INTERCOMPARISON OF LUNAR LASER AND TRADITIONAL DETERMINATIONS OF EARTH ROTATION

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ABSTRACT. The rotational orientation of the earth (UTO at McDonald Observatory) has been determined from lunar laser ranging (LLR) measurements for the interval 1971 to 1980. The results have been differenced from those obtained by conventional means as published by the Bureau International de l'Heure (BIH), on its 1979 system. The difference displays a quasi-seasonal signature, which we ascribe to systematic errors in the conventional measurements. The lunar data are well represented by a smooth curve, which

O. Calame (ed.), High-Precision Earth Rotation and Earth-Moon Dynamics, 53–88.

gives UT0 at McDonald with a precision of about 3/4 milliseconds or better, and UT1 to within 1 millisecond using BIH polar coordinates.

The amplitude spectrum of the UT1 differences (LLR-BIH) displays highest values at low frequencies, and diminishes toward higher frequencies until a white noise regime is reached for periods of 70 days or less. This suggests that a moderately smoothed version of UT1, corresponding to a Gaussian filter of the form $\exp\{-t^2/2\sigma^2\}$ with $\sigma = 10$ or 12 days, will usually be a good representation of Earth rotation. However, there appear to be short episodes of high acceleration revealed by the LLR data, showing that there are intervals during which frequent observation is scientifically valuable.

I: INTRODUCTION

Since August, 1969, McDonald Observatory in Texas has measured ranges by laser to one or more retroreflector arrays on the lunar surface (Bender *et al.* 1973; Mulholland, 1980). Analysis of these measurements improves determination, not only of the orbit and librations of the moon, but of the rotational parameters of the Earth: the X and Y coordinates of the terrestrial pole, and the true rotational angle of the Earth, UT1, with respect to atomic or to broadcast time. In previous studies, several methods have been used to determine Earth rotation from the lunar ranging data. In one investigation (King *et al.*, 1978), a simultaneous solution has been made both for Earth rotation and for lunar parameters. In another approach (Calame, 1980), range residuals generated from a model were fit over intervals, usually a week or more, using five parameters

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selected to absorb the effects of ephemeris error and an unknown component of polar motion. Calame's study used only the ranges to Apollo 15 in an attempt to minimize scatter associated with the lunar libration model used.

The approach used here is to derive the Universal Time, UT1, in two steps. First, we solve for the parameters of the lunar orbit and librations, and the coordinates of the retroreflectors on the moon and of McDonald Observatory, using all McDonald lunar laser ranging data, and the conventionally determined values of UT1, X, and Y published by the Bureau International de l'Heure. Second, we solve for improved values of UT0 and range corrections at McDonald from the postfit residuals generated in the first step. This two-step method (Stolz et al. 1976; Harris and Williams 1977; Shelus et al. 1977; Langley, King, Shapiro, 1981) relies on the fact that an error in the initial value of UT1 produces a near daily (25 hour) signature in the range residuals, which is clearly separable from the effects of lunar motion. In principle, the method used by King et al. has the advantage of using all the data, whereas the two-step method uses only the subset of range points for those dates on which ranges were measured through a sufficiently wide range of hour angle (in this study, .05 days or more). However, the advantage of the two-step method is that it provides a separate datum for each suitable day of ranging, with no assumptions made about the functional form of the variation of UT1 from day to day. By any technique, the accuracy of the UT1 results depends critically on the accuracy with which lunar motion can be represented.

II: THE LLR RAW DATA IN UT1:

The subset of ranging data for which two or more range normal points were obtained on the same retroreflector, separated by at least .05 days, included 701 days of observation distributed not too unevenly over the time span MJD 40867.03 to 44385.17 (7 October 1970 to 25 May 1980), plus ranges on two isolated dates (MJD 40691.10 and 40817.37), making a total of 703 daily decomposition values. The ith residual of the jth day of observation is expressed as

$$r_{ij} = A_j + B_j \sin H_{ij} \cos \delta_{ij}$$

where

B_j is presumed to contain the correction to UT0,

H_{ij} is lunar hour angle,

δ_{ij} is lunar declination,

and where A_j reflects the variation of latitude at McDonald (specifically, the component of error in the BIH published polar motion which lies along the McDonald meridian), as well as the effect of systematic ranging error and model error. The parameter B_j is a function of both the correction to the a priori value of UT1 and the component of polar motion normal to the McDonald meridian, according

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to the equation

$$(2) \quad B_j = \Delta UT1 + \Delta X \sin\lambda \tan\phi + \Delta Y \cos\lambda \tan\phi$$

where

λ = observatory east longitude,

ϕ = observatory latitude.

For McDonald Observatory, the expression becomes

$$B_j = \Delta UT1 - .572 \ \Delta X \ - .142 \ \Delta Y.$$

One of the systematic sources of error in estimating the value of UT1 from the McDonald lunar laser ranging data is the uncertainty in the X coordinate of polar motion. Although the set $[B_j]$ are, strictly speaking, corrections to UTO, we shall assume here that the values of BIH X and Y are correct, and treat $[B_j]$ as estimates of the UT1.

As the first step in the analysis, a simultaneous solution was made for forty parameters of the lunar model by a weighted least squares fit to 2954 lunar laser ranging normal points, obtained from August, 1969, to May, 1980. These data comprise returns from retroreflectors of the Apollo 11, 14, and 15 sites, and from Lunakhod 2. In this step, BIH Circular D smoothed values of UT1-UTC, X, and Y were used, transformed to the BIH 1979 system. The precession is applied according to the expressions adopted

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by the IAU in 1976 (Lieske et al., 1977; Lieske, 1979). The 1980 IAU Theory of Nutation is used (Seidelmann et al., 1981). To the conventional expression for universal time in terms of Greenwich mean sidereal time (Explanatory Supplement to the Ephemeris, p. 73) we have added the correction for the equinox drift $\dot{E}$ = 1.275 arcseconds/century (Fricke, 1981). The change from the old precession constant to the IAU 1976 value plus this $\dot{E}$ correction is equivalent to a change in UT1 rate of -0.1 milliseconds of time per year (for a discussion, see Williams and Melbourne, 1981).

The spectrum of UT1 changes for periods of one month or less is dominated by the discrete frequencies of the solid body tides. Theoretical calculations of these tidal terms are in good agreement with the lunar laser ranging data (Yoder, Williams and Parke, 1981; Yoder, Williams, Parke and Dickey, 1981). We have therefore used these theoretical calculations to remove the tidal effects from the values of UT1 given in this paper. For alternate calculations of the tidal terms, see also Merriam and Lambeck (1980), and Wahr (1981). We adopt k/C = 0.94. Our model includes terms 7, 8, 11, 15-20, 22, 24, 30-34, and 37-39 of Table 1 of Yoder, Williams and Parke (1981). We have added these tidal terms to the BIH Circular D values of UT1 from which the lunar laser ranging residuals are calculated; therefore the tidal effects do not appear in the tables and figures of this paper.

The daily decomposition estimates of UT1 -- that is, the set $[B_j]$ from Equation 1 -- are shown in Figure 1. The most prominent feature in the early data is a strong seasonal variation, which repeated in general shape from 1971 to 1974 and then became more irregular. In recent

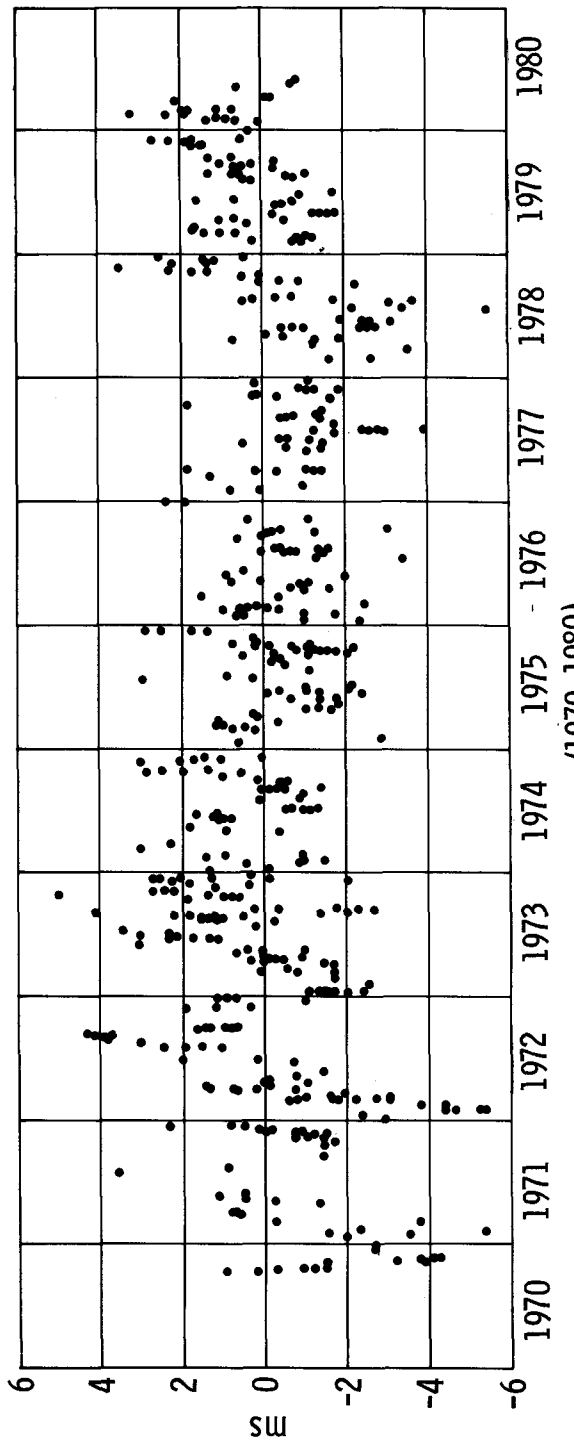

FIGURE 1

REVISED ΔUT1 ESTIMATES
LASER (McDONALD MINUS BIH (1979 SYSTEM)
RAW DAILY DECOMPOSITION VALUES

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years (1976, 1977, 1979 , and 1980), the BIH values of UT1 tend to be low relative to the lunar laser ranging values at the beginning of the year, producing the sharp peaks in Figure 1. These peaks contribute a high feature to the power spectrum of the residuals for periods just greater than one year (Figure 4), as will be discussed below. We suspect that the signature evident in Figure 1 represents errors in the astrometric data from which BIH Circular D values are calculated.

The lunar data can be used to give improved estimates of UT1, more accurate than those previously published by BIH. Real changes in UT1 tend to occur slowly, as will be shown by the Fourier spectra discussed below. Therefore, we have applied smoothing to the raw data to obtain Figures 2 and 3 and Table 2. Figures 2 and 3 show the result of smoothing the data of Figure 1 with a Gaussian filter, using the function $\exp\{-t^2/2\sigma^2\}$ and values of σ = 10 and 15 days. The interval σ = 15 days gives the smoothing function closest to that employed by the BIH in its Circulars D (see BIH Annual Report 1979). However, questions remain: how smooth a function UT1 really is, and whether or not there are short episodes of high acceleration.

