PRECISION OF STUDIES FROM ASTROMETRIC OBSERVATIONS: RECENT PROGRESS AND FUTURE PROSPECTS

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ABSTRACT. Recent progress of precision in astrometric studies is summarized and the weights of systematic errors in astrometric observation are analysed.

Precision improvement of certain studies based on a re-determination of 1962-1982 Earth Rotation Parameter(ERP) is described in Table 1.

TABLE 1. Improvement of precision based on improved ERP of the BIH

No.	Item	Improvement of precision	Reference
1	ERP: X,Y,UT1-UTC	24%,26%,29%	(Feissel,1985)
2	Auxiliary parameters: Z,W	about 30%	(Li,1988)
3	Primary nutation constants	over 50%	(Capitaine,1988)
4	Love number of the Earth	about 50%	(Nei,1988)
5	Plate motion	about 30%	(Li,1989)
6	Motion of the mean pole	good accordance with the IRIS's and LAGEOS's	(Markowitz,1988)

In the re-determination, average rms for the 24 most important instruments, after correcting their observational series by Z,W and Group Unknowns $G,\dot{G}$ which have been evaluated in a "global reduction" of almost 500,000 observations during the 20 years, diminish 22%,11% for a time, latitude group-observation respectively. It may be used to explain partly the above improvement.

In order to discuss the further possible improvement in studying from astrometric observations, the observational series in 1976-1977 of the photoelectric astrolabe at Shanghai Observatory is used to estimate the weights of different sources of error in astrometry. The ERP of the 20 years is used as a reference and rms of a group-observation is estimated after the adding of different kinds of correction. "Perfect correction" means only the residuals of a same group in a year are used and then estimate the rms after a fitting line is used.

J. H. Lieske and V. K. Abalakin (eds.), Inertial Coordinate System on the Sky, 145–146.

TABLE 2. rms of a group observation in the case of the photoelectric astrolabe at Shanghai

Correction	Time	Latitude
No correction	$0^{s}.0078$ (100%)	$0''.082$ (100%)
FK5-FK4	0.0074 (94%)	0.075 (91%)
G, $\dot{G}$	0.0070 (90%)	0.071 (87%)
G,$\dot{G}$ and W or Z	0.0069 (89%)	0.069 (84%)
Perfect correction	0.0064 (82%)	0.060 (73%)

From the above figures, the following points for the instrument are presented:

-- After the using of FK5 Catalog, rms of a group observation will decrease 6-9%;

-- Even the using of G,$\dot{G}$ alone can give a greater decrement to the rms (10-13%) than that of FK5 Catalog, but it should be mentioned here that G,$\dot{G}$ contain the catalog correction as well as some of the systematic local error existing in the observations;

-- The combine using of G,$\dot{G}$ and W,Z corrections will diminish the rms furthermore (11-16%), while Z does more (3%) than W (less than 1%) to the decrement of rms;

-- The difference of rms decrement between the using of G,$\dot{G}$,W,Z corrections and that of the "perfect correction" (7-11%) reflects the existence of unmodeled local errors. It is expected to be able to model them better in the future;

-- Future prospects of precision improvement in astrometry depends on the studies of local error, astronomical constants, and star catalog.

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