

ON THE SRS CATALOGUE

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1. INTRODUCTION

The Soviet astronomers B.P.Gerassimovich and N.I. Dneprovsky suggested in 1932 that a Catalogue of Faint Stars be compiled. The SRS catalogue is in fact a realization of this suggestion for the southern hemisphere. The final goal of the work is an international catalogue of faint stars IRS=AGK3R + SRS, containing about 40 000 stars of the 7-9th mag. evenly distributed over the celestial hemisphere at the rate of one star per square degree. This catalogue could supply reference coordinates for astrometric studies of the Universe.

The SRS program was initiated in 1955 at the astrometric conference in Brussels with the adoption of the AGK3R program for the northern celestial hemisphere. M.S.Zverev and A.A.Nemiro especially stressed the necessity of a similar survey of the southern sky. Thus, the IAU Assembly in Moscow in 1958 elected an SRS commission with D.Brouwer (USA) as President.

An SRS program list for the zones $+5^{\circ}$ to -30° and -30° to -90° declination was compiled at Washington (Scott, 1967) and at the Cape in the same manner as were the AGK3 and the KSZ, respectively. F.Scott compiled for the participants star lists and apparent places. Additional parameters for the reduction procedure were also computed at the USNO in Washington.

During 1963-1973, SRS meridian observations were made at 12 observatories including three special astrometric expeditions: the Pulkovo - expedition in Santiago (Chile), the USNO, Washington - station at el Leoncito (Argentina), and the Hamburg Observatory set up a transit circle at Perth (Australia).

During the first months of work, the Pulkovo expedition discovered rather large systematic $\Delta\alpha_g$ errors in the FK4. Polozhentsev (1977) (Pulkovo) studied the question to which system should SRS right ascensions be reduced and derived as a result a preliminary system of $\Delta\alpha_g$ corrections to the FK4 using observations made at different observatories.

At its 11th General Assembly at Berkeley, California, the IAU adopted a resolution to the effect that the SRS compilation should be carried out jointly at Pulkovo and Washington. This resolution was reaffirmed in 1973, at the IAU General Assembly in Sydney (Australia).

2. OBSERVATIONAL MATERIAL

The original SRS catalogues formed from meridian observations at the observatories of Nikolaiev, Bucharest, Bordeaux, Abbadia, Tokyo, Washington, Perth, San Juan, el Leoncito, Cape, Santiago - Pulkovo (Table 1) are to be used for the compilation of the general SRS catalogue. Moreover, the KSZ (Borovskikh, 1980, 1981), AGK3R (Scott, 1967) and PFKSZ-2 catalogues (Zverev et al., 1980) are also to be used (Table 1).

3. PRELIMINARY VERSION OF THE SRS CATALOGUE

A preliminary SRS version was intended as the basis for starting the reduction of photographic observations in the southern celestial hemisphere and for an estimation of the precision of the observations for the SRS. To this end all the SRS catalogues available by mid 1981 were used: Pulkovo, Santiago-67, Perth-70, Bucharest, Nikolaiev, San Juan, Tokyo, Abbadia, San Fernando, Cape, Bordeaux and the general KSZ catalogue (Table 1).

The data from all the observatories above were recorded on magnetic tape in a single format and sorted by a star number. Weighted means of these data gave average positions of the stars and observation epochs for the general SRS catalogue. The weights P_{ji} of the i -th catalogue were calculated to correspond to the standard error of the star position in the catalogue. The formula used was $P_{ji} = \epsilon_0^2 / \epsilon_{ji}^2$ where ϵ_0 is the standard error of unit of weight, and ϵ_{ji} is the error of the position of the j -th star in the i -th catalogue. The material was not analysed with respect to systematic errors in the preliminary version. Standard errors of the star positions in the SRS general catalogue (preliminary version) are given in Table 2.

