# 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 $\sigma$ 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.

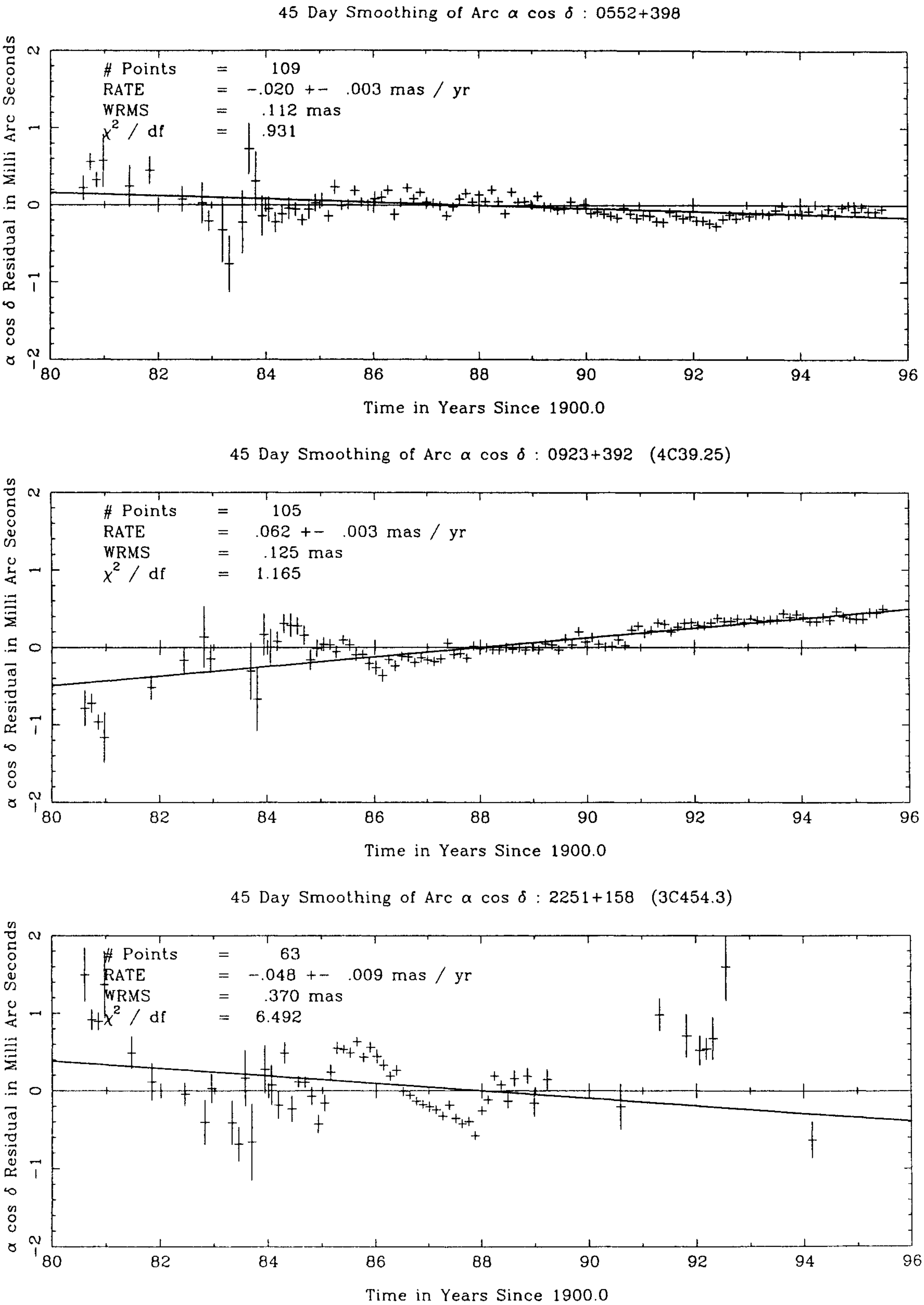


Figure 1. Smoothed time evolution of the astrometric position in right ascension for (top) 0552+398, (middle) 0923+392 (4C39.25) and (bottom) 2251+158 (3C454.3). In each case, the observed right ascension, after removal of the best fit mean, was multiplied by the cosine of the declination and subjected 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 $\chi^2$ 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 $\chi^2$ 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 $\chi^2$ 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 $\alpha$ and $\delta$ are assessed by fitting linear models to all four combinations ($\Delta\alpha$ *vs.* $\alpha$, $\delta$; $\Delta\delta$ *vs.* $\alpha$, $\delta$). 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.* $\delta$; the exceptions are $\Delta\alpha$ *vs.* $\alpha$ for IERS95-94, and $\Delta\delta$ *vs.* $\alpha$ for the WGRF no-arc-source and no-gradient variants.