III: HARMONIC ANALYSIS OF THE LLR UT1 DATA:

The amplitude spectrum of the 703 differences of UT1(LLR) - UT1(BIH), the B_j of Equation 2, is shown in Figure 4. This spectrum is generated from a weighted least squares fit for two components of a sine wave, repeated at each frequency sampled. As the LLR data is unevenly distributed, aliasing

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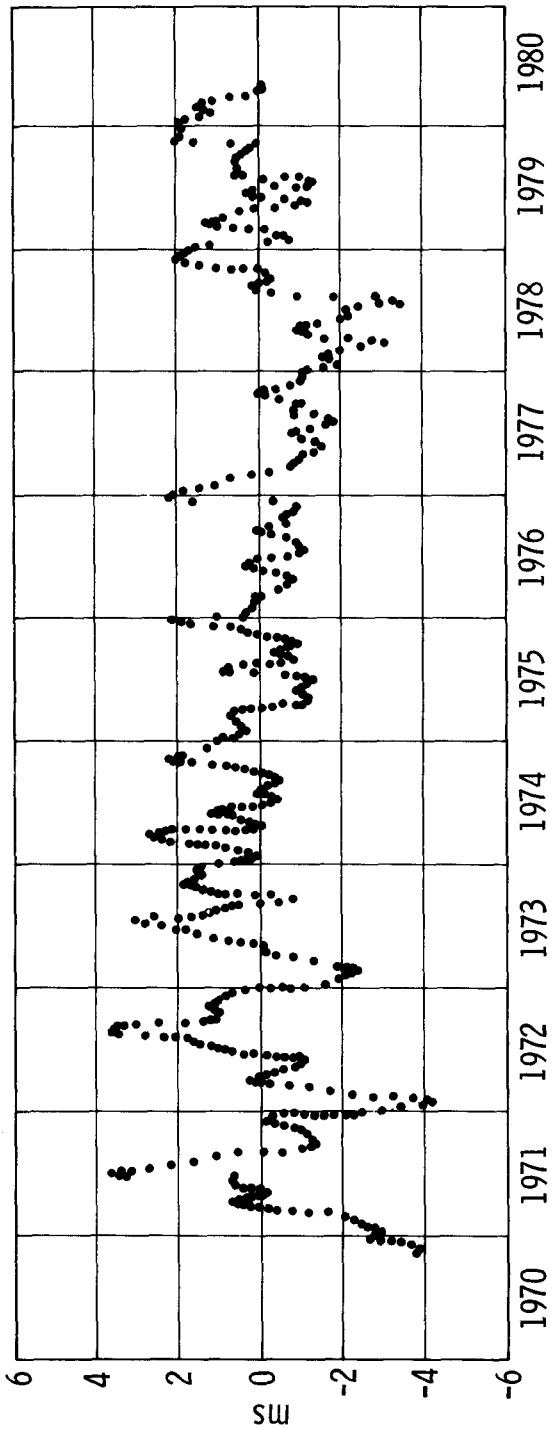

FIGURE 2
REVISED ΔUT1 ESTIMATES
LASER (McDONALD) MINUS BIH (1979 SYSTEM)
GAUSSIAN SMOOTHED: σ = 10 DAYS

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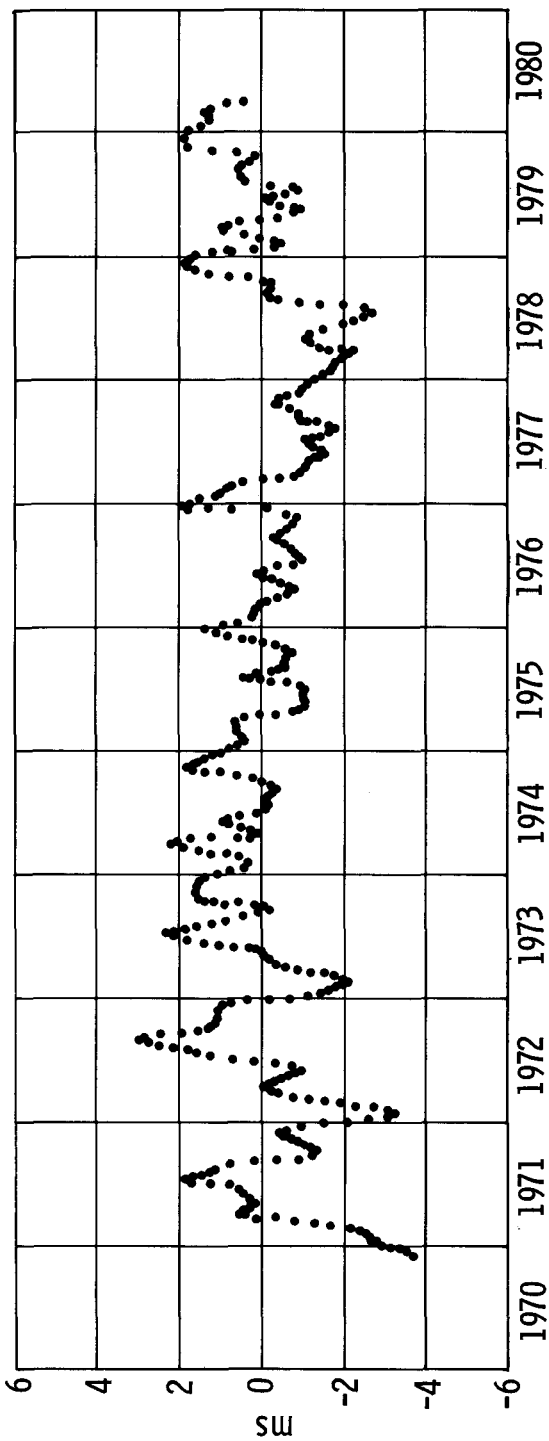

FIGURE 3

LASER (McDONALD) MINUS BIH (1979 SYSTEM)
GAUSSIAN SMOOTHED: σ = 15 DAYS

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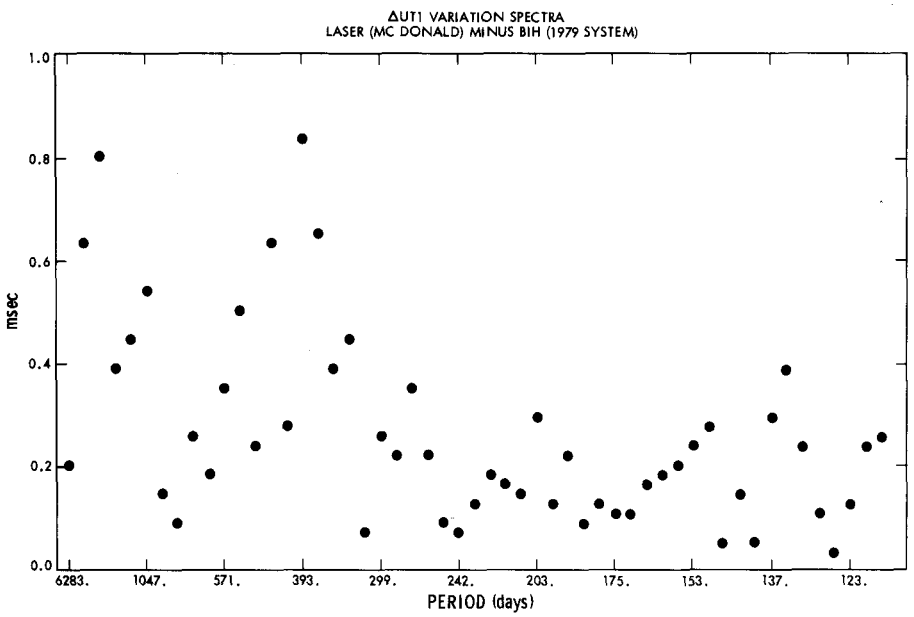

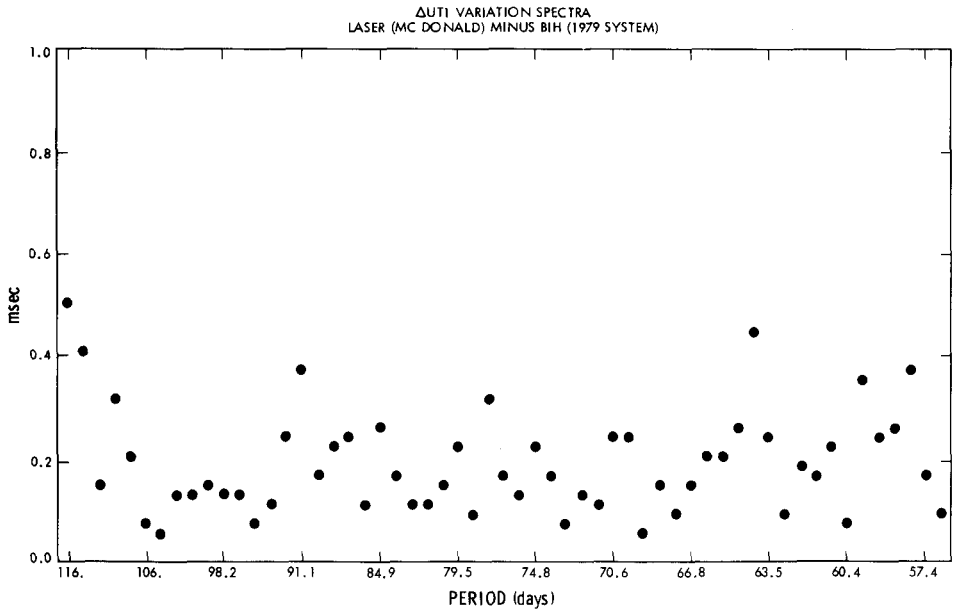

FIGURES 4a and b

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can occur. The general character of the spectrum is that there is significant power at low frequencies, which falls off as one goes to higher frequencies until a flat, white noise level is reached. This means that the BIH system is more stable at high frequencies. In addition, there is excess power near one year and (not shown) near one month and one-half month. The latter two features result from aliasing the low frequency power with the first and second harmonics of the principal aliasing period of 29.53 days, which arises because lunar laser data is not taken near new moon. We suspect that the power near one year could result from systematic annual errors in the BIH astrometric data which shift slightly from year to year so as to spread the peak. Coherent annual and semiannual errors of 0.7ms each were removed by BIH in going from the 1968 to the 1979 system. For UT0 at McDonald these changes were 1.36 and 0.70 ms for the annual and semiannual corrections. The coherent systematic errors of the BIH 1979 system can be checked by looking at the spectrum of differences at integral fractions of one year. Terms at these special periods can arise from catalog errors, nutation errors, and seasonal effects at the observatories (thermal, atmospheric, and tidal). The following table shows that the amplitudes at these special frequencies are not significantly larger than the adjacent continuum (see Figure 4), at least for UT0 at McDonald.

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Table 1

Period (yr)	Amplitude (ms)
1	0.19
1/2	0.26
1/3	0.23
1/4	0.26

The UT1 differences can be fit with a smooth curve composed of periodic components. The spectrum is used to guide the choice of periods, and then a constant plus two components for each frequency are simultaneously fit by weighted least squares. The significant Fourier components are selected in several steps. The very low frequencies are included first; a nine year term is the lowest. A new spectrum is calculated, using the UT1 differences with these terms subtracted out, and a choice is made for the next frequency terms to be included. These new frequencies are combined with the first set, and a new simultaneous solution of the Fourier components is made. This loop is done several times, finally with thirty frequencies in the fit. The entries in Table 1 were taken from this last fit. By solving for the low frequency terms first, we find that much of the white noise at higher frequencies is reduced. The shortest period term included is 70.7 days; periods shorter than this were disregarded as random error in the

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LLR measurements. The spectrum of differences after removal of the thirty frequencies has virtually all power removed for periods longer than 70 days, the average white noise level has dropped below 0.1 ms, and the highest remaining peak is 0.2 ms at 51 days. The previous excess power near one-half and one months has vanished, demonstrating that it was an artifact of aliasing.

The error in the BIH smoothed Circular D UT1 values over the ten year span can be estimated by calculating the change in the rms differences in UT1(LLR) - UT1(BIH) before and after the Fourier smoothing. The weighted rms difference is 1.42 ms before and 0.66 ms after, so that 1.25 ms (presumed to add quadratically) has been removed by the Fourier smoothing. The consistency and convergence of our procedures have been checked by iteration. The improved values of UT1 from the Fourier smoothing and the BIH polar motion were used in a new least squares solution for coordinates and the lunar orbit and libration parameters. This iterated solution has a simple rms residual of 31 cm (compared to 39 cm on BIH UT1) and a weighted rms residual of 27 cm. Further corrections to UT1 were not required.

IV: DATA DURING SHORT MERIT CAMPAIGN (AUGUST-OCTOBER 1980):

We have derived preliminary corrections to UT1 from the LLR data past May 1980, but the procedure was not identical to that of the earlier span. Solutions from the data through May 1980 were used to start integrations of the orbit and

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physical librations. While fitting the newer data, the orbit and physical librations were held fixed, but the reflector and observatory coordinates were solved for. The subsequent residuals were then decomposed into daily corrections as before. The corrections to UT1 given here for the period June thru December 1980 are to be considered preliminary. Table 3 gives the values during the short MERIT campaign from August through October 1980.

