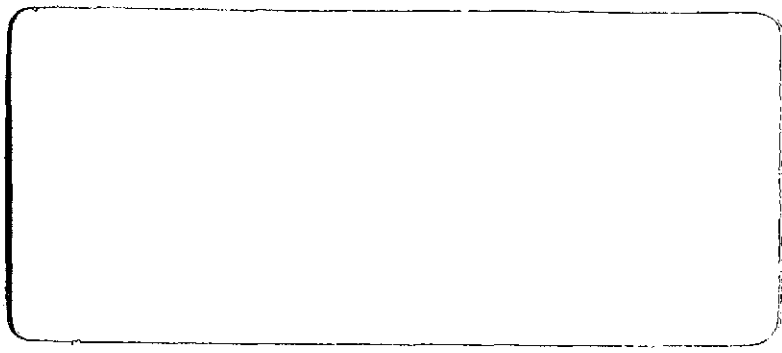


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INVESTIGATION OF THE IONOSPHERIC
FARADAY ROTATION FOR USE IN
ORBIT CORRECTIONS

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FARADAY ROTATION FOR USE IN
ORBIT CORRECTIONS

by

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1.0 Computation of the Faraday Factor

For use in orbit corrections, the Faraday rotation which is effected by both the earth's magnetic field and the ionosphere, has to be reduced to the ionospheric influence alone. The equations relating the Faraday rotation angle along the angular path to the vertical electron content are as follows:

$$\Omega = \frac{K}{f^2} \int_0^{h_u} B \cos \theta \sec \chi N dh = \frac{K}{f^2} \bar{M} \int_0^{h_u} N dh = \frac{K}{f^2} \bar{M} N_T = \frac{1}{F} N_T$$

where

Ω	=	rotation angle in radians
K	=	2.36 = constant
f	=	frequency in hertz
B	=	magnetic field strength in gauss
θ	=	angle between direction of propagation and magnetic field
χ	=	zenith angle
N	=	electron density in e/m^3
h	=	height above surface of earth in m
\bar{M}	=	mean value of $(B \cos \theta \sec \chi)$
N_T	=	vertical total electron content in e/m^2 column
F	=	Faraday rotation factor in $1/(m^2 \text{ radians})$
h_u	=	upper integration limit

In practice the measured amount of polarization twist, Ω , is converted to an equivalent vertical total electron content by removing $B \cos \theta \sec \chi$ from under the integral sign and replacing it with a mean value. Then:

$$\Omega = \frac{K}{f^2} \bar{M} \int_0^{h_u} N dh$$

where $\overline{B \cos \theta \sec \chi} = \bar{M}$ is computed in the following manner. A typical $N(h)$ profile is assumed and calculations of the mean value \bar{M} are found by computing:

$$\bar{M} = \frac{\int_0^{h_u} B \cos \theta \sec \chi N dh}{\int_0^{h_u} N dh}$$

The integrals are evaluated in computer mode by generating the electron density N and the function $(B \cos \theta \sec \chi N)$ at various height intervals and numerically integrating. Both Simpson's parabolic rule and Gaussian quadrature have been used. The electron density at each height h is calculated by the worldwide Bent Ionospheric profile model (Reference 1). Each parabolic and exponential segment of the profile was integrated separately with a varying number of points to achieve maximum accuracy. A total of 23 points was used to evaluate the integrals by Gaussian quadrature. The components of the magnetic field strength are obtained by a spherical harmonic analysis routine as described by Chapman and Bartels (Reference 2) which uses the coefficients of Epoch 1960 given by Jensen and Cain (Reference 3). The assumption of straight line propagation through a spherically stratified ionosphere was made. No bending corrections were calculated as this would have required a prohibitive amount of computer time, and at a frequency of 140 MHz, bending is a second order effect. Given the straight line propagation assumption the zenith angle at each height h then becomes a function of the ground elevation angle, and the angle θ is calculated using the station and satellite positions and the direction of the magnetic field.

In the following investigations the Faraday rotation factor F is the computed quantity, giving the direct conversion from angular measurement to vertical content, $N_T = F\Omega$. A frequency of $f = 137$ MHz is used to compute $F = f^2 / KM$, and the conversion factor is expressed in units of $1/m^2$ degrees.

2.0 Influence of Various Parameters on the Faraday Factor

The effects of many different conditions on the Faraday factor have been investigated to gain a better understanding of the variations and to test out the possibilities for mapping the factors. Variations with local time and season have been looked into as well as with magnetic latitude, elevation and azimuth angles. Typical day to day fluctuations of sudden increase and decrease in the ionospheric density and height have been imposed on the Faraday factor. The conditions and effects of the angle between the direction of propagation and the magnetic field have been examined. The influence of the high altitude topside extension of the ionospheric model and the importance of the upper integration limit in computing the factors have been studied.

2.1 Diurnal and Seasonal Influence

Test data was generated at 4 hour intervals for three different stations spaced at 10, 39, and 80 degrees magnetic latitude. Table 1 summarizes the computed values of f_oF2 , vertical electron content, and Faraday rotation factors resulting from integrations carried out to 1000, 2000, and 3000 km in height. Normal diurnal influences are causing changes of 2 to 6% in the Faraday factors.

Figure 1 shows the predicted monthly mean diurnal curves of the Faraday factors for the station Honolulu observing the ATS1 satellite during March, June, September, and December of 1968. The very definite changes of the factors with season amount to 3.1% considering the diurnal mean values for June and December, and are as high as 8.5% at 20 hours.

2.2 Effect of Sudden Changes in Critical Frequency and Ionospheric Height

The day to day changes that occur in the ionosphere cause increases and decreases in critical frequency that typically amount to $\pm 25\%$ of the monthly mean and also shifts in the ionospheric height of the order of ± 100 km. Such conditions were simulated for the three stations at 10, 39, and 80 degrees

magnetic latitude, and the Faraday factors along the vertical paths were examined. Deviations of $\pm 25\%$ from the predicted f_oF2 greatly effect the electron content, but only have a very small influence on the Faraday factor. 1.3% was the maximum change in the factor and most of the cases showed less than 1% variation; an example is given in Figure 2. Raising and lowering the height of a fixed ionospheric profile has no effect on the electron content, but causes a noticeable change in the Faraday factor from 4 to 6% of the original value. Figure 3a is a plot of the diurnal variation of the factors for the predicted profile height as well as for profiles 100 km higher and lower.

These first results were strictly for cases where the signal is received along the vertical path. In addition, however, a number of selected tests were performed for angular incidence with elevation angles ranging from 0 to 74 degrees. The striking results deviate considerably from the vertical case and are summarized in Figure 3b and Tables 2a-c. Time, station, and observation angle information are tabulated along with the critical frequency, the height at the maximum electron density, the vertical electron content, and the Faraday factor. For the situations where f_oF2 and the height were increased or decreased, the percentage differences of the new electron content and Faraday factor with respect to the basic predicted values are listed. Again, changes in f_oF2 greatly effect the vertical content by up to 80%, but only have a minor influence on the Faraday factor, causing mostly a percent difference of less than 2% and a maximum deviation of 6.3%. The percent differences in the Faraday factor due to height changes are, however, very large in many instances. For one 0° elevation case the variation is about $\pm 33\%$, for a 60° elevation case it is $\pm 19\%$, and for Huancayo observing ATS3 at 74° elevation the height changes cause $\pm 12\%$ variation in the Faraday factor. Several cases also yield smaller percentages of ± 5 to $\pm 7\%$.

The large variations of the Faraday factor with height seem to be related with the angle θ between the direction of propagation and the magnetic field. In separate columns of Table 2 values of the angle θ are listed for heights of 100 and 1000 km, and changes of up to 55° in θ can be noted over this interval. For the vertical incidence θ only varies by less than 1% and

the Faraday factors by 4 to 6% for the height test. For large variations in θ which can occur along an angular path, and for close approaches of θ to 90 degrees, but not so close as to yield the Faraday equation invalid, the height changes cause great variations in the Faraday factor.

2.3 Effects of Magnetic Latitude, Elevation and Azimuth

The diurnal curves of the Faraday factors for magnetic latitudes spaced at 10, 39, and 80 degrees and for observations along a vertical path are plotted in Figure 4. The diurnal variation of the factor is small compared to the changes with magnetic latitude. The Faraday factor basically increases in a non-linear fashion with decreasing magnetic latitude, yielding a large discrepancy between the values for mid and polar latitudes and the values close to the equator. The daily mean value of 15.1×10^{14} at 10 degrees that is much larger than the values of 3.8 and $3.0 \times 10^{14}/\text{m}^2 \text{ deg.}$ at 39 and 80 degrees respectively.

For the same three stations the Faraday factors along a multitude of angular paths were examined at fixed times, selected such that the hourly factors approximately reflected the diurnal mean values. Data was generated at 8 different azimuth angles starting at 0 degrees and increasing in 45 degree steps. For the magnetic latitudes of 80, 39, and 10 degrees, Figures 5a, b, and c show the variation of the Faraday factor with azimuth at elevation angles of 5, 10, 30, 45, 60 and 90 degrees elevation. The curves for every single elevation angle are of a sinusoidal type with an amplitude that is 0 for the 90 degree elevation curve and consistently increases with decreasing elevation. The smallest values of the Faraday factors at any fixed elevation are obtained between 135 and 180 degrees azimuth and the maximum values are reached between 315 and 360 degrees azimuth for the three stations that were selected on the 279.4 degree geographic longitude line. The minimum and maximum values are to be expected more exactly in the southern and northern direction for stations along the longitude line that connects the geographic and magnetic poles, since along it the azimuth angles with respect to both coordinate systems would be in closer agreement. In the same manner the minimum and maximum

values of the Faraday factors could occur at azimuth angles deviating more from the southern and northern direction for stations along geographic longitude lines further displaced from the magnetic pole. The maximum difference in the Faraday factors between the 5 and 90 degree elevation angles increases from 1.0×10^{14} to 2.4×10^{14} to $12.8 \times 10^{14}/\text{m}^2 \text{ deg.}$ for 80, 39 and 10 degrees magnetic latitude respectively. The variation with azimuth is the dominant influence on the Faraday factor except at very high elevations, encompassing the whole scale of possible values. This variation is due almost totally to the changing magnetic field angles for different azimuths.

Tables 3a-c present the variation of the Faraday factors with azimuth for the same three stations at elevation angles of 90, 45, and 10 degrees. Critical frequency and vertical electron content are listed as well and the integration in the computations is carried out to three different heights, 1000, 2000, and 3000 km.

2.4 Variation of the Angle Theta and Directional Changes in Polarization Twist

Several cases in Tables 3a-c are marked by an asterisk, denoting that the Faraday factors are not useable. In the same instances there are missing points in Figures 5b and c. The angle θ between the direction of propagation and the magnetic field passed through 90 degrees along the path, at the height indicated behind the asterisk, yielding the Faraday equation invalid. Equivalent to such a mathematically undefined case is a physical wave that experiences polarization in one direction from the satellite down to a certain height along the path and polarization in the opposite direction below that height. The polarization twist measured is smaller than the total absolute amount of polarization since contributions in reversed directions cancel out. Thus the measurement is not representative of the ionosphere between the satellite and the station, and the Faraday rotation equipment is of no use in these particular instances.

To further investigate at which locations and in which directions these undefined cases occur, graphs of the angle θ at heights between 100 and 1000 km along the wave path were plotted for 8 directions in azimuth starting with

0 degrees and increasing in 45° intervals, and for 6 elevation angles of 0, 15, 30, 45, 60, and 75 degrees. The data was produced for a multitude of stations at magnetic latitudes from 0 to 90 degrees at 15° steps along the magnetic longitude lines of 0, 90, 180, and 270 degrees. Figures 6a-d show the graphs selected at 0, 30, 60, and 90 degrees magnetic latitude and 0° magnetic longitude, and Figure 6e at 0° magnetic latitude and 90° magnetic longitude.

In Figure 6a for example at 0° elevation and below 1000 km height, the angle θ passes through 90° in a direction slightly north of west and of east. At 15° elevation in Figure 6b, θ crosses 90° in all directions between northeast and north at heights from 250 to 550 km, in all directions between northwest and north at heights from 400 to 550 km, and in directions slightly east of northeast and slightly west of northwest at heights somewhere below 250 and 400 km respectively. For the station at 60° magnetic latitude in Figure 3c, the angle θ remains larger than 90° in all directions and for all heights, permitting good Faraday rotation data to be reduced from all over the sky.

The following trend becomes apparent: Along the magnetic equator the angle θ passes through 90° below 1000 km height basically in eastern and western directions at all elevations. The further north the station is located, however, the more the directions at which θ crosses 90° shift from east and west toward north, and only in the lower elevation angles can the change of θ through 90° be observed. For stations south of the magnetic equator θ crosses 90° in southern, southeastern and southwestern directions. In Figure 6e for a station on the magnetic equator observing at 0° elevation it can be seen, however, that θ passes through 90° not in the eastern and western direction, but in the southern direction and slightly east and west of south. This occurs because the station coordinates are chosen for the dipole magnetic field and actually fall south of the true earth's magnetic equator.

The relationship between the geographic and the true magnetic coordinates is rather complex and the azimuth angle measured clockwise from geographic north does not easily fit into the irregular true field pattern; thus there exists no short and simple tabulation relating the geographic latitude and longitude

of the station and the elevation and azimuth angle of the observation to the occurrence of the angle θ passing through 90 degrees below 1000 km height. However, the general trend of occurrence can be considered as a first estimate, and will in many cases, eliminate the necessity for accurate determination of the angular conditions. For example, all stations that are located outside the equatorial region extending from about 12° north to 18° south, which is the range of the earth's magnetic equator, and are observing a geostationary satellite, remaining within a few degrees of the geographic equator, will not encounter the situation where θ passes through 90° below 1000 km height. The Faraday observations will be useful for ionospheric content reduction all over the visible sky. For stations within the equatorial band the relative locations of the station and satellite with respect to the magnetic equator might yield enough information for the decision whether careful examination and detailed computations for the particular case are necessary or not.

2.5 Effects of Additional Topside Model Layers

The latest improvement to the Bent ionospheric program was the modeling of 2 additional topside exponential layers, reaching from 1000 to 2000 and from 2000 to 3000 km height, above the existing 3 topside exponential layers. The complete model with 5 exponential topside layers was used in all prior tests for this investigation. To check out the influence of the high altitude topside extension of the ionospheric model on the computation of the Faraday factors, the data cases presented for the complete model in Table 1 and Tables 3a-c were recomputed using the 3 topside layer version of the model. Comparisons were performed for the cases where integration was carried out to 2000 km height, and it was found that the difference between the corresponding Faraday factors is very small. The use of the 5 layer versus the 3 layer model caused an increase in the vertical electron content on the average of 1.8% and in the extreme case of 2.9%; the Faraday factor only increased by 0.7% on the average and by 1.9% in the maximum case. The influence on the Faraday factor is even smaller than the influence on the electron content because of the effect

of the magnetic field that decreases in strength with increasing altitude. The added model layers can, in some instances, enlarge the vertical electron content considerably more, as is apparent from the results of the following tests in Table 4. The effect on the Faraday factors though is quite a bit smaller.

2.6 Variation of the Integration Limit

Important for the correct determination of the Faraday factor converting the polarization data to vertical electron content is the proper height selection for the integration limit in the Faraday equation in Section 1.0. Detailed studies have already been performed on this subject in the past by Klobuchar and Mendillo, (Reference 4). The argument brought forward was that the Faraday factor is in error if the integration is carried out to the satellite altitude. Instead the integration should only be carried out to heights above which the remaining amount of polarization is less than the absolute experimental error. At most observation sites, the equipment induces errors of $\pm 10^\circ$ and this portion of rotation can occur at heights above 1000 to 3000 km. The recommended approach was to compute Faraday factors for profiles up to 1000 km for converting the measured rotation angles to vertical electron content and to add to that amount a high altitude contribution of electron content in order to come up with the total electron content.

This concept seems to be substantiated by several tests computing the vertical electron content and the Faraday factors and integrating to heights of 1000 km as well as to 2000 and 3000 km. Table 4 lists the results for a station at 15° latitude and 0° longitude observing along the vertical path at 2 hour intervals, presenting the various integrated values and in addition the percentages by which the vertical content values and Faraday factors increase when stepping from the 1000 km to the 2000 km integration limit and from the 1000 to the 3000 km limit. Tables 1 and 3a-c include similar test results. Keeping in mind that the Faraday factor is proportional to the

vertical content $N_T = F\Omega$, we find that raising the integration limit from 1000 to 3000 km yields on average electron content values that are 10.8% larger and Faraday factors that are 2.9% larger than their respective values for the 1000 km integration limit. It is apparent that a sizable portion of the total electron content can be accumulated above 1000 km, while the corresponding increase in the rotation angle is clearly below the size of the experimental error.

Upon closer examination, however, this argument of fixing the upper integration limit of the integrals computing the Faraday factors does not hold up. A number of tests were performed computing total electron content and Faraday rotation from ground up to 33000 km, for various combinations of high, medium, and low magnetic latitude and solar activity conditions and different seasons. Electron content and Faraday conversion factors were computed for each 100 km height interval. The rotation angles for the same intervals were formed from these values, and the total values were obtained by summing over the contributions of all the segments.

Figure 7 shows the integrated electron content and Faraday rotation from ground up to height h as a percentage of the total values integrated to a satellite height of 33000 km for two selected cases. Faraday rotation is accumulated more rapid at lower heights than electron content; in the given cases 88 and 95% of the rotation are accumulated at 1000 km compared with 78 and 91% of the total content. The same condition is illustrated in Figure 8, only this time considering the percent of the total integrated values in each 100 km interval, and plotting the difference between these electron content and Faraday rotation contributions as a function of the interval height. For all intervals below 500-600 km the contributions to the total rotation exceed the corresponding percentages of electron content, but at the higher altitudes the contributions to the total content are considerably larger. This seems to indicate that the low altitude as well as the high altitude portion have to be included in the integration process for

the Faraday conversion factor, even though the amounts we are talking about are only of the same order or less than the instrumental errors. Excluding contributions above 1000 km from the computation by integrating only to a height of 1000 km and not all the way to the satellite would introduce a one-sided bias, and the resultant total content values would be consistently too small. The typical measurement errors of say $\pm 10\%$ may become $+2$ to -18% if this one-sided bias is not taken into account.

3.0 Conclusions

The results from the Faraday factor investigation point out the importance for modeling the factors correctly with respect to the station position where the magnetic latitude is of most significance and with respect to the direction of observation, since the elevation and azimuth angles determine the direction at which the magnetic field lines are intersected as well as the location at which the wave passes through the densest part of the ionosphere. For low accuracy requirements it might be acceptable to neglect the specific seasonal and diurnal influences since they only produce variations of about 2 to 6% in the Faraday factors. High precision in the high altitude end of the ionospheric model is not necessary, just as the day to day prediction errors in f_oF2 do not effect the Faraday factors to a great extent. However, prediction errors in ionospheric height, which could easily be caused by sudden day to day changes can have a significant influence on the Faraday factors. The predicted values of the height of maximum electron density obtained from the Bent Model are on average within the accuracy of the measured values, which considering instrumental and reduction techniques, are about 15 km. However, the day to day variations are quite a bit larger, and on occasion, deviations in the predictions of 100 km from the height measurements have been noted particularly in the equatorial region. The resulting errors in the Faraday factor are typically 5% for paths at vertical incidence. But for angular paths errors of around 30% in the Faraday factor might occur resulting in proportionally large errors in N_T , whenever the condition occurs that the

propagation angle θ falls between about 80 and 100° along a low elevation path.

To avoid errors in the computation of the Faraday factor, the angle θ between and the direction of propagation and the earth's magnetic field lines has to be carefully monitored along the ray path. When the condition $89.5^\circ \leq \theta \leq 90.5$ occurs, the equation relating the Faraday rotation angle and vertical electron content no longer holds true. When θ passes through 90° at a certain height, the wave experiences rotation of the polarization vector in one direction from the satellite down to that height, and rotation in the opposite direction below that height. Contributions to the rotation of the polarization vector in reversed directions cancel out, thus the measurement is not representative of the ionosphere between the satellite and the station.

There has been some question as to what the upper integration limit of the integrals computing the Faraday factors should be. In order to avoid any one-sided biases that might result in total electron content values being consistently too small and creating in effect unbalanced measurement errors of maybe +2 to -18%, the integration process should not be terminated at some fixed height, but carried out from ground all the way to the height of the satellite. In this case typical errors would be about $\pm 10\%$.

The possibility of mapping the Faraday factors on a worldwide basis was examined as a simple method of representing the conversion factors for any possible user. After the preceding investigations, however, it does not seem feasible. The complex relationship between the true magnetic coordinates and the geographic latitude, longitude, and azimuth angles eliminates the possibility of setting up some simple tables that would yield worldwide results of sufficient accuracy. If tabular results for specific stations are desired, however, such tables could be easily produced or could be represented in graphic form.

Table 1. Diurnal Variation of the Faraday Factor for 3 Stations with Integration Carried out to 1000, 2000, and 3000km Height

LAT.	LON.	DATE	UT	ELEV	AZIM	FOF2	INTEGRATED TO:	VEC(1.E15 E/M**2)			FAR.FAC.(1.E11/(DEG*M**2))			KM HEIGHT
								1000	2000	3000	1000	2000	3000	
-1.2	279.4	67	3 16	.0	90.0	0.	12.3	508.0	529.9	538.6	15100	15293	15422	
-1.2	279.4	67	3 16	4.0	90.0	0.	11.3	378.0	389.2	393.7	14771	14909	14998	
-1.2	279.4	67	3 16	8.0	90.0	0.	6.5	118.5	124.6	127.4	14704	14942	15117	
-1.2	279.4	67	3 16	12.0	90.0	0.	6.7	147.4	156.6	160.8	14780	15067	15276	
-1.2	279.4	67	3 16	16.0	90.0	0.	11.4	531.4	567.5	581.9	15289	15582	15780	
-1.2	279.4	67	3 16	20.0	90.0	0.	12.7	678.0	718.9	735.2	15220	15484	15661	
28.6	279.4	67	3 16	.0	90.0	0.	8.5	208.2	216.6	218.9	3678	3731	3753	
28.6	279.4	67	3 16	4.0	90.0	0.	5.4	83.5	90.9	93.2	3817	3926	3978	
28.6	279.4	67	3 16	8.0	90.0	0.	4.8	66.9	73.0	74.9	3796	3909	3964	
28.6	279.4	67	3 16	12.0	90.0	0.	6.2	121.3	129.6	132.0	3705	3792	3831	
28.6	279.4	67	3 16	16.0	90.0	0.	10.4	365.4	381.6	385.9	3685	3742	3766	
28.6	279.4	67	3 16	20.0	90.0	0.	10.5	359.2	376.5	381.2	3716	3777	3804	
68.6	279.4	67	3 16	.0	90.0	0.	5.8	123.7	137.5	139.8	2906	2994	3019	
68.6	279.4	67	3 16	4.0	90.0	0.	4.8	85.1	95.8	97.7	2923	3020	3049	
68.6	279.4	67	3 16	8.0	90.0	0.	4.2	67.4	76.9	78.6	2927	3035	3068	
68.6	279.4	67	3 16	12.0	90.0	0.	4.5	84.4	95.6	97.6	2897	3000	3030	
68.6	279.4	67	3 16	16.0	90.0	0.	6.0	155.1	173.6	176.7	2889	2983	3010	
68.6	279.4	67	3 16	20.0	90.0	0.	6.8	200.1	223.8	227.7	2903	2996	3022	

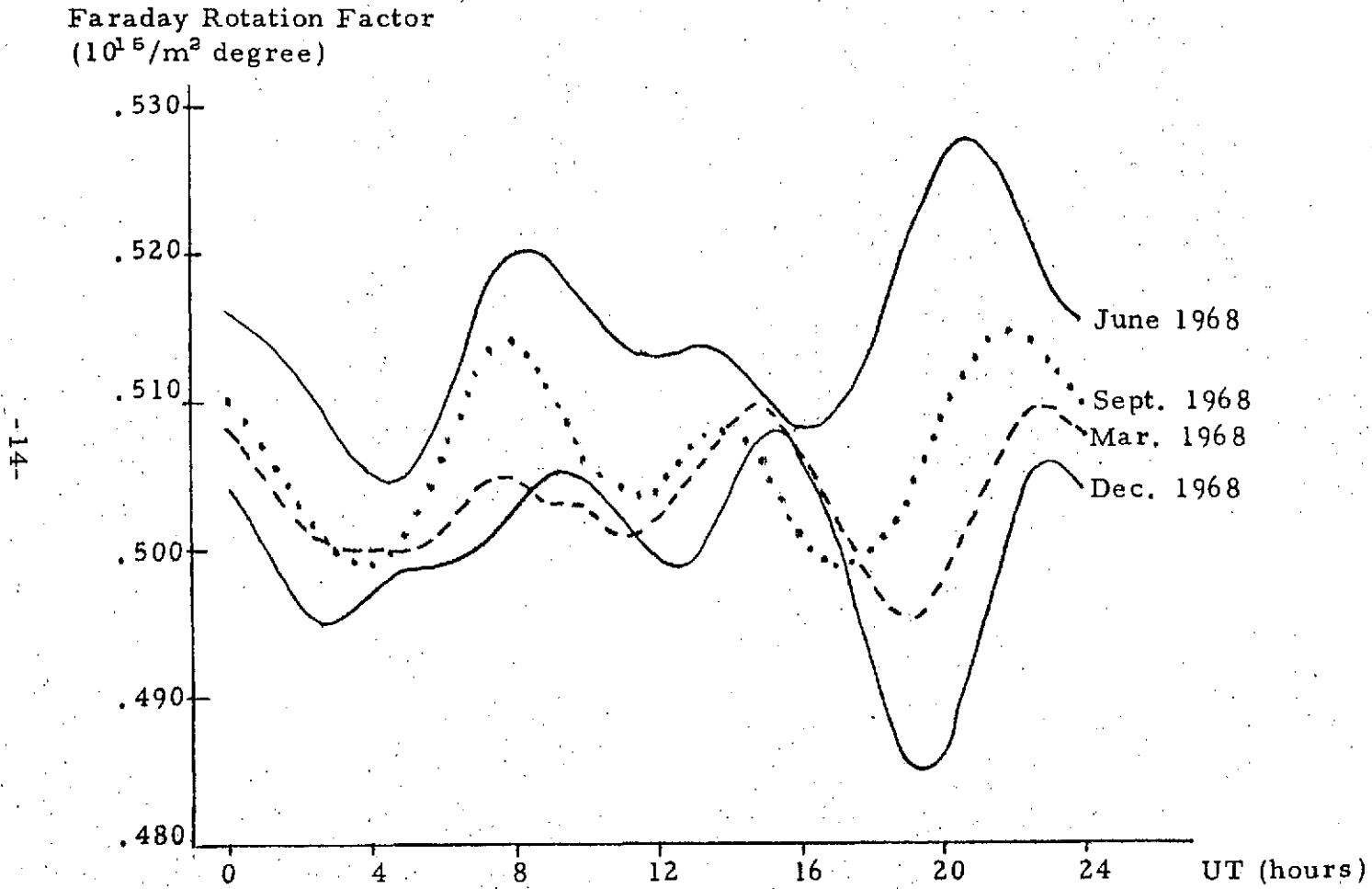


Figure 1. Seasonal and Diurnal Variation of the Faraday Factor F (equation (6)) for Honolulu Looking at an Elevation and Azimuth of 63.6° and 159.3° .

Faraday Rotation Factor
($10^{11}/m^2 \text{ deg}$)

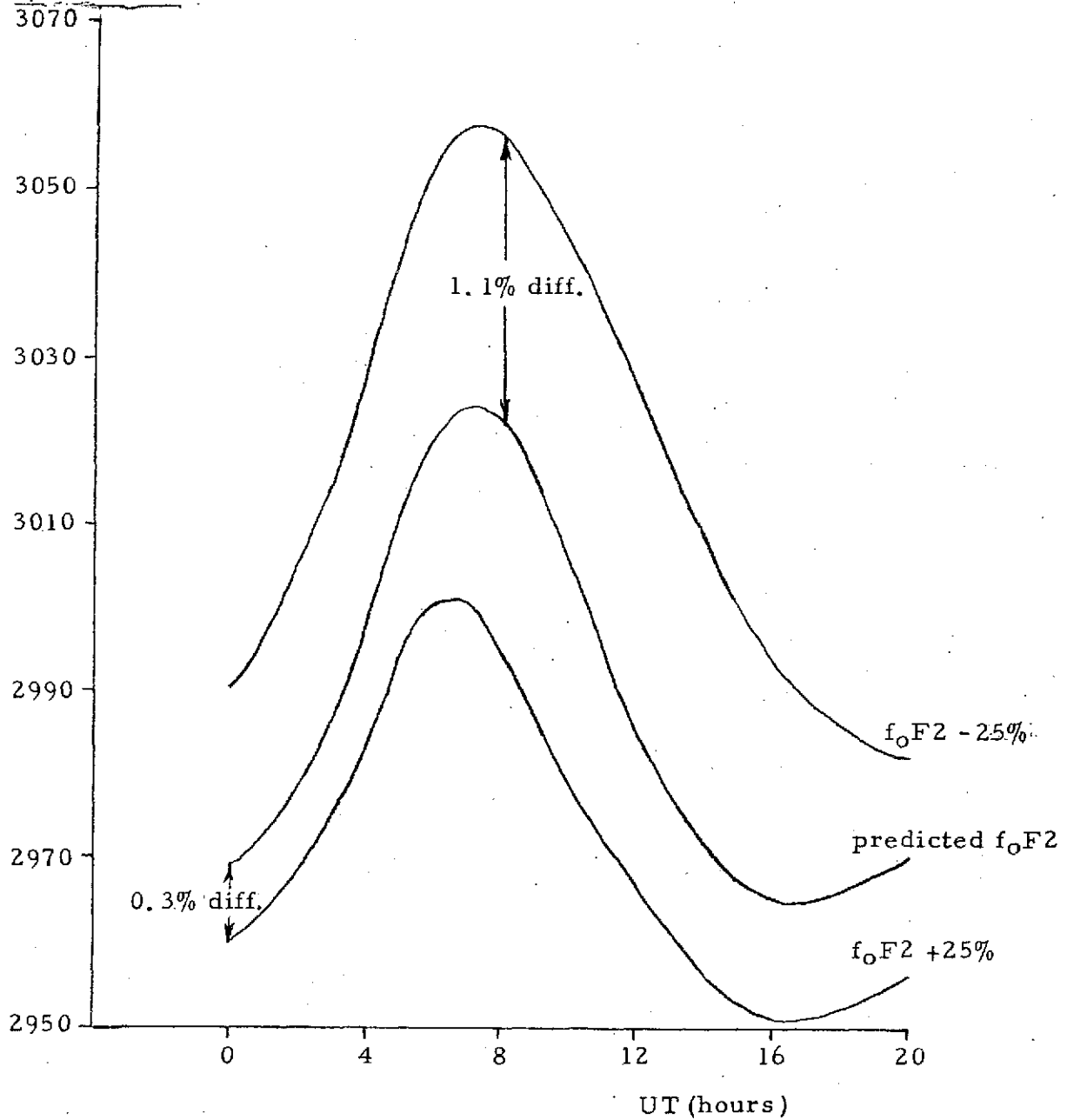


Figure 2. Effect of Increase and Decrease in f_0F2 on the Faraday Factor for a Vertical Path.
Station Position = $68.6^\circ, 279.4^\circ$, Date = 16 March 1967.

Faraday Rotation Factor
($10^{11}/m^2 \text{ deg}$)

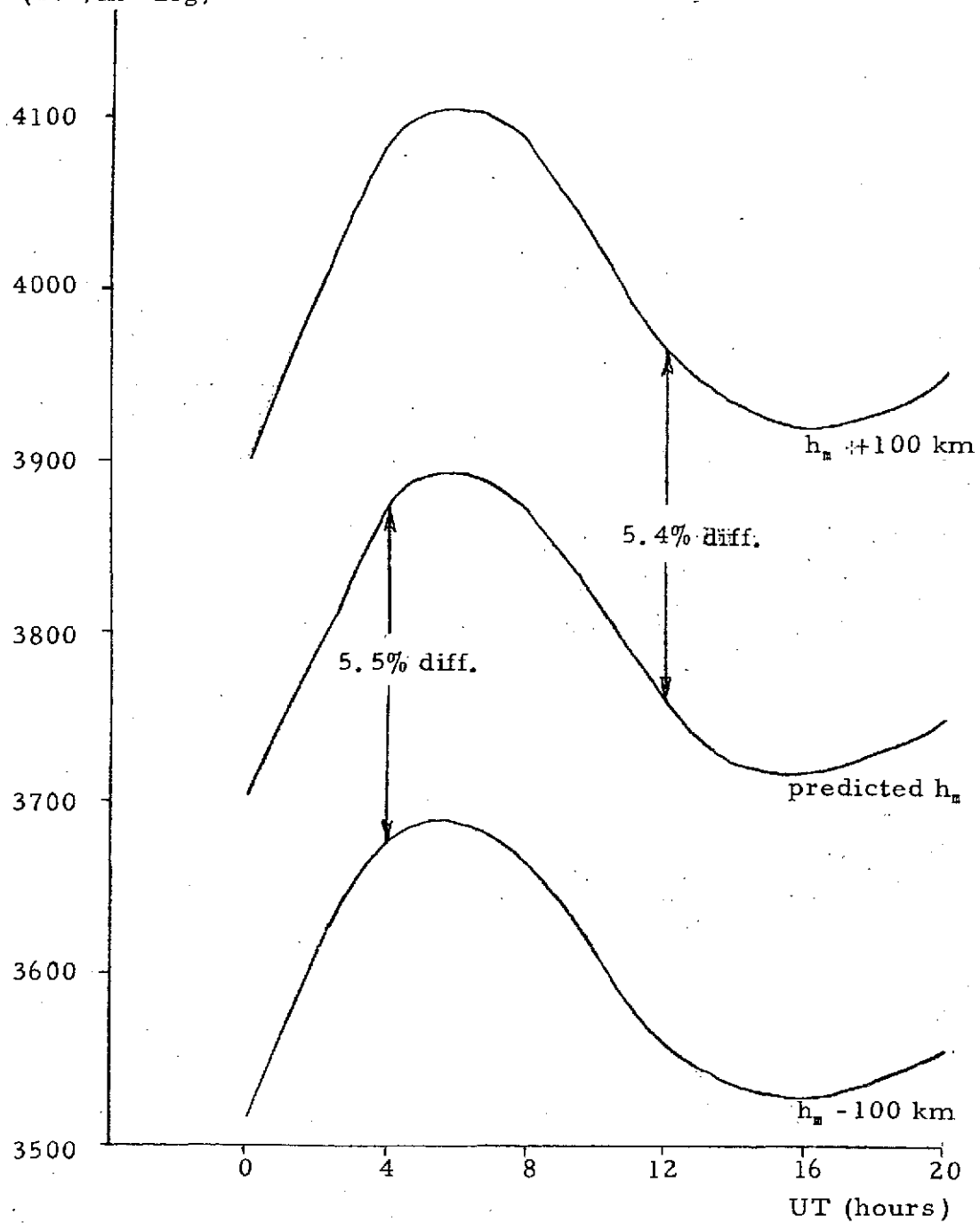


Figure 3a. Effect of Increase and Decrease in the Ionospheric Height on the Faraday Factor for a Vertical Path.
Station Position = 28.6° , 279.4° , Date = 16 March 1967.

