EARTH ROTATION PARAMETERS FROM DSN VLBI: 1997 **JPL 97 R 01**

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A description of the DSN VLBI data set and of most aspects of the data analysis can be found in IERS Technical Note 17, pp. R-19 to R-32 (see also IERS Technical Note 19, pp. R-21 to R-27).

This year we have adopted the new standard for Greenwich True Sidereal Time, which involves 18 yr and 9 yr terms (see IERS Technical Note 21, page 21) (see also IERS Gazette No 16; 1997 April 4).

Our approach to modeling the tropospheric effects on the VLBI observable was as follows. A priori dry zenith tropospheric delays were determined from barometric pressure measurements at the DSN sites, corrected for height differences between the pressure sensor and the antennas. A priori wet zenith tropospheric delays are based on historical radiosonde data and VLBI estimates from preliminary analyses. The Niell function was used for mapping zenith tropospheric delays to observed elevations. Adjustments to the wet troposphere zenith delays were estimated every two to three hours.

This year we have updated our data weighting scheme. For the delay observable, and separately for the delay rates, the raw uncertainties have been modified by adding quadratically several additional uncertainty components:

1: A source-specific constant determined from source-specific residual scatter, which tends to be associated with sources having known structure. Its value is zero for most sources.
2: For each of the two stations, a component proportional to the a priori wet tropospheric delay at that station, which grows as elevation angle decreases. For the delay rates, these components are also proportional to the -0.3 power of the scan duration. For the CAT M&E data the proportionality constants were adjusted separately for each observing session.
3: For the delay rates, a component for each station proportional to the a priori wet tropospheric delay rate at that station.
4: An "additive noise" constant that is adjusted for each of several blocks of observing sessions.

During calendar year 1996, the TEMPO project produced earth rotation measurements from 100 dual frequency observing sessions, with a median standard error along the minor axis of the error ellipse of 0.3 milliarcseconds (mas), and along the major axis of 1.6 mas. During 1996 the median turnaround time for TEMPO measurements, from observation to availability of earth orientation parameters, was 50 hours.

In the Tidal ERP table below, the argument conventions are those of Sovers et al. (1993). The formal errors range from 9 to 38 microarcseconds but realistic uncertainties are probably much larger.

ACKNOWLEDGEMENTS . We would like to thank each and every one of the many people who contributed to the acquisition and analysis of the DSN VLBI data. The work described in this paper was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

Technical description of solution JPL 97 R 01

1 - Technique: VLBI

2 - Analysis Center: JPL

3 - Software used: MODEST

4 - Data span: Ott 78 - Mar 97

5 - Celestial Reference Frame: RSC(JPL) 97 R 01

a - Nature: extragalactic

b - Definition of the orientation:
The Right Ascension and Declination of OJ 287 (0851+202) and the Declination of CTD 20 (0234+285) were held fixed at the values specified in RSC(IERS)94 C 01.

6 - Terrestrial Reference Frame: SSC(JPL) 97 R 01

a - Relativity scale: LET (TDT=geocentric with IAT)
The relativity model used is essentially equivalent to the "consensus model" described by Eubanks.

b - Velocity of light: 299 792 458 m/s

c - Geogravitational constant: 3.9860 0448 *1O**14 m**3*s**-2

d - Permanent tidal correction: Yes

e - Definition of the origin, and

f - Definition of the orientation:
Six constraints were applied to the nine coordinates (at epoch 1993.0) of DSS 15, DSS 45, and DSS 65, such that if a seven parameter transformation (3 translations, 3 rotations, 1 scale) between the JPL 1997-1 and ITRF-93 systems were estimated by unweighed least squares applied to the coordinates of DSS 15, 45, and 65, then the resulting 3 translation and 3 rotation parts of the transformation would be zero while the scale could be nonzero and unknown in advance of computing the catalog. (When expressed as the dot product of a nine dimensional unit vector with the nine station coordinates, each constraint is assigned an a priori standard deviation of 5 mm; this does not affect the resulting coordinates but does affect the calculated formal errors, giving them a more spherical distribution than would result if either very large or very small a priori standard deviations were used.)

g - Reference epoch: 1993.0

h - Tectonic plate model: ITRF-93 plus adjustments

i - Constraint for time evolution:
Three-dimensional site velocities were estimated for each of