Figure 5 shows the individual daily decomposition values of UT1(LLR) - UT1(BIH) from January to December 1980. The formal errors associated with each datum range over a factor of seven. The data with smallest standard deviation (0.3 milliseconds of time) are represented by filled circles. As can be seen, these more heavily weighted points do show smaller scatter than the open circles. The most interesting feature on the graph is the increase of at least two milliseconds between late September and late October. A gap in the distribution of observations does not permit the end of this event to be well dated, but it took place in not more than 31 days. Since we are plotting the difference from the BIH values, the BIH Circular D values of UT2 were examined. They show that UT2 was decelerating in late August and accelerating starting in early October, so that UT2 has an inflection point at some time in September. The lunar laser results indicate that the accelerative phase started in late September and the Circular D smoothed UT2 was a little slow in following it. The spectrum of the differential UT1 indicates low amounts of power at high frequencies. However, the interesting event seen during the preliminary MERIT campaign, and several similar events which can be seen in earlier years, indicate that there are intervals when frequent observation will prove scientifically valuable.

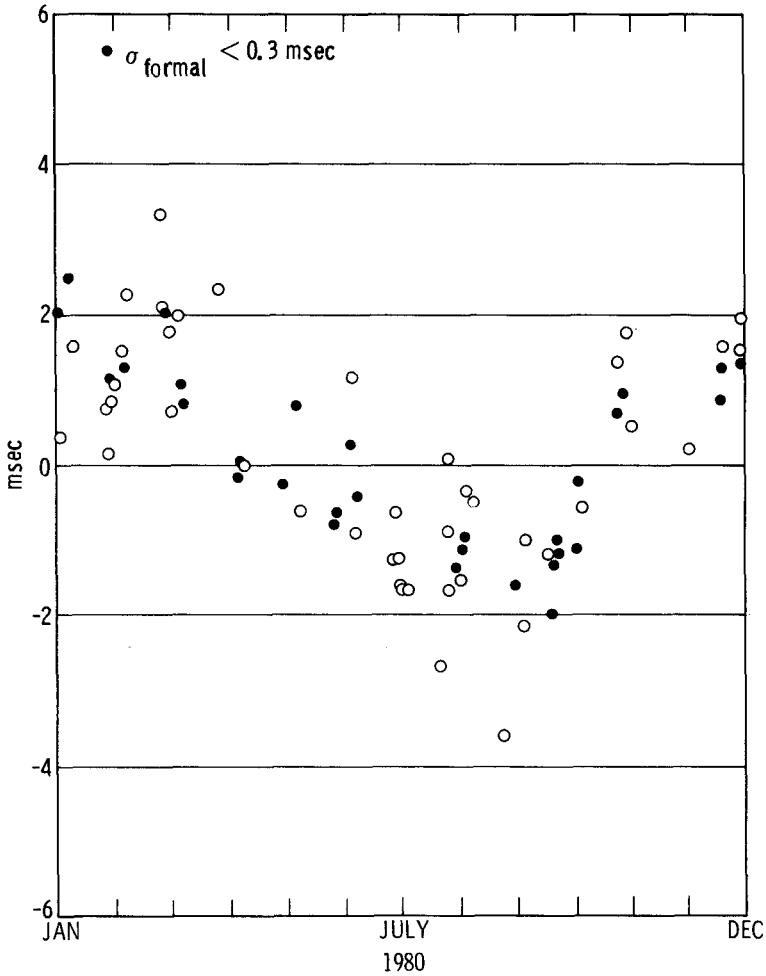

FIGURE 5

ΔUT1 ESTIMATES
LASER (McDONALD) MINUS BIH (1979 SYSTEM)
DAILY DECOMPOSITION VALUES

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V: COMPARISON OF DIFFERENT KINDS OF SMOOTHING:

In Figures 6 and 7, we compare the effects of two different kinds of smoothing on the UT1 differences (LLR-BIH) from 1970 to early 1980. The Fourier smoothed function is the result of Fourier synthesis using the truncated spectrum described above, in which terms of period shorter than 70.7 days have been discarded. The Gaussian smoothed function is identical to that displayed in Figure 3. By comparing these two curves and with the unsmoothed daily decomposition values, one obtains some idea how far the smoothed results may be trusted, and to what extent they represent an improvement over the values previously made available in BIH Circular D. It is clearly seen that the greatest uncertainties are encountered in the LLR data prior to 1975, and correspond to observational gaps in the lunar data. After January, 1975, the difference between the Fourier and the Gaussian representations equals or exceeds 1 ms. of time only three times, and then briefly: 22 November to 1 December, 1976; 28 September to 3 October, 1978; and 22 March to 6 April, 1979.

The two largest sources of error in the smoothed representations of UT1 given in this paper are the effects of gaps in the data, just discussed, and the uncertainty in the X-component of the polar motion. As estimate has been made from the LLR data of the standard deviation of the BIH Y-component (Dickey et al., 1981). We assume that the BIH value for X is not a factor of two worse than Y, and therefore that σ_x (BIH) < 40 cm. We believe that the Gaussian smoothed LLR values of UTO have a standard deviation of no more than 0.8 ms of time, and the inferred values of UT1, less than 1 millisecond.

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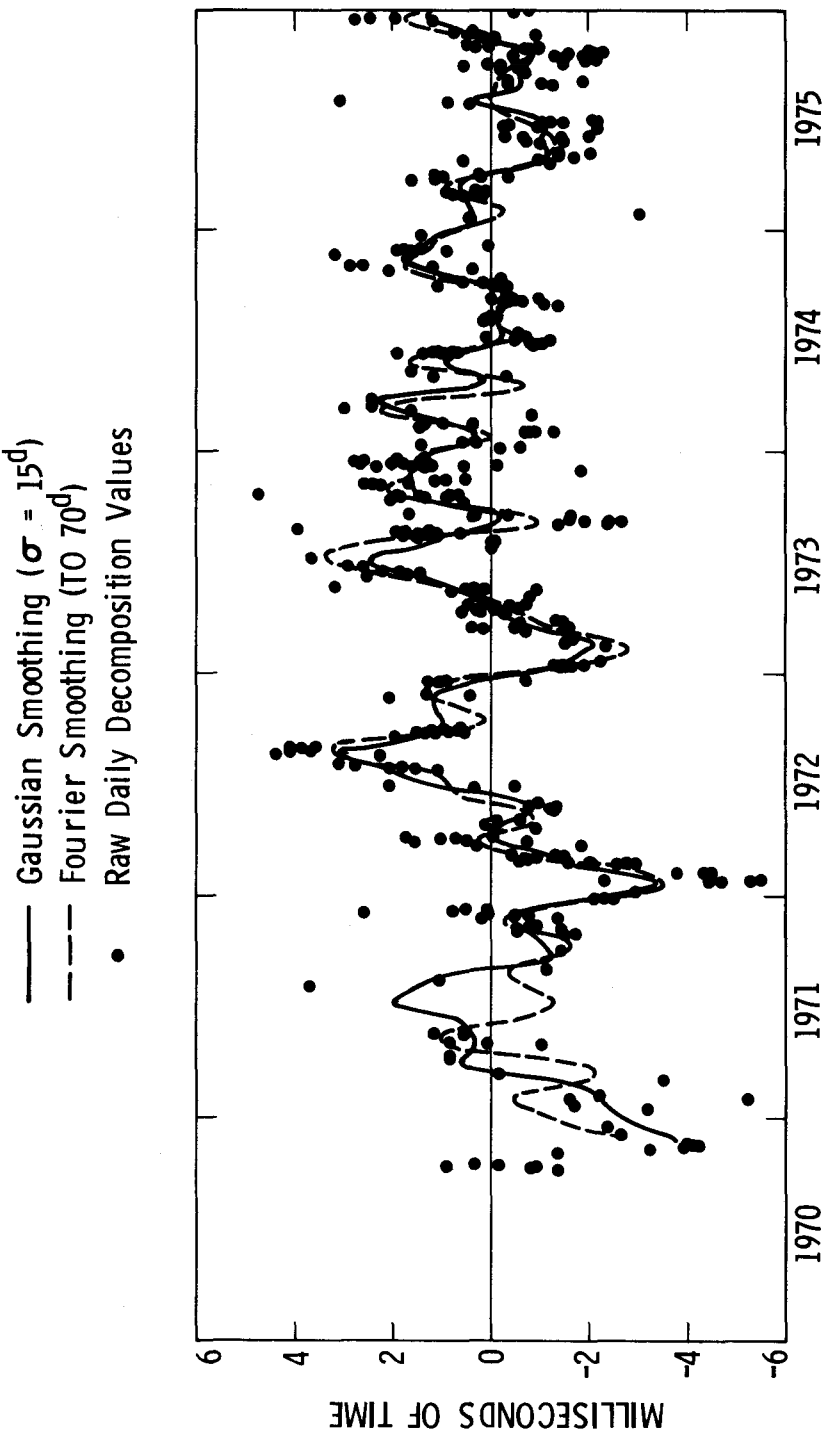

FIGURE 6

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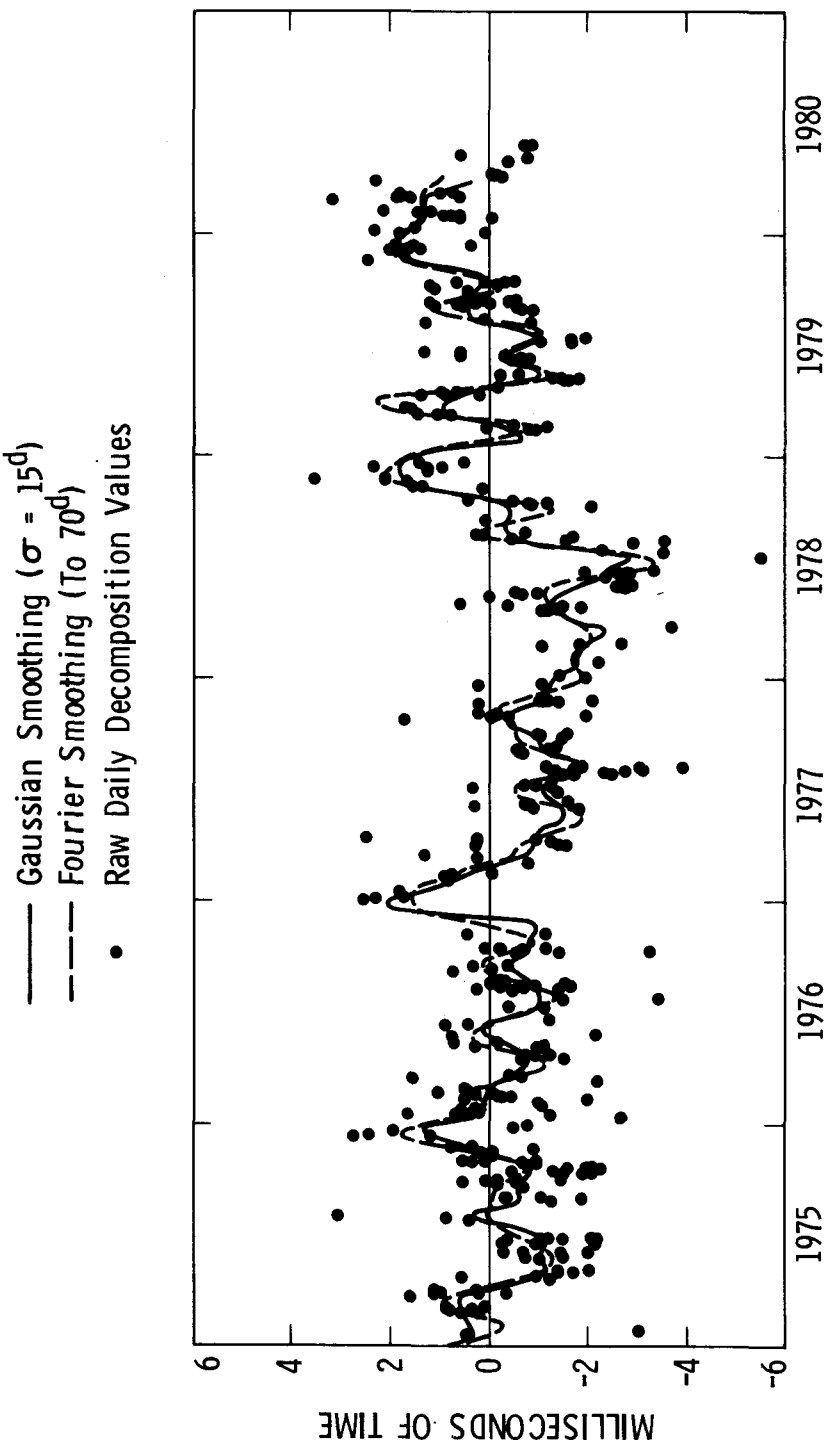

FIGURE 7

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VI: CONCLUSION:

Lunar laser ranging (LLR) data from McDonald Observatory have been used to obtain UT1 with an accuracy of a factor of 2 or more better than has previously been available from conventional astrometric data. We therefore give in Table 2 three sets of smoothed values of LLR UT1, together with BIH Circular D smoothed values converted where necessary to the BIH 1979 System. The Fourier smoothed values are consistent with the timing used in the final solution for lunar parameters. The Gaussian σ = 15 day values are smoothed to nearly the same extent as BIH Circular D, and we believe that they are the best UT1 values available for the period prior to about 1975. The Gaussian = 10 day values display structure in the function of UT1 which is probably real for the period 1975 and later, and are to be preferred for use in physical studies of the Earth's rotation.