Faraday Rotation 40,000
Factor ($10^{11}/m^2 \text{ deg}$)

Date = 12 March 1970

———— Faraday factor for predicted height h_m
 ++++++ Faraday factor for height $h_m + 100$ km
 ----- Faraday factor for height $h_m - 100$ km
 The percentages indicate the difference between
 F evaluated using height h_m and using height
 $h_m \pm 100$ km

-17-

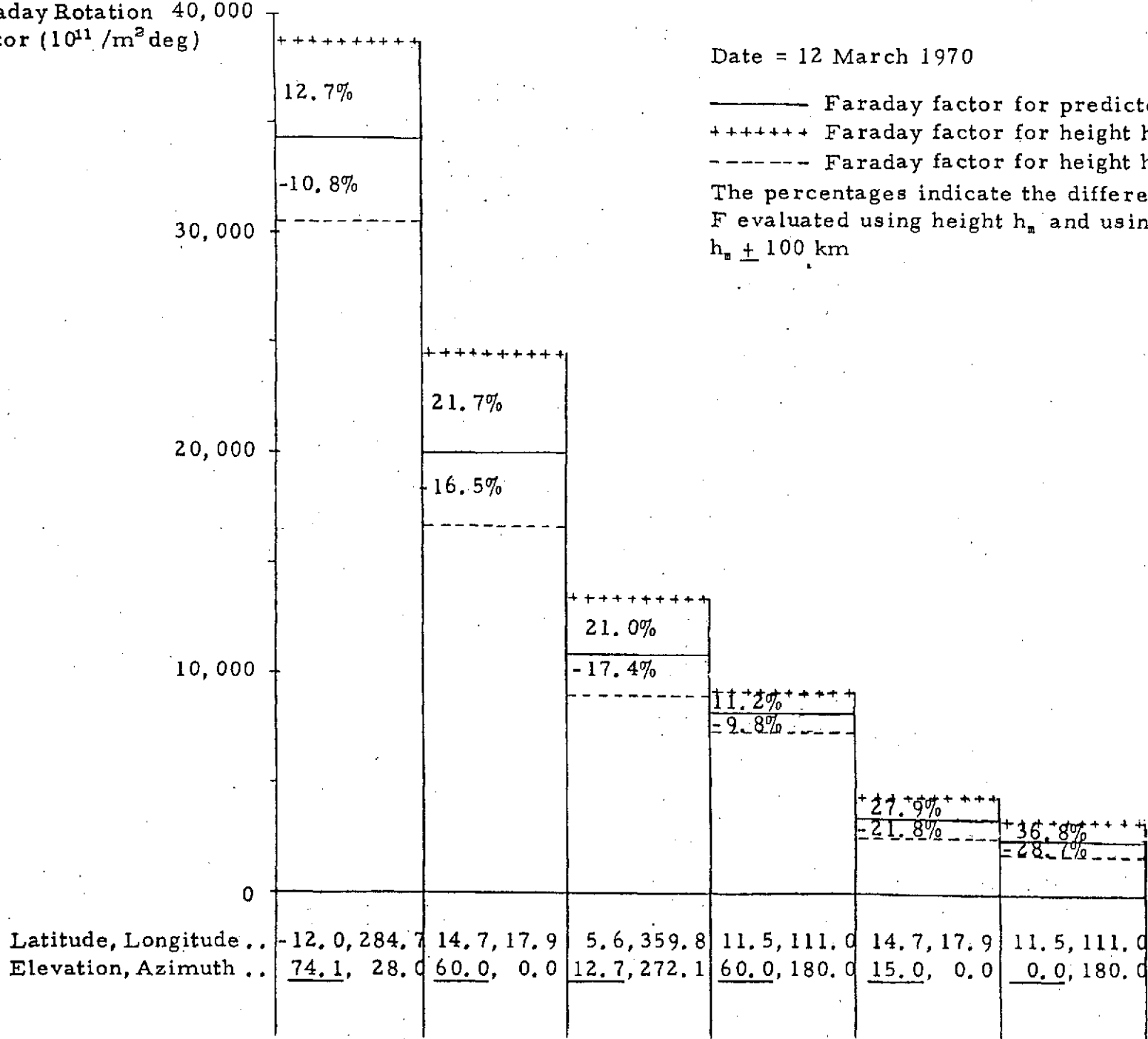


FIGURE 3b. Effect of Variation in Ionospheric Height on the Faraday Factor F for an Angular Path

TABLE 2a. EFFECT OF INCREASE AND DECREASE IN F₀F₂ AND HM ON THE FARADAY FACTOR FOR AN ANGULAR PATH

VERTICAL ELECTRON CONTENT (1.E15 E/M**2), FARADAY FACTOR (1.E11/(DEG*M**2))

DATE	UNIV TIME	GEOGRAPHIC		ELEV	AZIM	THETA AT HEIGHT		F ₀ F ₂	HM	VEC	%DIFF	FAR.FAC.	%DIFF
		LAT.	LN.			100 KM	1000 KM						
70 3 12	6.6	11.5	111.0	.0	180.0	153.6	98.2	14.4	366.	895.4		2425.	
								+25%		1611.5	80.0	2578.	6.3
								-25%		439.5	-50.9	2312.	-4.7
									+100 KM	905.9	1.2	3316.	36.8
									-100 KM	890.7	-.5	1729.	-28.7
70 3 12	12.8	14.7	17.9	15.0	.0	33.9	79.1	14.8	347.	805.9		3393.	
								+25%		1437.9	78.4	3531.	4.1
								-25%		400.3	-50.3	3297.	-2.8
									+100 KM	816.4	1.3	4340.	27.9
									-100 KM	800.7	-.6	2654.	-21.8
70 3 12	18.6	33.5	291.0	.0	270.0	101.6	130.1	11.9	332.	481.0		2467.	
								+25%		840.6	74.8	2484.	.7
								-25%		282.3	-41.3	2470.	.1
									+100 KM	488.5	1.6	2607.	5.7
									-100 KM	476.9	-.9	2368.	-4.0
70 3 12	23.8	43.9	212.3	.0	90.0	94.6	122.7	10.9	314.	379.9		3475.	
								+25%		643.2	69.3	3468.	-.2
								-25%		234.1	-38.4	3484.	.3
									+100 KM	385.7	1.5	3414.	-1.7
									-100 KM	376.5	-.9	3738.	7.6
70 3 12	6.6	11.5	111.0	60.0	180.0	125.0	111.7	10.6	455.	456.7		8260.	
								+25%		792.7	73.6	8380.	1.5
								-25%		285.6	-37.5	8282.	.3
									+100 KM	463.8	1.6	9182.	11.2
									-100 KM	453.8	-.6	7453.	-9.8
70 3 12	12.8	14.7	17.9	60.0	.0	70.4	85.5	13.1	393.	608.7		20064.	
								+25%		1075.9	76.8	20637.	2.9
								-25%		325.0	-46.6	19978.	-.4
									+100 KM	617.7	1.5	24419.	21.7
									-100 KM	604.4	-.7	16762.	-16.5

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TABLE 25. EFFECT OF INCREASE AND DECREASE IN F₀F₂ AND HM ON THE FARADAY FACTOR FOR AN ANGULAR PATH

VERTICAL ELECTRON CONTENT (1.E15 E/M**2), FARADAY FACTOR (1.E11/(DEG*M**2))

DATE	UNIV	GEOGRAPHIC		THETA AT HEIGHT				F ₀ F ₂	HM	VEC	%DIFF	FAR.FAC.	%DIFF	
		TIME	LAT.	LN.	ELEV	AZIM	100 KM							1000 KM
69 1 30 22.1	Stanford-ATS1	37.4	237.8	37.9	221.0	153.6	163.5	9.9	307.	292.2		2442.		
									+25%		472.9	61.8	2442.	-0.0
									-25%		178.6	-38.9	2459.	.7
										+100 KM	297.1	1.7	2620.	7.3
										-100 KM	289.2	-1.0	2276.	-6.8
69 1 30 22.1	Stanford-ATS3	37.4	237.8	27.8	123.0	124.1	137.5	10.0	305.	293.5		2839.		
									+25%		478.1	62.9	2839.	-0.0
									-25%		180.5	-38.5	2854.	.5
										+100 KM	298.5	1.7	2994.	5.4
										-100 KM	290.5	-1.0	2698.	-5.0
70 3 12 19.0	Huancayo-ATS3	-12.0	284.7	74.1	28.0	77.1	83.3	10.9	444.	492.6		34356.		
									+25%		861.5	74.9	34993.	1.9
									-25%		304.8	-38.2	34422.	.2
										+100 KM	499.9	1.5	38710.	12.7
										-100 KM	489.8	-.6	30634.	-10.8
70 3 12 18.7	Sagamore Hill-ATS3	42.6	289.2	40.9	177.3	149.3	163.0	11.0	330.	423.9		2400.		
									+25%		717.7	69.3	2409.	.4
									-25%		257.7	-39.2	2403.	.1
										+100 KM	430.1	1.5	2543.	6.0
										-100 KM	420.3	-.9	2267.	-5.6
70 3 12 14.0	Accra-ATS3	5.6	359.8	12.7	272.1	74.2	81.9	11.0	449.	451.7		11067.		
									+25%		784.0	73.6	11323.	2.3
									-25%		282.8	-37.4	11086.	.2
										+100 KM	459.1	1.6	13392.	21.0
										-100 KM	448.4	-.7	9141.	-17.4

TABLE 2a EFFECT OF INCREASE AND DECREASE IN FOF2 AND HM ON THE FARADAY FACTOR FOR AN ANGULAR PATH

VERTICAL ELECTRON CONTENT ($1 \cdot E15 \text{ E/M}^{**2}$), FARADAY FACTOR ($1 \cdot E11 / (\text{DEG} \cdot \text{M}^{**2})$)

DATE	UNIV TIME	GEOGRAPHIC		THETA AT HEIGHT		F0F2	HM	VEC	%DIFF	FAR.FAC.	%DIFF		
		LAT.	LON.	ELEV	AZIM							100 KM	1000 KM
69 1 30	8.5	18.4	293.1	67.0	198.8	159.1	154.1	3.4	330.	31.8		4006.	
		Arecibo-ATS3											
								+25%		51.7	62.9	3994.	-.3
								-25%		17.3	-45.6	4019.	.3
								+100 KM		32.7	3.0	4269.	6.6
								-100 KM		31.2	-1.8	3763.	-6.1
69 1 30	10.5	18.4	293.1	67.0	198.8	159.1	154.1	4.4	305.	56.4		3925.	
		Arecibo-ATS3											
								+25%		87.2	54.5	3921.	-.1
								-25%		29.0	-48.6	3949.	.6
								+100 KM		57.7	2.3	4180.	6.5
								-100 KM		55.6	-1.4	3687.	-6.1
69 1 30	12.5	18.4	293.1	67.0	198.8	159.1	154.1	9.1	258.	230.2		3774.	
		Arecibo-ATS3											
								+25%		365.0	58.5	3753.	-.6
								-25%		135.4	-41.2	3797.	.6
								+100 KM		233.7	1.5	4017.	6.4
								-100 KM		228.2	-.9	3546.	-6.0
69 1 30	14.5	18.4	293.1	67.0	198.8	159.1	154.1	10.4	273.	324.5		3789.	
		Arecibo-ATS3											
								+25%		547.3	68.7	3800.	.3
								-25%		196.9	-39.3	3811.	.6
								+100 KM		328.9	1.4	4031.	6.4
								-100 KM		321.9	-.8	3561.	-6.0
69 1 30	16.5	18.4	293.1	67.0	198.8	159.1	154.1	10.0	318.	294.4		3910.	
		Arecibo-ATS3											
								+25%		477.3	62.2	3908.	-.1
								-25%		180.8	-38.6	3929.	.5
								+100 KM		299.2	1.6	4159.	6.4
								-100 KM		291.6	-1.0	3676.	-6.0

Faraday Rotation Factor
($10^{17}/\text{deg m}^2$)

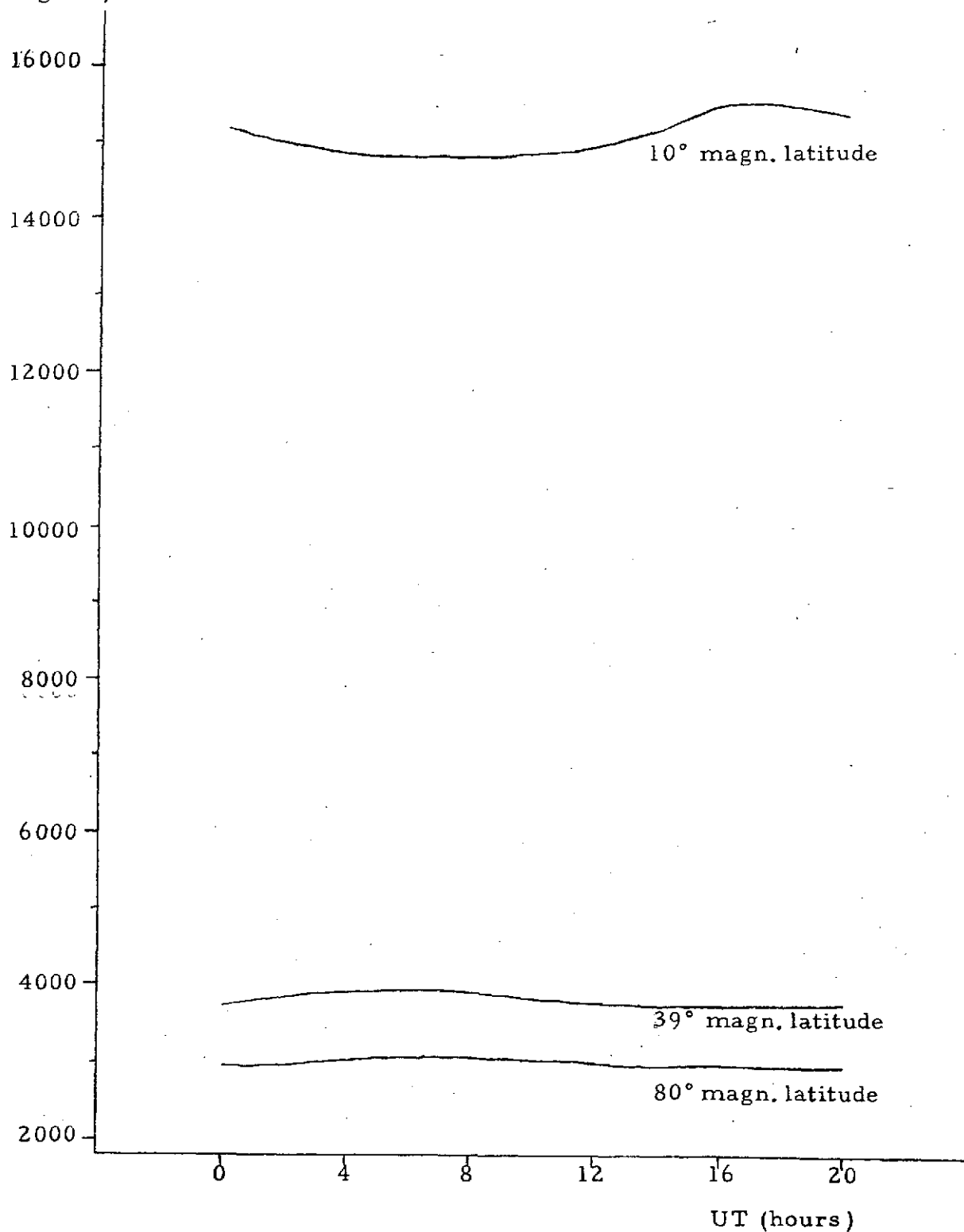


Figure 4. Variation of the Faraday Factor with Magnetic Latitude for a Vertical Path and with the Diurnal Changes on 16 March 1967.

Faraday Rotation Factor
($10^{11}/\text{m}^2 \text{ deg}$)

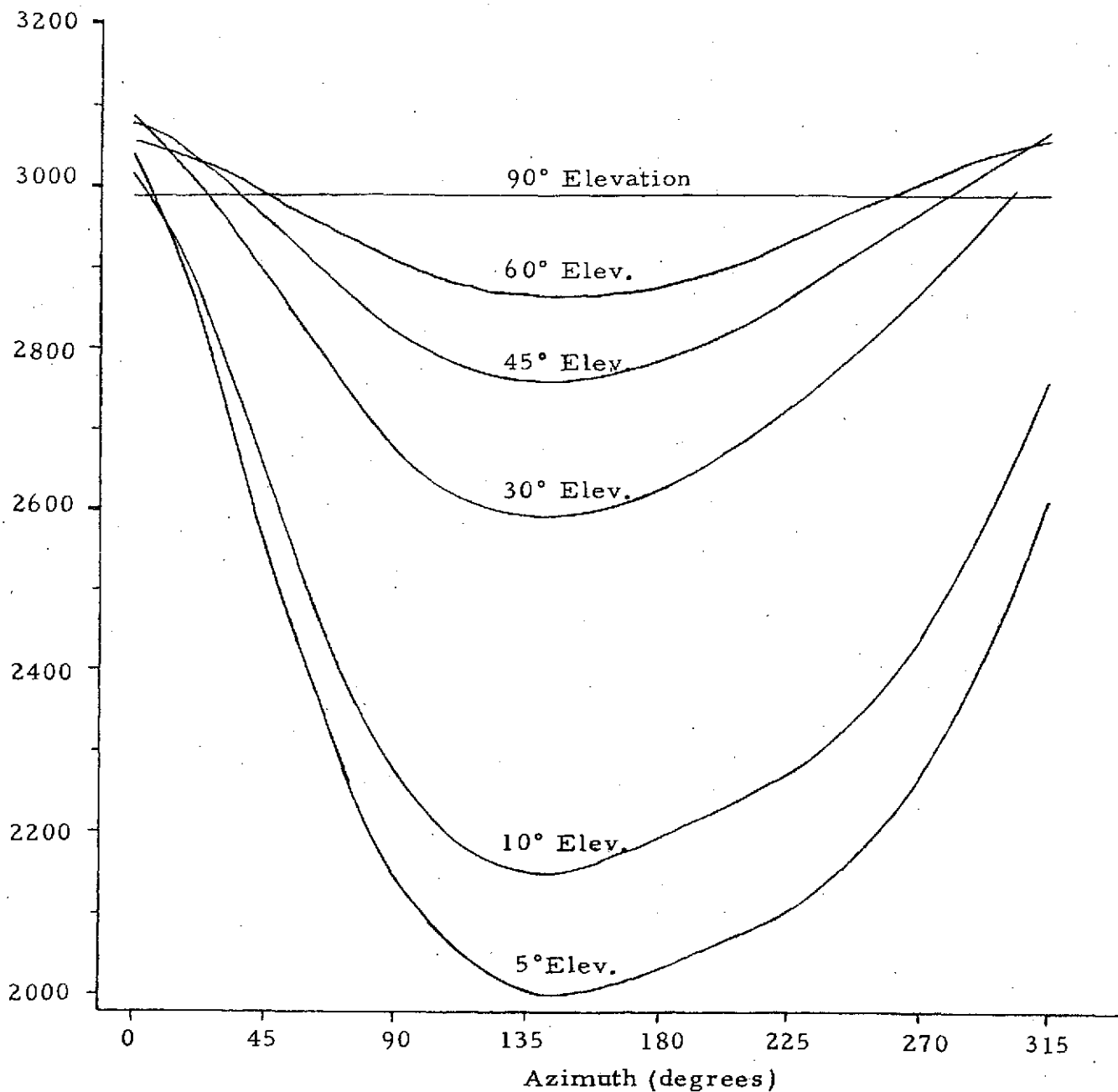


Figure 5a. Variation of the Faraday Factor with Changes in Elevation and Azimuth Angles at 80° Magnetic Latitude. Station Position = $68.6^\circ, 279.4^\circ$, Date = 16 March 1967, UT=12 hours.

Faraday Rotation Factor
($10^{11} / \text{m}^2 \text{ deg}$)

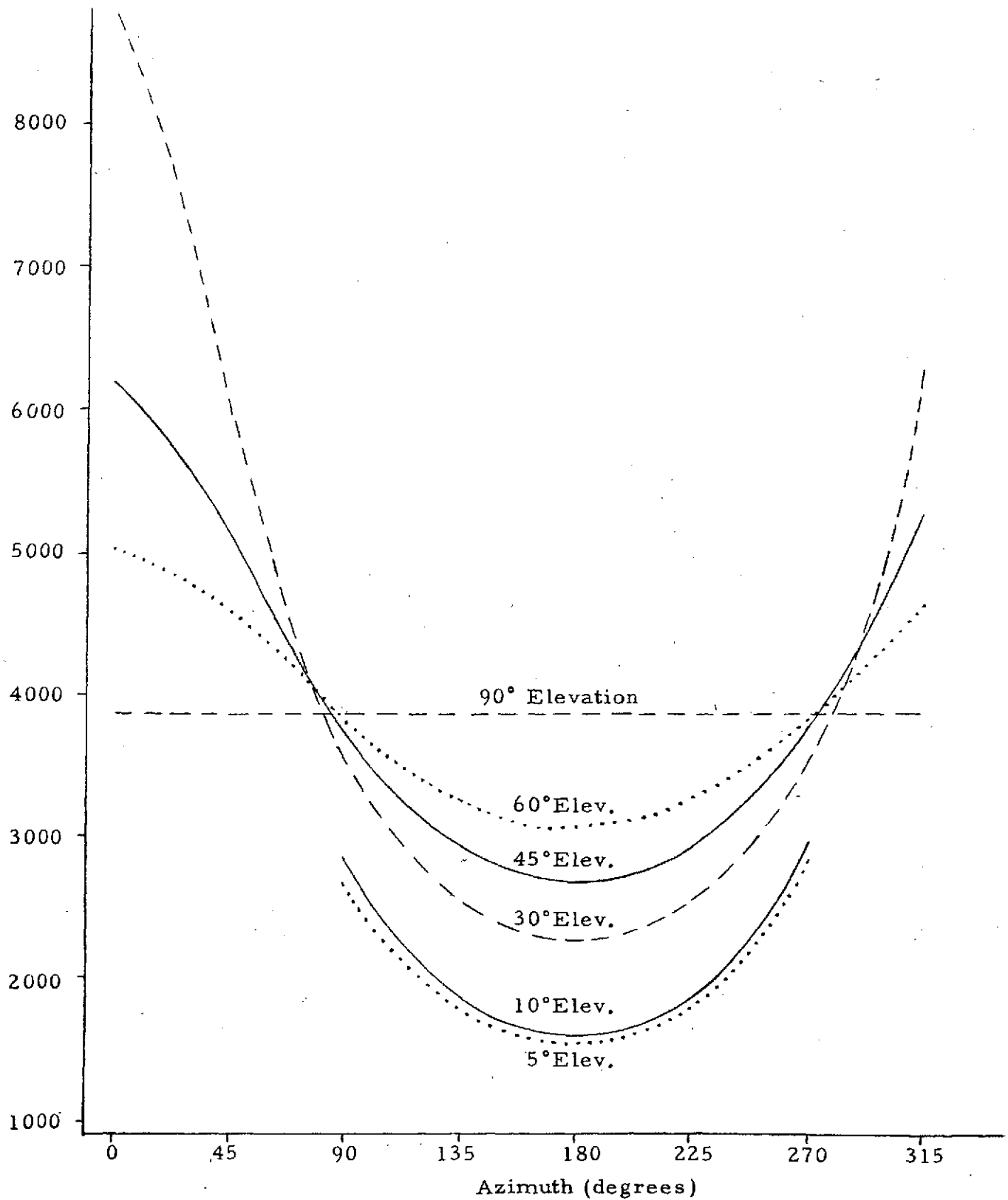


Figure 5b. Variation of the Faraday Factor with Changes in Elevation and Azimuth Angles at 39° Magnetic Latitude. Station Position= $28.6^\circ, 279.4^\circ$, Date=16 March 1967, UT=11 hours.

Faraday Rotation Factor
($10^{11} / \text{m}^2 \text{deg}$)

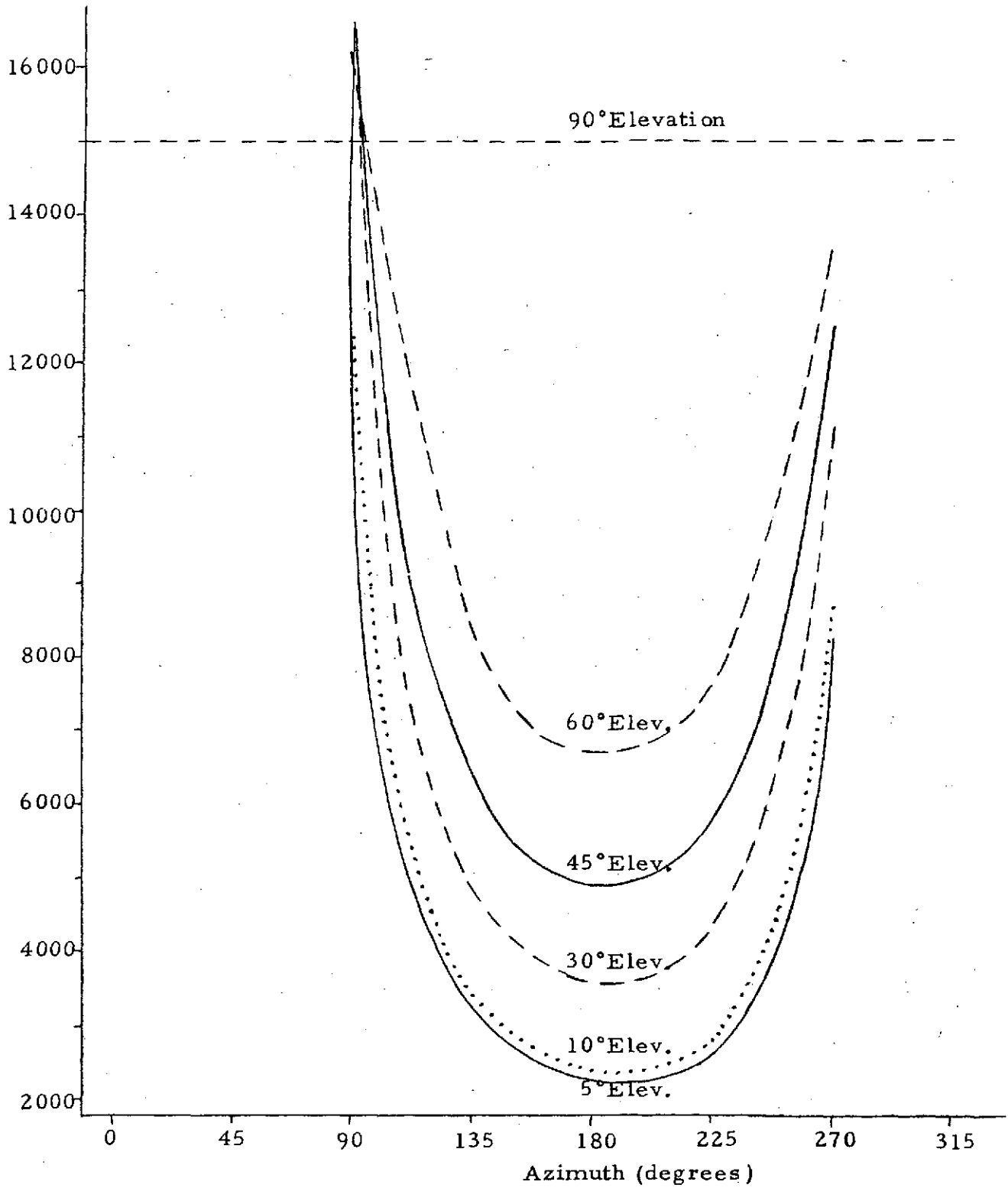


Figure 5c. Variation of the Faraday Factor with Changes in Elevation and Azimuth Angles at 10° Magnetic Latitude.
Station Position = -1.2° , 279.4° , Date = 16 Mar 1967, UT=14 hours.

Table 3a. Variation of the Faraday Factor with Changes in Elevation and Azimuth for 3 Stations
with Integration Carried out to 1000, 2000 and 3000 km Height

LAT.	LON.	DATE	UT	ELEV	AZIM	FOF2	INTEGRATED TO:	VEC(1.E15 E/M**2)			FAR.FAC.(1.E11/(DEG*M**2))			KM HEIGHT
								1000	2000	3000	1000	2000	3000	
-1.2	279.4	67	3 16	14.0	90.0	0.	10.7	419.7	440.3	448.6	14901	15124	15270	
-1.2	279.4	67	3 16	14.0	45.0	0.	10.6	400.1	418.5	425.8	12874	13390	13539	* 1250 km
-1.2	279.4	67	3 16	14.0	45.0	45.	10.8	420.9	440.4	448.1	25336	25977	26074	* 825
-1.2	279.4	67	3 16	14.0	45.0	90.	10.9	440.6	462.0	470.5	16611	16753	16881	
-1.2	279.4	67	3 16	14.0	45.0	135.	10.9	437.8	459.9	468.7	6273	6432	6525	
-1.2	279.4	67	3 16	14.0	45.0	180.	10.8	422.6	444.3	453.0	4844	4980	5058	
-1.2	279.4	67	3 16	14.0	45.0	225.	10.6	407.0	427.8	436.2	5674	5828	5916	
-1.2	279.4	67	3 16	14.0	45.0	270.	10.5	397.7	417.6	425.6	12408	12637	12778	
-1.2	279.4	67	3 16	14.0	45.0	315.	10.5	392.1	410.7	418.1	37272	37958	37922	* 750
-1.2	279.4	67	3 16	14.0	10.0	0.	10.1	349.9	364.4	369.7	2867	2976	3012	* 1200
-1.2	279.4	67	3 16	14.0	10.0	45.	10.8	415.0	431.7	438.1	4730	4889	4942	* 925
-1.2	279.4	67	3 16	14.0	10.0	90.	11.3	494.7	518.4	527.8	12292	12402	12521	
-1.2	279.4	67	3 16	14.0	10.0	135.	11.0	461.9	487.8	498.2	3323	3456	3523	
-1.2	279.4	67	3 16	14.0	10.0	180.	10.8	428.3	450.3	459.0	2371	2464	2510	* 2825
-1.2	279.4	67	3 16	14.0	10.0	225.	10.2	367.8	387.0	394.7	2715	2820	2873	* 3000
-1.2	279.4	67	3 16	14.0	10.0	270.	9.8	337.5	355.7	363.0	8536	8777	8907	
-1.2	279.4	67	3 16	14.0	10.0	315.	9.7	314.7	329.6	335.3	5130	5344	5411	* 1050

* Resultant Faraday factors are not useable since the angle θ between the direction of propagation and the magnetic field crossed 90° , indicating a change in the direction of the polarization twist along the path.

Table 3b. Variation of the Faraday Factor with Changes in Elevation and Azimuth for 3 Stations with Integration Carried out to 1000, 2000 and 3000 km Height

ST.	LON.	DATE	UT	ELEV	AZIM	FOF2	INTEGRATED	VEC(1.E15 E/M**2)			FAR.FAC.(1.E11/(DEG*M**2))			
								T0	1000	2000	3000	1000	2000	3000 KM HEIGHT
28.6	279.4	67	3 16	11.0	90.0	0.	4.6	68.7	74.9	76.9	3761	3874	3929	
28.6	279.4	67	3 16	11.0	45.0	0.	4.5	67.5	73.7	75.5	6153	6209	6252	
28.6	279.4	67	3 16	11.0	45.0	45.	4.7	73.1	79.6	81.5	5069	5155	5205	
28.6	279.4	67	3 16	11.0	45.0	90.	4.8	76.3	82.9	85.0	3630	3731	3781	
28.6	279.4	67	3 16	11.0	45.0	135.	4.8	73.9	80.4	82.5	2839	2938	2986	
28.6	279.4	67	3 16	11.0	45.0	180.	4.6	68.4	74.6	76.6	2600	2698	2745	
28.6	279.4	67	3 16	11.0	45.0	225.	4.5	64.3	70.2	72.2	2832	2935	2986	
28.6	279.4	67	3 16	11.0	45.0	270.	4.4	62.9	68.9	70.7	3655	3764	3819	
28.6	279.4	67	3 16	11.0	45.0	315.	4.4	63.8	69.8	71.6	5163	5253	5304	
28.6	279.4	67	3 16	11.0	10.0	0.	4.2	59.4	65.5	67.0	14619	12854	12612	* 300 km
28.6	279.4	67	3 16	11.0	10.0	45.	5.1	87.9	95.6	97.6	6791	6665	6679	* 150
28.6	279.4	67	3 16	11.0	10.0	90.	5.8	105.1	113.0	115.3	2829	2911	2950	
28.6	279.4	67	3 16	11.0	10.0	135.	5.3	89.6	96.6	99.0	1828	1909	1946	
28.6	279.4	67	3 16	11.0	10.0	180.	4.3	58.3	63.5	65.5	1588	1675	1719	
28.6	279.4	67	3 16	11.0	10.0	225.	4.0	49.6	54.5	56.3	1814	1915	1965	
28.6	279.4	67	3 16	11.0	10.0	270.	4.2	56.1	61.7	63.5	2929	3039	3093	
28.6	279.4	67	3 16	11.0	10.0	315.	4.0	52.4	57.9	59.3	7597	7332	7327	* 175

* Resultant Faraday factors are not useable since the angle θ between the direction of propagation and the magnetic field crossed 90° , indicating a change in the direction of the polarization twist along the path.

Table 3c. Variation of the Faraday Factor with Changes in Elevation and Azimuth for 3 Stations with Integration Carried out to 1000, 2000, and 3000 km Height.

LAT.	LBN.	DATE	UT	ELEV	AZIM	FOF2	INTEGRATED TO:	VEC(1.E15 E/M**2)			FAR.FAC.(1.E11/(DEG*M**2))		
								1000	2000	3000	1000	2000	3000 KM HEIGHT
68.6	279.4	67	3 16	12.0	90.0	0.	4.5	84.4	95.6	97.6	2897	3000	3030
68.6	279.4	67	3 16	12.0	45.0	0.	4.7	89.6	101.3	103.3	2993	3094	3124
68.6	279.4	67	3 16	12.0	45.0	45.	4.8	94.9	106.9	109.0	2876	2976	3005
68.6	279.4	67	3 16	12.0	45.0	90.	4.8	94.7	106.6	108.7	2741	2837	2865
68.6	279.4	67	3 16	12.0	45.0	135.	4.6	88.9	100.3	102.3	2682	2776	2804
68.6	279.4	67	3 16	12.0	45.0	180.	4.4	80.5	91.2	93.1	2706	2799	2828
68.6	279.4	67	3 16	12.0	45.0	225.	4.2	74.5	84.7	86.5	2782	2875	2905
68.6	279.4	67	3 16	12.0	45.0	270.	4.2	74.8	85.2	87.0	2889	2984	3013
68.6	279.4	67	3 16	12.0	45.0	315.	4.4	81.3	92.3	94.2	2989	3086	3116
68.6	279.4	67	3 16	12.0	10.0	0.	5.2	107.5	120.8	123.1	2902	3037	3082
68.6	279.4	67	3 16	12.0	10.0	45.	5.5	125.1	139.8	142.3	2572	2660	2687
68.6	279.4	67	3 16	12.0	10.0	90.	5.6	130.3	145.1	147.7	2208	2292	2315
68.6	279.4	67	3 16	12.0	10.0	135.	5.2	109.1	121.3	123.5	2089	2168	2191
68.6	279.4	67	3 16	12.0	10.0	180.	4.3	73.5	82.8	84.5	2131	2212	2239
68.6	279.4	67	3 16	12.0	10.0	225.	3.5	47.9	55.0	56.4	2201	2290	2322
68.6	279.4	67	3 16	12.0	10.0	270.	3.4	47.6	55.2	56.6	2360	2455	2488
68.6	279.4	67	3 16	12.0	10.0	315.	4.3	72.8	83.2	85.1	2688	2772	2805

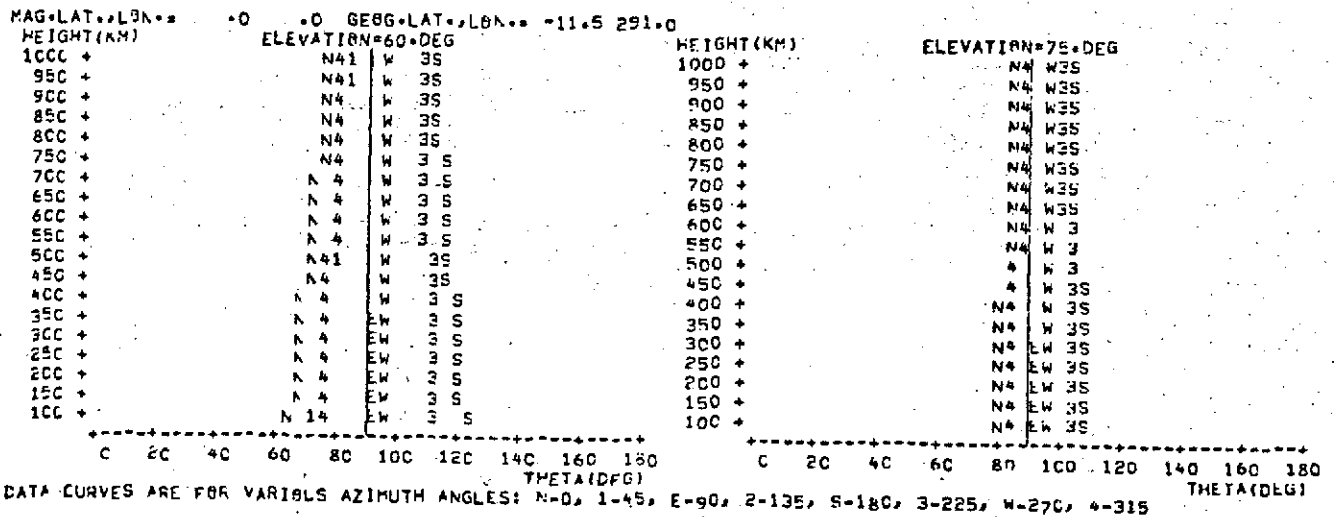
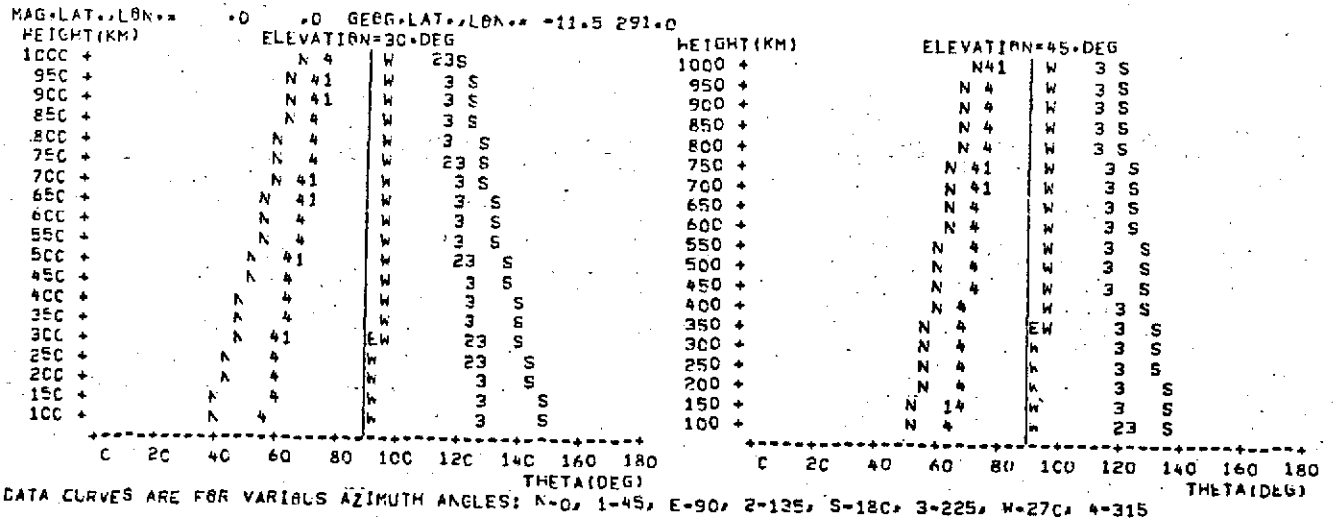
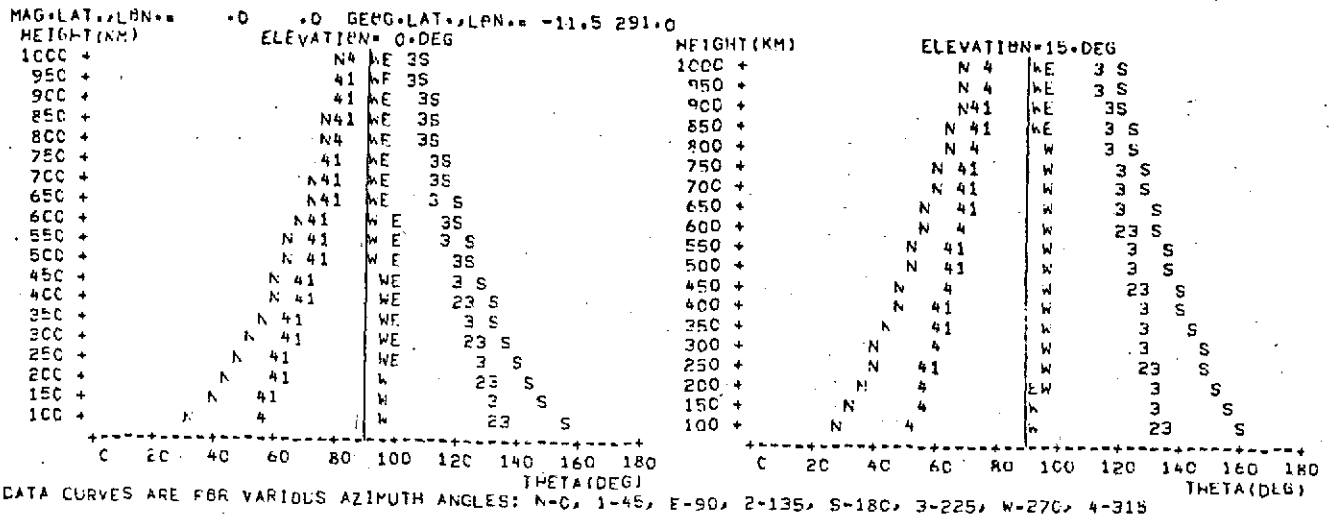


