A NEW APPROACH TO THE CONSTRUCTION OF A COMPILED CATALOGUE OF POSITIONS OF EXTRAGALACTIC RADIO SOURCES

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ABSTRACT. An attempt of the realisation of the radio reference frame was undertaken. For this purpose a new approach to the construction of a compiled catalogue from observation catalogues of extragalactic radio sources was used. As a numerical example a compilation catalogue of primary radio sources based on the three individual catalogues (GSFC, JPL,and NGS) was constructed. Comparison of this catalogue with recent compiled catalogues led to the conclusion that their r.m.s. differences were about 1 mas.

1. Introduction

At present, two compiled catalogues of extragalactic radio sources are known (Arias et al., 1988; Walter, 1989). The r.m.s. differences of coordinates in these catalogues are about 2 mas. For the construction of these catalogues two different methods of compilation were used. Therefore it sounds reasonable to study different realisations of radio reference frame (RRF) and to apply a new approach to the construction of a compiled catalogue. We shall distinguish two problems of realisation of an optimum RRF:

a) construction of primary radio reference frame (PRRF);
b) extension of the PRRF to secondary radio sources.

This paper describes the construction of the PRRF.

2. Method of construction of PRRF

The PRRF is constructed under the general principle that the positions of the sources common to all individual RRF are used for combination solution and under the general assumption that individual catalogues of positions of radio sources (RS) are independent of each other.

The compiled catalogue of the positions of extragalactic radio sources RSC(GAO UA) 89 C 01 was constructed in following steps:

a) calculation of the lengths of arcs between RS: S_{ij}^k;
b) comparison of arcs in different catalogues: (S_{ij}^k , S_{ij}^l);
c) estimation of mean value of $\bar{S}_{ij}$ and residuals : $\Delta S_{ij}^k = S_{ij}^k - \bar{S}_{ij}$
d) construction of individual reference frames (RF) defined by two selected RS;

J. H. Lieske and V. K. Abalakin (eds.), Inertial Coordinate System on the Sky, 295–296.

e) construction of compiled RF defined by two RS;
f) construction of compiled RF under the conditions: "not net rotation and mean displacements of RS";

The purpose of the steps a, b, c, is to construct the net of arcs between the radio sources which is free from the RRF orientation and to estimate the weights of individual catalogues. For the construction of the RF defined by two RS the positions of the RS 0234+285 and RS 0851+202 were used.

3. Numerical example

For the construction of the compiled catalogue RSC(GAO UA) 89 C 01 we have used the coordinates of 16 common RS given in the individual catalogues of GSFC, JPL and NGS (BIH Annual Report for 1987). The relative orientations (A1, A2, A3) and r.m.s. differences of coordinates ($\sigma_\alpha \cos\delta$, σ_δ) between our catalogue and well known compiled catalogues RSC(IERS) 88 C 01, RSC(IERS) 89 C 01 (IERS Annual Report for 1988) and CC (H.G. Walter) are given in the Table.

Table. Relative orientations and R.M.S. differences between compiled catalogues under consideration. Unit: mas.

Compiled catalogues	A1	A2	A3	$\sigma_\alpha \cos\delta$	σ_δ
RSC(IERS) 88 C 01	–0.06	+0.52	–0.19	0.072	0.202
RSC(IERS) 89 C 01	–0.89	+0.63	–0.11	0.426	1.203
CC(H.G.Walter)	+0.03	+1.74	+0.63	0.332	0.575

References

Arias, E.F., Feissel,M., Lestrade, J.-F. (1988), *BIH Annual Report for 1987*, p.D-113.
Walter, H.G. (1989), *Astron. Astrophys.* **210**, 455–461.
IERS Annual Report for 1988, p.II–34.

Discussion

WALTER: At present it seems premature to state which compilation catalogue is the more reliable one. Indeed, the discrepancies of catalogue comparisons draw one's attention to the original observation catalogues which need careful examination with respect to identity, data reduction methods used, and the epochs. Then a sound basis for comparison can be established.

YATSKIV: I agree.

ARIAS: In our opinion, the differences shown in the plots between the Yatskiv and Walter compilation catalogues and the IERS Celestial Reference Frame partly arise from the different approaches used. In IERS the combination is realized on the basis of the relative orientations between frames and regional effects are not considered.

YATSKIV: I agree. In our approach we have taken into account both the orientation and the regional errors.