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TABLE 2

JPL PROPOSED UT1 − UTC					LUNAR LASER RANGING DATA		
MJD	CIVIL DATE			BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
40919.0	1970	NOV	29.0	−.0334	−.0361	−.0372	−.0373
40924.0	1970	DEC	4.0	−.0350	−.0376	−.0388	−.0387
40929.0	1970	DEC	9.0	−.0363	−.0386	−.0400	−.0397
40934.0	1970	DEC	14.0	−.0373	−.0394	−.0409	−.0403
40939.0	1970	DEC	19.0	−.0382	−.0401	−.0416	−.0410
40944.0	1970	DEC	24.0	−.0388	−.0405	−.0420	−.0415
40949.0	1970	DEC	29.0	−.0391	−.0407	−.0421	−.0419
40954.0	1971	JAN	3.0	−.0391	−.0405	−.0420	−.0420
40959.0	1971	JAN	8.0	−.0391	−.0402	−.0419	−.0421
40964.0	1971	JAN	13.0	−.0389	−.0399	−.0416	−.0418
40969.0	1971	JAN	18.0	−.0388	−.0396	−.0415	−.0416
40974.0	1971	JAN	23.0	−.0388	−.0394	−.0414	−.0415
40979.0	1971	JAN	28.0	−.0390	−.0395	−.0415	−.0415
40984.0	1971	FEB	2.0	−.0393	−.0397	−.0418	−.0418
40989.0	1971	FEB	7.0	−.0390	−.0395	−.0414	−.0414
40994.0	1971	FEB	12.0	−.0388	−.0395	−.0411	−.0412
40999.0	1971	FEB	17.0	−.0386	−.0396	−.0408	−.0410
41004.0	1971	FEB	22.0	−.0388	−.0400	−.0407	−.0410
41009.0	1971	FEB	27.0	−.0390	−.0406	−.0406	−.0408
41014.0	1971	MARCH	4.0	−.0394	−.0413	−.0406	−.0408
41019.0	1971	MARCH	9.0	−.0406	−.0427	−.0414	−.0417
41024.0	1971	MARCH	14.0	−.0423	−.0445	−.0427	−.0430
41029.0	1971	MARCH	19.0	−.0451	−.0473	−.0451	−.0453
41034.0	1971	MARCH	24.0	−.0492	−.0513	−.0489	−.0489
41039.0	1971	MARCH	29.0	−.0541	−.0560	−.0537	−.0535
41044.0	1971	APRIL	3.0	−.0571	−.0586	−.0566	−.0564
41049.0	1971	APRIL	8.0	−.0594	−.0604	−.0589	−.0587
41054.0	1971	APRIL	13.0	−.0617	−.0622	−.0613	−.0611
41059.0	1971	APRIL	18.0	−.0638	−.0639	−.0635	−.0634
41064.0	1971	APRIL	23.0	−.0663	−.0660	−.0661	−.0662
41069.0	1971	APRIL	28.0	−.0694	−.0687	−.0692	−.0695
41074.0	1971	MAY	3.0	−.0727	−.0718	−.0726	−.0728
41079.0	1971	MAY	8.0	−.0763	−.0753	−.0762	−.0763
41084.0	1971	MAY	13.0	−.0796	−.0786	−.0794	−.0794
41089.0	1971	MAY	18.0	−.0824	−.0816	−.0821	−.0820
41094.0	1971	MAY	23.0	−.0849	−.0843	−.0846	−.0844
41099.0	1971	MAY	28.0	−.0868	−.0864	−.0864	−.0862
41104.0	1971	JUNE	2.0	−.0882	−.0881	−.0877	−.0876
41109.0	1971	JUNE	7.0	−.0892	−.0894	−.0887	−.0885
41114.0	1971	JUNE	12.0	−.0898	−.0902	−.0892	−.0891
41119.0	1971	JUNE	17.0	−.0897	−.0904	−.0891	−.0890
41124.0	1971	JUNE	22.0	−.0888	−.0897	−.0880	−.0853
41129.0	1971	JUNE	27.0	−.0872	−.0884	−.0860	−.0837
41134.0	1971	JULY	2.0	−.0856	−.0869	−.0839	−.0820
41139.0	1971	JULY	7.0	−.0840	−.0854	−.0822	−.0804
41144.0	1971	JULY	12.0	−.0830	−.0843	−.0812	−.0802
41149.0	1971	JULY	17.0	−.0825	−.0838	−.0808	−.0801

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JPL PROPOSED UT1 - UTC LUNAR LASER RANGING DATA

MJD	CIVIL DATE			BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
41154.0	1971	JULY	22.0	-.0819	-.0832	-.0803	-.0798
41159.0	1971	JULY	27.0	-.0814	-.0826	-.0800	-.0796
41164.0	1971	AUG	1.0	-.0807	-.0818	-.0794	-.0791
41169.0	1971	AUG	6.0	-.0797	-.0806	-.0785	-.0783
41174.0	1971	AUG	11.0	-.0783	-.0791	-.0772	-.0771
41179.0	1971	AUG	16.0	-.0770	-.0776	-.0760	-.0760
41184.0	1971	AUG	21.0	-.0758	-.0763	-.0750	-.0749
41189.0	1971	AUG	26.0	-.0752	-.0756	-.0746	-.0746
41194.0	1971	AUG	31.0	-.0756	-.0760	-.0755	-.0755
41199.0	1971	SEPT	5.0	-.0766	-.0770	-.0770	-.0773
41204.0	1971	SEPT	10.0	-.0780	-.0786	-.0789	-.0792
41209.0	1971	SEPT	15.0	-.0797	-.0804	-.0809	-.0811
41214.0	1971	SEPT	20.0	-.0815	-.0826	-.0828	-.0829
41219.0	1971	SEPT	25.0	-.0836	-.0849	-.0849	-.0850
41224.0	1971	SEPT	30.0	-.0860	-.0874	-.0873	-.0874
41229.0	1971	OCT	5.0	-.0890	-.0906	-.0902	-.0904
41234.0	1971	OCT	10.0	-.0927	-.0944	-.0939	-.0940
41239.0	1971	OCT	15.0	-.0969	-.0986	-.0980	-.0981
41244.0	1971	OCT	20.0	-.1015	-.1031	-.1025	-.1026
41249.0	1971	OCT	25.0	-.1063	-.1077	-.1073	-.1074
41254.0	1971	OCT	30.0	-.1115	-.1126	-.1124	-.1125
41259.0	1971	NOV	4.0	-.1167	-.1176	-.1176	-.1177
41264.0	1971	NOV	9.0	-.1221	-.1227	-.1229	-.1230
41269.0	1971	NOV	14.0	-.1273	-.1277	-.1280	-.1281
41274.0	1971	NOV	19.0	-.1322	-.1325	-.1328	-.1327
41279.0	1971	NOV	24.0	-.1366	-.1368	-.1371	-.1369
41284.0	1971	NOV	29.0	-.1404	-.1408	-.1409	-.1406
41289.0	1971	DEC	4.0	-.1439	-.1445	-.1445	-.1440
41294.0	1971	DEC	9.0	-.1465	-.1473	-.1473	-.1468
41299.0	1971	DEC	14.0	-.1479	-.1491	-.1490	-.1488
41304.0	1971	DEC	19.0	-.1489	-.1505	-.1504	-.1506
41309.0	1971	DEC	24.0	-.1494	-.1514	-.1513	-.1516
41314.0	1971	DEC	29.0	-.1498	-.1523	-.1521	-.1523
41319.0	1972	JAN	3.0	-.0484	-.0512	-.0510	-.0511
41324.0	1972	JAN	8.0	-.0633	-.0664	-.0662	-.0663
41329.0	1972	JAN	13.0	-.0789	-.0822	-.0820	-.0822
41334.0	1972	JAN	18.0	-.0945	-.0980	-.0978	-.0983
41339.0	1972	JAN	23.0	-.1102	-.1138	-.1136	-.1143
41344.0	1972	JAN	28.0	-.1261	-.1297	-.1294	-.1302
41349.0	1972	FEB	2.0	-.1424	-.1458	-.1454	-.1462
41354.0	1972	FEB	7.0	-.1594	-.1626	-.1621	-.1626
41359.0	1972	FEB	12.0	-.1773	-.1802	-.1797	-.1799
41364.0	1972	FEB	17.0	-.1948	-.1974	-.1969	-.1970
41369.0	1972	FEB	22.0	-.2112	-.2135	-.2131	-.2132
41374.0	1972	FEB	27.0	-.2279	-.2297	-.2297	-.2297
41379.0	1972	MARCH	3.0	-.2449	-.2462	-.2465	-.2465
41384.0	1972	MARCH	8.0	-.2621	-.2630	-.2635	-.2635
41389.0	1972	MARCH	13.0	-.2795	-.2800	-.2806	-.2805
41394.0	1972	MARCH	18.0	-.2971	-.2973	-.2980	-.2977
41399.0	1972	MARCH	23.0	-.3147	-.3146	-.3153	-.3148
41404.0	1972	MARCH	28.0	-.3321	-.3319	-.3324	-.3319
41409.0	1972	APRIL	2.0	-.3498	-.3496	-.3499	-.3495
41414.0	1972	APRIL	7.0	-.3675	-.3673	-.3676	-.3673

