PART II

THE INTERNATIONAL CELESTIAL REFERENCE FRAME

LIST OF FIGURES AND TABLES

Figures:

1. Time evolution of astrometric positions for three sources II- 6
2. JPL-GSFC catalogue comparison - disjoint data II-10
3. Tropospheric gradient effect on declinations II-11
4. Source maps with structure indices 1, 2, 3, 4 II-14
5. Corresponding structure correction maps II-15
6. Error distributions - defining, candidate, other, all II-18
7. Sky distributions - defining, candidate, other, all II-20

Tables:

1. Summary of catalogue differences II- 9
2. Differences between catalogues: same data, different software II-10
3. Selection of defining sources II-16
4. Alignment of the ICRF axes on ICRS II-17
5. Coordinates of the 212 defining sources in ICRF II-21
6. Coordinates of the 294 candidate sources in ICRF II-29
7. Coordinates of the 102 other sources in ICRF II-40

THE INTERNATIONAL CELESTIAL REFERENCE FRAME REALIZED BY VLBI

C. Ma [1], E.F. Arias [2,3], T.M. Eubanks [4], A.L. Fey [4], A.-M. Gontier [2], C.S. Jacobs [5], O.J. Sovers [5], B.A. Archinal [4], P. Charlot [2]

1. NASA Goddard Space Flight Center
2. Central Bureau of IERS, Observatoire de Paris/CNRS URA1125
3. Facultad de Ciencias Astronomicas y Geofisicas de La Plata; Observatorio Naval Buenos Aires; CONICET, Argentina
4. U.S. Naval Observatory
5. Jet Propulsion Laboratory

Introduction

As described in Part I of this Technical Note, there exists a large resource of high accuracy, dual frequency VLBI data which were acquired from various networks for geodetic and astrometric purposes over a span of more than fifteen years and from which various radio source catalogues have been constructed. (See bibliography in Part I.). The goal of the work described below was to create the definitive catalogue for the ICRF (International Celestial Reference Frame) using the best data and methods available at the time the work was done. This work is the joint cooperative effort of a subgroup of the IAU Working Group on Reference Frames (WGRF) formed expressly for this purpose.

The subgroup has taken an empirical approach in the selection of data, analysis, estimation of errors, and categorization of the final results. Having gained experience from the past efforts listed in Part I., we let the data speak for themselves. The characterization of a radio source, *i.e.*, its position, how it was treated in the analysis, and whether it is suitable for use as a defining object, is derived entirely from the VLBI data and analysis and not from any other information. This approach leads to a rigorous selection of defining objects and a reliable realization of the ICRF as a set of relative positions oriented to the axes of the International Celestial Reference System, ICRS (Arias *et al.*, 1995).

Several points should be noted at the outset. The source positions and characteristics are derived from a particular, although comprehensive, set of data using specific frequencies and networks of stations and covering a certain interval of time. The underlying physics of the radio objects is not as well understood as that of stars, and we can only describe with certainty what the objects did during this particular time. It is clear that many quasars undergo changes in structure that can affect their realized positions at some level. From the data set we can see what has happened and surmise, but not predict theoretically, what can be expected. Unfortunately, while any given star is overwhelmingly likely to continue doing exactly what it has been doing, the same cannot be said of quasars. The brighter side of quasars and VLBI astrometry is that the level of astrometric uncertainty is at least one order of magnitude better than optical measurements of stars. The potential weakness is that the quality of the ICRF so derived cannot easily be given a purely theoretical underpinning.

Because the vast majority of observations were made for geodetic purposes and therefore used the brightest compact radio sources while the strictly astrometric observations constitute a small fraction of the total, the information available on the sources from the VLBI data varies enormously. The approach we have taken is to derive the measure of ideal behavior, *i.e.*, invariant position in the celestial frame, from the available data. In some cases thousands of observations lead to the discovery of statistically significant position variations. For other sources we might only be able to say that the variations in position are not inconsistent with their measurement uncertainties. Fortunately there is a sufficiently large class of radio sources with more than enough observations and minimal position variations to make the effort worthwhile.

Again proceeding in an empirical mode, this realization of the ICRF was considered only one of many, both actual and potential, better than preceding ones but by no means attaining perfection. Therefore, when discrepancies were discovered in comparisons with other realizations, the particular sources were considered less reliable for use in the ICRF. It was not possible, given the number of observations, to try to explain the small number of discrepant positions.

The geodetic/astrometric VLBI data set has a rich variety of stations and networks. Antennas range from 3 to 100 meters in diameter. Baselines range from a few tens of meters to nearly the diameter of the Earth. Although extreme baselines contributed very little to the number of observations and smaller mobile antennas lacked sensitivity to see any but the brightest sources, the entire data set was used (except for sessions entirely between antennas at a single observatory), pooled cooperatively from all the various observing programs. Besides providing the potential for extracting the maximum information, the use of the entire data set includes the widest variation that the network geometry and station size can impose upon the realized ICRF. The ICRF positions and stated uncertainties should then represent realistically how confidently the positions can be used in the future with arbitrary VLBI measurements. The VLBI data for this work were edited following the usual procedures of each contributing group.

It was considered essential that the realization of the ICRF be derived from a single analysis, even if imperfect, rather than from a combination catalogue made of several VLBI solutions. While the various recent catalogues are not inconsistent, except for a few discrepant sources, a combination loses certain information. The operational realization of the ICRF is a set of right ascensions and declinations, but the actual information is the much larger set of relative positions, whose quality is contained in the full covariance matrix. A typical combination catalogue does not give access to this information. In addition, there is extensive but not complete overlap of data used in some of the VLBI analyses. There are differences in modeling between groups. Consequently understanding the statistics and systematic errors of a combination solution is not straightforward.

Preparation for analysis

As suggested above, the sources can be characterized along several lines. The most important are variations in position seen in the data and number of observations. The underlying conceptual basis of this type of realization of the celestial reference frame is that positions are invariant with time. Therefore the first task was to ensure that this condition was not significantly violated. A series of solutions was made. In each solution the positions of all sources except for a small test set were estimated as time-invariant parameters. The position of each test source was re-estimated for each day the source was observed. Each source was treated as a test source in some solution. The complete set of source positions as functions of time was analysed to determine which sources had statistically significant variations in their positions. In addition, in another solution apparent linear motion was estimated simultaneously for all sources with sufficient data, generally two or more observing sessions. Two modes of variation were recognized. For sources with sufficient data to derive statistically significant apparent linear motions, a source was considered problematical if the apparent motion exceeded 50 microarcsecond/year and was larger than the formal error. Other sources were rejected if the weighted root-mean-square of the source position variations exceeded 0.5 milliarcsecond (mas) in arc length and were also more than 4 σ based on the formal position errors. Since these two classes of sources showed undesirably large position variation, they were treated differently from other sources in the final analysis. To accommodate their position variations without deforming the rigid geometry of the remaining sources, the positions of these sources were adjusted separately for each session in which they were observed.

The variations in position seen in the data set were not comprehensively analyzed to determine the causes. The position variations for some sources show clear correlations with changes in mapped structure and to some extent the position changes can be derived from the structure, but there is no strong evidence of any regularly repeated behavior. Figure 1 shows the smoothed time evolution of the astrometric positions in right ascension for three well observed sources of different quality. These images were derived from a 45-day moving average, with no overlap, of the arc source position data presented in Section III.4. The smoothed residuals in right ascension are multipled by the cosine of the declination to provide true arc residuals on the sky. A 45-day averaging period was chosen because a

spectral analysis of the position determinations for all sources provided no evidence of significant motions on periods shorter than this. The best-fit rate estimate for the smoothed data is shown for reference only.

More rigorous estimates for the apparent motion of these sources were obtained from proper motion solutions using the original VLBI data. The full solutions for apparent proper motions of all ICRF sources show that there is a net rotation rate of about 10 microarcseconds per year between the ICRF and a no-net rotation frame defined by averaging over all of the source proper motions. These small residual rotations were not removed from the data presented in Figure 1 or in Section III.4.

Figure 1(top) shows the time evolution of 0552+398, the most observed source in the ICRF, which shows a small, apparently linear motion. When the net ICRF rotation rate is removed using a full solution for proper motions, the observed angular rate for this source is only 8.1 ± 5.1 micro arc seconds per year, fully consistent with no motion. Figure 1(middle) shows the time evolution of 0923+392 (4C39.25) which, by contrast, is moving, in an approximately linear fashion at a much larger rate than can be explained by any residual rotation of the ICRF. This motion is not seen in other, angularly nearby, ICRF sources and clearly represents an intrinsic motion of the source. The observed angular rate of 57 ± 6 microarcseconds per year for this source in the full no-net-rotation proper motion solution translates to an apparent transverse velocity of 1.3 times the speed of light, strong evidence that this motion is not due to transverse velocity but instead to source structure changes.

Both 0552+398 and 0923+392 have weighted rms residual scatters of about 0.1 mas about the best fit line after the 45-day smoothing is applied, indicating that the short term stability of the ICRF is at approximately the 0.1 mas level, or better.

Figure 1(bottom) shows the time evolution of 2251+158 (3C454.3) (in the ICRF list of "Other" sources), which is not well represented by any linear trend over periods much longer than a few months. The scatter of the residuals of the smoothed right ascension data about the straight line fit is very much larger than can be explained from the formal errors. Clearly, the position of this source cannot be repeated to much better than 1 mas, which indicates the dangers involved in using such source positions as fiducial marks.

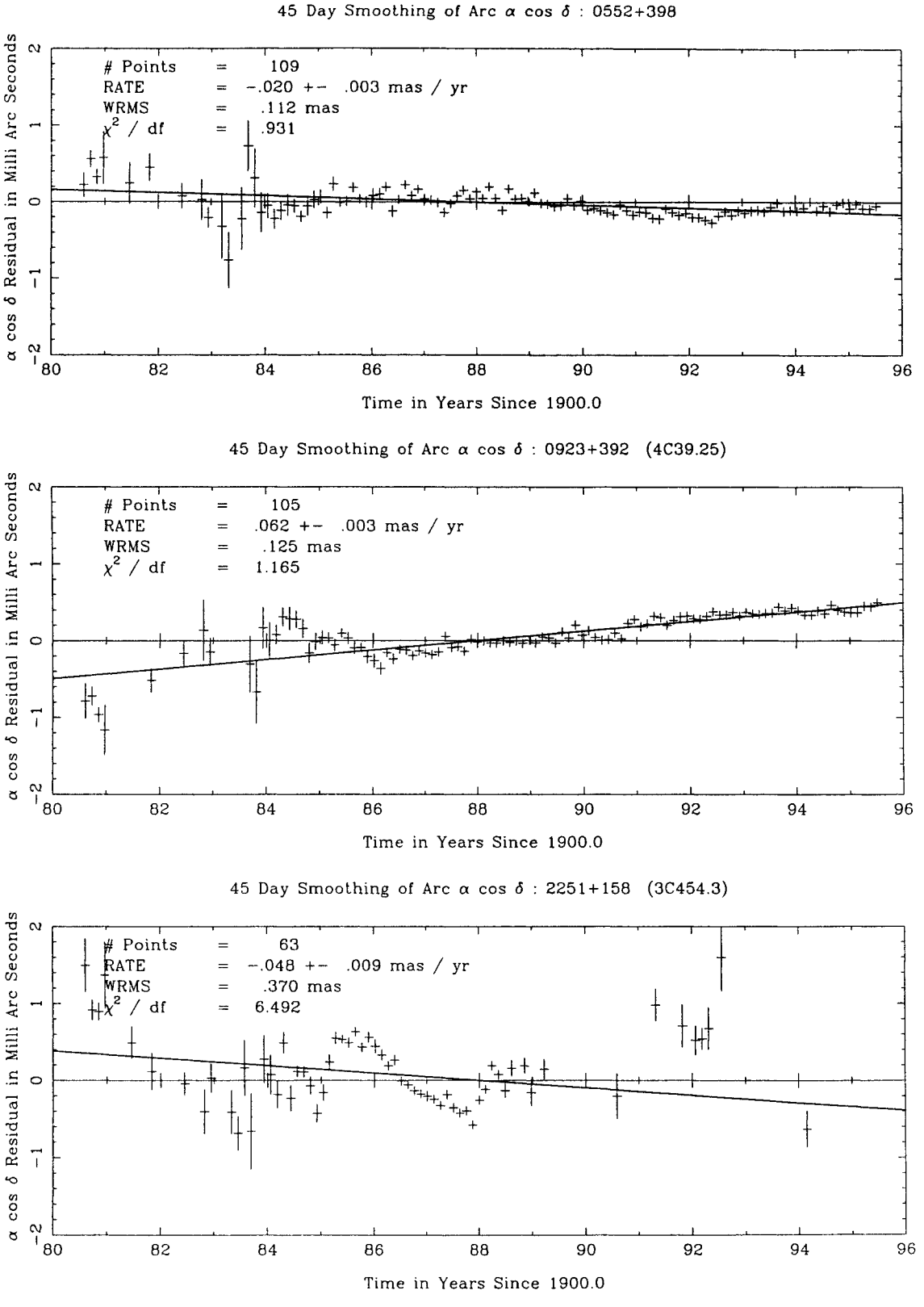


Figure 1. Smoothed time evolution of the astrometric position in right ascension for (top) 0552+398, (middle) 0923+392 (4C39.25) and (bottom) 2251+158 (3C454.3). In each case, the observed right ascension, after removal of the best fit mean, was multiplied by the cosine of the declination and subjected to a 45-day moving average, as discussed in the text.

Configuration of the ICRF Analysis

While the subgroup had access to several analysis systems and data sets, the solution for the ICRF was made at Goddard Space Flight Center (GSFC) largely for two reasons, one of convenience and one for better modeling. The Goddard system had access to more data and had already implemented an improved troposphere model. Similar results could have been obtained at the other analysis centers such as the Jet Propulsion Laboratory (JPL) but with greater effort.

The configuration of the ICRF analysis was developed as a balance between competing goals: the most data and the least systematic error, the best models and available options, the largest number of useful estimated parameters and computer speed, and the like. As improvements occur in the future, the balance will shift and the results will be better still.

The most important choices are related to data and modeling/estimation. To extract the most information from the data set both delay and delay rates were used, and only observations below 6 degrees were excluded. There may have been a slight increase in systematic error because of poorer modeling of low elevation and delay rate observations. The troposphere was modeled using the MTT mapping function (Herring, 1992) and estimates of the zenith troposphere effects in the form of 1-hr piecewise linear, continuous functions with constraints on the size of variations. While shorter time intervals have been shown to produce better geodetic results, they were not used in this analysis because of computer speed limitations. Time-variable troposphere gradients were estimated. The effect on the position results is described later. Because it was not available in the Goddard analysis system, no atmosphere structure information was used.

The primary geodetic parameters, the station positions, were estimated separately for each session. In this way any non-linear motion of the stations does not affect the integrity of the invariant source positions. There is no distortion of the relative source positions derived from a single day caused by forcing the station motions to follow a linear model. Station motions within a day from solid Earth tides and ocean loading were derived from unadjusted *a priori* models (McCarthy, 1992).

The weighting of the data followed the usual Goddard practice. For each session a pair of added noise values was computed for delays and delay rates which caused the reduced χ^2 to be close to unity when added to the variance of the observations derived from the correlation and fringe-finding process as well as the calibration of the ionosphere. Other modifications of the observation errors such as elevation-dependent and source-dependent noise were not used.

The unadjusted *a priori* models for geophysical effects and precession/nutation generally followed the IERS Standards (1992) (McCarthy, 1992). The VLBI theoretical model was the so-called consensus model given in the IERS Conventions (1996) (McCarthy, 1996).

The parameters were estimated using arc-parameter elimination (Ma *et al.*, 1990), which is an incremental least-squares method that can accommodate large numbers of parameters if they are associated only with particular data intervals. In the ICRF analysis several classes of parameters were adjusted. For each observing session, the adjusted arc parameters included:

1) positions of "arc" sources with identified excessive apparent motion or random variation,
2) two celestial pole offsets to account for errors in the standard precession/nutation models,
3) positions of the stations,
4) the rate of UT1 relative to a good *a priori* time series,
5) 1-hour troposphere parameters described above,
6) troposphere gradients in the E-W and N-S directions, linear in time,
7) quadratic clock polynomials for the gross clock behavior,
8) 1-hour clock parameters similar to the 1-hr troposphere parameters, and
9) necessary nuisance parameters such as clock jumps and baseline clock offsets.

Certain parameters were adjusted as invariant quantities from the entire data set. These global parameters included:

1) invariant source positions,
2) geometric axis offsets for all fixed antennas, and
3) 252 parameters for Earth rotation variations in the diurnal and semidiurnal bands caused by ocean tides.

The axis offset and ocean tide Earth rotationadjustments were all small but the estimates were included to eliminate any influence on the source positions.

After a series of test solutions to refine various aspects of the analysis, a final solution was run which included 1.6 million pairs of delays and rates from August 1979 through July 1995. The postfit weighted root-mean-square residuals were 32.6 ps for delay and 104.2 fs/s for rates with χ^2 per degree of freedom of 1.08. There were 1305 global parameters, ~650 000 arc parameters, and over 2.5 million degrees of freedom.

There are several results from the final solution, designated WGRF for the following discussions. Of primary importance is the set of invariant source positions and their formal errors, which are the basis for assigning realistic errors. The full covariance matrix of these source positions is another important result although rather massive for everyday use. The time series of source positions for arc sources from the individual session estimates show the level and character of their variations. For these sources an additional step was taken to calculate the weighted mean positions and weighted root-mean-square scatter as a measure of error. In addition, the observation and session counts for each source give some indication of the source's usefulness.

Determination of Realistic Error

Given the very large number of observations for some sources, the error contribution from their observation noise is very small and not a meaningful measure of uncertainty. It is necessary to consider several other effects to assign realistic errors. One is the statistical validity of the formal errors. Another is the cumulative influence of all modeling errors and editing decisions. Yet another is the magnitude of specific, identifiable systematic errors that could have distorted the results.

The VLBI data used here have also been analyzed for geodetic purposes. Extensive tests of the geodetic results (Ryan *et al.*, 1993) indicate that a multiplicative factor of 1.5 is appropriate to scale the formal errors of parameters such as station position to represent their actual variation over subsets of data. Because of the relative paucity of data for many sources and the computer time required, a similar analysis was not undertaken for the astrometric results. Nonetheless, it is probably necessary to apply a similar scaling factor to the formal errors of the source positions.

The cumulative effect of modeling errors and data editing can be examined by comparison of results from independent analyses. Intercomparison of different radio source catalogues addresses the problem of mismodeling and consequent systematic errors. Aspects that can be probed by catalogue comparisons include:

1) extension of the data set used in analysis;
2) analysis differences at different centers;
3) agreement between subsets of data;
4) intentional perturbations of modeling.

A number of such comparisons involved the current catalogue (WGRF), associated catalogues from the identical data base that were created for test purposes, and existing radio source catalogues. Existing catalogues include the 1994 and 1995 IERS realizations of the celestial reference frame (IERS94 and IERS95) and the radio-optical reference frame of Johnston *et al.* (1995) (RORF). Comparing WGRF with the latter indicates the magnitude of coordinate discrepancies to be expected among global catalogues that are intended to provide stable reference frames, and to some extent, points 1) and 2) as well. Points 2) and 3) were tested by comparisons with two catalogues based on independent data, analyzed with independent software. The two catalogues are denoted GSFC and JPL and are based, respectively, on CDP/SGP/IRIS/NAVNET/NEOS and JPL DSN data. They were analyzed, respectively at GSFC with CALC/SOLVE and at JPL with Modest. Finally, point 4) was tested with three additional catalogues: WGRFna, WGRFel, and WGRFng. In the solution giving

WGRFna, all source coordinates were treated as global parameters (*i.e.*, no sources were arc parameters). For WGRFel, the threshold for eliminating low-elevation observations was raised from 6 to 7 degrees. Finally, in the solution leading to WGRFng, no troposphere gradient parameters were estimated.

Assessment of the comparisons relies on several measures of the overall alignment and agreement of the coordinates. Table 1 shows such results for the nine pairs of catalogues in the comparisons. Rotational offsets (A_1, A_2, A_3) are the rotations about Cartesian axes to bring each pair into best coincidence; the χ^2 are calculated from differences after the rotation is applied to one catalogue of the pair. Off-diagonal covariances are neglected in all comparisons. Agreement between right ascensions and declinations is indicated by rms differences about the mean; another measure is a similar quantity for arc lengths between all pairs of sources. Potentially significant internal trends in variation of coordinate differences with α and δ are assessed by fitting linear models to all four combinations ($\Delta\alpha$ *vs.* α, δ; $\Delta\delta$ *vs.* α, δ). The largest variations of these fits over the celestial sphere, as well as their significance in units of the formal uncertainty of the slope, are reported in the last columns of the table. With three exceptions, they are all in $\Delta\delta$ *vs.* δ; the exceptions are $\Delta\alpha$ *vs.* α for IERS95-94, and $\Delta\delta$ *vs.* α for the WGRF no-arc-source and no-gradient variants.

Table 1. Summary of Catalogue Differences.

Catalogue pair	Rotation A_1	A_2	A_3	χ^2	rms residuals α	δ	Arc	Max. trend	trend signific.
	0.001"				0.001"			0.001" /100°	
WGRF - IERS95	0.1	-0.4	0.0	2.92	0.23	0.39	0.55	0.32	14
- RORF	-0.2	-0.5	0.0	2.77	0.10	0.38	0.42	0.32	15
IERS95 - IERS94	0.0	0.0	0.0	2.85	0.30	0.31	0.52	0.29	12
WGRF - GSFC	-0.1	-0.1	-0.0	1.68	0.09	0.29	0.39	0.15	7
- JPL	0.1	-0.3	-0.2	2.84	0.26	0.44	0.51	0.66	15
GSFC - JPL	0.2	-0.3	0.2	3.42	0.30	0.36	0.58	0.38	14
WGRF - WGRFna	0.2	-0.0	0.0	0.18	0.05	0.06	0.12	0.07	2
- WGRFel	0.0	0.0	0.0	0.04	0.01	0.02	0.04	0.02	2
- WGRFng	0.0	0.0	0.0	0.16	0.03	0.04	0.08	0.07	2

Table 1 shows that all the tested catalogues are rather well aligned: rotational offsets do not exceed 0.5 mas around any of the three axes. Systematic errors appear to be present, however, as indicated by the normalized χ^2 values of 2 to 3 for many comparisons after the removal of the rotational offsets. Note that the rotations and χ^2 values are considerably smaller for the last three pairs, which involve minor modeling variations on the same data set. This observation also holds true for the root-mean-square differences and their trends: these remain below 0.1 mas. In the "independent" and "subset" categories (lines 1-3 and 4-6, respectively), however, the picture is substantially different.

