REPORT UAG - 53

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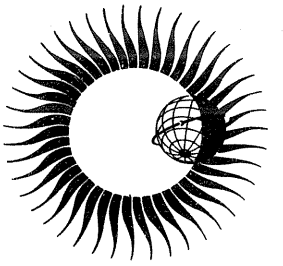
DESCRIPTION AND CATALOG OF IONOSPHERIC F-REGION DATA, JICAMARCA RADAR OBSERVATORY

(NOVEMBER 1966 - APRIL 1969)



April 1976

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(NOVEMBER 1966 - APRIL 1969)

by

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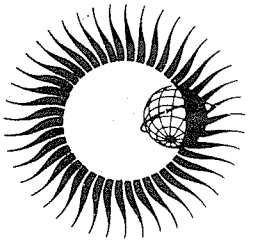

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Introduction

This report basically describes equatorial ionospheric F-region data reduced from the Jicamarca Radar Observatory (JRO) incoherent scatter observations for particular periods. It lists in catalog form the times of the observations made during those periods. These F-region data include the electron concentration, Ne, and the electron and ion temperatures, Te and Ti. The data were inferred from the incoherent scatter observations of JRO which is located at S11.95 E283.13. JRO is the only incoherent scatter observatory close to the magnetic equator at 2°N magnetic dip.

For the period 11 November 1966 to 29 April 1969, Ne, Te and Ti data reduced from the JRO observations are now available both in digital form (on magnetic tape) and in graphical and tabular form (on microfilm) from the World Data Center A for Solar-Terrestrial Physics. Some results of similar analyses are already published, in particular the Ne data were presented in graphical form by McClure *et al.* [1970] for the period 27 May 1964 to 1 December 1966. Small amounts of data have appeared in other published papers and reports. Ionospheric drift velocity measurements reduced from the JRO incoherent scatter observations for the period July 1967 to March 1970 are found in an earlier UAG Report, Report UAG-17 [Balsley *et al.*, 1971].

Measurement Techniques and Analysis Methods

In the Faraday rotation experiment as performed at JRO, two pulses are transmitted simultaneously with opposite circular polarization. By comparing the phases of the echoes of the two pulses as a function of time delay between transmission and reception, the Faraday rotation angle as a function of height is determined. The electron concentration profile is obtained from the height derivative of the Faraday rotation angle. This technique is discussed fully by Farley [1969]. See also Evans [1969] for a general review of the incoherent scatter technique.

In addition to the measurements for Ne, the temporal autocorrelation function ρ of the radar echoes is measured at a series of time separations τ. The method by which these measurements are made is described in considerable detail by Farley *et al.* [1967] and Farley [1969] and will not be discussed here. Our concern is with the analysis of the measured autocorrelation function to deduce parameters of the ionospheric plasma.

The JRO measurements of the autocorrelation functions are usually valid only in the ionospheric F2 layer where almost all of the ions are ionized oxygen (O^+). Therefore, the ionic composition has been approximated by pure O^+, so that the only parameters determined by the present analysis are Te and Ti. The presence of appreciable concentrations of ions other than O^+ will, of course, cause errors in the derived values of Te and Ti. In particular, near the top of the analyzed height range, especially at night during solar minimum, there may be appreciable concentrations of ionized hydrogen (H^+). For small fractional concentrations of H^+, the fractional errors in Te and Ti are of the order of -1 and +1 times the fractional concentration, respectively. Since the fractional concentration of H^+ in the F2 layer typically increases with height with a scale height of the order of 150 km, the presence of appreciable concentrations of H^+ leads to a characteristic and obvious decrease in Te and an increase in Ti with height.

Examples of theoretical curves of $\rho(\tau)$ for pure O^+, two values of Te and three values of Te/Ti are shown in Figure 1. Two important laws are illustrated. The first law states that the value of τ at $\rho = -0.08$ varies as $Te^{-\frac{1}{2}}$ with only a negligible dependence on Te/Ti. The second law states that the minimum value of ρ (ρmin) in the first negative loop varies approximately linearly with Te/Ti, as illustrated in Figure 2, but is otherwise independent of Te. The following empirical formula gives Te/Ti to two decimal places:

$$Te/Ti = .2305 - 4.666\ \rho min + 9.23\ \rho min^2 \qquad (1)$$

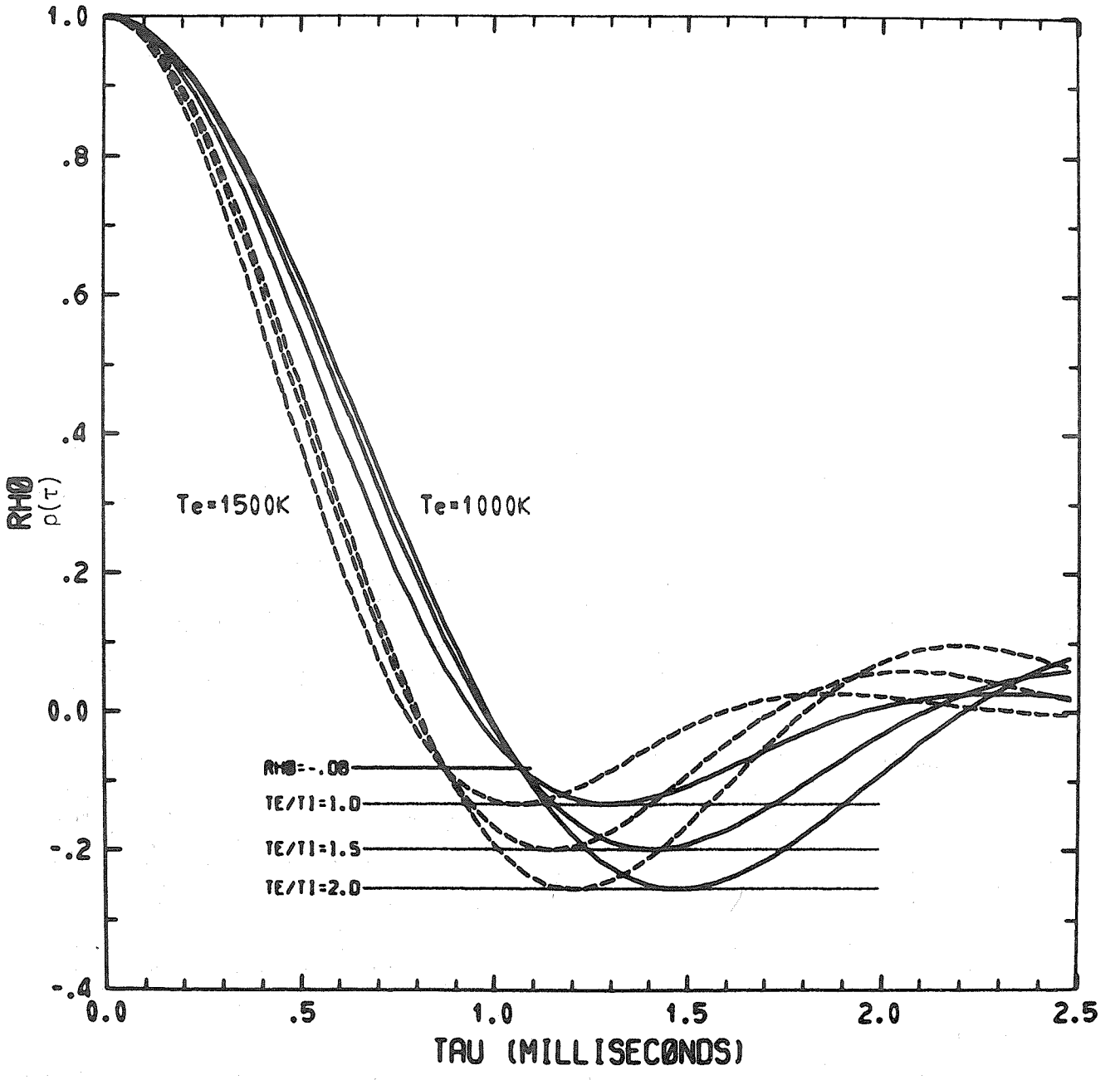


Fig. 1. Examples of the theoretical autocorrelation function $\rho(\tau)$ for Te=1000K and 1500K while Te/Ti = 1.0, 1.5 and 2.0. These curves illustrate that τ at the ρ = -0.08 point is essentially independent of Ti and that the depth of the first negative loop depends only on Te/Ti. These laws assume a constant ion composition, in this case pure O^+.

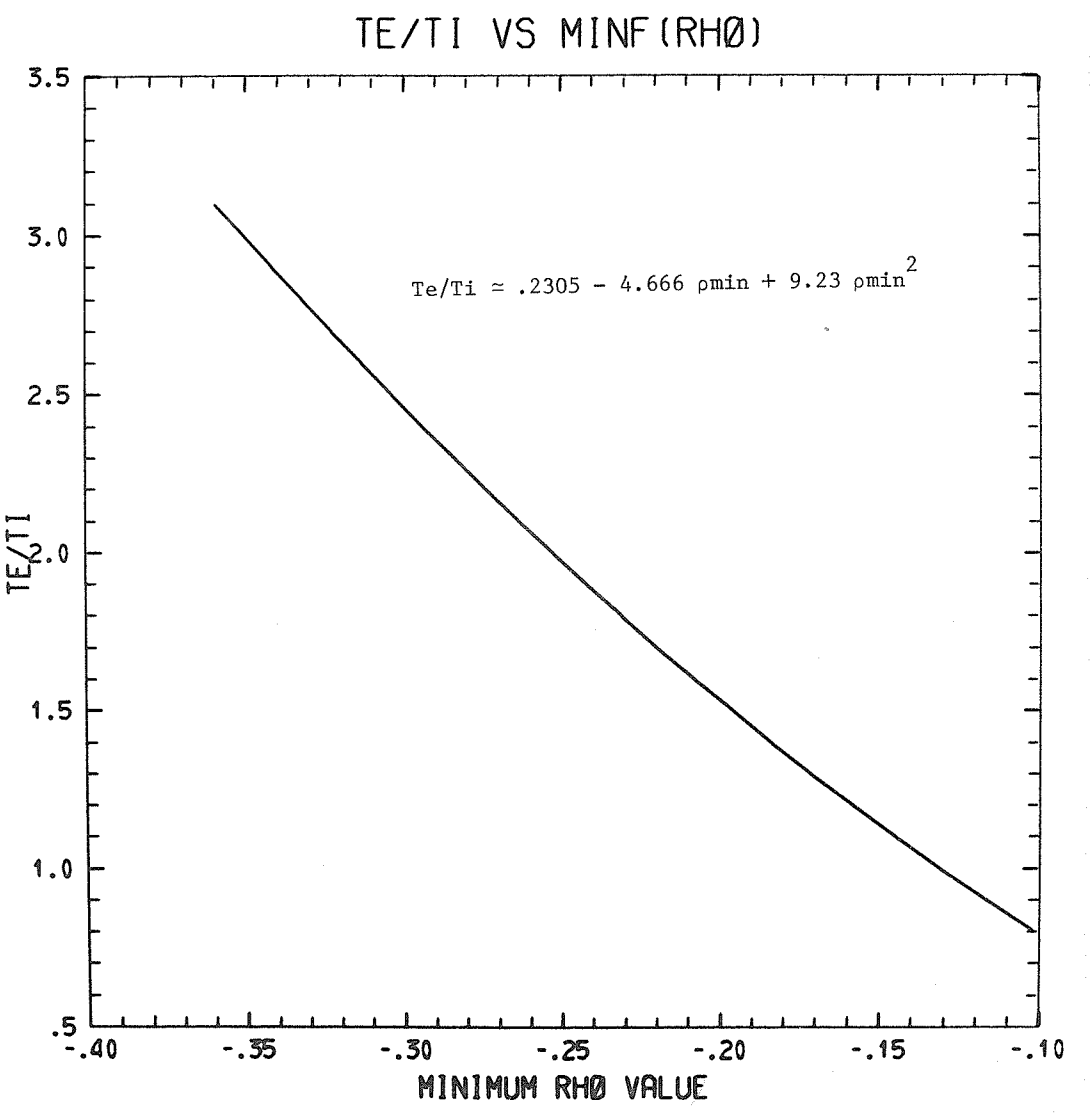


Fig. 2. Te/Ti plotted as a function of ρmin (the minimum value of the autocorrelation function). The quadratic equation gives Te/Ti to two decimal places.

With these two laws, Te and Te/Ti may be found from the autocorrelation data by scaling the value of τ at $\rho = -0.08$ and at ρmin. Alternatively, Te and Te/Ti can be determined by fitting the theoretical curves to the measured values of ρ. The fitting has been done in the present analysis by adjusting the values of Te and Te/Ti until the best fit in a least squares sense is obtained. This method has the advantage of using all the data and so reduces the effects of noise.

Examination of the actual autocorrelation data along with the functions fitted during the analysis can provide valuable insight into the quality of the Te and Ti values found at any particular height and time. Therefore, for each height a plot of measured ρ's versus τ and the corresponding best-fitting function, when actually found, is included on the microfilm. A rather compact format was used to enable easy visual comparison of data from one height to the next. A sample frame is shown in Figure 3.