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MJD	CIVIL DATE	BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
41419.0	1972 APRIL 12.0	-.3852	-.3852	-.3853	-.3852
41424.0	1972 APRIL 17.0	-.4029	-.4032	-.4031	-.4031
41429.0	1972 APRIL 22.0	-.4203	-.4208	-.4206	-.4206
41434.0	1972 APRIL 27.0	-.4377	-.4384	-.4381	-.4381
41439.0	1972 MAY 2.0	-.4547	-.4555	-.4552	-.4551
41444.0	1972 MAY 7.0	-.4718	-.4728	-.4724	-.4724
41449.0	1972 MAY 12.0	-.4892	-.4901	-.4900	-.4900
41454.0	1972 MAY 17.0	-.5063	-.5071	-.5072	-.5074
41459.0	1972 MAY 22.0	-.5230	-.5237	-.5240	-.5242
41464.0	1972 MAY 27.0	-.5395	-.5399	-.5405	-.5407
41469.0	1972 JUNE 1.0	-.5554	-.5555	-.5564	-.5566
41474.0	1972 JUNE 6.0	-.5709	-.5708	-.5717	-.5719
41479.0	1972 JUNE 11.0	-.5859	-.5855	-.5865	-.5865
41484.0	1972 JUNE 16.0	-.6002	-.5997	-.6004	-.6001
41489.0	1972 JUNE 21.0	-.6140	-.6133	-.6137	-.6133
41494.0	1972 JUNE 26.0	-.6272	-.6265	-.6265	-.6263
41499.0	1972 JULY 1.0	.3599	.3607	.3609	.3609
41504.0	1972 JULY 6.0	.3472	.3481	.3484	.3483
41509.0	1972 JULY 11.0	.3349	.3358	.3363	.3362
41514.0	1972 JULY 16.0	.3227	.3238	.3242	.3241
41519.0	1972 JULY 21.0	.3107	.3119	.3124	.3122
41524.0	1972 JULY 26.0	.2984	.2998	.3002	.3000
41529.0	1972 JULY 31.0	.2855	.2874	.2875	.2873
41534.0	1972 AUG 5.0	.2720	.2742	.2743	.2740
41539.0	1972 AUG 10.0	.2585	.2610	.2611	.2610
41544.0	1972 AUG 15.0	.2449	.2477	.2477	.2480
41549.0	1972 AUG 20.0	.2318	.2349	.2348	.2352
41554.0	1972 AUG 25.0	.2188	.2220	.2218	.2224
41559.0	1972 AUG 30.0	.2064	.2096	.2092	.2100
41564.0	1972 SEPT 4.0	.1937	.1968	.1962	.1969
41569.0	1972 SEPT 9.0	.1799	.1827	.1819	.1823
41574.0	1972 SEPT 14.0	.1653	.1677	.1670	.1669
41579.0	1972 SEPT 19.0	.1502	.1521	.1516	.1514
41584.0	1972 SEPT 24.0	.1341	.1355	.1353	.1352
41589.0	1972 SEPT 29.0	.1177	.1187	.1189	.1188
41594.0	1972 OCT 4.0	.1010	.1016	.1021	.1020
41599.0	1972 OCT 9.0	.0846	.0849	.0857	.0856
41604.0	1972 OCT 14.0	.0683	.0684	.0693	.0693
41609.0	1972 OCT 19.0	.0520	.0520	.0530	.0530
41614.0	1972 OCT 24.0	.0358	.0359	.0368	.0368
41619.0	1972 OCT 29.0	.0198	.0200	.0208	.0209
41624.0	1972 NOV 3.0	.0039	.0043	.0050	.0051
41629.0	1972 NOV 8.0	-.0121	-.0114	-.0110	-.0109
41634.0	1972 NOV 13.0	-.0283	-.0274	-.0272	-.0272
41639.0	1972 NOV 18.0	-.0448	-.0438	-.0438	-.0437
41644.0	1972 NOV 23.0	-.0616	-.0603	-.0606	-.0606
41649.0	1972 NOV 28.0	-.0784	-.0771	-.0774	-.0774
41654.0	1972 DEC 3.0	-.0951	-.0938	-.0942	-.0941
41659.0	1972 DEC 8.0	-.1115	-.1103	-.1108	-.1105
41664.0	1972 DEC 13.0	-.1278	-.1267	-.1273	-.1269
41669.0	1972 DEC 18.0	-.1438	-.1430	-.1437	-.1430
41674.0	1972 DEC 23.0	-.1599	-.1594	-.1602	-.1595
41679.0	1972 DEC 28.0	-.1758	-.1757	-.1765	-.1762

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MJD	CIVIL DATE	BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
41684.0	1973 JAN 2.0	.8081	.8077	.8070	.8070
41689.0	1973 JAN 7.0	.7923	.7915	.7910	.7908
41694.0	1973 JAN 12.0	.7766	.7753	.7751	.7750
41699.0	1973 JAN 17.0	.7608	.7591	.7592	.7591
41704.0	1973 JAN 22.0	.7450	.7429	.7433	.7433
41709.0	1973 JAN 27.0	.7290	.7265	.7272	.7272
41714.0	1973 FEB 1.0	.7129	.7103	.7110	.7109
41719.0	1973 FEB 6.0	.6964	.6936	.6944	.6942
41724.0	1973 FEB 11.0	.6797	.6769	.6776	.6774
41729.0	1973 FEB 16.0	.6631	.6603	.6609	.6607
41734.0	1973 FEB 21.0	.6461	.6435	.6439	.6438
41739.0	1973 FEB 26.0	.6292	.6267	.6271	.6270
41744.0	1973 MARCH 3.0	.6123	.6101	.6104	.6103
41749.0	1973 MARCH 8.0	.5952	.5933	.5935	.5936
41754.0	1973 MARCH 13.0	.5779	.5763	.5765	.5766
41759.0	1973 MARCH 18.0	.5603	.5589	.5592	.5592
41764.0	1973 MARCH 23.0	.5424	.5413	.5416	.5415
41769.0	1973 MARCH 28.0	.5245	.5235	.5239	.5238
41774.0	1973 APRIL 2.0	.5063	.5055	.5059	.5058
41779.0	1973 APRIL 7.0	.4885	.4878	.4882	.4882
41784.0	1973 APRIL 12.0	.4710	.4704	.4707	.4708
41789.0	1973 APRIL 17.0	.4538	.4532	.4536	.4536
41794.0	1973 APRIL 22.0	.4367	.4363	.4365	.4365
41799.0	1973 APRIL 27.0	.4197	.4194	.4196	.4195
41804.0	1973 MAY 2.0	.4029	.4028	.4028	.4027
41809.0	1973 MAY 7.0	.3862	.3863	.3862	.3861
41814.0	1973 MAY 12.0	.3697	.3701	.3698	.3697
41819.0	1973 MAY 17.0	.3536	.3542	.3538	.3538
41824.0	1973 MAY 22.0	.3379	.3389	.3383	.3383
41829.0	1973 MAY 27.0	.3224	.3237	.3231	.3232
41834.0	1973 JUNE 1.0	.3073	.3089	.3082	.3085
41839.0	1973 JUNE 6.0	.2925	.2943	.2937	.2940
41844.0	1973 JUNE 11.0	.2779	.2801	.2794	.2796
41849.0	1973 JUNE 16.0	.2638	.2661	.2655	.2656
41854.0	1973 JUNE 21.0	.2503	.2529	.2522	.2523
41859.0	1973 JUNE 26.0	.2376	.2404	.2397	.2398
41864.0	1973 JULY 1.0	.2254	.2284	.2277	.2280
41869.0	1973 JULY 6.0	.2139	.2171	.2163	.2168
41874.0	1973 JULY 11.0	.2025	.2058	.2048	.2056
41879.0	1973 JULY 16.0	.1911	.1944	.1931	.1940
41884.0	1973 JULY 21.0	.1793	.1825	.1809	.1814
41889.0	1973 JULY 26.0	.1674	.1704	.1688	.1688
41894.0	1973 JULY 31.0	.1551	.1578	.1563	.1563
41899.0	1973 AUG 5.0	.1426	.1449	.1437	.1437
41904.0	1973 AUG 10.0	.1302	.1320	.1312	.1313
41909.0	1973 AUG 15.0	.1177	.1188	.1186	.1188
41914.0	1973 AUG 20.0	.1049	.1054	.1056	.1059
41919.0	1973 AUG 25.0	.0919	.0919	.0923	.0925
41924.0	1973 AUG 30.0	.0786	.0781	.0788	.0786
41929.0	1973 SEPT 4.0	.0649	.0641	.0648	.0643
41934.0	1973 SEPT 9.0	.0508	.0498	.0505	.0500
41939.0	1973 SEPT 14.0	.0362	.0353	.0359	.0354
41944.0	1973 SEPT 19.0	.0215	.0207	.0213	.0209

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MJD	CIVIL DATE	BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
41949.0	1973 SEPT 24.0	.0064	.0060	.0064	.0063
41954.0	1973 SEPT 29.0	-.0089	-.0088	-.0085	-.0084
41959.0	1973 OCT 4.0	-.0243	-.0238	-.0235	-.0233
41964.0	1973 OCT 9.0	-.0398	-.0388	-.0387	-.0385
41969.0	1973 OCT 14.0	-.0554	-.0540	-.0541	-.0540
41974.0	1973 OCT 19.0	-.0714	-.0697	-.0700	-.0699
41979.0	1973 OCT 24.0	-.0876	-.0857	-.0861	-.0860
41984.0	1973 OCT 29.0	-.1039	-.1018	-.1023	-.1022
41989.0	1973 NOV 3.0	-.1204	-.1184	-.1187	-.1186
41994.0	1973 NOV 8.0	-.1370	-.1350	-.1353	-.1352
41999.0	1973 NOV 13.0	-.1534	-.1516	-.1518	-.1517
42004.0	1973 NOV 18.0	-.1701	-.1683	-.1685	-.1685
42009.0	1973 NOV 23.0	-.1863	-.1847	-.1848	-.1848
42014.0	1973 NOV 28.0	-.2023	-.2007	-.2008	-.2009
42019.0	1973 DEC 3.0	-.2181	-.2165	-.2166	-.2166
42024.0	1973 DEC 8.0	-.2338	-.2322	-.2323	-.2323
42029.0	1973 DEC 13.0	-.2493	-.2477	-.2478	-.2477
42034.0	1973 DEC 18.0	-.2643	-.2628	-.2629	-.2627
42039.0	1973 DEC 23.0	-.2790	-.2776	-.2777	-.2776
42044.0	1973 DEC 28.0	-.2924	-.2912	-.2913	-.2914
42049.0	1974 JAN 2.0	.6965	.6975	.6974	.6972
42054.0	1974 JAN 7.0	.6840	.6847	.6847	.6846
42059.0	1974 JAN 12.0	.6698	.6702	.6703	.6703
42064.0	1974 JAN 17.0	.6561	.6563	.6565	.6565
42069.0	1974 JAN 22.0	.6446	.6446	.6449	.6448
42074.0	1974 JAN 27.0	.6331	.6330	.6334	.6331
42079.0	1974 FEB 1.0	.6197	.6196	.6200	.6198
42084.0	1974 FEB 6.0	.6052	.6054	.6056	.6055
42089.0	1974 FEB 11.0	.5908	.5913	.5913	.5913
42094.0	1974 FEB 16.0	.5772	.5782	.5779	.5779
42099.0	1974 FEB 21.0	.5640	.5654	.5649	.5650
42104.0	1974 FEB 26.0	.5499	.5517	.5511	.5512
42109.0	1974 MARCH 3.0	.5348	.5369	.5363	.5365
42114.0	1974 MARCH 8.0	.5189	.5212	.5206	.5210
42119.0	1974 MARCH 13.0	.5025	.5047	.5045	.5048
42124.0	1974 MARCH 18.0	.4864	.4883	.4885	.4888
42129.0	1974 MARCH 23.0	.4711	.4726	.4733	.4736
42134.0	1974 MARCH 28.0	.4565	.4575	.4587	.4591
42139.0	1974 APRIL 2.0	.4419	.4424	.4439	.4443
42144.0	1974 APRIL 7.0	.4275	.4274	.4291	.4292
42149.0	1974 APRIL 12.0	.4125	.4120	.4134	.4130
42154.0	1974 APRIL 17.0	.3963	.3955	.3967	.3963
42159.0	1974 APRIL 22.0	.3789	.3781	.3791	.3788
42164.0	1974 APRIL 27.0	.3614	.3608	.3615	.3613
42169.0	1974 MAY 2.0	.3445	.3442	.3446	.3445
42174.0	1974 MAY 7.0	.3286	.3287	.3289	.3287
42179.0	1974 MAY 12.0	.3131	.3137	.3136	.3134
42184.0	1974 MAY 17.0	.2984	.2994	.2991	.2990
42189.0	1974 MAY 22.0	.2835	.2849	.2843	.2844
42194.0	1974 MAY 27.0	.2685	.2701	.2694	.2697
42199.0	1974 JUNE 1.0	.2541	.2557	.2550	.2553
42204.0	1974 JUNE 6.0	.2408	.2423	.2416	.2420
42209.0	1974 JUNE 11.0	.2288	.2300	.2295	.2298