Table 1. Summary of Catalogue Differences.

| Catalogue pair | | Rotation $A_1$ (0.001") | Rotation $A_2$ (0.001") | Rotation $A_3$ (0.001") | $\chi^2$ | rms residuals $\alpha$ (0.001") | rms residuals $\delta$ (0.001") | rms residuals Arc (0.001") | Max. 0.001" /100° | trend signific. |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 $\chi^2$ values of 2 to 3 for many comparisons after the removal of the rotational offsets. Note that the rotations and $\chi^2$ 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 $\sigma$ 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.

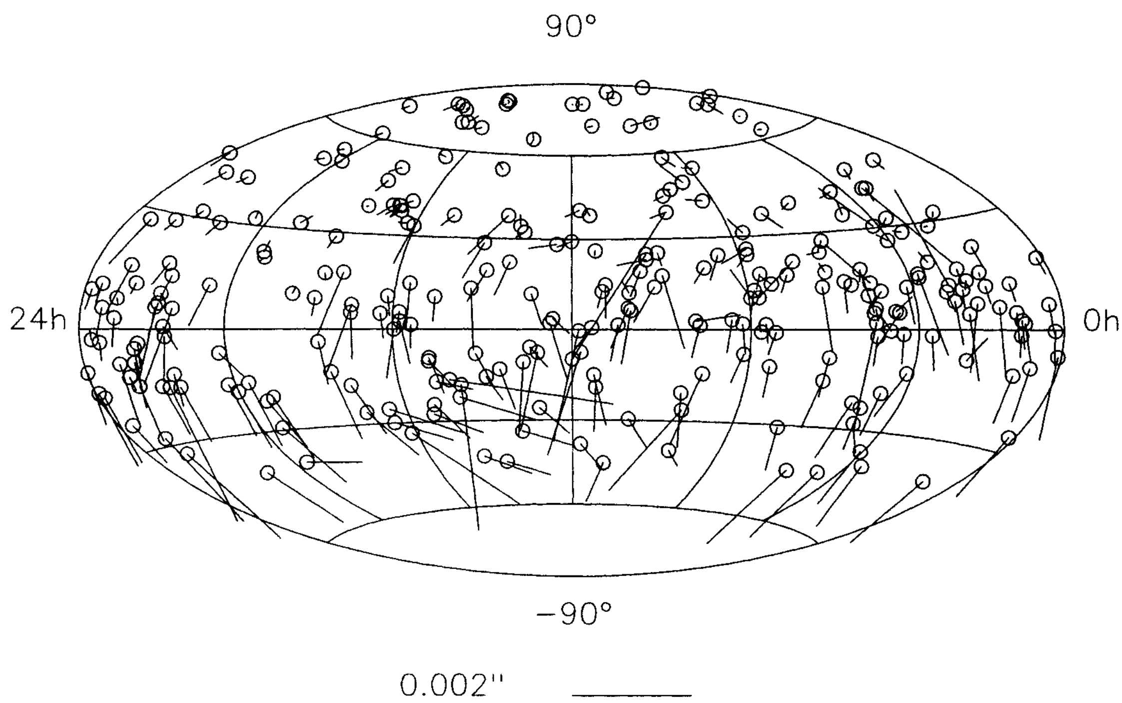


Figure 2. Vector position difference ($\alpha\cos\delta$, $\delta$) between JPL and GSFC catalogues. The data and analysis are completely disjoint. The scale is given at the bottom.

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")

| $A_1$ | $A_2$ | $A_3$ | | $\alpha\cos\delta$ | $\delta$ |
|---|---|---|---|---|---|
| 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 $\alpha\cos\delta$, $\delta$, 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.