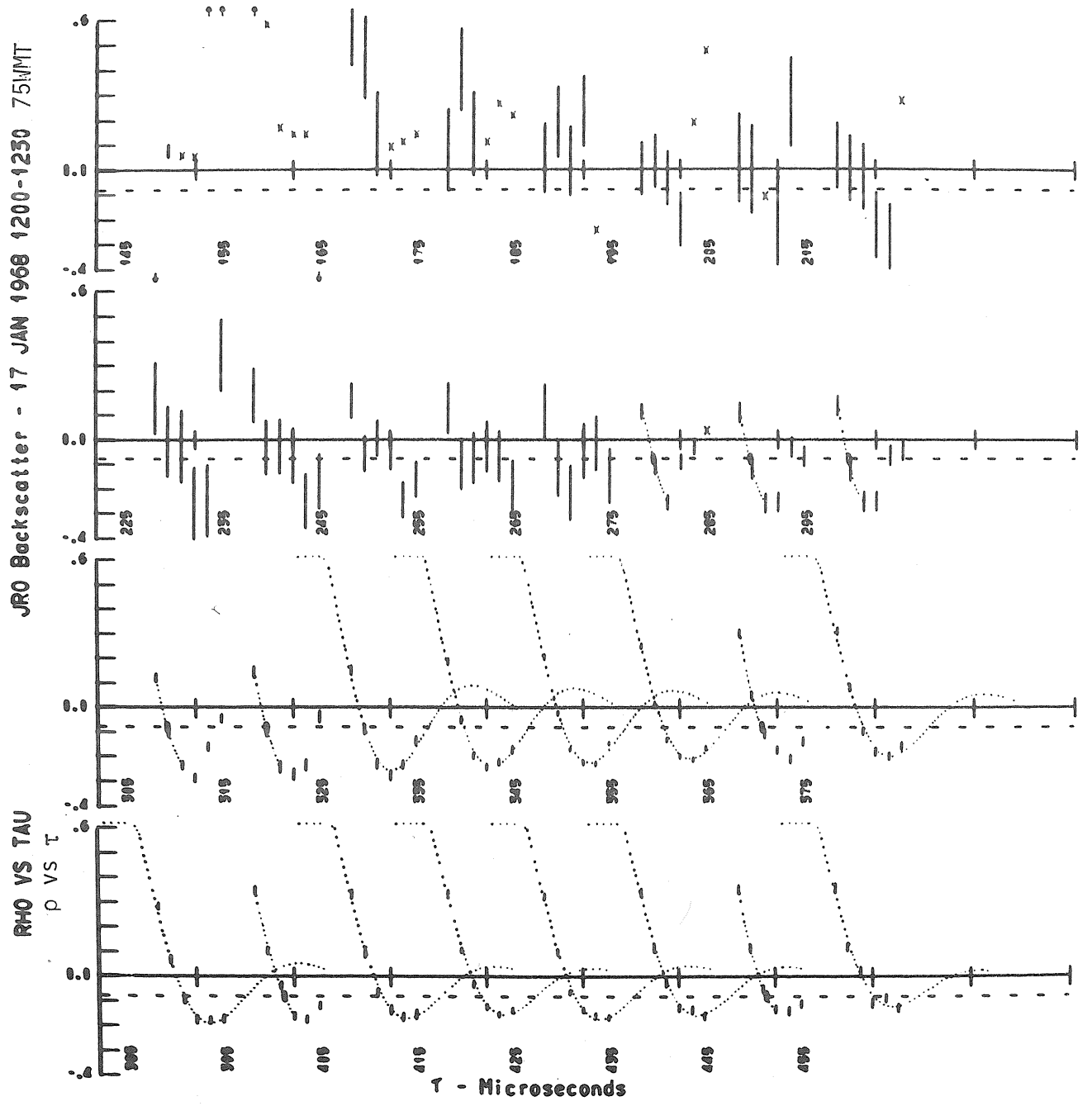


Fig. 3. A sample microfilm frame presenting the autocorrelation function found by the analysis program using the raw data and the best fitting functions. Data for 32 heights are given on each frame. This frame, for 17 Jan., 1968, 1200-1230 (75° W time), presents data for heights between 145 and 455 km in 10 kilometer steps. A much more detailed explanation of this Figure is given in the text.

Figure 3 presents data taken on 17 January 1968 during an integration from 1200 to 1230 hours (75°W time), as indicated by the title along the left margin. The Figure looks very complex because data for 32 heights are presented in overlapping form beginning with a height of 145 km and increasing in 10 km increments to 455 km. This complexity can be avoided by examining one feature at a time. Consider the bottom row of the Figure. The ordinate is the ρ axis, ranging from -0.4 to +0.6, and the abscissa is the τ axis, with a tick every 1000 μs. Each tick mark also denotes $\tau = 0$ for the height printed sideways, below and to the right of the tick. Each measured value of ρ is plotted as a vertical bar centered on the measured value and extending $\pm \sigma$ ($\pm$ one standard deviation). The sinuous, dotted curves in the plots for 385, 405, 415, 425, 435, and 455 km are the theoretical autocorrelation functions that best fit the measured values of ρ. The flattened part of each curve from 0 to 300 μs is a result of an imposed plot limit just above $\rho = 0.6$; the actual curves in this region are as shown in Figure 1.

Often an autocorrelation function could not be fitted because of some deficiency in the data. If the deficiency was only a lack of data about the first negative loop, a partial analysis was carried out. A parabola was fitted by least squares to all the points up to and including the first point whose value of ρ was ≤ -0.08. Then the value of τ where this parabola intersects the $\rho = -0.08$ line (the dashed line below and parallel to the τ axis inserted for ease in reading values) was used to obtain Te. This parabola, when used, is plotted through the data points as a dotted curve, and the point of intersection is indicated by a circle (e.g., at heights 395 and 445 km in Figure 3). When even this partial analysis could not be completed, only the data bars are plotted, as for the first 13 heights (145-265 km) in Figure 3.

In the first row of Figure 3 some of the measured ρ's are plotted using other symbols. The x's seen throughout the data in the first eight heights (145-215 km) indicate points that have been rejected because the space-time geometry of the JRO configuration implies a high probability of contamination by strong echoes from the equatorial electrojet or by a succeeding pulse. The up and down arrow symbols ($\uparrow$ $\downarrow$) are used for data points that exceed the -0.4 to +0.6 plotter range for ρ, which was imposed to avoid confusion with other data.

The ρ values as used in this analysis and presented on the microfilm have been adjusted in a manner that must be discussed in some detail. When the preliminary Te and Ti values were plotted, it was noticed that at night the ratio Te/Ti was usually less than unity by a significant factor which was statistically independent of height. If this were true, it would require a large heat input to the ion gas with a special height dependence. Since in the nighttime equatorial F2 layer there is not known to be any large heat input with the required height dependence, we have assumed that this effect was caused by systematic errors.