Figure 6a. Variation of the Angle θ Between the Direction of Propagation and the Magnetic Field

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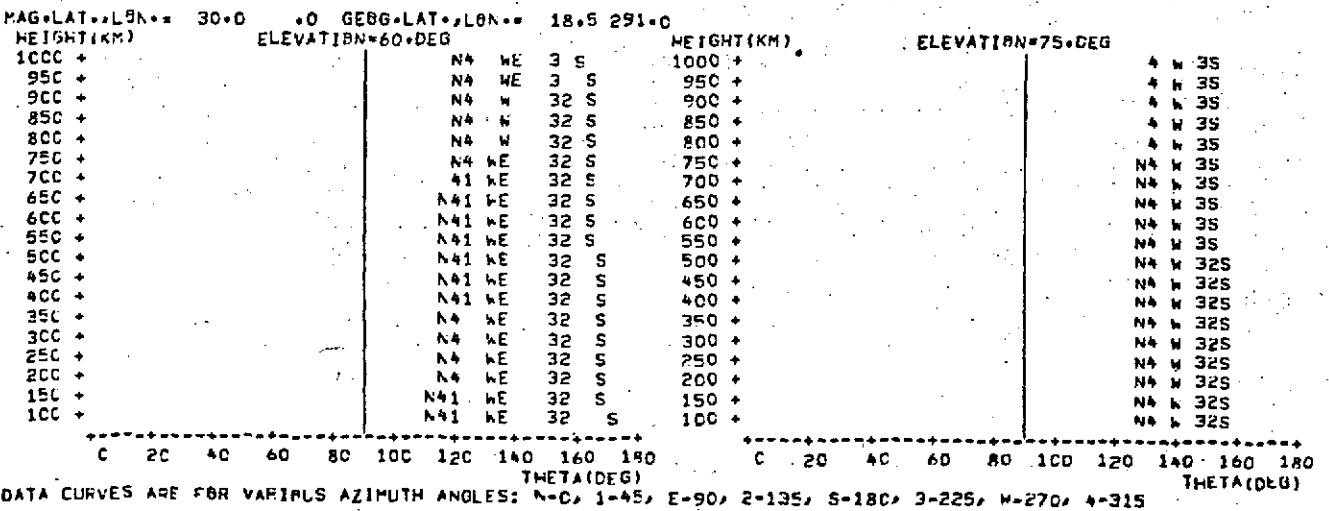
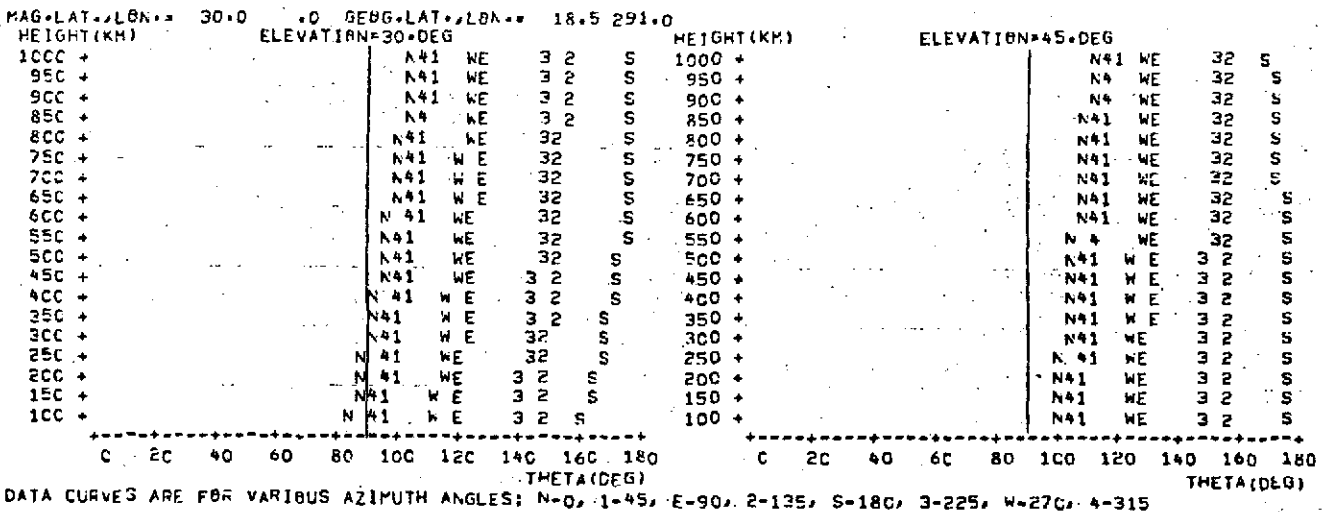
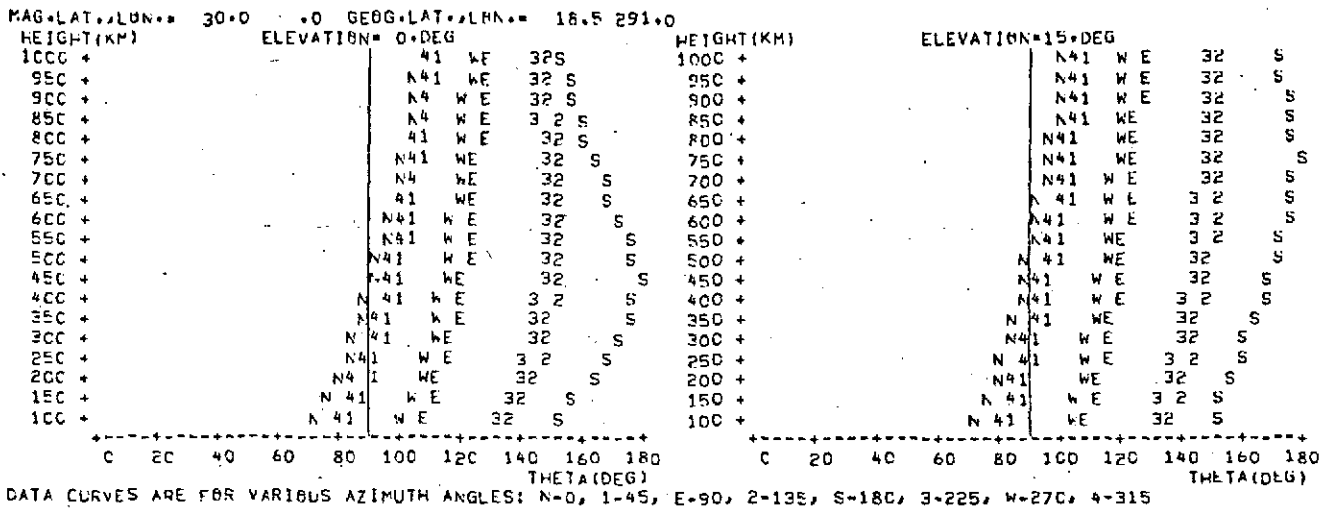


Figure 6b. Variation of the Angle θ Between the Direction of Propagation and the Magnetic Field

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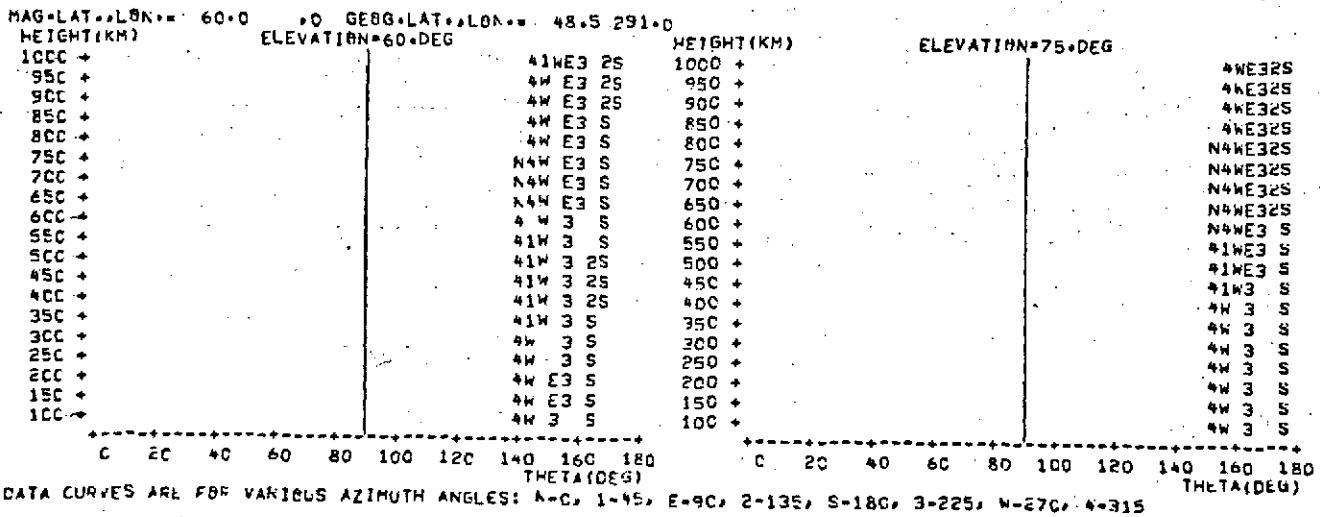
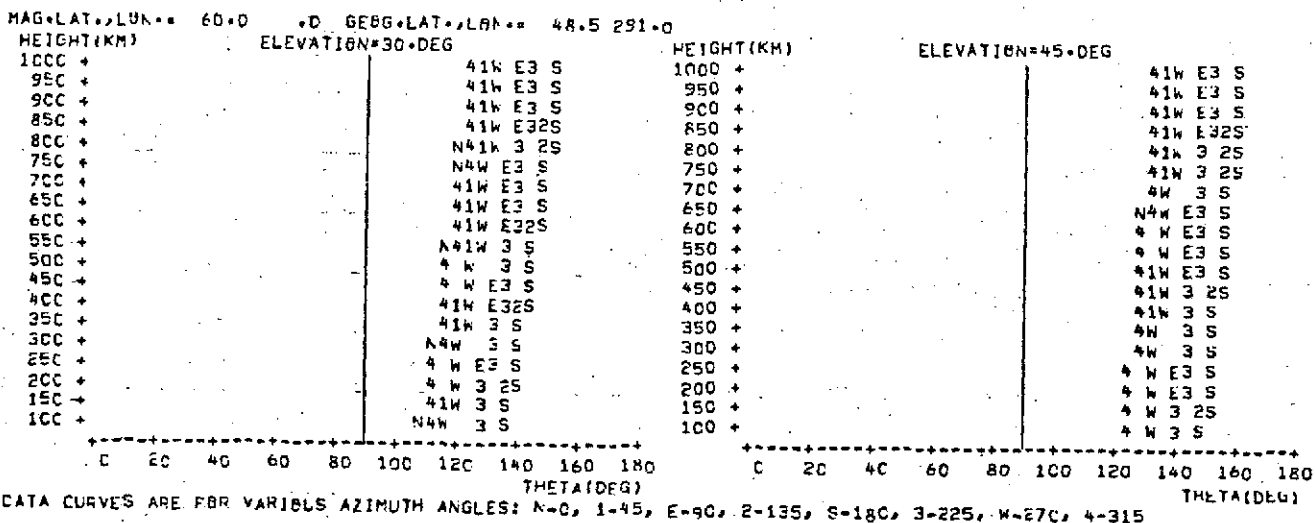
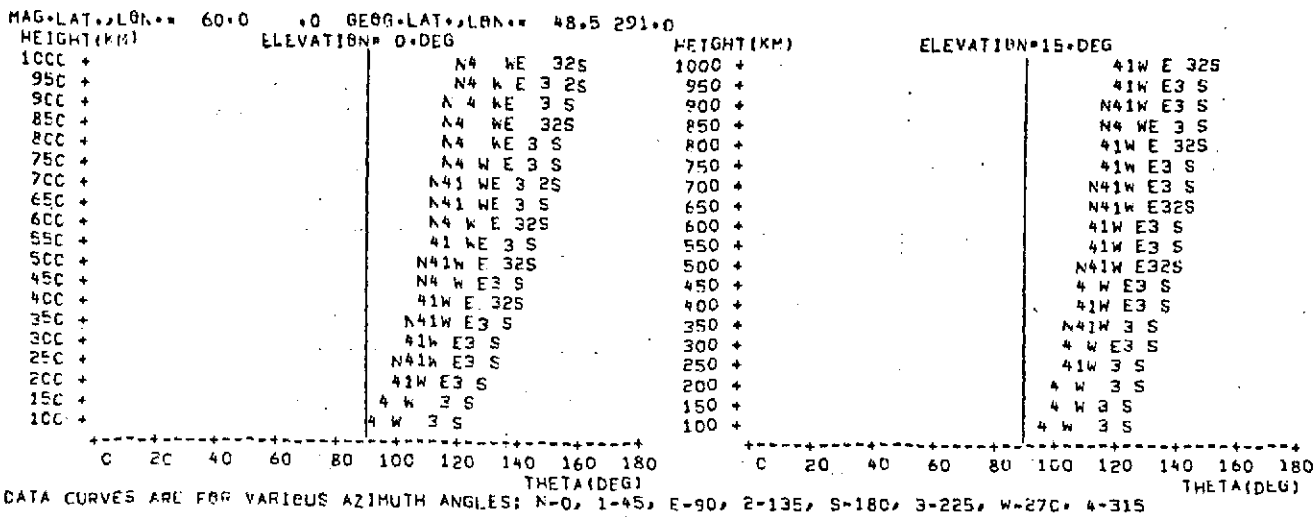


Figure 6c. Variation of the Angle θ Between the Direction of Propagation and the Magnetic Field.

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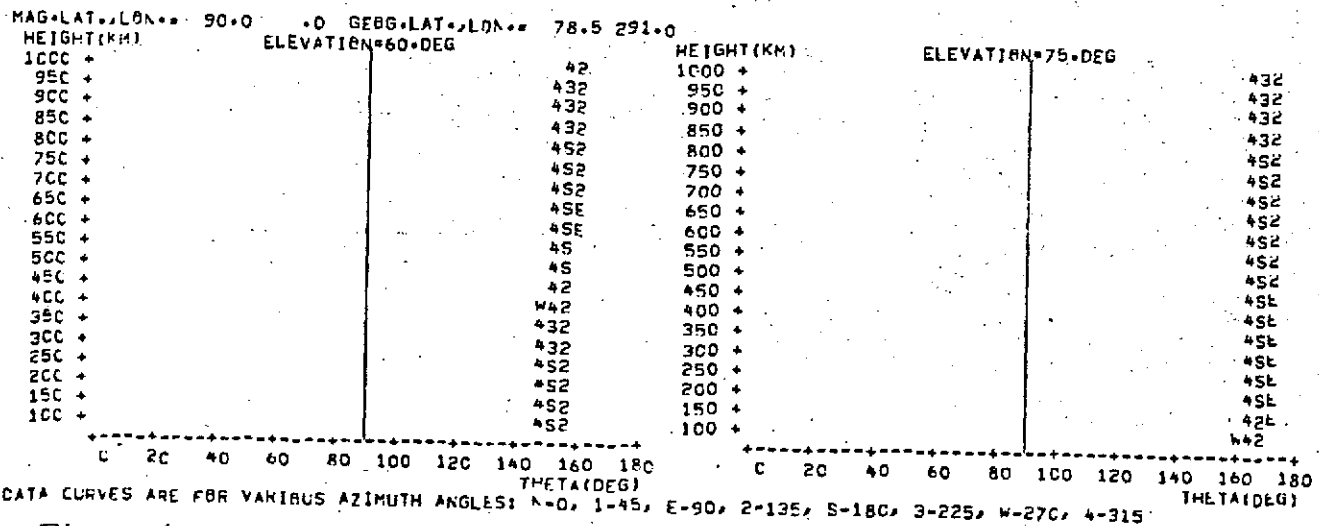
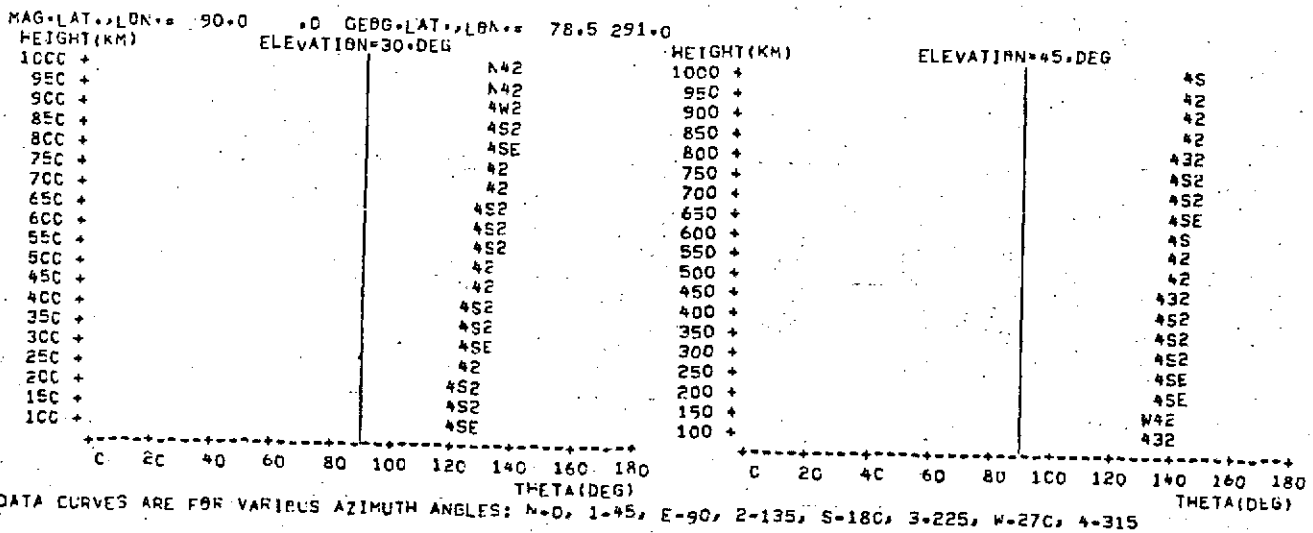
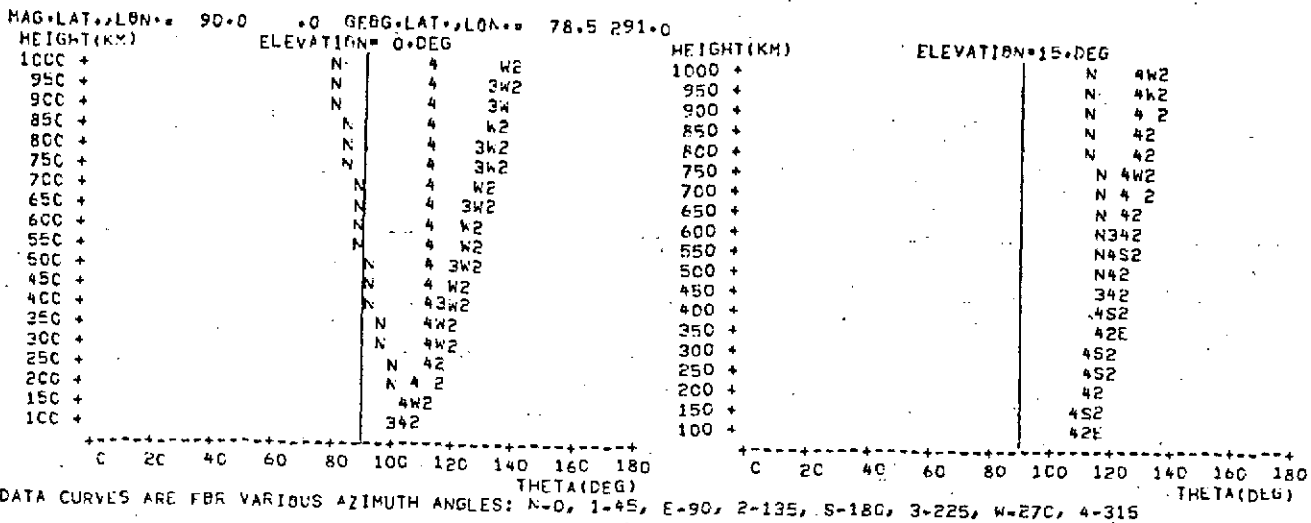


Figure 6d. Variation of the Angle θ Between the Direction of Propagation and the Magnetic Field

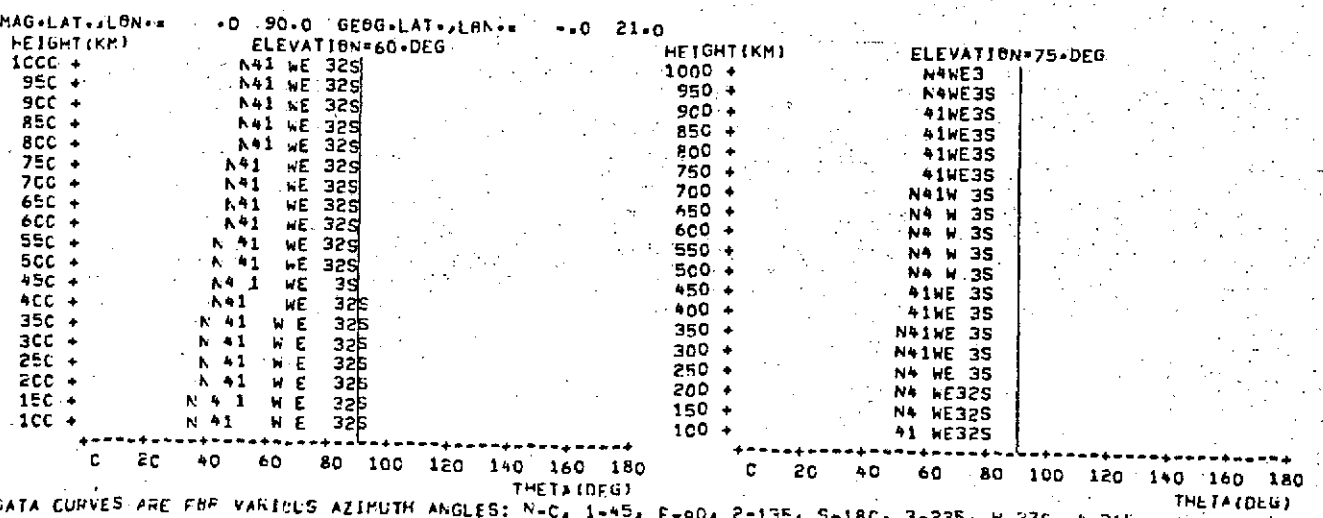
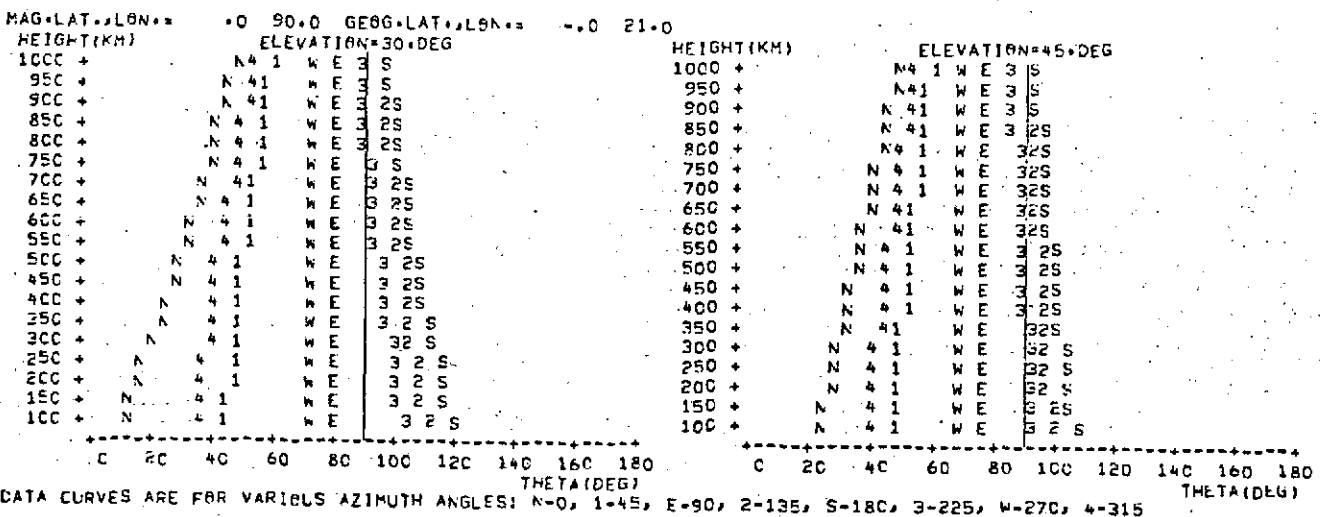
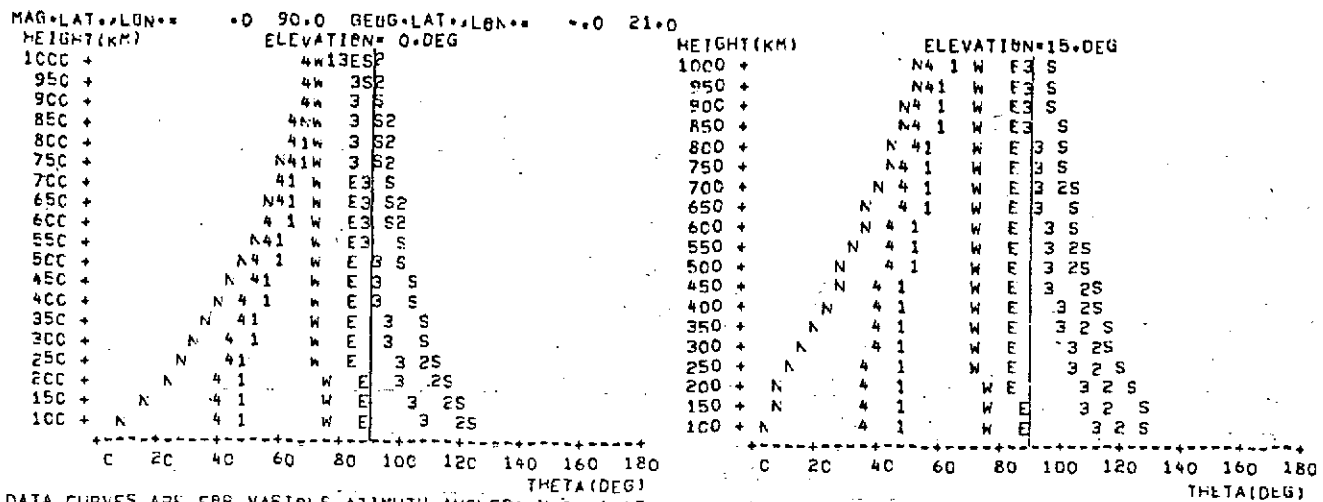


Figure 6e. Variation of the Angle θ Between the Direction of Propagation and the Magnetic Field

Table 4. Comparison of Changes in Vertical Electron Content and Faraday Factor due to Integration Carried to 1000, 2000 and 3000 km Height

LAT.	LBN.	DATE	UT	ELEV	AZIM	FOF2	VEC(1.E15 E/M**2)			FAR.FAC.(1.E11/(DEG*M**2))		
							INTEGRATED	T0: 1000	2000	3000	1000	2000
15.0	.0	65 10 10	.0	90.0	0.	6.6	105.7	111.5	114.5	19537	19787	20002
						% DIFF.1-2K		5.5	8.3		1.3	2.4
						&1-3K:						
15.0	.0	65 10 10	2.0	90.0	0.	5.0	64.0	68.4	70.9	19526	19840	20125
						% DIFF.1-2K		6.9	10.7		1.6	3.1
						&1-3K:						
15.0	.0	65 10 10	4.0	90.0	0.	2.8	21.5	25.3	27.6	19773	20506	21181
						% DIFF.1-2K		17.7	28.2		3.7	7.1
						&1-3K:						
15.0	.0	65 10 10	6.0	90.0	0.	4.4	57.5	62.9	66.0	19577	19997	20383
						% DIFF.1-2K		9.4	14.8		2.1	4.1
						&1-3K:						
15.0	.0	65 10 10	8.0	90.0	0.	7.8	179.0	191.1	197.0	19639	19939	20184
						% DIFF.1-2K		6.7	10.0		1.5	2.8
						&1-3K:						
15.0	.0	65 10 10	10.0	90.0	0.	8.2	224.0	240.2	247.9	19817	20128	20382
						% DIFF.1-2K		7.2	10.6		1.6	2.9
						&1-3K:						
15.0	.0	65 10 10	12.0	90.0	0.	9.3	285.9	306.0	315.1	19876	20176	20410
						% DIFF.1-2K		7.0	10.2		1.5	2.7
						&1-3K:						
15.0	.0	65 10 10	14.0	90.0	0.	10.1	314.6	334.3	343.2	19779	20052	20264
						% DIFF.1-2K		6.3	9.1		1.4	2.5
						&1-3K:						
15.0	.0	65 10 10	16.0	90.0	0.	10.9	339.4	355.5	362.7	19690	19902	20065
						% DIFF.1-2K		4.7	6.9		1.1	1.9
						&1-3K:						
15.0	.0	65 10 10	18.0	90.0	0.	10.4	279.2	291.5	297.0	19657	19854	20006
						% DIFF.1-2K		4.4	6.4		1.0	1.8
						&1-3K:						
15.0	.0	65 10 10	20.0	90.0	0.	9.1	209.4	218.7	223.0	19645	19845	19999
						% DIFF.1-2K		4.5	6.5		1.0	1.8
						&1-3K:						
15.0	.0	65 10 10	22.0	90.0	0.	8.2	162.7	170.7	174.5	19610	19832	20012
						% DIFF.1-2K		4.9	7.3		1.1	2.0
						&1-3K:						

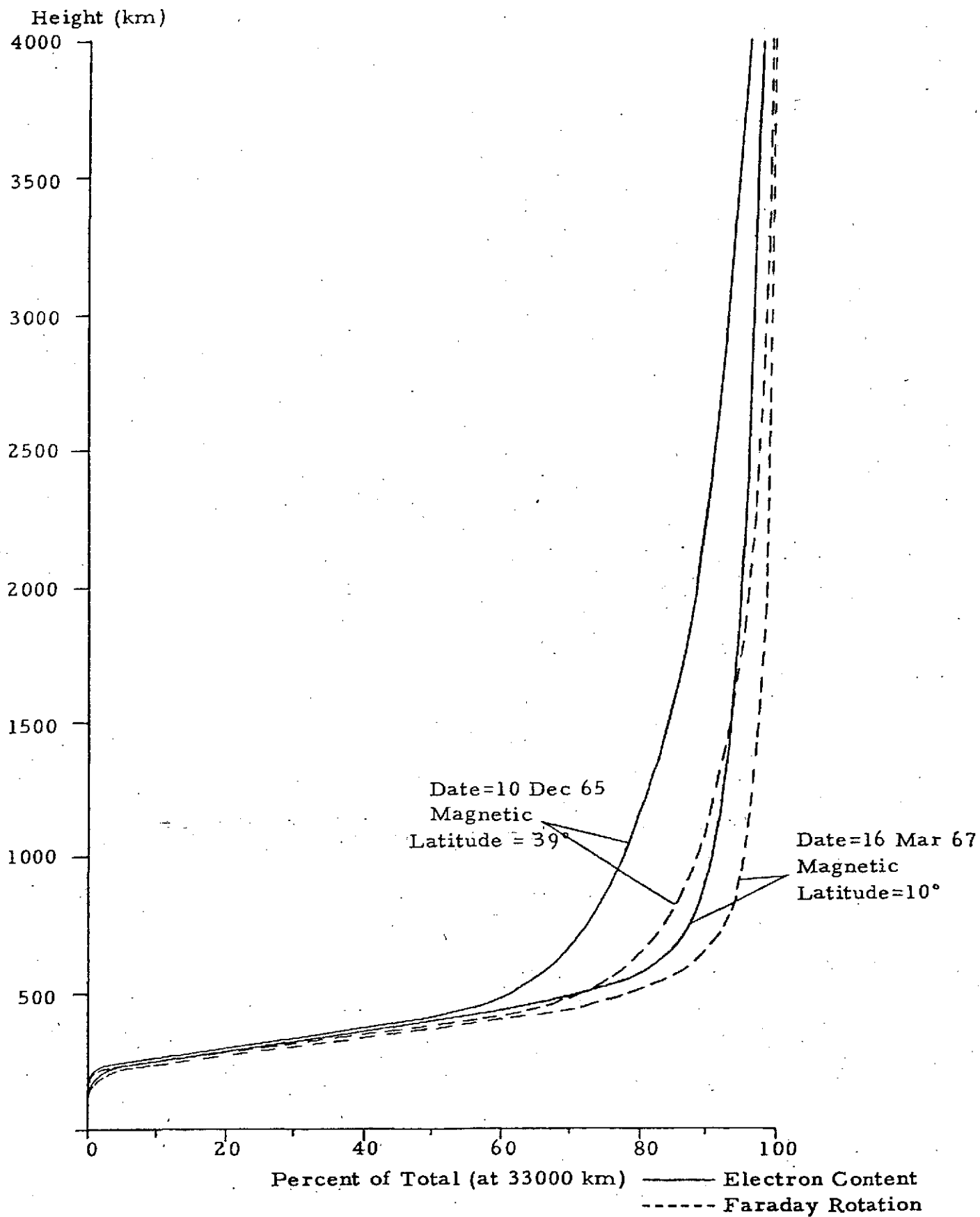
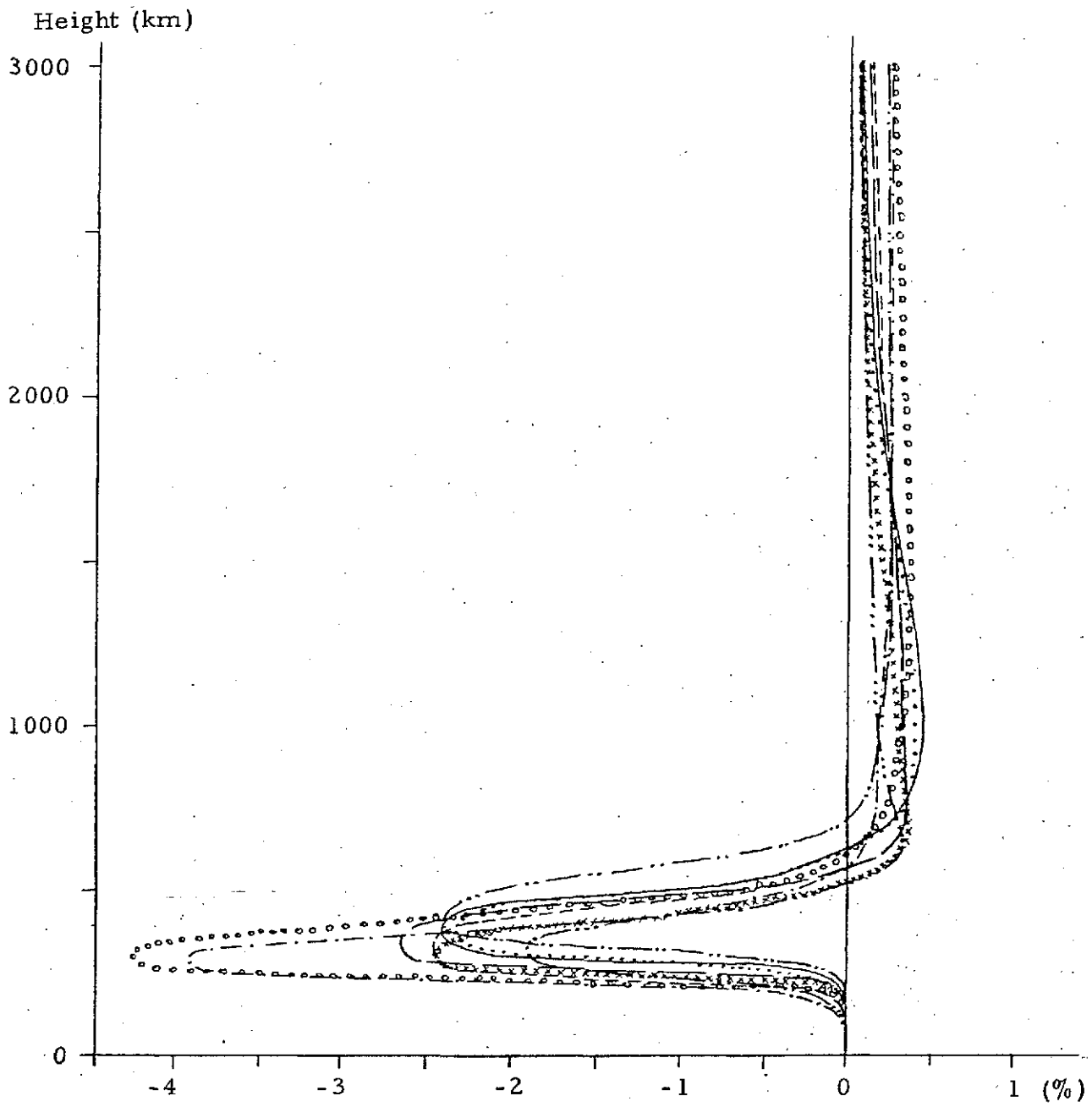


Figure 7. Comparison of the Amount of EC and Far. Rotation Accumulated from Ground up to a Varying Height



	Mag. Lat. =10°	Mag. Lat. =39°	Mag. Lat. =80°
10 Dec 65	— — — — —	• • • • •	× × × × ×
16 Mar 67	• • • • •	— — — — —	— — — — —
20 Jun 71	• • • • •	— — — — —	• • • • •

Figure 8. Difference between Percent Contributions of Electron Content and Faraday Rotation in each 100 km Height Interval. Percentages are taken of the total values integrated from 0 to a satellite height of 33000 km.

APPENDIX A

Observations at Cape Kennedy

At the Cape Kennedy location, latitude = 28.4° , longitude = 279.4° , 2 types of experiments were set up, a digisonde measuring critical frequency f_oF2 and height of the F layer $h'F$, and a polarimeter measuring Faraday rotation angles Ω that were converted to total electron content N_T . Approximately a 6 month span of data was reduced, f_oF2 and height data for two time periods 19 October 73 to 24 Nov 73 and from 20 Dec 73 to 7 Mar 74, and total content data from 20 Dec 73 to 7 March 74.

The height of the F layer was converted to an approximate height at f_oF2 by a rough conversion process relating the mean $h'F$ observation to the mean h_m prediction on an hourly basis for the total reduction period. Figure 9 shows the mean height curves along with the resultant scale constants. The Faraday rotation angles were converted to total electron content by the relation $N_T = F\Omega$ using a fixed conversion factor of $F = 0.293 \times 10^{15} \text{ el/m}^2 \text{ degrees}$. Considering the results from the preceding report, the error introduced by the use of a fixed rather than a variable factor was thought acceptable for the following reasons. For this particular case, both station position and direction of observation were fixed. The specific seasonal and diurnal variations will introduce at most, errors of about 6%, and the day to day variations in f_oF2 and height may contribute up to a 5% error in the Faraday factor. The large possible errors due to height changes do not apply to this case, since the angular observation path has a relatively high elevation of 54° and azimuth of 156° for which the propagation angle θ does not come close to 90° . Thus the use of a fixed factor will at most introduce an error of 7.8%, and combining this in RSS fashion with the inherent instrumental errors of about 10%, the overall error in the total electron content values should not exceed 12.7%.

