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SYSTEMATIC DIFFERENCES BETWEEN NZC AND FK4

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Abstract

The systematic differences between NZC and FK4 are investigated by direct comparison of tabular values of the both catalogues, and their formulae are given empirically. Published differences coincide well with these formulae.

1. Introduction

The observation of occultations, as well as the meridian observation, is one of the most powerful methods for determining the motion of the moon. For the reduction of occultation observations is widely used NZC (Robertson, 1940), while the fundamental celestial coordinate system is fixed by FK4 (Fricke and Kopff, 1963). It is therefore necessary to investigate the systematic differences between the two catalogues. For this purpose a comparison is made between their tabular values about the position for 1950.0 and the proper motion for those stars which are contained in both of the catalogues in common.

2. Distribution of the Common Stars

NZC, of which the coverage lies within $\pm 8°$ of latitude, contains 3539 stars. FK4 consists of 1596 stars which are distributed over the whole celestial sphere uniformly, and we have FK4 Sup with 1987 stars, which can be additionally used for our purpose. Of these stars 228 are listed in common in both of FK4 and NZC and, if FK4 Sup is included, they become to 432, as shown in Table 1.

3. Expression of Differences and Calculation

Since the zodiac is in a fairly narrow band, the declination of a star in this zone practically depends on the right ascension. Hence, the differences can be treated as functions of the right ascension alone. We now assume that each function has an expression of a form,

$$\Delta = A_0 + A_{11} \sin \alpha + A_{12} \cos \alpha + A_{21} \sin 2\alpha + A_{22} \cos 2\alpha .$$

The differences (FK4—NZC) in right ascension and declination for 1950.0 and their proper motions are calculated for all the common stars, respective differences for each star are substituted into the above expression and then the coefficients are determined by means of the least squares method.

4. Result of the Calculation

The result is shown in Tables 2 and 3. In Figures 1 and 2, the solid lines show the values of the above expression with the coefficients obtained here, and the dotted lines show the mean values of the differences for every one hour of right ascension. The solid lines and the corresponding dotted lines show a comparatively good agreement.

5. Differences from the Published Differences

We have two published systematic differences, FK4—FK3 and FK3—NZC, which are found at the ends of FK4 and NZC catalogues, respectively. We evaluate the systematic differences FK4—NZC as the summation of these two differences along $\beta=0°$. The result thus obtained is shown in Table 4 and also in Figure 1 by dots. It coincides well with the result of present investigation, the standard deviations in $\Delta\alpha$, $\Delta\mu$, $\Delta\delta$ and $\Delta\mu'$ being $0^s.0021$, $0^s.0052$, $0''.026$ and $0''.024$ respectively.

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References

Robertson, J. 1940, Astr. Pap. Amer. Eph., **10.**
Fricke, W. and Kopff, A. 1963, Veröff. Rech. Inst., **11.**

TABLE 1 DISTRIBUTION OF THE COMMON STARS WITH NZC

R.A.	0^h ~1^h	1 ~2	2 ~3	3 ~4	4 ~5	5 ~6	6 ~7	7 ~8	8 ~9	9 ~10	10 ~11	11 ~12	
FK4	7	11	12	10	11	8	7	12	8	8	8	11	
FK4 Sup	10	10	8	8	10	9	9	7	15	10	9	9	
R.A.	12^h ~13^h	13 ~14	14 ~15	15 ~16	16 ~17	17 ~18	18 ~19	19 ~20	20 ~21	21 ~22	22 ~23	23 ~24	Total
FK4	8	7	12	12	7	9	10	11	8	11	8	12	228
FK4 Sup	7	9	6	6	8	5	7	7	8	7	9	11	204