In order to study these systematic errors, we first restricted our attention to data taken between 1900 and 0300 hours (75° W time) since earlier evening data and later morning data often seemed to be in a transition state between day and nighttime conditions. Heights between 300 and 400 km only were considered in order to reduce the possibility of composition effects. The median Te/Ti, denoted (Te/Ti)med, within this height range was found for each integration, and the results were plotted versus time.

Examination of this graph showed periods when the Te/Ti bias seemed to be constant except for statistical fluctuations. For each of these periods the factor RF (ρ Factor) by which the ρ values should be divided so that the median of the (Te/Ti)med's would become 1.0 was calculated. A graph of the RF values versus date is shown in Figure 4.

This normalization method changes Ti much more than Te, because ρmin is changed inversely as RF but τ at $\rho = -0.08$ is changed very little. Indeed, the changes in Te are usually within the estimated standard deviation of Te, although Te always decreases for RF ≥ 1, and vice versa.

This method obviously provides only a first-order correction of Te/Ti. During some periods there was no nighttime data suitable for a determination of RF. For this reason the last two months of 1966 data and the first two and one-half months of 1967 data had to be assigned the mean RF value (namely, 0.9) of all of the other data. The periods when the nighttime values of Te/Ti were obtained are indicated at the bottom of Figure 4. Furthermore, the statistical fluctuations about (Te/Ti)med over the periods for which each RF was determined are not negligible. Therefore, in some studies the user may wish to renormalize Te/Ti according to a physical model of temperature structure. This can be done approximately by changing the RF for each profile or set of profiles, with the aid of Equation (1). Unless the change in RF is large, the changes in Te are negligible, that is, all of the changes in Te/Ti can be attributed to changes in Ti.