Table 1

No	Catalogue	Observat. period	Declination zone	Number of stars	Number of observation of 1 star	RA system	Standard error of position $\epsilon_{\alpha \cos \delta}$	ϵ_{ξ}
1	Pulkovo	1963-68	-47°	5491	4.8	Instrum.	$\pm 0^{\circ}008$	$\pm 0^{\circ}19$
2	Santiago-67	1963-72	-25°	5992	5.1	FK4	6	12
3	Perth-70	1967-72	+05°	19371	3.5	Instrum.	8	20
4	Bucharest	1962-67	+05°	1175	6.6	FK4	7	12
5	Nikolaiev	1964-66	0°	5971	3.1	FK4	14	27
6	San Juan	1969-77	-40°	7184	2.0	FK4	17	33
7	Tokyo	1963-69	-10°	3648	4.0	FK4	12	22
8	Abbadia	1962-66	0°	1103	4.0	FK4	10x	20x
9	San Ferbando	1963-69	-10°	3647	4.0	FK4	10x	20x
10	Cape	1961-64	-40°	2900	4.0	FK4	11	21
11	Bordeaux	1962-67	0°	1481	4.0	FK4	10x	20x
12	Leencite	1968-72	+05°	20186	4.0	FK4	8	17
13	Washington	1966-72	+05°	9939	4.0	FK4	8	21
14	KSZ	1954-72	-05°	2679	16.0	FK4	8	13
15	AGK3R(KSZ)	1955-63	+05*	3363	22.3	FK4	5	09
16	PFKSZ-2	1940-75	+05*	156	93.9	FK4	5	09

x)- approximate values

*)- utilized zone

Table 2

Standard Errors of a Star Position in the
SRS Preliminary Version

δ Zone	number of stars	number of catalogues	$\epsilon_{\alpha} \cos \delta$	ϵ_{δ}
-60° to -90°	2724	3	0 ^o 0060	0 ^o 112
-40° to -60°	4464	4	60	.124
-20° to -40°	5620	2	55	.135
+ 5° to -20°	7647	4-8	65	.128
Total	20455		60	.126

The mean epoch of the preliminary SRS version is 1967.75.

4. FORMATION OF THE SRS SYSTEM

The system of the SRS general catalogue will be constructed on the following scheme:

1. The reduction of the individual observations to the FK4 system. Then a K_0 catalogue will be computed whose coordinates are either averaged over the individual catalogues or a weighted mean in accordance with their standard errors.
2. Derivation of $K-K_0$ systematic differences with respect to all errors and derivation of weights with respect to systematic errors.
3. Computation of the coordinates in the compiled K_{cb} catalogue.
4. Reduction of all K to the K_{cb} system.
5. Computation of residual deviations $K - K_{cb}$ for the stars in each catalogue. The nomination of weights with respect to accidental errors for each catalogue (P_i) is carried out according to the dispersion of the differences.

5. COMPUTATION OF MEAN POSITIONS OF THE SRS CATALOGUE

The mean positions will be calculated in the following way:

1. The mean coordinates of the SRS are given by

$$K_{SRS} = \frac{\sum P_i K_i}{\sum P_i}$$

where K_i are in the K_{cb} system. Mean epochs of the general

catalogue are found in a similar way.

2. Right ascensions are improved by $\Delta\alpha_{\delta}$ systematic corrections (Polozhentsev, 1977) and thus are reduced to the "Preliminary SRS system". The reduction for the FK4 system will be also given. The catalogue declinations are on the system of the FK4.

3. Thus, the derived catalogue positions are reduced to the epoch and equinox 2000.0 taking into account the new system of astronomical constants.

The precision of the positions of the SRS general catalogue is expected to be ± 0.005 sec δ in α and ± 0.11 in δ at the mean epoch 1967.0.

6. COMPUTATION OF SRS PROPER MOTIONS

SRS proper motions will be derived in two approximations. Here we shall only consider the first one. Two epochs of observations will be used: the epoch of the SRS catalogue (1967) and the epoch of SRS stars in the SAOC (1896-1946). If we assume $E_{SRS} = 1967.85$, $E_{SAOC} = 1928.4$, $\epsilon_{SRS} = \pm 0.12$, $\epsilon_{SAOC} = \pm 0.20$ then it is straightforward to find the proper motion error $\epsilon_{M_{SRS}} = \pm 0.59$. The only question is: How well do the SAOC positions represent the FK4 system?

7. CONCLUSION

The completion of the SRS general catalogue is a result of an important international undertaking where 130 observers and 21 observatories took part.

Due to the errors of proper motions the precision of the compiled catalogue will deteriorate with time (Table 3). Hence, it is very desirable that re-observation of the SRS list be organized with all available instruments.

Table 3

Approximate Accuracy of the SRS Catalogue
for the Epoch 1970-2000

Epoch	$\epsilon_{\alpha \cos \delta}$	ϵ_{δ}
1970.0	± 0.005	± 0.12
1980.0	7	.14
1990.0	10	.18
2000.0	14	.22

The work on this has already begun. V.N. Ershov (Pulkovo) compiled an IRS list containing 38687 stars of the SRS and AGK3R lists. The list was reported on at the XVII IAU

General Assembly in Montreal in 1979. The problem was also discussed at IAU Colloquium No 48 (Modern Astrometry) in Vienna in 1978 and at the XVII IAU General Assembly in Greece in 1982.

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