ABSOLUTE ASTROMETRY FROM VLBA RDV OBSERVATIONS

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ABSTRACT. The Very Long Baseline Array began participating in geodetic VLBI experiments in earnest in 1997 through the Research and Development VLBI (RDV) program. These experiments involve the 10 stations of the VLBA plus several antennas of the geodetic VLBI network and have occurred about every two months since the inception of the program. The VLBA RDV experiments are part of a collaborative program of geodetic and astrometric research between the National Aeronautics and Space Administration, the National Radio Astronomy Observatory and the U.S. Naval Observatory and are scheduled to accommodate the diverse goals of the participating institutions. The catalog of radio positions derived from these data and the frame they define are compared to ICRF-Ext.2. Because the VLBA RDV data are so prolific and of such high quality, when combined with the existing database of VLBI astrometric/geodetic experiments, they will make a significant contribution to the construction of the next realization of the ICRF.

1. VLBA RDV POSITION ESTIMATION

Radio positions were estimated from VLBA RDV data based upon a global solution similar to that for the ICRF and its extensions except that only data from the VLBA RDV series of experiments were used. A total of 65 VLBA RDV sessions, each of 24-hours duration, were used resulting in 1 119 464 measurements of group delay and phase delay rate. A total of 18 geodetic antennas participated in the observations. Accurate astrometric positions were estimated using the Goddard Space Flight Center CALC/SOLVE software. Parametrization of the solution followed that of the ICRF. Astrometric positions were estimated for 732 sources. The distribution on the sky of the observed sources is shown in Figure 1.

2. COMPARISON OF CATALOG TO ICRF-EXT.2

The source positions estimated from the VLBA RDV data were compared to ICRF-Ext.2. Table 1 lists statistics of the catalog differences. Results show that the VLBA RDV catalog compares very well in $\alpha\cos\delta$ with a weighted mean offset near zero. However, the VLBA RDV catalog appears to be biased slightly with respect to ICRF-Ext.2 in δ with weighted mean offset of about 70 μas. The offset in δ may be due to the fact that the VLBA is primarily a northern hemisphere array. However, the weighted mean offsets are not significant in terms of the weighted root-mean-square (wrms) differences.

Table 1: Weighted Root-Mean-Square Differences

	Matching	Weighted Mean (μas)		wrms (μas)	
Catalogs Compared	Sources	$\alpha\cos\delta$	δ	$\alpha\cos\delta$	δ
VLBA RDV/ICRF-Ext.2	558	-15	-69	190	275
VLBA RDV/ICRF-Ext.2	191[a]	$+1$	-32	257	285

[a]Includes only sources designated ICRF Defining.

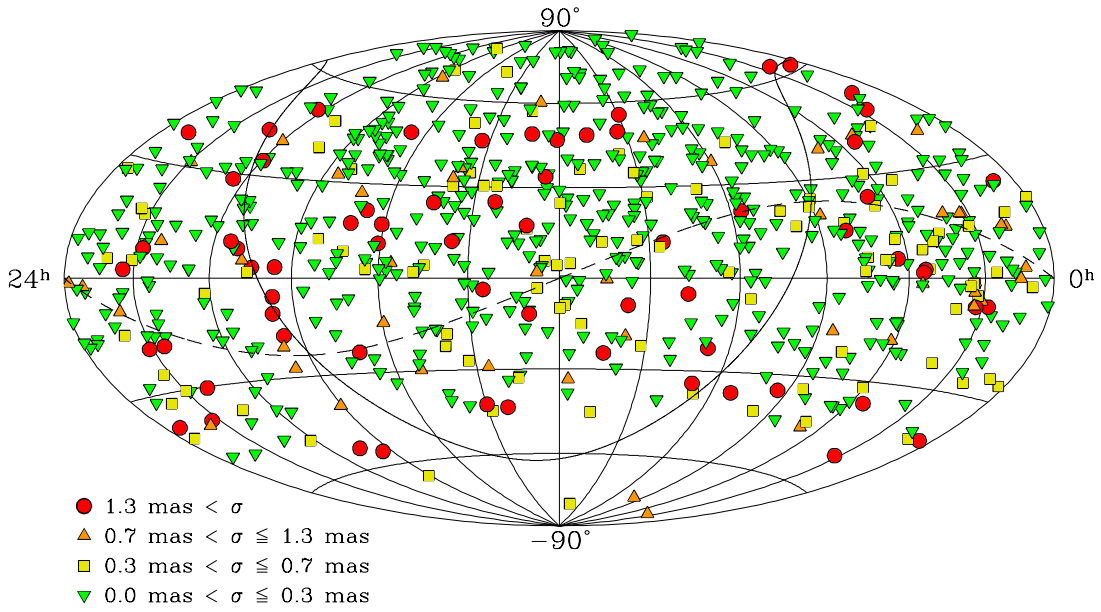

Figure 1: Distribution of the sources observed in 65 VLBA RDV sessions on an Aitoff equal-area projection of the celestial sphere. Position formal uncertainty (root-sum-square of $\sigma_{\alpha\cos\delta}$ and σ_δ) is indicated by the key. The dashed line represents the ecliptic plane and the solid line represents the Galactic equator.

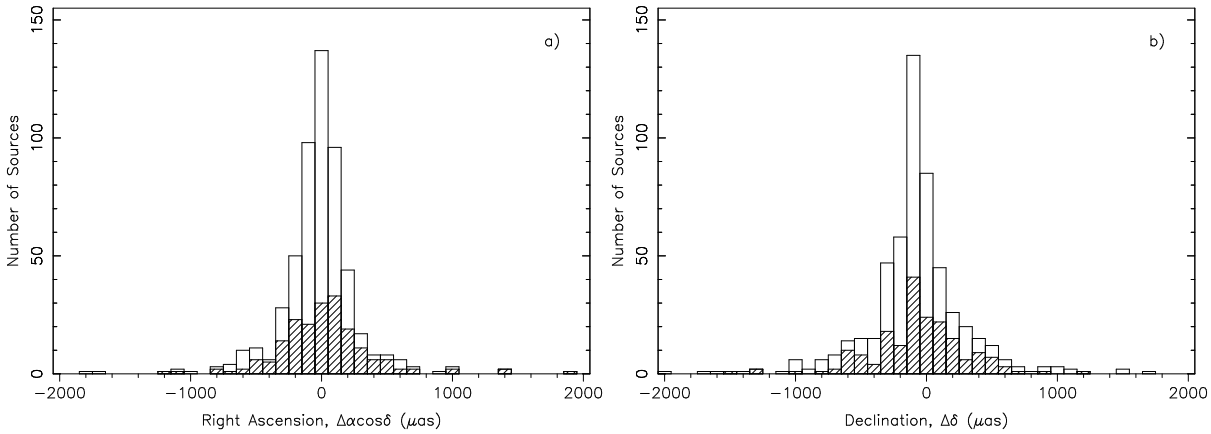

Figure 2: Distribution of differences in a) $\alpha\cos\delta$ and b) δ between positions derived from VLBA RDV data and their ICRF-Ext.2 positions. The hashed portions of the bins show the distribution for the 191 sources designated ICRF Defining. The weighted mean and wrms differences in $\alpha\cos\delta$ and δ for all 558 matching sources are -15 ± 190 μas and -69 ± 275 μas, respectively. The weighted mean and wrms differences in $\alpha\cos\delta$ and δ for just the 191 sources designated ICRF Defining are 1 ± 257 μas and -32 ± 285 μas, respectively. No fitted rotations or deformations between frames were removed for this comparison.