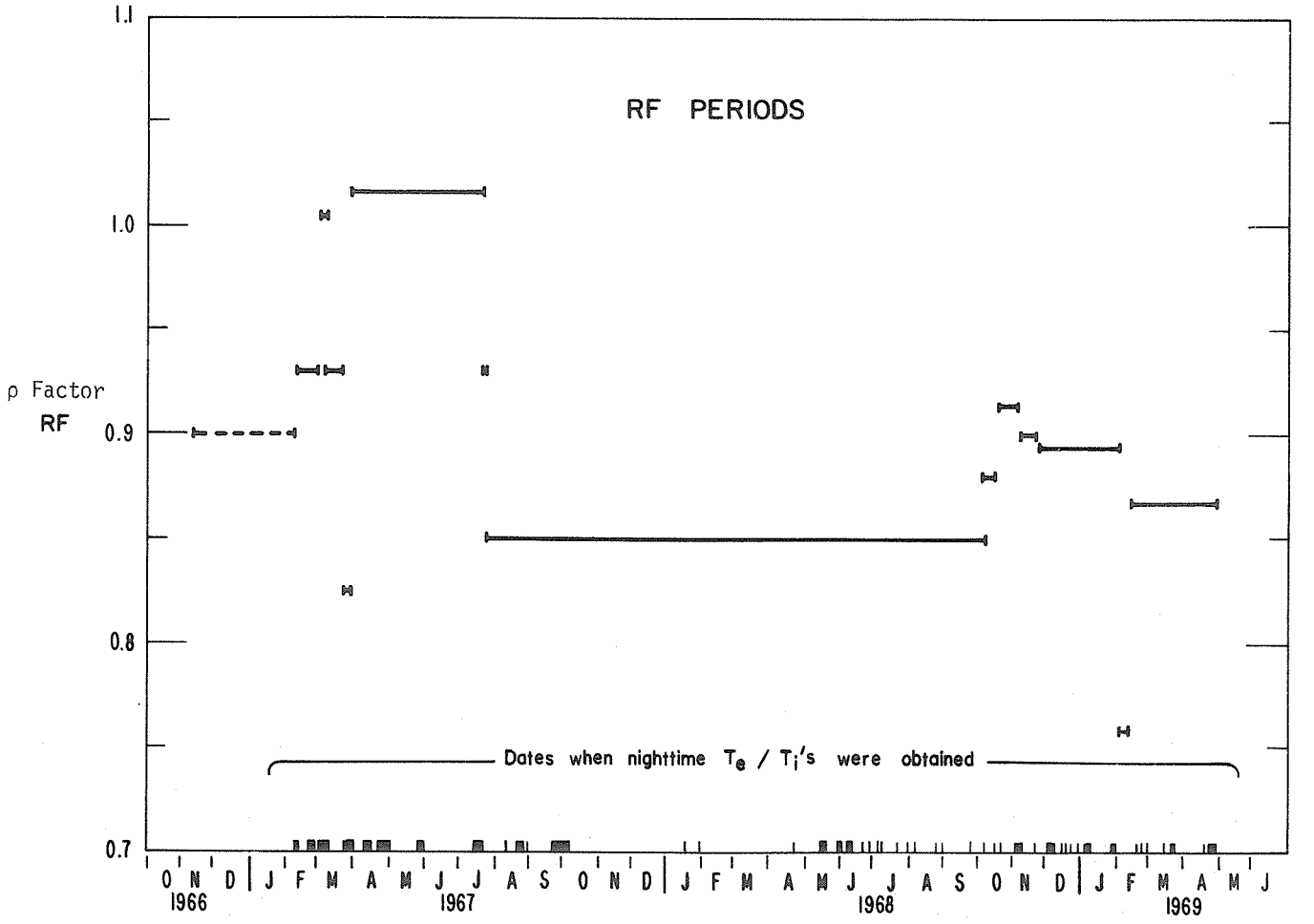


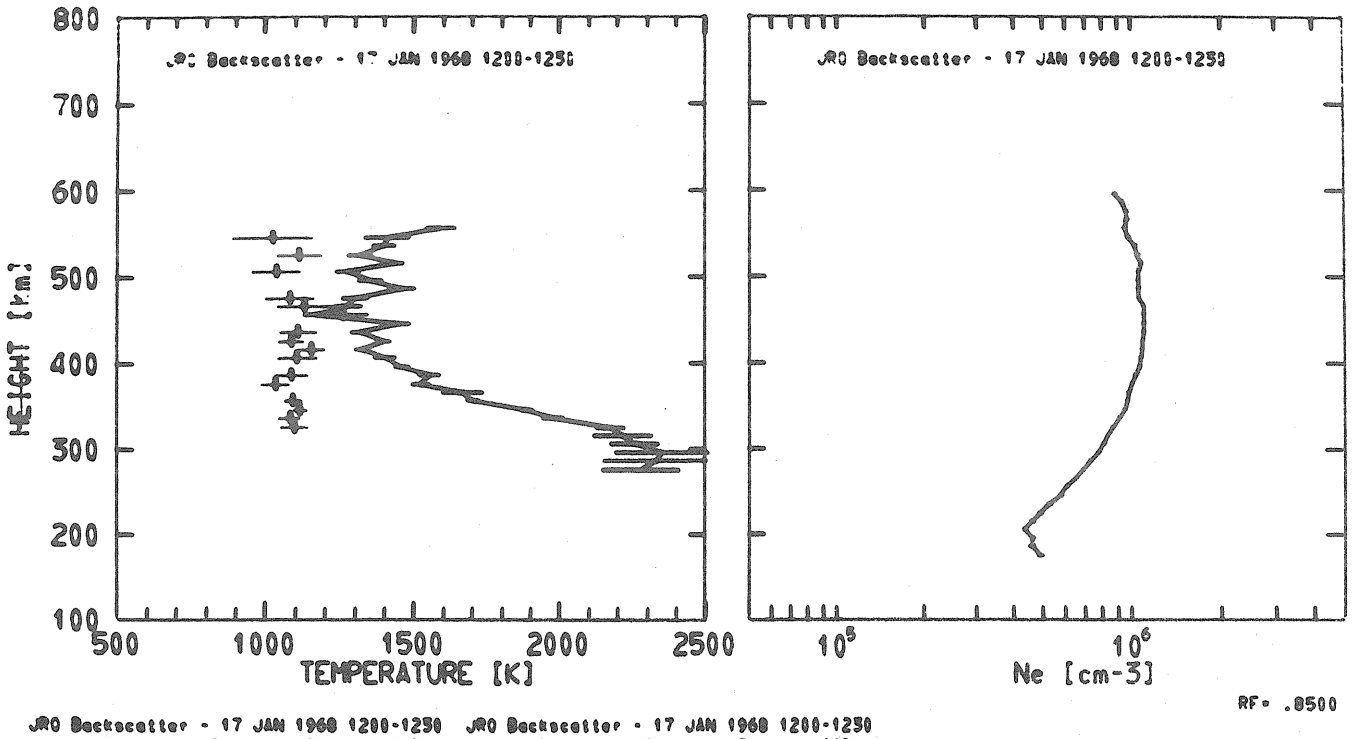
Fig. 4. The RF divisor values applied to the ρ's plotted over the periods of their use. The periods when nighttime Te/Ti values were obtained and used in the determination of RF are indicated at the bottom of the graph. The mean RF value of 0.9 was used until 11 February 1967. The process used to determine RF is described in the text.

Format of Archived Data

An example of the graphical and tabular data as it appears on the microfilm is shown in Figure 5. The electron concentration data is presented in the upper right graph and in the second column of the table, labeled Ne. The calculated standard deviation of Ne resulting from the differentiation of the Faraday angle is shown as a horizontal bar on the graph (too small to be visible in this example) and in the first ε column, just to the right of the Ne column. It must be emphasized that ε is only the standard deviation due to statistical errors, and that the accuracy of Ne can also be affected by systematic errors. In general, rapid variations of Ne with either height or time must be treated with caution. For example, in Figure 5 the rapid increase of Ne with decreasing altitude below 205 km is a systematic error caused by strong scatter from field-aligned irregularities in the E region. At night, when spread-F irregularities are also often present, this kind of error can extend to greater heights, Certain other systematic errors are caused by imperfections in the detectors, particularly at the greatest altitudes where the signal-to-noise ratio is small. Such imperfections probably cause the weak sinusoidal variation in Ne from about 450 to 600 km in Figure 5.

The Te and Ti data are presented in the upper left graph and in columns four and six, respectively, in the table. On the graph, the Te points are connected by a solid line and the Ti points are denoted by circles. The estimated standard deviations resulting from statistical errors in the measured values of ρ are shown as horizontal bars on the graph and are listed in the respective ε columns (i.e., columns five and seven) in the table. The column labeled ICD is a diagnostic code used in the analysis program and can be ignored.

The original magnetic tape archived in the data center is a 9-track, 1600 phase encoded binary tape. A detailed description of the format is available upon request from WDC-A, and other types of tapes (such as 7-track binary) may be made available. The tape contains all the Ne, Te, and Ti results, but does not contain the autocorrelation function data from which they were obtained.



JRO Backscatter - 17 JAN 1968 1200-1250

Ht	Ne x10(5)	ε	Te	ε	Ti	ε	ICD
145	0.00	0.00	0	0	0	0	814
155	0.00	0.00	0	0	0	0	814
165	0.00	0.00	0	0	0	0	114
175	4.93	.14	0	0	0	0	110
185	4.62	.12	0	0	0	0	110
195	4.64	.07	0	0	0	0	110
205	4.56	.04	0	0	0	0	110
215	4.64	.09	0	0	0	0	110
225	4.93	.11	0	0	0	0	110
235	5.31	.11	0	0	0	0	110
245	5.77	.10	0	0	0	0	110
255	6.06	.06	0	0	0	0	110
265	6.50	.01	0	0	0	0	110
275	6.85	.04	2278	195	0	0	40
285	7.25	.04	2551	180	0	0	40
295	7.72	.04	2562	165	0	0	40
305	8.06	.04	2256	85	0	0	40
315	8.53	.05	2215	105	0	0	40
325	8.85	.05	2175	51	1097	48	0
335	9.08	.05	1979	38	1081	40	0
345	9.40	.06	1886	21	1114	24	0
355	9.67	.06	1700	25	1090	51	0
365	9.79	.04	1666	71	0	0	40
375	10.06	.06	1522	55	1052	55	0
385	10.35	.10	1584	57	1086	57	0
395	10.64	.09	1457	28	0	0	40
405	10.75	.08	1405	30	1107	60	0
415	10.84	.07	1522	25	1154	47	0

JRO Backscatter - 17 JAN 1968 1200-1250

Ht	Ne x10(5)	ε	Te	ε	Ti	ε	ICD
425	10.89	.08	1390	25	1087	44	0
435	10.99	.10	1319	55	1112	64	0
445	10.98	.12	1449	38	0	0	40
455	10.96	.12	1175	45	1262	89	0
465	10.93	.10	1276	49	1152	96	0
475	10.57	.09	1303	44	1081	85	0
485	10.58	.10	1461	44	0	0	40
495	10.49	.05	1383	42	0	0	40
505	10.57	.06	1275	45	1057	85	0
515	10.01	.07	1490	51	0	0	40
525	10.46	.16	1317	42	1116	80	0
535	10.25	.15	1400	38	0	0	40
545	9.75	.15	1411	79	1026	159	0
555	9.46	.15	1592	52	0	0	40
565	9.65	.15	0	0	0	0	110
575	9.57	.11	0	0	0	0	110
585	9.52	.08					990
595	8.80	.11					990
605	0.00	0.00					994
615	0.00	0.00					994

Fig. 5. Te and Ti are plotted against height in the graph at the upper left. Te is plotted using connected error bars (± one standard deviation) while Ti is plotted using circles intersected with error bars. Ne is plotted against the same height scale in the graph at the upper right, using connected error bars. The table in the lower part of the Figure presents the same information in tabular form. Zero values indicate that no results were obtained. The ε column gives the estimated standard deviation of the parameter in the column just to the left, in the same units. The "ICD" column contains a computer diagnostic code and may be ignored.