Differences are as large as 0.4 mas for coordinates and 0.6 mas for arc lengths, with trends reaching 0.7 mas and 15 σ apparent significance over the celestial sphere. These differences appear to be slightly larger when GSFC/JPL data differences are involved. The individual differences between the JPL and GSFC catalogues are shown on figure 2. They are present, however, with existing catalogues as well. Even the changes in the IERS celestial frame between successive years (line 3) can be as large as 0.3 mas in coordinates and their trends, and 0.5 mas in arc lengths. The significance of the systematic trends in coordinate differences is exaggerated in the results of Table 1, which were calculated with diagonal covariances. When correlations among all source coordinates are taken into account, the significance of such trends is known to decrease substantially. This is an indication that the quality of the source coordinates over some limited regions of the sky is considerably better than their coherence over the entire celestial sphere. The most likely source of such behavior is in the correlations among observations introduced by limitations of observing networks and schedules.

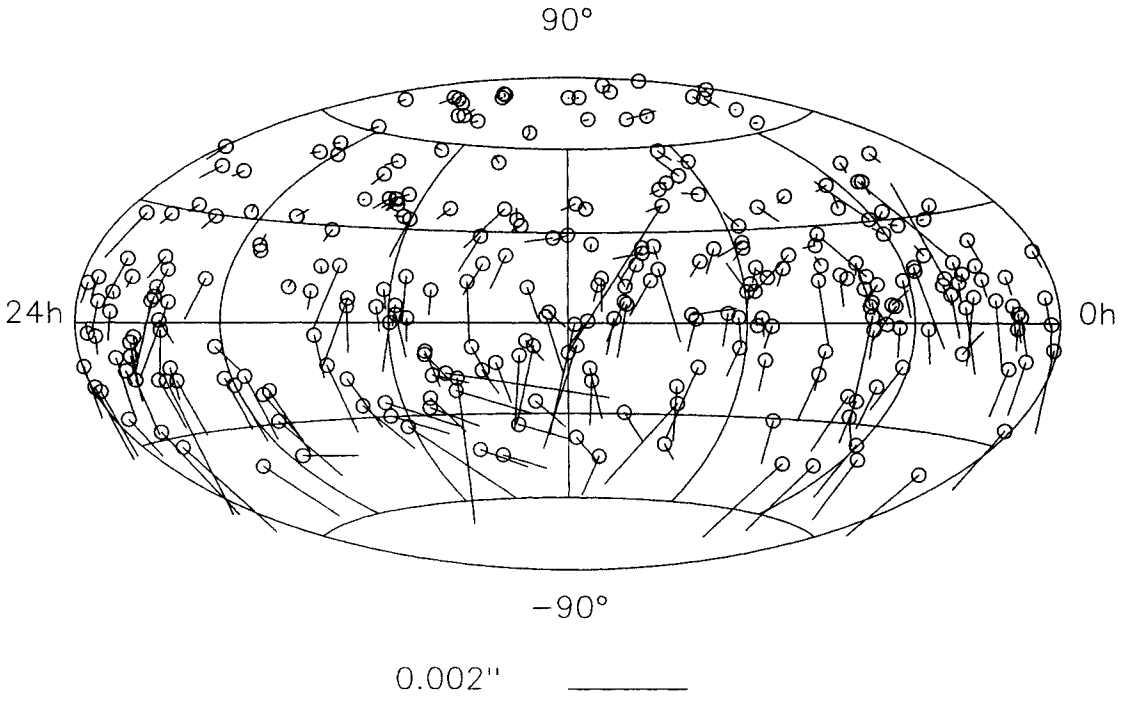


Figure 2. Vector position difference (αcosδ, δ) between JPL and GSFC catalogues. The data and analysis are completely disjoint. The scale is given at the bottom.

Another consideration of a comparison is whether one should expect such a level of agreement in light of the different models and different implementations. The influence of differences in software and analyst choices on VLBI analyses is a source of potential error. Comparisons of independent catalogues do not separate the software and analyst effects, however. In order to focus solely on the software component, a program of model comparison was undertaken. Three software packages (GSFC's CALC, used to generate the WGRF catalogue, JPL's Modest, and Paris Observatory's GLORIA) were compared in detail for all observables in one 24-hour VLBI observing session. After considerable effort to match modeling options, the delay and rate observables agreed to within ~1 ps and 1 fs/s wrms, respectively. Repercussions for source positions would thus be limited to the order of 1 ps = 0.3 mm, which on a 10000-km baseline is ~0.005 mas. This is approximately a factor of 60 lower than some of the systematic problems exposed in Table 1. Having isolated modeling differences, we next built catalogues using an identical subset of the data but different software (GSFC, JPL) and analyst choices. The resulting catalogues agreed as shown in Table 2.

Table 2. Differences between catalogues: same data, different software (unit: 0.001")

A_1	A_2	A_3		αcosδ	δ
0.14	-0.01	+0.00	bias:	0.007	0.020
±0.03	±0.02	±0.02	wrms:	0.154	0.207

Analyst choices may introduce scatter of a little less than one formal error (which are 0.178 and 0.290 mas in the median for α cosδ, δ, respectively) but do not significantly bias the coordinate means. The closeness of the model comparisons indicates that the level of agreement seen for the source positions is determined by other factors. The model comparisons indicate that one can place a very high confidence in the correctness of the model implementation.

The gradients in the troposphere, estimated from the data, illustrate how a systematic effect on the source positions can arise from a discrete change in the analysis. Figure 3 shows the differences between source declinations from analyses with and without gradient estimates. The effect is much larger than the formal errors and is caused by the greater troposphere thickness nearer the equator (MacMillan and Ma, 1997). While the effect is not large in absolute terms, it is systematic and would distort the celestial reference frame if ignored.

From a consideration of error sources such as described above, the subgroup concluded that a realistic error estimate for the invariant source positions could be made by inflating the formal errors by a factor of 1.5 followed by a root-sum-square increase of 0.25 mas. For the most frequently observed sources the 0.25 mas is the dominant error. The errors of the arc sources were also increased by 0.25 mas.

The method adopted at the IERS until 1995 for the realization of the extragalactic reference frame consisted of combining individual VLBI frames by applying an algorithm based on catalogue comparison. The position uncertainties derived from the combination reflected the disagreement between individual analyses.

To address the question of whether adopting a unique "error calibration law" for all sources eliminated or at least minimized systematic effects, a combined frame was made by adopting a 6-parameter comparison model (three angles, drifts in right ascension and declination as functions of declination, and a bias in declination). Individual VLBI frames submitted by GSFC, JPL, NOAA and USNO to the IERS in 1995 (Charlot, 1995) were then included in this combination.

The comparison of the "inflated" uncertainties with those obtained from catalogue combination showed that there were still a non-negligible number of sources whose inflated uncertainties were smaller than those resulting from the comparison of parallel analyses with a deformation correction model. For these sources the uncertainty for each coordinate was set to be the larger of the inflated or the comparison value.

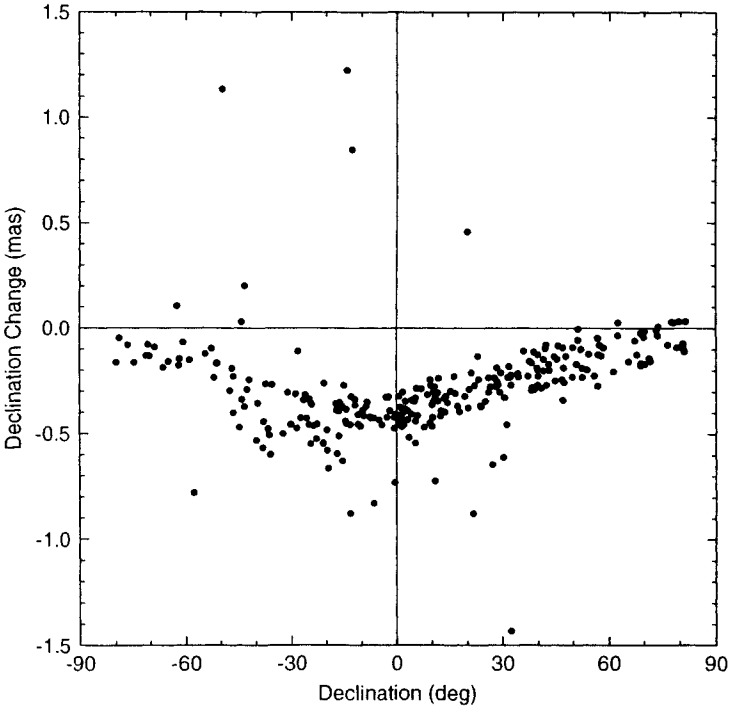


Figure 3. Effect of tropospheric gradients on declinations as a function of declination. The sense is (declinations with gradients estimated) - (declinations without gradients estimated).

Astrophysical Causes for Source Position Variations

Many extragalactic sources display structure on milliarcsecond scales for the strong radio emission associated with their compact cores. Temporal variations of the intrinsic structure of these objects may result in apparent motion when observations are made at several epochs. Until recently, the intrinsic structure of the majority of the sources has been mostly unknown. The surveys of Fey, Clegg, and Fomalont (1996) and Fey and Charlot (1997) show that most sources, when examined in detail, exhibit spatial structure on milliarcsecond scales. Their results show that the variation of intrinsic structure from source to source can be quite extreme, ranging from relatively compact naked-core objects, to compact double sources, to complex core-jet objects. The situation is exacerbated by the fact that compact extragalactic radio sources are known to have variable intensity and to have frequency and time-dependent intrinsic structure. Consequently, unknown and/or unmodeled source structure effects may be introduced into the astrometric solution.

Charlot (1990) has modeled the effects of radio source structure on measured VLBI group delays and delay rates. Results of this modeling suggest that these effects can be significant for extended sources (typically at a level of 100 picoseconds [~3 cm at the surface of the Earth or ~1 mas] in the group delay). Fey and Charlot (1997) calculated structure corrections based on the Charlot analysis using source models derived from Very Long Baseline Array (VLBA) observations of 169 extragalactic sources. Results of these calculations show that intrinsic structure contributions to the measured bandwidth synthesis delay are significant, ranging from maximum corrections of only a few picoseconds for the most compact sources to maximum corrections of several nanoseconds for the most extended sources. Fey and Charlot found a correlation between the compactness of the sources and their position uncertainties indicating that the more extended sources have larger position formal errors. They also define a source « structure index » based on the median of the calculated structure corrections. They suggest that this index can be used as an estimate of the astrometric quality of the sources as follows. Sources with an X band structure index of 1 may be considered very good astrometric sources. Sources with an X band index of 2 may be considered good sources while sources with an X band index of 3 should be considered marginal (and should only be used with caution). Finally, sources with an X band index of 4 should not be used at all for astrometric work. Additionally, sources should have an S band structure index of either 1 or 2, with a preferred value of 1, regardless of the value of their X band structure index.

Shown in Figure 4 are contour plots of the radio emission at 4 cm wavelength for four sources (0138-097, 0108+388, 0544+273, and 2201+315) observed by Fey and Charlot (1997). We have chosen these sources as representative of each structure index class. The X band structure index of these sources is indicated in each panel. The S band structure index of each source is 1 with the exception of 0108+388, which has an S band structure index of 2. Only the two sources 0544+273 (structure index 1) and 0138-097 (structure index 2) are ICRF defining sources (see next section). Figure 5 shows the corresponding structure effect maps. These indicate the corrections to the VLBI observables as a function of interferometer resolution. The mean, rms, median and maximum values of the structure corrections calculated by Fey and Charlot (1997) for these sources are also indicated in each panel.

Since even apparently stable sources can suddenly begin exhibiting rapid structure variations, the entire ICRF catalogue must be reobserved over time to ensure its continued precision on the submilliarcsecond level. Structure observations of the entire set of ICRF sources are either planned or in progress. This is being accomplished in the Northern Hemisphere with the VLBA. It will be more difficult to ascertain the structure of sources in the Southern Hemisphere due to the lack of observing facilities capable of adequate spatial imaging on the required scales. Almost all of the ICRF sources whose detailed structure is known are in the Northern Hemisphere. In addition, the ICRF can be improved in the future by enhancing the accuracy of the observations and the number of sources defining the frame can be expanded. New sources will continually be evaluated for addition to the ICRF catalogue and the radio positions of sources already in the catalogue will be revised through improved observational techniques. New data will be added to the existing database and reanalyzed, producing from first principles an improved and updated version of the catalogue whenever necessary.

Plans also exist for adding corrections of heretofore unmodeled source structure effects to the data. Charlot (1994) has demonstrated that the effect of intrinsic source structure on the bandwidth

synthesis delay observable can be successfully modeled. The author has shown that the variation in the astrometric position of the quasar 3C273 over an approximately 2-year period was due to variations of the intrinsic structure of the source. The work of Charlot also shows that global astrometry combined with imaging observations provides a method for measuring apparent motions of source components with respect to the global celestial reference frame and can thereby identify astrometrically stable components in extragalactic radio sources.

Categorization of sources

To be most useful in defining the ICRF a source should ideally show no variation in position in the data set, have sufficient data to support the absence of variation, and not have shown unexplained differences in position between realizations of equivalent validity. Several quality levels can be established for each of the 608 sources in the WGRF catalogue. These are based on one of three sets of criteria:

1) quality of data and observation history
2) consistency of coordinates derived from subsets of data
3) repercussions of source structure

To qualify for the list of sources that was used to orient the WGRF catalogue with respect to the IERS celestial reference system, a source must pass muster in all three categories. An attempt to quantify the criteria follows. In category 1) a source is disqualified if it is observed fewer than 20 times, or if the observations span less than 2 years. Each of the individual coordinate uncertainties and $\sigma_\alpha \cos\delta$ and σ_δ must also be smaller than 1 mas. In category 2) a source may be disqualified on the basis of the magnitudes and significance of its coordinate differences in several pairwise catalogue comparisons. After application of a global 3-dimensional rotation to place each pair of catalogues in best coincidence, if the coordinate differences exceed 0.5 mas or 3 σ in either coordinate, the source is disqualified. In category 3) three separate tests for structure effects must be satisfied. First, the source must have shown enough stability not to qualify for « arc position » estimation. Second, the average (absolute value) structure correction for VLBI delays, based on structure maps assumed to be valid for all observations, must not exceed 10 ps. Finally, in subsidiary fits that estimated time-rates-of-change of right ascension and declination, the time rate significance must not exceed two σ.

Some criteria that can be used to identify "problem sources" are related to their internal structure and their variation with time. If the structure varies with time, the effective centroid can move. Even with static structure, the baselines and their time-varying orientation can induce apparent shifts in position. A simple way to assess the time variability is to estimate rates of change of right ascension and declinations with time. An equivalent method, which also has the virtue of tracking nonlinear changes with time, is to estimate a new set of angular coordinates for each observing session or some other relatively short time period. The former method produces the list of sources with significant apparent « proper motion ». The latter method is used to select sources whose coordinates are not assumed to be constant in time but rather are estimated as arc parameters.

A more direct assessment of the effects of extended source structure is provided by using externally generated source maps to calculate structure corrections to VLBI observables. A number of such maps were available from the work of Fey with the VLBA. Only the source structure information for the 42 sources observed by Fey, Clegg, and Fomalont (1996) was explicitly used to classify sources for fitness in the ICRF. Out of these 42 sources, only two (1308+326 and 2145+067) are in the ICRF defining list (see next page) of 212 sources. While the fraction of sources with maps is rather small (42 of 608), the corresponding fraction of VLBI observations involving these sources is respectable (55%). Making the gross approximation that the structures do not vary with time, VLBI delay corrections could in principle be calculated for these observations. The average (absolute) correction exceeds 10 ps for 17 of the 42 mapped sources. After the WGRF analysis was completed, more sources were mapped and their structure indices computed. Four sources (0153+744, 0518+165, 0831+557, 1532+016) with stable positions and already included in the best category were found to have an X band structure index of 4. The structure of the first three sources, however, appears to be stable over time.

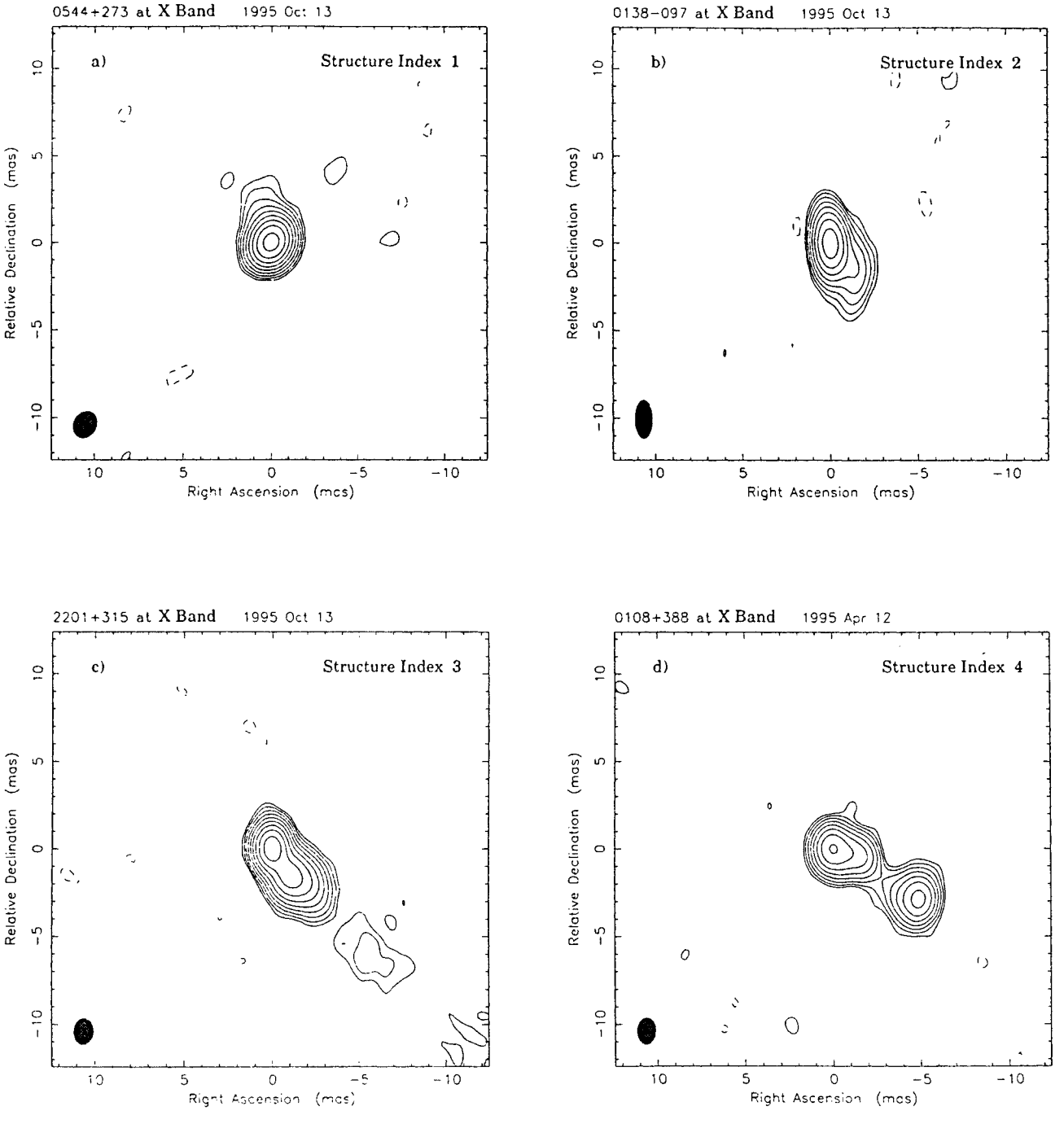


Figure 4. Contour plots of the radio emission at 4 cm wavelength for the four sources a) 0544+273, b) 0138-097, c) 2201+315, and d) 0108+388. These sources are representative of each structure index class. The X band structure index of these sources is indicated in each panel. The S band structure index of each source is 1 with the exception of 0108+388 which has an S band structure index of 2. Fey and Charlot (1997) suggest that sources with an X band structure index of 1 may be considered very good astrometric sources. Sources with an X band index of 2 may be considered good sources while sources with an X band index of 3 should be considered marginal (and should only be used with caution). Finally, these authors suggest that sources with an X band index of 4 should not be used at all for astrometric work.

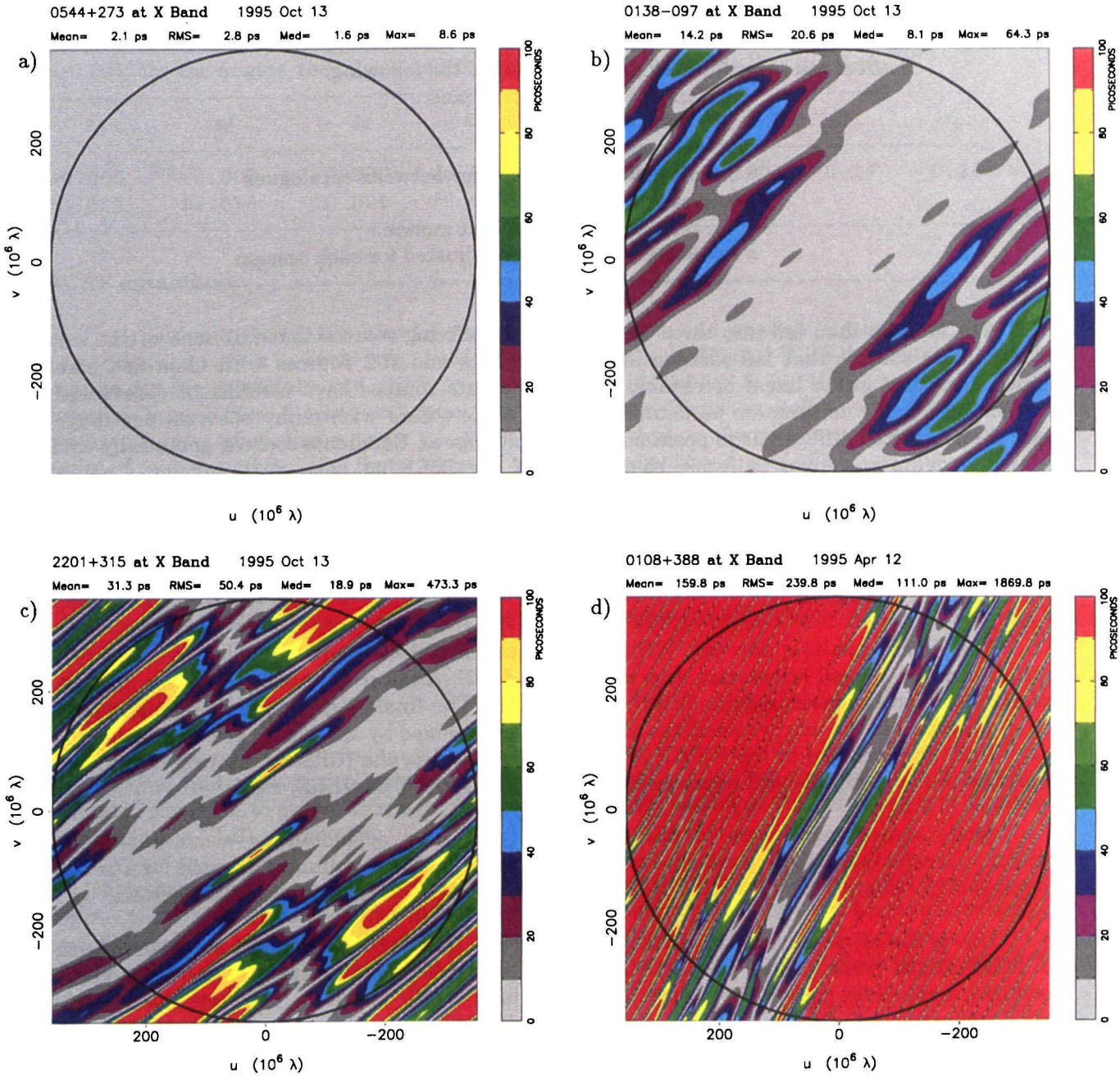


Figure 5: Color plots showing the magnitude of the structure correction (absolute value) induced in the bandwidth synthesis delay by the extended radio emission at X band of the four sources a) 0544+273, b) 0138−097, c) 2201+315 and d) 0108+388. The structure correction is plotted as a function of the length and orientation of the VLBI baseline projected onto the sky, expressed in millions of wavelengths (u, v coordinates). The color scale is identical in each panel and ranges from 0 to 100 picoseconds (ps). All structure corrections larger than 100 ps are plotted as red. The circle drawn in these plots has a radius equal to one Earth diameter, corresponding to the longest baselines that can be theoretically observed with Earth-based VLBI. The mean, rms, median, and maximum values of the structure corrections for all baselines contained within this circle are indicated in each panel. The structure index classes defined by Fey & Charlot (1997) are based on the median.