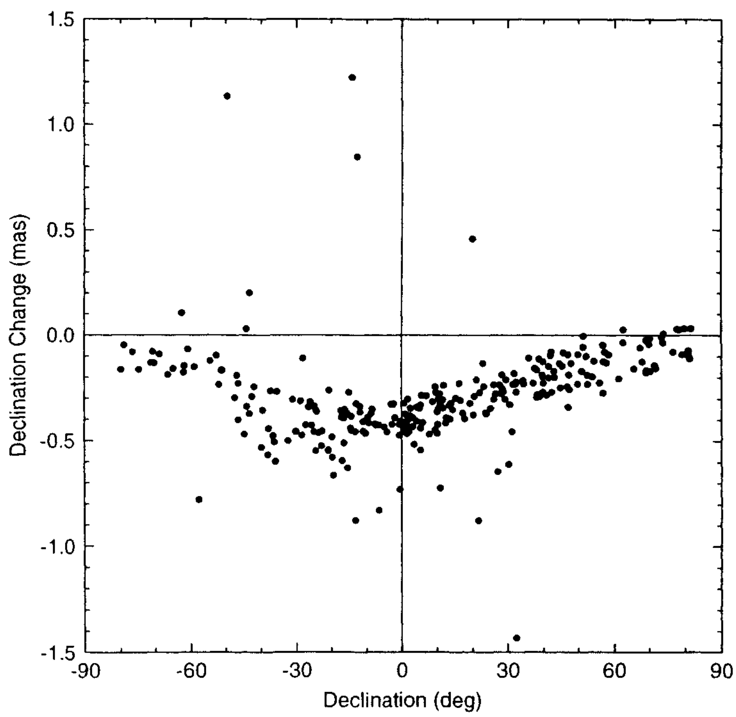


Figure 3. Effect of tropospheric gradients on declinations as a function of declination. The sense is (declinations with gradients estimated) - (declinations without gradients estimated).

**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 $\sigma_\delta$ 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 $\sigma$ 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 $\sigma$.

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.

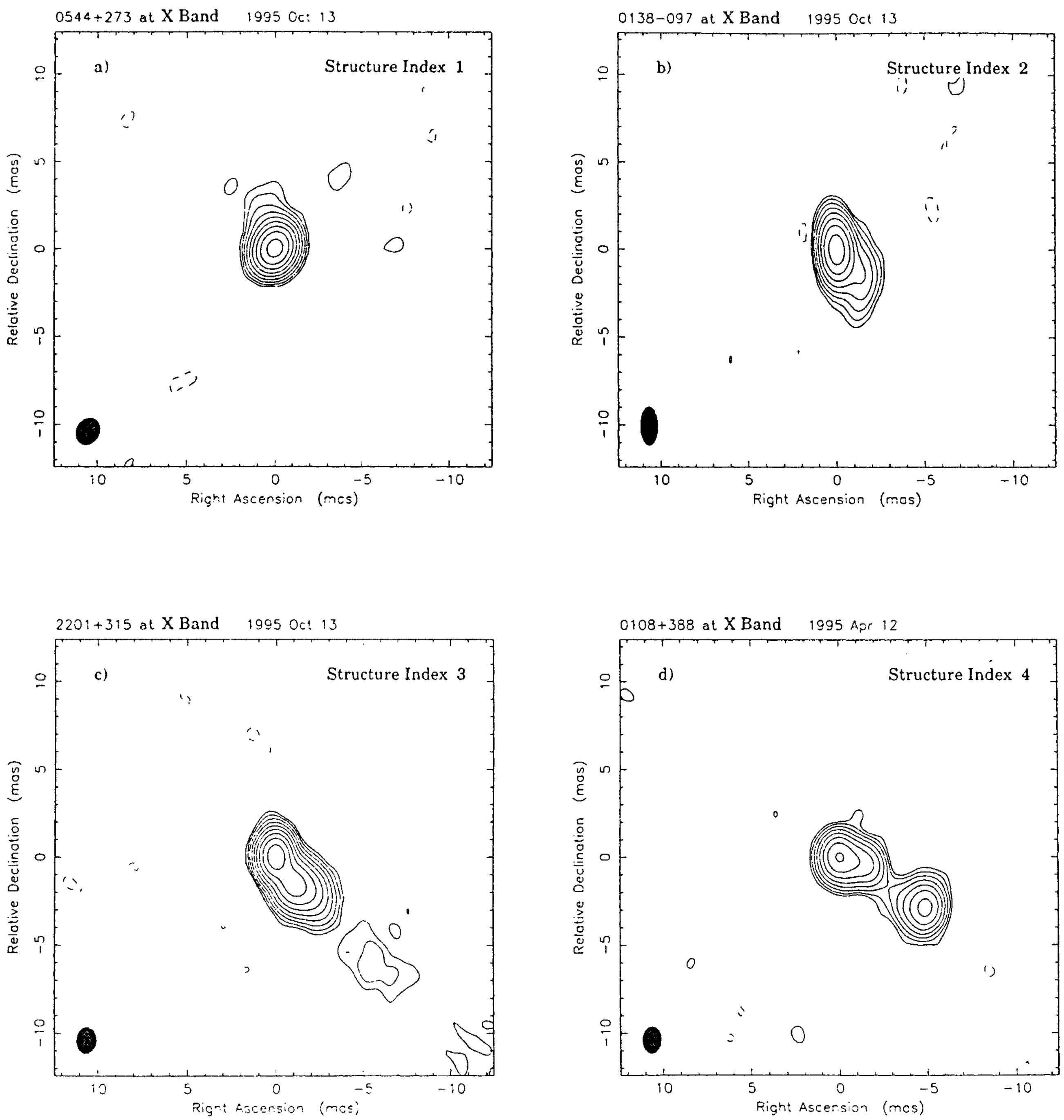


Figure 4. Contour plots of the radio emission at 4 cm wavelength for the four sources a) 0544+273, b) 0138-097, c) 2201+315, and d) 0108+388. These sources are representative of each structure index class. The X band structure index of these sources is indicated in each panel. The S band structure index 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.