On a daily and monthly mean basis comparisons were performed between the measured values of f_oF2 , height and total electron content and the

corresponding predictions and updated values obtained from the Bent Ionospheric Model. The diurnal plots are given day by day showing the height variations in Figures 12a-1 and the changes in f_oF2 in Figures 11a-1. Figures 10a-1 show the curves for the total electron content predictions and the measurements as reduced from the Faraday rotation observations as well as the total content values updated with the f_oF2 measurements. The diurnal curves giving the monthly means of the measurements as well as the RMS residuals, measured minus predicted or updated values, are plotted in Figures 13 a-f and 14, 15a-g for electron content, f_oF2 and height respectively. The monthly mean statistics are listed in more detail in Tables 5a-g, where the daytime percent errors and the number of data points are included.

The overall results are summarized in Table 6 as the RMS percent errors for the daytime period from 8 to 18 hours local time. Over the total reduction period the Bent model f_oF2 predictions deviate by 14% from the measurements and for the height by 8%; the error in the total electron content predictions of 31.5% is reduced to 24.0% when updating with f_oF2 observations. These percentages fit in with the results from previous extensive investigations at many different sites quoted in Reference 1. The update with realtime data, however, shows a much greater improvement for the time span from Jan-Mar 74 than for the total period; here the daytime RMS error is reduced from 30.9% for the predictions to 20.6% for the updated values of total content.

It requires closer examination to find out why the f_oF2 update is not as effective for the Dec 73 and April-May 74 results of total content as for the data during the remaining months. As seen on Figure 13a, the RMS error in electron content for Dec 73 is greater for the update than for the predictions at 15 and 16 hours UT. On the daily curves in Figure 10c for Dec 24 at 16 UT for example, we find the measured content value to be smaller than the basic prediction while the update is considerably larger due to a larger than predicted f_oF2 measurement as seen in Figure 11c.

Here we have an ionospheric irregularity where a sudden sharp increase in f_oF2 is not accompanied by a corresponding increase in total content; the increased electron density must be limited to a very narrow interval close to $h_p F2$. A few such points effect the monthly averages significantly, and replacing for example the update by the predictions at 13, 15, and 16 hours UT when the update does not give an overall improvement, would result in an RMS error for the Dec 73 update statistics of 17.2%. This is an improvement over the 21.8% error for the predictions alone that fits in with the Jan-Mar 74 results.

The update in April and May 74 shows a less than average improvement for the same reason as in Dec 73. The Bent Model fits extremely good to an average relationship for the variation between the quantities of f_oF2 and total content. On Jan 25 for example, the much higher than normal f_oF2 observations between about 16 and 20 hours UT as seen in Figure 11e, are used to update the total content predictions resulting in a near perfect match for the much higher than average electron content measurements in Figure 10e. On several occasions in April and May 74, however, the higher than predicted f_oF2 observations are not accompanied by a typical increase in the total electron content, and large discrepancies between the predicted and measured values can be noted, as on April 12 and 13 in Figure 10k.

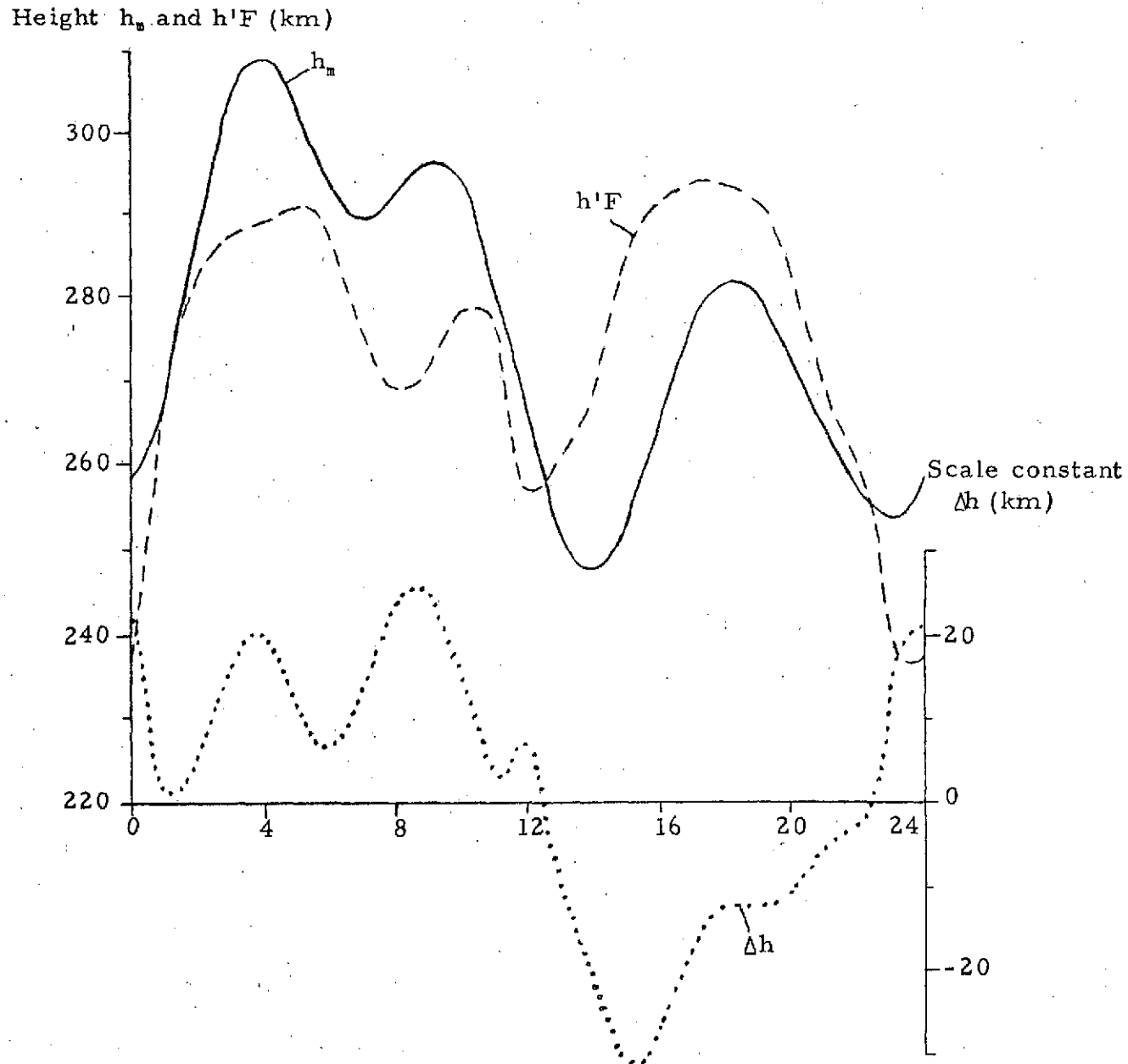
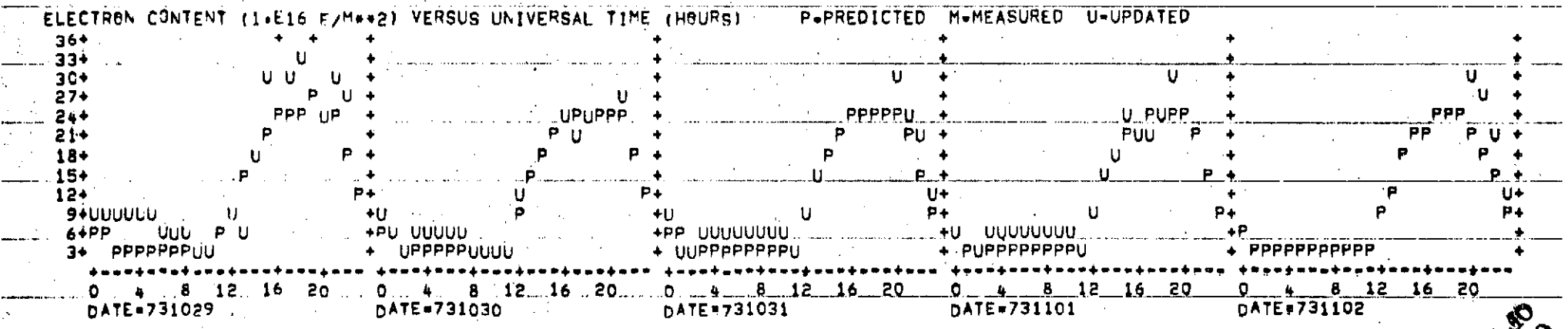
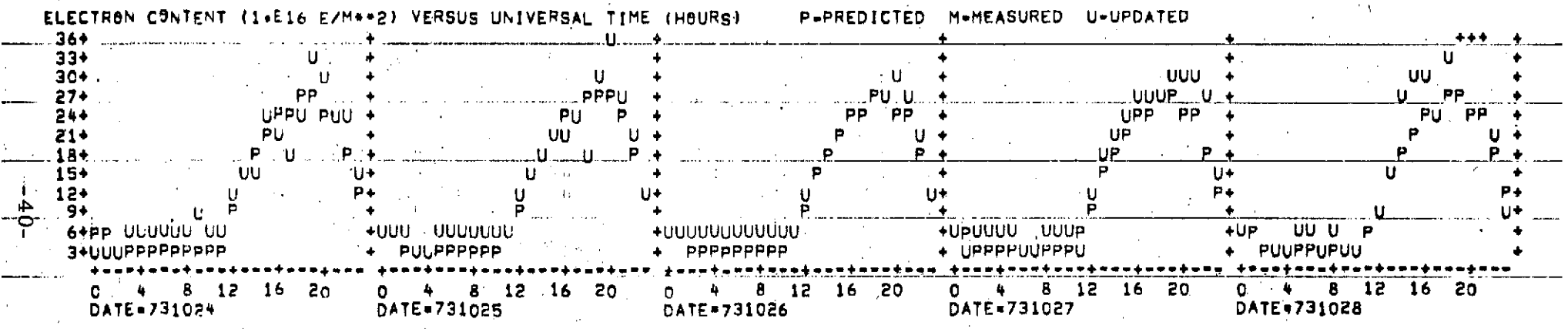
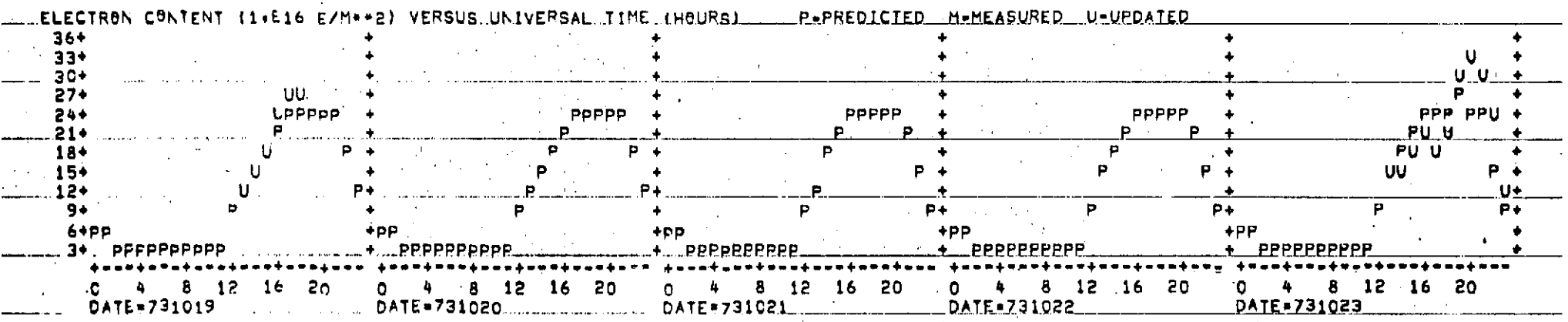


Figure 9. Diurnal Mean Curves for Oct 73-May 74 of Predicted h_m , Observed $h'F$, and the Difference Δh .



-40-

Figure 10a.

ORIGINAL PAGE IS OF POOR QUALITY

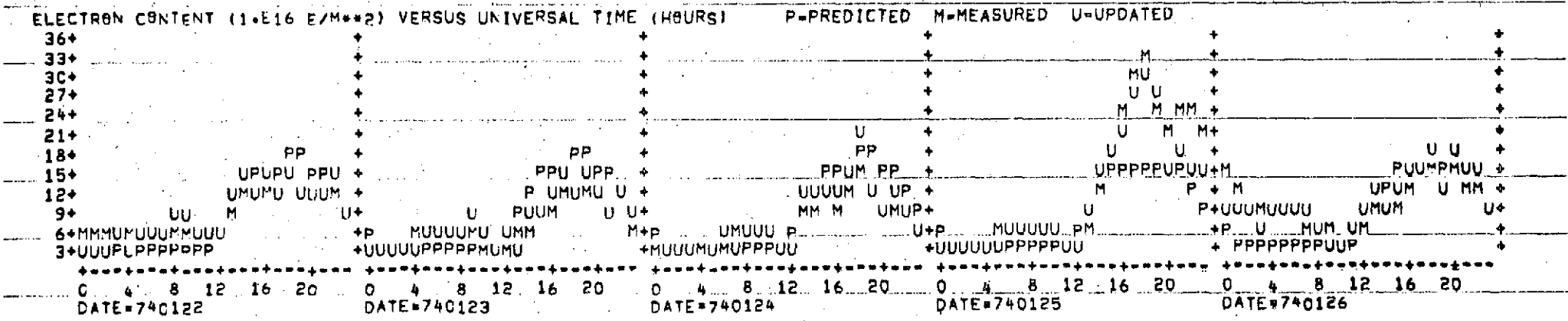
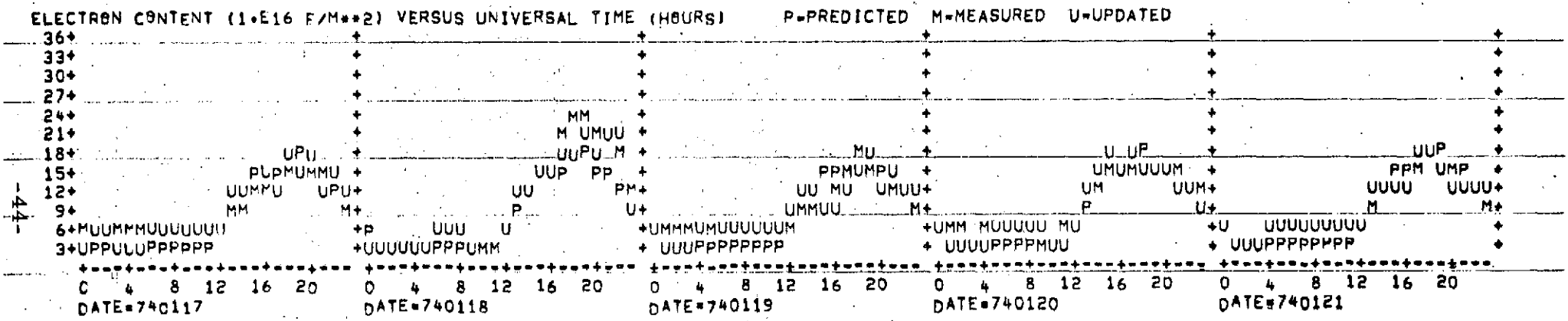
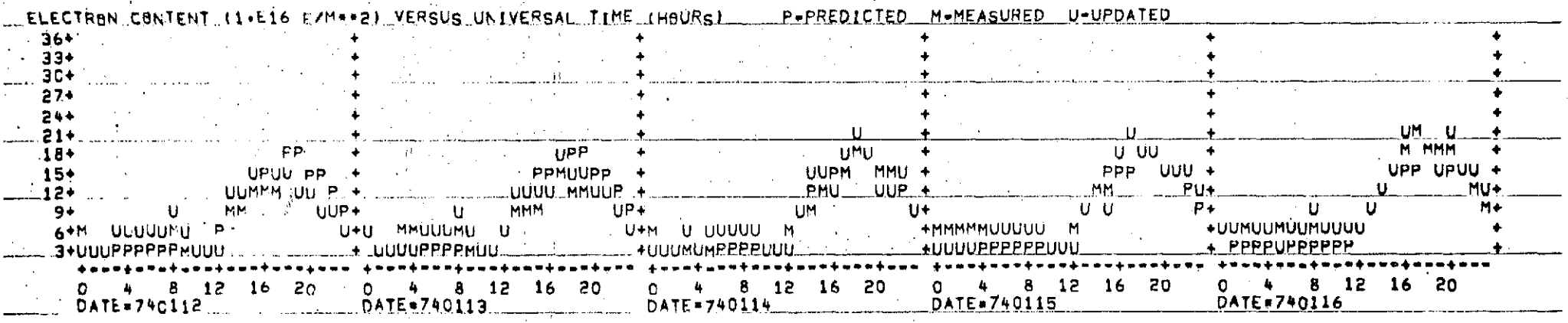


Figure 10e.

ELECTRON CONTENT (1.516 E/M**2) VERSUS UNIVERSAL TIME (HOURS)		P-PREDICTED		M-MEASURED		U-UPDATED	
DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME
740221	0 4 8 12 16 20	740221	0 4 8 12 16 20	740221	0 4 8 12 16 20	740221	0 4 8 12 16 20
740222	0 4 8 12 16 20	740222	0 4 8 12 16 20	740222	0 4 8 12 16 20	740222	0 4 8 12 16 20
740223	0 4 8 12 16 20	740223	0 4 8 12 16 20	740223	0 4 8 12 16 20	740223	0 4 8 12 16 20
740224	0 4 8 12 16 20	740224	0 4 8 12 16 20	740224	0 4 8 12 16 20	740224	0 4 8 12 16 20
740225	0 4 8 12 16 20	740225	0 4 8 12 16 20	740225	0 4 8 12 16 20	740225	0 4 8 12 16 20
740216	0 4 8 12 16 20	740216	0 4 8 12 16 20	740216	0 4 8 12 16 20	740216	0 4 8 12 16 20
740217	0 4 8 12 16 20	740217	0 4 8 12 16 20	740217	0 4 8 12 16 20	740217	0 4 8 12 16 20
740218	0 4 8 12 16 20	740218	0 4 8 12 16 20	740218	0 4 8 12 16 20	740218	0 4 8 12 16 20
740219	0 4 8 12 16 20	740219	0 4 8 12 16 20	740219	0 4 8 12 16 20	740219	0 4 8 12 16 20
740215	0 4 8 12 16 20	740215	0 4 8 12 16 20	740215	0 4 8 12 16 20	740215	0 4 8 12 16 20
740211	0 4 8 12 16 20	740211	0 4 8 12 16 20	740211	0 4 8 12 16 20	740211	0 4 8 12 16 20

ELECTRON CONTENT (1.E16 E/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED	M-MEASURED	U-UPDATED															
36+							U+++ +															
33+				U			U +															
30+				UMU			+ +															
27+		UU		M MU			+ + P U															
24+		MPPP		UPPP			+ + UU UPUU															
21+		M MU P		U MU	PPPP		+ + MMU P															
18+	P	MUUP		M P	UUU PU		+ + UM UPUU															
15+	PM	MUU		UU MP	PMMMUMU		+ + UM M+ M+															
12+P	PM	MM+P		U U+P	UU M M M+		+ + UM +P UU															
9+UP	PM	+UP	U	+ P	UM		+ + U M U+ P UM															
6+ UPP		+ UPP	UU M	+ UMP	UUUUUUUUUM		+ + MPP UUUUUU +UUUUUUU M															
3+ UUUUUUUUU		+ UUUUUUUUMPU		+ UUMMP	PPPPM		+ + UUUUUMPPMM + PPUUUUU															

C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20					
DATE=740313						DATE=740314						DATE=740315					DATE=740316					DATE=740317

ELECTRON CONTENT (1.E16 E/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED	M-MEASURED	U-UPDATED														
36+						U++	++ +														
33+						UUUUM+	U U +														
30+						MM	U M +														
27+		U U		U UU		UM	+ UMUP + U UU														
24+		PUUPU		PPUU U+		UP PP +U	+ M P PP U + U U=MP +														
21+		U P P		UPUU P +U		PM P +M	+ MU P PM + UPM MP +														
18+		U P M M M M M M		U M M M M M M M		UUUM P +	+ U P P + MMU MU +														
15+		U PU M+		UM P+		U MM P+	+ P M+U UP MU +														
12+U		MM		UM		M	+ PU P U+M UP M +														
9+MP		M		U M		U	+ P U P M +														
6+ UPPU UU				MUPUUUUU U		MPUUUUUUUU	+ P M UUUUUU P + UUUUMU P +														
3+ UUUUUUUUMU				U M M M M M M M		U M M M M M M M	+ P P P P M U U + U U M U M U U														

C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20				
DATE=740318						DATE=740319						DATE=740320					DATE=740321				DATE=740322

ELECTRON CONTENT (1.E16 E/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED	M-MEASURED	U-UPDATED														
36+						UU	+ +														
33+							+ +														
30+							+ +														
27+		P		P		UM UU	+ + P P														
24+		P PP		U PP		M MP	+ + P P P P														
21+		P P P		UMU P		UUU MP	+ + PU P + P P														
18+		P UUU P		P M P		MM MU	+ + P MU U P + P P														
15+		UU UM M U U P		PM M M U U P		UM MR	+ + P U M U P + P M U U U U U P														
12+PU		PMU M M M U + U		PUU MU + U		M	+ + P U U M M U U + P P M M M U														
9+UM		PM		PU		M + U P	+ + U U + U P P U U M +														
6+ UUUU PU				M M U U U U U PU		M U U U U U U PU	+ + M U U P U U PM + U P P P U PU U														
3+ P P U U U M U				P P P P U U		P P M M U U U	+ + M U M M U U U U U + U U U U M U U U U														

0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20				
DATE=740323						DATE=740324						DATE=740325					DATE=740326				DATE=740327

Figure 10i.

ELECTRON CONTENT (1.E16 F/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED					U-UPDATED														
36+																													
33+																													
30+		UUU																											
27+																													
24+																													
21+																													
18+																													
15+																													
12+P																													
9+ P																													
6+U																													
3+ UUUUUPPPUM																													

C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20
DATE=740328					DATE=740329					DATE=740330					DATE=740331					DATE=740401									

ELECTRON CONTENT (1.E16 F/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED					U-UPDATED														
36+																													
33+																													
30+																													
27+																													
24+																													
21+																													
18+																													
15+																													
12+P																													
9+ P																													
6+UUUUUP U																													
3+ MMMUUUUUUU																													

C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20
DATE=740402					DATE=740403					DATE=740404					DATE=740405					DATE=740406									

ELECTRON CONTENT (1.E16 F/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED					U-UPDATED														
36+																													
33+																													
30+																													
27+																													
24+																													
21+																													
18+																													
15+U																													
12+P																													
9+MP																													
6+ UUUUUUUU PM																													
3+ MMMMMUUUUU																													

C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20
DATE=740407					DATE=740408					DATE=740409					DATE=740410					DATE=740411									

Figure 10j.

ELECTRON CONTENT (1.E16 E/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED	M-MEASURED	U-UPDATED																	
36+		+U	+			+																		
33+		U	+		UU	+																		
30+		U U	+		U UU	+																		
27+		MPP	+		UPPP	+																		
24+		U MMM	+		PMM P	+																		
21+		PM PU	+		PM MMP	+																		
18+		U	M	+	U	M	+																	
15+P		PU		+	UU	U+U																		
12+LP		UUUM		M+UP	UUUM		+																	
9+M P		UPMM		+M P	PM		+																	
6+ UUPLP UUUUM				+ UUUUUUUUUUM			+																	
3+ MUPUUMMM				+ MMPMM			+																	
-----					-----	-----	-----																	
C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20							
DATE=740412						DATE=740413						DATE=740414						DATE=740415						DATE=740416

ELECTRON CONTENT (1.E16 E/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED	M-MEASURED	U-UPDATED																
36+		U	+			+++	+																
33+		U U UU	+			M MU	+																
30+		U	+			U	+																
27+		U PPP	+			PPP	U+																
24+		U UP P U+				P P	+																
21+		UP PP+				P	PP+																
18+M		MMM				UU	+																
15+PU		U PP				PP	+																
12+ M		UP				U	+																
9+ U U UP						UUU	P																
6+ MUUUUUUU						PPUUU U	+																
3+ PPPP						PPUU	+																
-----					-----	-----	-----																
C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20						
DATE=740417						DATE=740418						DATE=740419						DATE=740420					DATE=740421

ELECTRON CONTENT (1.E16 E/M**2) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED	M-MEASURED	U-UPDATED																
36+			+				+																
33+			+				+																
30+			+			UU U+	+																
27+			+			U U	+																
24+			PPP	+		UPP	+																
21+U			P PP	+		P PP	+																
18+			P	P+		PMU U P+	+																
15+M			P MUU	+		PM MUU	+																
12+ M			PP MU MU	+		PMU MUU+UP	+																
9+ U			P MM			UUU	+																
6+ MUUUUU UUU						UMUPPPU UM	+																
3+ PM PFUUM						MUUUUUUUM	+																
-----					-----	-----	-----																
C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20						
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Figure 10k.

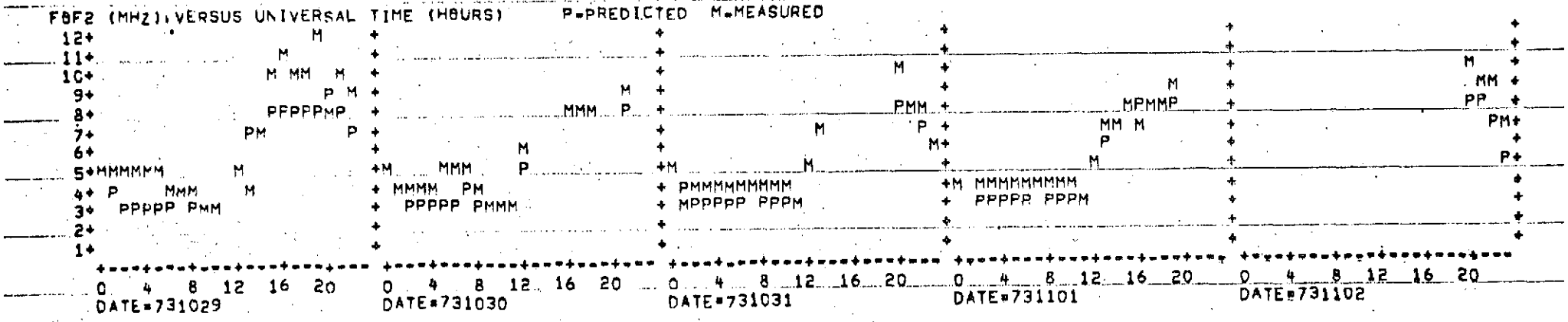
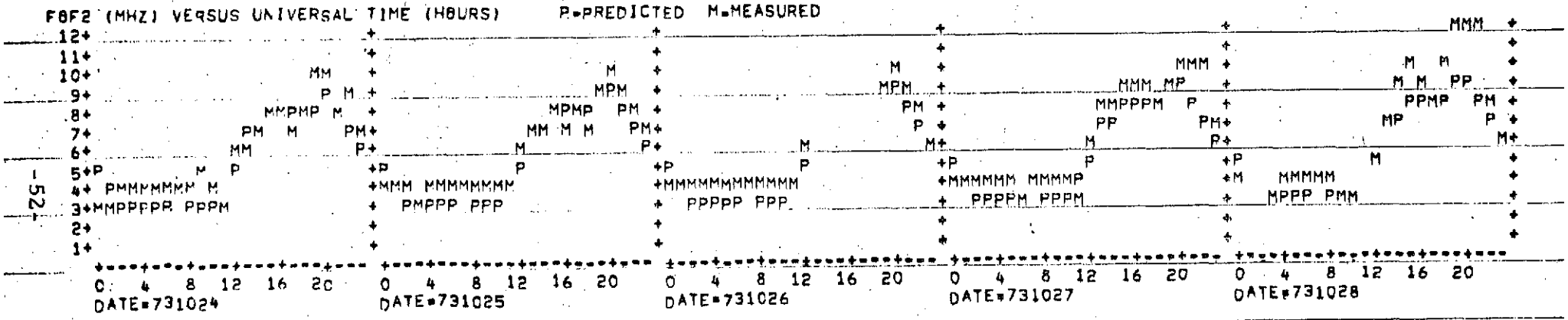
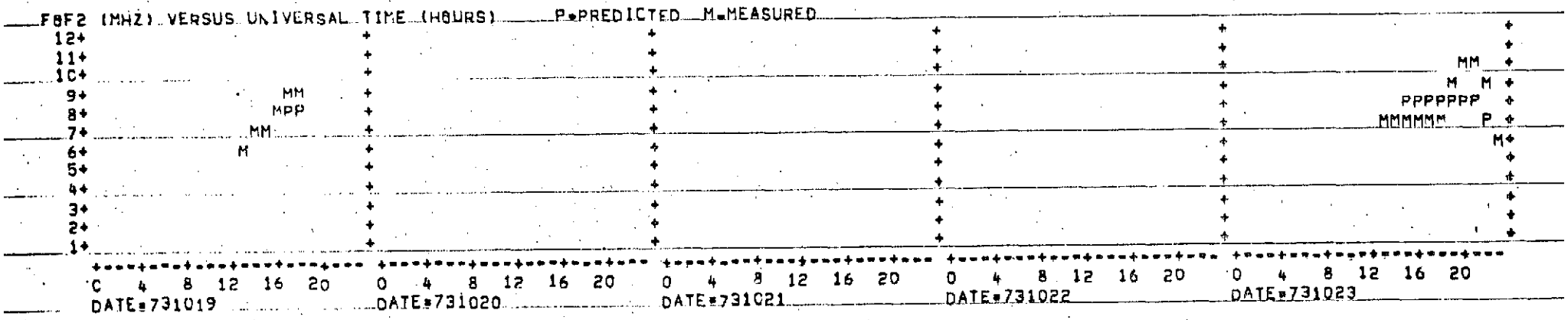


Figure 11a.

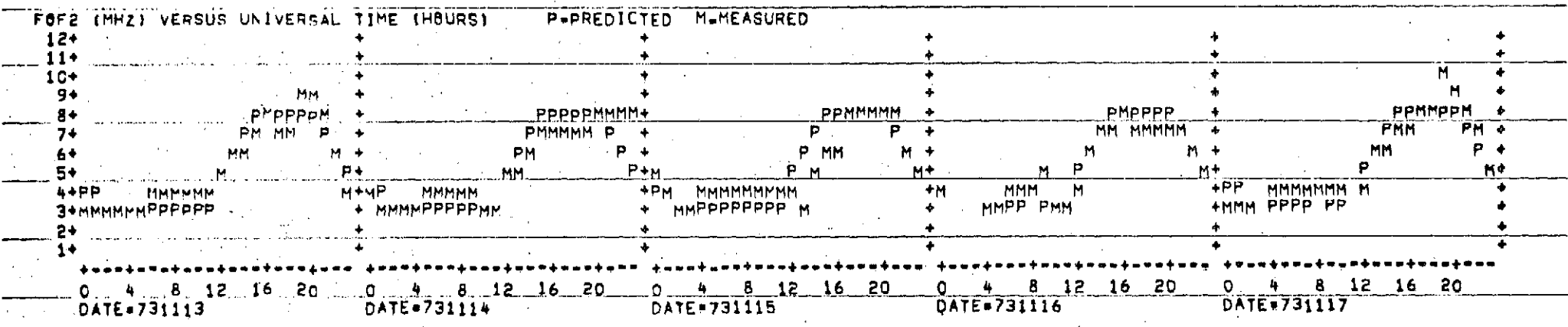
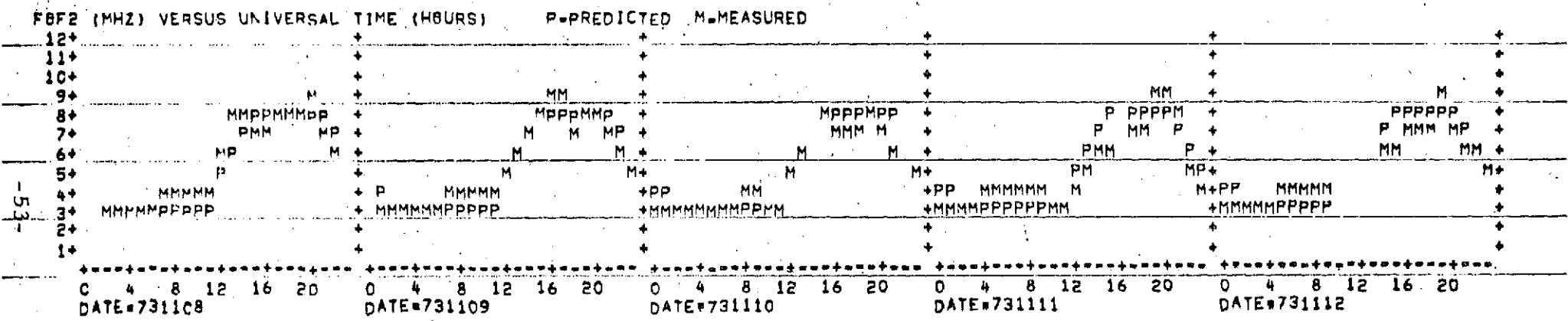
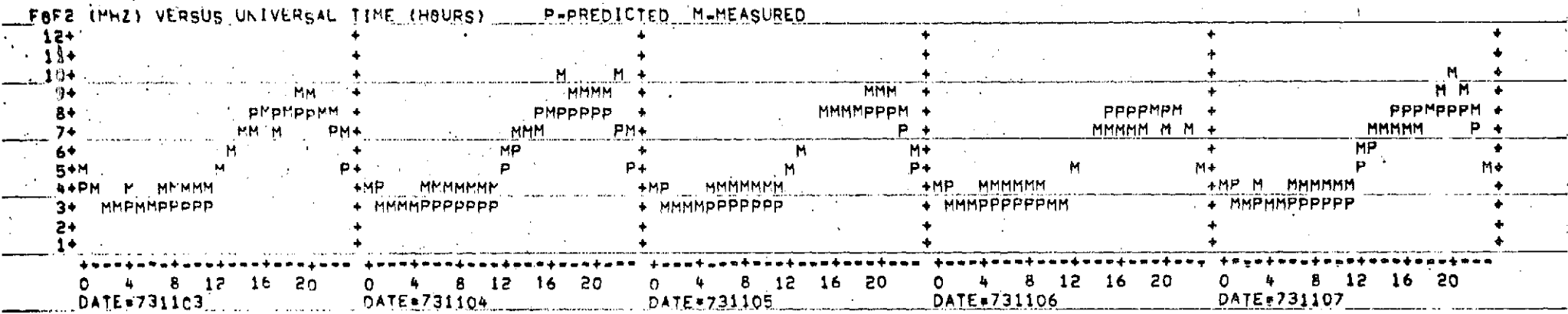


Figure 11b.

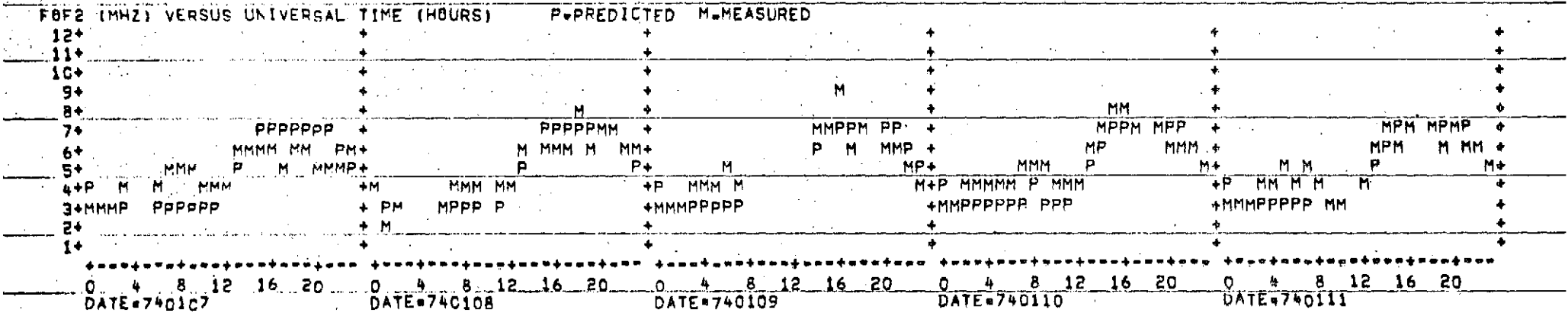
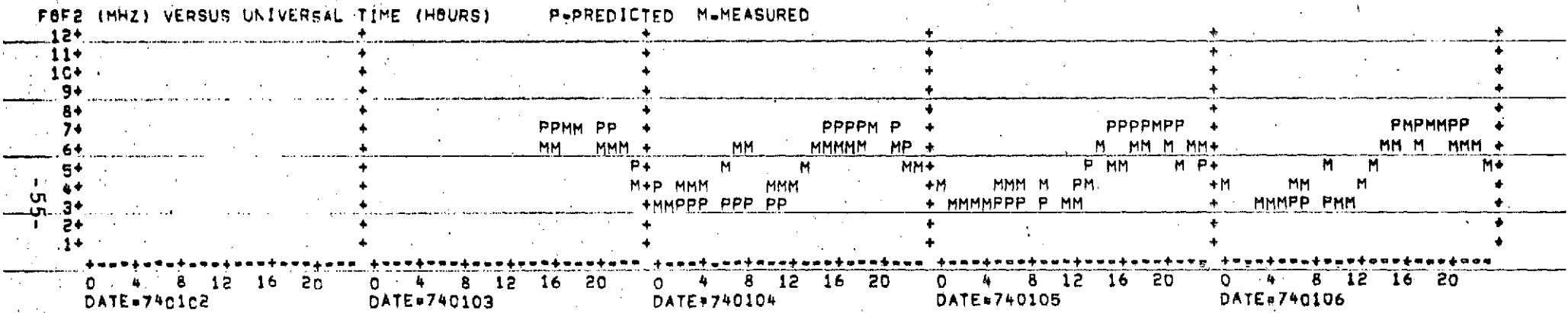
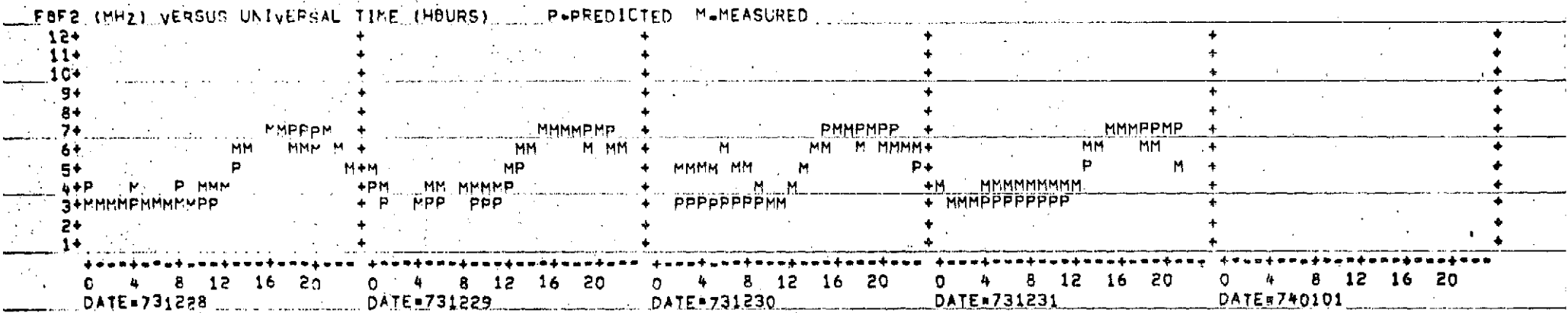


Figure 1ld.