SUMMARY, JPL,97, R,01

JPL . NASA's Deep Space Network operates radio telescopes in three complexes: in Australia, Spain, and the USA (California) . VLBI data collected from these sites by JPL between 1978 and 1997 were analyzed for celestial and terrestrial frames and earth rotation parameters, and reported as JPL 97 R 01. The celestial frame gives coordinates for 287 radio sources and is tied to RSC(IERS)94 C 01 through three coordinates of two sources. The terrestrial frame gives station coordinates and velocities for 10 stations in 3 sites, and is tied to ITRF-93 in both location and velocity using one station in each site. The analysis gives a time series EOP(JPL)97 R 01 containing the UT0-UTC and Variation of Latitude of a baseline vector at a frequency of two measurements per week. Additional earth rotation information is provided in estimated corrections to precession, obliquity rate, celestial pole offsets at epoch, 23 coefficients of nutation terms, and 40 coefficients of a parametric model for the nearly-diurnal and nearly-semidiurnal tidal frequency variations of UT1 and polar motion.

RSC(JPL)97R01

DEEP SPACE NETWORK VLBI RADIO SOURCE POSITIONS FROM REFERENCE FRAME JPL 1997-1 IN THE IERS 1993 FORMAT

IAU name	Alt. name	Right ascension hr mn sec	Declination dg mn arc sec	RA error time sec	Dec error arc sec	Corr. RA-Dec	Mean MJD	First MJD	Last MJD	No. Sns	Delay Obs	Rate Obs
0003-066	0003-066	0 6 13.89288932	- 6 23 35.3341077	0.00000785	0.0001871	-0.1752	49024.6	48196.3	50054.3	51	109	**109**
0007+171	GC 0007+17	0 10 33.99061875	17 24 18.7614339	0.00001061	0.0001847	-0.2580	49109.8	48196.4	49791.1	21	38	**38**
0008-264	P 0008-264	0 11 1.24679533	-26 12 33.3765770	0.00006291	0.0007557	-0.9044	46063.4	44227.2	48196.2	20	42	42
0013-005	P 0013-00	0 16 11.08855349	- 0 15 12.4446343	0.00000984	0.0001980	-0.3877	48972.5	47381.3	50098.2	36	76	76
0014+813	0014+813	0 17 8.47489586	81 35 8.1361263	0.00008446	0.0001390	0.0659	48607.3	48352.9	48732.5	5	14	14
0016+731	0016+731	0 19 45.78639996	73 27 30.0170979	0.00003760	0.0001298	-0.0539	49044.8	48158.1	50198.1	44	92	92
0019+058	P 0019+058	0 22 32.44121554	6 8 4.2698321	0.00001353	0.0002344	-0.6209	47179.9	45151.6	50054.3	41	85	85
0048-097	P 0048-09	0 50 41.31738344	- 9 29 5.2093514	0.00000885	0.0001905	-0.3293	49009.8	46609.4	50271.4	110	197	197
0104-408	P 0104-408	1 6 45.10804873	-40 34 19.9594573	0.00002573	0.0002802	-0.4746	47861.8	43809.2	50316.5	107	254	255
0106+013	P 0106+01	1 8 38.77110870	1 35 0.3177991	0.00000710	0.0001415	-0.1402	46941.9	43809.3	50097.9	175	382	383
0111+021	P 0111+021	1 13 43.14494095	2 22 17.3172050	0.00002903	0.0004336	-0.9283	47584.5	44227.2	50098.1	43	92	92
0112-017	P 0112-017	1 15 17.09997363	- 1 27 4.5765722	0.00000723	0.0001476	-0.1883	48718.4	47254.9	50097.9	76	158	158
0113-118	P 0113-118	1 16 12.52198370	-11 36 15.4327833	0.00000855	0.0002017	-0.3080	47479.5	43809.4	50097.9	79	133	137
0119+115	P 0119+11	1 21 41.59504218	11 49 50.4136982	0.00000709	0.0001207	-0.0490	48697.8	47255.0	50054.3	61	121	121
0119+041	GC 0119+04	1 21 56.86169420	4 22 24.7351287	0.00000770	0.0001462	-0.2473	48243.9	45476.6	50316.5	45	86	86
0133+476	DA 55	1 36 58.59478228	47 51 29.1003174	0.00001243	0.0001074	-0.0624	47329.0	43873.4	50097.8	171	313	316
0146+056	0146+056	1 49 22.37087231	5 55 53.5695721	0.00001607	0.0002516	-0.7984	48306.1	47254.9	50054.3	21	43	43
0149+218	P 0149+21	1 52 18.05903697	22 7 7.7003352	0.00000828	0.0001049	-0.2010	48828.2	47301.6	50054.3	47	96	96
0159+723	0159+723	2 3 33.38494603	72 32 53.6673422	0.00003992	0.0001431	**-0.1011**	48929.4	48352.9	49431.0	12	34	**34**
0201+113	P 0201+113	2 3 46.65706532	11 34 45.4100246	0.00000768	0.0001191	-0.3190	48612.2	45432.7	50185.7	53	110	110
0202+149	P 0202+14	2 4 50.41391170	15 14 11.0435554	0.00000708	0.0000910	-0.1609	48114.6	44203.1	50442.4	171	323	324
0202+319	DW 0202+31	2 5 4.92534450	32 12 30.0958306	0.00001154	0.0001144	-0.4343	48934.1	48196.4	50054.4	29	57	57
0212+735	0212+735	2 17 30.81329043	73 49 32.6217565	0.00003104	0.0001034	-0.3216	48014.1	45301.0	50453.6	345	667	670
0221+067	GC 0221+06	2 24 28.42818718	6 59 23.3421575	0.00000785	0.0001237	-0.4273	48911.1	47255.0	50054.5	47	100	100
0224+671	DW 0224+67	2 28 50.05145225	67 21 3.0295260	0.00002379	0.0001452	-0.2356	47630.3	44203.2	50453.5	235	394	409
0229+131	P 0229+13	2 31 45.89405260	13 22 54.7164612	0.00000684	0.0000946	-0.2652	48824.1	47255.0	50185.8	69	157	157
0234+285	CTD 20	2 37 52.40567237	28 48 8.9902100	0.00000767	0.0000796	-0.1713	48024.8	44203.0	50446.1	**410**	989	989
2345-167	P 2345-16	23 48 2.60851447	-16 31 12.0210743	0.00001106	0.0002467	-0.3864	47928.8	43809.2	50316.5	101	200	209
2351+456	2351+456	23 54 21.68026342	45 53 4.2368072	0.00001500	0.0001550	0.1840	48901.7	47941.2	50054.3	26	46	46
2351-154	2351-154	23 54 30.19519725	-15 13 11.2121181	0.00001041	0.0002365	-0.3668	48617.5	47381.3	49605.5	38	68	68
2355-106	P 2355-106	23 58 10.88241979	-10 20 8.6106076	0.00000944	0.0002124	-0.3309	48427.8	46337.1	50098.1	62	131	131