TABLE 2 OBTAINED COEFFICIENTS, FK4—NZC, n=228

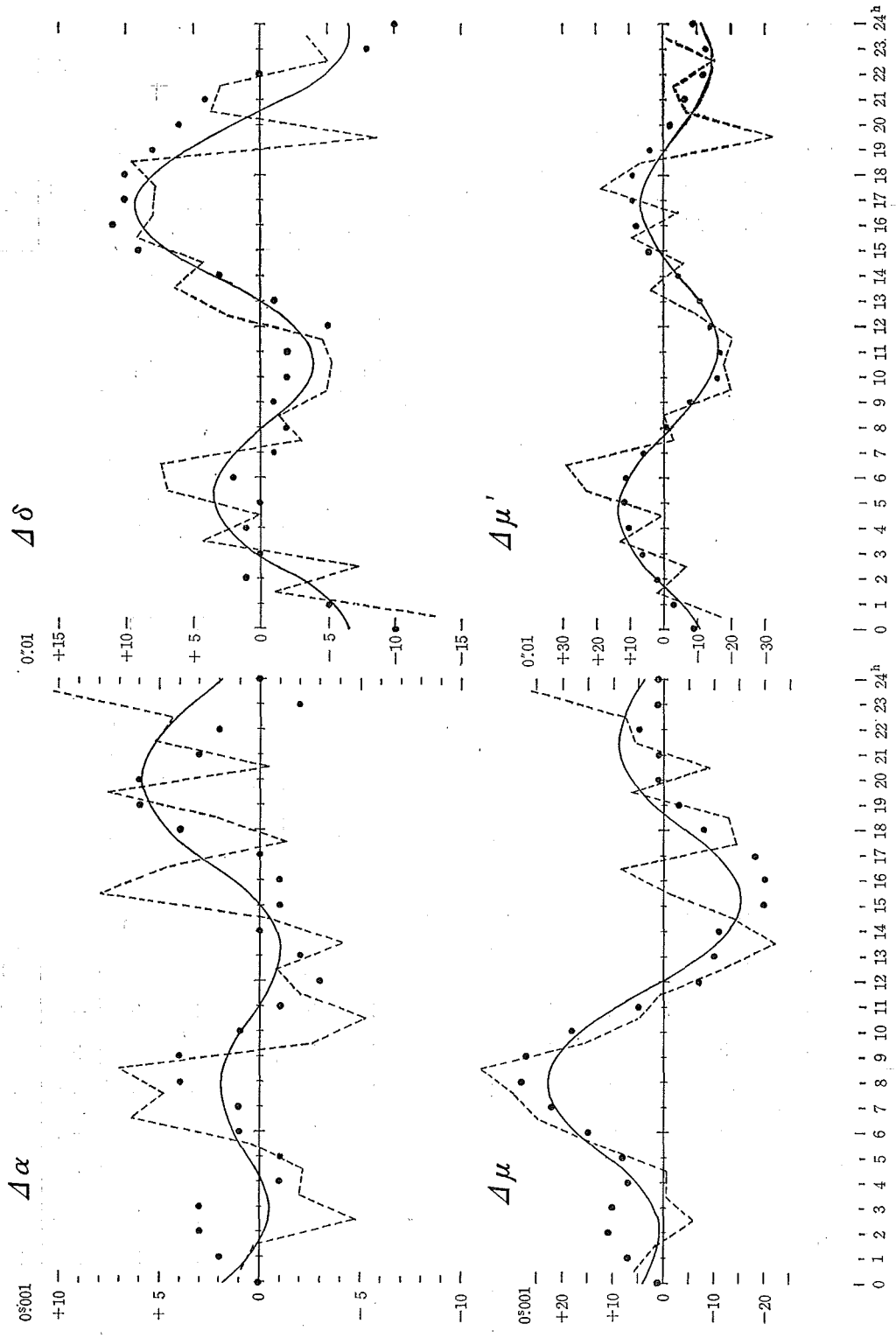
	A_0	A_{11}	A_{12}	A_{21}	A_{22}
$\Delta\alpha$	+0s.0017	−0s.0016	+0s.0012	−0s.0019	−0s.0012
p. e.	± 5	± 7	± 7	± 7	± 7
$\Delta\mu$	+0s.0042	+0s.0017	+0s.0017	−0s.0110	−0s.0021
p. e.	± 11	± 15	± 15	± 15	± 16
$\Delta\delta$	+0″.006	−0″.024	−0″.021	+0″.028	−0″.050
p. e.	± 7	± 10	± 10	± 10	± 11
$\Delta\mu'$	−0″.028	+0″.033	+0″.018	+0″.072	−0″.108
p. e.	± 15	± 21	± 21	± 21	± 21

TABLE 3 OBTAINED COEFFICIENTS, FK4 AND FK4 Sup—NZC, n=432

	A_0	A_{11}	A_{12}	A_{21}	A_{22}
$\Delta\alpha$	+0s.0033	−0s.0043	+0s.0011	−0s.0026	−0s.0005
p. e.	± 5	± 7	± 7	± 7	± 7
$\Delta\mu$	+0s.0078	+0s.0058	+0s.0009	−0s.0128	−0s.116
p. e.	± 11	± 16	± 16	± 16	± 16
$\Delta\delta$	+0″.005	−0″.017	+0″.005	+0″.024	−0″.039
p. e.	± 7	± 9	± 9	± 9	± 9
$\Delta\mu'$	−0″.008	+0″.062	+0″.086	+0″.047	−0″.116
p. e.	± 16	± 22	± 22	± 22	± 22