F0F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED														
12+																								
11+																								
10+																								
9+																								
8+																								
7+			P MMPPP			PPMPMP			MMPMPMP			PMPMMMM		M M										
6+		MMM	MMMM			MMMM M MMM			MPMM	MMP+		P+		M MP MM										
5+		MM	P			M	P		M+			M M M		MMM M										
4+	P	MMM	PM	P		M+M	MMMPM	M		M MM	MMMM	P		M+ MM M P MMM										
3+	MMMMPPPP	PM				MMMPPPP	PM			MPPMP	PM			MMM PPP PMM										
2+														P PMPPP PPP										
1+																								
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740112					DATE=740113					DATE=740114					DATE=740115					DATE=740116				

F0F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED														
12+																								
11+																								
10+																								
9+																								
8+				M			M MM																	
7+			PPMPPP			MMMMMP			PPMPMP	M+		MMMMMM		PPMPMP M+										
6+		MM	M	MP			MM		PM+		MM M M M		MP	MPM										
5+		P		P+		M	P		P+		M	MP	MM	P+										
4+	PM	MMMM				MMP	M				M M M	MMMM		M+ MP MMMMM P										
3+	MPMPMP	PP				MMMPPMP	M				PMMP	PP	PP	+ PPMPP PM										
2+				M										+ MMMPPPP										
1+																								
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740117					DATE=740118					DATE=740119					DATE=740120					DATE=740121				

F0F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED														
12+																								
11+																								
10+													M											
9+													M M											
8+										M			M M											
7+			MPMPMP			PPMPMP				PPMPPP			MPMPMP											
6+		MP	M	MP			M		P	MMM	M	PM		PMMPMP										
5+		MP	P			PM	M			P	MP		P+	MMM M										
4+	PM	MP	MP			PPM	MMM	M		P	MMMM	P		M+PPM										
3+	MPMPMP	PP				MPMPMP	PP			MMM	MPMPMP			MP										
2+							M							PP										
1+																								
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740122					DATE=740123					DATE=740124					DATE=740125					DATE=740126				

Figure 11e.

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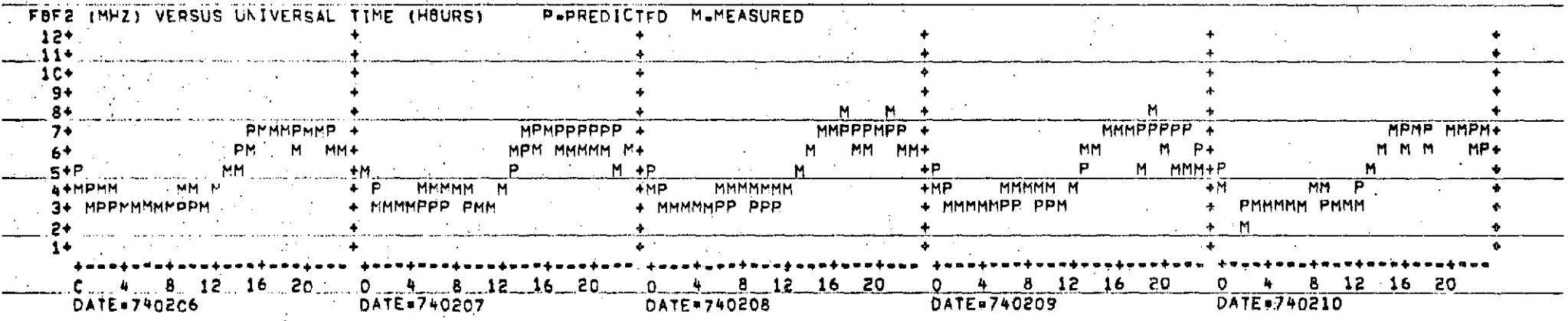
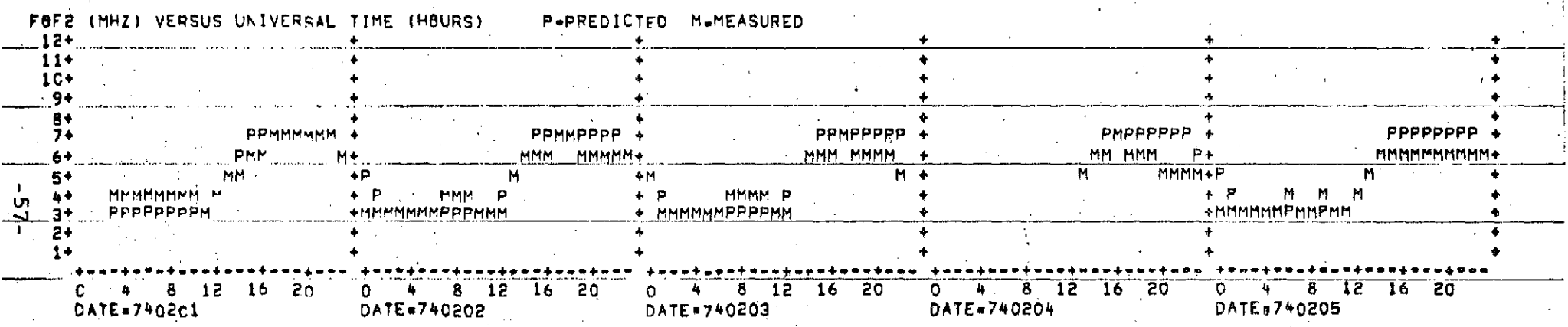
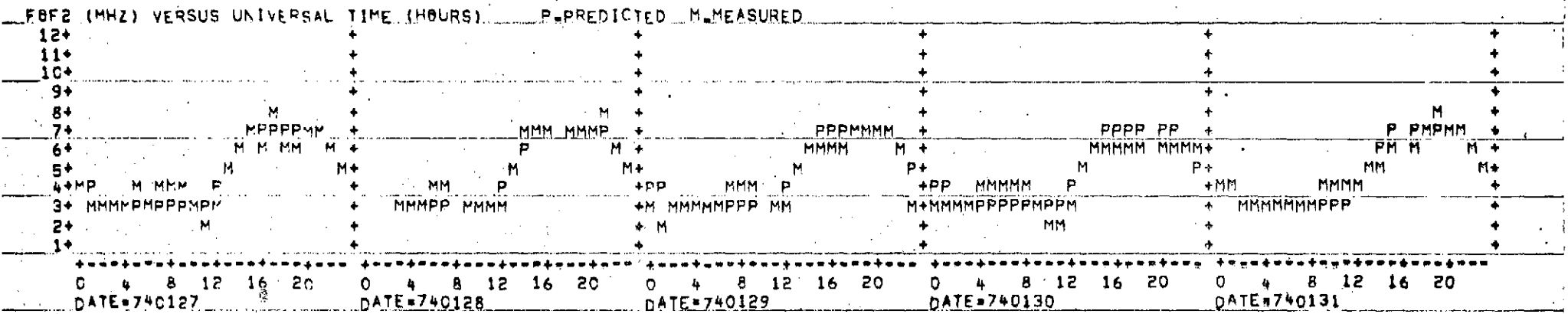


Figure 11f.

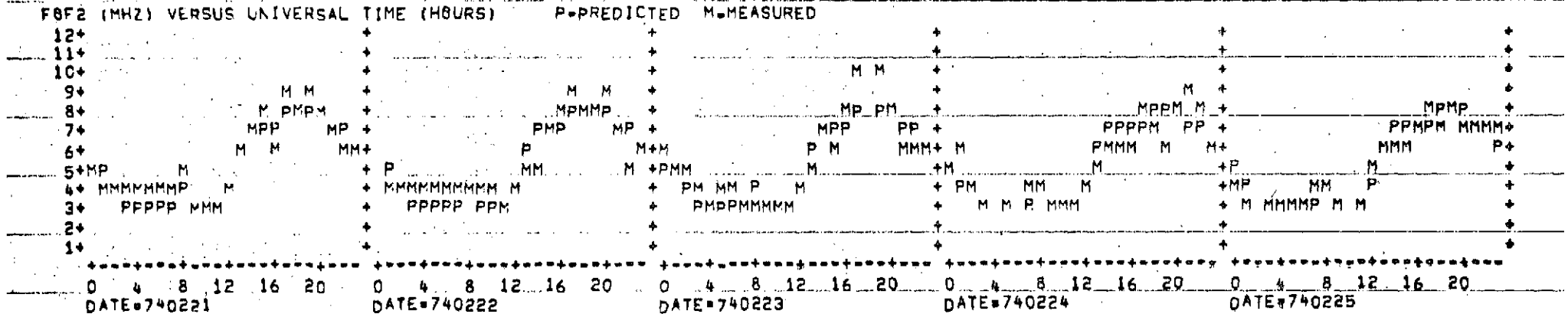
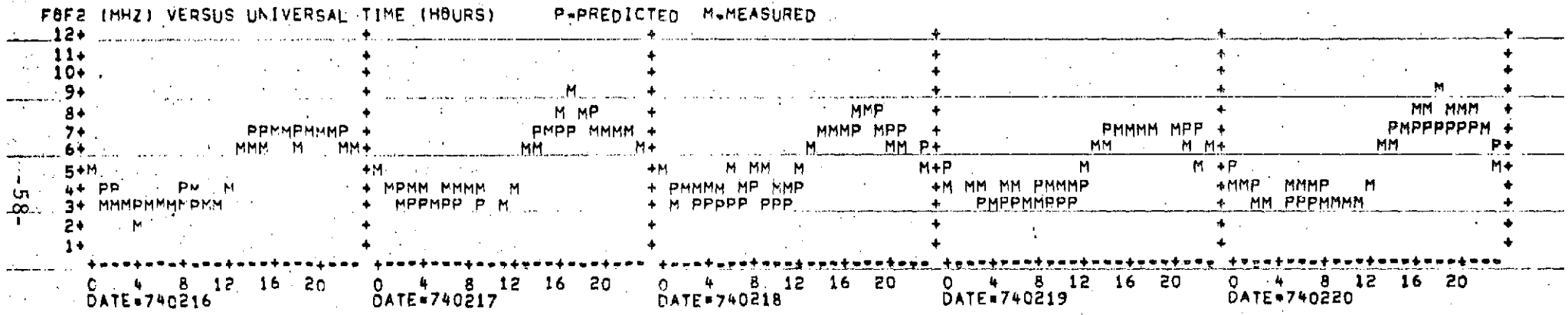
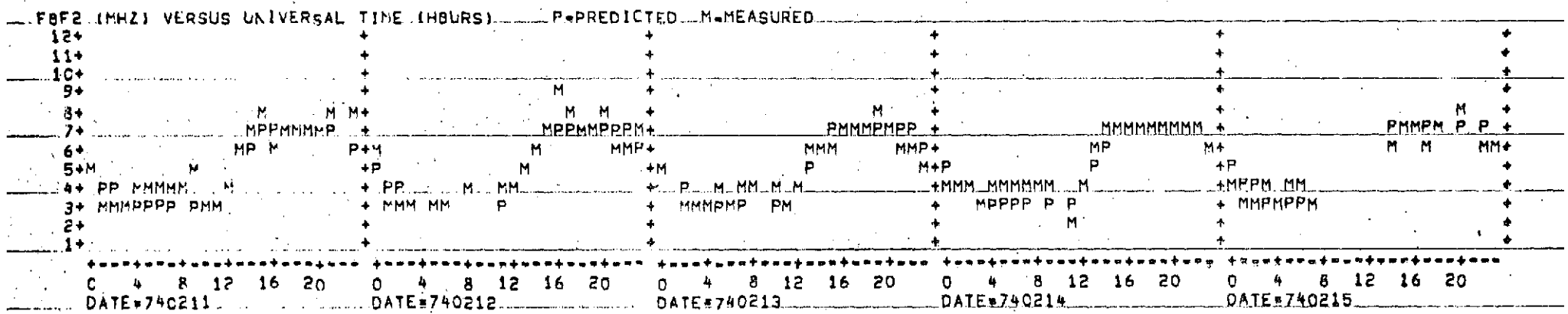


Figure 1lg.

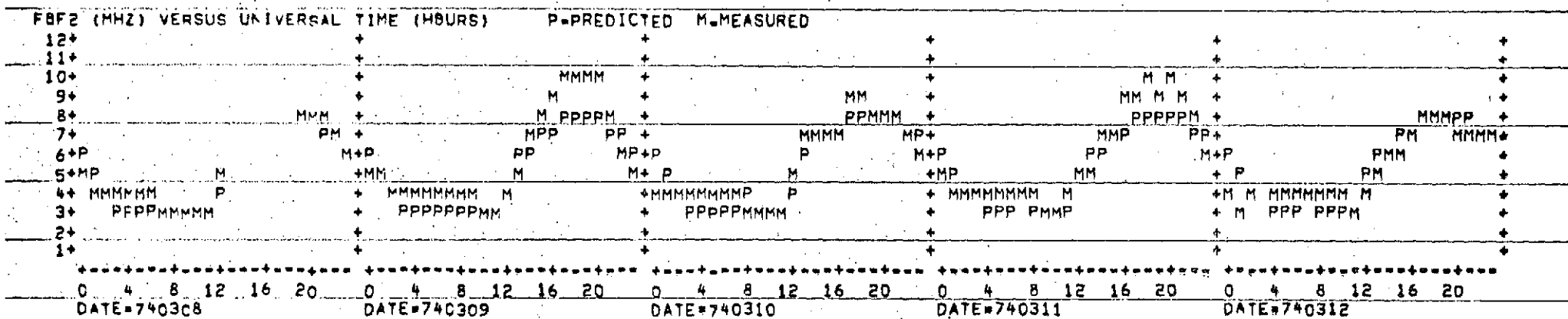
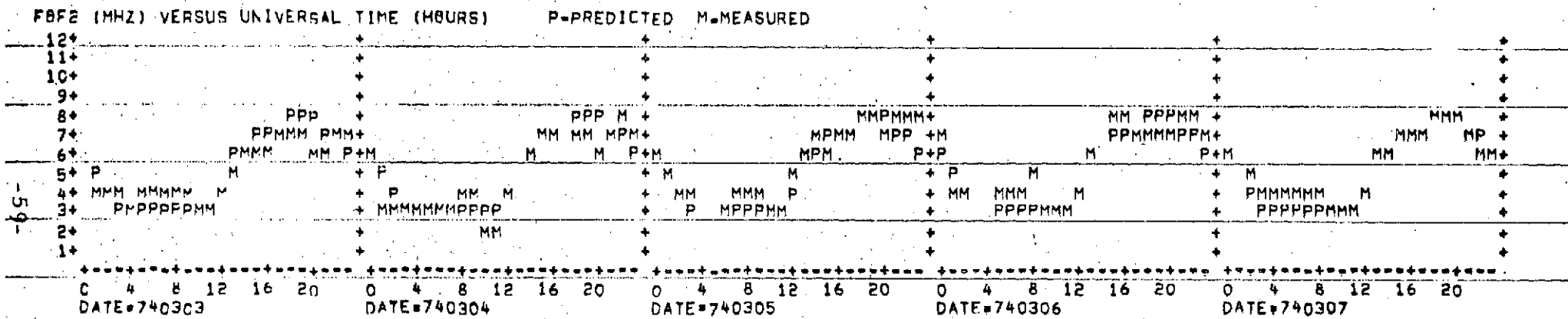
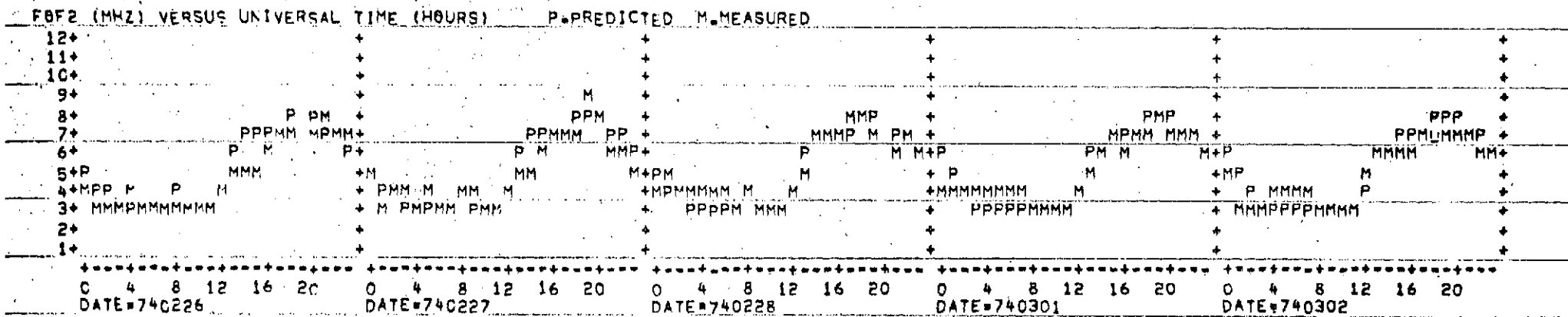


Figure 11h.

F0F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED														
12+																								
11+																								
10+																								
9+																								
8+		MMM				PP			PPP			PPP												
7+		PP	MPPP+			PP	PPPP+		PP	PPP+		PP	M	PPP+										
6+P		PPPK	MMM+P			PPP	MMMM	+P	P	MMMMMM+P		PPP	MM	MMMM+P										
5+ P		M	M			+MP	P	MM		M	+P	M	P	M										
4+M	PPM	MMM	M	M		+MMMMMM	MM		M	+MMMMPPMM		MM		+MMMM										
3+	MMM	MPPPMM				PPPPMM	M			M	PPPMPPM			+MMMMMM										
2+										M														
1+																								
0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740328					DATE=740329					DATE=740330					DATE=740331					DATE=740401				

F0F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED														
12+																								
11+																								
10+													MMM											
9+							M						M	MMM										
8+		M					M	M			M			MMM										
7+		PP	MPPP+				MMMMPPPPPP+			PMMPPPP+			PPPPPPPP+	M	PPPPPPMM+									
6+P		PP	M	MM	+MMM		PPM	MM	+P		PMM	MM	+M	P	MMM	MM	+P							
5+ P		P	PM	MM	M		+P	M	MP		M	+MM		MMM		MM	+M							
4+M	MMP	M	PM				PPPM	P			+P	PM			MPP		+MMMMMM							
3+	M	MMMMMM					PPMMMM				M	MMPPM			MMMMMM		+M							
2+												MM					+MMMM							
1+																								
0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740402					DATE=740403					DATE=740404					DATE=740405					DATE=740406				

F0F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS)					P-PREDICTED					M-MEASURED														
12+																								
11+																								
10+							MM				MM			MM	M									
9+		MM					MMM				M	M			M	MM								
8+		M					M				M	MPP	MM+		M	PPP	M+							
7+		PM	PPPP+				MPPPPPPPP+				MPP	PPP+	M		MPP	PPP+	P							
6+M		PM	M+P				P	P			MPP				MPP		+MP							
5+ P		MM					+MP		MM						M	M								
4+	MMMMMM	P					+M	PM	P			MMMMMMMM			MMMMMMMM	P								
3+	PPPM						+M	MMMMMM				PPPP			P	PM	MM							
2+		M																						
1+																								
0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740407					DATE=740408					DATE=740409					DATE=740410					DATE=740411				

Figure 11j.

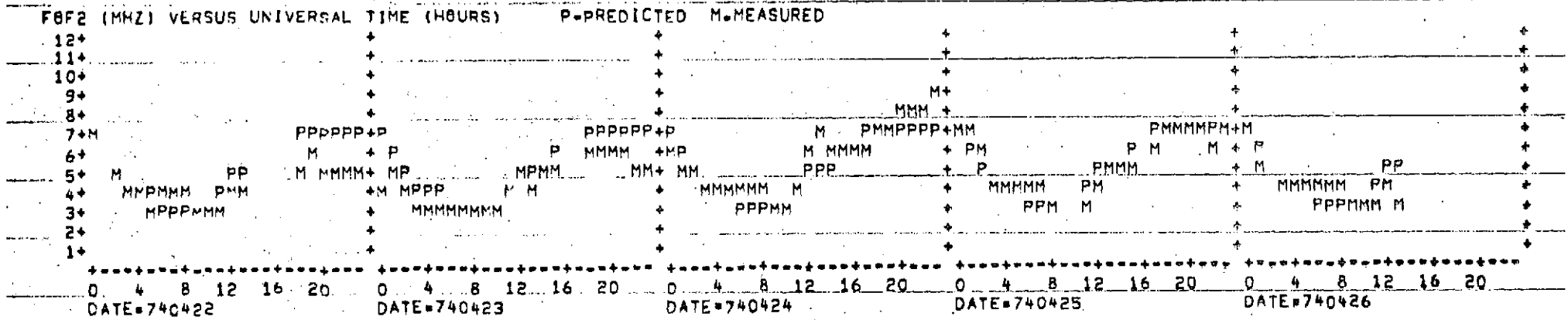
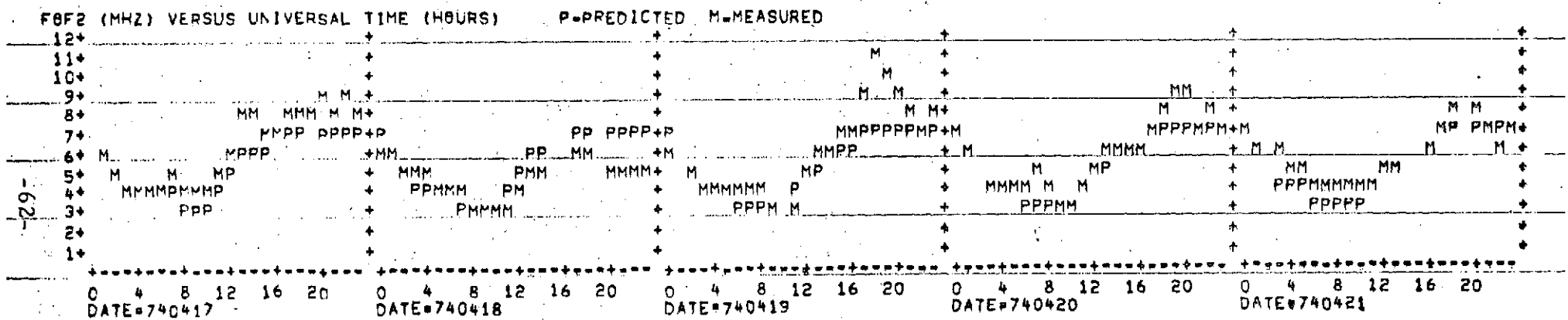
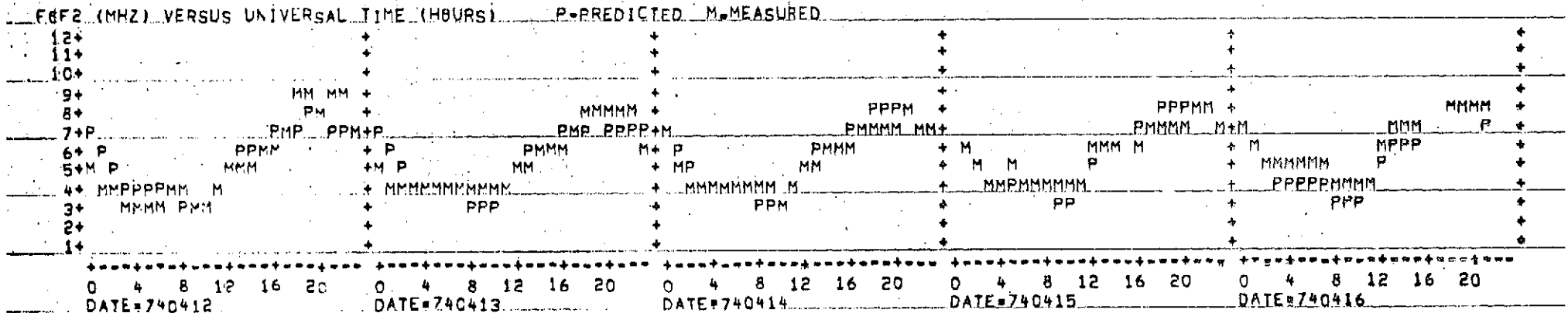
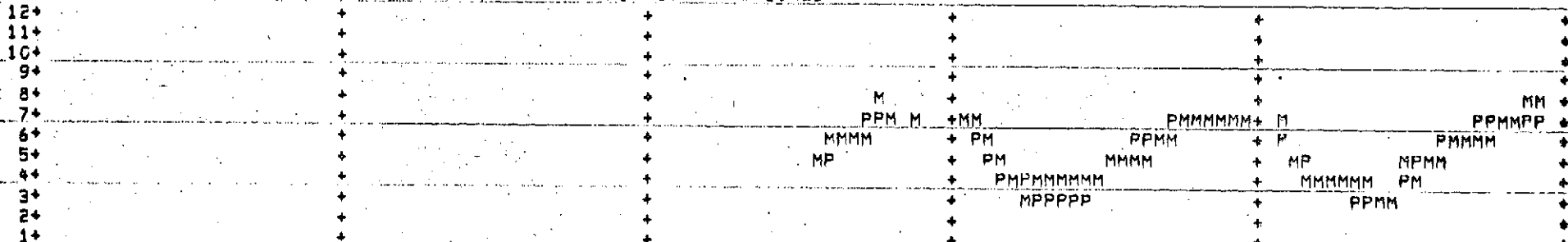


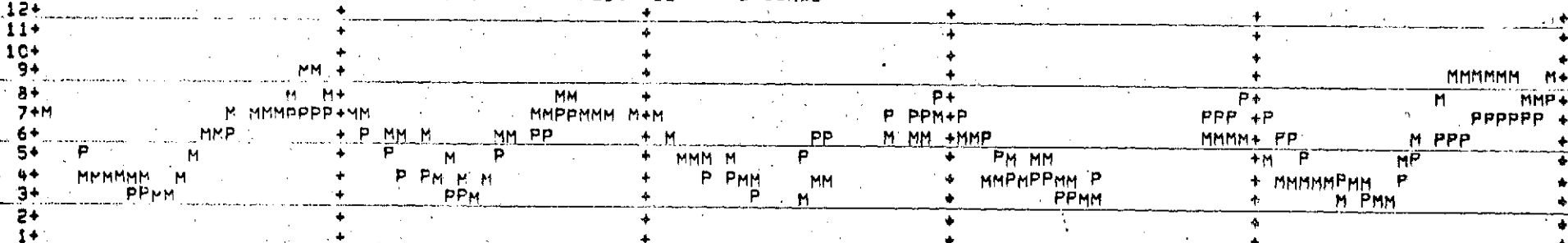
Figure 11k.

F8F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS) P-PREDICTED M-MEASURED



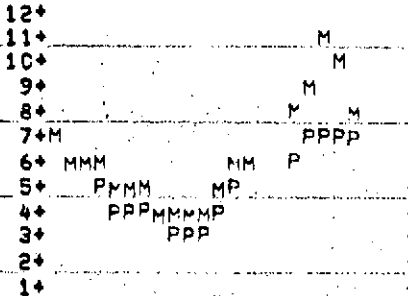
C 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20
 DATE=740427 DATE=740428 DATE=740429 DATE=740430 DATE=740501

F8F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS) P-PREDICTED M-MEASURED



0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20
 DATE=740502 DATE=740503 DATE=740504 DATE=740505 DATE=740506

F8F2 (MHZ) VERSUS UNIVERSAL TIME (HOURS) P-PREDICTED M-MEASURED



C 4 8 12 16 20
 DATE=740507

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Figure 11-1.

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F8F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY														
420+																								
400+																								
380+																								
360+																								
340+																								
320+														M										
300+			P											PM										
280+			P											P PPM										
260+			PP											MMMM MPPP+										
240+			PP											MP MM+										
220+																								
200+																								
DATE=731019					DATE=731020					DATE=731021					DATE=731022					DATE=731023				

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F8F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY														
420+																								
400+																								
380+																								
360+																								
340+	M								M					M										
320+	MM	M			MPM				PP					PM										
300+	M	MPMPPP			M	MP MPPMPP			PM					M										
280+	MP	MP MMM			M	MP MPP			PM					MPMPP										
260+	P	MPMPP			M	MP MPP			PM					P PP										
240+		PPM			M	MPM			MM					MPM										
220+																								
200+																								
DATE=731024					DATE=731025					DATE=731026					DATE=731027					DATE=731028				

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F8F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY														
420+																								
400+																								
380+																								
360+	M																							
340+			M						M	MM	M													
320+	M	MM	MM			MPMM	M																	
300+	P	MMMPPP				P	PP PPP																	
280+	M	P	M	M	MMPP				MP	P	P			P										
260+	P	M	P	MPP	MP	MM	P	P	M					MPMPP										
240+		PP	M	MM	MM+				M	MM				MPM										
220+																								
200+																								
DATE=731029					DATE=731030					DATE=731031					DATE=731101					DATE=731102				

Figure 12a.

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED.HEIGHT AT F0F2					M-MEAS.HEIGHT ADJUSTED TO MAX.DENSITY														
420+																								
400+																								
380+																								
360+																								
340+		M	M				M						M											
320+	M	M	M			MMM	M						M											
300+	M	PM	MP			PP	M	YP			MPP	MMP		MMMP										
280+	MPP	PPPP	MP			MM					PP	PMMP	MM											
260+	P		MPPP			MM	M	PPPPMM			MP	MPPPPM	M+M											
240+		MMMMMP				MPPM		PPP+M			MM	MPM	MPMP+											
220+							M																	
200+																								
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=731103					DATE=731104					DATE=731105					DATE=731106					DATE=731107				

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED.HEIGHT AT F0F2					M-MEAS.HEIGHT ADJUSTED TO MAX.DENSITY														
420+																								
400+																								
380+																								
360+																								
340+		M																						
320+		M	M					M																
300+	M	PM	PPM					MPP	MM	MM														
280+	P	PPMM	MP					MP	MMPPP	P														
260+		M	M					M	M	PPMPM	M+p													
240+			MPPM					M	MM	MMMP														
220+																								
200+																								
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=731108					DATE=731109					DATE=731110					DATE=731111					DATE=731112				

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED.HEIGHT AT F0F2					M-MEAS.HEIGHT ADJUSTED TO MAX.DENSITY														
420+																								
400+																								
380+																								
360+																								
340+																								
320+																								
300+	M	PP	PP					MMM	MPP															
280+	PM	MMMM	MP					MM	M+MMM	PMMPMP														
260+	M		MM					MM	M	MMMPMM	M+M													
240+			MPMM					MMMM	PPP+	M														
220+																								
200+																								
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=731113					DATE=731114					DATE=731115					DATE=731116					DATE=731117				

Figure 12b.

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F8F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																
420+				+					+					+												
400+				+					+					+												
380+				+					+					+												
360+		M		+					+		M			+												
340+	M	M		+		M			+			M		+												
320+		M	M	+		M			+	M		MMM	M	+												
300+	M	M	PP	+	MP	M	PM		+	PPMMM	MPM		M	PP	PP	+										
280+	PP	PPPP	P	+	MMM	MPPP	M		+	PPM	PPPM	P		PP	PPMM	MP	+									
260+	M		P	+	PMMP	M	P	M		+	M	M	M	M	PM	MM	PM	+	P	M	M	MMMMP	M	+		
240+		M		+	PKPPM	MMMP				+	MM	PM	MMPMP		MMMMM	PMP					PMMP	PM	M	MMMP	MMMP	+
220+		M	MM	+				M		+											M					+
200+				+						+																+
C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20						
DATE=731118					DATE=731119					DATE=731120					DATE=731121					DATE=731122						

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F8F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																
420+				+					+					+												
400+				+					+					+												
380+				+					+				M	+												
360+				+					+					+												
340+		M		+					+					+												
320+		M	M	+		M			+		M	M		+	M						M		+			
300+	M	M	PP	+	M	PM	MP		+	M	M	PM	MMMM		+	M	MP	MM					+			
280+	MP	PPPP	P	+	PM	MMMM	M		+		M	PM	MPPPPP			M	M	M			P	MPPPMPPM		+		
260+	M		M	+					+		PMM	PM				MM	MM	M			PM	MMM	P	MMP	MMM	+
240+		M	M	+					+		PPMP					MMMMP	PPMP						MMMMP	MPP	+	
220+				+					+																+	
200+				+					+																+	
C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20						
DATE=731123					DATE=731124					DATE=731220					DATE=731221					DATE=731222						

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F8F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																	
420+				+					+					+													
400+				+					+					+													
380+				+					+					+													
360+				+					+					+													
340+				+		M			+		M			+	MMMM								+				
320+		M		+					+		M		MMM	M							+	M	MM	M	+		
300+	MP	M	MMM	+		M	MM	M	MM		+	PM	MM			MM	MP	M			+	PP	M		+		
280+	MMM	MPPPP	P	+		M	MP	PPPM			+	P	PM	PP	MM	M	M				+	P	MPPPPPPMM		M	+	
260+	PP	MM	PM	+		PP	MM	PP			+	M		P	PM	PP							MM	M	PP	+	
240+				+		PM	MM	PP	+			MM	MM	PM	MM								MM	MP	PM	PP	+
220+				+					+																	+	
200+				+					+																	+	
C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20					C 4 8 12 16 20							
DATE=731223					DATE=731224					DATE=731225					DATE=731226					DATE=731227							

Figure 12c.

HEIGHT (KM)	VERSUS UNIVERSAL TIME (HOURS)	P-PRED. HEIGHT AT F8F2	M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY
420+		+	+
400+		+	+
380+		+	+
360+	M	+	+
340+	M	+	+
320+	MM M M	+	+
300+MM	PPMM M	+	+
280+	P MPPPPPPM	+	+
260+PP	P MPPM +PP	+	+
240+	MM PP MPPM + M	+	+
220+	M	+	+
200+		+	+

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HEIGHT (KM)	VERSUS UNIVERSAL TIME (HOURS)	P-PRED. HEIGHT AT F8F2	M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY
420+		+	+
400+		+	+
380+		+	+
360+		+	+
340+		+	+
320+		+	+
300+		+	+
280+		+	+
260+		+	+
240+		+	+
220+		+	+
200+		+	+

HEIGHT (KM)	VERSUS UNIVERSAL TIME (HOURS)	P-PRED. HEIGHT AT F8F2	M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY
420+		+	+
400+		+	+
380+		+	+
360+		+	+
340+		+	+
320+		+	+
300+	P	+	+
280+	PM MPPMMM	+	+
260+MP	MM P MPPPM +PP	+	+
240+	MMPP MPPM +M	+	+
220+	M	+	+
200+		+	+

Figure 12d.

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																			
420+					+					+					+														
400+					+					+					+														
380+					+					+					+														
360+					+					+					+														
340+					+					+					+														
320+					+					+					+														
300+	MMMMM	MM			+	MMPPMM			PPM	+	M			MMM	+														
280+	P M MMPPPPM		M		+	PMM PMPPPM		M		+	MM	MMPPPM	MM		+														
260+	PP	MM P	PMPP		+	MP	MMM M	MPMPPM		+	MP M	MM P	PPPPM	MM	+														
240+	M		PPM	MMPP	+		MPPPM	MPPM		+	PMPM	MPPM		M M PP	+														
220+		MM M		MM	+		M	M		+	M M	M			+														
200+					+					+					+														

C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20
DATE=740112					DATE=740113					DATE=740114					DATE=740115					DATE=740116									

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																			
420+					+					+					+														
400+					+					+					+														
380+					+					+					+														
360+					+					+					+														
340+					+					+					+														
320+					+					+					+														
300+					+					+					+														
280+	PM	PPMMMPM		MM	+	M P	PMMM M		M	+	M	MMPPPPM		M	+														
260+	MMM		MP	PPMM	+	PFM	P	MMMPMM		+	MM	MM P	MPMPPMM	MPM	+														
240+		MPMM		MMM	+		PMMP	PMMP		+	MPPP	MPPM		MMM M	+														
220+					+		M			+	M				+														
200+					+					+					+														

C	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20
DATE=740117					DATE=740118					DATE=740119					DATE=740120					DATE=740121									

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																			
420+					+					+					+														
400+					+					+					+														
380+					+					+					+														
360+					+					+					+														
340+					+					+					+														
320+					+					+					+														
300+					+					+					+														
280+	PPM				+	M	PPM			+	M P M				+														
260+	PM	MMMMMPPPP		M	+	PMMPPPM		MM		+	M	MMPPMPPM		M	+														
240+	M		MPMM	MPMM	+	PP	M	PPM M		+	M P	MMMM	PPMM		+														
220+					+					+	M MPM	PMMP		MPMM	+														
200+					+					+					+														

0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20	0	4	8	12	16	20
DATE=740122					DATE=740123					DATE=740124					DATE=740125					DATE=740126									

Figure 12e.