Table 3 summarizes the somewhat arbitrary criteria used to reject sources based on their data, behavior, and structure.

Table 3. Selection of Defining Sources

Sources fail to be defining sources for any of the following:

- Arclength formal error >1 mas
- <20 observations
- <2-year span of data
- 3 σ or >0.5 mas discrepancy between catalogues
- Excessive structure
- Large, significant apparent motions
- Arc source, *i.e.*, position adjusted for each session

The sources then fall into three categories: 212 defining sources that fail none of the criteria, 294 candidate sources that fail some or all of the criteria, and 102 sources with identified excessive position variation, either linear or random. Some candidate sources have insufficient observations or duration for reliable designation as defining sources while others with many observations may have larger than expected differences in position between catalogues. Candidate sources potentially could be designated defining sources in future realizations of the ICRF as more data become available or analysis improves. The third category of other sources does include sources that may be useful for purposes such as radio-optical frame ties. While only the defining sources have a formal role in the ICRF, the positions of all sources are consistent with the ICRF.

Orientation of the ICRF

The VLBI analysis for the WGRF catalogue described above provided accurate relative positions and an overall orientation very near to the ICRS (Arias *et al.*, 1995). However, the solution was not designed to obtain results directly on the ICRS. The final stage in the ICRF realization was the rigid rotation of the relative positions to the ICRS maintained by the IERS. The extragalactic radio source catalogue obtained in the WGRF solution was aligned to the ICRS by rotating it onto the last realization of the IERS celestial reference frame, RSC(IERS) 95 C 02 (IERS, 1996).

Radio source coordinates in RSC(IERS) 95 C 02 were evaluated by combining individual extragalactic reference frames submitted to the IERS in 1995. The coordinates adopted for a set of 236 defining sources aligned the axes of RSC(IERS) 95 C 02 to the IERS celestial reference system.

Due to the model adopted in the compilation of RSC(IERS) 95 C 02, the frame was affected by the deformations coming from the individual catalogues. The improvements in the models and procedures applied in the WGRF solution resulted in a frame free from deformations but slightly misoriented with respect to RSC(IERS) 95 C 02. In the procedure applied to rotate the WGRF solution to IERS frame, care was taken not to transfer to the former the deformations of the latter.

The algorithm used to put the WGRF coordinates in ICRS was based on catalogue comparison on the basis of common sources (Arias *et al.*, 1988). However, not all common sources contributed to the calculation of the rotation angles between frames. From the 212 highest quality sources selected by the WGRF, 117 were defining sources in RSC(IERS) 95 C 02. These sources are well distributed in the northern hemisphere but rather sparse in the south. To obtain a better sky distribution of sources, 16 IERS defining sources not in the WGRF list but with rather high quality were added, resulting in 133 common objects for comparison.

The extragalactic frame RSC(WGRF) 95 R 01 was obtained by putting the radio source coordinates from the WGRF solution in ICRS via comparison to RSC(IERS) 95 C 02. Table 4 shows that both frames are aligned to better than 0.010 mas. The deformation of RSC(IERS) 95 C 02 relative to RSC(WGRF) 95 R 01 is represented mainly by a bias of the principal plane. To test the stability of the axes of the system, we estimated the relative orientation between RSC(WGRF) 95 R 01 and RSC(IERS) 95 C 02 on the basis of different subsets of sources. The scattering of the rotation parameters obtained in the different comparisons indicate that the axes are stable within 0.020 mas.

Table 4. Alignment of the ICRF axes on ICRS. Relative orientation and deformation parameters to transform RSC(IERS) 95 C 02 to RSC(WGRF) 95 R 01. A_1, A_2, A_3 are the rotation angles between axes of the frames; D_α and D_δ are the drifts in right ascension and declination as functions of declination, respectively; B_δ is the bias in declination. All these parameters have been adjusted on the basis of the 133 common defining sources. r_α and r_δ are the weighted rms residuals in $\alpha \cos \delta$ and δ respectively. Units: 0.001" for the angles, the biases and the rms residuals; 0.001"/deg for the drifts.

A_1	A_2	A_3	D_α	D_δ	B_δ	r_α	r_δ
-0.006	+0.007	+0.005	+0.000	+0.002	-0.280	0.14	0.20
±0.018	±0.018	±0.021	±0.001	±0.000	±0.020		

The ICRF catalogue

The positions, errors, δ-α correlations, and observation and session statistics of the ICRF defining sources are given in Table 5 (p. II-22) identified by the ICRF and IERS designations. Similar information for the candidate and other sources is given in Tables 6 (p. II-29) and 7 (p. II-40), respectively. X band and S band structure indices are given where available, and Hipparcos link sources are also identified. Figures 6. a, b, c, d show the distribution of errors respectively for the three categories of sources and for all of them. Figure 7 shows the distributions of objects on the sky for the same four categories. It can be seen that there is moderately even distribution of all sources but the southern hemisphere is deficient in defining sources. This is caused by the small number of VLBI stations in the south and limited observing programs. While all sources are given ICRF designations, it should be emphasized that the quality and intended use of the three categories are quite different. The best astrometric quality resides in the defining sources and those candidate sources with the smallest errors. The positions of the "other" sources should be used carefully and only where less accuracy can be tolerated.

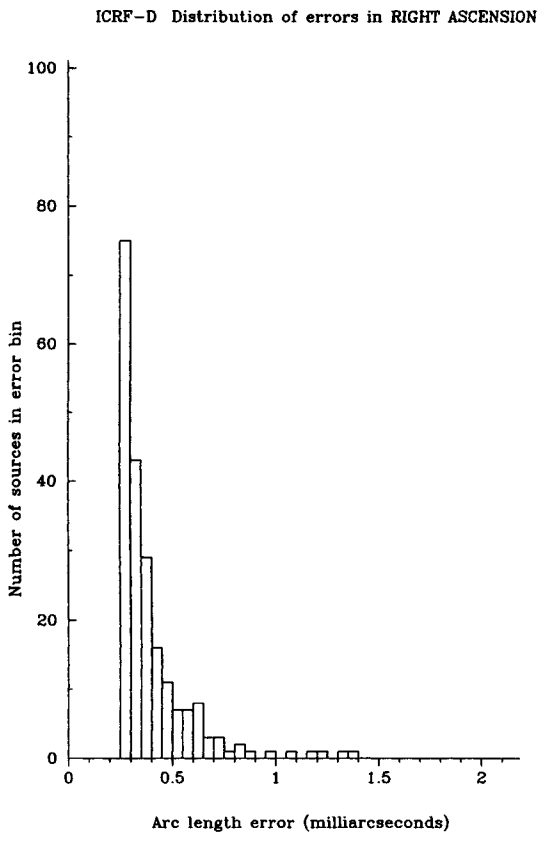
Evolution of the ICRF

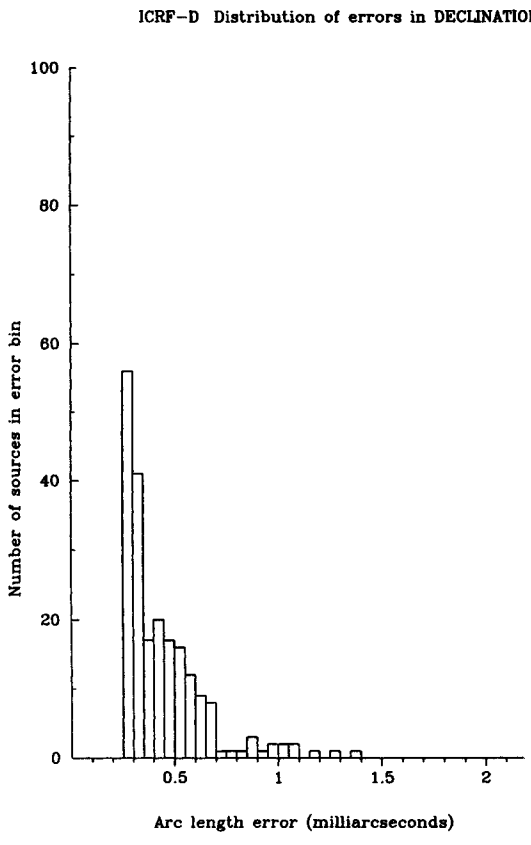
The current realization condenses the information from a particular VLBI data set spanning a defined interval and reflects a certain state of VLBI analysis. As time progresses we expect the realization of the ICRF to evolve although changes in the ICRF catalogue will be infrequent compared to past practice in VLBI astrometry.

There are several features that distinguish this type of realization from the conventional stellar catalogues that formerly defined the celestial reference frame. First, while we know the positional history of the sources, we cannot predict with absolute certainty what future observations will reveal. The current positions and velocities are a snapshot (or a movie), and continued observations are essential to maintain the viability and integrity of the ICRF. New sources must be observed to replenish and expand the list of candidates, and their positions in the ICRF must be determined. Current sources need to be observed periodically to track their behavior. Second, as observations accumulate, it should be possible to move candidate sources up or down the scale of usefulness. However, it is conceivable, perhaps even probable, that an identical categorization of sources from an analysis using twice as long an interval would show sources changing categories in unpredictable ways. For example, there is no physical reason to expect that linear position changes can continue indefinitely. Such motion would call into question the fundamental basis of the extragalactic frame, the great distances of the objects. Directed position changes should cease at some time. Conversely, a source now stationary could start apparent motion. Only the data analysis will show. The problem of position variation may be solved in the future if the application of source structure information permits the identification and use of truly kinematically stable points in the sky. This remains to be demonstrated. Unlike stellar catalogues, however, the original VLBI observations should always be accessible for improved analysis *de novo*.

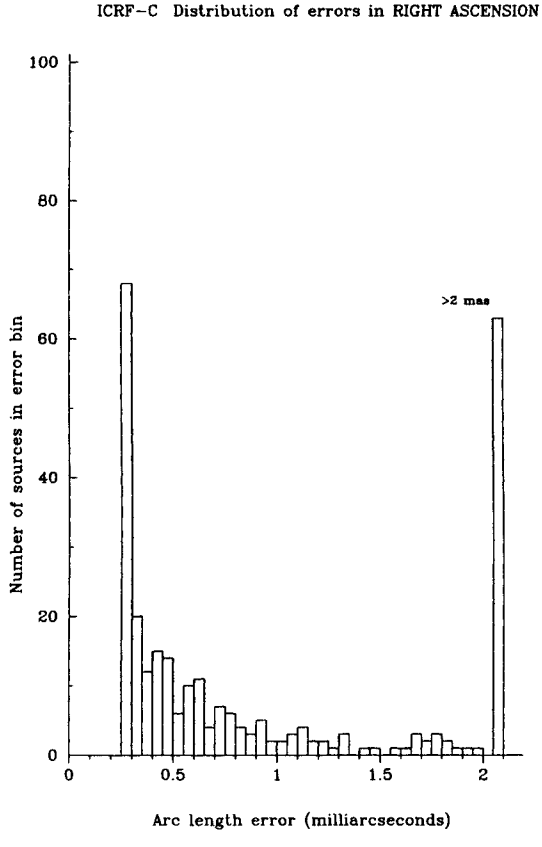
Despite the burden of maintenance, the ICRF realized by VLBI astrometry is a great step forward. Compared to stellar realizations it is intrinsically simpler, much more accurate, more stable, and less susceptible to systematic deformations. It will serve the purposes of astronomy well.

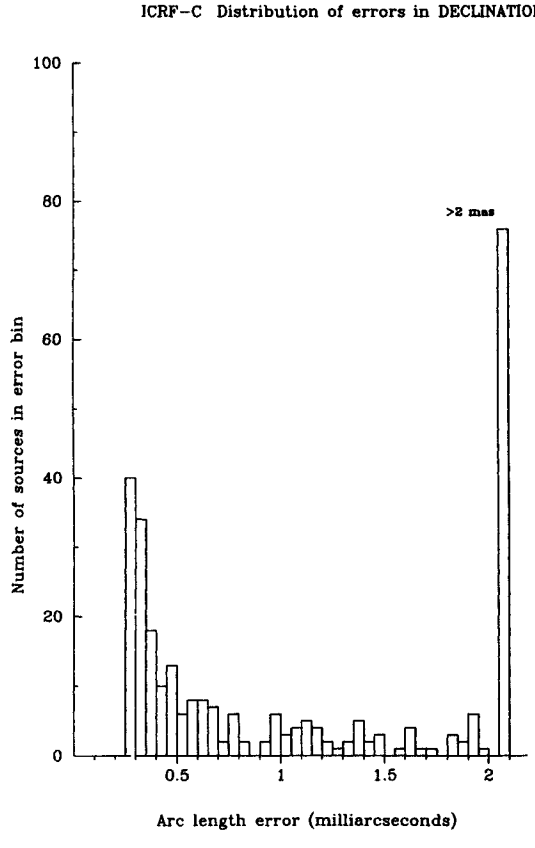
a)





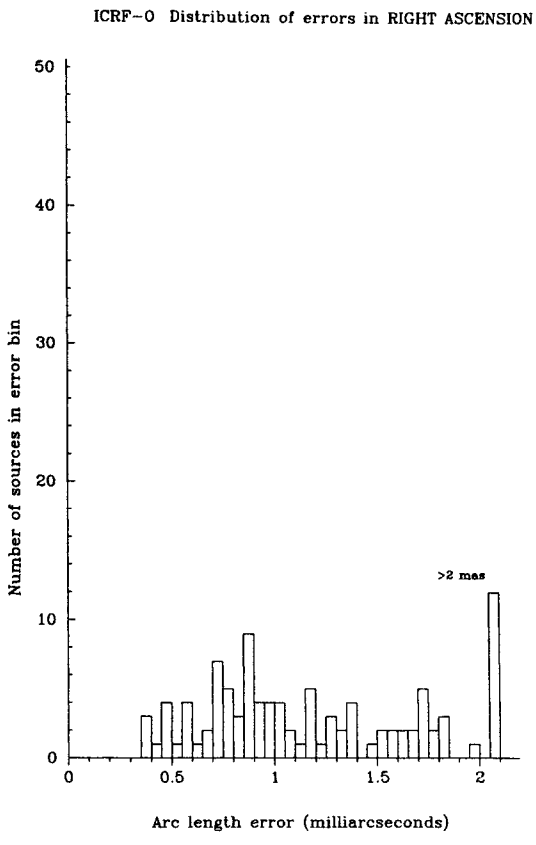
b)

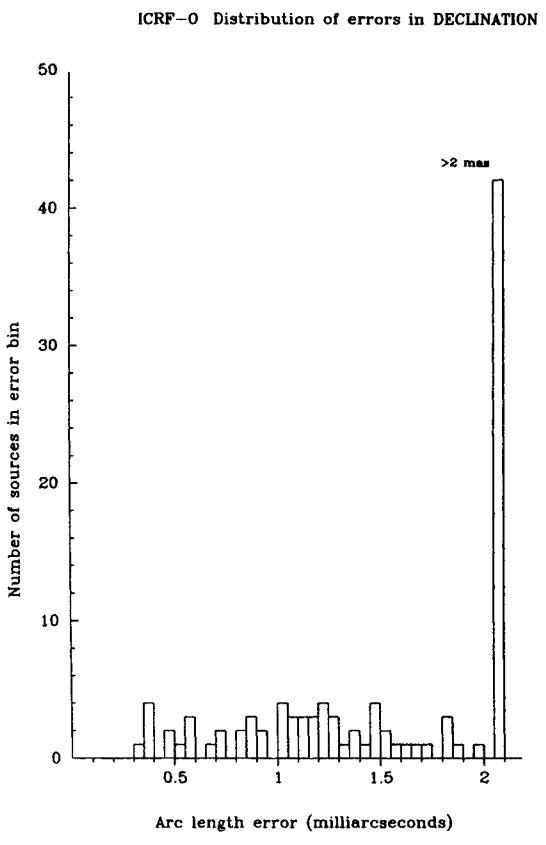




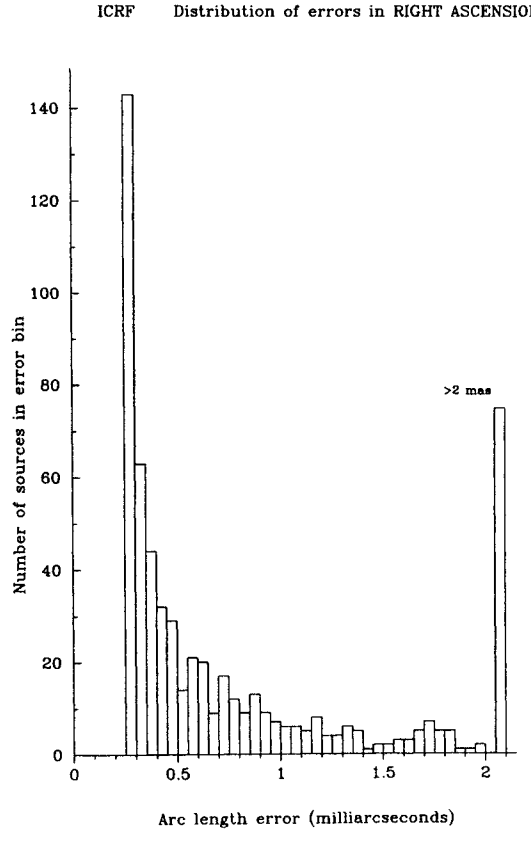
Figures 6. Histograms of source position errors for
a) defining sources; b) candidate sources.

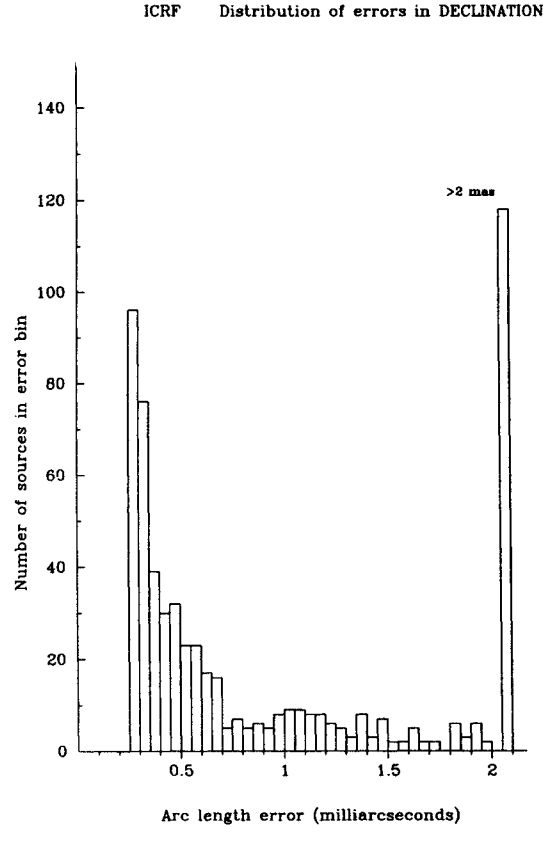
c)



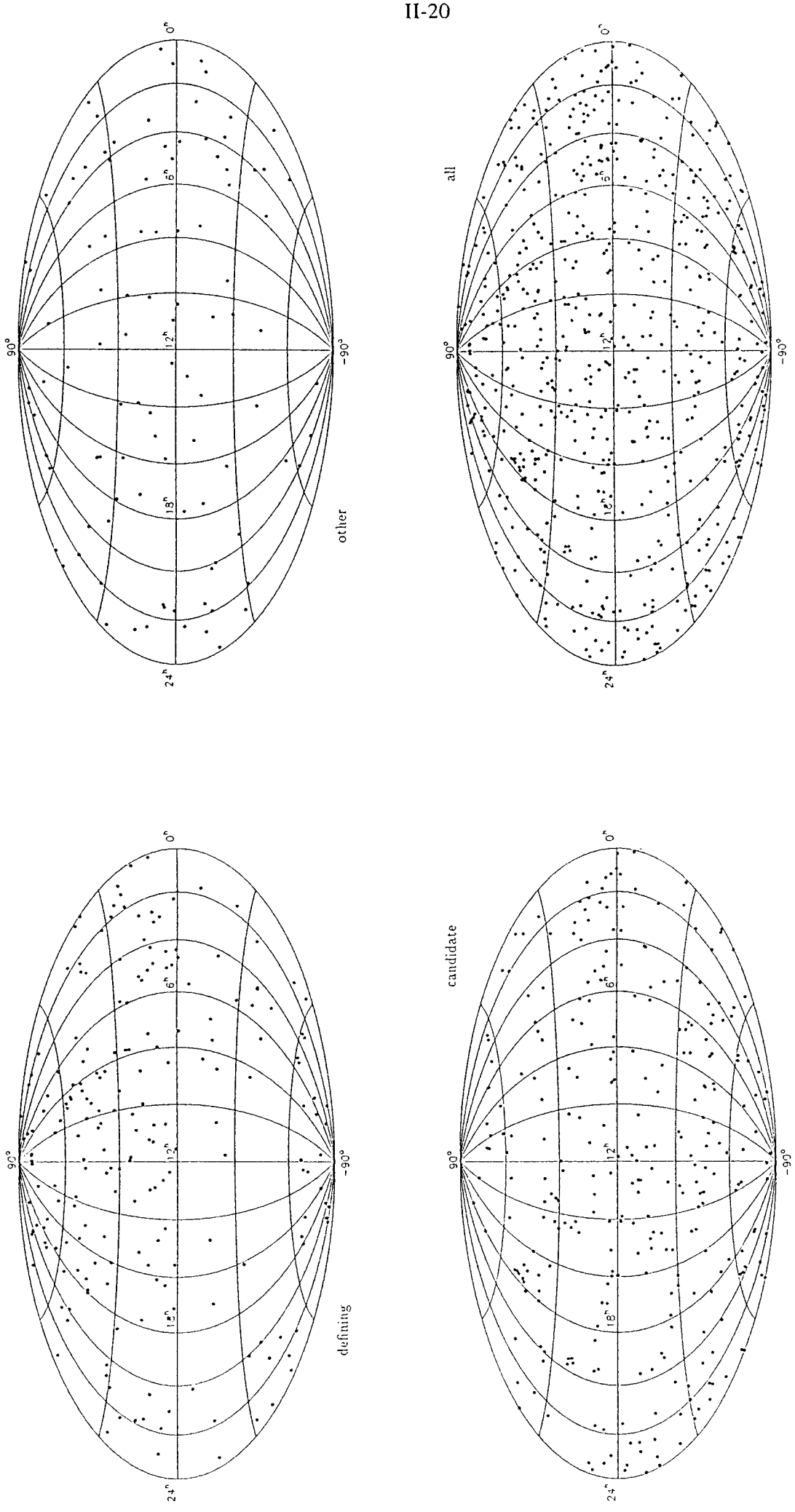


d)





Figures 6. (cont.) Histograms of source position errors for
c) other sources; d) all sources.