Catalog

Values of Ne, Te, and Ti (normalized as discussed above) along with their associated dates, times and heights and estimated errors are archived at WDC-A on magnetic tape and microfilm. Table 1 is a catalog of the observing periods during which measurements were made. Within each observing period there are one or more radar integrations, each of which is an average of several thousand samples received over 5 to 10 minutes during sunrise, 15 to 30 minutes in the daytime, and 15 to 45 minutes at night. The integrations are usually contiguous in time, but occasionally there are gaps caused by operational difficulties. There are a few time discontinuities on the tape, resulting from integrations being entered on the magnetic tape in non-chronological order. The times written on the magnetic tape and microfilm are correct. Approximately 1600 hours of radar data were analyzed.

Reliability of the Data

The reliability of the present data for any particular aeronomical study can be determined only by careful consideration of the statistical and systematic errors described in this report. The Ne data should be adequate for any study consistent with the statistical errors. On the other hand, the limitation to regions of nearly pure O^+ and the normalization of Te/Ti are especially important to the accuracy of the temperature measurements. Judgment of the adequacy of the data for any particular study or of the correctness of a renormalization procedure must, of course, be the responsibility of the user.

Acknowledgements

We thank A. S. Oldfather and R. H. Winkler for their very significant contributions in the preparation of these data for analysis and we acknowledge the long term efforts of R. Cohen, D. T. Farley, Jr., J. L. Green, D. L. Sterling and the staff of the Jicamarca Radar Observatory in making these measurements. The Jicamarca Radar Observatory was a joint operation of the Instituto Geofísico del Peru and the Environmental Sciences Services Administration (ESSA), a predecessor of NOAA. The research at Jicamarca was partially supported by the National Aeronautical and Space Administration (NASA) Fund Transfer R-06-012-008. The National Center for Atmospheric Research (NCAR), which is sponsored by the National Science Foundation, granted the computer time used for the analyses.

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TABLE 1

CATALOG OF NE, TE AND TI MEASUREMENTS AT JICAMARCA RADAR OBSERVATORY

TIME INTERVAL COVERED					NO. OF
YEAR	DATE	75WMT	DATE	75WMT	PROFILES
1966	NOV 11,	0422 TO NOV 11,	1915		50
	NOV 12,	0315 TO NOV 12,	1215		55
	NOV 13,	0530 TO NOV 13,	1145		29
	NOV 14,	1640 TO NOV 16,	0605		121
	DEC 1,	1210 TO DEC 2,	0430		45
	DEC 2,	0835 TO DEC 2,	1130		7
	DEC 7,	1506 TO DEC 7,	1635		2
	DEC 9,	1353 TO DEC 9,	1619		3
	DEC 12,	0912 TO DEC 12,	1240		5
	DEC 13,	1715 TO DEC 14,	0930		50
	DEC 14,	1500 TO DEC 14,	1600		3
	DEC 15,	1830 TO DEC 15,	2300		7
	DEC 16,	1615 TO DEC 17,	0300		20
	DEC 19,	1745 TO DEC 20,	0315		20
	DEC 20,	1645 TO DEC 20,	1845		5
	DEC 21,	1625 TO DEC 22,	0245		22
	DEC 22,	1430 TO DEC 22,	1830		10
1967	JAN 2,	1400 TO JAN 2,	1800		9
	JAN 3,	1036 TO JAN 3,	1530		6
	JAN 3,	1900 TO JAN 4,	0330		10
	JAN 4,	1015 TO JAN 5,	0215		20
	JAN 5,	1020 TO JAN 6,	0145		19
	JAN 6,	1410 TO JAN 6,	1845		8
	JAN 10,	1036 TO JAN 10,	2000		145
	JAN 11,	1555 TO JAN 12,	0245		17
	JAN 12,	1745 TO JAN 13,	0245		14
	JAN 13,	1104 TO JAN 14,	0145		25
	JAN 14,	0922 TO JAN 15,	0245		31
	JAN 15,	0830 TO JAN 16,	0245		34
	JAN 19,	1030 TO JAN 20,	0300		29
	JAN 20,	1425 TO JAN 20,	1430		2
	JAN 20,	1800 TO JAN 21,	0300		14
	JAN 22,	1325 TO JAN 22,	2025		84
	JAN 23,	1520 TO JAN 24,	0300		20
	JAN 24,	1022 TO JAN 24,	2200		23
	JAN 25,	0300 TO JAN 25,	0300		1
	JAN 31,	1903 TO JAN 31,	1926		3
	JAN 31,	2200 TO FEB 1,	0840		22
	FEB 2,	0300 TO FEB 2,	1045		27
	FEB 7,	1330 TO FEB 8,	0400		24
	FEB 8,	0930 TO FEB 9,	0500		30
	FEB 9,	0845 TO FEB 9,	1100		8
	FEB 10,	1000 TO FEB 11,	0500		30
	FEB 16,	1015 TO FEB 17,	0245		29
	FEB 17,	0845 TO FEB 18,	0530		44
	FEB 21,	1545 TO FEB 21,	1700		4
	FEB 22,	1130 TO FEB 22,	1505		9
	FEB 23,	0905 TO FEB 23,	0950		4
	FEB 23,	1200 TO FEB 24,	0330		31
	FEB 24,	0830 TO FEB 24,	1315		11
	FEB 24,	1600 TO FEB 25,	0200		16
	FEB 27,	1200 TO FEB 27,	1230		2
	FEB 28,	1130 TO FEB 28,	1230		2
	MAR 1,	0915 TO MAR 1,	1757		120
	MAR 3,	0900 TO MAR 3,	0900		1
	MAR 3,	1145 TO MAR 3,	1330		4
	MAR 3,	1600 TO MAR 4,	0345		25
	MAR 6,	1215 TO MAR 6,	1230		2
	MAR 7,	0930 TO MAR 7,	1230		8
	MAR 22,	1400 TO MAR 22,	1700		6
	MAR 22,	2030 TO MAR 22,	2030		1
	MAR 23,	1100 TO MAR 23,	2230		13
	MAR 24,	0100 TO MAR 24,	0100		1
	MAR 27,	1045 TO MAR 27,	1700		48
	MAR 29,	1400 TO MAR 29,	1400		1
	MAR 29,	1630 TO MAR 29,	1800		2
	MAR 30,	1530 TO MAR 31,	0330		24
	MAR 31,	1145 TO MAR 31,	1230		3
	APR 5,	1000 TO APR 5,	1730		15
	APR 12,	1430 TO APR 13,	0330		27
	APR 13,	1030 TO APR 14,	0115		33
	APR 14,	1115 TO APR 14,	1445		8