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42214.0	1974 JUNE 16.0	.2180	.2188	.2185	.2187
42219.0	1974 JUNE 21.0	.2078	.2082	.2081	.2081
42224.0	1974 JUNE 26.0	.1977	.1977	.1978	.1976
42229.0	1974 JULY 1.0	.1876	.1873	.1875	.1873
42234.0	1974 JULY 6.0	.1771	.1766	.1769	.1767
42239.0	1974 JULY 11.0	.1666	.1660	.1664	.1662
42244.0	1974 JULY 16.0	.1564	.1558	.1562	.1561
42249.0	1974 JULY 21.0	.1466	.1461	.1464	.1464
42254.0	1974 JULY 26.0	.1371	.1368	.1370	.1370
42259.0	1974 JULY 31.0	.1277	.1276	.1276	.1277
42264.0	1974 AUG 5.0	.1175	.1175	.1174	.1176
42269.0	1974 AUG 10.0	.1062	.1062	.1061	.1063
42274.0	1974 AUG 15.0	.0940	.0940	.0938	.0940
42279.0	1974 AUG 20.0	.0819	.0818	.0817	.0817
42284.0	1974 AUG 25.0	.0703	.0701	.0700	.0699
42289.0	1974 AUG 30.0	.0593	.0589	.0589	.0588
42294.0	1974 SEPT 4.0	.0480	.0475	.0476	.0475
42299.0	1974 SEPT 9.0	.0358	.0352	.0354	.0353
42304.0	1974 SEPT 14.0	.0230	.0224	.0227	.0226
42309.0	1974 SEPT 19.0	.0097	.0092	.0095	.0094
42314.0	1974 SEPT 24.0	-.0040	-.0043	-.0041	-.0041
42319.0	1974 SEPT 29.0	-.0176	-.0175	-.0176	-.0176
42324.0	1974 OCT 4.0	-.0312	-.0308	-.0310	-.0311
42329.0	1974 OCT 9.0	-.0456	-.0449	-.0452	-.0453
42334.0	1974 OCT 14.0	-.0610	-.0599	-.0604	-.0605
42339.0	1974 OCT 19.0	-.0767	-.0754	-.0758	-.0757
42344.0	1974 OCT 24.0	-.0924	-.0908	-.0911	-.0909
42349.0	1974 OCT 29.0	-.1079	-.1062	-.1064	-.1060
42354.0	1974 NOV 3.0	-.1231	-.1214	-.1214	-.1210
42359.0	1974 NOV 8.0	-.1383	-.1366	-.1365	-.1362
42364.0	1974 NOV 13.0	-.1535	-.1519	-.1517	-.1515
42369.0	1974 NOV 18.0	-.1688	-.1674	-.1671	-.1671
42374.0	1974 NOV 23.0	-.1842	-.1828	-.1826	-.1827
42379.0	1974 NOV 28.0	-.1994	-.1982	-.1979	-.1980
42384.0	1974 DEC 3.0	-.2147	-.2135	-.2133	-.2134
42389.0	1974 DEC 8.0	-.2293	-.2282	-.2280	-.2281
42394.0	1974 DEC 13.0	-.2432	-.2421	-.2419	-.2421
42399.0	1974 DEC 18.0	-.2563	-.2554	-.2551	-.2553
42404.0	1974 DEC 23.0	-.2694	-.2686	-.2683	-.2684
42409.0	1974 DEC 28.0	-.2823	-.2816	-.2813	-.2813
42414.0	1975 JAN 2.0	.7045	.7050	.7053	.7054
42419.0	1975 JAN 7.0	.6911	.6914	.6918	.6917
42424.0	1975 JAN 12.0	.6778	.6779	.6783	.6783
42429.0	1975 JAN 17.0	.6641	.6640	.6646	.6645
42434.0	1975 JAN 22.0	.6503	.6501	.6507	.6507
42439.0	1975 JAN 27.0	.6360	.6357	.6364	.6363
42444.0	1975 FEB 1.0	.6211	.6207	.6215	.6214
42449.0	1975 FEB 6.0	.6062	.6060	.6066	.6065
42454.0	1975 FEB 11.0	.5915	.5914	.5919	.5919
42459.0	1975 FEB 16.0	.5768	.5769	.5773	.5772
42464.0	1975 FEB 21.0	.5623	.5626	.5628	.5628
42469.0	1975 FEB 26.0	.5480	.5486	.5485	.5485
42474.0	1975 MARCH 3.0	.5341	.5348	.5347	.5346

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MJD	CIVIL DATE	BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
42479.0	1975 MARCH 8.0	.5197	.5206	.5203	.5203
42484.0	1975 MARCH 13.0	.5052	.5061	.5058	.5058
42489.0	1975 MARCH 18.0	.4902	.4911	.4908	.4909
42494.0	1975 MARCH 23.0	.4746	.4754	.4751	.4753
42499.0	1975 MARCH 28.0	.4587	.4592	.4591	.4593
42504.0	1975 APRIL 2.0	.4431	.4434	.4433	.4436
42509.0	1975 APRIL 7.0	.4283	.4283	.4282	.4284
42514.0	1975 APRIL 12.0	.4139	.4136	.4135	.4135
42519.0	1975 APRIL 17.0	.3994	.3988	.3987	.3985
42524.0	1975 APRIL 22.0	.3844	.3836	.3835	.3833
42529.0	1975 APRIL 27.0	.3692	.3683	.3682	.3680
42534.0	1975 MAY 2.0	.3541	.3530	.3530	.3528
42539.0	1975 MAY 7.0	.3393	.3381	.3381	.3380
42544.0	1975 MAY 12.0	.3248	.3235	.3237	.3236
42549.0	1975 MAY 17.0	.3110	.3096	.3099	.3099
42554.0	1975 MAY 22.0	.2974	.2961	.2963	.2964
42559.0	1975 MAY 27.0	.2843	.2830	.2833	.2833
42564.0	1975 JUNE 1.0	.2717	.2703	.2707	.2707
42569.0	1975 JUNE 6.0	.2593	.2580	.2582	.2583
42574.0	1975 JUNE 11.0	.2472	.2460	.2461	.2461
42579.0	1975 JUNE 16.0	.2354	.2342	.2343	.2342
42584.0	1975 JUNE 21.0	.2237	.2227	.2226	.2225
42589.0	1975 JUNE 26.0	.2125	.2117	.2114	.2113
42594.0	1975 JULY 1.0	.2020	.2013	.2009	.2008
42599.0	1975 JULY 6.0	.1921	.1916	.1911	.1910
42604.0	1975 JULY 11.0	.1824	.1820	.1816	.1816
42609.0	1975 JULY 16.0	.1730	.1727	.1726	.1729
42614.0	1975 JULY 21.0	.1638	.1637	.1637	.1643
42619.0	1975 JULY 26.0	.1547	.1546	.1549	.1555
42624.0	1975 JULY 31.0	.1451	.1452	.1455	.1460
42629.0	1975 AUG 5.0	.1352	.1352	.1356	.1360
42634.0	1975 AUG 10.0	.1246	.1245	.1248	.1250
42639.0	1975 AUG 15.0	.1136	.1135	.1135	.1134
42644.0	1975 AUG 20.0	.1026	.1025	.1022	.1019
42649.0	1975 AUG 25.0	.0918	.0917	.0912	.0909
42654.0	1975 AUG 30.0	.0809	.0807	.0802	.0800
42659.0	1975 SEPT 4.0	.0693	.0691	.0687	.0685
42664.0	1975 SEPT 9.0	.0573	.0571	.0567	.0567
42669.0	1975 SEPT 14.0	.0451	.0448	.0445	.0446
42674.0	1975 SEPT 19.0	.0326	.0322	.0321	.0322
42679.0	1975 SEPT 24.0	.0196	.0192	.0190	.0192
42684.0	1975 SEPT 29.0	.0060	.0055	.0054	.0055
42689.0	1975 OCT 4.0	-.0079	-.0085	-.0086	-.0086
42694.0	1975 OCT 9.0	-.0225	-.0233	-.0233	-.0235
42699.0	1975 OCT 14.0	-.0375	-.0384	-.0383	-.0386
42704.0	1975 OCT 19.0	-.0531	-.0540	-.0538	-.0541
42709.0	1975 OCT 24.0	-.0689	-.0697	-.0695	-.0697
42714.0	1975 OCT 29.0	-.0849	-.0856	-.0853	-.0854
42719.0	1975 NOV 3.0	-.1008	-.1013	-.1010	-.1010
42724.0	1975 NOV 8.0	-.1169	-.1171	-.1170	-.1169
42729.0	1975 NOV 13.0	-.1328	-.1327	-.1327	-.1326
42734.0	1975 NOV 18.0	-.1486	-.1480	-.1483	-.1483
42739.0	1975 NOV 23.0	-.1641	-.1632	-.1637	-.1637

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MJD	CIVIL DATE			BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
42744.0	1975	NOV	28.0	−.1792	−.1780	−.1786	−.1786
42749.0	1975	DEC	3.0	−.1940	−.1924	−.1931	−.1929
42754.0	1975	DEC	8.0	−.2080	−.2063	−.2069	−.2064
42759.0	1975	DEC	13.0	−.2219	−.2201	−.2206	−.2199
42764.0	1975	DEC	18.0	−.2356	−.2340	−.2342	−.2335
42769.0	1975	DEC	23.0	−.2492	−.2478	−.2479	−.2474
42774.0	1975	DEC	28.0	−.2625	−.2614	−.2615	−.2613
42779.0	1976	JAN	2.0	.7244	.7252	.7251	.7249
42784.0	1976	JAN	7.0	.7110	.7116	.7115	.7113
42789.0	1976	JAN	12.0	.6975	.6977	.6978	.6977
42794.0	1976	JAN	17.0	.6836	.6837	.6838	.6838
42799.0	1976	JAN	22.0	.6692	.6692	.6694	.6694
42804.0	1976	JAN	27.0	.6544	.6543	.6545	.6545
42809.0	1976	FEB	1.0	.6394	.6393	.6395	.6394
42814.0	1976	FEB	6.0	.6241	.6242	.6242	.6241
42819.0	1976	FEB	11.0	.6095	.6096	.6095	.6095
42824.0	1976	FEB	16.0	.5951	.5953	.5951	.5951
42829.0	1976	FEB	21.0	.5810	.5812	.5810	.5811
42834.0	1976	FEB	26.0	.5668	.5669	.5668	.5669
42839.0	1976	MARCH	2.0	.5523	.5523	.5523	.5523
42844.0	1976	MARCH	7.0	.5372	.5369	.5371	.5371
42849.0	1976	MARCH	12.0	.5215	.5211	.5213	.5213
42854.0	1976	MARCH	17.0	.5056	.5049	.5053	.5054
42859.0	1976	MARCH	22.0	.4893	.4884	.4889	.4891
42864.0	1976	MARCH	27.0	.4726	.4715	.4720	.4722
42869.0	1976	APRIL	1.0	.4556	.4544	.4549	.4549
42874.0	1976	APRIL	6.0	.4385	.4373	.4378	.4377
42879.0	1976	APRIL	11.0	.4218	.4207	.4210	.4209
42884.0	1976	APRIL	16.0	.4053	.4043	.4045	.4044
42889.0	1976	APRIL	21.0	.3889	.3882	.3882	.3881
42894.0	1976	APRIL	26.0	.3728	.3723	.3721	.3721
42899.0	1976	MAY	1.0	.3566	.3564	.3560	.3560
42904.0	1976	MAY	6.0	.3405	.3406	.3400	.3401
42909.0	1976	MAY	11.0	.3238	.3240	.3235	.3236
42914.0	1976	MAY	16.0	.3068	.3070	.3066	.3068
42919.0	1976	MAY	21.0	.2902	.2905	.2902	.2903
42924.0	1976	MAY	26.0	.2748	.2751	.2749	.2751
42929.0	1976	MAY	31.0	.2602	.2603	.2603	.2606
42934.0	1976	JUNE	5.0	.2462	.2463	.2464	.2465
42939.0	1976	JUNE	10.0	.2336	.2335	.2337	.2338
42944.0	1976	JUNE	15.0	.2218	.2214	.2217	.2219
42949.0	1976	JUNE	20.0	.2108	.2103	.2106	.2106
42954.0	1976	JUNE	25.0	.2002	.1995	.1997	.1997
42959.0	1976	JUNE	30.0	.1894	.1885	.1887	.1886
42964.0	1976	JULY	5.0	.1785	.1775	.1776	.1775
42969.0	1976	JULY	10.0	.1668	.1656	.1658	.1657
42974.0	1976	JULY	15.0	.1547	.1534	.1537	.1535
42979.0	1976	JULY	20.0	.1426	.1412	.1416	.1414
42984.0	1976	JULY	25.0	.1305	.1291	.1295	.1294
42989.0	1976	JULY	30.0	.1185	.1171	.1176	.1175
42994.0	1976	AUG	4.0	.1066	.1054	.1057	.1057
42999.0	1976	AUG	9.0	.0952	.0941	.0943	.0943
43004.0	1976	AUG	14.0	.0839	.0830	.0830	.0830