Figures 7. Distribution on the sky for defining sources; candidates sources; other sources; all sources.

Table 5. Coordinates of the 212 defining sources in ICRF (see notes p. II-28)

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb del. (4)
ICRF J000557.1+382015	0003+380		0 5 57.175409	38 20 15.14857	0.000041	0.00051	-.041	49087.0	48720.9	49554.8	2	41
ICRF J001031.0+105829	0007+106		0 10 31.005888	10 58 29.50412	0.000032	0.00068	.540	47938.9	47288.7	49690.0	10	74
ICRF J001033.9+172418	0007+171		0 10 33.990619	17 24 18.76135	0.000021	0.00035	-.402	48730.8	47931.6	49662.8	19	57
ICRF J001331.1+405137	0010+405	2 1	0 13 31.130213	40 51 37.14407	0.000026	0.00034	-.038	49549.6	48434.7	49820.5	7	219
ICRF J001708.4+813508	0014+813		0 17 8.474953	81 35 8.13633	0.000121	0.00026	.012	49505.2	47023.7	49924.8	78	1453
ICRF J004204.5+232001	0039+230		0 42 4.545183	23 20 1.06129	0.000036	0.00060	.090	48898.1	48328.5	49533.8	3	44
ICRF J004959.4-573827	0047-579		0 49 59.473091	-57 38 27.33992	0.000047	0.00053	.298	48697.0	47626.5	49407.6	13	46
ICRF J011205.8+224438	0109+224	*	1 12 5.824718	22 44 38.78619	0.000027	0.00049	.082	48733.1	48434.7	49736.9	7	97
ICRF J012642.7+255901	0123+257		1 26 42.792631	25 59 1.30079	0.000030	0.00054	.167	48856.4	48328.5	49659.8	4	71
ICRF J013305.7-520003	0131-522		1 33 5.762585	-52 0 3.94693	0.000049	0.00081	.399	49039.1	48162.4	49895.6	6	30
ICRF J013658.5+475129	0133+476	2 2	1 36 58.594810	47 51 29.10006	0.000026	0.00027	.021	48629.0	45138.8	49750.8	190	2196
ICRF J013738.3-243053	0135-247		1 37 38.346378	-24 30 53.88526	0.000055	0.00042	-.188	48321.8	47640.2	49790.7	3	29
ICRF J014125.8-092843	0138-097	2 1	1 41 25.832025	- 9 28 43.67381	0.000081	0.00088	.063	47138.1	46875.8	49498.8	2	20
ICRF J015127.1+274441	0148+274		1 51 27.146149	27 44 41.79365	0.000031	0.00043	-.064	48963.9	48328.5	49659.8	5	112
ICRF J015218.0+220707	0149+218		1 52 18.059047	22 7 7.70004	0.000020	0.00029	-.437	48294.0	46977.9	49848.8	50	243
ICRF J015734.9+744243	0153+744	4 3 *	1 57 34.964908	74 42 43.22998	0.000091	0.00031	.059	49495.7	47019.9	49820.5	11	400
ICRF J020333.3+723253	0159+723		2 3 33.385004	72 32 53.66741	0.000072	0.00031	.033	48800.7	47011.4	49667.9	17	108
ICRF J020504.9+321230	0202+319		2 5 4.925371	32 12 30.09560	0.000022	0.00030	-.441	48017.7	45466.3	49736.9	35	214
ICRF J021748.9+014449	0215+015	1 1	2 17 48.954740	1 44 49.69909	0.000022	0.00039	-.215	49302.1	48328.5	49547.8	5	133
ICRF J022239.6+430207	0219+428		2 22 39.611500	43 2 7.79884	0.000034	0.00043	-.098	49103.6	48650.8	49554.8	7	64
ICRF J022256.4-344128	0220-349		2 22 56.401625	-34 41 28.73011	0.000050	0.00044	-.209	48679.5	47640.2	49790.7	4	35
ICRF J022850.0+672103	0224+671		2 28 50.051459	67 21 3.02926	0.000052	0.00031	-.080	45097.6	44090.5	49600.3	42	801
ICRF J022934.9-784745	0230-790		2 29 34.946647	-78 47 45.60129	0.000149	0.00049	.028	48828.1	47626.5	49895.6	11	52
ICRF J023838.9+163659	0235+164	1 1	2 38 38.930108	16 36 59.27471	0.000018	0.00027	.090	47475.7	44447.0	49909.6	194	2595
ICRF J024229.1+110100	0239+108	2 2	2 42 29.170847	11 1 0.72823	0.000018	0.00030	-.483	48582.3	47511.1	49662.8	43	153
ICRF J025134.5+431515	0248+430		2 51 34.536779	43 15 15.82858	0.000027	0.00033	-.074	49109.4	47931.6	49690.0	10	169
ICRF J025927.0+074739	0256+075		2 59 27.076633	7 47 39.64323	0.000021	0.00035	-.607	48247.0	47011.4	49445.6	44	190
ICRF J030350.6-621125	0302-623		3 3 50.631333	-62 11 25.54983	0.000047	0.00033	.129	49059.2	48162.4	49650.8	15	97
ICRF J030903.6+102916	0306+102		3 9 3.623523	10 29 16.34082	0.000023	0.00042	-.804	48974.1	47394.1	49667.9	18	76
ICRF J030956.0-605839	0308-611		3 9 56.099167	-60 58 39.05628	0.000038	0.00029	.037	49029.5	47626.5	49895.6	79	738

Table 5. (cont.) Coordinates of the 212 defining sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD span	Last MJD	Nb sess.	Nb del. (4)
ICRF J031301.9+412001	0309+411	*	3 13 1.962129	41 20 1.18353	0.000026	0.00031	-.321	48371.0	47165.8	49848.8	29	127
ICRF J034506.4+145349	0342+147		3 45 6.416546	14 53 49.55818	0.000021	0.00032	-.622	48809.6	47394.1	49445.6	23	177
ICRF J040305.5+260001	0400+258	3 2 *	4 3 5.586048	26 0 1.50274	0.000020	0.00030	-.127	48990.5	47005.8	49820.5	37	397
ICRF J040922.0+121739	0406+121	2 1	4 9 22.008740	12 17 39.84750	0.000021	0.00033	-.704	48399.2	46977.9	49565.9	28	149
ICRF J041636.5-185108	0414-189		4 16 36.544466	-18 51 8.34012	0.000051	0.00048	-.078	47814.6	46840.8	49790.7	3	31
ICRF J042442.2-375620	0422-380		4 24 42.243727	-37 56 20.78423	0.000033	0.00119	.251	49081.7	48162.4	49750.8	11	60
ICRF J042446.8+003606	0422+004	2 1	4 24 46.842052	0 36 6.32983	0.000020	0.00063	.038	48938.2	45997.8	49820.5	11	245
ICRF J042636.6+051819	0423+051		4 26 36.604102	5 18 19.87204	0.000031	0.00087	.101	48977.3	48194.7	49667.9	9	64
ICRF J042840.4-375619	0426-380		4 28 40.424306	-37 56 19.58031	0.000036	0.00047	.011	48125.7	47640.2	49692.6	5	39
ICRF J043900.8-452222	0437-454		4 39 0.854714	-45 22 22.56260	0.000057	0.00078	-.123	49443.5	48766.9	49895.6	7	32
ICRF J044238.6-001743	0440-003	1 1	4 42 38.660762	- 0 17 43.41910	0.000025	0.00064	.262	47735.2	47011.4	49576.9	15	111
ICRF J044907.6+112128	0446+112		4 49 7.671119	11 21 28.59662	0.000024	0.00051	-.143	49312.0	47394.1	49854.8	5	32
ICRF J045005.4-810102	0454-810		4 50 5.440195	-81 1 2.23146	0.000137	0.00032	-.005	48784.2	47626.5	49895.6	18	148
ICRF J045952.0+022931	0457+024		4 59 52.050664	2 29 31.17631	0.000019	0.00032	.062	48993.4	47005.8	49750.8	36	394
ICRF J050145.2+135607	0458+138	2 2	5 1 45.270840	13 56 7.22063	0.000037	0.00064	-.770	48830.7	47394.1	49848.8	13	20
ICRF J050523.1+045942	0502+049		5 5 23.184723	4 59 42.72448	0.000037	0.00060	-.584	48897.7	47394.1	49667.9	6	28
ICRF J050643.9-610940	0506-612		5 6 43.988739	-61 9 40.99328	0.000047	0.00035	.145	48760.5	48110.9	49594.7	16	69
ICRF J050842.3+843204	0454+844		5 8 42.363503	84 32 4.54402	0.000194	0.00028	-.046	48674.7	46977.9	49611.9	42	250
ICRF J051002.3+180041	0507+179	2 2	5 10 2.369122	18 0 41.58171	0.000020	0.00030	-.396	49401.9	47605.1	49820.5	24	339
ICRF J051644.9-620705	0516-621		5 16 44.926178	-62 7 5.38930	0.000048	0.00042	.202	49455.4	48749.6	49895.6	9	56
ICRF J052109.8+163822	0518+165	4 4	5 21 9.886021	16 38 22.05122	0.000048	0.00101	.569	48535.4	47931.6	49659.8	9	77
ICRF J052257.9-362730	0521-365	*	5 22 57.984651	-36 27 30.85092	0.000036	0.00106	.404	49078.4	48110.9	49895.6	6	25
ICRF J052930.0-724528	0530-727		5 29 30.042235	-72 45 28.50731	0.000073	0.00035	-.149	48819.8	47626.5	49911.8	50	200
ICRF J053954.2-283955	0537-286		5 39 54.281429	-28 39 55.94745	0.000036	0.00046	.282	48980.5	48573.8	49629.6	18	58
ICRF J054138.0-054149	0539-057	2 1	5 41 38.083384	- 5 41 49.42839	0.000019	0.00046	-.188	49489.2	47176.5	49820.5	6	173
ICRF J054236.1+495107	0538+498		5 42 36.137916	49 51 7.23356	0.000053	0.00054	.185	49065.1	48538.8	49533.8	4	45
ICRF J054734.1+272156	0544+273	1 1	5 47 34.148941	27 21 56.84240	0.000032	0.00043	-.730	49054.4	47394.1	49659.8	14	34
ICRF J055932.0+235353	0556+238		5 59 32.033133	23 53 53.92690	0.000022	0.00032	-.591	48492.7	47394.1	49848.8	28	57
ICRF J061423.8+604621	0609+607	3 2	6 14 23.866195	60 46 21.75538	0.000044	0.00034	.058	48014.6	45466.3	49498.8	16	217
ICRF J062603.0+820225	0615+820		6 26 3.006188	82 2 25.56764	0.000142	0.00030	.009	48606.5	47019.9	49600.3	30	230

Table 5. (cont.) Coordinates of the 212 defining sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb del. (4)
ICRF J063111.9-415426	0629-418		6 31 11.998059	-41 54 26.94611	0.000086	0.00095	-.001	48257.9	47626.5	49790.7	6	24
ICRF J063546.5-751616	0637-752	*	6 35 46.507934	-75 16 16.81533	0.000071	0.00027	.005	49058.3	47626.5	49911.8	156	2417
ICRF J064204.2+675835	0636+680	1 1	6 42 4.257418	67 58 35.62085	0.000053	0.00030	-.086	49495.2	48357.8	49820.5	29	550
ICRF J064632.0+445116	0642+449	1 1	6 46 32.025985	44 51 16.59013	0.000024	0.00027	.070	49389.0	45466.3	49924.8	86	1250
ICRF J065024.5-163739	0648-165		6 50 24.581852	-16 37 39.72500	0.000042	0.00070	-.059	47534.9	46875.8	49594.7	2	33
ICRF J071046.1+473211	0707+476	2 1	7 10 46.104900	47 32 11.14267	0.000028	0.00029	.003	49334.4	46977.9	49820.5	9	326
ICRF J072153.4+712036	0716+714	*	7 21 53.448459	71 20 36.36339	0.000058	0.00028	.092	48388.0	47165.8	49750.8	115	688
ICRF J072516.8+142513	0722+145		7 25 16.807752	14 25 13.74684	0.000023	0.00046	.001	48703.8	47394.1	49694.8	10	62
ICRF J072550.6-005456	0723-008	3 2	7 25 50.639953	- 0 54 56.54438	0.000019	0.00034	-.190	48083.7	44773.8	49820.5	19	334
ICRF J072611.7+791131	0718+792	2 1	7 26 11.735177	79 11 31.01624	0.000097	0.00027	.060	49787.0	48223.7	49924.8	38	1457
ICRF J073545.8-173548	0733-174		7 35 45.812508	-17 35 48.50131	0.000061	0.00138	-.342	48915.0	45900.1	49272.7	7	48
ICRF J073856.4-673550	0738-674		7 38 56.496292	-67 35 50.82583	0.000090	0.00052	.054	49189.4	47626.5	49895.6	7	33
ICRF J074110.7+311200	0738+313		7 41 10.703308	31 12 0.22862	0.000022	0.00029	.031	48627.1	45466.3	49848.8	22	512
ICRF J074625.8+254902	0743+259		7 46 25.874166	25 49 2.13488	0.000033	0.00066	-.372	48511.9	47407.6	49498.8	6	21
ICRF J074836.1+240024	0745+241		7 48 36.109278	24 0 24.11018	0.000019	0.00028	-.022	48240.5	47517.4	49600.3	114	617
ICRF J075301.3+535259	0749+540	1 1	7 53 1.384573	53 52 59.63716	0.000030	0.00027	.060	49755.0	45775.8	49897.8	37	2087
ICRF J075706.6+095634	0754+100		7 57 6.642936	9 56 34.85210	0.000021	0.00034	-.086	47266.2	45997.8	49848.8	15	215
ICRF J080839.6+495036	0804+499	1 1	8 8 39.666274	49 50 36.53046	0.000027	0.00026	.081	49582.5	47165.8	49924.8	155	9947
ICRF J080856.6+405244	0805+410	2 1	8 8 56.652038	40 52 44.88889	0.000023	0.00027	.050	49673.4	48720.9	49897.8	36	1519
ICRF J081525.9+363515	0812+367		8 15 25.944824	36 35 15.14830	0.000031	0.00046	.189	47764.8	45775.8	49554.8	6	75
ICRF J082057.4-125859	0818-128	*	8 20 57.447616	-12 58 59.16949	0.000029	0.00046	-.480	48831.3	47512.0	49896.8	8	37
ICRF J082447.2+555242	0820+560	2 1	8 24 47.236351	55 52 42.66938	0.000031	0.00026	.054	49263.8	46977.9	49848.8	48	2072
ICRF J082455.4+391641	0821+394		8 24 55.483865	39 16 41.90430	0.000029	0.00037	.164	48624.1	48194.7	49576.9	9	102
ICRF J082804.7-373106	0826-373	*	8 28 4.780268	-37 31 6.28064	0.000051	0.00050	-.053	48454.6	47511.1	49629.6	9	48
ICRF J083148.8+042939	0829+046		8 31 48.876955	4 29 39.08534	0.000026	0.00053	-.018	49137.6	48649.8	49533.8	4	59
ICRF J083223.2+491321	0828+493		8 32 23.216688	49 13 21.03823	0.000031	0.00037	.078	48526.3	47023.7	49498.8	18	133
ICRF J083454.9+553421	0831+557	4 3	8 34 54.903997	55 34 21.07080	0.000097	0.00068	.096	48902.3	47931.6	49456.8	8	70
ICRF J083639.2-201659	0834-201		8 36 39.215215	-20 16 59.50350	0.000035	0.00071	-.113	47992.1	46840.8	49650.8	5	33
ICRF J083722.4+582501	0833+585	3 1	8 37 22.409733	58 25 1.84521	0.000043	0.00031	.060	49393.6	46977.9	49820.5	19	334
ICRF J084205.0+183540	0839+187		8 42 5.094180	18 35 40.99061	0.000026	0.00048	.243	48609.7	47875.8	49659.8	8	118

Table 5. (cont.) Coordinates of the 212 defining sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X	S	H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD	Last MJD	span	Nb sess.	Nb del. (4)
ICRF J085441.9+575729	0850+581				8 54 41.996385	57 57 29.93928	0.000055	0.00044	-.252	49254.7	48720.9	49533.8		3	56
ICRF J090303.9+465104	0859+470	3	2		9 3 3.990103	46 51 4.13753	0.000026	0.00028	.029	48772.2	47005.8	49820.5		107	653
ICRF J091552.4+293324	0912+297	1	1	*	9 15 52.401620	29 33 24.04274	0.000032	0.00057	.223	49057.0	48194.7	49659.8		7	100
ICRF J092058.4+444153	0917+449				9 20 58.458480	44 41 53.98502	0.000026	0.00030	-.124	48755.5	46977.9	49600.3		28	141
ICRF J092136.2+621552	0917+624	2	1		9 21 36.231054	62 15 52.18035	0.000039	0.00027	.030	49215.0	45775.8	49820.5		11	477
ICRF J094855.3+403944	0945+408	2	2		9 48 55.338145	40 39 44.58719	0.000027	0.00033	.094	48666.4	47931.6	49659.8		9	123
ICRF J095456.8+174331	0952+179				9 54 56.823626	17 43 31.22242	0.000024	0.00053	-.040	48755.5	48158.8	49565.9		15	91
ICRF J095819.6+472507	0955+476	1	1		9 58 19.671648	47 25 7.84250	0.000026	0.00026	.039	49398.1	48720.9	49924.8		335	11583
ICRF J095820.9+322402	0955+326			*	9 58 20.949621	32 24 2.20929	0.000031	0.00047	.081	48569.4	47761.7	49554.8		6	101
ICRF J095847.2+653354	0954+658				9 58 47.245101	65 33 54.81806	0.000042	0.00026	.017	48614.9	46976.8	49883.8		236	7668
ICRF J101447.0+230116	1012+232				10 14 47.065445	23 1 16.57091	0.000024	0.00039	-.344	48580.3	47407.6	49576.9		11	83
ICRF J102311.5+394815	1020+400	3	1		10 23 11.565623	39 48 15.38539	0.000029	0.00036	.017	48469.6	46977.9	49694.8		9	116
ICRF J103303.7+411606	1030+415				10 33 3.707841	41 16 6.23297	0.000042	0.00044	.195	47892.4	47019.9	49498.8		12	82
ICRF J103502.1-201134	1032-199				10 35 2.155274	-20 11 34.35975	0.000050	0.00048	.050	48645.5	47176.5	49790.7		4	33
ICRF J104117.1+061016	1038+064	3	1		10 41 17.162504	6 10 16.92378	0.000020	0.00035	-.423	48204.3	47568.6	49736.9		16	114
ICRF J104146.7+523328	1038+528				10 41 46.781639	52 33 28.23127	0.000029	0.00028	.061	49331.0	48524.8	49883.8		43	525
ICRF J104148.8+523355	1038+529				10 41 48.897638	52 33 55.60790	0.000073	0.00056	-.323	49506.7	48650.8	49883.8		12	67
ICRF J104244.6+120331	1040+123				10 42 44.605212	12 3 31.26407	0.000024	0.00040	-.077	48805.3	47659.7	49790.7		9	89
ICRF J104423.0+805439	1039+811				10 44 23.062554	80 54 39.44303	0.000117	0.00027	.009	48930.0	47288.7	49694.8		34	266
ICRF J105148.7+211952	1049+215	2	1		10 51 48.789073	21 19 52.31411	0.000020	0.00030	.018	49497.7	47931.6	49820.5		6	218
ICRF J105811.5+811432	1053+815	1	1		10 58 11.535365	81 14 32.67521	0.000118	0.00027	.095	49403.8	47453.0	49909.6		92	1916
ICRF J105843.3-800354	1057-797				10 58 43.309786	-80 3 54.15949	0.000106	0.00027	.004	49023.8	47626.5	49911.8		148	2004
ICRF J111358.6+144226	1111+149				11 13 58.695097	14 42 26.95262	0.000023	0.00042	-.107	48224.7	47005.8	49456.8		16	149
ICRF J111857.3+123441	1116+128	3	2		11 18 57.301443	12 34 41.71806	0.000018	0.00031	-.156	49282.2	47274.8	49820.5		23	243
ICRF J113053.2+381518	1128+385	1	1		11 30 53.282612	38 15 18.54707	0.000022	0.00026	-.042	49534.8	45775.8	49924.8		175	7357
ICRF J113320.0+004052	1130+009	2	1		11 33 20.055797	0 40 52.83720	0.000022	0.00051	-.515	49111.9	47019.9	49820.5		23	211
ICRF J114608.1-244732	1143-245				11 46 8.103374	-24 47 32.89681	0.000080	0.00068	-.205	48071.1	47640.2	49895.6		3	33
ICRF J115019.2+241753	1147+245				11 50 19.212173	24 17 53.83503	0.000045	0.00063	-.108	49039.0	48720.9	49533.8		2	23
ICRF J115113.4-672811	1148-671				11 51 13.426591	-67 28 11.09423	0.000088	0.00059	.431	48705.2	48043.8	49407.6		5	33
ICRF J115312.4+805829	1150+812	2	2		11 53 12.499130	80 58 29.15451	0.000114	0.00027	.009	49157.4	46976.8	49820.5		41	1058