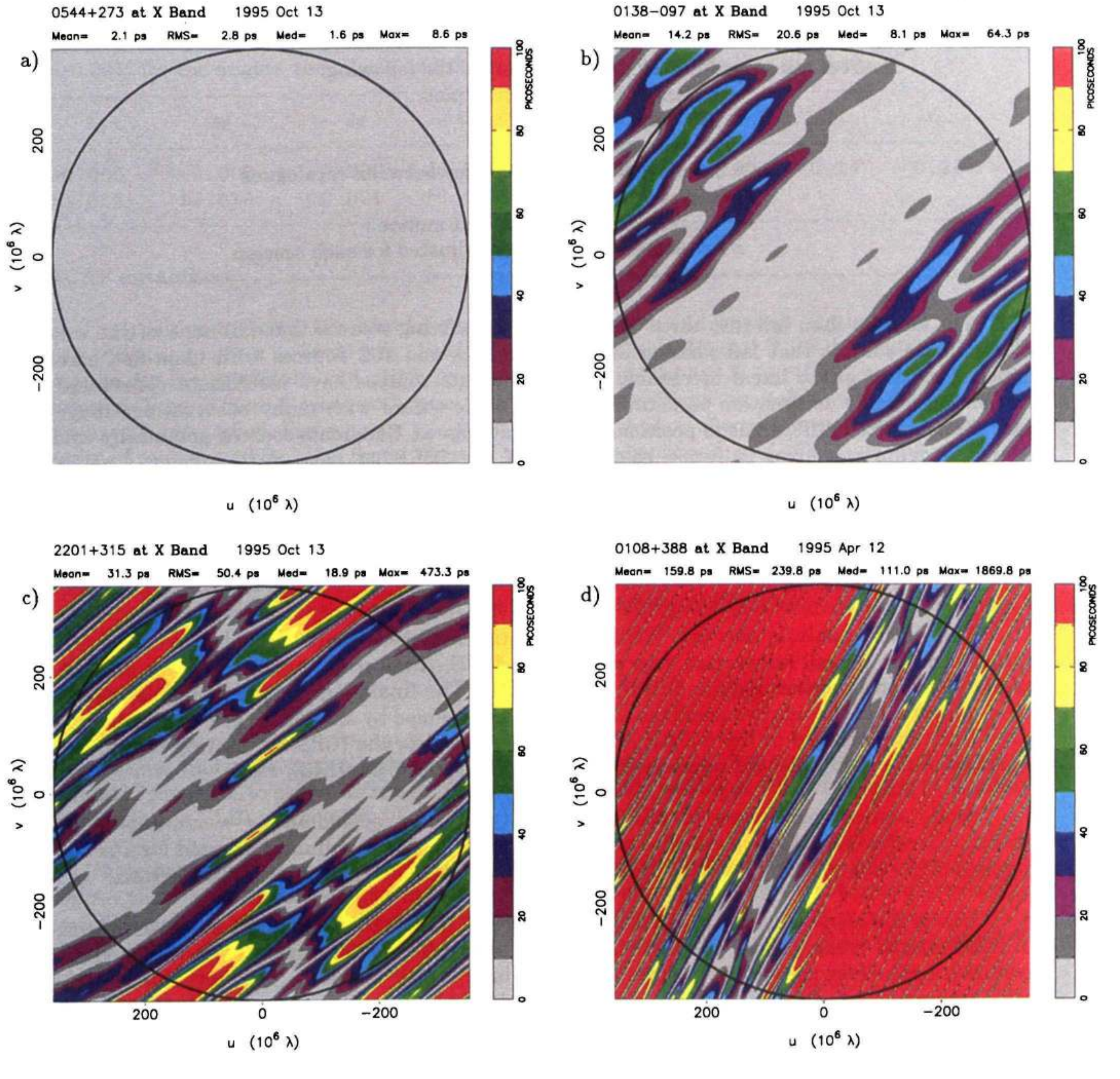


Figure 5: Color plots showing the magnitude of the structure correction (absolute value) induced in the bandwidth synthesis delay by the extended radio emission at X band of the four sources a) 0544+273, b) 0138−097, c) 2201+315 and d) 0108+388. The structure correction is plotted as a function of the 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