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 NUMBER OF UNKNOWNS             13629
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    54 VELZ 1563 1    1 93:001:00000 m/y  2 1.9311732523881D-02 3.0049D+07
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    60 VELZ 1565 1    1 93:001:00000 m/y  2 1.9311732523881D-02 3.0049D+07
-SOLUTION/APRIORI
*-------------------------------------------------------------------------------
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     3     1 -.21301847816404D-04 -.56257154514644D-04  0.16124177724883D-03
     4     1 0.56167484621573D-06 0.24319454199558D-06 -.11773414361655D-06
     4     4 0.77609500233363D-06
     5     1 0.31206346104532D-06 0.92754843139077D-06 -.87236588383946D-06
     5     4 -.56086335440425D-07 0.14728884547273D-05
     6     1 0.76666490410413D-07 -.61060624024988D-06  0.64811935981663D-06
     6     4 -.49917628342710D-06 -.22922078517514D-07 0.14272927715813D-05

    60    58 0.13635806361779D-05 -.70203134199865D-06 0.32006812758080D-05
-SOLUTION/MATRIX_ESTIMATE L COVA
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+soLuTION/MATRIX_APRIORI L COVA
*PARAl PARA2 PARA2 + o_________ PARA2+1 _________ P A R A 2 + 2_________
     1     1 0.89875517873682D+11
     2     1 -.20337384708476D-15  0.89875517873682D+11
     3     1 -.12005393211418D-15 -.36408562546393D-15 0.89875517873682D+11
     4     1 0.29311466084084D-10  0.88892364358297D-10 0.52474192441564D-10
     4     4 0.14181419311316D+16
     5     1 0.38974773795746D-10  0.11819814002009D-09 0.69773731149506D-10
     5     4 0.53686306383017D+15  0.14136697794325D+16
     6     1 -. 16367537542219D-10 -.49637569523998D-10 -.29301632179832D-10
     6     4 0.34397100527078D+15 -.88911561089028D+15 0.94183369964288D+15

    60    58 0.90330996458277D+15 -.47008735461073D+15 0.90294589971190D+15
-SOLUTION/MATRIX_APRIORI L COVA
*---- ---- -------- ---- ---- ---- ----- ---- ----- ----- ------------- ---- ---------- ----- ---
%ENDSNX
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