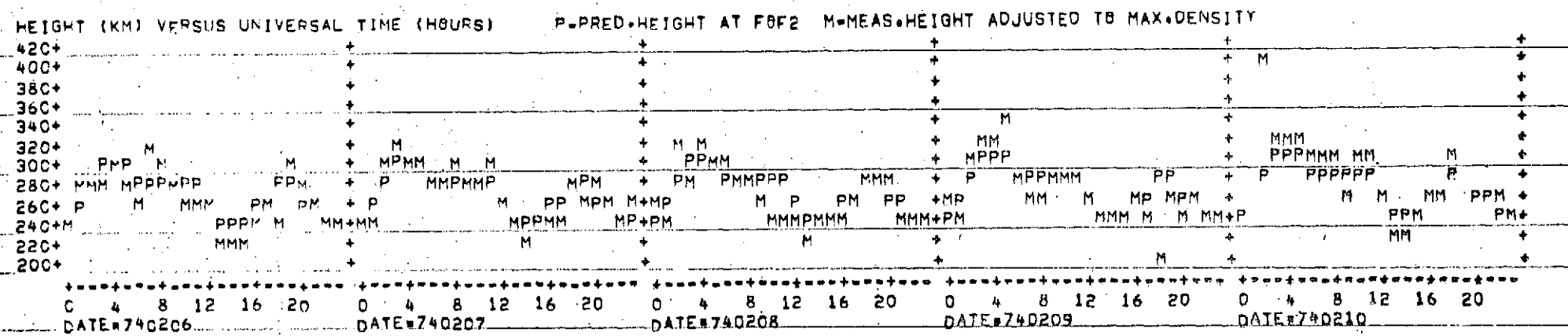
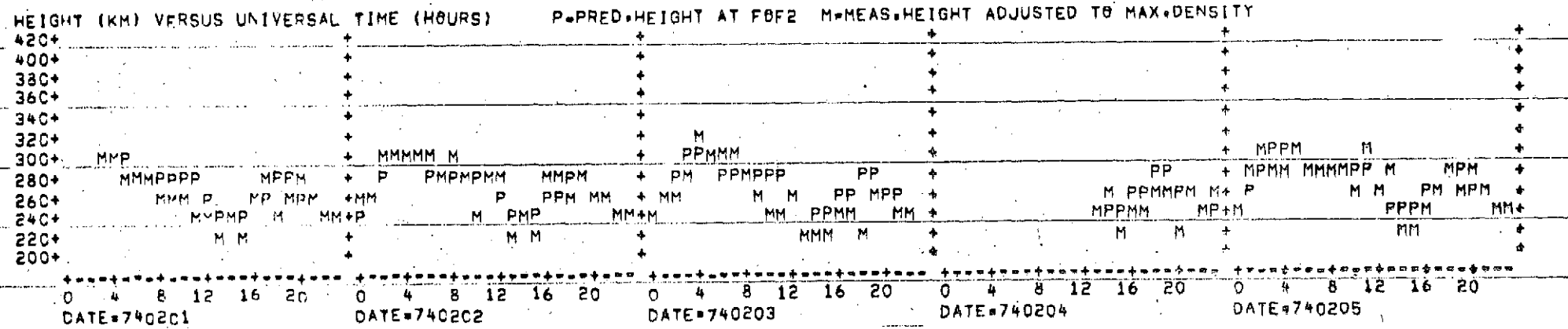
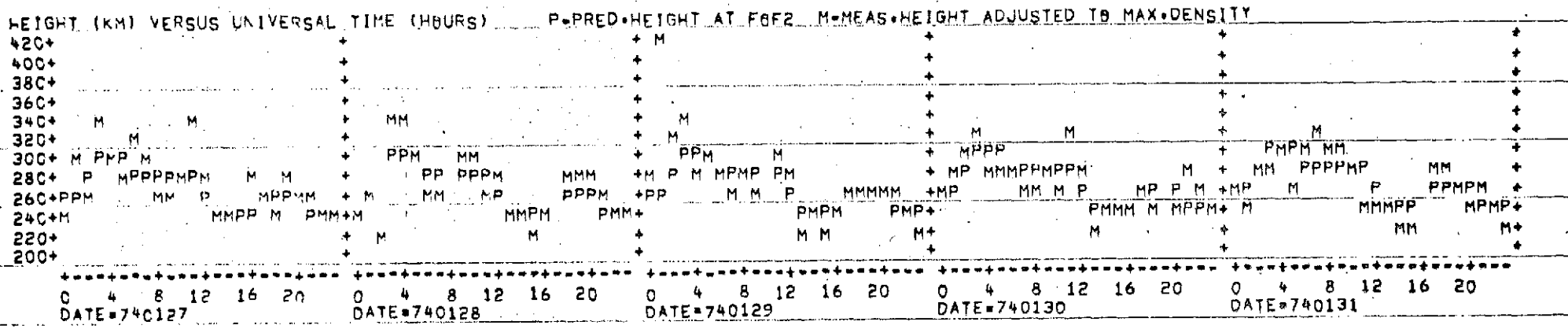


Figure 12f.

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY														
420+				+					+					+										
400+				+					+					+										
380+				+					+					+										
360+				+					+					+										
340+				+					+					+										
320+	MM	M		+		M	M		+		M	M		+										
300+	PPMM			+		MPPPM	M		+		MMMP	M		+										
280+	P	PMPPMM		+		M			+		MP	MMPPPMP		+										
260+MM		MM	MP	+		M			+		M	P		+										
240+P		PMP		+		PP+M			+		MM	PM	MPM	+										
220+				+					+					+										
200+				+					+					+										
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740226					DATE=740227					DATE=740228					DATE=740301					DATE=740302				

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY														
420+				+					+					+										
400+				+					+					+										
380+				+					+					+										
360+				+					+					+										
340+				+					+					+										
320+	MPPM			+		M	M		+		M	M	P	+										
300+	P	M	PPMM	+		P	PP		+		M	M	PP	+										
280+	M	M	M	+		P	M	M	+		M	M	M	+										
260+M		M	MP	+		M			+		M	M	M	+										
240+		MM		+		M	M		+		M	M		+										
220+				+					+					+										
200+				+					+					+										
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740303					DATE=740304					DATE=740305					DATE=740306					DATE=740307				

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY														
420+				+					+					+										
400+				+					+					+										
380+				+					+					+										
360+				+					+					+										
340+				+					+					+										
320+	MM	M		+		M	M		+		M	M		+										
300+	P	M	PPPPM	+		M	MMPPP		+		M	PP	PP	+										
280+	P	M	M	+		M	M		+		M	M	M	+										
260+MM		P		+		M	PP+M		+		M	PP	PP	+										
240+		M		+		MM			+		M			+										
220+				+					+					+										
200+				+					+					+										
C 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740308					DATE=740309					DATE=740310					DATE=740311					DATE=740312				

Figure 12h.

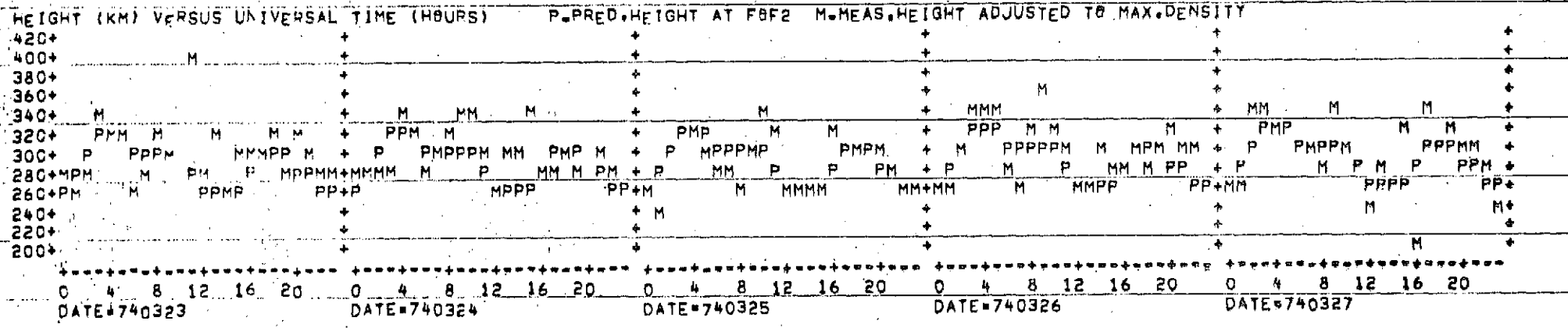
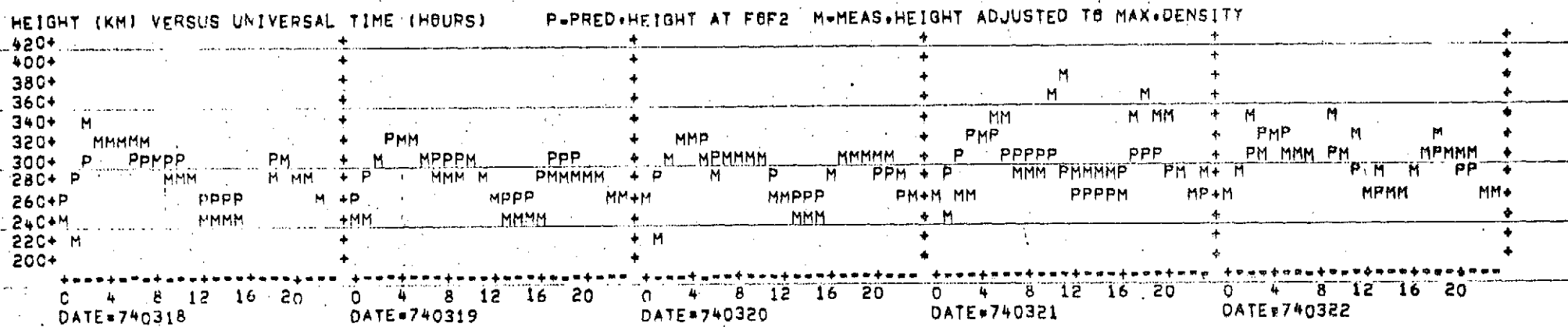
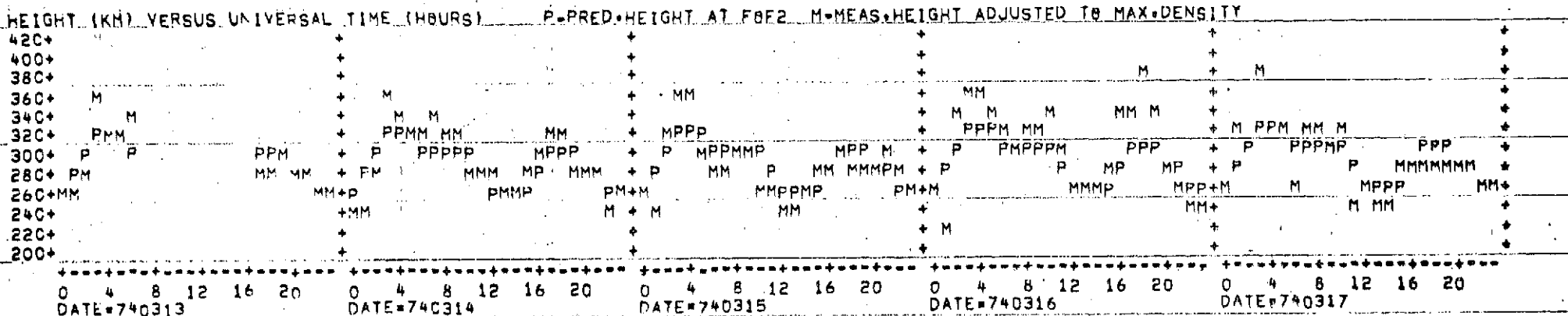


Figure 12-i.

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																				
420+																														
400+																														
380+																														
360+	M				MM			MM																						
340+	M	M	M					M	M	M	MM	MM																		
320+	MPPM		M		MPP			M	MPP	M	M																			
300+	MP	PPMP		MMP		M	MMMPPM	PPMMP		P	PPPP			PPPM		P	MMPMPM	PPMM		P	M	MM	P	MPP						
280+	P	MM	M	P	MMM		M	MP		P	PP	M	P	M	P	P	PPM		PM		P	M	P	PPM	PPM	M	M	P	MP	MPPM
260+	M			MPPP		PM	M		PPPP		PP	M	PP			PM	MM													
240+			M																											
220+																														
200+																														
DATE=740328					DATE=740329					DATE=740330					DATE=740331					DATE=740401										

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																				
420+																														
400+																														
380+																														
360+	M			M				M																						
340+	M			M				MM																						
320+	MPPMPPM			PPM				PPPPPM			PPM			MPP		PMP			M	PP										
300+	M	MM	P	MP	PP		MM	M	P	M	P	MPP		P	M	P	P	PP		M	P	P	PP							
280+	PP		M	P	MM	PP	MP	MMM		P	MM		M	MM	MP	M														
260+	MM			MM		MM		PP	M																					
240+																														
220+																														
200+																														
DATE=740402					DATE=740403					DATE=740404					DATE=740405					DATE=740406										

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED. HEIGHT AT F0F2					M-MEAS. HEIGHT ADJUSTED TO MAX. DENSITY																				
420+																														
400+																														
380+																														
360+	MM																													
340+		MM		M				MM																						
320+	PPMPPP			PMP				PPPPPPM			MMPP			MPMPPP			PMP													
300+	P	M	PM	MM	MPP			MM	MP	P	PPM		M	MMMPP		P	MPMP		P											
280+	PP		M	PM	P		MMPP	PP		M	P	M	MM	MP	MMM	M	MM	PP		M	P	P	MMM	PP	PPM					
260+	MM		M	PM				MMP		M	M	M																		
240+																														
220+			M																											
200+																														
DATE=740407					DATE=740408					DATE=740409					DATE=740410					DATE=740411										

Figure 12j.

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED.HEIGHT AT F0F2					M-MEAS.HEIGHT ADJUSTED TO MAX.DENSITY														
420+																								
400+																								
380+																								
360+																								
340+																								
320+																								
300+																								
280+																								
260+																								
240+																								
220+																								
200+																								
0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20														
DATE=740427					DATE=740428					DATE=740429					DATE=740430					DATE=740501				

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED.HEIGHT AT F0F2					M-MEAS.HEIGHT ADJUSTED TO MAX.DENSITY														
420+																								
400+																								
380+																								
360+																								
340+																								
320+																								
300+																								
280+																								
260+																								
240+																								
220+																								
200+																								
0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20					0 4 8 12 16 20									
DATE=740502					DATE=740503					DATE=740504					DATE=740505					DATE=740506				

HEIGHT (KM) VERSUS UNIVERSAL TIME (HOURS)					P-PRED.HEIGHT AT F0F2					M-MEAS.HEIGHT ADJUSTED TO MAX.DENSITY				
420+														
400+														
380+														
360+														
340+														
320+														
300+														
280+														
260+														
240+														
220+														
200+														
0 4 8 12 16 20														
DATE=740507														

Figure 12-1.

YEAR=73 MONTH=12

ELECTRON CONTENT (1.E16 E/M**2)

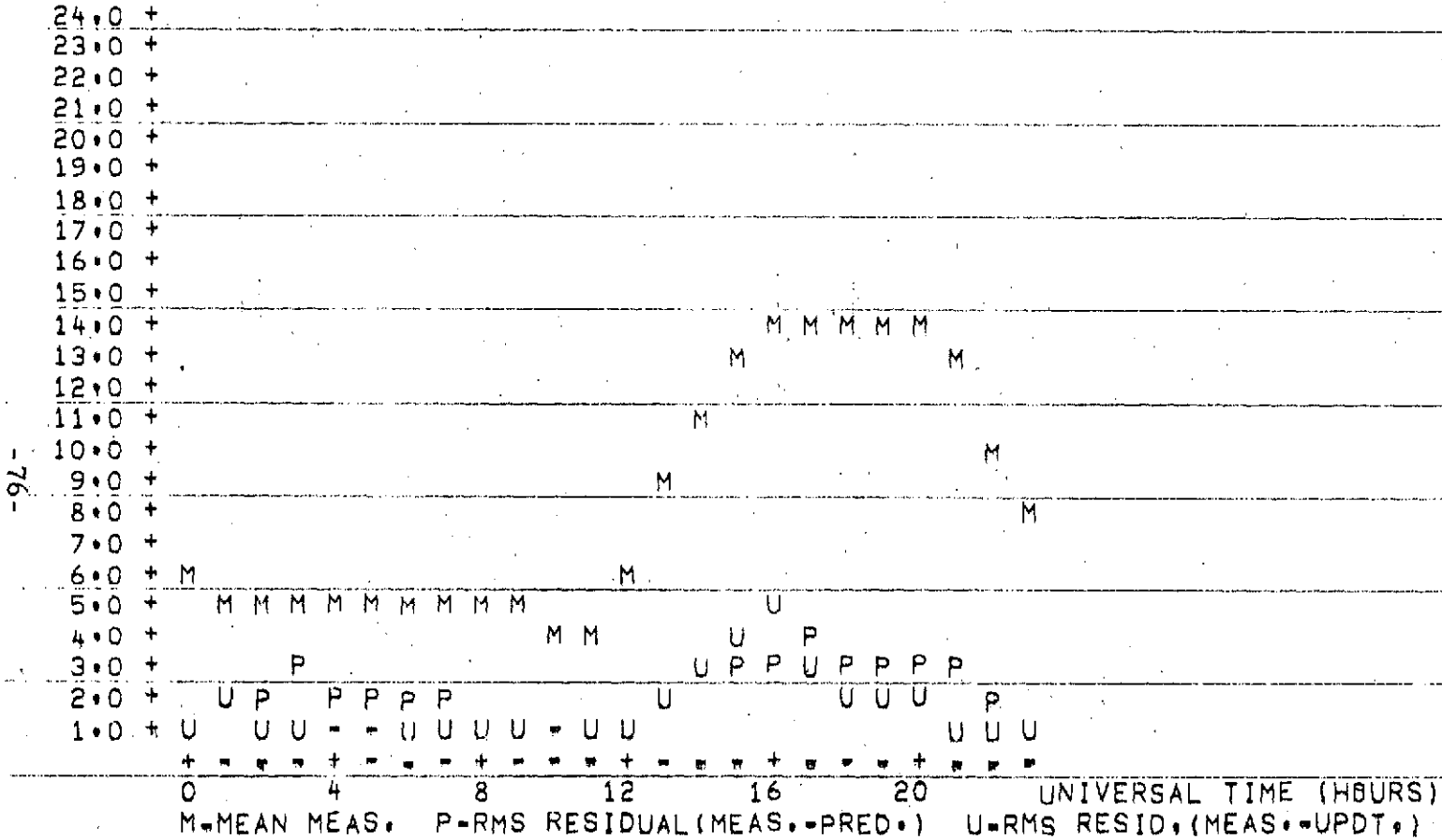
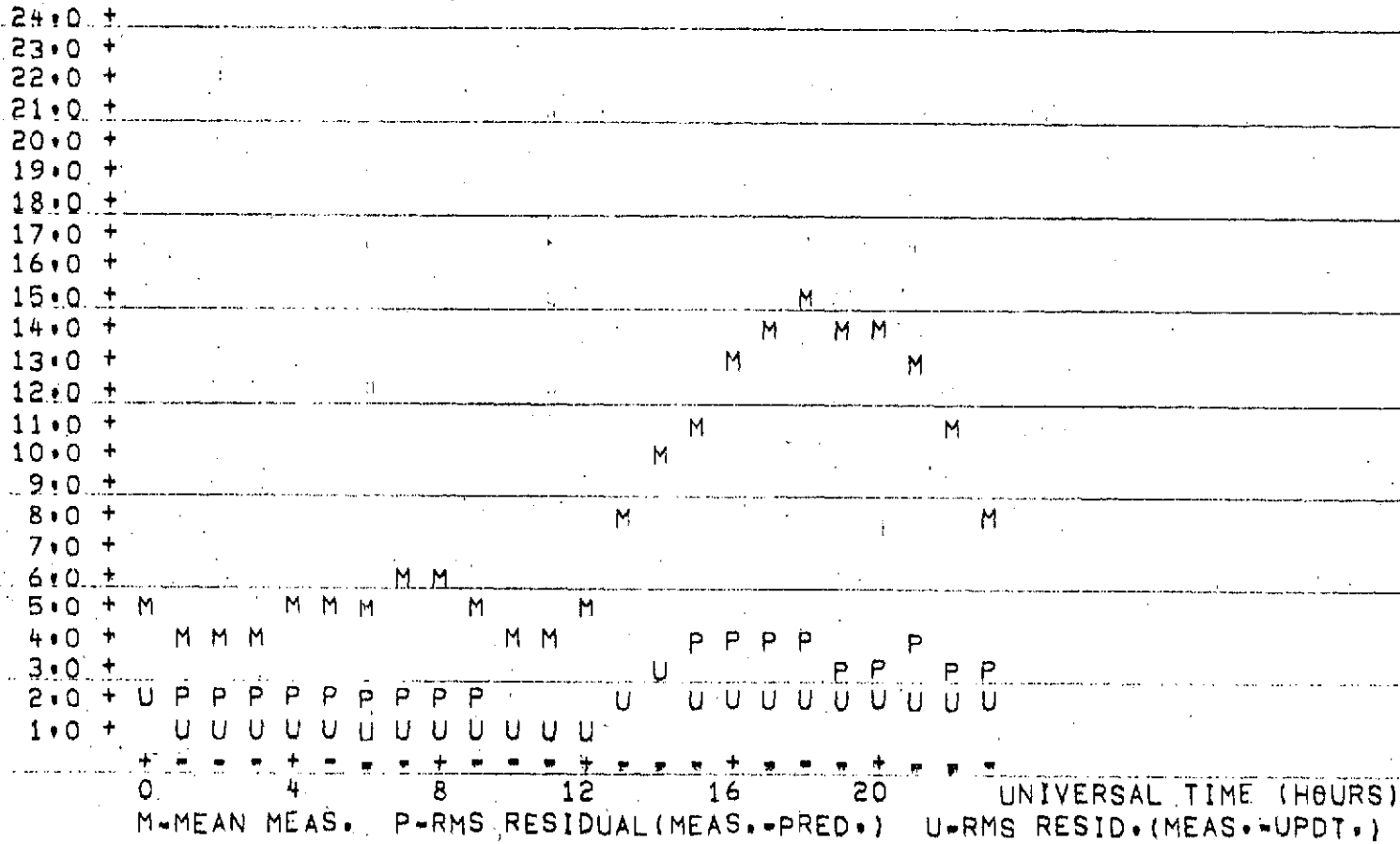


Figure 13a. Monthly Mean and Error Curves.

YEAR=74 MONTH= 1

ELECTRON CONTENT (1.E16 E/M**2)



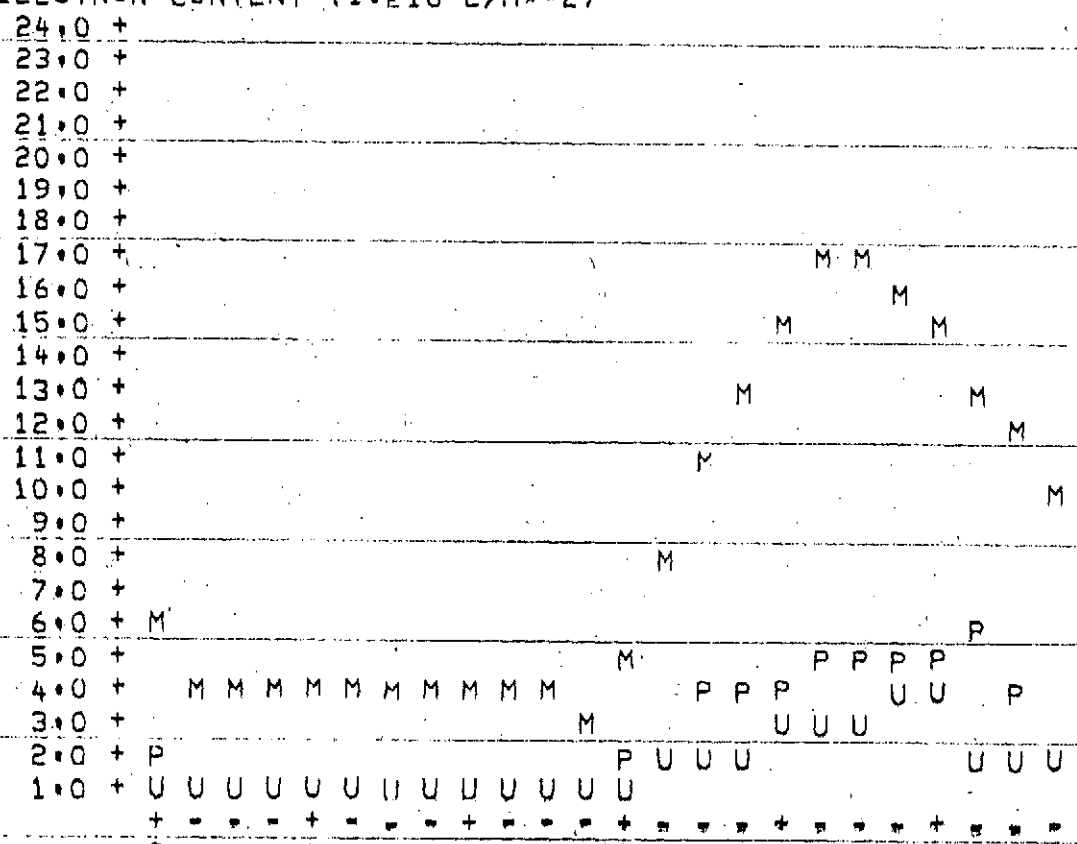
-77-

Figure 13b. Monthly Mean and Error Curves.

YEAR=74 MONTH= 2

ELECTRON CONTENT (1.E16 E/M**2)

-78-

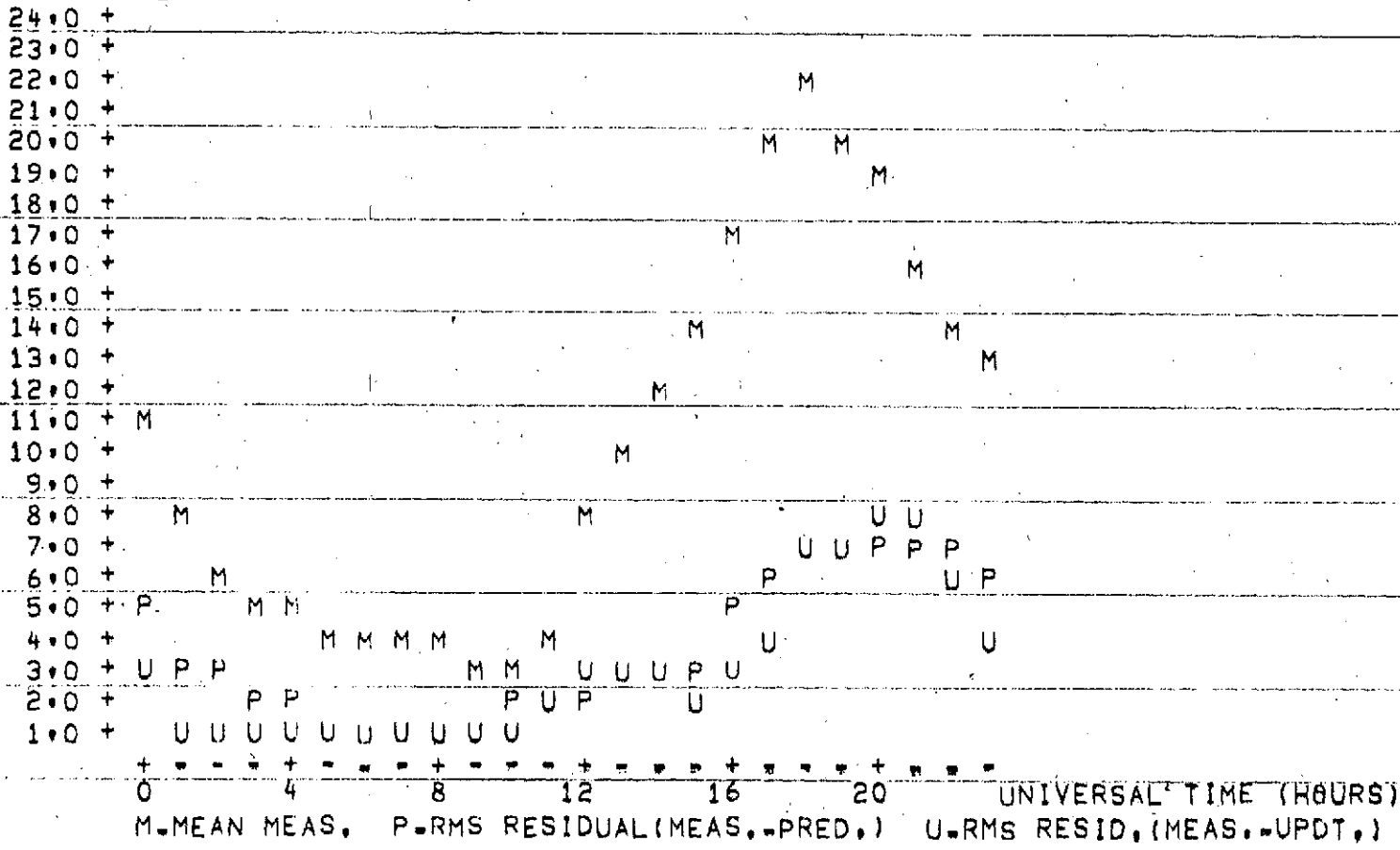


0 4 8 12 16 20 UNIVERSAL TIME (HOURS)
M-MEAN MEAS. P-RMS RESIDUAL (MEAS.-PRED.) U-RMS RESID. (MEAS.-UPDT.)

Figure 13c. Monthly Mean and Error Curves.

YEAR=74 MONTH= 4

ELECTRON CONTENT (1.E16 E/M**2)



YEAR=74 MONTH= 5

ELECTRON CONTENT (1.F16 E/M**2)

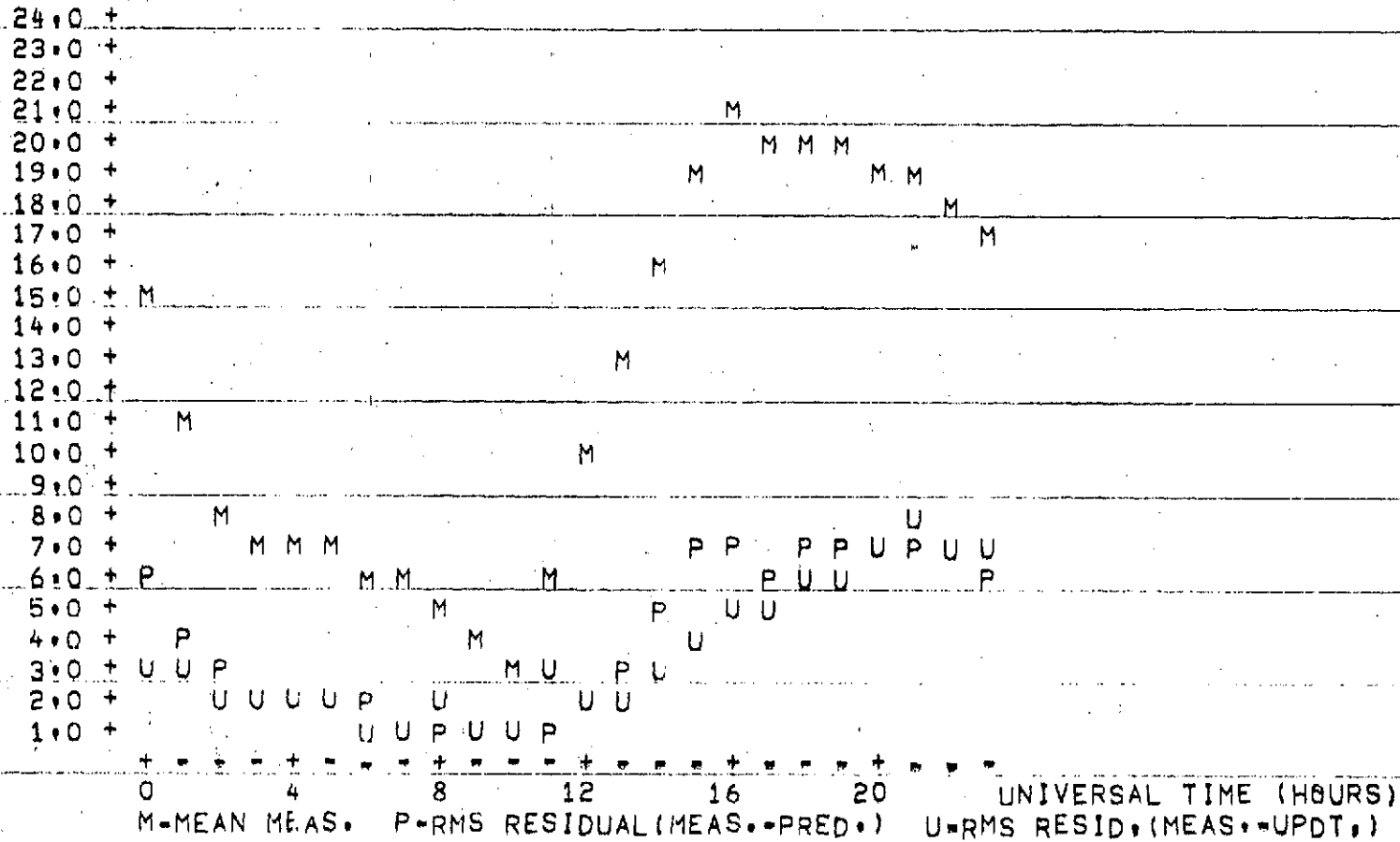
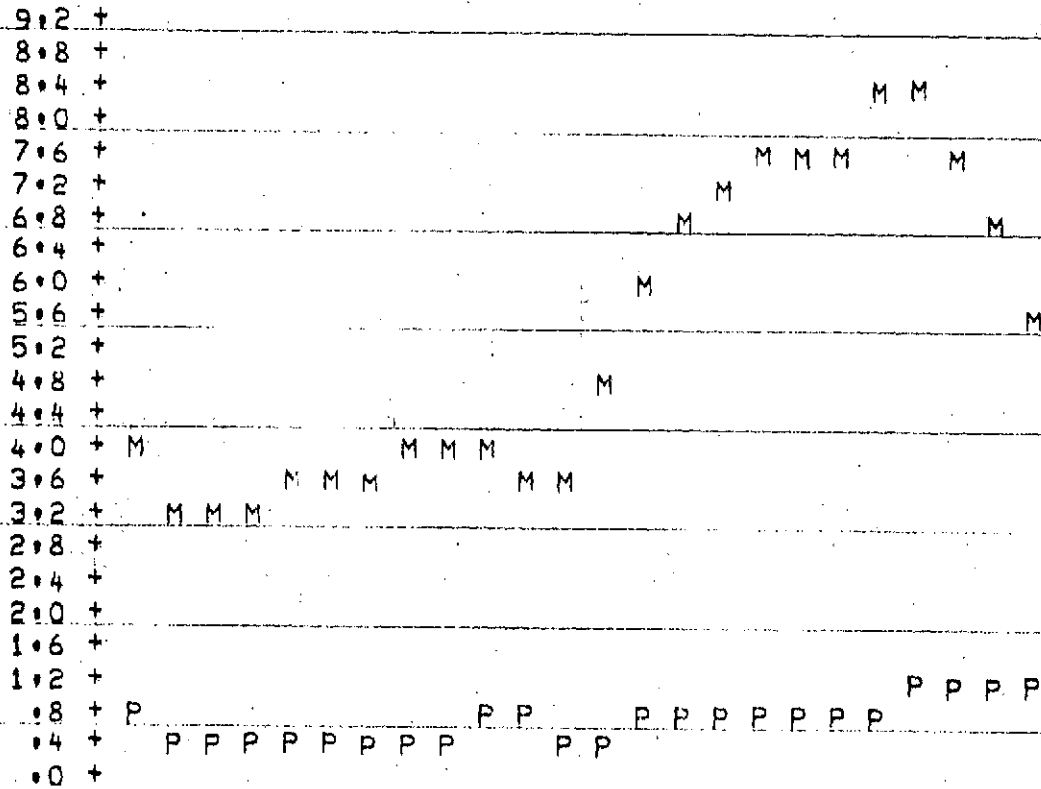


Figure 13f. Monthly Mean and Error Curves

YEAR=73 MONTH=11

F8F2 (MHZ)

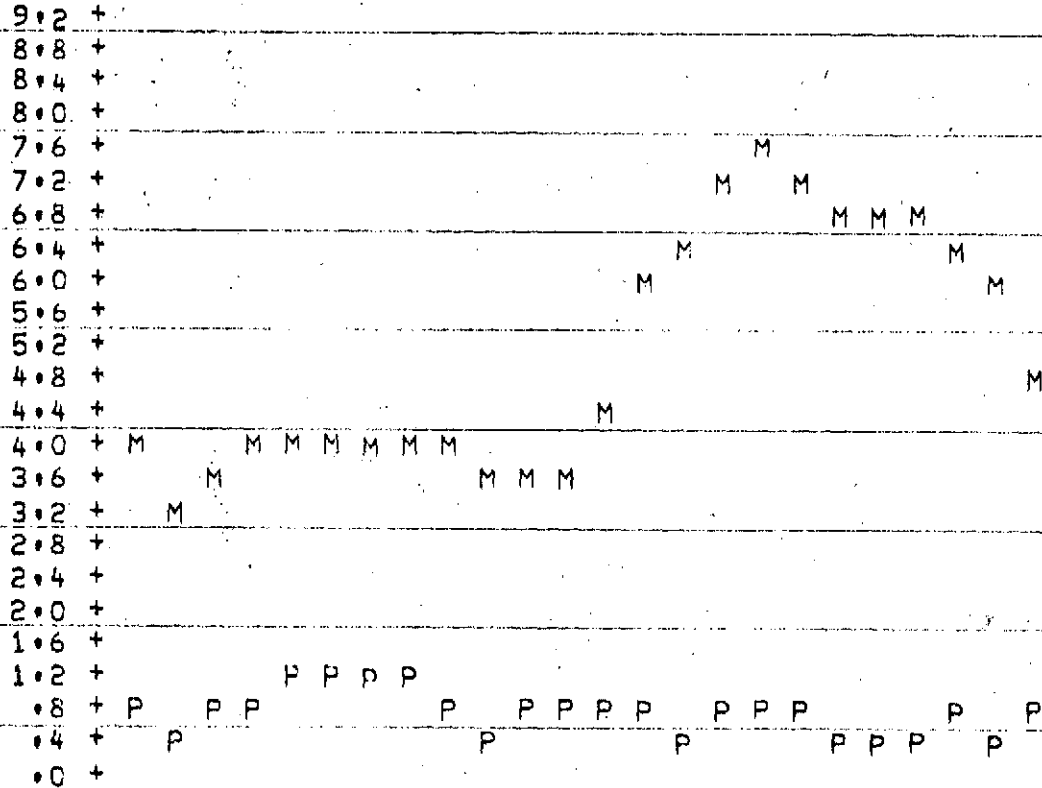


0 4 8 12 16 20 UNIVERSAL TIME (HOURS)
 M-MEAN MEAS. P-RMS RESIDUAL (MEAS.-PRED.)

Figure 14a. Monthly Mean and Error Curves.