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

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

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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; $D_\alpha$ and $D_\delta$ are the drifts in right ascension and declination as functions of declination, respectively; $B_\delta$ is the bias in declination. All these parameters have been adjusted on the basis of the 133 common defining sources. $r_\alpha$ and $r_\delta$ are the weighted rms residuals in $\alpha \cos \delta$ and $\delta$ respectively. Units: 0.001" for the angles, the biases and the rms residuals; 0.001"/deg for the drifts.

| $A_1$ | $A_2$ | $A_3$ | $D_\alpha$ | $D_\delta$ | $B_\delta$ | $r_\alpha$ | $r_\delta$ |
|---|---|---|---|---|---|---|---|
| -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.

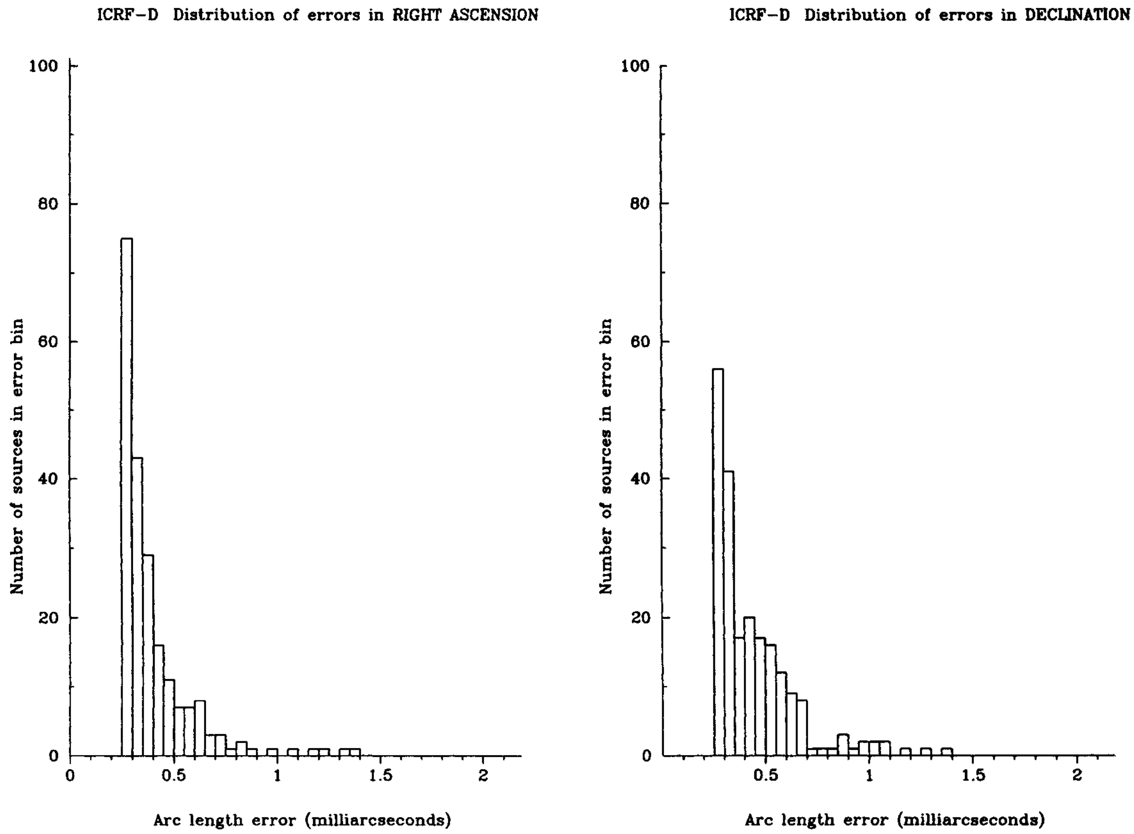
## Evolution of the ICRF

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.

