CONCLUSION

The celestial system of the International Earth Rotation Service (IERS) is maintained for the study of the Earth's orientation and geodynamics studies at the level of 0.0001". The direction of its axes relative to physical directions related to the Earth rotation (mean celestial pole) and orbit (dynamical equinox) are known within ±0.001" and ±0.005" respectively. Its 1991 realization contains 396 objects in the declination range -84° to +85°, nearly 100 objects have positions that are known within ±0.0005". Its largest systematic errors are smaller than 0.002", associated with low declinations.

The International Astronomical Union recommends that efforts be made to elaborate a list of primary radio sources which will define the direction of axes of the primary celestial frame, and a list of secondary sources candidate to become primary in the future. In agreement with these recommendations, and using the wealth of observations accumulated in the Earth rotation and other programs, the Central Bureau of IERS processes VLBI results from IERS analysis centres and evaluate their astrometric quality on a regular basis.

From the analysis of the differences between five pairs of independent VLBI catalogues of extragalactic radio sources available in 1990 from GSFC, JPL, NGS, and USNO, we can make the following comments. The formal uncertainties on the source coordinates in the catalogues follow a law in $N^{-0.5}$ for numbers of observations up to a few thousands. A limit is reached at the level of 0.0001" in the case of GSFC. The dominant source of dispersion in the source coordinates seems to be the low declinations, an effect already mentionned by several analysts. This effect is not reflected in full scale by the formal uncertainties. The source coordinates uncertainty, estimated from the comparisons on the 39 sources common to the four catalogs, is at the level of 0.0002" in the northern hemisphere, and not larger than 0.0009" in the southern hemisphere. The influence, if any, of the total flux, the spectral index, the type of object, and the redshift of the sources is presently overruled by the low declination effect.

The comparison of global frames obtained either by combining the observations of various networks, or by combining the partial frames based on these various networks shows a good statistical agreement of the two sets of coordinates. The distribution of the differences is consistent with the formal uncertainties evaluated by IERS.

The contribution of Earth rotation observations to the extragalactic celestial frame includes the monitoring of the sources. The data available to IERS in 1991 concern 179 sources monitored in at least two programs of observations. The histogram of their position uncertainties, derived from the agreement of coordinates in the GSFC and JPL analyses, after taking out a global relative rotation, is plotted in figure 20. Also available to IERS are 217 objects (113 in the northern hemisphere, 104 in the southern hemisphere) with coordinates in only one frame (GSFC: 153 objects; JPL: 64 objects). The networks are operated in parallel by groups which tend to extend their lists of observed objects both with common and non common sources, in order to perpetuate their celestial references on a sound basis; this results in a progressive improvement in precision and distribution of the global celestial frame. In the near future, as a consequence of the extension of the networks in the southern hemisphere for a better coverage of the planet, the sky coverage in the southern hemisphere will be improved, and the systematic errors due to unsatisfactory latitude distribution of stations will be diminished.

The link between the extragalactic VLBI and the galactic Hipparcos frames via radio stars has been evaluated, based on a realistic simulation of the Hipparcos mission and on the distribution of stars likely to be measured by VLBI. It is shown that the rotation at the initial epoch can be determined with an accuracy at the milliarcsecond level. The accuracy of the relative rotation velocity is in the range 0.0007"/year - 0.0015"/year. Although the number of link stars is relatively small, the tests have shown that the solution for the rotation angles is robust.

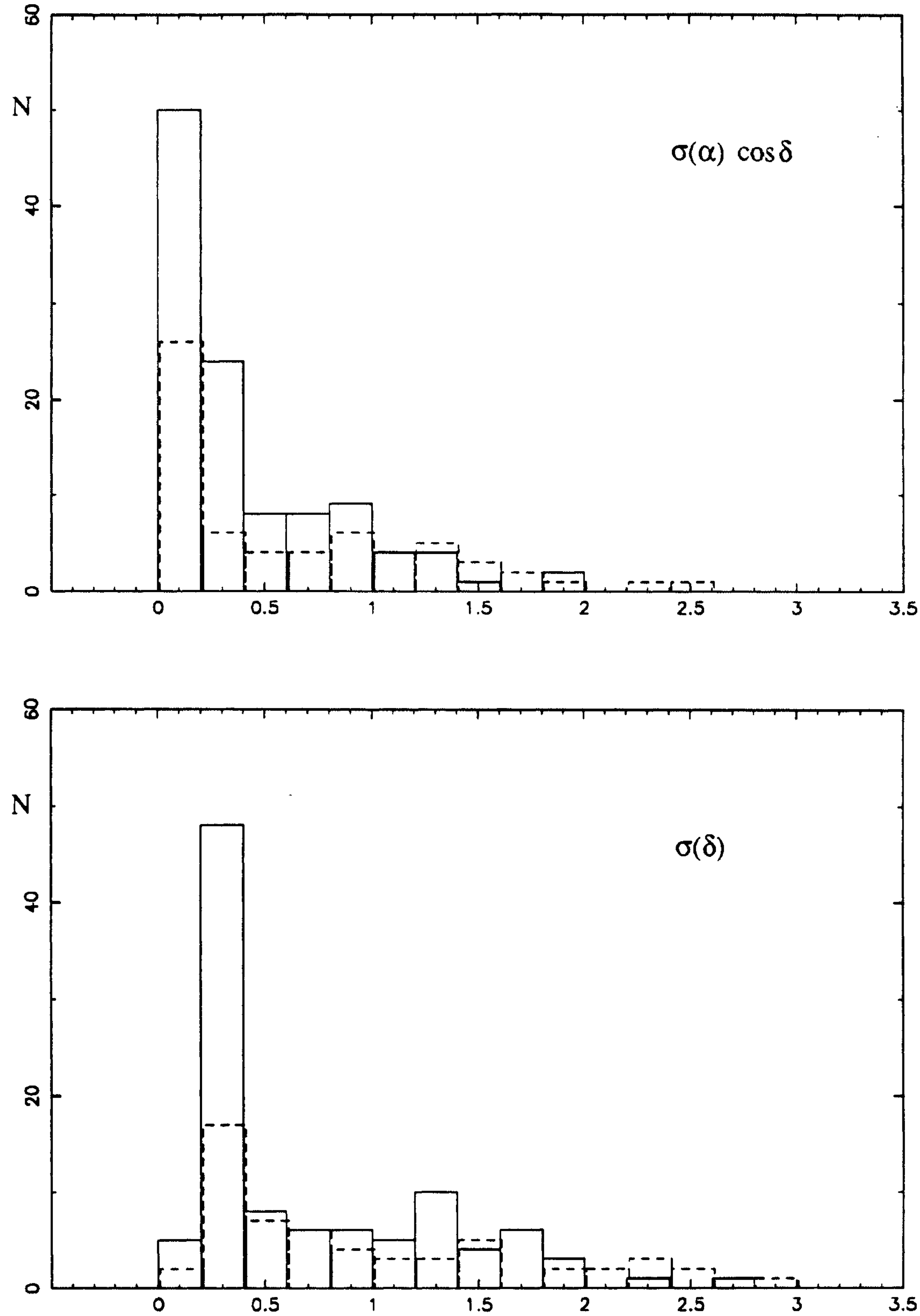

Figure 20. Histogram of the precision of source coordinates in the IERS celestial reference frame for 170 objects available from two programs; northern hemisphere (solid line) and southern hemisphere (dashed line). Unit: 0.001".