

PRELIMINARY VALUES OF THE VARIATION OF LATITUDE AT GREENWICH DURING 1936-1938, TOGETHER WITH AN ACCOUNT OF THE NEW OBSERVING PROGRAMME.

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1. *Description of New Programme*

In 1936 the Cookson floating telescope for the determination of the variation of latitude was moved from the courtyard of the Royal Observatory to a new site in the Christie Enclosure. At the same time a new programme of observations was introduced, as it was now no longer necessary to determine the constant of aberration.

The purpose of this note is to give a short account of the results obtained during the first two years of observations based on the new programme.

The stars chosen for observation are taken mainly from the new Boss General Catalogue, advance values for the Declinations and Proper Motions having been kindly supplied by Professor B. Boss. The programme contains 148 pairs in all, but of these, 36 pairs were observed on the previous Cookson programme for a number of years, and for these pairs the mean zenith distances and proper motions are taken from the latitude observations. These values are considerably more accurate than any which could be obtained by ordinary meridian observations of the separate stars. Nine pairs contain stars not in the Boss General Catalogue, and data for these have been obtained from other catalogues.

The star pairs are divided into 24 groups, each containing from 10 to 18 stars, extending over a period of about one hour in R.A. At present the arrangement is that three groups are observed each night. Starting, for example, with groups 6, 7, 8, after about a fortnight this is replaced by 7, 8, 9, and so on. Each group is therefore observed over a period of about six weeks.

This programme requires one observer for each night, the observations being centred round midnight, whereas the previous programme involved one evening and one morning observer. A corresponding disadvantage arises, however, because each group is observed for six consecutive weeks in each year. This results in the group corrections not being so well determined as when each group is observed in two periods separated by two to four months, as in the old programme. It should be added that in the old programme the groups were observed as near to 6 a.m. and 6 p.m. as possible, in order to obtain a large aberration factor. The systematic difference between evening and morning latitudes is not now regarded as being due to an error in the constant of aberration, so that a large spread in the times of observation of each group is no longer important from this point of view.

2. Discussion of Results

In dealing with the results obtained for the first two years, no attempt has been made to obtain the group corrections and latitude variation by the method of least squares, as used in treating the results of previous years (see the Greenwich publications on the Variation of Latitude). It is not possible to obtain, in this way, group corrections of any accuracy from two years' results only. Instead we have taken the 36 pairs observed also in the previous programme to form a basis for the latitude variation. The reductions have been made as follows:—

(i) It is first necessary to bring the “old” stars and the “new” stars to the same system of declinations. As stated in the previous paper, the system of the Boss General Catalogue requires a correction to declination which is periodic in R.A. and is given by

$$+12.8 \sin \theta + 5.4 \cos \theta,$$

where θ is the R.A. and the unit is $0''.01$. We therefore apply first this correction to the Boss places.

We then find for the 36 stars common to the old and new programmes

$$\left. \begin{array}{l} \text{Mean Z.D. north calculated from the cor-} \\ \text{rected Boss declinations for an assumed} \\ \text{value of the latitude} = 51^\circ 28' 38''.03 \end{array} \right\} - \left\{ \begin{array}{l} \text{Mean Z.D. north found from} \\ \text{observation on the old site} \end{array} \right. = 1''.01 \pm 0''.02.$$

We therefore add $1''.01$ to the values taken from the Cookson observations to bring them to the same system as the (corrected) Boss declinations. The 36 pairs common to the two programmes therefore give the latitude of the old Cookson site as $51^\circ 28' 39''.04$, in agreement with the latitude derived in the preceding paper. The preliminary value for the latitude of the new site was obtained by measuring its distance south of the old site, which is 101 feet approximately. As the ground slopes away rather quickly to the north of the old site, we should expect the latitude of the new site to be rather less than $51^\circ 28' 38''.03$, the value assumed (see § 3).

(ii) Having obtained the ephemerides of all the star pairs, the residuals (observed *minus* tabulated mean zenith distance north for each pair) were first corrected to reduce the mean of each pair to the mean of the group for reasons given in the Greenwich publications quoted.