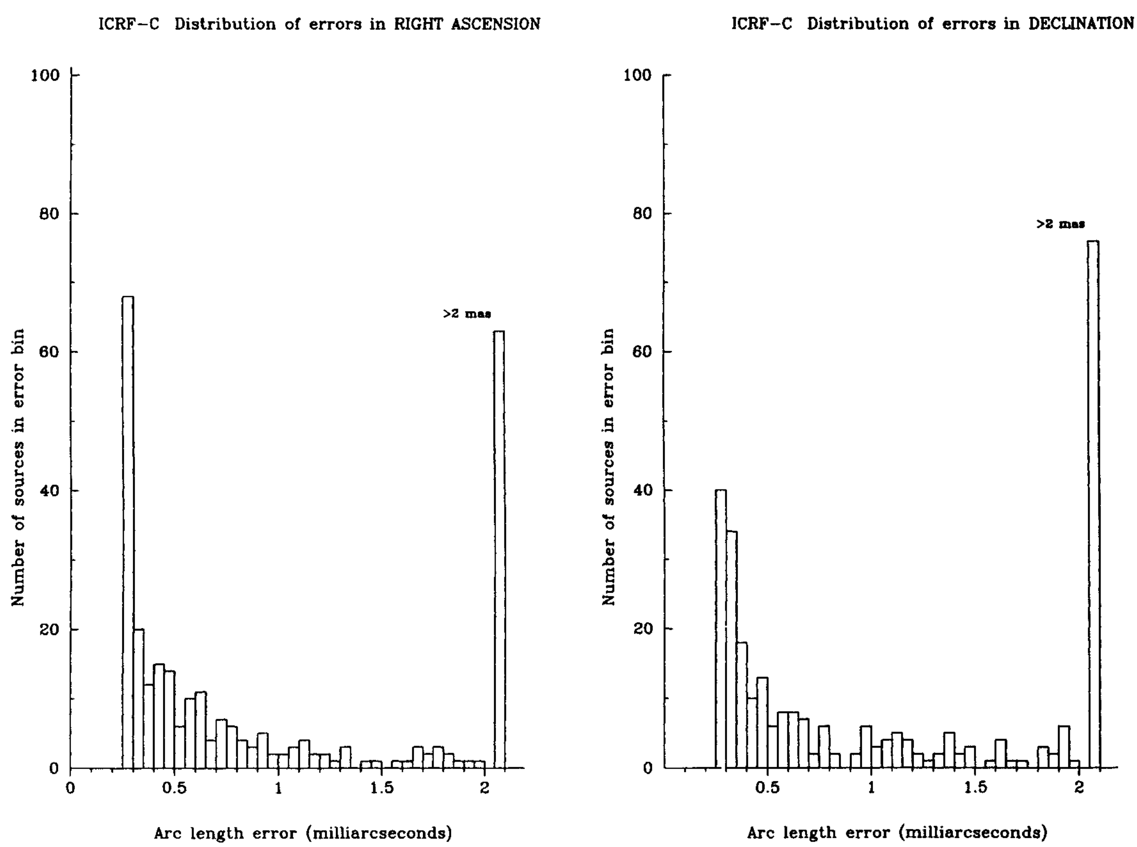
There are several features that distinguish this type of realization from the conventional stellar catalogues that formerly defined the celestial reference frame. First, while we know the positional history of the sources, we cannot predict with absolute certainty what future observations will reveal. 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)