TIME INTERVAL COVERED					NO. OF
YEAR	DATE	75WMT	DATE	75WMT	PROFILES
1967	APR 14,	2145 TO APR 15,	0245		16
	APR 16,	1035 TO APR 16,	1220		8
	APR 17,	1200 TO APR 17,	1330		4
	APR 20,	1345 TO APR 20,	1500		3
	APR 21,	1330 TO APR 21,	2100		15
	APR 25,	0100 TO APR 25,	0415		7
	APR 25,	1215 TO APR 25,	1500		6
	APR 26,	1845 TO APR 26,	2130		6
	APR 27,	0130 TO APR 27,	0330		5
	APR 27,	1210 TO APR 28,	0300		25
	APR 30,	1900 TO APR 30,	2330		10
	MAY 1,	1900 TO MAY 1,	2230		14
	MAY 2,	1020 TO MAY 2,	1605		13
	MAY 3,	1130 TO MAY 3,	1315		4
	MAY 3,	1530 TO MAY 3,	1615		3
	MAY 12,	0000 TO MAY 12,	0530		19
	MAY 12,	1115 TO MAY 12,	1505		33
	MAY 16,	1600 TO MAY 16,	1615		2
	MAY 24,	1150 TO MAY 25,	0330		35
	MAY 25,	1045 TO MAY 25,	2100		29
	MAY 26,	0030 TO MAY 26,	0200		4
	MAY 26,	0920 TO MAY 26,	1715		13
	MAY 27,	1645 TO MAY 27,	2330		15
	MAY 29,	1210 TO MAY 29,	1800		109
	MAY 30,	1200 TO MAY 30,	1800		100
	MAY 31,	0118 TO MAY 31,	0130		2
	MAY 31,	0415 TO MAY 31,	0445		3
	MAY 31,	0815 TO MAY 31,	0930		3
	MAY 31,	1645 TO MAY 31,	1845		6
	MAY 31,	2230 TO JUN 1,	0345		7
	JUN 1,	1035 TO JUN 1,	1035		1
	JUN 1,	1345 TO JUN 1,	1400		2
	JUN 1,	1645 TO JUN 1,	1700		2
	JUN 2,	1100 TO JUN 2,	1100		1
	JUN 2,	1515 TO JUN 2,	1600		2
	JUN 8,	1122 TO JUN 8,	1225		2
	JUN 8,	1545 TO JUN 8,	1545		1
	JUN 9,	1545 TO JUN 9,	1545		1
	JUN 12,	0910 TO JUN 12,	0945		2
	JUN 16,	1500 TO JUN 16,	1808		6
	JUN 22,	1530 TO JUN 22,	2315		17
	JUN 24,	1315 TO JUN 24,	1415		3
	JUN 24,	1715 TO JUN 24,	1945		9
	JUN 27,	1145 TO JUN 27,	1215		3
	JUL 6,	1100 TO JUL 6,	1600		9
	JUL 7,	0950 TO JUL 7,	1550		13
	JUL 11,	2300 TO JUL 11,	2300		1
	JUL 12,	0200 TO JUL 12,	0400		2
	JUL 13,	0405 TO JUL 13,	0405		1
	JUL 13,	0725 TO JUL 13,	0725		1
	JUL 13,	1550 TO JUL 13,	1550		1
	JUL 17,	1400 TO JUL 20,	0750		149
	JUL 21,	0400 TO JUL 21,	0400		1
	JUL 21,	0800 TO JUL 21,	0800		1
	JUL 24,	2305 TO JUL 24,	2305		1
	JUL 25,	2000 TO JUL 26,	0800		33
	JUL 31,	0920 TO JUL 31,	0940		2
	JUL 31,	1630 TO JUL 31,	1730		2
	AUG 1,	2230 TO AUG 2,	0200		7
	AUG 2,	0500 TO AUG 2,	0915		12
	AUG 2,	1615 TO AUG 3,	1200		40
	AUG 7,	2040 TO AUG 7,	2040		1
	AUG 9,	2330 TO AUG 9,	2330		1
	AUG 10,	1500 TO AUG 11,	0115		19
	AUG 11,	0935 TO AUG 12,	0750		52
	AUG 14,	1300 TO AUG 17,	1030		157
	AUG 17,	2311 TO AUG 17,	2311		1
	AUG 23,	1145 TO AUG 23,	1515		5
	AUG 28,	1745 TO AUG 29,	1200		48
	AUG 29,	1510 TO AUG 31,	0900		104
	SEP 1,	1450 TO SEP 1,	1940		59
	SEP 5,	1845 TO SEP 6,	0100		16

TABLE 1 (CONT'D)

