ACCURATE POSITIONS OF 120 RADIO SOURCES WITH DECLINATIONS ABOVE -45^o +

A.E. Niell, J.L. Fanselow, O.J. Sovers, J.B. Thomas, K.M. Liewer, R.N. Treuhaft, K.S. Wallace

Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109

Development of a catalogue of approximately 100 radio sources having positional accuracy of $\sim$0.005 arcseconds is one goal of the DSN radio reference frame program. This objective is set by the navigation requirements of the Galileo Project for reconstruction of the probe entry angle into the atmosphere of Jupiter. These radio positions are determined by VLBI observations using the antennas of the NASA Deep Space Network on two intercontinental baselines -- California-Spain and California-Australia. Since 1978, measurements have been made simultaneously at 2.3 and 8.4 Ghz. Sixteen to twenty-four hours of data on each of the two baselines are usually obtained within a few days of each other, and since mid-1982 these pairs of observations have been made at approximately six week intervals.

From the data taken between 1978 September and 1982 November positions have been estimated for 120 sources well distributed in the declination range -45^o to $+84^o$. The formal uncertainties of these positions, derived from this relatively short span of data, are 2 to 10 milliarcseconds (mas). We have compared our results and those of Ma et al. (1982, unpublished), which are the only other measurements of comparable accuracy. The two data sets are almost completely independent, having been obtained with different telescopes, VLBI systems, post-processing software, ephemerides, algorithms, and people. The weighted RMS differences are 2 mas in right ascension and 3 mas in declination. The comparison shown in Figure 1 of the sources in common illustrate two points: 1) the precision of radio position measurements is at the level of a few thousandths of an arcsecond for many sources; and 2) the uncertainties quoted are not unrealistic. However, both data sets cover a comparable and rather short time span, and both have a mean epoch of about 1980, so they are not sensitive to the longer term components of the earth's rotation axis. There is a clear systematic difference in the right ascensions of the two catalogues. In addition to an average offset of 3 milliarcseconds (which has been removed in Figure 1), there is a 24 hour term with an amplitude of 2 mas. Any differences in declination are less significant.

The right ascension origin of both catalogs is defined by the

+ Discussion on page 467

R. Fanti et al. (eds.), VLBI and Compact Radio Sources, 363–364.

https://doi.org/10.1017/S0074180900078499 Published online by Cambridge University Press

position of 3C273. The average offset between catalogs may be due to 1) the statistical uncertainty in the position determined for 3C273 or 2) differences in the structure of 3C273 as seen by the different geometries of the telescopes (baselines of 8,000 to 10,000 km for our observations, 800 to 4000 km for the majority of Ma et al.), or it may be related to the as yet unknown cause of the 2 mas periodic difference.

In an attempt to relate the right ascension origin of the radio source catalogue to the dynamical equinox we have been using differential VLBI to measure the positions of spacecraft orbiting the planets Mars and Venus relative to sources in the radio catalog. Preliminary results indicate that the right ascension origin can be determined with an accuracy of better than 0$''$.03 by this method.

REFERENCES:

Kaplan, G.H.: 1981, U.S.N.O. Circular No. 163.
Ma, C., et al.: 1982, unpublished.

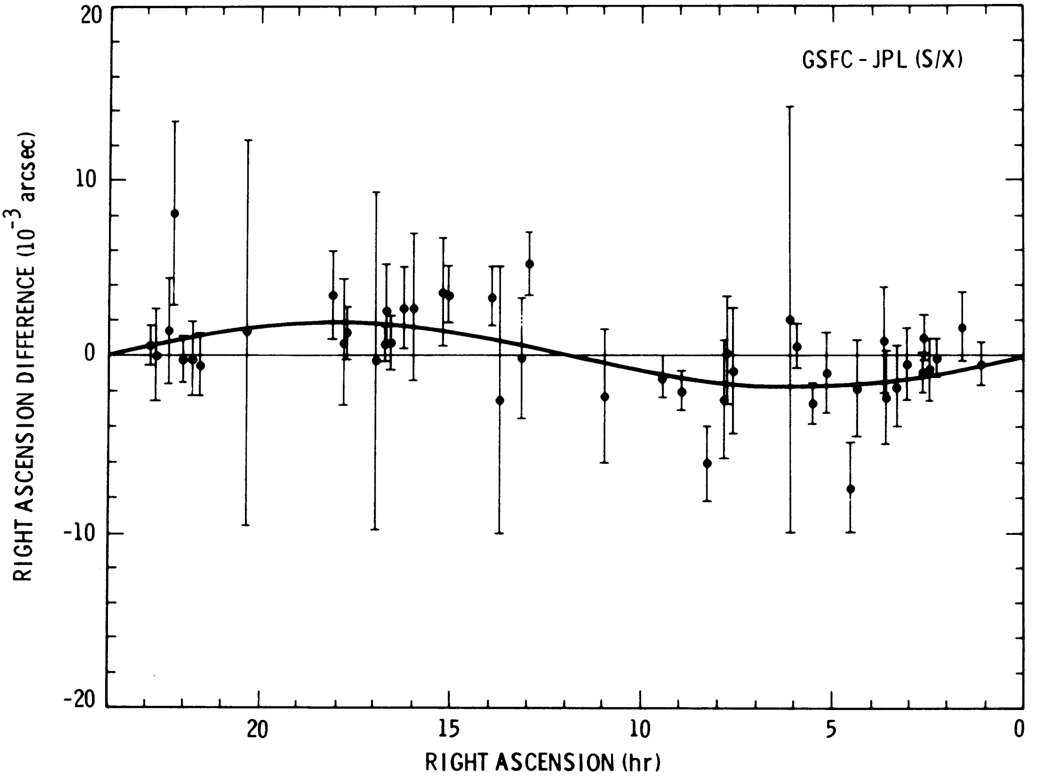

Figure 1: Right ascension difference with respect to Ma et al.

https://doi.org/10.1017/S0074180900078499 Published online by Cambridge University Press