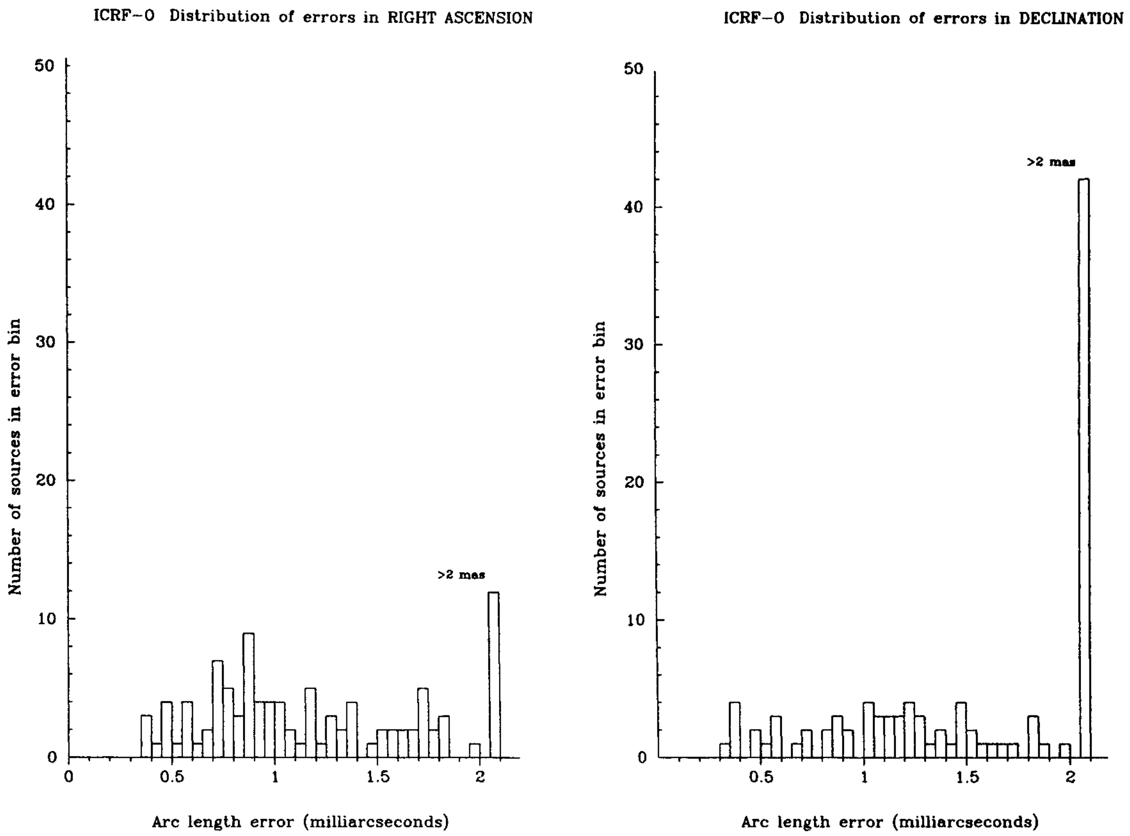



b)

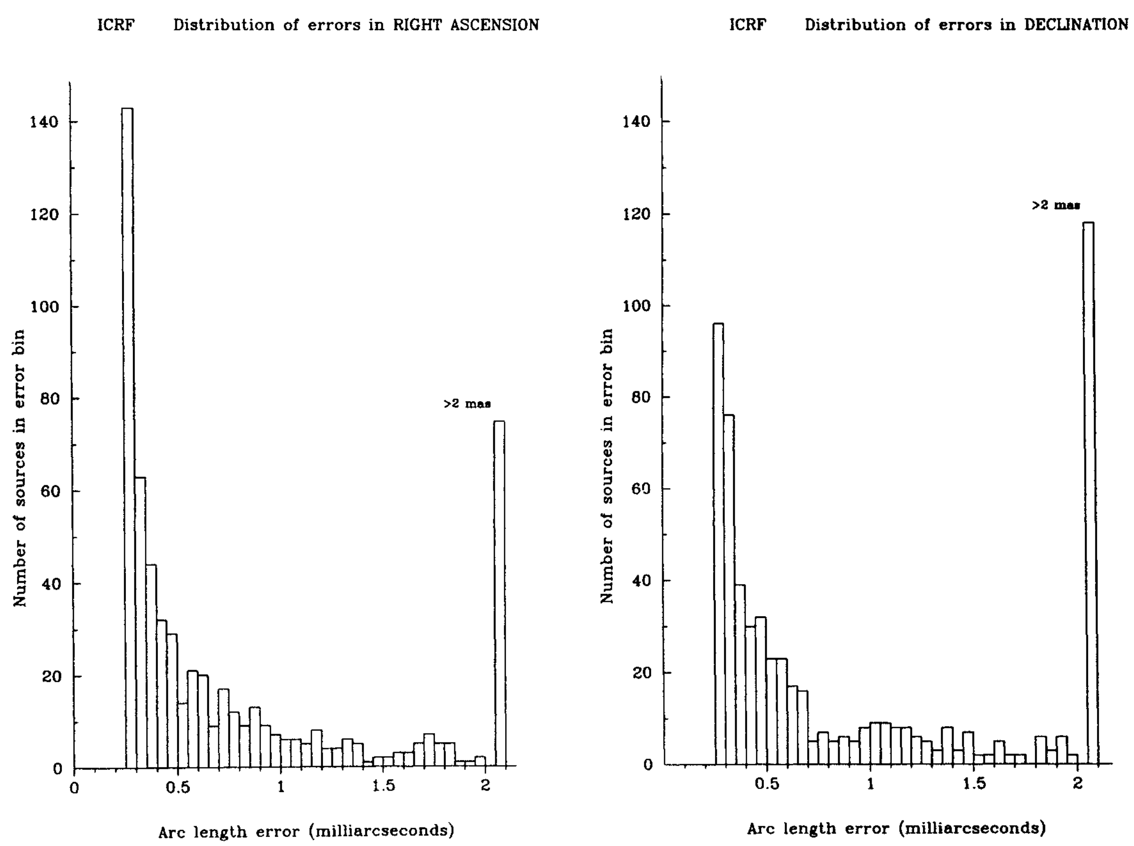



Figures 6. Histograms of source position errors for
a) defining sources; b) candidate sources.