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MJD	CIVIL DATE			BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
43009.0	1976	AUG	19.0	.0726	.0720	.0718	.0717
43014.0	1976	AUG	24.0	.0609	.0605	.0602	.0601
43019.0	1976	AUG	29.0	.0487	.0485	.0481	.0481
43024.0	1976	SEPT	3.0	.0358	.0358	.0353	.0356
43029.0	1976	SEPT	8.0	.0219	.0220	.0215	.0219
43034.0	1976	SEPT	13.0	.0071	.0072	.0068	.0071
43039.0	1976	SEPT	18.0	-.0084	-.0084	-.0088	-.0085
43044.0	1976	SEPT	23.0	-.0246	-.0246	-.0250	-.0250
43049.0	1976	SEPT	28.0	-.0410	-.0413	-.0415	-.0416
43054.0	1976	OCT	3.0	-.0575	-.0580	-.0581	-.0583
43059.0	1976	OCT	8.0	-.0743	-.0750	-.0750	-.0751
43064.0	1976	OCT	13.0	-.0914	-.0923	-.0921	-.0921
43069.0	1976	OCT	18.0	-.1085	-.1095	-.1092	-.1092
43074.0	1976	OCT	23.0	-.1256	-.1267	-.1263	-.1263
43079.0	1976	OCT	28.0	-.1426	-.1436	-.1434	-.1434
43084.0	1976	NOV	2.0	-.1591	-.1600	-.1599	-.1600
43089.0	1976	NOV	7.0	-.1750	-.1757	-.1759	-.1759
43094.0	1976	NOV	12.0	-.1903	-.1907	-.1912	-.1913
43099.0	1976	NOV	17.0	-.2053	-.2054	-.2062	-.2063
43104.0	1976	NOV	22.0	-.2202	-.2199	-.2211	-.2212
43109.0	1976	NOV	27.0	-.2350	-.2345	-.2357	-.2360
43114.0	1976	DEC	2.0	-.2500	-.2491	-.2503	-.2505
43119.0	1976	DEC	7.0	-.2650	-.2639	-.2645	-.2638
43124.0	1976	DEC	12.0	-.2800	-.2787	-.2786	-.2780
43129.0	1976	DEC	17.0	-.2946	-.2932	-.2928	-.2925
43134.0	1976	DEC	22.0	-.3090	-.3075	-.3071	-.3069
43139.0	1976	DEC	27.0	-.3232	-.3217	-.3213	-.3211
43144.0	1977	JAN	1.0	.6631	.6646	.6649	.6651
43149.0	1977	JAN	6.0	.6491	.6507	.6507	.6511
43154.0	1977	JAN	11.0	.6352	.6367	.6366	.6370
43159.0	1977	JAN	16.0	.6212	.6226	.6224	.6227
43164.0	1977	JAN	21.0	.6072	.6085	.6083	.6083
43169.0	1977	JAN	26.0	.5935	.5947	.5944	.5944
43174.0	1977	JAN	31.0	.5800	.5810	.5809	.5809
43179.0	1977	FEB	5.0	.5666	.5675	.5674	.5675
43184.0	1977	FEB	10.0	.5533	.5539	.5541	.5541
43189.0	1977	FEB	15.0	.5399	.5403	.5406	.5406
43194.0	1977	FEB	20.0	.5263	.5265	.5268	.5268
43199.0	1977	FEB	25.0	.5122	.5122	.5125	.5124
43204.0	1977	MARCH	2.0	.4975	.4973	.4976	.4973
43209.0	1977	MARCH	7.0	.4828	.4824	.4825	.4824
43214.0	1977	MARCH	12.0	.4677	.4673	.4671	.4671
43219.0	1977	MARCH	17.0	.4524	.4519	.4516	.4516
43224.0	1977	MARCH	22.0	.4369	.4363	.4360	.4360
43229.0	1977	MARCH	27.0	.4211	.4204	.4201	.4201
43234.0	1977	APRIL	1.0	.4051	.4043	.4041	.4041
43239.0	1977	APRIL	6.0	.3889	.3880	.3879	.3878
43244.0	1977	APRIL	11.0	.3726	.3716	.3715	.3715
43249.0	1977	APRIL	16.0	.3562	.3549	.3551	.3551
43254.0	1977	APRIL	21.0	.3397	.3383	.3386	.3386
43259.0	1977	APRIL	26.0	.3235	.3219	.3224	.3224
43264.0	1977	MAY	1.0	.3075	.3057	.3063	.3063
43269.0	1977	MAY	6.0	.2917	.2898	.2904	.2903

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MJD	CIVIL DATE			BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
43274.0	1977	MAY	11.0	.2763	.2743	.2749	.2748
43279.0	1977	MAY	16.0	.2612	.2592	.2597	.2596
43284.0	1977	MAY	21.0	.2467	.2448	.2452	.2451
43289.0	1977	MAY	26.0	.2329	.2311	.2314	.2314
43294.0	1977	MAY	31.0	.2196	.2180	.2182	.2181
43299.0	1977	JUNE	5.0	.2070	.2058	.2056	.2056
43304.0	1977	JUNE	10.0	.1950	.1940	.1937	.1936
43309.0	1977	JUNE	15.0	.1836	.1828	.1824	.1824
43314.0	1977	JUNE	20.0	.1726	.1720	.1715	.1716
43319.0	1977	JUNE	25.0	.1622	.1616	.1612	.1613
43324.0	1977	JUNE	30.0	.1523	.1517	.1513	.1515
43329.0	1977	JULY	5.0	.1428	.1421	.1417	.1419
43334.0	1977	JULY	10.0	.1335	.1325	.1323	.1325
43339.0	1977	JULY	15.0	.1242	.1230	.1228	.1229
43344.0	1977	JULY	20.0	.1151	.1136	.1136	.1136
43349.0	1977	JULY	25.0	.1060	.1043	.1044	.1042
43354.0	1977	JULY	30.0	.0965	.0947	.0948	.0946
43359.0	1977	AUG	4.0	.0871	.0852	.0853	.0851
43364.0	1977	AUG	9.0	.0775	.0755	.0758	.0755
43369.0	1977	AUG	14.0	.0673	.0655	.0657	.0655
43374.0	1977	AUG	19.0	.0565	.0549	.0550	.0551
43379.0	1977	AUG	24.0	.0453	.0439	.0440	.0443
43384.0	1977	AUG	29.0	.0334	.0322	.0323	.0326
43389.0	1977	SEPT	3.0	.0208	.0198	.0198	.0200
43394.0	1977	SEPT	8.0	.0073	.0064	.0064	.0064
43399.0	1977	SEPT	13.0	-.0068	-.0076	-.0077	-.0077
43404.0	1977	SEPT	18.0	-.0213	-.0220	-.0222	-.0223
43409.0	1977	SEPT	23.0	-.0361	-.0367	-.0370	-.0372
43414.0	1977	SEPT	28.0	-.0510	-.0517	-.0518	-.0521
43419.0	1977	OCT	3.0	-.0661	-.0667	-.0668	-.0671
43424.0	1977	OCT	8.0	-.0817	-.0823	-.0822	-.0824
43429.0	1977	OCT	13.0	-.0976	-.0982	-.0980	-.0979
43434.0	1977	OCT	18.0	-.1139	-.1145	-.1142	-.1140
43439.0	1977	OCT	23.0	-.1302	-.1307	-.1305	-.1302
43444.0	1977	OCT	28.0	-.1464	-.1468	-.1467	-.1465
43449.0	1977	NOV	2.0	-.1622	-.1626	-.1626	-.1624
43454.0	1977	NOV	7.0	-.1777	-.1780	-.1783	-.1782
43459.0	1977	NOV	12.0	-.1930	-.1934	-.1937	-.1938
43464.0	1977	NOV	17.0	-.2084	-.2088	-.2093	-.2094
43469.0	1977	NOV	22.0	-.2237	-.2243	-.2247	-.2248
43474.0	1977	NOV	27.0	-.2390	-.2399	-.2400	-.2401
43479.0	1977	DEC	2.0	-.2542	-.2553	-.2553	-.2554
43484.0	1977	DEC	7.0	-.2697	-.2711	-.2708	-.2709
43489.0	1977	DEC	12.0	-.2856	-.2871	-.2867	-.2867
43494.0	1977	DEC	17.0	-.3015	-.3033	-.3027	-.3026
43499.0	1977	DEC	22.0	-.3177	-.3196	-.3189	-.3189
43504.0	1977	DEC	27.0	-.3339	-.3359	-.3351	-.3352
43509.0	1978	JAN	1.0	.6499	.6479	.6486	.6485
43514.0	1978	JAN	6.0	.6339	.6320	.6325	.6324
43519.0	1978	JAN	11.0	.6182	.6163	.6167	.6165
43524.0	1978	JAN	16.0	.6025	.6007	.6009	.6006
43529.0	1978	JAN	21.0	.5871	.5853	.5854	.5851
43534.0	1978	JAN	26.0	.5718	.5701	.5701	.5698

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MJD	CIVIL DATE			BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
43539.0	1978	JAN	31.0	.5562	.5544	.5545	.5544
43544.0	1978	FEB	5.0	.5400	.5382	.5383	.5384
43549.0	1978	FEB	10.0	.5230	.5211	.5212	.5214
43554.0	1978	FEB	15.0	.5054	.5035	.5036	.5037
43559.0	1978	FEB	20.0	.4877	.4856	.4859	.4859
43564.0	1978	FEB	25.0	.4699	.4678	.4680	.4680
43569.0	1978	MARCH	2.0	.4524	.4502	.4504	.4504
43574.0	1978	MARCH	7.0	.4352	.4330	.4331	.4331
43579.0	1978	MARCH	12.0	.4183	.4162	.4161	.4159
43584.0	1978	MARCH	17.0	.4018	.3998	.3996	.3990
43589.0	1978	MARCH	22.0	.3851	.3832	.3829	.3820
43594.0	1978	MARCH	27.0	.3681	.3662	.3661	.3653
43599.0	1978	APRIL	1.0	.3508	.3491	.3491	.3486
43604.0	1978	APRIL	6.0	.3332	.3315	.3317	.3316
43609.0	1978	APRIL	11.0	.3156	.3140	.3143	.3144
43614.0	1978	APRIL	16.0	.2984	.2968	.2972	.2972
43619.0	1978	APRIL	21.0	.2817	.2803	.2806	.2806
43624.0	1978	APRIL	26.0	.2656	.2642	.2645	.2645
43629.0	1978	MAY	1.0	.2499	.2486	.2488	.2489
43634.0	1978	MAY	6.0	.2341	.2329	.2330	.2331
43639.0	1978	MAY	11.0	.2184	.2172	.2172	.2174
43644.0	1978	MAY	16.0	.2024	.2013	.2011	.2013
43649.0	1978	MAY	21.0	.1870	.1858	.1855	.1856
43654.0	1978	MAY	26.0	.1723	.1710	.1706	.1706
43659.0	1978	MAY	31.0	.1581	.1567	.1562	.1561
43664.0	1978	JUNE	5.0	.1450	.1434	.1430	.1428
43669.0	1978	JUNE	10.0	.1324	.1305	.1303	.1301
43674.0	1978	JUNE	15.0	.1205	.1183	.1183	.1182
43679.0	1978	JUNE	20.0	.1093	.1066	.1071	.1071
43684.0	1978	JUNE	25.0	.0985	.0955	.0962	.0963
43689.0	1978	JUNE	30.0	.0881	.0849	.0857	.0858
43694.0	1978	JULY	5.0	.0782	.0748	.0757	.0757
43699.0	1978	JULY	10.0	.0689	.0655	.0663	.0660
43704.0	1978	JULY	15.0	.0599	.0567	.0571	.0564
43709.0	1978	JULY	20.0	.0511	.0482	.0483	.0474
43714.0	1978	JULY	25.0	.0421	.0396	.0395	.0386
43719.0	1978	JULY	30.0	.0328	.0308	.0307	.0299
43724.0	1978	AUG	4.0	.0228	.0215	.0212	.0208
43729.0	1978	AUG	9.0	.0119	.0111	.0107	.0108
43734.0	1978	AUG	14.0	.0001	-.0002	-.0007	-.0005
43739.0	1978	AUG	19.0	-.0121	-.0121	-.0126	-.0124
43744.0	1978	AUG	24.0	-.0246	-.0244	-.0250	-.0248
43749.0	1978	AUG	29.0	-.0371	-.0369	-.0374	-.0372
43754.0	1978	SEPT	3.0	-.0498	-.0498	-.0500	-.0498
43759.0	1978	SEPT	8.0	-.0624	-.0627	-.0626	-.0624
43764.0	1978	SEPT	13.0	-.0750	-.0757	-.0752	-.0750
43769.0	1978	SEPT	18.0	-.0881	-.0891	-.0884	-.0882
43774.0	1978	SEPT	23.0	-.1017	-.1029	-.1020	-.1020
43779.0	1978	SEPT	28.0	-.1156	-.1170	-.1159	-.1161
43784.0	1978	OCT	3.0	-.1300	-.1313	-.1303	-.1305
43789.0	1978	OCT	8.0	-.1447	-.1459	-.1450	-.1451
43794.0	1978	OCT	13.0	-.1596	-.1605	-.1598	-.1599
43799.0	1978	OCT	18.0	-.1747	-.1751	-.1747	-.1749