CATALOG OF NE, TE AND TI MEASUREMENTS AT JICAMARCA RADAR OBSERVATORY

TIME INTERVAL COVERED					
YEAR	DATE	75WMT	DATE	75WMT	NO. OF PROFILES
1967	SEP 7,	1815	TO SEP 8,	0100	18
	SEP 8,	1428	TO SEP 8,	1645	3
	SEP 12,	1700	TO SEP 13,	0930	36
	OCT 10,	1228	TO OCT 12,	0800	105
	OCT 12,	1200	TO OCT 12,	1230	2
	OCT 24,	1600	TO OCT 24,	2345	16
	OCT 26,	1645	TO OCT 26,	2345	13
	OCT 28,	1700	TO OCT 28,	2300	14
	OCT 30,	1555	TO OCT 30,	1555	1
	NOV 3,	0515	TO NOV 3,	0830	7
	NOV 16,	1115	TO NOV 16,	1400	5
	NOV 16,	1740	TO NOV 16,	2300	10
	NOV 17,	0500	TO NOV 17,	0715	4
	NOV 17,	1245	TO NOV 17,	1245	1
	NOV 20,	1535	TO NOV 20,	1535	1
	NOV 23,	0850	TO NOV 25,	0800	180
	NOV 28,	1815	TO NOV 29,	0130	19
	NOV 29,	0830	TO NOV 29,	0918	2
	NOV 29,	1215	TO NOV 29,	1245	2
	NOV 29,	1745	TO NOV 29,	2300	20
	DEC 12,	1140	TO DEC 12,	1230	3
	DEC 12,	1750	TO DEC 13,	0330	23
	DEC 13,	1845	TO DEC 13,	1945	5
	DEC 18,	1300	TO DEC 19,	2300	84
	DEC 21,	1200	TO DEC 21,	1300	3
	DEC 26,	1200	TO DEC 26,	1300	3
	DEC 27,	1145	TO DEC 27,	1415	6
	DEC 29,	1200	TO DEC 29,	1330	4
1968	JAN 2,	1145	TO JAN 2,	1330	5
	JAN 3,	1200	TO JAN 3,	1230	2
	JAN 4,	1200	TO JAN 4,	1300	3
	JAN 16,	0930	TO JAN 16,	1330	9
	JAN 16,	1625	TO JAN 17,	2345	71
	JAN 28,	2220	TO JAN 28,	2300	3
	FEB 22,	1200	TO FEB 22,	2330	28
	MAR 13,	0855	TO MAR 13,	1330	8
	MAR 13,	1600	TO MAR 14,	0800	53
	APR 2,	1830	TO APR 3,	0830	48
	APR 3,	1400	TO APR 4,	0815	55
	APR 23,	1215	TO APR 24,	0800	40
	APR 24,	1200	TO APR 24,	1300	3
	APR 24,	1645	TO APR 24,	2357	21
	APR 25,	0200	TO APR 25,	0800	17
	APR 26,	0130	TO APR 26,	0800	20
	APR 29,	2215	TO APR 30,	0300	10
	APR 30,	1645	TO APR 30,	2345	20
	MAY 2,	0100	TO MAY 2,	0400	6
	MAY 15,	1745	TO MAY 16,	0745	22
	MAY 16,	1345	TO MAY 16,	1405	3
	MAY 17,	0930	TO MAY 18,	0745	41
	JUN 5,	1230	TO JUN 6,	1430	44
	JUN 11,	0945	TO JUN 12,	0830	44
	JUN 20,	1250	TO JUN 21,	1500	54
	JUN 24,	1030	TO JUN 24,	1200	5
	JUN 24,	1630	TO JUN 24,	2245	13
	JUN 25,	1245	TO JUN 26,	1550	67
	JUL 1,	1245	TO JUL 1,	1300	2
	JUL 8,	1645	TO JUL 8,	1705	2
	JUL 9,	0800	TO JUL 10,	1630	69
	JUL 11,	1500	TO JUL 11,	1500	1
	JUL 12,	1440	TO JUL 12,	1440	1
	JUL 16,	1515	TO JUL 16,	1530	2
	JUL 17,	1220	TO JUL 17,	1250	2
	JUL 22,	1300	TO JUL 22,	1450	4
	JUL 23,	1100	TO JUL 23,	1300	5

TIME INTERVAL COVERED					
YEAR	DATE	75WMT	DATE	75WMT	NO. OF PROFILES
1968	JUL 23,	1615	TO JUL 24,	0745	32
	JUL 24,	1145	TO JUL 24,	2345	23
	JUL 30,	0800	TO JUL 31,	0730	52
	AUG 6,	1630	TO AUG 7,	1600	56
	AUG 8,	1415	TO AUG 8,	1430	2
	AUG 9,	1200	TO AUG 9,	1230	3
	AUG 26,	1650	TO AUG 26,	2300	16
	AUG 27,	2145	TO AUG 28,	1530	42
	SEP 3,	1620	TO SEP 4,	0830	36
	SEP 4,	1430	TO SEP 5,	1500	58
	SEP 13,	1200	TO SEP 13,	1315	3
	SEP 23,	1330	TO SEP 23,	1530	4
	SEP 23,	1845	TO SEP 24,	0900	33
	OCT 7,	1330	TO OCT 7,	1745	9
	OCT 8,	1132	TO OCT 9,	1607	57
	OCT 15,	1605	TO OCT 16,	0200	30
	OCT 16,	1515	TO OCT 17,	0200	34
	OCT 18,	1240	TO OCT 18,	1610	21
	OCT 21,	1100	TO OCT 21,	1435	19
	OCT 21,	1720	TO OCT 22,	0800	47
	OCT 22,	1130	TO OCT 22,	1200	2
	OCT 22,	1630	TO OCT 23,	0345	36
	OCT 31,	1315	TO NOV 1,	1200	58
	NOV 1,	1405	TO NOV 1,	2345	22
	NOV 2,	0200	TO NOV 5,	0600	170
	NOV 5,	1015	TO NOV 6,	0500	43
	NOV 6,	1230	TO NOV 6,	1250	2
	NOV 6,	1530	TO NOV 6,	2330	15
	NOV 19,	1110	TO NOV 21,	0615	97
	DEC 3,	1245	TO DEC 3,	2045	20
	DEC 3,	2300	TO DEC 4,	1545	40
	DEC 16,	1545	TO DEC 16,	2133	11
	DEC 17,	0930	TO DEC 17,	1100	3
	DEC 17,	1400	TO DEC 18,	0800	45
	DEC 18,	1130	TO DEC 18,	1300	4
	DEC 20,	1515	TO DEC 21,	0000	29
	DEC 23,	1640	TO DEC 24,	0015	23
	DEC 27,	1530	TO DEC 27,	2345	18
	DEC 30,	1405	TO DEC 30,	1405	1
	DEC 30,	1730	TO DEC 30,	2345	15
1969	JAN 7,	0700	TO JAN 7,	1003	6
	JAN 7,	1330	TO JAN 8,	0800	41
	JAN 28,	1020	TO JAN 28,	1100	3
	JAN 28,	1345	TO JAN 29,	0800	42
	JAN 29,	1120	TO JAN 30,	0800	53
	FEB 17,	1530	TO FEB 19,	1130	105
	FEB 24,	1302	TO FEB 24,	1323	2
	FEB 26,	0830	TO FEB 28,	0330	102
	FEB 28,	1145	TO FEB 28,	1230	3
	MAR 4,	1715	TO MAR 6,	0800	93
	MAR 17,	1645	TO MAR 18,	1100	62
	MAR 18,	1650	TO MAR 19,	0900	62
	MAR 19,	1640	TO MAR 20,	0900	60
	MAR 25,	1145	TO MAR 26,	0830	54
	MAR 27,	1315	TO MAR 27,	1600	4
	APR 3,	0945	TO APR 3,	1100	5
	APR 10,	1805	TO APR 10,	2345	24
	APR 11,	1920	TO APR 11,	2245	14
	APR 12,	2020	TO APR 12,	2230	10
	APR 13,	2040	TO APR 13,	2345	14
	APR 14,	2030	TO APR 14,	2315	12
	APR 15,	1845	TO APR 15,	2345	21
	APR 16,	2045	TO APR 16,	2230	8
	APR 22,	1620	TO APR 24,	1500	115
	APR 28,	1400	TO APR 29,	1130	50

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