YEAR=73 MONTH=12

F0F2 (MHZ)

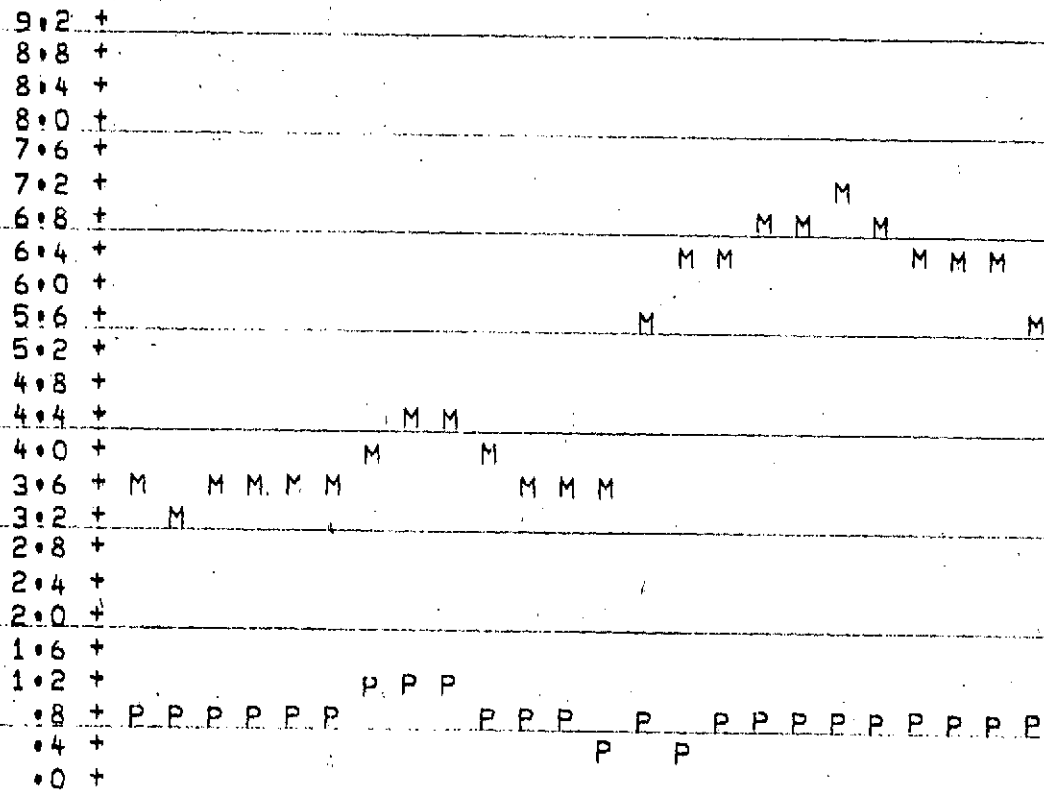


+ - - - + - - - + - - - + - - - + - - - + - - - + - - - + - - -
 0 4 8 12 16 20 UNIVERSAL TIME (HOURS)
 M-MEAN MEAS. P-RMS RESIDUAL (MEAS.-PRED.)

Figure 14b. Monthly Mean and Error Curves.

YEAR=74 MONTH= 1

F0F2 (MHZ)



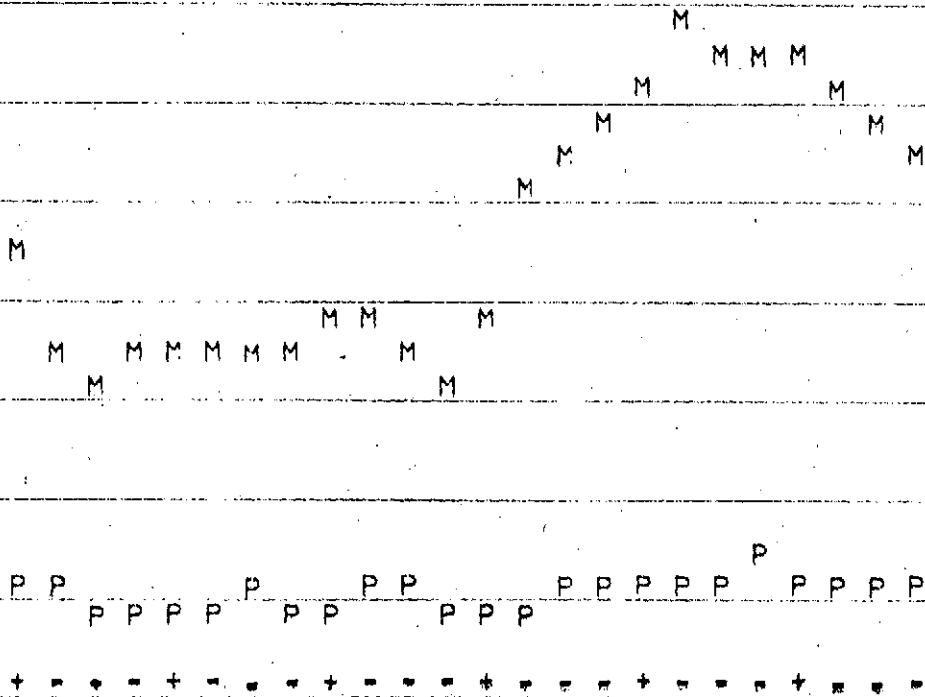
-84-

Figure 14c. Monthly Mean and Error Curves.

YEAR=74 MONTH= 2

F0F2 (MHZ)

9.2 +
 8.8 +
 8.4 +
 8.0 +
 7.6 +
 7.2 +
 6.8 +
 6.4 +
 6.0 +
 5.6 +
 5.2 +
 4.8 +
 4.4 +
 4.0 +
 3.6 +
 3.2 +
 2.8 +
 2.4 +
 2.0 +
 1.6 +
 1.2 +
 .8 +
 .4 +
 .0 +



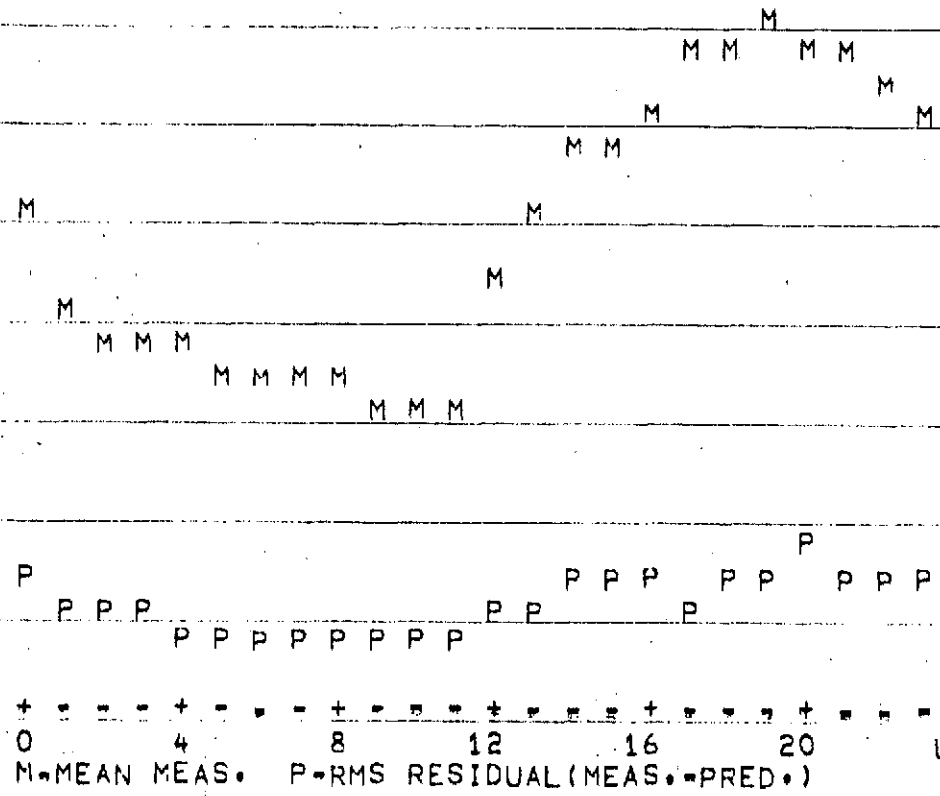
0 4 8 12 16 20 UNIVERSAL TIME (HOURS)
 M-MEAN MEAS. P-RMS RESIDUAL (MEAS.-PRED.)

Figure 14d. Monthly Mean and Error Curves.

YEAR=74 MONTH= 3

F0F2 (MHZ)

9.2 +
 8.8 +
 8.4 +
 8.0 +
 7.6 +
 7.2 +
 6.8 +
 6.4 +
 6.0 +
 5.6 +
 5.2 +
 4.8 +
 4.4 +
 4.0 +
 3.6 +
 3.2 +
 2.8 +
 2.4 +
 2.0 +
 1.6 +
 1.2 +
 .8 +
 .4 +
 .0 +

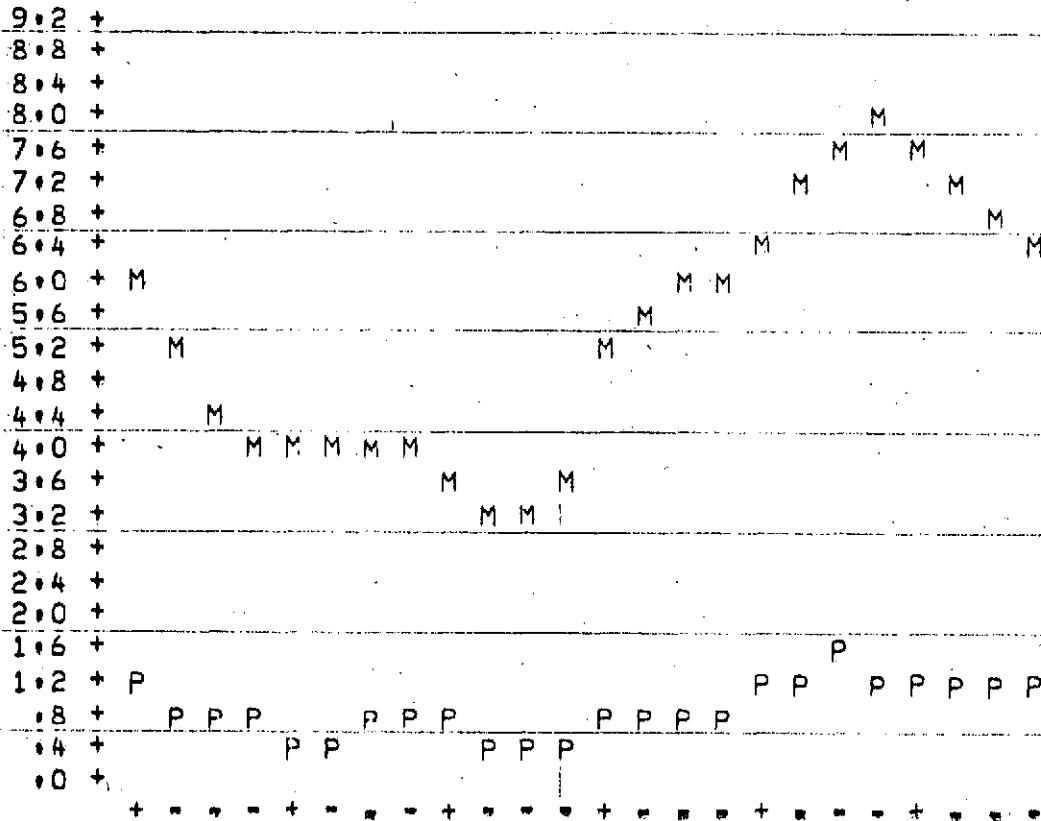


-98-

Figure 14e. Monthly Mean and Error Curves.

YEAR=74 MONTH= 4

F0F2 (MHZ)

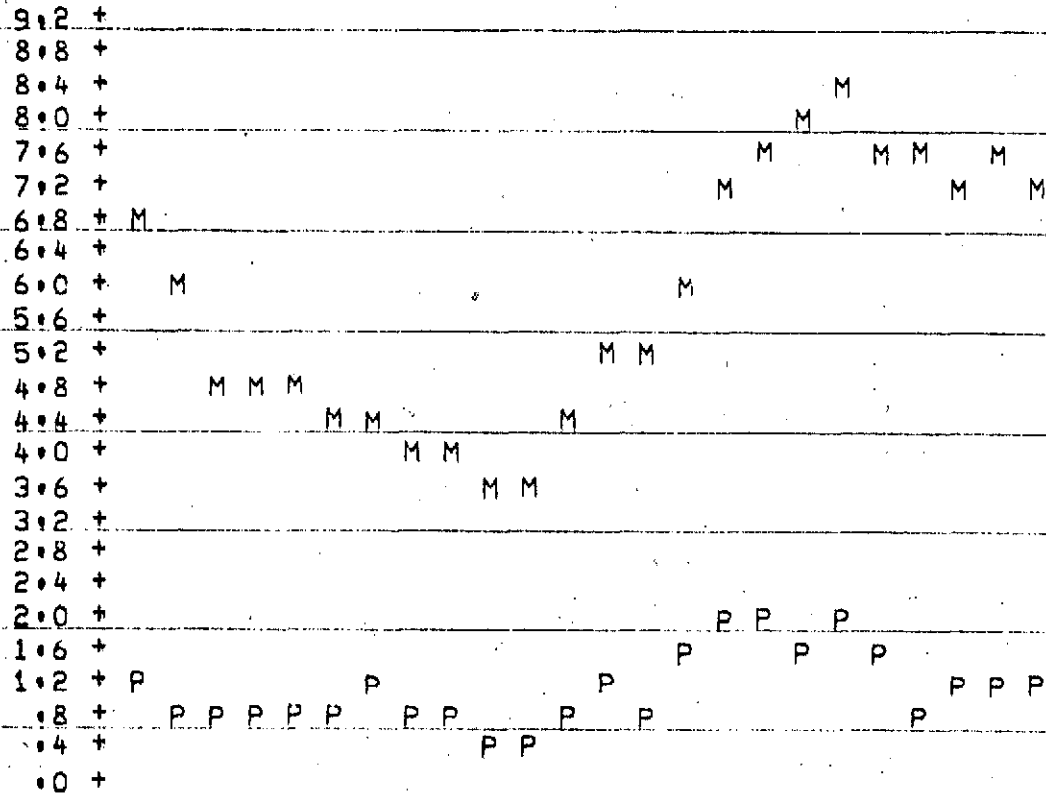


0 4 8 12 16 20 UNIVERSAL TIME (HOURS)
M-MEAN MEAS. P-RMS RESIDUAL (MEAS.-PRED.)

Figure 14f. Monthly Mean and Error Curves.

YEAR=74 MONTH= 5

F0F2 (MHZ)



+ . . . + . . . + . . . + . . . + . . . + . . . + . . . + . . . + . . .
 0 4 8 12 16 20 UNIVERSAL TIME (HOURS)
 M-MEAN MEAS. P-RMS RESIDUAL (MEAS.-PRED.)

Figure 14g. Monthly Mean and Error Curves.

YEAR=73 MONTH=11

HEIGHT AT F0F2 (KM)

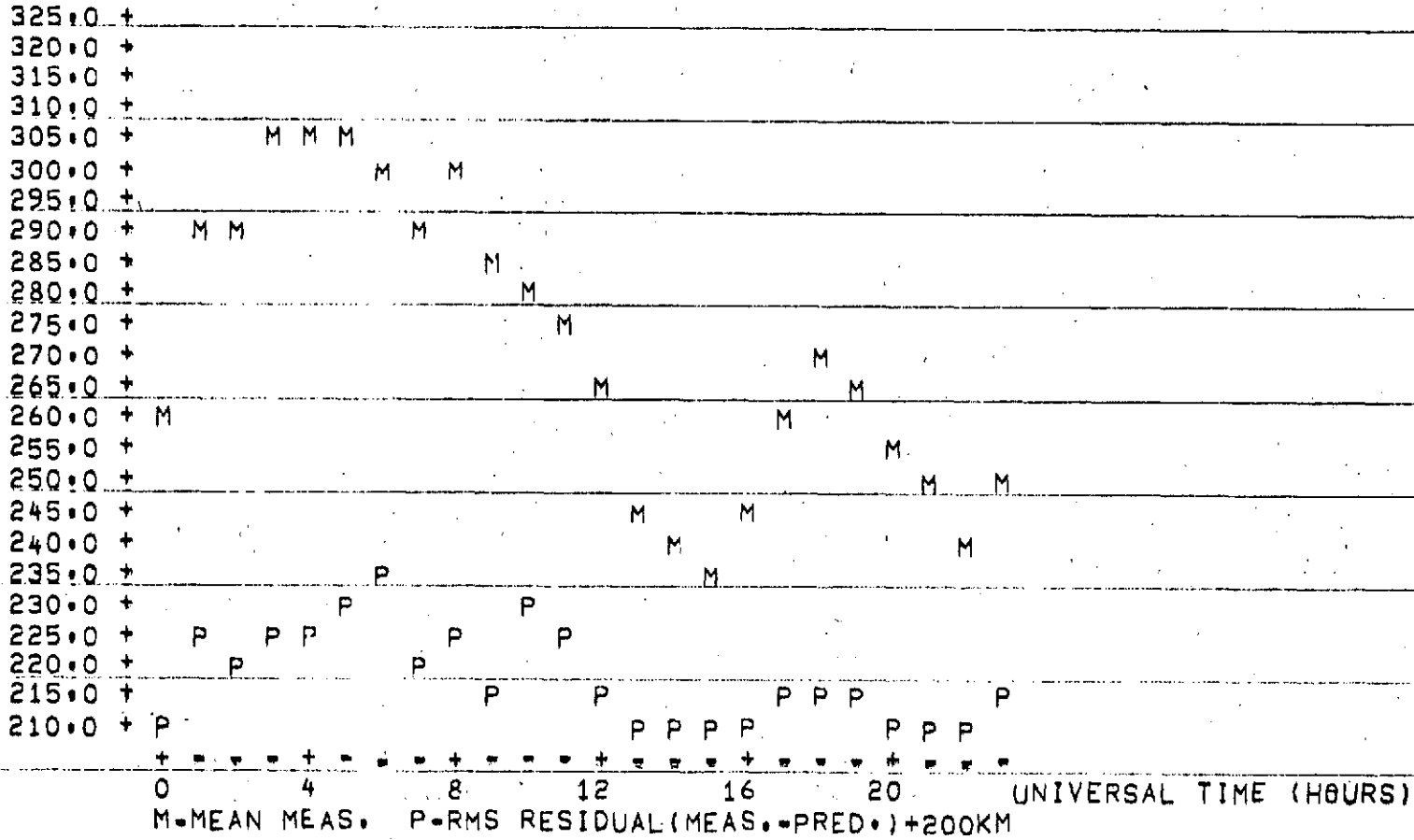


Figure 15a. Monthly Median and Error Curves.

YEAR=73 MONTH=12

HEIGHT AT F0F2 (KM)

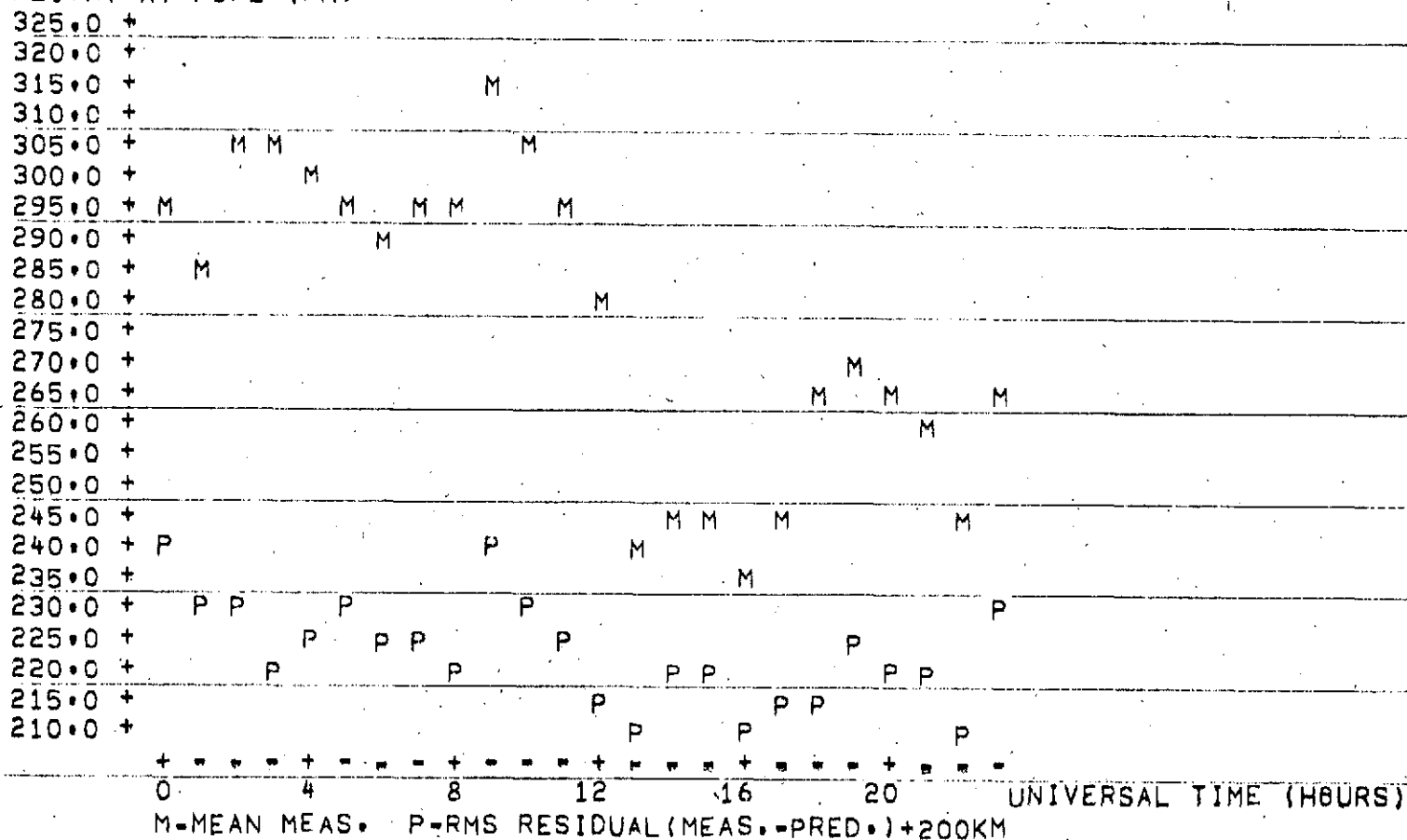


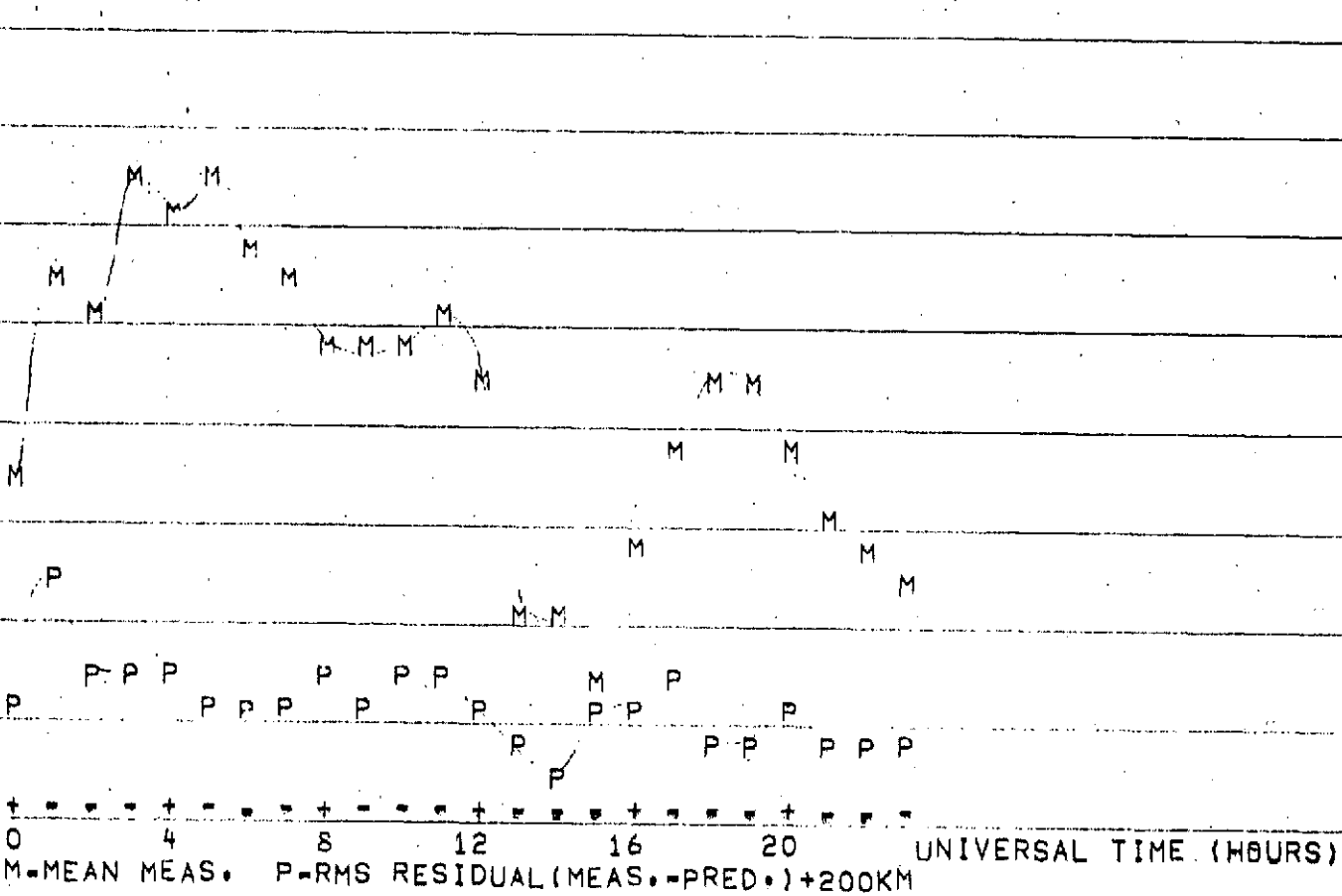
Figure 15b. Monthly Mean and Error Curves.

C-2

YEAR=74 MONTH= 1

HEIGHT AT F0F2 (KM)

325.0 +
320.0 +
315.0 +
310.0 +
305.0 +
300.0 +
295.0 +
290.0 +
285.0 +
280.0 +
275.0 +
270.0 +
265.0 +
260.0 +
255.0 +
250.0 +
245.0 +
240.0 +
235.0 +
230.0 +
225.0 +
220.0 +
215.0 +
210.0 +

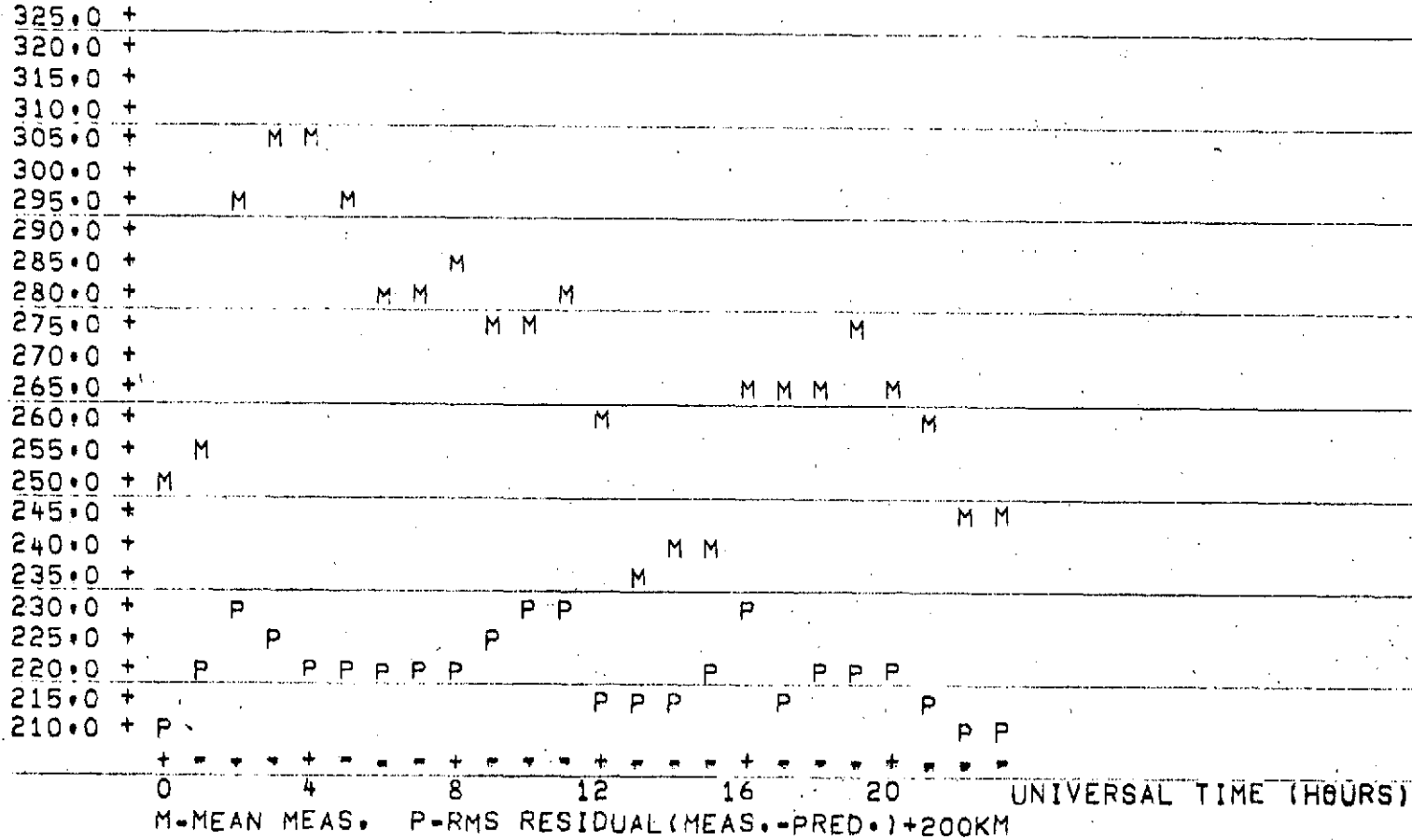


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Figure 15c. Monthly Mean and Error Curves.

YEAR=74 MONTH= 2

HEIGHT AT F0F2 (KM)

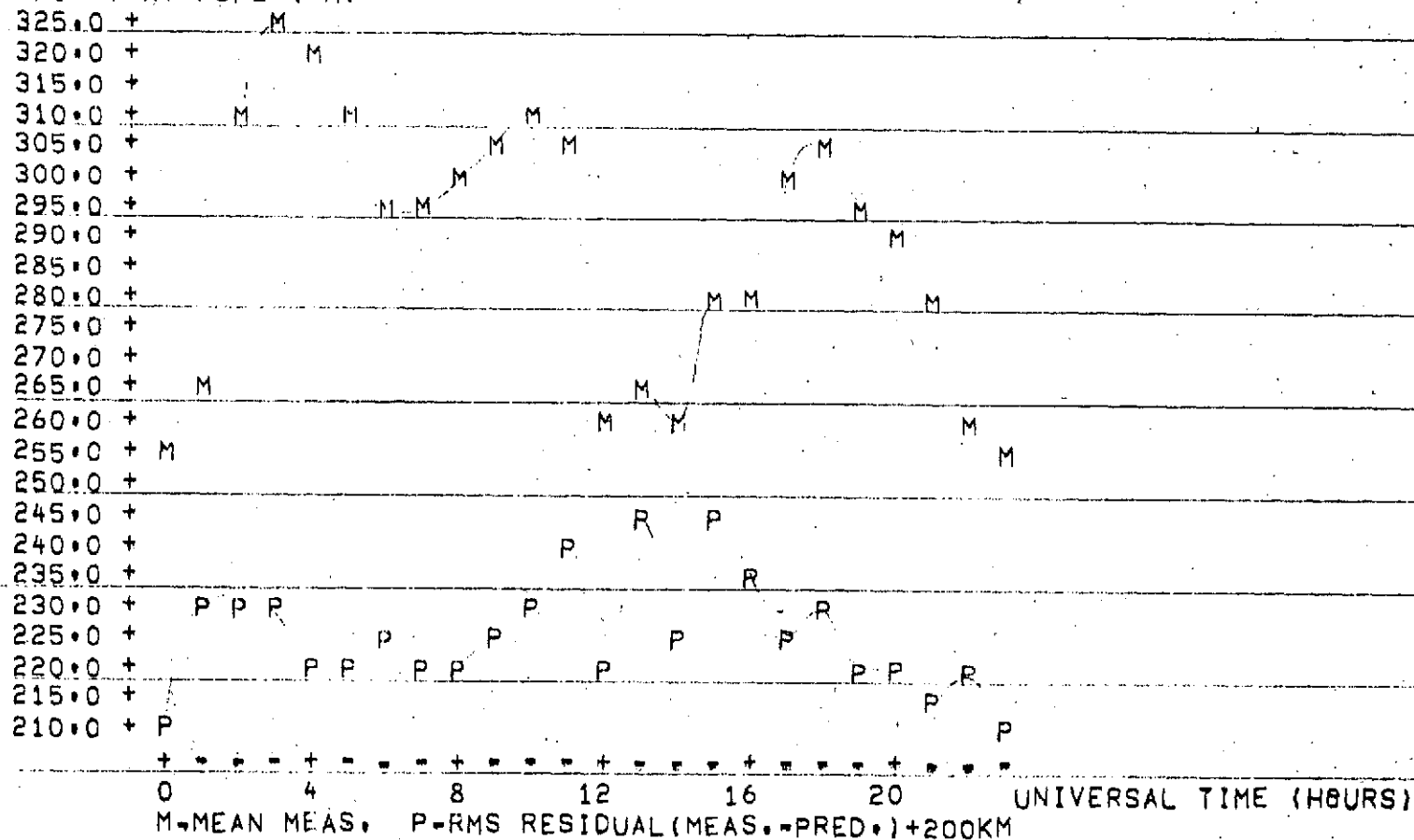


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Figure 15d. Monthly Mean and Error Curves.

YEAR=74 MONTH= 3

HEIGHT AT F0F2 (KM)

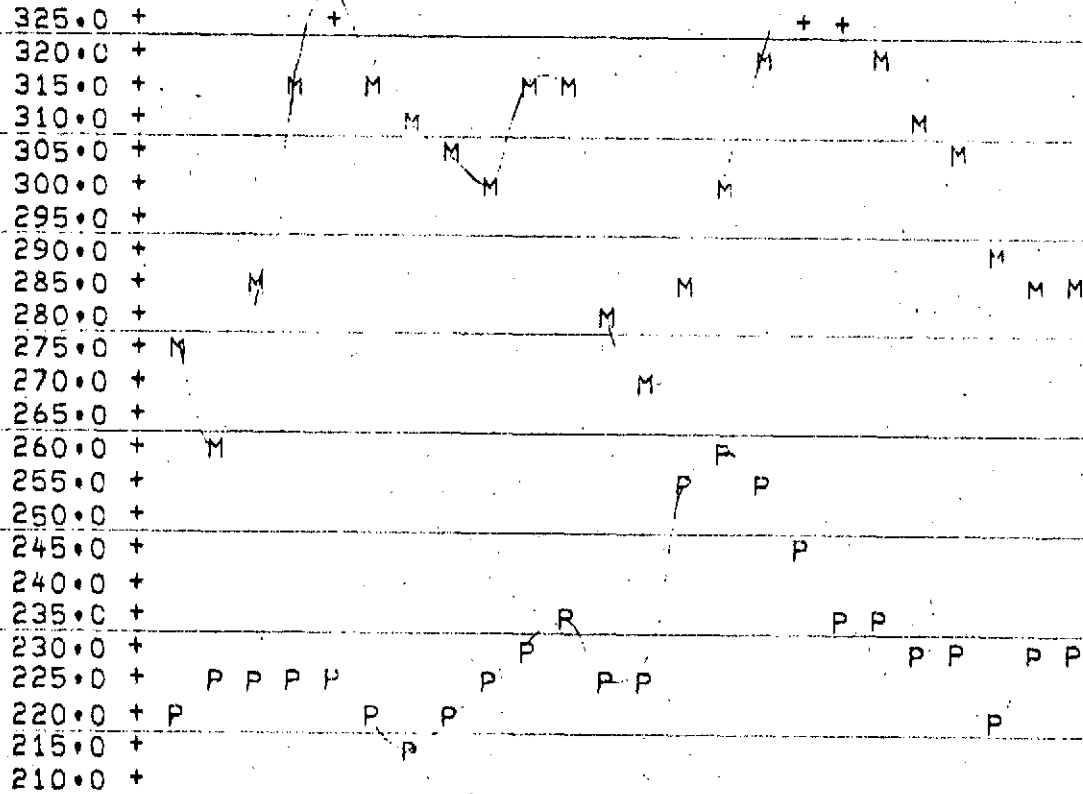


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Figure 15e. Monthly Mean and Error Curves.

YEAR=74 MONTH= 4

HEIGHT AT F8F2 (KM)



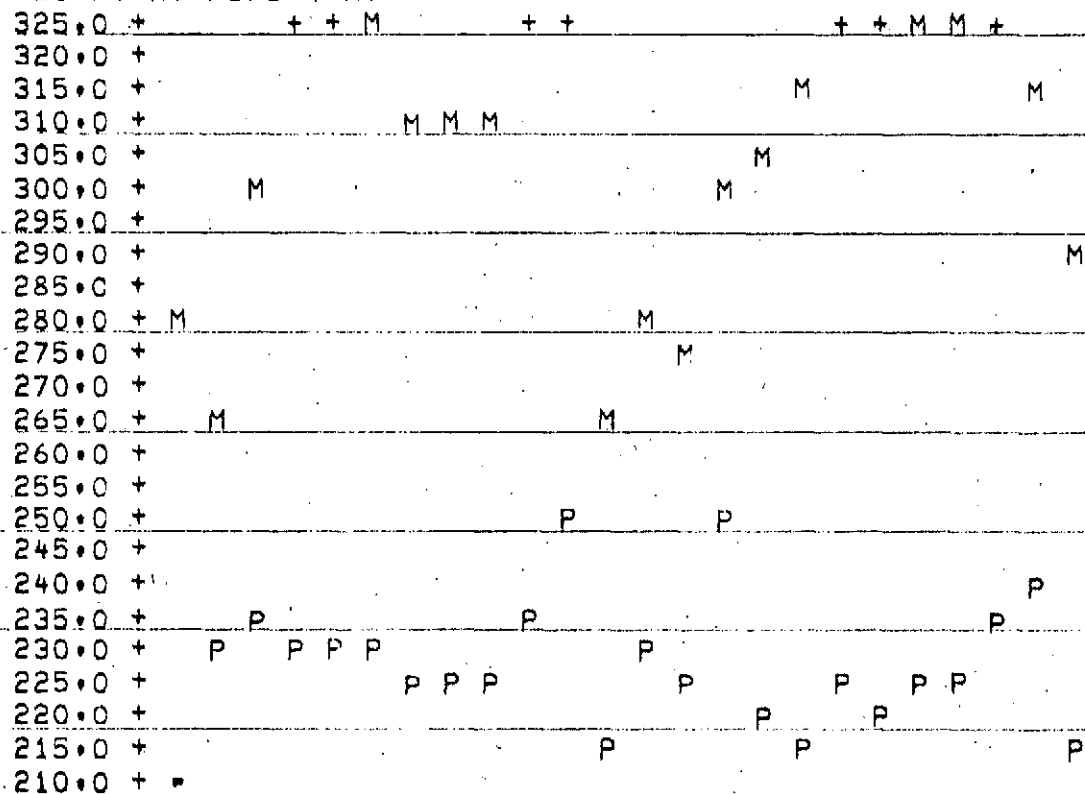
-94-

+ * * * + * * * + * * * + * * * + * * * + * * * + * * *
 0 4 8 12 16 20 UNIVERSAL TIME (HOURS)
 M-MEAN MEAS. P-RMS RESIDUAL (MEAS.-PRED.)+200KM

Figure 15f. Monthly Mean and Error Curves.