Table 5. (cont.) Coordinates of the 212 defining sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X	S	H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD span	Last MJD	Nb sess.	Nb del. (4)
ICRF J115324.4+493108	1150+497			*	11 53 24.466626	49 31 8.83014	0.000036	0.00037	.296	48715.7	47931.6	49694.8	6	80
ICRF J115825.7+245017	1155+251				11 58 25.787505	24 50 17.96369	0.000037	0.00060	.266	48860.8	48179.7	49659.8	7	78
ICRF J121555.6+344815	1213+350	3	1		12 15 55.601049	34 48 15.22053	0.000027	0.00035	.014	49425.3	48194.7	49820.5	11	298
ICRF J121752.0+300700	1215+303				12 17 52.081987	30 7 0.63625	0.000030	0.00054	.198	48795.4	48434.7	49667.9	5	77
ICRF J121906.4+482956	1216+487				12 19 6.414733	48 29 56.16497	0.000032	0.00032	.081	48755.8	46977.9	49736.9	12	204
ICRF J122222.5+041315	1219+044	2	1		12 22 22.549618	4 13 15.77630	0.000017	0.00026	-.238	49589.0	48378.8	49924.8	237	7633
ICRF J122340.4+804004	1221+809	2	1		12 23 40.493698	80 40 4.34031	0.000123	0.00030	-.088	49531.2	48022.7	49820.5	9	515
ICRF J122847.4+370612	1226+373	1	1		12 28 47.423662	37 6 12.09578	0.000027	0.00032	-.073	49313.1	48378.8	49750.8	6	167
ICRF J123924.5+073017	1236+077	2	1		12 39 24.588312	7 30 17.18909	0.000021	0.00042	-.068	49639.0	48378.8	49820.5	4	163
ICRF J123946.6-684530	1236-684				12 39 46.651396	-68 45 30.89260	0.000155	0.00100	-.358	49261.0	48043.8	49895.6	3	24
ICRF J125438.2+114105	1252+119				12 54 38.255601	11 41 5.89507	0.000019	0.00032	-.035	48651.0	46977.9	49848.8	36	241
ICRF J125459.9-713818	1251-713				12 54 59.921421	-71 38 18.43664	0.000066	0.00032	.067	48770.8	47626.5	49692.6	19	144
ICRF J130020.9+141718	1257+145				13 0 20.918799	14 17 18.53107	0.000038	0.00063	.297	49383.4	48804.9	49690.0	10	59
ICRF J131028.6+322043	1308+326	1	1		13 10 28.663845	32 20 43.78295	0.000020	0.00026	-.152	49096.1	44773.8	49924.8	869	40832
ICRF J132700.8+221050	1324+224			*	13 27 0.861311	22 10 50.16306	0.000020	0.00031	-.534	48961.9	48429.0	49736.9	37	116
ICRF J134345.9+660225	1342+662	2	1		13 43 45.959534	66 2 25.74503	0.000059	0.00035	-.014	49242.0	47783.2	49611.9	6	116
ICRF J134408.6+660611	1342+663				13 44 8.679674	66 6 11.64381	0.000047	0.00029	.144	48481.3	47453.0	49848.8	36	226
ICRF J134934.6+534117	1347+539	3	2		13 49 34.656623	53 41 17.04028	0.000034	0.00032	-.001	49519.9	47931.6	49820.5	10	358
ICRF J141908.1+062834	1416+067	2	1		14 19 8.180173	6 28 34.80349	0.000083	0.00129	.186	49420.1	48194.7	49820.5	8	118
ICRF J141946.5+542314	1418+546			*	14 19 46.597401	54 23 14.78721	0.000031	0.00027	-.048	47698.1	45138.8	49848.8	130	2179
ICRF J143645.8+633637	1435+638			*	14 36 45.802138	63 36 37.86658	0.000048	0.00033	.141	48265.6	47023.7	49611.9	12	192
ICRF J144516.4+095836	1442+101				14 45 16.465213	9 58 36.07244	0.000027	0.00040	.430	48733.3	47011.4	49883.8	33	200
ICRF J144815.0-162024	1445-161				14 48 15.054162	-16 20 24.54888	0.000030	0.00043	-.865	48520.9	47605.1	49565.9	18	39
ICRF J144828.7+760111	1448+762				14 48 28.778877	76 1 11.59717	0.000176	0.00045	.285	48457.2	47019.9	49554.8	8	67
ICRF J150048.6+475115	1459+480	2	1		15 0 48.654199	47 51 15.53826	0.000034	0.00038	.118	48587.3	47459.8	49554.8	9	98
ICRF J150609.5+373051	1504+377				15 6 9.529958	37 30 51.13241	0.000024	0.00029	-.091	49017.6	46977.9	49611.9	18	198
ICRF J151656.7+193212	1514+197				15 16 56.796194	19 32 12.99187	0.000026	0.00049	-.040	48620.5	48434.7	49533.8	5	91
ICRF J153452.4+013104	1532+016	4	2		15 34 52.453675	1 31 4.20657	0.000020	0.00049	-.539	48646.8	47407.6	49576.9	23	110
ICRF J154049.4+144745	1538+149				15 40 49.491511	14 47 45.88485	0.000019	0.00030	-.536	48426.7	45138.8	49790.7	39	201
ICRF J154917.4+503805	1547+507				15 49 17.468534	50 38 5.78820	0.000035	0.00036	.345	48164.7	47005.8	49498.8	11	106

Table 5. (cont.) Coordinates of the 212 defining sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb del. (4)
ICRF J155658.8-791404	1549-790		15 56 58.869899	-79 14 4.28134	0.000111	0.00032	.105	48792.8	47626.5	49895.6	15	156
ICRF J160207.2+332653	1600+335	3 1	16 2 7.263468	33 26 53.07267	0.000027	0.00053	-.159	49180.9	48103.5	49694.8	9	43
ICRF J160734.7-333108	1604-333		16 7 34.762344	-33 31 8.91313	0.000047	0.00048	-.881	49164.5	48393.7	49790.7	15	39
ICRF J160846.2+102907	1606+106	2 1	16 8 46.203179	10 29 7.77585	0.000017	0.00026	-.426	49344.4	45138.8	49924.8	533	18985
ICRF J161903.6+061302	1616+063		16 19 3.687684	6 13 2.24357	0.000028	0.00067	.049	49119.5	48194.7	49554.8	5	76
ICRF J162418.4-680912	1619-680		16 24 18.437150	-68 9 12.49811	0.000071	0.00057	-.053	48839.8	47626.5	49407.6	7	46
ICRF J162557.6+413440	1624+416	3 2	16 25 57.669700	41 34 40.62922	0.000026	0.00031	-.046	48372.9	46364.9	49883.8	31	247
ICRF J163813.4+572023	1637+574		16 38 13.456293	57 20 23.97918	0.000032	0.00027	-.085	47192.8	44857.8	49692.6	292	4339
ICRF J164207.8+685639	1642+690	3 2	16 42 7.848514	68 56 39.75640	0.000050	0.00027	.004	45979.8	44090.5	49848.8	150	1899
ICRF J165801.4+344328	1656+348		16 58 1.419204	34 43 28.40240	0.000048	0.00058	-.393	49385.0	48853.8	49883.8	5	56
ICRF J170734.4+014845	1705+018	2 1	17 7 34.415277	1 48 45.69923	0.000019	0.00031	-.103	49323.7	48194.7	49883.8	30	296
ICRF J170934.3-172853	1706-174		17 9 34.345380	-17 28 53.36480	0.000039	0.00056	-.924	48907.6	48093.0	49662.8	18	43
ICRF J172341.0-650036	1718-649		17 23 41.029765	-65 0 36.61518	0.000092	0.00106	.239	48651.6	48110.9	49407.6	5	21
ICRF J172727.6+453039	1726+455	2 1	17 27 27.650808	45 30 39.73139	0.000024	0.00026	-.127	49589.8	48720.9	49917.8	128	4185
ICRF J172818.6+501310	1727+502		17 28 18.623853	50 13 10.47001	0.000140	0.00098	-.188	48540.1	47459.8	49576.9	9	39
ICRF J172824.9+042704	1725+044	2 1	17 28 24.952716	4 27 4.91401	0.000020	0.00041	.000	49212.9	47931.6	49883.8	10	274
ICRF J174535.2+172001	1743+173	2 1	17 45 35.208181	17 20 1.42341	0.000018	0.00030	-.257	49272.9	46977.9	49848.8	31	296
ICRF J174614.0+622654	1745+624	1 2	17 46 14.034146	62 26 54.73842	0.000038	0.00027	-.043	49664.5	48916.8	49924.8	60	1609
ICRF J174832.8+700550	1749+701		17 48 32.840231	70 5 50.76882	0.000077	0.00037	-.025	47325.4	44203.7	49924.8	16	210
ICRF J175322.6+440945	1751+441		17 53 22.647901	44 9 45.68608	0.000032	0.00033	.169	49015.8	47931.6	49533.8	6	144
ICRF J180132.3+440421	1800+440		18 1 32.314854	44 4 21.90031	0.000036	0.00046	.115	48687.0	48194.7	49659.8	8	71
ICRF J180323.4-650736	1758-651	*	18 3 23.496605	-65 7 36.76177	0.000085	0.00054	.081	49241.4	48043.8	49895.6	4	29
ICRF J182407.0+565101	1823+568	1 1 *	18 24 7.068372	56 51 1.49088	0.000033	0.00028	-.047	48232.8	45138.8	49750.8	92	703
ICRF J183250.1+283335	1830+285		18 32 50.185631	28 33 35.95530	0.000035	0.00065	-.283	48734.8	48357.8	49659.8	7	50
ICRF J184208.9+794617	1845+797		18 42 8.989953	79 46 17.12801	0.000137	0.00036	-.399	48610.5	44203.7	49659.8	15	161
ICRF J184233.6+680925	1842+681	2 1	18 42 33.641636	68 9 25.22788	0.000061	0.00034	.056	48518.1	47165.8	49694.8	8	136
ICRF J184916.0+670541	1849+670	1 2	18 49 16.072300	67 5 41.67993	0.000048	0.00028	-.003	49709.0	48649.8	49820.5	4	412
ICRF J185457.2+735119	1856+737		18 54 57.299946	73 51 19.90747	0.000094	0.00043	.276	48602.2	47011.4	49667.9	8	101
ICRF J191240.0-801005	1903-802		19 12 40.019176	-80 10 5.94627	0.000169	0.00041	.004	48421.5	47626.5	48865.8	5	26
ICRF J195542.7+513148	1954+513	2 1	19 55 42.738273	51 31 48.54623	0.000028	0.00027	.001	48836.6	45775.8	49820.5	41	673

Table 5. (cont.) Coordinates of the 212 defining sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD span	Last MJD span	Nb sess.	Nb del. (4)
ICRF J195759.8-384506	1954-388		19 57 59.819271	-38 45 6.35626	0.000025	0.00039	.103	49775.4	48766.9	49917.8	13	257
ICRF J200324.1-325145	2000-330		20 3 24.116306	-32 51 45.13231	0.000040	0.00068	.175	48685.0	47512.0	49535.0	11	33
ICRF J201114.2-064403	2008-068		20 11 14.215847	- 6 44 3.55519	0.000050	0.00063	-.838	49068.6	48346.0	49662.8	13	29
ICRF J201713.0+744047	2017+745	2 1	20 17 13.079311	74 40 47.99991	0.000072	0.00028	.091	49459.5	47288.7	49820.5	23	465
ICRF J202319.0+315302	2021+317	3 1	20 23 19.017351	31 53 2.30595	0.000022	0.00031	.091	48563.6	45775.8	49611.9	22	215
ICRF J203147.9+545503	2030+547		20 31 47.958562	54 55 3.14060	0.000042	0.00051	.080	48616.4	47023.7	49659.8	7	86
ICRF J203154.9+121941	2029+121	3 1	20 31 54.994279	12 19 41.34043	0.000019	0.00034	.073	48966.6	47019.9	49848.8	14	230
ICRF J203837.0+511912	2037+511		20 38 37.034755	51 19 12.66269	0.000028	0.00027	.038	47284.6	45138.8	49736.9	190	3063
ICRF J205051.1+312727	2048+312		20 50 51.131502	31 27 27.37368	0.000108	0.00090	.151	49098.3	48194.7	49690.0	6	34
ICRF J205133.7+744140	2051+745		20 51 33.734576	74 41 40.49823	0.000110	0.00038	-.491	48765.0	47011.4	49554.8	20	73
ICRF J205616.3-471447	2052-474		20 56 16.359851	-47 14 47.62768	0.000033	0.00043	-.139	49285.7	48162.4	49911.8	15	104
ICRF J210138.8+034131	2059+034	2 1	21 1 38.834187	3 41 31.32159	0.000026	0.00058	-.033	48629.7	48434.7	49533.8	4	74
ICRF J210544.9-782534	2059-786		21 5 44.961453	-78 25 34.54664	0.000205	0.00058	.030	48784.8	47626.5	49895.6	7	24
ICRF J210933.1-411020	2106-413		21 9 33.188582	-41 10 20.60530	0.000032	0.00042	-.221	48703.7	47626.5	49662.8	17	72
ICRF J211529.4+293338	2113+293	1 1	21 15 29.413455	29 33 38.36694	0.000020	0.00028	-.027	48852.1	46977.9	49820.5	37	641
ICRF J211630.8-805355	2109-811		21 16 30.845958	-80 53 55.22339	0.000180	0.00039	-.020	49328.3	48043.8	49895.6	9	66
ICRF J213901.3+142335	2136+141	1 1	21 39 1.309267	14 23 35.99199	0.000018	0.00029	-.042	48861.8	45466.3	49848.8	22	351
ICRF J214622.9-152543	2143-156		21 46 22.979340	-15 25 43.88526	0.000028	0.00044	-.770	48854.6	48196.8	49565.9	14	24
ICRF J214805.4+065738	2145+067	2 2	21 48 5.458679	6 57 38.60422	0.000023	0.00026	.000	48939.7	44773.8	49924.8	1087	33641
ICRF J215203.1-780706	2146-783		21 52 3.154504	-78 7 6.63962	0.000221	0.00063	.316	48577.3	47626.5	49330.5	7	29
ICRF J215224.8+173437	2150+173	2 2	21 52 24.819405	17 34 37.79482	0.000020	0.00039	-.028	48516.6	47005.8	49456.8	23	150
ICRF J220743.7-534633	2204-540		22 7 43.733296	-53 46 33.82004	0.000045	0.00056	.016	48786.5	48110.9	49790.7	6	27
ICRF J221205.9+235540	2209+236		22 12 5.966318	23 55 40.54388	0.000023	0.00039	-.031	48674.5	48194.7	49848.8	9	141
ICRF J223036.4+694628	2229+695		22 30 36.469725	69 46 28.07698	0.000071	0.00034	.161	48418.0	47459.8	49600.3	16	95
ICRF J223513.2-483558	2232-488		22 35 13.236524	-48 35 58.79455	0.000049	0.00065	.394	49223.5	48162.4	49741.7	6	30
ICRF J225717.3+074312	2254+074		22 57 17.303120	7 43 12.30284	0.000023	0.00052	-.519	48052.0	47011.4	49736.9	26	139
ICRF J231448.5-313839	2312-319		23 14 48.500631	-31 38 39.52651	0.000050	0.00103	.340	48250.7	47511.1	49895.6	6	27
ICRF J232159.8+273246	2319+272	3 1	23 21 59.862235	27 32 46.44343	0.000021	0.00033	.020	49197.7	47023.7	49820.5	21	321
ICRF J232225.9+505751	2320+506	3 1	23 22 25.982159	50 57 51.96371	0.000041	0.00044	-.011	49021.5	48720.9	49498.8	2	44
ICRF J232917.7-473019	2326-477		23 29 17.704369	-47 30 19.11519	0.000039	0.00053	.264	48341.4	47305.8	49629.6	31	138

Table 5. (cont.) Coordinates of the 212 defining sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD of observation	Last MJD of observation	Nb sess.	Nb del. (4)
ICRF J233138.6-155657	2329-162		23 31 38.652436	-15 56 57.00952	0.000039	0.00051	.012	48859.0	47176.5	49650.8	2	25
ICRF J233159.4-381147	2329-384		23 31 59.476115	-38 11 47.65053	0.000042	0.00066	.095	48273.4	47640.2	49895.6	5	22

Notes

(1) ICRF Designations, constructed from J2000.0 coordinates with the format
ICRF JHHMMSS.s+DDMMSS or ICRF JHHMMSS.s-DDMMSS.
They follow the recommendations of the IAU Task Group on Designations.

(2) IERS Designations, previously constructed from B1950 coordinates.
The complete format, including acronym and epoch in addition to the coordinates, is
IERS BHHMM+DDd or IERS BHHMM-DDd

(3) X: Structure index at X band
S: Structure index at S band
H: Asterisk indicates that the source serves to link the Hipparcos stellar reference frame to the ICRS.

(4) Number of pairs of delay and delay rate observations.

Table 6. Coordinates of the candidate sources in ICRF (see notes p. II-39)

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X	S	H	Right Ascension J2000.0 h	m	s	Declination J2000.0 °	'	"	Uncertainty R.A. s	Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD span	Last MJD	Nb sess.	Nb del. (4)
ICRF J000435.6-473619	0002-478				0	4	35.655596	-47	36	19.60356	0.000079	0.00097	.019	49435.5	49330.5	49524.7	3	7
ICRF J000613.8-062335	0003-066	3	1		0	6	13.892887	- 6	23	35.33485	0.000019	0.00034	-.575	48728.1	47176.5	49565.9	41	114
ICRF J001052.5-415310	0008-421				0	10	52.519641	-41	53	10.78780	0.000652	0.00728	-.548	48551.8	48162.4	49330.5	2	6
ICRF J001101.2-261233	0008-264				0	11	1.246752	-26	12	33.37686	0.000035	0.00040	-.427	48892.4	47686.1	49790.7	7	38
ICRF J001611.0-001512	0013-005				0	16	11.088555	- 0	15	12.44534	0.000020	0.00037	-.675	48920.3	47394.1	49611.9	27	116
ICRF J002442.9-420203	0022-423				0	24	42.989850	-42	2	3.94978	0.000250	0.00222	-.528	49003.5	48162.4	49895.6	3	10
ICRF J003824.8+413706	0035+413				0	38	24.843613	41	37	6.00069	0.000053	0.00066	-.266	49422.9	49422.9	49422.9	1	19
ICRF J005846.5-565911	0056-572				0	58	46.581252	-56	59	11.47054	0.000084	0.00113	.454	48583.5	47626.5	49330.5	4	12
ICRF J005905.5+000651	0056-001	4	3		0	59	5.514949	0	6	51.62203	0.000033	0.00093	.304	49186.6	47005.8	49659.8	11	173
ICRF J011137.3+390628	0108+388	4	2		1	11	37.316975	39	6	28.10422	0.000030	0.00035	.077	49711.2	49099.7	49820.5	3	203
ICRF J011327.0+494824	0110+495				1	13	27.006813	49	48	24.04351	0.000055	0.00060	-.525	49422.9	49422.9	49422.9	1	23
ICRF J011343.1+022217	0111+021			*	1	13	43.144954	2	22	17.31631	0.000023	0.00038	-.822	48461.2	47023.7	49667.9	28	160
ICRF J011517.0-012704	0112-017				1	15	17.099966	- 1	27	4.57725	0.000018	0.00031	-.497	48419.3	47278.8	49662.8	57	200
ICRF J011935.0+321050	0116+319	4	4		1	19	35.000523	32	10	50.05410	0.001257	0.00806	.231	49284.0	48787.9	49820.5	4	10
ICRF J012031.6-270124	0118-272				1	20	31.663311	-27	1	24.65133	0.000124	0.00112	-.587	48170.1	47512.0	49650.8	2	13
ICRF J012141.5+114950	0119+115	2	1		1	21	41.595041	11	49	50.41319	0.000018	0.00030	-.429	48683.5	47394.1	49848.8	50	150
ICRF J012156.8+042224	0119+041	2	1		1	21	56.861698	4	22	24.73438	0.000017	0.00026	.412	48822.9	46977.9	49911.8	1050	23707
ICRF J014922.3+055553	0146+056	3	1		1	49	22.370918	5	55	53.56852	0.000022	0.00035	-.691	48208.1	47288.7	49736.9	23	107
ICRF J015002.6-072548	0147-076				1	50	2.697551	- 7	25	48.49067	0.000628	0.00580	-.229	49687.7	49535.0	49895.6	3	7
ICRF J015310.1-331025	0150-334				1	53	10.121676	-33	10	25.86226	0.000063	0.00142	.164	47846.0	47511.1	48757.4	3	17
ICRF J015456.2+474326	0151+474				1	54	56.289917	47	43	26.53907	0.000049	0.00046	.002	49750.8	49750.8	49750.8	1	36
ICRF J015537.0-404842	0153-410				1	55	37.059396	-40	48	42.35592	0.000439	0.00283	-.052	49203.1	48766.9	49535.0	3	9
ICRF J020213.6-762003	0202-765				2	2	13.694218	-76	20	3.05655	0.002733	0.00592	.145	48780.2	48110.9	49895.6	2	8
ICRF J020346.6+113445	0201+113	2	1		2	3	46.657063	11	34	45.40956	0.000018	0.00027	-.163	49139.9	47237.4	49924.8	122	856
ICRF J020450.4+151411	0202+149	2	2		2	4	50.413908	15	14	11.04337	0.000018	0.00026	.194	49004.4	45997.8	49924.8	238	4191
ICRF J020457.6-170119	0202-172				2	4	57.674364	-17	1	19.84022	0.000031	0.00039	-.097	48904.2	47171.5	49790.7	6	72
ICRF J022428.4+065923	0221+067	2	2		2	24	28.428183	6	59	23.34182	0.000019	0.00031	-.653	48789.9	47394.1	49662.8	35	77
ICRF J023145.8+132254	0229+131	2	1		2	31	45.894055	13	22	54.71630	0.000017	0.00026	.341	48150.5	44773.8	49917.8	1314	35363
ICRF J023752.4+284808	0234+285	3	2		2	37	52.405677	28	48	8.99008	0.000019	0.00026	.160	47723.9	44447.0	49904.8	1021	31420
ICRF J023945.4-023440	0237-027				2	39	45.472273	- 2	34	40.91378	0.000029	0.00077	-.429	49376.1	49253.8	49554.8	2	32