TABLE 4 DIFFERENCES FK4—NZC FROM THE PUBLISHED DIFFERENCES

R.A.	0^h	1	2	3	4	5	6	7	8	9	10	11	12
$\Delta\alpha$ 0s.001	0	+ 2	+ 3	+ 3	− 1	− 1	+ 1	+ 1	+ 4	+ 4	+ 1	− 1	− 3
$\Delta\mu$ 0s.001	+ 1	+ 7	+11	+10	+ 7	+ 8	+15	+22	+28	+27	+18	+ 5	− 7
$\Delta\delta$ 0″.01	−10	− 5	+ 1	0	+ 1	0	+ 2	− 1	− 2	− 1	− 2	− 2	− 5
$\Delta\mu'$ 0″.01	− 9	− 3	+ 2	+ 6	+10	+11	+10	+ 6	− 1	− 8	−16	−17	−14
R.A.	12^h	13	14	15	16	17	18	19	20	21	22	23	24
$\Delta\alpha$ 0s.001	− 3	− 2	0	− 1	− 1	0	+ 4	+ 6	+ 6	+ 3	+ 2	− 2	0
$\Delta\mu$ 0s.001	− 7	−10	−11	−20	−20	−18	− 8	− 3	+ 1	+ 1	+ 5	+ 1	+ 1
$\Delta\delta$ 0″.01	− 5	− 1	+ 3	+ 9	+11	+10	+10	+ 8	+ 6	+ 4	0	− 8	−10
$\Delta\mu'$ 0″.01	−14	−11	− 5	+ 4	+ 8	+ 9	+ 9	+ 4	− 2	− 6	−12	−13	− 9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0
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−10
Δδ
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+15
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+5
0
−5
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−15
Δμ
0ˢ001
+20
+10
0
−10
−20
Δμ′
0″01
+30
+20
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0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24h

Fig. 1 FK4—NZC

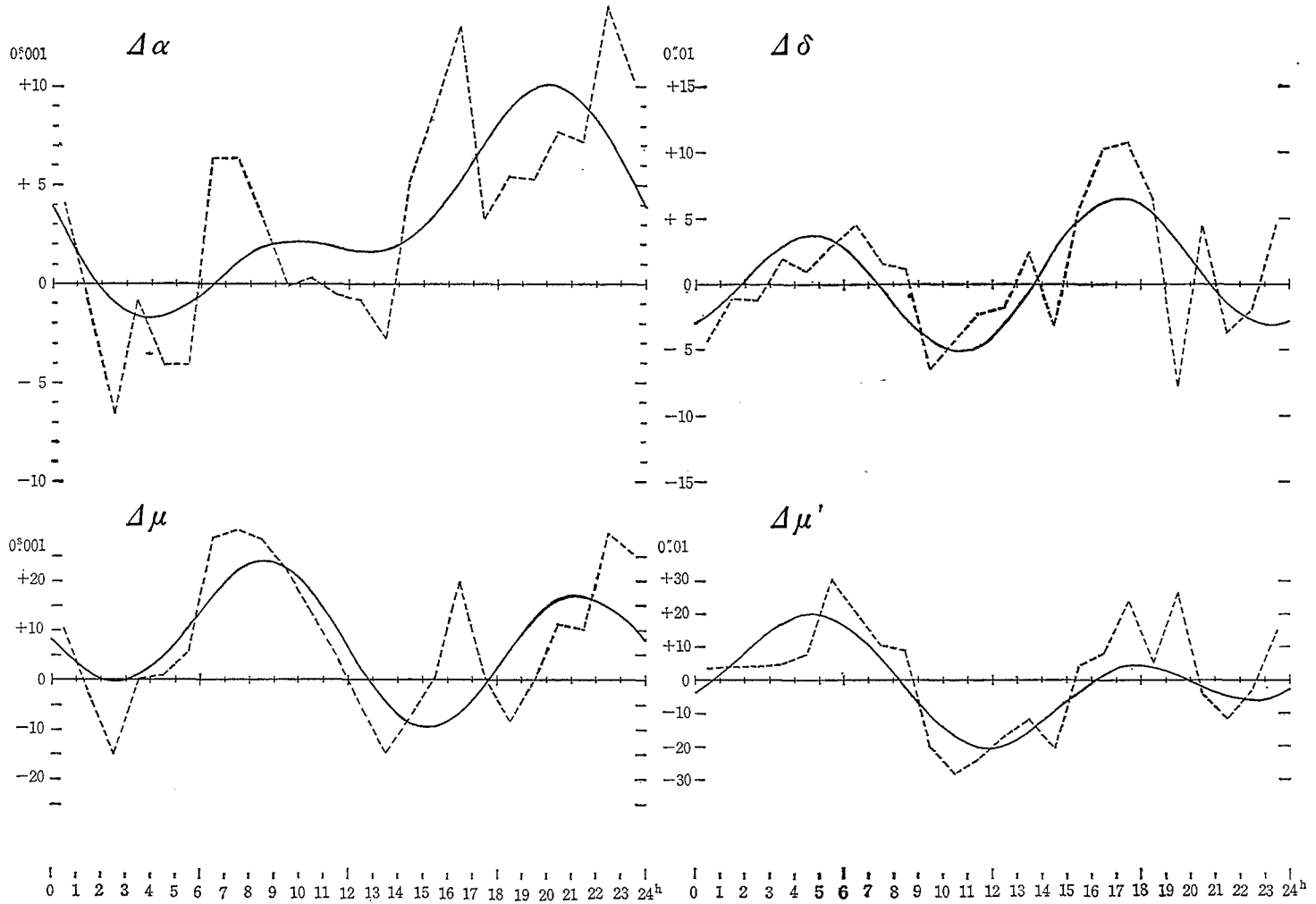

Fig. 2 (FK4 and FK4 Sup)—NZC