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43804.0	1978	OCT	23.0	−.1901	−.1900	−.1899	−.1902
43809.0	1978	OCT	28.0	−.2056	−.2050	−.2051	−.2053
43814.0	1978	NOV	2.0	−.2211	−.2200	−.2203	−.2202
43819.0	1978	NOV	7.0	−.2368	−.2354	−.2356	−.2354
43824.0	1978	NOV	12.0	−.2525	−.2508	−.2511	−.2508
43829.0	1978	NOV	17.0	−.2683	−.2664	−.2666	−.2664
43834.0	1978	NOV	22.0	−.2839	−.2819	−.2821	−.2820
43839.0	1978	NOV	27.0	−.2994	−.2974	−.2976	−.2974
43844.0	1978	DEC	2.0	−.3149	−.3129	−.3130	−.3130
43849.0	1978	DEC	7.0	−.3301	−.3282	−.3283	−.3282
43854.0	1978	DEC	12.0	−.3452	−.3433	−.3434	−.3434
43859.0	1978	DEC	17.0	−.3601	−.3583	−.3583	−.3584
43864.0	1978	DEC	22.0	−.3750	−.3733	−.3733	−.3733
43869.0	1978	DEC	27.0	−.3898	−.3882	−.3881	−.3882
43874.0	1979	JAN	1.0	.5956	.5971	.5972	.5971
43879.0	1979	JAN	6.0	.5810	.5823	.5824	.5824
43884.0	1979	JAN	11.0	.5666	.5676	.5676	.5677
43889.0	1979	JAN	16.0	.5522	.5528	.5526	.5522
43894.0	1979	JAN	21.0	.5378	.5380	.5376	.5371
43899.0	1979	JAN	26.0	.5234	.5233	.5229	.5226
43904.0	1979	JAN	31.0	.5090	.5085	.5084	.5082
43909.0	1979	FEB	5.0	.4946	.4939	.4940	.4938
43914.0	1979	FEB	10.0	.4799	.4791	.4795	.4792
43919.0	1979	FEB	15.0	.4652	.4644	.4649	.4646
43924.0	1979	FEB	20.0	.4506	.4501	.4506	.4503
43929.0	1979	FEB	25.0	.4358	.4356	.4360	.4359
43934.0	1979	MARCH	2.0	.4210	.4213	.4215	.4216
43939.0	1979	MARCH	7.0	.4062	.4071	.4069	.4071
43944.0	1979	MARCH	12.0	.3912	.3926	.3921	.3923
43949.0	1979	MARCH	17.0	.3762	.3781	.3772	.3775
43954.0	1979	MARCH	22.0	.3611	.3632	.3621	.3624
43959.0	1979	MARCH	27.0	.3457	.3479	.3466	.3468
43964.0	1979	APRIL	1.0	.3303	.3324	.3311	.3312
43969.0	1979	APRIL	6.0	.3147	.3164	.3153	.3155
43974.0	1979	APRIL	11.0	.2992	.3005	.2996	.2999
43979.0	1979	APRIL	16.0	.2836	.2843	.2838	.2841
43984.0	1979	APRIL	21.0	.2680	.2680	.2679	.2681
43989.0	1979	APRIL	26.0	.2527	.2522	.2523	.2523
43994.0	1979	MAY	1.0	.2374	.2365	.2368	.2365
43999.0	1979	MAY	6.0	.2223	.2211	.2215	.2211
44004.0	1979	MAY	11.0	.2076	.2063	.2067	.2064
44009.0	1979	MAY	16.0	.1933	.1920	.1924	.1921
44014.0	1979	MAY	21.0	.1795	.1784	.1786	.1785
44019.0	1979	MAY	26.0	.1662	.1653	.1655	.1655
44024.0	1979	MAY	31.0	.1535	.1529	.1531	.1532
44029.0	1979	JUNE	5.0	.1413	.1409	.1411	.1413
44034.0	1979	JUNE	10.0	.1293	.1291	.1292	.1295
44039.0	1979	JUNE	15.0	.1176	.1174	.1175	.1178
44044.0	1979	JUNE	20.0	.1064	.1061	.1062	.1065
44049.0	1979	JUNE	25.0	.0953	.0948	.0949	.0950
44054.0	1979	JUNE	30.0	.0846	.0839	.0840	.0837
44059.0	1979	JULY	5.0	.0743	.0734	.0735	.0730
44064.0	1979	JULY	10.0	.0644	.0633	.0635	.0630

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JPL PROPOSED UT1 - UTC LUNAR LASER RANGING DATA

MJD	CIVIL DATE			BIH	FOURIER SMOOTHED	GAUSSIAN 15 DAY SMOOTHED	GAUSSIAN 10 DAY SMOOTHED
44069.0	1979	JULY	15.0	.0546	.0534	.0537	.0532
44074.0	1979	JULY	20.0	.0449	.0438	.0442	.0439
44079.0	1979	JULY	25.0	.0352	.0342	.0348	.0349
44084.0	1979	JULY	30.0	.0256	.0249	.0255	.0259
44089.0	1979	AUG	4.0	.0157	.0154	.0159	.0162
44094.0	1979	AUG	9.0	.0056	.0057	.0060	.0061
44099.0	1979	AUG	14.0	-.0047	-.0042	-.0043	-.0042
44104.0	1979	AUG	19.0	-.0152	-.0144	-.0147	-.0147
44109.0	1979	AUG	24.0	-.0257	-.0247	-.0252	-.0252
44114.0	1979	AUG	29.0	-.0364	-.0354	-.0359	-.0359
44119.0	1979	SEPT	3.0	-.0472	-.0462	-.0467	-.0467
44124.0	1979	SEPT	8.0	-.0583	-.0575	-.0578	-.0578
44129.0	1979	SEPT	13.0	-.0696	-.0691	-.0691	-.0691
44134.0	1979	SEPT	18.0	-.0814	-.0811	-.0809	-.0809
44139.0	1979	SEPT	23.0	-.0936	-.0936	-.0932	-.0931
44144.0	1979	SEPT	28.0	-.1063	-.1065	-.1059	-.1059
44149.0	1979	OCT	3.0	-.1195	-.1198	-.1191	-.1191
44154.0	1979	OCT	8.0	-.1329	-.1332	-.1326	-.1326
44159.0	1979	OCT	13.0	-.1463	-.1465	-.1461	-.1462
44164.0	1979	OCT	18.0	-.1599	-.1598	-.1597	-.1599
44169.0	1979	OCT	23.0	-.1735	-.1732	-.1733	-.1735
44174.0	1979	OCT	28.0	-.1872	-.1865	-.1868	-.1872
44179.0	1979	NOV	2.0	-.2009	-.1999	-.2001	-.2004
44184.0	1979	NOV	7.0	-.2144	-.2131	-.2131	-.2130
44189.0	1979	NOV	12.0	-.2276	-.2261	-.2260	-.2257
44194.0	1979	NOV	17.0	-.2407	-.2390	-.2389	-.2388
44199.0	1979	NOV	22.0	-.2537	-.2519	-.2519	-.2518
44204.0	1979	NOV	27.0	-.2667	-.2648	-.2648	-.2648
44209.0	1979	DEC	2.0	-.2795	-.2776	-.2776	-.2776
44214.0	1979	DEC	7.0	-.2923	-.2905	-.2904	-.2904
44219.0	1979	DEC	12.0	-.3051	-.3033	-.3032	-.3033
44224.0	1979	DEC	17.0	-.3178	-.3161	-.3159	-.3159
44229.0	1979	DEC	22.0	-.3305	-.3288	-.3286	-.3286
44234.0	1979	DEC	27.0	-.3430	-.3414	-.3411	-.3410
44239.0	1980	JAN	1.0	.6444	.6460	.6462	.6464
44244.0	1980	JAN	6.0	.6318	.6333	.6335	.6337
44249.0	1980	JAN	11.0	.6191	.6206	.6207	.6208
44254.0	1980	JAN	16.0	.6065	.6079	.6079	.6079
44259.0	1980	JAN	21.0	.5939	.5953	.5952	.5951
44264.0	1980	JAN	26.0	.5813	.5826	.5826	.5824
44269.0	1980	JAN	31.0	.5690	.5703	.5703	.5701
44274.0	1980	FEB	5.0	.5567	.5580	.5580	.5579
44279.0	1980	FEB	10.0	.5446	.5458	.5459	.5460
44284.0	1980	FEB	15.0	.5324	.5336	.5338	.5339
44289.0	1980	FEB	20.0	.5203	.5216	.5217	.5218
44294.0	1980	FEB	25.0	.5082	.5095	.5096	.5097
44299.0	1980	MARCH	1.0	.4962	.4975	.4975	.4976
44304.0	1980	MARCH	6.0	.4840	.4853	.4852	.4852
44309.0	1980	MARCH	11.0	.4716	.4729	.4727	.4727
44314.0	1980	MARCH	16.0	.4591	.4603	.4600	.4600
44319.0	1980	MARCH	21.0	.4465	.4476	.4472	.4471

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TABLE 3

PRELIMINARY MERIT CAMPAIGN

1980 DATE	LLR-BIH ΔUT1 ms		FORMAL ERROR ms	No. of Ranges
AUG 1.46	-1.11	±	0.24	3
2.49	-0.95		0.23	3
3.53	-0.34		0.55	2
6.64	-0.48		1.19	2
23.17	-3.58		1.11	2
29.41	-1.59		0.20	3
SEPT 2.56	-2.13		0.83	2
3.59	-0.99		0.64	2
17.01	-1.19		0.98	2
18.04	-1.99		0.28	3
19.08	-1.30		0.23	3
20.12	-0.99		0.25	3
21.16	-1.16		0.29	3
30.51	-1.11		0.23	3
OCT 1.54	-0.22		0.21	3
3.62	-0.55		0.36	3
22.22	0.69		0.24	3
23.25	1.37		0.55	2
25.33	0.95		0.26	3
27.41	1.75		0.81	2
30.53	0.53		0.51	2

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DISCUSSION

Klepczynski : In comparing your data with the BIH, to be consistent must you not use Woolard's nutation data, but you introduce a systematic difference ?

Fliegel : To be consistent, it would be necessary for both to use Wahr's series. The errors enter very differently into VLBI and BIH classical astrometry. There is, however, a partial averaging out of the nutation effect on classical UT1 determination due to the wide range of right ascension observed on a given night.

Guinot : The effects of nutation errors on UT1 are not strongly reduced. Their frequency is biased due to the fact that astrometrists are making only night observations, but the amplitude is only slightly reduced.