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X	S	H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD span	Last MJD	Nb sess.	Nb del. (4)
ICRF J023951.2+041621	0237+040	2	1		2 39 51.263052	4 16 21.41185	0.000020	0.00036	-.578	48874.7	47941.3	49662.8	20	103
ICRF J024457.6+622806	0241+622			*	2 44 57.696828	62 28 6.51494	0.000425	0.00185	.022	49045.4	48223.7	49690.0	3	16
ICRF J025246.1-710435	0252-712				2 52 46.156121	-71 4 35.27541	0.003779	0.02839	.328	48162.4	48162.4	48162.4	1	2
ICRF J025329.1-544151	0252-549				2 53 29.180453	-54 41 51.43623	0.000055	0.00079	.141	48887.3	47626.5	49895.6	6	18
ICRF J025334.8+180542	0250+178				2 53 34.882297	18 5 42.52378	0.002758	0.03513	-.999	48977.5	48977.5	48977.5	1	1
ICRF J030230.5+121856	0259+121	3	1		3 2 30.546782	12 18 56.75084	0.009783	0.12252	-.397	49643.1	47941.3	49820.5	12	130
ICRF J030642.6+624302	0302+625	2	1		3 6 42.659562	62 43 2.02420	0.000065	0.00058	-.169	49179.4	48614.0	49896.8	21	70
ICRF J031155.2-765150	0312-770			*	3 11 55.250335	-76 51 50.84843	0.000221	0.00067	.476	48768.1	48110.9	49895.6	3	17
ICRF J031951.2+190131	0317+188	2	1		3 19 51.256736	19 1 31.29032	0.000028	0.00048	-.737	49377.6	48942.5	49662.8	9	20
ICRF J033553.9-543025	0334-546				3 35 53.924919	-54 30 25.11446	0.000066	0.00137	.211	48994.3	47626.5	49650.8	5	13
ICRF J033717.1+013722	0334+014	2	2		3 37 17.108822	1 37 22.74287	0.003043	0.01491	.615	49396.1	49177.8	49694.8	3	4
ICRF J033930.9-014635	0336-019	2	1	*	3 39 30.937785	- 1 46 35.80391	0.000017	0.00026	.337	49437.7	44773.8	49924.8	303	7113
ICRF J034423.1+155943	0341+158	2	1		3 44 23.172178	15 59 43.36987	0.000039	0.00132	-.382	48969.0	47394.1	49659.8	11	34
ICRF J035721.9-481215	0355-483				3 57 21.917867	-48 12 15.16075	0.000092	0.00221	.698	48656.4	48162.4	49330.5	3	9
ICRF J040221.2-314725	0400-319				4 2 21.266012	-31 47 25.94544	0.000044	0.00052	-.361	49318.6	48766.9	49482.7	4	27
ICRF J040659.0-382628	0405-385				4 6 59.035298	-38 26 28.04070	0.000189	0.00122	-.367	48971.9	48162.4	49692.6	3	10
ICRF J040748.4-121136	0405-123			*	4 7 48.430971	-12 11 36.65948	0.000177	0.00123	-.152	49297.5	48766.9	49398.5	2	25
ICRF J040820.3-654509	0407-658				4 8 20.380244	-65 45 9.07841	0.001072	0.00630	-.236	48507.8	48162.4	48766.9	2	7
ICRF J040905.7-123848	0406-127				4 9 5.769741	-12 38 48.14414	0.000029	0.00044	-.816	48894.7	47941.3	49790.7	18	35
ICRF J042356.0+415002	0420+417				4 23 56.009804	41 50 2.71305	0.000029	0.00035	.233	48365.2	47568.6	49694.8	18	173
ICRF J042747.5+045708	0425+048	3	3		4 27 47.570443	4 57 8.32698	0.000111	0.01110	-.983	48867.5	47394.1	49662.8	12	25
ICRF J043221.1-510925	0431-512				4 32 21.178158	-51 9 25.18839	0.000237	0.00323	.864	48510.0	48043.8	49895.6	3	7
ICRF J044017.1-433308	0438-436				4 40 17.179991	-43 33 8.60397	0.000031	0.00038	-.187	49195.4	47941.3	49790.7	20	89
ICRF J044331.6+344106	0440+345	2	1		4 43 31.635194	34 41 6.66403	0.000037	0.00047	-.050	49754.1	48093.0	49868.8	13	290
ICRF J044923.3+633209	0444+634				4 49 23.310440	63 32 9.43451	0.000094	0.00066	-.115	49422.9	49422.9	49422.9	1	23
ICRF J045314.6-280737	0451-282				4 53 14.646803	-28 7 37.32750	0.000100	0.00188	-.694	48761.9	47176.5	49398.5	9	41
ICRF J045550.7-461558	0454-463				4 55 50.772475	-46 15 58.68148	0.000064	0.00271	-.122	49015.7	49015.7	49015.7	1	6
ICRF J050112.8-015914	0458-020	2	1		5 1 12.809889	- 1 59 14.25619	0.000017	0.00026	.398	49316.0	44773.8	49924.8	559	15943
ICRF J050215.4+060907	0459+060	3	1		5 2 15.445934	6 9 7.49448	0.000034	0.00106	-.339	49685.6	47394.1	49820.5	6	94
ICRF J050401.7-604952	0503-608				5 4 1.701356	-60 49 52.53773	0.000252	0.00138	.520	48563.7	48110.9	49330.5	3	12

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb del. (4)
ICRF J050927.4+101144	0506+101		5 9 27.457073	10 11 44.60026	0.000065	0.00130	-.654	48909.0	47394.1	49736.9	28	63
ICRF J051349.1-215916	0511-220		5 13 49.114333	-21 59 16.09208	0.000052	0.00140	-.550	48768.7	47176.5	49790.7	13	43
ICRF J051637.7-723707	0517-726		5 16 37.719042	-72 37 7.46573	0.000622	0.00284	.426	49423.7	48757.4	49895.6	3	12
ICRF J052234.4-610757	0522-611		5 22 34.425537	-61 7 57.13318	0.000069	0.00060	.295	48382.0	47626.5	48757.4	3	15
ICRF J052531.4-455754	0524-460		5 25 31.400087	-45 57 54.68568	0.000125	0.00164	.521	49750.8	49750.8	49750.8	1	18
ICRF J053056.4+133155	0528+134	1 1	5 30 56.416744	13 31 55.14954	0.000017	0.00026	.277	48026.8	44773.8	49924.8	1884	51914
ICRF J053238.9+073243	0529+075		5 32 38.998447	7 32 43.34567	0.000105	0.00111	.252	48474.9	44773.8	49694.8	10	53
ICRF J053932.0-155030	0537-158		5 39 32.010168	-15 50 30.32097	0.000051	0.00104	-.716	48283.7	47941.3	49031.1	7	9
ICRF J055530.8+394849	0552+398	2 1	5 55 30.805608	39 48 49.16500	0.000022	0.00026	.108	48175.6	44090.5	49924.8	2343	118072
ICRF J060309.1+174216	0600+177	2 1	6 3 9.130274	17 42 16.81064	0.000038	0.00111	-.746	49534.7	47394.1	49820.5	23	191
ICRF J060752.6+672055	0602+673		6 7 52.671683	67 20 55.40986	0.000078	0.00043	-.096	49750.8	49750.8	49750.8	1	37
ICRF J060759.6-083449	0605-085		6 7 59.699234	- 8 34 49.97806	0.000019	0.00033	-.423	47995.7	44773.8	49750.8	31	149
ICRF J060940.9-154240	0607-157		6 9 40.949516	-15 42 40.67238	0.000049	0.00140	-.443	49047.1	45466.3	49790.7	19	89
ICRF J061357.6+130645	0611+131		6 13 57.692754	13 6 45.40144	0.000047	0.00117	-.529	48945.9	47394.1	49667.9	9	27
ICRF J061635.9-345616	0614-349		6 16 35.981345	-34 56 16.56410	0.005405	0.03903	-.947	48766.9	48766.9	48766.9	1	2
ICRF J061732.3-363414	0615-365		6 17 32.323936	-36 34 14.80314	0.004648	0.04163	-.969	48766.9	48766.9	48766.9	1	3
ICRF J062331.7-441302	0622-441		6 23 31.786306	-44 13 2.54171	0.000640	0.00450	-.068	48162.4	48162.4	48162.4	1	5
ICRF J062419.0+385648	0620+389		6 24 19.021315	38 56 48.73591	0.000025	0.00033	-.016	49631.0	49391.7	49690.0	6	112
ICRF J063920.9-334600	0637-337		6 39 20.904728	-33 46 0.11360	0.000095	0.00117	.168	47782.3	47511.1	48865.8	3	10
ICRF J064524.0+212151	0642+214		6 45 24.099488	21 21 51.20191	0.000034	0.00054	-.878	49125.6	48093.0	49662.8	15	43
ICRF J064814.0-304419	0646-306	2 2	6 48 14.096463	-30 44 19.65964	0.000035	0.00041	-.601	49131.7	47640.2	49662.8	8	145
ICRF J064848.4-473427	0647-475		6 48 48.452021	-47 34 27.18600	0.005321	0.02110	-.739	48766.9	48766.9	48766.9	1	2
ICRF J065358.2+370540	0650+371		6 53 58.282844	37 5 40.60649	0.000035	0.00052	-.227	49030.1	48348.6	49750.8	37	113
ICRF J070001.5+170921	0657+172	2 1	7 0 1.525540	17 9 21.70163	0.000018	0.00027	-.026	48854.1	47517.4	49692.6	113	849
ICRF J070134.5-463436	0700-465		7 1 34.547145	-46 34 36.62034	0.000469	0.00392	-.332	48162.4	48162.4	48162.4	1	3
ICRF J072905.4-363945	0727-365		7 29 5.425027	-36 39 45.29030	0.054838	0.28833	-.999	48766.9	48766.9	48766.9	1	1
ICRF J073816.9-332212	0736-332		7 38 16.949145	-33 22 12.77740	0.000305	0.00193	-.452	49082.7	48766.9	49398.5	2	8
ICRF J073918.0+013704	0736+017		7 39 18.033894	1 37 4.61797	0.000020	0.00035	-.560	47553.9	44773.8	49600.3	26	130
ICRF J074202.7+490015	0738+491		7 42 2.748951	49 0 15.60912	0.000042	0.00039	-.096	49750.8	49750.8	49750.8	1	34
ICRF J074331.6-672625	0743-673		7 43 31.611506	-67 26 25.54618	0.001087	0.06235	-.185	48600.5	48110.9	49535.0	4	17

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb del. (4)
ICRF J075052.0+123104	0748+126		7 50 52.045731	12 31 4.82823	0.000019	0.00030	-.154	47761.5	44773.8	49662.8	19	239
ICRF J080815.5-075109	0805-077	3 1	8 8 15.536036	- 7 51 9.88642	0.000019	0.00032	-.459	48618.6	47176.5	49790.7	27	95
ICRF J081108.8-492943	0809-493		8 11 8.802530	-49 29 43.50928	0.000722	0.00539	-.152	48043.8	48043.8	48043.8	1	5
ICRF J081126.7+014652	0808+019	1 1	8 11 26.707322	1 46 52.21998	0.000018	0.00031	-.317	49268.6	46977.9	49820.5	29	279
ICRF J081815.9+422245	0814+425		8 18 15.999611	42 22 45.41498	0.000024	0.00027	.029	48208.8	45138.8	49690.0	137	1496
ICRF J082526.8-501038	0823-500		8 25 26.869117	-50 10 38.48735	0.000227	0.00148	-.399	48784.2	48162.4	49895.6	3	21
ICRF J082538.6+615728	0821+621		8 25 38.612165	61 57 28.57917	0.000111	0.00050	.293	49422.9	49422.9	49422.9	1	28
ICRF J082550.3+030924	0823+033	2 1	8 25 50.338356	3 9 24.52016	0.000017	0.00026	.123	49199.7	45466.3	49911.8	408	11767
ICRF J082601.5-223027	0823-223		8 26 1.572952	-22 30 27.20373	0.000123	0.00278	-.556	47023.6	46875.8	47171.5	2	12
ICRF J083052.0+241059	0827+243		8 30 52.086191	24 10 59.82068	0.000023	0.00037	.003	48238.8	47023.7	49611.9	11	123
ICRF J083322.3-444138	0831-445		8 33 22.315631	-44 41 38.71463	0.000603	0.00381	-.254	49027.6	48043.8	49895.6	6	15
ICRF J083520.6-451035	0833-450		8 35 20.655289	-45 10 35.15391	0.001715	0.01125	-.395	48132.8	48043.8	48162.4	2	4
ICRF J084124.3+705342	0836+710		8 41 24.365236	70 53 42.17328	0.000117	0.00064	.140	48387.6	46977.9	49694.8	7	105
ICRF J084127.0-754027	0842-754		8 41 27.034888	-75 40 27.87078	0.002953	0.00740	-.514	48205.3	48110.9	48865.8	2	8
ICRF J085448.8+200630	0851+202	2 1 *	8 54 48.874924	20 6 30.64088	0.000018	0.00026	.086	47708.7	44203.7	49924.8	2173	64014
ICRF J090216.8-141530	0859-140		9 2 16.830898	-14 15 30.87530	0.000042	0.00044	-.560	48495.2	46875.8	49600.3	20	70
ICRF J090910.0+012135	0906+015		9 9 10.091601	1 21 35.61770	0.000020	0.00035	-.422	48304.1	47005.8	49750.8	22	186
ICRF J091437.9+024559	0912+029		9 14 37.913439	2 45 59.24629	0.000072	0.00109	-.898	48863.7	47407.6	49554.8	4	13
ICRF J092246.4-395935	0920-397		9 22 46.418275	-39 59 35.06753	0.000035	0.00075	-.471	49064.5	47686.1	49911.8	20	90
ICRF J092314.4+384939	0920+390		9 23 14.452940	38 49 39.91017	0.000025	0.00032	-.134	49847.9	49736.9	49910.8	11	110
ICRF J092751.8-203451	0925-203		9 27 51.824304	-20 34 51.23227	0.000091	0.00626	-.526	48662.3	47941.3	49517.3	24	68
ICRF J093032.5-853359	0936-853		9 30 32.571196	-85 33 59.69200	0.004016	0.00396	.068	48887.3	48162.4	49650.8	4	15
ICRF J095524.7+690113	0951+692		9 55 24.774751	69 1 13.70255	0.000107	0.00065	.123	49238.5	49225.8	49267.8	3	97
ICRF J100159.9-443800	0959-443		10 1 59.907283	-44 38 0.60564	0.000549	0.00411	-.490	48506.8	48043.8	49895.6	2	8
ICRF J100614.0-501813	1004-500		10 6 14.009559	-50 18 13.47089	0.001635	0.01727	-.887	49535.0	49535.0	49535.0	1	2
ICRF J101353.4+244916	1011+250		10 13 53.428730	24 49 16.44127	0.000038	0.00069	-.276	49233.4	48353.6	49694.8	17	42
ICRF J101725.8+611627	1014+615		10 17 25.887530	61 16 27.49687	0.000085	0.00053	.199	49422.9	49422.9	49422.9	1	34
ICRF J102232.7-103744	1020-103	*	10 22 32.798030	-10 37 44.38842	0.007404	0.02425	.877	49650.8	49650.8	49650.8	1	2
ICRF J102444.8+191220	1022+194	2 2	10 24 44.809595	19 12 20.41526	0.000047	0.00099	-.218	49688.4	47783.2	49820.5	8	175
ICRF J103507.0+562846	1031+567	*	10 35 7.040181	56 28 46.79673	0.000209	0.00185	.562	48462.2	47023.7	49690.0	15	95

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD span	Last MJD	Nb sess.	Nb del. (4)
ICRF J104142.9-474006	1039-474		10 41 42.939703	-47 40 6.52738	0.029517	0.28851	-1.000	49535.0	49535.0	49535.0	1	1
ICRF J104455.9+065538	1042+071		10 44 55.911265	6 55 38.26250	0.000035	0.00069	-.504	48909.9	47783.2	49498.8	5	19
ICRF J104827.6+714335	1044+719	1 1	10 48 27.619892	71 43 35.93846	0.000056	0.00026	.024	49651.6	47605.1	49909.6	108	4169
ICRF J105104.7-313814	1048-313		10 51 4.777555	-31 38 14.30773	0.000069	0.00058	-.228	47671.5	47640.2	47686.1	2	22
ICRF J105653.6+701145	1053+704		10 56 53.617499	70 11 45.91587	0.000057	0.00029	-.010	49462.0	49125.7	49883.8	17	246
ICRF J110331.5-325116	1101-325	*	11 3 31.526414	-32 51 16.69195	0.000064	0.00183	.297	48815.6	47511.1	49650.8	5	7
ICRF J110352.2-535700	1101-536		11 3 52.221670	-53 57 0.69643	0.000033	0.00033	.134	49235.8	47626.5	49895.6	25	181
ICRF J110427.3+381231	1101+384	1 1 *	11 4 27.313906	38 12 31.79908	0.000039	0.00052	.557	49668.7	49519.8	49690.0	2	32
ICRF J110712.6-682050	1105-680		11 7 12.694528	-68 20 50.72894	0.000304	0.00163	.640	48934.7	48388.4	49330.5	3	19
ICRF J111826.9-463415	1116-462		11 18 26.957601	-46 34 15.00140	0.000062	0.00082	.491	48556.1	48110.9	49330.5	6	16
ICRF J112027.8+142054	1117+146	3 4	11 20 27.807269	14 20 54.99422	0.000538	0.00710	-.454	49207.4	49098.6	49533.8	2	4
ICRF J112704.3-185717	1124-186		11 27 4.392428	-18 57 17.44154	0.000019	0.00030	-.208	49242.7	46875.8	49911.8	91	684
ICRF J112813.3+592514	1125+596		11 28 13.340725	59 25 14.80002	0.000118	0.00076	.263	49422.9	49422.9	49422.9	1	27
ICRF J113007.0-144927	1127-145	4 2	11 30 7.052573	-14 49 27.38793	0.000037	0.00114	-.351	49312.6	45259.2	49790.7	26	352
ICRF J113130.5-050019	1128-047		11 31 30.516713	- 5 0 19.65713	0.000031	0.00061	-.087	49408.6	49099.7	49547.8	4	48
ICRF J113143.2-581853	1129-580		11 31 43.287417	-58 18 53.44656	0.001192	0.01188	.805	49535.0	49535.0	49535.0	1	2
ICRF J114701.3-381211	1144-379		11 47 1.370687	-38 12 11.02348	0.000024	0.00030	-.328	49308.2	47654.0	49924.8	64	314
ICRF J114751.5-072441	1145-071	3 1	11 47 51.554038	- 7 24 41.14107	0.000018	0.00029	-.045	49194.8	47176.5	49819.8	56	464
ICRF J115043.8-002354	1148-001		11 50 43.870784	- 0 23 54.20485	0.000024	0.00056	.089	48127.8	47023.7	49848.8	17	128
ICRF J115912.7-094052	1156-094	3 3	11 59 12.711697	- 9 40 52.04888	0.000079	0.00322	-.773	49323.1	47941.3	49790.7	8	17
ICRF J115931.8+291443	1156+295	2 2	11 59 31.833914	29 14 43.82693	0.000020	0.00026	-.071	48185.2	46977.9	49848.8	285	7176
ICRF J120935.2-401613	1206-399		12 9 35.243318	-40 16 13.10027	0.018417	0.02742	.244	47807.2	47511.1	48043.8	3	9
ICRF J121546.7-173145	1213-172		12 15 46.751764	-17 31 45.40287	0.000043	0.00041	.004	48762.4	46840.8	49868.8	4	34
ICRF J121806.2-460029	1215-457		12 18 6.252147	-46 0 29.01041	0.001021	0.00776	-.811	48746.5	48162.4	49330.5	2	6
ICRF J122131.6+281358	1219+285		12 21 31.690512	28 13 58.50014	0.000023	0.00034	-.495	46621.3	44447.0	49848.8	27	203
ICRF J122452.4+033050	1222+037		12 24 52.421888	3 30 50.29322	0.000053	0.00195	-.032	48144.4	46502.8	49576.9	47	185
ICRF J122454.3-831310	1221-829		12 24 54.383445	-83 13 10.10523	0.003023	0.00611	-.493	48043.8	48043.8	48043.8	1	4
ICRF J123049.4+122328	1228+126	3 2	12 30 49.423381	12 23 28.04390	0.000034	0.00047	-.057	49380.5	46502.8	49924.8	40	457
ICRF J123715.2-504623	1234-504		12 37 15.238939	-50 46 23.17192	0.001450	0.00627	-.679	48766.9	48766.9	48766.9	1	6
ICRF J123943.0-102328	1237-101		12 39 43.061423	-10 23 28.69259	0.000043	0.00064	.221	49398.5	49398.5	49398.5	1	8