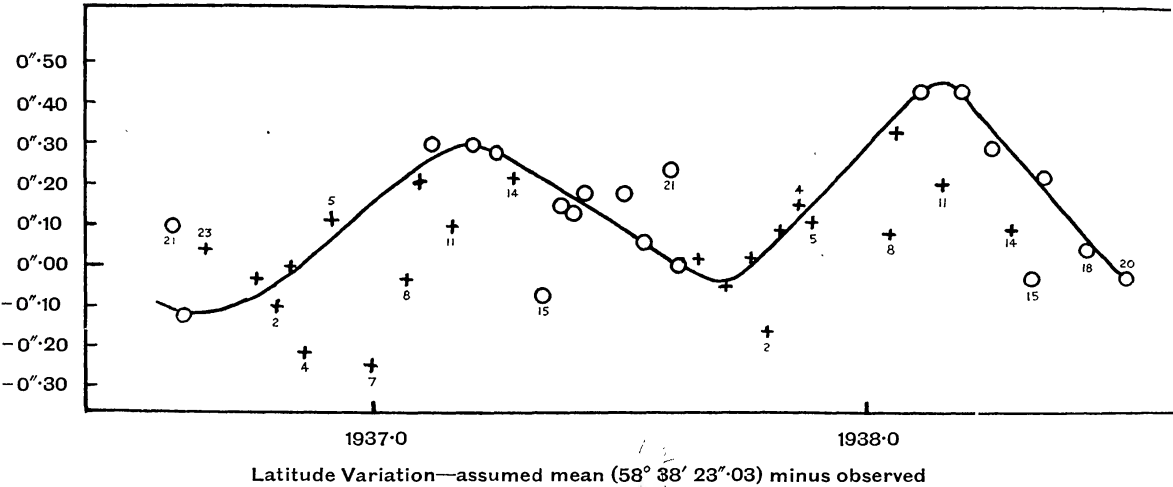
(iii) For those groups which contain two or more pairs from the old programme, a group correction was arrived at on the assumption that these pairs required no correction. As each group has been observed for two periods (one each year), this procedure is equivalent to making the mean latitude of the two periods equal to the latitude given by the “old” star pairs only, the difference between the two periods, however, depending on all the pairs observed.

(iv) For groups consisting entirely of new pairs, and two groups each containing only one “old” star, group corrections were adopted to bring the two values of the latitude as near as possible to the curve given by the

“old” pairs. In the five months September to January there are only three old pairs on the programme, so that in this region the latitude variation and group corrections are rather weak.

3. Results

The results are shown in the figure below, in which the assumed mean *minus* the observed latitudes are plotted.



The circles represent results obtained from the old Cookson stars as explained in § 2 (iii), the group corrections having been already applied. The crosses represent values for the groups containing new stars only, or not more than one old star, *before* any group corrections have been applied. To avoid overcrowding, only a selection of the groups have been numbered.

From the figure the (assumed) mean latitude, 51° 28' 38".03, is seen to be too large by about 0".10, as anticipated in § 2 (i).

The preliminary group corrections are given below :

Group	Correction (Unit = ".01)	Group	Correction (Unit = ".01)
I	0	XIII	+19
II	+13	XIV	+10
III	0	XV	-19 +25
IV	...	XVI	-15
V	0	XVII	-2
VI	...	XVIII	-2
VII	...	XIX	...
VIII	+26	XX	-1
IX	0	XXI	+2 -20
X	+8	XXII	+6
XI	+20	XXIII	-10
XII	+25	XXIV	0

The figures in italics represent group corrections which have already been added to obtain the points marked with circles in the figure. For groups XV and XXI a further correction seems to be required, and for

groups IV, VI, VII and XIX the group corrections are too weak to be of any value.

The smoothed values of the corrections to be applied to the assumed mean latitude of $51^{\circ} 38' 28''.03$, or alternately to the observed declinations reduced with this value of the latitude, are as follows :—

1936.6	+0.12	1937.6	-0.02
36.7	+0.11	37.7	+0.03
36.8	+0.05	37.8	-0.04
36.9	-0.05	37.9	-0.17
37.0	-0.16	38.0	-0.29
37.1	-0.25	38.1	-0.40
37.2	-0.30	38.2	-0.44
37.3	-0.25	38.3	-0.26
37.4	-0.18	38.4	-0.12
37.5	-0.10	38.5	+0.02

A further investigation was made in order to see if there was any "wind effect" in the new site. To do this the latitude variation was subtracted from the corrected mean residuals of each group for each night, and the resulting residuals correlated with the direction of the wind at the time of observation. A definite wind effect is apparent, the residuals (observed *minus* tabulated mean zenith distance north) being about $0''.07$ greater for N. winds than for S. winds. The data are not sufficient, however, to justify the adoption of any functional relationship between the mean residuals and the direction of the wind. The values of the latitude given above are not corrected for wind effect.