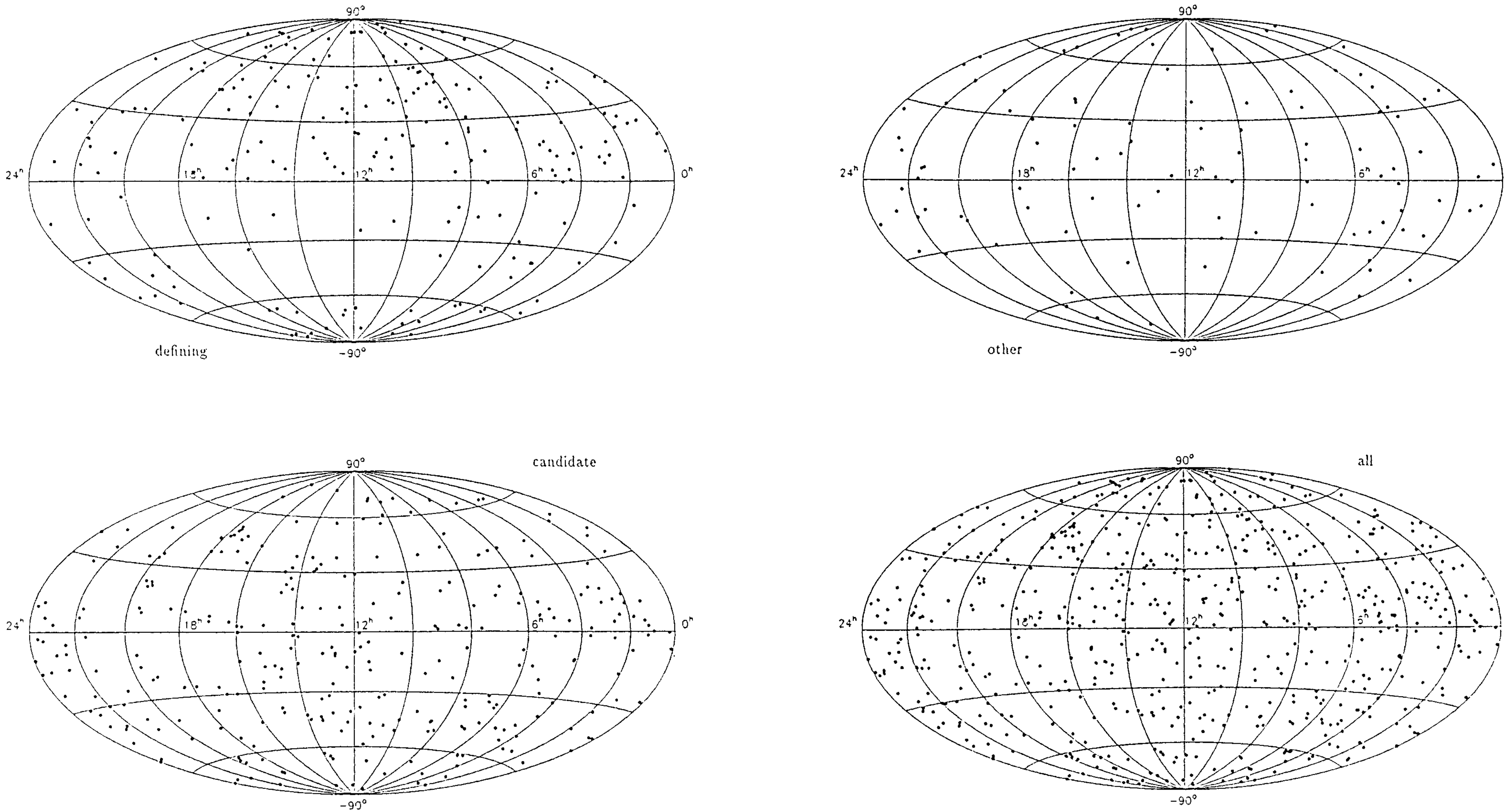
c)




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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 |

Mean, First and Last MJD: of observation span

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 | First MJD | Last MJD | 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 | First MJD | Last MJD | Nb sess. | Nb del. (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | of observation span | | | | |
| 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 | First MJD | 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 |

(Mean, First and Last MJD: of observation span)

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 ° ' " | Uncertainty R.A. s | Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | Nb sess. | Nb del. (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | of observation span | | | | |
| 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | Nb sess. | Nb del. (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | of observation span | | | | |
| 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 | First MJD | Last MJD | Nb sess. | Nb del. (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | of observation span | | | | |
| 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Corr. RA-Dc | Mean MJD | First MJD | Last MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Mean MJD | First MJD | Last MJD | Nb sess. | Nb del. (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | of observation span | | | | |
| 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Mean MJD | First MJD | Last MJD | 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Mean MJD | First MJD | Last MJD | Nb sess. | Nb del. (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | of observation span | | | | |
| 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 ° ' " | Uncertainty R.A. s | Uncertainty Dec. " | Mean MJD | First MJD | Last MJD | Nb sess. | Nb del. (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | of observation span | | | | |
| 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.

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