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X	S	H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD	Last MJD span	Nb sess.	Nb del. (4)
ICRF J123959.4-113722	1237-113				12 39 59.430198	-11 37 22.98492	0.001402	0.01335	-.675	49889.7	49883.8	49895.6	2	4
ICRF J124251.3+375100	1240+381				12 42 51.369079	37 51 0.02510	0.000051	0.00042	-.316	49534.2	49429.9	49750.8	2	80
ICRF J124604.2-073046	1243-072				12 46 4.232116	- 7 30 46.57478	0.000027	0.00046	-.578	47836.0	47176.5	49498.8	11	40
ICRF J124646.8-254749	1244-255				12 46 46.802038	-25 47 49.28871	0.000020	0.00029	-.299	49085.4	46875.8	49895.6	87	557
ICRF J125359.5-405930	1251-407				12 53 59.533598	-40 59 30.68936	0.000171	0.00503	.543	49814.0	49650.8	49895.6	2	9
ICRF J125614.2+565225	1254+571			*	12 56 14.233964	56 52 25.23721	0.000105	0.00096	.656	49690.0	49690.0	49690.0	1	24
ICRF J125759.0-315516	1255-316				12 57 59.060767	-31 55 16.85182	0.000025	0.00041	.220	49500.7	47640.2	49911.8	13	208
ICRF J130533.0-103319	1302-102			*	13 5 33.015018	-10 33 19.42796	0.000020	0.00033	-.481	48565.2	47176.5	49600.3	25	78
ICRF J130933.9+115424	1307+121	3	2		13 9 33.932424	11 54 24.55204	0.000044	0.00076	.098	49705.3	49099.7	49820.5	3	137
ICRF J131607.9-333859	1313-333	1	1		13 16 7.985934	-33 38 59.17236	0.000024	0.00031	-.466	49069.2	47415.7	49692.6	67	322
ICRF J131736.4+342515	1315+346	2	1	*	13 17 36.494181	34 25 15.93257	0.000025	0.00049	-.464	49169.7	47946.4	49690.0	21	88
ICRF J132304.2-445233	1320-446				13 23 4.245804	-44 52 33.85272	0.000623	0.00321	.149	49065.5	48766.9	49895.6	3	17
ICRF J132527.6-430108	1322-427				13 25 27.615217	-43 1 8.80528	0.000198	0.00161	.732	49205.8	48110.9	49895.6	3	14
ICRF J132616.5+315409	1323+321	4	4		13 26 16.511396	31 54 9.51991	0.000188	0.00199	.028	49398.8	48223.7	49542.2	6	110
ICRF J133108.2+303032	1328+307				13 31 8.288145	30 30 32.95986	0.000094	0.00119	.442	49095.9	48787.9	49498.8	4	25
ICRF J133237.5-664650	1329-665				13 32 37.517448	-66 46 50.44682	0.092072	0.94670	.979	48766.9	48766.9	48766.9	1	1
ICRF J133752.4-650924	1334-649				13 37 52.444609	-65 9 24.89757	0.000798	0.00335	-.259	48969.7	48043.8	49895.6	2	10
ICRF J134022.9+375443	1338+381			*	13 40 22.951763	37 54 43.83468	0.000111	0.00120	-.483	49287.4	49031.1	49848.8	7	29
ICRF J134733.3+121724	1345+125	4	4		13 47 33.361635	12 17 24.24023	0.000028	0.00064	.032	49297.5	47659.7	49542.2	9	187
ICRF J135256.5-441240	1349-439				13 52 56.534909	-44 12 40.38741	0.000038	0.00066	-.548	48911.6	48110.9	49692.6	16	49
ICRF J135406.8-020603	1351-018				13 54 6.895314	- 2 6 3.19053	0.000018	0.00030	.023	49625.3	48573.8	49910.8	38	417
ICRF J135546.6-632642	1352-632				13 55 46.611660	-63 26 42.57485	0.000518	0.00349	.265	49573.6	49535.0	49650.8	2	6
ICRF J135711.2-152728	1354-152				13 57 11.244965	-15 27 28.78636	0.000020	0.00031	-.512	48251.4	46875.8	49662.8	91	309
ICRF J135755.3+764321	1357+769	1	1		13 57 55.371524	76 43 21.05116	0.000076	0.00026	-.068	49585.2	47011.4	49924.8	178	17427
ICRF J135900.1-415252	1355-416				13 59 0.183255	-41 52 52.63210	0.001757	0.01158	-.393	48110.9	48110.9	48110.9	1	4
ICRF J140445.8-013021	1402-012				14 4 45.895486	- 1 30 21.94945	0.000122	0.00160	.297	49287.6	48664.8	49690.0	6	34
ICRF J140501.1+041535	1402+044	2	1		14 5 1.119805	4 15 35.81906	0.000018	0.00031	-.212	49589.6	48888.7	49883.8	33	322
ICRF J140856.4-075226	1406-076				14 8 56.481199	- 7 52 26.66622	0.000041	0.00043	-.673	48701.5	47176.5	49790.7	22	58
ICRF J141154.8+213423	1409+218				14 11 54.862136	21 34 23.43722	0.000076	0.00209	-.406	49001.4	48863.2	49498.8	2	23
ICRF J141946.6+382148	1417+385				14 19 46.613740	38 21 48.47498	0.000050	0.00054	-.193	49750.8	49750.8	49750.8	1	30

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X	S	H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation	First MJD of observation	Last MJD of observation	Nb sess.	Nb del. (4)
ICRF J141959.2+270625	1417+273				14 19 59.297083	27 6 25.55244	0.000070	0.00166	-.455	48930.3	48863.2	49533.8	2	30
ICRF J142230.3+322310	1420+326				14 22 30.379016	32 23 10.43924	0.000082	0.00579	-.568	49086.8	48863.2	49533.8	2	9
ICRF J142700.3+234800	1424+240			*	14 27 0.391837	23 48 0.03493	0.000073	0.00149	-.500	48914.2	48863.2	49554.8	3	40
ICRF J143257.6-180135	1430-178				14 32 57.690619	-18 1 35.24845	0.000059	0.00445	-.897	48767.6	48160.3	49565.9	13	23
ICRF J143439.7+195200	1432+200	2	1		14 34 39.793350	19 52 0.73552	0.000141	0.00099	.016	49740.0	48863.2	49820.5	3	169
ICRF J143535.4+301224	1433+304	2	1		14 35 35.402170	30 12 24.51975	0.000173	0.00211	.168	48926.8	48863.2	49498.8	2	10
ICRF J143809.4-220454	1435-218				14 38 9.469411	-22 4 54.74790	0.000081	0.00069	-.746	48901.4	47176.5	49445.6	23	60
ICRF J144553.3-162901	1443-162				14 45 53.376319	-16 29 1.61908	0.000032	0.00046	-.872	48583.9	47941.3	49565.9	13	29
ICRF J145427.4-374733	1451-375				14 54 27.409777	-37 47 33.14437	0.000029	0.00047	-.010	48839.4	47511.1	49650.8	12	60
ICRF J145432.9-401232	1451-400				14 54 32.912346	-40 12 32.51446	0.000029	0.00037	-.050	49399.3	47640.2	49895.6	14	108
ICRF J150506.4+032630	1502+036				15 5 6.477205	3 26 30.81298	0.000032	0.00075	-.180	49101.0	48853.8	49554.8	3	49
ICRF J150704.7-165230	1504-166				15 7 4.786942	-16 52 30.26722	0.000021	0.00032	-.659	48398.5	46840.8	49694.8	39	122
ICRF J151002.9+570243	1508+572				15 10 2.922371	57 2 43.37606	0.000035	0.00030	-.067	49715.9	49541.8	49917.8	8	213
ICRF J151344.8-101200	1511-100				15 13 44.893455	-10 12 0.26452	0.000024	0.00038	-.685	48337.8	46875.8	49611.9	23	68
ICRF J151741.8-242219	1514-241			*	15 17 41.813134	-24 22 19.47579	0.000026	0.00035	-.702	48400.4	46840.8	49565.9	20	59
ICRF J152237.6-273010	1519-273				15 22 37.675993	-27 30 10.78535	0.000020	0.00029	-.206	49033.8	46875.8	49895.6	119	531
ICRF J154929.4+023701	1546+027	2	1		15 49 29.436848	2 37 1.16336	0.000018	0.00032	-.362	49030.9	47005.8	49848.8	29	240
ICRF J155059.1-825806	1540-828				15 50 59.144724	-82 58 6.84194	0.004432	0.00508	.149	48779.1	48043.8	49330.5	2	7
ICRF J155751.4-000150	1555+001				15 57 51.433965	- 0 1 50.41366	0.000018	0.00030	-.570	48287.7	44773.8	49659.8	62	235
ICRF J155821.9-140959	1555-140				15 58 21.949635	-14 9 59.07210	0.001209	0.01638	-.999	48833.4	48704.1	48977.5	4	4
ICRF J155930.9+030448	1557+032				15 59 30.972613	3 4 48.25682	0.000029	0.00040	-.133	49678.0	49541.8	49883.8	7	91
ICRF J160140.4+431647	1600+432				16 1 40.443935	43 16 47.75702	0.000164	0.00210	-.012	49883.8	49883.8	49883.8	1	5
ICRF J160140.5+431646	1600+431				16 1 40.515432	43 16 46.47617	0.000161	0.00471	.292	49883.8	49883.8	49883.8	1	3
ICRF J160431.0-444131	1600-445				16 4 31.020029	-44 41 31.95353	0.042414	0.65519	.999	49535.0	49535.0	49535.0	1	1
ICRF J161341.0+341247	1611+343	3	1	*	16 13 41.064250	34 12 47.90905	0.000021	0.00026	-.216	48648.8	44773.8	49924.8	834	27514
ICRF J161637.5+045932	1614+051				16 16 37.556818	4 59 32.73653	0.000018	0.00030	-.154	49199.1	47605.1	49904.8	41	296
ICRF J162606.0-295126	1622-297				16 26 6.020829	-29 51 26.97074	0.000029	0.00038	-.613	48640.5	46840.8	49917.8	20	124
ICRF J165039.5-294346	1647-296				16 50 39.544133	-29 43 46.95469	0.000072	0.00082	-.958	48973.9	48346.0	49662.8	13	17
ICRF J165352.2+394536	1652+398	3	2	*	16 53 52.216693	39 45 36.60877	0.000023	0.00029	-.029	49018.2	45997.8	49910.8	25	420
ICRF J165802.7+473749	1656+477				16 58 2.779637	47 37 49.23143	0.000044	0.00045	.000	49234.0	49184.9	49498.8	2	32

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb del. (4)
ICRF J165809.0+074127	1655+077		16 58 9.011473	7 41 27.54050	0.000021	0.00037	-.387	48578.9	47407.6	49659.8	15	96
ICRF J165833.4+051516	1656+053		16 58 33.447346	5 15 16.44429	0.000018	0.00031	-.089	48005.3	44773.8	49429.9	41	584
ICRF J170053.1-261051	1657-261		17 0 53.154046	-26 10 51.72492	0.000024	0.00033	-.620	48238.6	46875.8	49662.8	36	123
ICRF J170717.7+453610	1705+456	3 2	17 7 17.753406	45 36 10.55272	0.000069	0.00077	-.079	49682.5	48434.7	49820.5	6	183
ICRF J173315.1-372232	1729-373		17 33 15.192721	-37 22 32.39565	0.000550	0.00354	-.335	49650.8	49650.8	49650.8	1	2
ICRF J173420.5+385751	1732+389		17 34 20.578531	38 57 51.44298	0.000023	0.00029	-.174	48576.0	46977.9	49600.3	43	257
ICRF J173549.0+504911	1734+508		17 35 49.005166	50 49 11.56586	0.000037	0.00042	.219	49429.9	49429.9	49429.9	1	87
ICRF J173735.7-563403	1733-565		17 37 35.770462	-56 34 3.15477	0.000665	0.00430	.887	49173.5	48388.4	49330.5	2	6
ICRF J173927.3+495503	1738+499		17 39 27.390512	49 55 3.36831	0.000039	0.00037	-.118	49590.6	49422.9	49750.8	3	92
ICRF J173957.1+473758	1738+476	2 1	17 39 57.129064	47 37 58.36131	0.000031	0.00034	.176	48364.5	47288.7	49848.8	13	135
ICRF J174036.9+521143	1739+522	2 1	17 40 36.977847	52 11 43.40753	0.000028	0.00026	-.104	48846.4	47165.8	49909.6	1006	58894
ICRF J174425.4-514443	1740-517		17 44 25.450704	-51 44 43.79284	0.000633	0.00373	.627	48766.9	48766.9	48766.9	1	5
ICRF J174726.6+465850	1746+470		17 47 26.647300	46 58 50.92630	0.000036	0.00037	-.231	49596.3	49422.9	49750.8	3	89
ICRF J175132.8+093900	1749+096	1 1	17 51 32.818576	9 39 0.72846	0.000017	0.00026	-.436	48923.8	44447.0	49924.8	825	20158
ICRF J175151.2-252400	1748-253		17 51 51.263054	-25 24 0.06011	0.000470	0.00503	.230	48802.3	48110.9	49098.6	2	10
ICRF J180024.7+384830	1758+388		18 0 24.765360	38 48 30.69771	0.000024	0.00029	-.052	49570.0	49429.9	49826.8	4	157
ICRF J180045.6+782804	1803+784	2 1 *	18 0 45.683911	78 28 4.01854	0.000087	0.00026	-.027	47884.0	45138.8	49917.8	1620	68029
ICRF J180650.6+694928	1807+698		18 6 50.680653	69 49 28.10859	0.000052	0.00027	.032	48181.8	45997.8	49882.8	50	423
ICRF J180821.8+454220	1806+456		18 8 21.885910	45 42 20.86644	0.000034	0.00040	-.338	49495.4	49422.9	49547.8	2	50
ICRF J180957.8-455241	1806-458		18 9 57.871831	-45 52 41.01367	0.000485	0.00233	-.565	49629.6	49629.6	49629.6	1	2
ICRF J181935.0-634548	1814-637		18 19 35.002525	-63 45 48.19427	0.000794	0.00851	-.293	49277.1	48162.4	49895.6	3	12
ICRF J182057.8-252812	1817-254		18 20 57.848684	-25 28 12.58397	0.000119	0.00104	-.117	49362.8	48804.9	49833.8	4	24
ICRF J182402.8+104423	1821+107	3 1	18 24 2.855269	10 44 23.77392	0.000020	0.00036	-.156	48819.1	45466.3	49790.7	20	341
ICRF J183537.2-714958	1829-718		18 35 37.205091	-71 49 58.21900	0.001166	0.00475	.412	48766.9	48766.9	48766.9	1	7
ICRF J183728.7-710843	1831-711		18 37 28.714952	-71 8 43.55453	0.000064	0.00033	-.004	48850.0	47626.5	49692.6	17	189
ICRF J191109.6-200655	1908-201		19 11 9.652867	-20 6 55.10860	0.000030	0.00091	-.623	48874.2	46840.8	49790.7	41	153
ICRF J192332.1-210433	1920-211		19 23 32.189804	-21 4 33.33284	0.000024	0.00035	-.724	48637.7	47407.6	49662.8	40	92
ICRF J192559.6+210626	1923+210		19 25 59.605374	21 6 26.16209	0.000019	0.00028	-.197	48372.8	45138.8	49662.8	109	665
ICRF J192840.8+084848	1926+087		19 28 40.855498	8 48 48.41260	0.000075	0.00258	.041	49678.3	49541.8	49690.0	3	29
ICRF J193006.1-605609	1925-610		19 30 6.160015	-60 56 9.18402	0.000082	0.00098	-.157	48438.5	47626.5	49330.5	5	18

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb del. (4)
ICRF J193124.9+224331	1929+226	1 1	19 31 24.916786	22 43 31.25884	0.000029	0.00050	-.149	49755.2	48614.0	49904.8	9	256
ICRF J193435.0+104340	1932+106		19 34 35.025577	10 43 40.36503	0.000050	0.00173	-.310	49690.0	49690.0	49690.0	1	22
ICRF J193510.4+203154	1932+204	1 1	19 35 10.472891	20 31 54.15344	0.000041	0.00137	.232	49168.1	48804.9	49554.8	5	22
ICRF J193716.2-395801	1933-400		19 37 16.217368	-39 58 1.55290	0.000034	0.00046	-.604	48596.7	47640.2	49662.8	23	85
ICRF J193925.0-634245	1934-638		19 39 25.026661	-63 42 45.62554	0.000430	0.00187	-.214	48963.3	48766.9	49650.8	2	9
ICRF J193926.6-152543	1936-155		19 39 26.657726	-15 25 43.05792	0.000029	0.00108	-.839	48722.5	47176.5	49662.8	22	62
ICRF J193957.2-100241	1937-101		19 39 57.256570	-10 2 41.52067	0.000027	0.00096	-.215	49357.5	48110.9	49650.8	5	77
ICRF J194121.7-621121	1936-623		19 41 21.768473	-62 11 21.05558	0.000753	0.00583	-.331	48162.4	48162.4	48162.4	1	5
ICRF J194606.2+230004	1943+228		19 46 6.251939	23 0 4.41107	0.000518	0.00620	-.408	48861.0	48797.8	48919.9	3	10
ICRF J195330.8+353759	1951+355	2 1	19 53 30.875733	35 37 59.36071	0.000073	0.00207	.554	49144.8	48919.9	49533.8	3	32
ICRF J195740.5+333827	1955+335	*	19 57 40.550036	33 38 27.94555	0.000099	0.00148	-.429	49163.8	49098.6	49554.8	2	21
ICRF J200925.3-484953	2005-489	*	20 9 25.390729	-48 49 53.72128	0.000643	0.00737	.369	48833.8	47626.5	49750.8	7	36
ICRF J202510.8+334300	2023+335	3 3	20 25 10.842102	33 43 0.21600	0.000142	0.00193	-.454	48976.5	48223.7	49667.9	4	27
ICRF J204008.7-250746	2037-253		20 40 8.772845	-25 7 46.66253	0.000060	0.00056	-.420	48666.1	47686.1	49650.8	3	18
ICRF J205741.6-373402	2054-377		20 57 41.603472	-37 34 2.98978	0.000258	0.00195	-.426	49089.5	48162.4	49398.5	2	12
ICRF J210159.1-421916	2058-425		21 1 59.114188	-42 19 16.16206	0.000936	0.00935	.669	49017.6	48162.4	49895.6	4	11
ICRF J210217.0+470216	2100+468	*	21 2 17.056050	47 2 16.25468	0.000181	0.00193	.186	49467.2	49177.8	49690.0	3	10
ICRF J211810.5-301911	2115-305		21 18 10.597647	-30 19 11.60596	0.000236	0.00247	-.741	48904.1	48162.4	49398.5	2	5
ICRF J212912.1-153841	2126-158		21 29 12.175895	-15 38 41.04054	0.000020	0.00033	-.242	49109.4	47176.5	49883.8	44	163
ICRF J213410.3-015317	2131-021	2 1	21 34 10.309614	- 1 53 17.23883	0.000018	0.00030	-.537	48519.0	47176.5	49736.9	56	195
ICRF J214710.1+092946	2144+092		21 47 10.162975	9 29 46.67236	0.000020	0.00032	-.284	47658.1	45997.8	49848.8	23	321
ICRF J214712.7-753613	2142-758		21 47 12.730293	-75 36 13.22513	0.000192	0.00060	.280	48289.6	47626.5	48749.6	4	14
ICRF J215137.8+055212	2149+056		21 51 37.875502	5 52 12.95459	0.000021	0.00034	-.662	48377.8	45466.3	49662.8	23	125
ICRF J215705.9-694123	2152-699		21 57 5.980566	-69 41 23.68553	0.000212	0.00132	.780	48509.0	48110.9	49330.5	3	11
ICRF J215852.0-301332	2155-304		21 58 52.065068	-30 13 32.11840	0.000354	0.00191	-.376	49253.6	48766.9	49895.6	3	14
ICRF J221302.4-252930	2210-257		22 13 2.498009	-25 29 30.08140	0.000084	0.00201	-.400	48701.6	46875.8	49694.8	3	13
ICRF J221438.5-383545	2211-388		22 14 38.569326	-38 35 45.01022	0.000564	0.00353	.160	49127.8	48766.9	49398.5	2	7
ICRF J221620.0+351814	2214+350		22 16 20.009936	35 18 14.18072	0.000051	0.00080	-.197	49750.8	49750.8	49750.8	1	28
ICRF J222547.2-045701	2223-052		22 25 47.259294	- 4 57 1.39048	0.000019	0.00061	-.646	48183.0	44773.8	49736.9	34	111
ICRF J222940.0-083254	2227-088	1 1	22 29 40.084339	- 8 32 54.43530	0.000018	0.00062	-.309	49215.2	45466.3	49820.5	37	208

Table 6. (cont.) Coordinates of the candidate sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Corr. RA-Dc	Mean MJD of observation span	First MJD of observation span	Last MJD of observation span	Nb sess.	Nb del. (4)
ICRF J223040.2-394252	2227-399		22 30 40.278611	-39 42 52.06692	0.000053	0.00106	.510	48896.9	48162.4	49895.6	4	16
ICRF J223622.4+282857	2234+282	2 1	22 36 22.470868	28 28 57.41338	0.000019	0.00026	.100	48611.2	45725.8	49924.8	1125	34156
ICRF J223634.0-143322	2233-148		22 36 34.087158	-14 33 22.18931	0.000055	0.00062	-.694	48636.1	47176.5	49662.8	16	32
ICRF J224838.6-323552	2245-328		22 48 38.685719	-32 35 52.18748	0.000073	0.00161	-.795	48728.9	47394.1	49662.8	26	85
ICRF J225504.2-084404	2252-090	3 3	22 55 4.239777	- 8 44 4.02151	0.000057	0.00234	-.619	49610.8	47394.1	49820.5	17	137
ICRF J225536.7+420252	2253+417		22 55 36.707842	42 2 52.53256	0.000027	0.00031	-.146	48127.3	47005.8	49662.8	46	266
ICRF J225717.5+024317	2254+024	1 1	22 57 17.563086	2 43 17.51193	0.000022	0.00050	-.679	48809.9	47394.1	49848.8	22	122
ICRF J230223.8-371806	2259-375		23 2 23.888469	-37 18 6.84027	0.008831	0.06321	-.434	48746.5	48162.4	49330.5	2	2
ICRF J230305.8-303011	2300-307		23 3 5.821287	-30 30 11.47289	0.021640	0.03255	.246	48368.5	48110.9	49398.5	2	5
ICRF J230343.5-680737	2300-683	*	23 3 43.565673	-68 7 37.45706	0.035391	0.45061	-.999	49650.8	49650.8	49650.8	1	1
ICRF J231409.3-445549	2311-452		23 14 9.382823	-44 55 49.23782	0.000320	0.00259	.111	48863.3	48162.4	49330.5	2	10
ICRF J232044.8+051349	2318+049		23 20 44.856618	5 13 49.95245	0.000019	0.00032	-.606	48446.7	47019.9	49667.9	35	166
ICRF J232331.9-031705	2320-035		23 23 31.953753	- 3 17 5.02363	0.000018	0.00040	-.552	48886.2	47394.1	49736.9	54	193
ICRF J232747.9-144755	2325-150		23 27 47.964255	-14 47 55.75021	0.000051	0.00102	.302	48034.2	47176.5	49535.0	2	11
ICRF J233040.8+110018	2328+107		23 30 40.852252	11 0 18.70971	0.000020	0.00032	-.498	48250.9	46977.9	49611.9	27	157
ICRF J233355.2-234340	2331-240		23 33 55.237802	-23 43 40.65782	0.000080	0.00233	-.773	48803.8	46875.8	49398.5	25	67
ICRF J233612.1-523621	2333-528		23 36 12.144624	-52 36 21.94997	0.000534	0.00372	.468	48579.6	48110.9	49573.6	3	9
ICRF J233757.3-023057	2335-027	3 1	23 37 57.339083	- 2 30 57.62923	0.000096	0.00784	-.716	48729.9	47941.3	49600.3	24	40
ICRF J234636.8+093045	2344+092		23 46 36.838560	9 30 45.51493	0.000020	0.00032	-.458	48573.6	47288.7	49667.9	25	122
ICRF J235430.1-151311	2351-154		23 54 30.195186	-15 13 11.21285	0.000103	0.00538	-.675	48664.2	47394.1	49694.8	31	62
ICRF J235600.6-682003	2353-686		23 56 0.681458	-68 20 3.47158	0.000103	0.00056	-.012	48560.7	48162.4	48757.4	3	17
ICRF J235753.2-531113	2355-534		23 57 53.266123	-53 11 13.68933	0.000040	0.00048	.180	48516.8	47626.5	49790.7	18	81
ICRF J235810.8-102008	2355-106		23 58 10.882414	-10 20 8.61132	0.000018	0.00028	-.261	48848.8	47394.1	49883.8	134	616
ICRF J235933.1+385042	2356+385		23 59 33.180777	38 50 42.31796	0.000085	0.00144	-.282	49519.8	49519.8	49519.8	1	4

Notes

(1) ICRF Designations, constructed from J2000.0 coordinates with the format
ICRF JHHMMSS.s+DDMMSS or ICRF JHHMMSS.s-DDMMSS.
They follow the recommendations of the IAU Task Group on Designations.