YEAR=74 MONTH= 5

HEIGHT AT F0F2 (KM)



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0 4 8 12 16 20 UNIVERSAL TIME (HOURS)
M-MEAN MEAS. P-RMS RESIDUAL (MEAS.-PRED.)+200KM

Figure 15g. Monthly Mean and Error Curves.

Table 5a. Monthly Mean Statistics.

| YEAR=73 MONTH=11 | | | | | | | | | | | | | |
|------------------|-------------------|------|-------|--|---------------|------|------|----------|----------------------|------|-----|-------|------------|
| UT | MEAN MEASUREMENTS | | | | RMS RESIDUALS | | | | DAYTIME RMS % ERRORS | | | | NO. POINTS |
| | NT | F0F2 | HM | | NT(PRED) | F0F2 | HM | NT(UPDT) | NT(P) | F0F2 | HM | NT(U) | |
| 0 | .000E 00 | 3.88 | 261.0 | | .000E 00 | .97 | 12.3 | .000E 00 | | | | | 0 20 20 0 |
| 1 | .000E 00 | 3.16 | 290.3 | | .000E 00 | .56 | 27.4 | .000E 00 | | | | | 0 20 20 0 |
| 2 | .000E 00 | 3.18 | 289.5 | | .000E 00 | .27 | 21.0 | .000E 00 | | | | | 0 22 22 0 |
| 3 | .000E 00 | 3.37 | 306.6 | | .000E 00 | .39 | 22.7 | .000E 00 | | | | | 0 21 21 0 |
| 4 | .000E 00 | 3.46 | 306.5 | | .000E 00 | .39 | 25.3 | .000E 00 | | | | | 0 23 23 0 |
| 5 | .000E 00 | 3.58 | 303.2 | | .000E 00 | .50 | 30.8 | .000E 00 | | | | | 0 23 23 0 |
| 6 | .000E 00 | 3.74 | 301.9 | | .000E 00 | .53 | 33.3 | .000E 00 | | | | | 0 23 23 0 |
| 7 | .000E 00 | 3.90 | 288.8 | | .000E 00 | .52 | 21.5 | .000E 00 | | | | | 0 23 23 0 |
| 8 | .000E 00 | 3.91 | 298.6 | | .000E 00 | .56 | 25.2 | .000E 00 | | | | | 0 23 23 0 |
| 9 | .000E 00 | 3.98 | 286.7 | | .000E 00 | .91 | 15.6 | .000E 00 | | | | | 0 23 23 0 |
| 10 | .000E 00 | 3.57 | 280.8 | | .000E 00 | .81 | 30.9 | .000E 00 | | | | | 0 22 22 0 |
| 11 | .000E 00 | 3.44 | 277.4 | | .000E 00 | .44 | 27.4 | .000E 00 | | | | | 0 20 20 0 |
| 12 | .000E 00 | 4.88 | 265.6 | | .000E 00 | .59 | 14.1 | .000E 00 | | | | | 0 21 21 0 |
| 13 | .000E 00 | 6.17 | 244.6 | | .000E 00 | .98 | 10.2 | .000E 00 | .0 | 15.9 | 4.2 | .0 | 0 20 20 0 |
| 14 | .000E 00 | 6.85 | 238.6 | | .000E 00 | .84 | 10.1 | .000E 00 | .0 | 12.3 | 4.2 | .0 | 0 20 20 0 |
| 15 | .000E 00 | 7.34 | 237.3 | | .000E 00 | .73 | 11.4 | .000E 00 | .0 | 10.0 | 4.8 | .0 | 0 21 21 0 |
| 16 | .000E 00 | 7.66 | 246.0 | | .000E 00 | .79 | 10.8 | .000E 00 | .0 | 10.3 | 4.4 | .0 | 0 21 21 0 |
| 17 | .000E 00 | 7.71 | 259.1 | | .000E 00 | .78 | 16.6 | .000E 00 | .0 | 10.1 | 6.4 | .0 | 0 22 22 0 |
| 18 | .000E 00 | 7.70 | 269.1 | | .000E 00 | .70 | 16.9 | .000E 00 | .0 | 9.1 | 6.3 | .0 | 0 22 22 0 |
| 19 | .000E 00 | 8.34 | 264.1 | | .000E 00 | .88 | 14.1 | .000E 00 | .0 | 10.6 | 5.4 | .0 | 0 21 21 0 |
| 20 | .000E 00 | 8.32 | 253.8 | | .000E 00 | 1.05 | 12.1 | .000E 00 | .0 | 12.6 | 4.8 | .0 | 0 22 22 0 |
| 21 | .000E 00 | 7.72 | 248.3 | | .000E 00 | 1.05 | 9.4 | .000E 00 | .0 | 13.6 | 3.8 | .0 | 0 22 22 0 |
| 22 | .000E 00 | 6.94 | 239.5 | | .000E 00 | 1.21 | 11.7 | .000E 00 | .0 | 17.5 | 4.9 | .0 | 0 21 21 0 |
| 23 | .000E 00 | 5.54 | 250.4 | | .000E 00 | 1.24 | 12.7 | .000E 00 | .0 | 22.3 | 5.1 | .0 | 0 21 21 0 |

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Table 5b. Monthly Mean Statistics.

| YEAR=73 MONTH=12 | | | | | | | | | | | | | | | | | | |
|------------------|-------------------|------|------|-------|---------------|------|------|----------|----------------------|------|------|-------|------------|------|----|----|----|----|
| UT | MEAN MEASUREMENTS | | | | RMS RESIDUALS | | | | DAYTIME RMS % ERRORS | | | | NO. POINTS | | | | | |
| | NT | F0F2 | HM | | NT(PRED) | F0F2 | HM | NT(UPDT) | NT(P) | F0F2 | HM | NT(U) | | | | | | |
| 0 | .563E | 17 | 3.82 | 293.5 | .146E | 17 | .63 | 41.7 | .119E | 17 | | | | 12 | 9 | 9 | 9 | |
| 1 | .507E | 17 | 3.33 | 286.7 | .189E | 17 | .43 | 31.0 | .150E | 17 | | | | 12 | 9 | 9 | 9 | |
| 2 | .510E | 17 | 3.51 | 305.1 | .233E | 17 | .69 | 29.3 | .118E | 17 | | | | 12 | 10 | 10 | 10 | |
| 3 | .536E | 17 | 3.81 | 303.1 | .263E | 17 | 1.00 | 19.4 | .655E | 16 | | | | 12 | 10 | 10 | 10 | |
| 4 | .526E | 17 | 3.90 | 301.1 | .244E | 17 | 1.09 | 25.6 | .481E | 16 | | | | 12 | 11 | 11 | 11 | |
| 5 | .531E | 17 | 3.93 | 296.4 | .232E | 17 | 1.03 | 28.2 | .431E | 16 | | | | 12 | 11 | 11 | 11 | |
| 6 | .519E | 17 | 3.95 | 290.5 | .226E | 17 | 1.12 | 27.0 | .525E | 16 | | | | 12 | 11 | 11 | 11 | |
| 7 | .507E | 17 | 4.19 | 294.9 | .178E | 17 | 1.15 | 24.7 | .938E | 16 | | | | 12 | 9 | 9 | 9 | |
| 8 | .470E | 17 | 3.88 | 296.1 | .116E | 17 | .65 | 21.2 | .673E | 16 | | | | 12 | 11 | 11 | 11 | |
| 9 | .459E | 17 | 3.76 | 315.2 | .991E | 16 | .53 | 41.0 | .904E | 16 | | | | 12 | 11 | 11 | 11 | |
| 10 | .445E | 17 | 3.73 | 303.3 | .149E | 17 | .72 | 29.4 | .484E | 16 | | | | 12 | 10 | 10 | 10 | |
| 11 | .442E | 17 | 3.63 | 297.5 | .133E | 17 | .61 | 23.6 | .634E | 16 | | | | 12 | 11 | 11 | 11 | |
| 12 | .588E | 17 | 4.30 | 279.3 | .113E | 17 | .61 | 16.4 | .935E | 16 | | | | 12 | 11 | 11 | 11 | |
| 13 | .914E | 17 | 5.97 | 240.4 | .159E | 17 | .77 | 8.3 | .233E | 17 | 17.4 | 12.9 | 3.4 | 25.5 | 12 | 10 | 10 | 10 |
| 14 | .113E | 18 | 6.53 | 247.1 | .290E | 17 | .47 | 18.5 | .256E | 17 | 25.7 | 7.2 | 7.5 | 22.7 | 12 | 11 | 11 | 11 |
| 15 | .131E | 18 | 7.24 | 244.7 | .341E | 17 | .72 | 21.7 | .359E | 17 | 26.1 | 10.0 | 8.9 | 27.5 | 12 | 10 | 10 | 10 |
| 16 | .144E | 18 | 7.65 | 236.8 | .316E | 17 | .84 | 8.5 | .484E | 17 | 21.9 | 10.9 | 3.6 | 33.5 | 12 | 11 | 11 | 11 |
| 17 | .140E | 18 | 7.07 | 246.7 | .421E | 17 | .70 | 17.2 | .316E | 17 | 30.1 | 9.9 | 7.0 | 22.6 | 12 | 11 | 11 | 11 |
| 18 | .141E | 18 | 6.98 | 265.4 | .348E | 17 | .55 | 14.5 | .185E | 17 | 24.6 | 7.8 | 5.4 | 13.1 | 12 | 11 | 11 | 11 |
| 19 | .145E | 18 | 6.86 | 267.7 | .252E | 17 | .53 | 25.7 | .152E | 17 | 17.4 | 7.7 | 9.6 | 10.5 | 12 | 12 | 12 | 12 |
| 20 | .144E | 18 | 6.98 | 266.0 | .263E | 17 | .58 | 21.4 | .173E | 17 | 18.2 | 8.2 | 8.1 | 12.0 | 12 | 12 | 12 | 12 |
| 21 | .126E | 18 | 6.50 | 258.4 | .260E | 17 | .65 | 19.2 | .974E | 16 | 20.6 | 10.0 | 7.4 | 7.7 | 12 | 12 | 12 | 12 |
| 22 | .102E | 18 | 5.99 | 246.9 | .172E | 17 | .40 | 12.1 | .846E | 16 | 16.8 | 6.7 | 4.9 | 8.3 | 12 | 11 | 11 | 11 |
| 23 | .754E | 17 | 4.71 | 267.2 | .124E | 17 | .68 | 28.0 | .115E | 17 | 16.4 | 14.4 | 10.5 | 15.3 | 12 | 10 | 10 | 10 |

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Table 5c. Monthly Mean Statistics.

| YEAR=74 MONTH= 1 | | | | | | | | | | | | | | | |
|------------------|-------------------|------|-------|----------|---------------|------|----------|-------|----------------------|-----|-------|----|------------|----|----|
| UT | MEAN MEASUREMENTS | | | | RMS RESIDUALS | | | | DAYTIME RMS % ERRORS | | | | NO. POINTS | | |
| | NT | FOE2 | HM | NT(PRED) | FOE2 | HM | NT(UPDT) | NT(P) | FOE2 | HM | NT(U) | | | | |
| 0 | .531E 17 | 3.75 | 255.9 | .219E 17 | .77 | 18.7 | .176E 17 | | | | | 30 | 26 | 26 | 25 |
| 1 | .441E 17 | 3.30 | 284.7 | .190E 17 | .79 | 38.6 | .105E 17 | | | | | 30 | 26 | 25 | 25 |
| 2 | .436E 17 | 3.46 | 281.1 | .186E 17 | .76 | 24.6 | .569E 16 | | | | | 30 | 25 | 25 | 24 |
| 3 | .438E 17 | 3.47 | 299.9 | .178E 17 | .74 | 27.4 | .671E 16 | | | | | 31 | 27 | 27 | 27 |
| 4 | .453E 17 | 3.55 | 295.8 | .185E 17 | .85 | 23.9 | .553E 16 | | | | | 31 | 24 | 24 | 24 |
| 5 | .470E 17 | 3.72 | 299.4 | .184E 17 | .88 | 19.8 | .621E 16 | | | | | 31 | 24 | 24 | 24 |
| 6 | .509E 17 | 4.02 | 292.3 | .191E 17 | 1.02 | 19.4 | .645E 16 | | | | | 31 | 28 | 28 | 28 |
| 7 | .552E 17 | 4.40 | 286.4 | .190E 17 | 1.21 | 20.4 | .115E 17 | | | | | 31 | 28 | 27 | 28 |
| 8 | .562E 17 | 4.47 | 275.1 | .167E 17 | 1.09 | 23.4 | .112E 17 | | | | | 31 | 24 | 24 | 24 |
| 9 | .503E 17 | 4.11 | 275.6 | .161E 17 | 1.00 | 21.6 | .135E 17 | | | | | 31 | 26 | 26 | 26 |
| 10 | .429E 17 | 3.65 | 277.4 | .150E 17 | .84 | 26.8 | .605E 16 | | | | | 31 | 23 | 23 | 23 |
| 11 | .394E 17 | 3.45 | 281.0 | .120E 17 | .71 | 25.2 | .682E 16 | | | | | 31 | 25 | 25 | 25 |
| 12 | .459E 17 | 3.76 | 271.3 | .138E 17 | .56 | 17.8 | .788E 16 | | | | | 31 | 27 | 27 | 27 |
| 13 | .804E 17 | 5.50 | 233.3 | .162E 17 | .84 | 13.9 | .231E 17 | 20.2 | 15.3 | 5.9 | 28.7 | 31 | 27 | 27 | 27 |
| 14 | .989E 17 | 6.25 | 233.2 | .297E 17 | .54 | 11.1 | .253E 17 | 30.0 | 8.7 | 4.8 | 25.5 | 31 | 26 | 26 | 26 |
| 15 | .111E 18 | 6.28 | 227.1 | .398E 17 | .74 | 19.7 | .209E 17 | 35.8 | 11.9 | 8.7 | 18.8 | 30 | 28 | 28 | 27 |
| 16 | .127E 18 | 6.64 | 243.0 | .401E 17 | .81 | 21.3 | .248E 17 | 31.7 | 12.2 | 8.8 | 19.6 | 30 | 27 | 27 | 26 |
| 17 | .142E 18 | 6.73 | 260.4 | .408E 17 | .92 | 24.8 | .240E 17 | 28.8 | 13.7 | 9.5 | 16.9 | 31 | 26 | 26 | 26 |
| 18 | .151E 18 | 7.06 | 268.6 | .406E 17 | .81 | 16.7 | .234E 17 | 26.9 | 11.4 | 6.2 | 15.5 | 31 | 27 | 27 | 27 |
| 19 | .144E 18 | 6.96 | 270.8 | .341E 17 | .70 | 14.3 | .176E 17 | 23.7 | 10.1 | 5.3 | 12.2 | 31 | 26 | 26 | 26 |
| 20 | .135E 18 | 6.59 | 261.3 | .340E 17 | .74 | 21.8 | .201E 17 | 25.1 | 11.2 | 8.3 | 14.9 | 31 | 28 | 28 | 28 |
| 21 | .127E 18 | 6.47 | 251.3 | .354E 17 | .82 | 15.7 | .167E 17 | 27.9 | 12.7 | 6.3 | 13.2 | 31 | 29 | 29 | 29 |
| 22 | .113E 18 | 6.29 | 244.8 | .287E 17 | .67 | 12.6 | .212E 17 | 25.5 | 10.6 | 5.1 | 18.8 | 31 | 29 | 29 | 29 |
| 23 | .847E 17 | 5.47 | 239.9 | .288E 17 | .97 | 12.6 | .173E 17 | 34.0 | 17.7 | 5.2 | 20.4 | 31 | 29 | 29 | 29 |

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Table 15d. Monthly Mean Statistics.

| YEAR=74 MONTH= 2 | | | | | | | | | | | | | |
|------------------|-------------------|------|------|-------|---------------|------|------|----------|----------------------|------|------|-------|-------------|
| UT | MEAN MEASUREMENTS | | | | RMS RESIDUALS | | | | DAYTIME RMS % ERRORS | | | | NO. POINTS |
| | NT | F0F2 | HM | | NT(PRED) | F0F2 | HM | NT(UPDT) | NT(P) | F0F2 | HM | NT(U) | |
| 0 | .639E | 17 | 4.61 | 251.9 | .165E | 17 | .80 | 11.6 | .874E | 16 | | | 22 25 24 19 |
| 1 | .446E | 17 | 3.59 | 256.8 | .149E | 17 | .89 | 22.4 | .599E | 16 | | | 22 23 23 18 |
| 2 | .385E | 17 | 3.38 | 296.3 | .102E | 17 | .47 | 31.4 | .542E | 16 | | | 22 25 24 19 |
| 3 | .384E | 17 | 3.44 | 302.6 | .885E | 16 | .40 | 25.7 | .693E | 16 | | | 22 27 26 21 |
| 4 | .399E | 17 | 3.49 | 305.2 | .912E | 16 | .59 | 22.0 | .658E | 16 | | | 22 24 23 19 |
| 5 | .396E | 17 | 3.62 | 294.3 | .106E | 17 | .56 | 17.6 | .931E | 16 | | | 19 27 27 18 |
| 6 | .406E | 17 | 3.72 | 280.6 | .113E | 17 | .67 | 20.8 | .774E | 16 | | | 20 26 26 18 |
| 7 | .433E | 17 | 3.70 | 282.5 | .102E | 17 | .47 | 18.9 | .688E | 16 | | | 22 26 26 21 |
| 8 | .447E | 17 | 3.85 | 284.2 | .993E | 16 | .52 | 18.5 | .825E | 16 | | | 22 26 26 20 |
| 9 | .431E | 17 | 3.83 | 276.2 | .118E | 17 | .70 | 25.7 | .901E | 16 | | | 22 24 24 19 |
| 10 | .376E | 17 | 3.50 | 277.0 | .124E | 17 | .66 | 30.1 | .639E | 16 | | | 22 22 22 17 |
| 11 | .323E | 17 | 3.26 | 281.6 | .111E | 17 | .48 | 27.7 | .720E | 16 | | | 22 26 25 20 |
| 12 | .479E | 17 | 3.99 | 257.6 | .174E | 17 | .36 | 12.8 | .144E | 17 | | | 22 26 25 20 |
| 13 | .828E | 17 | 5.57 | 235.1 | .239E | 17 | .39 | 17.0 | .209E | 17 | 28.9 | 7.0 | 7.2 25.2 |
| 14 | .107E | 18 | 6.07 | 241.7 | .361E | 17 | .70 | 15.6 | .250E | 17 | 33.7 | 11.6 | 6.5 23.3 |
| 15 | .132E | 18 | 6.58 | 242.0 | .381E | 17 | .63 | 17.8 | .236E | 17 | 28.8 | 9.6 | 7.4 17.8 |
| 16 | .151E | 18 | 6.90 | 266.7 | .409E | 17 | .70 | 29.4 | .266E | 17 | 27.1 | 10.1 | 11.0 17.6 |
| 17 | .168E | 18 | 7.40 | 266.6 | .465E | 17 | .81 | 17.1 | .349E | 17 | 27.8 | 10.9 | 6.4 20.8 |
| 18 | .168E | 18 | 7.02 | 267.4 | .517E | 17 | .84 | 22.2 | .346E | 17 | 30.8 | 12.0 | 8.3 20.6 |
| 19 | .163E | 18 | 7.16 | 274.2 | .475E | 17 | 1.03 | 17.5 | .373E | 17 | 29.1 | 14.4 | 6.4 22.9 |
| 20 | .152E | 18 | 7.14 | 265.1 | .453E | 17 | .73 | 21.1 | .399E | 17 | 29.7 | 10.2 | 8.0 26.2 |
| 21 | .131E | 18 | 6.62 | 259.9 | .552E | 17 | .98 | 13.5 | .167E | 17 | 42.2 | 14.8 | 5.2 12.8 |
| 22 | .117E | 18 | 6.27 | 246.1 | .393E | 17 | .89 | 10.5 | .166E | 17 | 33.7 | 14.2 | 4.3 14.2 |
| 23 | .969E | 17 | 6.07 | 247.4 | .201E | 17 | .62 | 10.1 | .173E | 17 | 20.7 | 10.2 | 4.1 17.9 |

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Table 15e. Monthly Mean Statistics.

| YEAR=74 MONTH= 3 | | | | | | | | | | | | | | | | | | |
|------------------|-------------------|------|------|-------|---------------|------|------|----------|----------------------|------|------|-------|------------|------|----|----|----|----|
| UT | MEAN MEASUREMENTS | | | | RMS RESIDUALS | | | | DAYTIME RMS % ERRORS | | | | NO. POINTS | | | | | |
| | NT | F0F2 | HM | | NT(PRED) | F0F2 | HM | NT(UPDT) | NT(P) | F0F2 | HM | NT(U) | | | | | | |
| 0 | .872E | 17 | 5.58 | 257.0 | .363E | 17 | 1.21 | 9.7 | .227E | 17 | | | | 31 | 30 | 28 | 30 | |
| 1 | .577E | 17 | 4.39 | 265.1 | .240E | 17 | .97 | 31.0 | .118E | 17 | | | | 31 | 30 | 30 | 30 | |
| 2 | .456E | 17 | 3.85 | 310.4 | .167E | 17 | .63 | 29.3 | .717E | 16 | | | | 31 | 31 | 29 | 31 | |
| 3 | .444E | 17 | 3.83 | 326.6 | .129E | 17 | .68 | 28.8 | .105E | 17 | | | | 31 | 29 | 27 | 29 | |
| 4 | .434E | 17 | 3.82 | 322.3 | .109E | 17 | .55 | 17.6 | .128E | 17 | | | | 31 | 29 | 28 | 29 | |
| 5 | .408E | 17 | 3.79 | 311.6 | .909E | 16 | .54 | 17.8 | .113E | 17 | | | | 31 | 30 | 29 | 30 | |
| 6 | .407E | 17 | 3.79 | 295.4 | .818E | 16 | .50 | 23.3 | .109E | 17 | | | | 31 | 31 | 30 | 31 | |
| 7 | .401E | 17 | 3.68 | 294.6 | .863E | 16 | .36 | 19.4 | .815E | 16 | | | | 31 | 30 | 30 | 30 | |
| 8 | .378E | 17 | 3.62 | 299.3 | .904E | 16 | .45 | 21.1 | .981E | 16 | | | | 31 | 29 | 29 | 29 | |
| 9 | .352E | 17 | 3.35 | 305.4 | .822E | 16 | .48 | 23.5 | .798E | 16 | | | | 31 | 30 | 30 | 30 | |
| 10 | .329E | 17 | 3.18 | 309.2 | .868E | 16 | .58 | 27.7 | .655E | 16 | | | | 31 | 29 | 29 | 29 | |
| 11 | .290E | 17 | 3.15 | 302.5 | .154E | 17 | .50 | 41.1 | .112E | 17 | | | | 31 | 30 | 29 | 30 | |
| 12 | .648E | 17 | 4.70 | 262.3 | .165E | 17 | .73 | 20.4 | .231E | 17 | | | | 30 | 30 | 29 | 30 | |
| 13 | .101E | 18 | 5.76 | 263.6 | .288E | 17 | .90 | 44.3 | .244E | 17 | 28.6 | 15.7 | 16.8 | 24.2 | 31 | 28 | 28 | 28 |
| 14 | .131E | 18 | 6.35 | 260.9 | .342E | 17 | 1.04 | 24.6 | .305E | 17 | 26.1 | 16.4 | 9.4 | 23.3 | 31 | 27 | 24 | 27 |
| 15 | .156E | 18 | 6.47 | 280.9 | .373E | 17 | 1.01 | 45.7 | .262E | 17 | 23.9 | 15.5 | 16.3 | 16.7 | 30 | 28 | 27 | 27 |
| 16 | .185E | 18 | 6.97 | 281.9 | .414E | 17 | 1.07 | 34.2 | .314E | 17 | 22.4 | 15.3 | 12.1 | 17.0 | 30 | 28 | 27 | 27 |
| 17 | .204E | 18 | 7.46 | 300.1 | .568E | 17 | .97 | 27.4 | .335E | 17 | 27.8 | 13.0 | 9.1 | 16.4 | 30 | 28 | 27 | 27 |
| 18 | .213E | 18 | 7.68 | 305.9 | .681E | 17 | 1.14 | 29.7 | .408E | 17 | 32.0 | 14.8 | 9.7 | 19.1 | 31 | 30 | 29 | 30 |
| 19 | .213E | 18 | 7.80 | 293.9 | .832E | 17 | 1.19 | 21.2 | .487E | 17 | 39.2 | 15.2 | 7.2 | 22.9 | 30 | 31 | 30 | 30 |
| 20 | .201E | 18 | 7.78 | 291.0 | .848E | 17 | 1.40 | 21.2 | .412E | 17 | 42.3 | 18.0 | 7.3 | 20.5 | 31 | 30 | 30 | 30 |
| 21 | .175E | 18 | 7.61 | 280.1 | .678E | 17 | 1.27 | 14.5 | .484E | 17 | 38.6 | 16.7 | 5.2 | 27.6 | 31 | 31 | 31 | 31 |
| 22 | .148E | 18 | 7.20 | 262.1 | .533E | 17 | 1.05 | 17.8 | .391E | 17 | 36.0 | 14.6 | 6.8 | 26.4 | 31 | 31 | 31 | 31 |
| 23 | .122E | 18 | 6.61 | 256.9 | .504E | 17 | 1.29 | 11.7 | .297E | 17 | 41.3 | 19.5 | 4.6 | 24.3 | 31 | 30 | 28 | 30 |

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Table 15f. Monthly Mean Statistics.

| YEAR=74 MONTH= 4 | | | | | | | | | | | | | | | |
|------------------|-------------------|------|------|-------|---------------|------|------|----------|----------------------|------|------|-------|------------|-------------|-------------|
| UT | MEAN MEASUREMENTS | | | | RMS RESIDUALS | | | | DAYTIME RMS % ERRORS | | | | NO. POINTS | | |
| | NT | F0F2 | HM | | NT(PRED) | F0F2 | HM | NT(UPDT) | NT(P) | F0F2 | HM | NT(U) | | | |
| 0 | .112E | 18 | 6.04 | 274.1 | .492E | 17 | 1.10 | 20.8 | .255E | 17 | | | | 29 25 25 24 | |
| 1 | .816E | 17 | 5.14 | 262.5 | .346E | 17 | .98 | 27.1 | .141E | 17 | | | | 29 25 25 24 | |
| 2 | .605E | 17 | 4.42 | 284.8 | .259E | 17 | .76 | 24.9 | .135E | 17 | | | | 29 23 23 22 | |
| 3 | .498E | 17 | 4.19 | 317.2 | .226E | 17 | .66 | 26.8 | .130E | 17 | | | | 29 27 27 26 | |
| 4 | .458E | 17 | 4.03 | 330.9 | .186E | 17 | .55 | 24.9 | .124E | 17 | | | | 29 27 27 26 | |
| 5 | .442E | 17 | 3.90 | 314.2 | .141E | 17 | .55 | 21.1 | .941E | 16 | | | | 29 26 26 25 | |
| 6 | .428E | 17 | 3.93 | 308.6 | .127E | 17 | .61 | 17.5 | .104E | 17 | | | | 29 26 26 25 | |
| 7 | .424E | 17 | 3.90 | 306.8 | .127E | 17 | .63 | 21.1 | .116E | 17 | | | | 29 26 25 25 | |
| 8 | .396E | 17 | 3.76 | 298.4 | .126E | 17 | .64 | 26.6 | .132E | 17 | | | | 29 26 26 25 | |
| 9 | .339E | 17 | 3.34 | 317.4 | .125E | 17 | .58 | 32.4 | .921E | 16 | | | | 29 25 25 24 | |
| 10 | .300E | 17 | 3.16 | 315.3 | .152E | 17 | .51 | 32.9 | .803E | 16 | | | | 29 24 24 23 | |
| 11 | .398E | 17 | 3.64 | 277.6 | .217E | 17 | .45 | 24.7 | .155E | 17 | | | | 29 26 26 25 | |
| 12 | .789E | 17 | 5.07 | 272.2 | .211E | 17 | .68 | 23.0 | .267E | 17 | | | | 29 26 26 25 | |
| 13 | .104E | 18 | 5.59 | 282.9 | .299E | 17 | .97 | 54.6 | .298E | 17 | 28.9 | 17.4 | 19.3 | 28.8 | 29 28 28 27 |
| 14 | .122E | 18 | 5.92 | 301.1 | .292E | 17 | .93 | 59.9 | .309E | 17 | 23.9 | 15.8 | 19.9 | 25.4 | 29 24 24 23 |
| 15 | .145E | 18 | 6.18 | 319.7 | .339E | 17 | .89 | 52.5 | .238E | 17 | 23.4 | 14.4 | 16.4 | 16.4 | 29 22 22 22 |
| 16 | .168E | 18 | 6.59 | 336.1 | .462E | 17 | 1.04 | 42.9 | .314E | 17 | 27.5 | 15.8 | 12.8 | 18.7 | 27 22 22 20 |
| 17 | .200E | 18 | 7.24 | 336.4 | .561E | 17 | 1.23 | 34.1 | .444E | 17 | 28.0 | 16.9 | 10.1 | 22.1 | 29 24 23 23 |
| 18 | .216E | 18 | 7.75 | 321.8 | .682E | 17 | 1.43 | 33.2 | .730E | 17 | 31.6 | 18.4 | 10.3 | 33.8 | 29 26 26 25 |
| 19 | .202E | 18 | 7.88 | 308.1 | .748E | 17 | 1.21 | 28.8 | .741E | 17 | 37.0 | 15.4 | 9.3 | 36.6 | 29 25 25 24 |
| 20 | .187E | 18 | 7.68 | 302.8 | .722E | 17 | 1.22 | 32.4 | .762E | 17 | 38.6 | 15.9 | 10.7 | 40.8 | 29 26 26 25 |
| 21 | .164E | 18 | 7.38 | 288.8 | .729E | 17 | 1.11 | 18.9 | .755E | 17 | 44.5 | 15.0 | 6.5 | 46.1 | 29 27 26 26 |
| 22 | .144E | 18 | 6.96 | 287.3 | .714E | 17 | 1.14 | 29.8 | .594E | 17 | 49.6 | 16.4 | 10.4 | 41.2 | 29 25 25 24 |
| 23 | .134E | 18 | 6.55 | 286.7 | .603E | 17 | 1.25 | 29.4 | .409E | 17 | 44.9 | 19.1 | 10.3 | 30.5 | 29 25 25 24 |

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Table 15g. Monthly Mean Statistics.

| YEAR=74 MONTH= 5 | | | | | | | | | | | | | | | |
|------------------|-------------------|------|-------|----------|---------------|------|----------|-------|----------------------|------|-------|---|------------|---|---|
| UT | MEAN MEASUREMENTS | | | | RMS RESIDUALS | | | | DAYTIME RMS % ERRORS | | | | NO. POINTS | | |
| | NT | F0F2 | HM | NT(PRED) | F0F2 | HM | NT(UPDT) | NT(P) | F0F2 | HM | NT(U) | | | | |
| 0 | .147E 18 | 6.62 | 278.0 | .582E 17 | 1.13 | 7.2 | .306E 17 | | | | | 7 | 6 | 6 | 6 |
| 1 | .108E 18 | 6.10 | 266.9 | .441E 17 | .95 | 28.6 | .297E 17 | | | | | 7 | 6 | 6 | 6 |
| 2 | .789E 17 | 4.96 | 298.1 | .340E 17 | .96 | 34.1 | .218E 17 | | | | | 7 | 5 | 5 | 5 |
| 3 | .697E 17 | 4.71 | 330.9 | .219E 17 | .77 | 31.2 | .170E 17 | | | | | 7 | 7 | 7 | 7 |
| 4 | .683E 17 | 4.66 | 336.6 | .210E 17 | .83 | 32.2 | .155E 17 | | | | | 7 | 7 | 7 | 7 |
| 5 | .660E 17 | 4.36 | 326.9 | .223E 17 | .75 | 29.7 | .174E 17 | | | | | 7 | 5 | 5 | 5 |
| 6 | .626E 17 | 4.43 | 309.8 | .248E 17 | 1.13 | 24.2 | .145E 17 | | | | | 7 | 7 | 7 | 7 |
| 7 | .565E 17 | 4.13 | 308.1 | .134E 17 | .72 | 24.7 | .124E 17 | | | | | 7 | 7 | 7 | 7 |
| 8 | .498E 17 | 4.11 | 309.8 | .834E 16 | .84 | 25.6 | .204E 17 | | | | | 7 | 7 | 7 | 7 |
| 9 | .393E 17 | 3.58 | 330.2 | .728E 16 | .40 | 34.0 | .117E 17 | | | | | 7 | 6 | 6 | 6 |
| 10 | .342E 17 | 3.45 | 331.3 | .149E 17 | .26 | 50.3 | .118E 17 | | | | | 7 | 6 | 6 | 6 |
| 11 | .611E 17 | 4.38 | 264.2 | .145E 17 | .69 | 16.2 | .263E 17 | | | | | 7 | 6 | 6 | 6 |
| 12 | .101E 18 | 5.22 | 279.5 | .248E 17 | 1.01 | 28.7 | .244E 17 | | | | | 7 | 6 | 6 | 6 |
| 13 | .134E 18 | 5.32 | 275.9 | .325E 17 | .93 | 25.5 | .221E 17 | 24.2 | 17.6 | 9.2 | 16.5 | 7 | 5 | 5 | 5 |
| 14 | .161E 18 | 6.00 | 300.6 | .470E 17 | 1.64 | 47.8 | .277E 17 | 29.2 | 27.4 | 15.9 | 17.2 | 7 | 4 | 4 | 4 |
| 15 | .187E 18 | 7.20 | 306.7 | .662E 17 | 1.92 | 18.4 | .438E 17 | 35.4 | 26.7 | 6.0 | 23.4 | 7 | 4 | 4 | 4 |
| 16 | .207E 18 | 7.80 | 316.6 | .718E 17 | 2.02 | 16.4 | .456E 17 | 34.7 | 25.9 | 5.2 | 22.1 | 7 | 4 | 4 | 4 |
| 17 | .203E 18 | 7.84 | 337.7 | .634E 17 | 1.72 | 23.7 | .458E 17 | 31.2 | 22.0 | 7.0 | 22.6 | 6 | 5 | 5 | 4 |
| 18 | .204E 18 | 8.30 | 328.0 | .716E 17 | 2.01 | 18.3 | .555E 17 | 35.0 | 24.2 | 5.6 | 27.2 | 6 | 5 | 5 | 4 |
| 19 | .204E 18 | 7.73 | 326.0 | .726E 17 | 1.49 | 26.0 | .621E 17 | 35.6 | 19.3 | 8.0 | 30.5 | 6 | 6 | 6 | 5 |
| 20 | .195E 18 | 7.47 | 324.3 | .739E 17 | .98 | 25.8 | .682E 17 | 37.9 | 13.1 | 8.0 | 35.0 | 6 | 6 | 6 | 5 |
| 21 | .186E 18 | 7.27 | 330.1 | .749E 17 | 1.10 | 35.3 | .810E 17 | 40.2 | 15.2 | 10.7 | 43.5 | 6 | 6 | 6 | 6 |
| 22 | .179E 18 | 7.44 | 314.9 | .749E 17 | 1.18 | 37.8 | .739E 17 | 41.8 | 15.9 | 12.0 | 41.2 | 6 | 5 | 5 | 5 |
| 23 | .171E 18 | 7.40 | 291.7 | .640E 17 | 1.05 | 14.6 | .679E 17 | 37.5 | 14.2 | 5.0 | 39.8 | 6 | 5 | 5 | 5 |

Table 6. Daytime RMS Percent Errors (for 8-18 hours local time).

| Time Period | Daytime RMS Percent Errors and Number of Observations for | | | | | | | |
|--------------------|---|------|---------------|------|---------|------|-------|------|
| | N_T Predicted | No. | N_T Updated | No. | f_oF2 | No. | h_m | No. |
| Nov 73 | -- | 0 | -- | 0 | 13.7 | 233 | 5.0 | 233 |
| Dec 73 | 21.8 | 132 | 19.7 | 121 | 9.9 | 121 | 7.3 | 121 |
| Jan 74 | 28.4 | 339 | 19.1 | 300 | 12.5 | 302 | 6.9 | 302 |
| Feb 74 | 30.7 | 242 | 20.3 | 232 | 11.6 | 296 | 7.0 | 289 |
| Mar 74 | 33.3 | 337 | 22.1 | 318 | 16.0 | 322 | 10.3 | 312 |
| Apr 74 | 35.5 | 317 | 32.7 | 263 | 16.5 | 274 | 13.0 | 272 |
| May 74 | 34.9 | 70 | 31.4 | 51 | 20.8 | 55 | 9.0 | 55 |
| Nov 73 -
May 74 | 31.5 | 1437 | 24.0 | 1285 | 14.2 | 1603 | 8.6 | 1584 |
| Jan 74-
Mar 74 | 30.9 | 918 | 20.6 | 850 | 13.6 | 920 | 8.3 | 903 |

APPENDIX B

Brief Plan Regarding the Collection, Intercomparison, and Analysis of the INTASAT Worldwide Data

The NASA Space Science Data Center is not at present, scheduled to receive any polarimeter data from INTASAT. It is suggested that the NSSDC request this data from the worldwide users of INTASAT in the same way that they do with many other international satellite experiments. The format should be compatible with the NSSDC computers and be on magnetic tapes or punched cards.

The data should be collected from users throughout the world and could provide a unique data base for many ionospheric investigations. It has been suggested that the data could be used for modeling the total electron content (TEC) on a worldwide basis, but we do not recommend this because much larger and more comprehensive data bases of f_oF_2 already exist from which TEC can be deduced.

The data could be used for investigating traveling ionospheric disturbances or sudden ionospheric disturbances. Such areas of research are of particular interest at the present time for the development of two global navigation satellite systems, GPS and AEROSAT. In these areas the behavior and movement of ionospheric disturbances are important. If two or more INTASAT users are simultaneously recording Faraday data from INTASAT, then the disturbances can be monitored along these two or more different paths through the ionosphere as the satellite moves across the sky. These results will provide a unique analysis tool for such effects.

Comparisons of INTASAT data from its low orbit could also be made with similar Faraday satellites and two frequency satellites such as ATS-F and Timation II at higher orbits. Analysis of TEC above 1500 km could be undertaken along with the investigation of Faraday factor errors using group delay and Faraday techniques.

The unmodeled part of the ionosphere just above the height of the maximum of the F2 layer in the Bent model could also be investigated in detail around the world rather than at the few sites on the continental United States reported in the model description.

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