circ} 04' 00'' .870 = 52^m 16^s .058,$$

which agrees with the values used by Bureau de l'Heure (see e.g. Bulletin Horaire, 1961, p. 391).

In 1962 the introduction of the FK4 catalogue caused a recomputation of the adopted longitudes, see (Stoyko and Stoyko, 1961, 1964). The new value is

$$\lambda_{\text{ÖMH}}^3 = 52^{\text{m}}16^{\text{s}}.069 (= 13^{\circ}04'01''.035),$$

which gives

$$\lambda_{\text{HT}}^3 = 52^{\text{m}}16^{\text{s}}.122 = 13^{\circ}04'01''.830. \quad (6)$$

Finally in 1968 the time system is changed to BIH 1968, where a new mean pole is adopted and the aberration constant is changed, see (Guinot and Feissel, 1969). Here the longitude observations for ÖMH gives

$$\lambda_{\text{ÖMH}}^4 = 52^{\text{m}}16^{\text{s}}.0480$$

The longitude difference between this point and HT is given by eq. (2), hence

$$\lambda_{\text{HT}}^4 = 52^{\text{m}}16^{\text{s}}.1010 (= 13^{\circ}04'01''.5150). \quad (7)$$

In this way we have determined observatory corrections for 4 systems of longitude:

Albrecht's system:

$$\Delta\lambda^0 = \lambda_{\text{HT}}^4 - \lambda_{\text{HT}}^0 = - 0''.210 \quad (8)$$

Baltic longitude system:

$$\Delta\lambda^1 = \lambda_{\text{HT}}^4 - \lambda_{\text{HT}}^1 = - 0''.165 \quad (9)$$

"ED 1950-System":

$$\Delta\lambda^2 = \lambda_{\text{HT}}^4 - \lambda_{\text{HT}}^2 = - 0''.150 \quad (10)$$

"FK4-System":

$$\Delta\lambda^3 = \lambda_{\text{HT}}^4 - \lambda_{\text{HT}}^3 = - 0''.315 \quad (11)$$

The values (8) - (11) should be added to longitudes referring to Potsdam, which have been determined using the values (1), (3), (4) or (6).

Example: The Baltic system longitude of Buddinge "Öst. Beobachtungshaus" has been fixed to (Baltische Geodätische Kommission, 1937, p. 44)

$$\lambda_{\text{BUD}}^1 = 50^{\text{m}}00^{\text{s}}.584 (= 12^{\circ}30'08''.760) \quad (12)$$

Its value is, after applying the correction (9)

$$\lambda_{\text{BUD}}^4 = 50^{\text{m}}00^{\text{s}}.5730 = 12^{\circ}30'08''.5950. \quad (13)$$

The Danish main station, DK610 Buddinge has a longitude difference of + 0''.210 with respect to "Östl. Beobachtungshaus", cf. (Andersen, 1948, p. 44). This gives the following astronomical longitude for DK610 Buddinge

$$\lambda_{610}^4 = 50^{\text{m}}00^{\text{s}}.3630 (= 12^{\circ}30'05''.4450). \quad (14)$$

Note, however, that value of λ_{BUD}^1 as given above (12), has not been used in Denmark. The value used was the preliminary value

$$\lambda_{\text{BUD}}^{1/2} = 50^{\text{m}}00^{\text{s}}.585 (= 12^{\circ}30'08''.775), \quad (15)$$

see (Andersen, 1948, p. 7) and (Baltische Geodätische Kommission, 1934, p. 91).

On Danish longitudes, based on the value (15), there should therefore be applied a correction

$$\Delta\lambda_{\text{DK}}^{1/2} = - 0''.180. \quad (16)$$

This example shows how careful these corrections must be applied, indeed.

3. Conclusion

The above stated correction may be applied to astronomical longitudes and Laplace azimuths in order to eliminate this type of systematic error. It is comforting to see, that the corrections are rather small.

I recommend, that similar investigations are done for other observatories in the European area, and that the corrections are considered for the future phases of RETrig.

References

- Albrecht, Th.: Ausgleichung des zentraleuropäischen Längennetzes. Astr. Nach., Vol. 167, pp. 145-161, 1905.
- Andersen, E.: Determination of the Latitude at Buddinge by the Horrebow-Talcott Method. Mémoires de l'Institut Géodésique de Danemark, Troisième Série, Tome Douzième, Kopenhagen, 1948.
- Baltische Geodätische Kommission: Bestimmung der Längenunterschiede der Landeszentralen, I, II. Helsinki, 1934.
- Baltische Geodätische Kommission: Verhandlungen 1936. Helsinki, 1937.
- Bulletin Horaire, Serie G, No. 13, 1961.
- Guinot, B. and Annual Report for 1968. Bureau International de l'Heure, 1969.
- Feissel, M.:
- Ledersteger, K.: Die absolute Lotabweichung in Potsdam und die Geodätischen Ausgangswerte des gesamteuropäischen Netzes auf dem Hayfordschen Ellipsoid. Bulletin Géodésique, No. 23, pp. 101-104, 1952.
- Stoyko, A. and Revision des Longitudes Conventionnelles. Bulletin Horaire, Ser. 5, Stoyko, N.: No. 16, pp. 361-367, 1961.
- Stoyko, A. and Rapport sur le Changement des Longitudes Conventionnelles des Stoyko, N.: Services Horaires. Bulletin Géodésique, No. 72, p. 114, 1964.
- Wolf, H.: Die zweite Lotabweichungsausgleichung für das Zentraleuropäische Netz. Veröffentlichungen des Instituts für Erdmessung, No. 6, pp. 91-106, Bamberger Verlagshaus Meisenbach und Co., Bamberg, 1949.
- Ölander, V. R.: Adjustment of the Baltic Ring, Baltic Geodetic Commission, Special Publ. No. 10, Helsinki, 1949.