(2) IERS Designations, previously constructed from B1950 coordinates.
The complete format, including acronym and epoch in addition to the coordinates, is
IERS BHHMM+DDd or IERS BHHMM-DDd

(3) X: Structure index at X band
S: Structure index at S band
H: Asterisk indicates that the source serves to link the Hipparcos stellar reference frame to the ICRS.

(4) Number of pairs of delay and delay rate observations.

Table 7. Coordinates of the other sources in ICRF (see notes p. II-43)

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X	S	H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Dec. "	Mean MJD of observation	First MJD	Last MJD span	Nb sess.	Nb del. (4)
ICRF J001945.7+732730	0016+731	2	1		0 19 45.786433	73 27 30.01751	0.000093	0.00039	48894.7	47165.8	49750.8	411	21652
ICRF J002232.4+060804	0019+058				0 22 32.441263	6 8 4.26943	0.000172	0.00351	49127.9	47394.1	49790.7	18	51
ICRF J002914.2+345632	0026+346	4	4		0 29 14.242502	34 56 32.24702	0.000312	0.00248	49382.7	47011.4	49820.5	12	201
ICRF J005041.3-092905	0048-097	1	1		0 50 41.317392	- 9 29 5.21022	0.000037	0.00090	49249.2	44773.8	49924.8	374	9641
ICRF J010245.7+582411	0059+581	2	1		1 2 45.762387	58 24 11.13669	0.000046	0.00038	49501.0	48720.9	49924.8	244	31138
ICRF J010645.1-403419	0104-408				1 6 45.107969	-40 34 19.96036	0.000150	0.00259	49399.7	47511.1	49917.8	116	719
ICRF J010838.7+013500	0106+013				1 8 38.771070	1 35 0.31714	0.000079	0.00214	46746.8	44447.0	49897.8	1204	24158
ICRF J011612.5-113615	0113-118				1 16 12.521959	-11 36 15.43371	0.000103	0.00293	48898.9	47176.5	49600.3	28	92
ICRF J013741.2+330935	0134+329			*	1 37 41.299454	33 9 35.13378	0.000194	0.00650	48597.5	48194.7	49667.9	10	64
ICRF J021046.2-510101	0208-512				2 10 46.200412	-51 1 1.89187	0.000105	0.00128	49152.9	47305.8	49911.8	166	1871
ICRF J021730.8+734932	0212+735	2	2		2 17 30.813365	73 49 32.62180	0.000118	0.00049	47445.3	44857.8	49600.3	1304	42970
ICRF J024008.1-230915	0237-233	4	3		2 40 8.174536	-23 9 15.73288	0.000407	0.00752	49347.5	48126.7	49662.8	19	244
ICRF J024104.7-081520	0238-084	4	2		2 41 4.798520	- 8 15 20.75174	0.000056	0.00290	49625.2	47176.5	49917.8	38	378
ICRF J030335.2+471616	0300+470	2	1		3 3 35.242225	47 16 16.27549	0.000047	0.00057	48144.6	45138.8	49736.9	736	23188
ICRF J031948.1+413042	0316+413			*	3 19 48.160106	41 30 42.10328	0.000182	0.00380	46427.5	44090.5	49751.9	195	5784
ICRF J032153.1+122113	0319+121				3 21 53.103501	12 21 13.95380	0.000068	0.00148	48586.6	47019.9	49790.7	12	144
ICRF J032957.6+275615	0326+277			*	3 29 57.669425	27 56 15.49901	0.000138	0.00210	48673.3	47165.8	49694.8	24	108
ICRF J033413.6-400825	0332-403				3 34 13.654484	-40 8 25.39779	0.000142	0.00163	48667.0	47640.2	49790.7	15	72
ICRF J033630.1+321829	0333+321				3 36 30.107611	32 18 29.34237	0.000068	0.00117	48549.1	44773.8	49576.9	73	424
ICRF J034035.6-211931	0338-214				3 40 35.607839	-21 19 31.17150	0.000097	0.00072	48292.6	46875.8	49629.6	4	34
ICRF J035929.7+505750	0355+508				3 59 29.747263	50 57 50.16149	0.000146	0.00142	46522.7	44090.5	49771.8	509	14647
ICRF J040353.7-360501	0402-362				4 3 53.749905	-36 5 1.91299	0.000142	0.00247	48953.0	47415.7	49924.8	104	445
ICRF J040534.0-130813	0403-132				4 5 34.003421	-13 8 13.69129	0.000052	0.00149	48959.3	47176.5	49650.8	3	43
ICRF J040820.3+303230	0405+304			*	4 8 20.377574	30 32 30.49043	0.000201	0.00512	49508.6	49177.8	49690.0	8	56
ICRF J042315.8-012033	0420-014	3	1	*	4 23 15.800726	- 1 20 33.06524	0.000051	0.00116	48071.3	44773.8	49895.6	1289	28507
ICRF J043311.0+052115	0430+052	4	3	*	4 33 11.095560	5 21 15.61961	0.000117	0.00261	46766.3	44090.5	49542.2	51	679
ICRF J043701.4-184448	0434-188				4 37 1.482726	-18 44 48.61337	0.000095	0.00212	48633.6	46875.8	49861.8	120	478
ICRF J045703.1-232452	0454-234	2	1		4 57 3.179223	-23 24 52.01989	0.000065	0.00158	48881.0	46440.9	49924.8	1090	15911
ICRF J050321.1+020304	0500+019				5 3 21.197194	2 3 4.67555	0.000097	0.00328	48702.4	47394.1	49848.8	13	92
ICRF J053007.9-250329	0528-250				5 30 7.962815	-25 3 29.89975	0.000113	0.00122	48755.0	47512.0	49650.8	12	72

Table 7. (cont.) Coordinates of the other sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Mean MJD of observation	First MJD	Last MJD span	Nb sess.	Nb del. (4)
ICRF J053850.3-440508	0537-441	3 1 *	5 38 50.361540	-44 5 8.93895	0.000126	0.00216	49238.2	47305.8	49911.8	266	2098
ICRF J053942.3+143345	0536+145	1 1	5 39 42.365997	14 33 45.56181	0.000061	0.00286	48975.3	47605.1	49667.9	32	78
ICRF J071338.1+434917	0710+439	4 3	7 13 38.164136	43 49 17.20702	0.000120	0.00272	49264.0	48179.7	49611.9	23	307
ICRF J071424.8+353439	0711+356		7 14 24.817575	35 34 39.79350	0.000131	0.00223	48238.8	45466.3	49667.9	13	131
ICRF J073019.1-114112	0727-115	2 1	7 30 19.112468	-11 41 12.60041	0.000043	0.00105	48776.5	45259.2	49924.8	1384	32167
ICRF J073807.3+174218	0735+178	*	7 38 7.393745	17 42 18.99829	0.000039	0.00056	49065.8	44773.8	49750.8	503	12686
ICRF J074533.0+101112	0742+103	4 1	7 45 33.059509	10 11 12.69254	0.000049	0.00108	48006.6	44773.8	49820.5	316	6712
ICRF J074554.0-004417	0743-006	2 1	7 45 54.082299	- 0 44 17.53921	0.000105	0.00284	47387.2	45997.8	49694.8	25	198
ICRF J092129.3-261843	0919-260	3 2	9 21 29.353871	-26 18 43.38615	0.000128	0.00339	49223.8	46840.8	49911.8	187	2389
ICRF J092703.0+390220	0923+392	2 1	9 27 3.013906	39 2 20.85196	0.000042	0.00047	48039.2	44090.5	49924.8	2185	96427
ICRF J095533.1+690355	0951+693		9 55 33.173011	69 3 55.06104	0.000215	0.00089	49464.9	49141.8	49917.8	10	397
ICRF J095649.8+251516	0953+254	2 1	9 56 49.875356	25 15 16.04963	0.000043	0.00060	49232.2	44447.0	49909.6	250	5878
ICRF J100741.4+135629	1004+141	3 2	10 7 41.498082	13 56 29.60073	0.000050	0.00104	49254.9	47011.4	49904.8	21	317
ICRF J102429.5-005255	1021-006		10 24 29.586611	- 0 52 55.49786	0.000119	0.00244	49253.9	48664.8	49690.0	9	97
ICRF J103716.0-293402	1034-293	1 1	10 37 16.079728	-29 34 2.81318	0.000107	0.00242	48768.6	46440.9	49911.8	620	5639
ICRF J104806.6-190935	1045-188		10 48 6.620574	-19 9 35.72656	0.000084	0.00173	48683.5	47176.5	49629.6	3	18
ICRF J105829.6+013358	1055+018		10 58 29.605209	1 33 58.82372	0.000052	0.00182	47703.2	44773.8	49662.8	266	4021
ICRF J110708.6-444907	1104-445		11 7 8.694143	-44 49 7.61841	0.000152	0.00247	49113.9	47626.5	49911.8	216	1478
ICRF J112553.7+261019	1123+264		11 25 53.711931	26 10 19.97862	0.000067	0.00112	48715.5	46977.9	49848.8	147	1120
ICRF J114658.2+395834	1144+402		11 46 58.297906	39 58 34.30461	0.000078	0.00116	47065.9	45138.8	49662.8	138	2084
ICRF J122906.6+020308	1226+023	*	12 29 6.699728	2 3 8.59824	0.000119	0.00284	46610.7	44090.5	49751.9	1120	27264
ICRF J125611.1-054721	1253-055		12 56 11.166507	- 5 47 21.52481	0.000111	0.00300	47337.9	44090.5	49882.8	242	4321
ICRF J130252.4+574837	1300+580	1 1	13 2 52.465276	57 48 37.60941	0.000069	0.00075	49830.6	49422.9	49897.8	14	874
ICRF J133739.7-125724	1334-127	2 1	13 37 39.782777	-12 57 24.69308	0.000054	0.00130	48947.4	46840.8	49924.8	1080	23245
ICRF J135704.4+191907	1354+195		13 57 4.436658	19 19 7.37228	0.000057	0.00131	47372.1	44447.0	49692.6	103	1482
ICRF J140700.3+282714	1404+286	3 1 *	14 7 0.394410	28 27 14.68993	0.000051	0.00111	47270.8	44342.2	49694.8	1180	33641
ICRF J141558.8+132023	1413+135	1 3	14 15 58.817491	13 20 23.71254	0.000088	0.00260	48463.5	45138.8	49848.8	29	107
ICRF J142756.2-420619	1424-418		14 27 56.297557	-42 6 19.43749	0.000165	0.00285	48891.8	47305.8	49909.6	182	934
ICRF J145907.5+714019	1458+718	3 3	14 59 7.583954	71 40 19.86799	0.000188	0.00092	49543.4	48194.7	49820.5	10	417
ICRF J150424.9+102939	1502+106	2 1	15 4 24.979782	10 29 39.19865	0.000050	0.00137	48080.2	44447.0	49662.8	603	12485

Table 7. (cont.) Coordinates of the other sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Mean MJD of observation	First MJD	Last MJD span	Nb sess.	Nb del. (4)
ICRF J151250.5-090559	1510-089	3 1	15 12 50.532937	- 9 5 59.82948	0.000064	0.00181	48546.6	44773.8	49895.6	312	3756
ICRF J155035.2+052710	1548+056		15 50 35.269244	5 27 10.44822	0.000046	0.00103	47546.1	44773.8	49692.6	258	5739
ICRF J160913.3+264129	1607+268	4 4	16 9 13.320772	26 41 29.03661	0.000091	0.00206	49315.3	44090.5	49820.5	10	247
ICRF J161749.2-771718	1610-771		16 17 49.276341	-77 17 18.46743	0.000239	0.00092	49185.0	47626.5	49911.8	144	1849
ICRF J162546.8-252738	1622-253	1 1	16 25 46.891640	-25 27 38.32671	0.000081	0.00205	48907.5	46840.8	49924.8	750	10193
ICRF J163515.4+380804	1633+382	3 1	16 35 15.492972	38 8 4.50061	0.000061	0.00069	47914.7	44447.0	49924.8	456	13175
ICRF J164029.6+394646	1638+398	1 1	16 40 29.632774	39 46 46.02854	0.000031	0.00039	49368.5	45322.5	49924.8	233	14985
ICRF J164258.8+394836	1641+399	*	16 42 58.809950	39 48 36.99399	0.000091	0.00104	46595.1	44090.5	49771.8	1145	42754
ICRF J171913.0+174506	1717+178		17 19 13.048474	17 45 6.43699	0.000065	0.00147	48244.5	47011.4	49667.9	12	133
ICRF J173302.7-130449	1730-130		17 33 2.705785	-13 4 49.54820	0.000089	0.00250	47500.6	45259.2	49924.8	624	14448
ICRF J174358.8-035004	1741-038	1 1	17 43 58.856142	- 3 50 4.61667	0.000037	0.00084	48671.3	44773.8	49924.8	1467	41345
ICRF J175342.4+284804	1751+288	2 1	17 53 42.473634	28 48 4.93913	0.000066	0.00147	49206.3	47005.8	49848.8	22	244
ICRF J181945.3-552120	1815-553		18 19 45.399520	-55 21 20.74557	0.000198	0.00196	48756.8	47626.5	49911.8	74	554
ICRF J182314.1+793849	1826+796	4 2	18 23 14.108739	79 38 49.00270	0.000383	0.00122	49348.0	47019.9	49542.2	20	403
ICRF J190255.9+315941	1901+319		19 2 55.938891	31 59 41.70211	0.000070	0.00114	49072.8	48103.5	49756.8	19	190
ICRF J192451.0-291430	1921-293	2 1	19 24 51.055959	-29 14 30.12084	0.000084	0.00217	48425.1	45259.2	49917.8	899	15705
ICRF J192748.4+735801	1928+738		19 27 48.495214	73 58 1.56997	0.000181	0.00081	48080.8	44772.8	49611.9	116	944
ICRF J194025.5-690756	1935-692		19 40 25.528136	-69 7 56.97209	0.000340	0.00189	48972.8	47626.5	49895.6	10	36
ICRF J195510.7-611519	1950-613		19 55 10.770607	-61 15 19.14003	0.000792	0.00365	49048.7	48766.9	49330.5	2	12
ICRF J200057.0-174857	1958-179	1 1	20 0 57.090449	-17 48 57.67236	0.000069	0.00185	49067.1	46875.8	49911.8	591	7567
ICRF J200530.9+775243	2007+777	3 1	20 5 30.998513	77 52 43.24766	0.000146	0.00039	49097.1	45997.8	49694.8	235	11430
ICRF J200617.6+642445	2005+642		20 6 17.694616	64 24 45.41805	0.000133	0.00035	49573.8	49422.9	49798.8	3	52
ICRF J200744.9+402948	2005+403		20 7 44.944909	40 29 48.60472	0.000355	0.00489	48064.0	44773.8	49667.9	8	46
ICRF J201115.7-154640	2008-159		20 11 15.710887	-15 46 40.25296	0.000144	0.00507	48225.6	46840.8	49662.8	35	83
ICRF J202206.6+613658	2021+614	4 3	20 22 6.681695	61 36 58.80479	0.000123	0.00124	49304.3	47165.8	49600.3	27	658
ICRF J212344.5+053522	2121+053	2 1	21 23 44.517381	5 35 22.09321	0.000063	0.00110	47948.5	44773.8	49909.6	657	18823
ICRF J213032.8+050217	2128+048		21 30 32.877495	5 2 17.47450	0.000268	0.00328	48208.4	47288.7	49554.8	22	79
ICRF J213135.2-120704	2128-123	3 2 *	21 31 35.261752	-12 7 4.79583	0.000068	0.00168	48886.9	45466.3	49924.8	462	4897
ICRF J213638.5+004154	2134+004	4 1	21 36 38.586304	0 41 54.21353	0.000115	0.00333	46731.8	44090.5	49897.8	884	18282
ICRF J215155.5-302753	2149-307		21 51 55.524002	-30 27 53.69786	0.000078	0.00154	48434.1	47640.2	49020.5	12	61

Table 7. (cont.) Coordinates of the other sources in ICRF

ICRF Designation (1)	IERS Des. (2)	Inf. (3) X S H	Right Ascension J2000.0 h m s	Declination J2000.0 o ' "	Uncertainty R.A. s	Uncertainty Dec. "	Mean MJD of observation	First MJD	Last MJD span	Nb sess.	Nb del. (4)
ICRF J215806.2-150109	2155-152		21 58 6.281926	-15 1 9.32725	0.000186	0.00303	47917.2	46835.8	49600.3	37	130
ICRF J220243.2+421639	2200+420	3 1 *	22 2 43.291381	42 16 39.97998	0.000066	0.00087	46736.2	44090.5	49883.8	839	21824
ICRF J220314.9+314538	2201+315	3 1 *	22 3 14.975796	31 45 38.27004	0.000034	0.00053	49110.2	45492.6	49883.8	188	7996
ICRF J221852.0-033536	2216-038	3 1 *	22 18 52.037725	- 3 35 36.87944	0.000056	0.00152	47624.5	44773.8	49848.8	449	9472
ICRF J223236.4+114350	2230+114	4 2	22 32 36.408913	11 43 50.90434	0.000079	0.00202	48000.6	45997.8	49662.8	165	1315
ICRF J224618.2-120651	2243-123		22 46 18.231969	-12 6 51.27684	0.000051	0.00124	49115.0	44773.8	49924.8	133	930
ICRF J225357.7+160853	2251+158	*	22 53 57.747938	16 8 53.56088	0.000079	0.00137	46700.1	44090.5	49848.8	1121	30988
ICRF J225805.9-275821	2255-282	1 2	22 58 5.962888	-27 58 21.25659	0.000088	0.00240	48869.9	46875.8	49911.8	662	7579
ICRF J234029.0+264156	2337+264	4 3 *	23 40 29.029471	26 41 56.80428	0.000095	0.00106	49388.4	48357.8	49848.8	10	363
ICRF J234802.6-163112	2345-167		23 48 2.608517	-16 31 12.02167	0.000139	0.00287	47712.9	46440.9	49662.8	153	849
ICRF J235421.6+455304	2351+456	*	23 54 21.680275	45 53 4.23669	0.000096	0.00127	48370.1	47011.4	49662.8	29	172
ICRF J235509.4+495008	2352+495		23 55 9.458164	49 50 8.34014	0.000208	0.00262	48116.3	47019.9	49659.8	14	140

Notes

(1) ICRF Designations, constructed from J2000.0 coordinates with the format
ICRF JHHMMSS.s+DDMMSS or ICRF JHHMMSS.s-DDMMSS.
They follow the recommendations of the IAU Task Group on Designations.

(2) IERS Designations, previously constructed from B1950 coordinates.
The complete format, including acronym and epoch in addition to the coordinates, is
IERS BHHMM+DDd or IERS BHHMM-DDd

(3) X: Structure index at X band
S: Structure index at S band
H: Asterisk indicates that the source serves to link the Hipparcos stellar reference frame to the ICRS.

(4) Number of pairs of delay and delay rate observations.

References

ARIAS, E.F., FEISSEL, M., LESTRADE, J.-F., 1988: Comparison of VLBI celestial reference frames, *Astron. Astrophys.*, **199**, p. 357-363.

ARIAS, E. F., CHARLOT, P., FEISSEL, M., LESTRADE, J.-F., 1995: The Extragalactic Reference System of the International Earth Rotation Service, ICRS, *Astron. Astrophys.*, **303**, p. 604-608.

CHARLOT, P., 1990: Radio-source structure in astrometric and geodetic very long baseline interferometry, *Astron. J.*, **99**, p. 1309-1326.

CHARLOT, P., 1994: Evidence for source structure effects caused by the quasar 3C273 in geodetic VLBI data, Proceedings of the international symposium: "VLBI Technology - Progress and Future Observational Possibilities", held in Kyoto, Japan (September 1993), T. Sasao, S.Manabe, O. Kameya and M. Inoue (eds), Terra Scientific Publishing Company, Tokyo, p. 287-294.

CHARLOT, P., 1995: *IERS Technical Note No 19*, Observatoire de Paris.

FEY, A. L., CLEGG, A. W., FOMALONT, E. B., 1996: VLBA Observations of radio reference frame sources. I., *Astrophys. J. Suppl.*, **105**, p. 299-330.

FEY, A. L., CHARLOT, P., 1997: VLBA Observations of radio reference frame sources. II. Astrometric suitability based on observed structure, *Astrophys. J. Suppl.*, **111**, in press.

HERRING, T. A., 1992: Modeling atmospheric delays in the analysis of space geodetic data, Symposium on Refraction of Transatmospheric Signals in Geodesy, J. C. De Munk and T. A. Spoelstra (eds.), Netherlands Geod. Comm., Delft, p. 157-164.

IERS, 1996: *1995 IERS Annual Report*, Observatoire de Paris, p. II-19.

JOHNSTON, K. J., FEY, A. L., ZACHARIAS, N., RUSSELL, J. L., MA, C., DE VEGT, C., REYNOLDS, J. E., JAUNCEY, D. L., ARCHINAL, B. A., CARTER, M. S., CORBIN, T. E., EUBANKS, T. M., FLORKOWSKI, D. R., HALL, D. M., MCCARTHY, D. D., MCCULLOCH, P. M., KING, E. A., NICOLSON, G., SHAFFER, D. B., 1995: A radio reference frame, *Astron. J.*, **110**, p. 880-915.

MA, C., SAUBER, J. M., BELL, L. J., CLARK, T. A., GORDON, D., HIMWICH, W. E., RYAN, J. W., 1990: Measurement of horizontal motions in Alaska using very long baseline interferometry, *J. Geophys. Res.*, **95**, p. 21991-22011

McCARTHY, D.D.(ed.), 1992: *IERS Standards (1992), IERS Technical Note No13*, Observatoire de Paris.

McCARTHY, D.D.(ed.), 1996: *IERS Conventions (1996), IERS Technical Note No21*, Observatoire de Paris.

McMILLAN, D. S., MA, C., 1997: Atmospheric gradients and the VLBI terrestrial and celestial reference frames, *Geophys. Res. Lett.*, **24**, p. 453-456.

RYAN, J. W., CLARK, T. A., MA, C., GORDON, D., CAPRETTE, D. S., HIMWICH, W. E., 1993: Global scale tectonic plate motions measured with CDP VLBI data, Contributions of Space Geodesy to Geodynamics: Earth Dynamics, D. E. Smith and D. L. Turcotte (eds), *American Geophysical Union, Washington D.C., Geodynamics Series* **23**, p. 37-49.