

CRPL-F52

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IONOSPHERIC DATA

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PREPARED BY CENTRAL RADIO PROPAGATION LABORATORY
National Bureau of Standards
Washington, D.C.



IONOSPHERIC DATA

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TERMINOLOGY AND SCALING PRACTICES

The symbols and terminology used in this report are those adopted by the International Radio Propagation Conference, and given in detail on pages 24 to 26 of the report IRPL-C61, "Report of International Radio Propagation Conference," and in the section on "Terminology" in report IRPL-F5.

Beginning with IRPL-F14 the symbol L, defined as follows, is used in detailed tabulations of hourly values of ionosphere characteristics observed at Washington:

L or l = critical frequency, muf, or muf factor for F1 layer omitted because no definite and abrupt change in slope of the h'f curve occurs either for the first reflection or for any of the multiples.

In the past, ionospheric conditions were summarized on a monthly basis by using average or mean values for each hour of the day for each month. However, following the recommendations of the International Radio Propagation Conference, held in Washington April 17 to May 5, 1944, beginning with data for January 1, 1945, median values are published wherever possible.

Where averages are reported, they are, at any hour, the average for all the days during the month for which numerical data exist.

The monthly median values used here are the values equaled or exceeded on half the days of the month at the given hour. The following conventions are used in determining the medians for hours when no measured values are given because of equipment limitations and ionospheric irregularities. Symbols used are those given in the report referred to above, IRPL-C61.

a. For all ionospheric characteristics:

Values missing because of A, B, C, or F (see terminology referred to above) are omitted from the median count.

b. For critical frequencies and virtual heights:

Values of f^oF2 (and f^oE near sunrise and sunset) missing because of E are counted as equal to or less than the lower limit of the recorder. Values of h^iF2 (and h^iE near sunrise and sunset) missing for this reason are counted as equal to or greater than the median. Other characteristics missing because of E are omitted from the median count. See CRPL-F38, page 9.

Values missing because of D are counted as equal to or greater than the upper limit of the recorder.

Values missing because of G are counted:

1. For f^oF2 , as equal to or less than f^oF1 .
2. For h^iF2 , as equal to or greater than the median.

Values missing for any other reason are omitted from the median count.

c. For muf factors (M-factors):

Values missing because of G are counted as equal to or less than the median.

Values missing for any other reason are omitted from the median count.

d. For sporadic E (Es):

Values of f^cEs missing because no Es reflections appeared, the equipment functioning normally otherwise, are counted as equal to or less than the median f^cE, or equal to or less than the lower frequency count of the recorder.

Values of f^cEs missing for any other reason, and values of hEs missing for any reason at all are omitted from the median count.

Beginning with data for November 1945, doubtful monthly median values for ionospheric observations at Washington, D. C., are indicated by parentheses, in accordance with the practice already in use for doubtful hourly values. The following are the conventions used to determine whether or not a median value is doubtful:

1. If only four values or less are available, the data are considered insufficient and no median value is computed.

2. For the F2 layer, if only five to nine values are available, the median is considered doubtful. The E and F1 layers are so regular in their characteristics that, as long as there are at least five values, the median is not considered doubtful.

3. For all layers, if more than half of the values used to compute the median are doubtful (either doubtful or interpolated), the median is considered doubtful.

The same conventions are used by the CRPL in computing the medians from tabulations of daily and hourly data for stations other than Washington, beginning with the tables in IRPL-F18.

Beginning with CRPL-F33, an additional group of symbols is used in recording the Washington, D. C., data. The list of additional symbols and their meanings follows:

N - unable to make logical interpretation.

P - trace extrapolated to a critical frequency.

Q - the F1 layer not present as a distinct layer.

R - curve becomes incoherent near the F2 critical frequency.

S - no observation obtainable because of interference.

V - forked record.

Z - triple split near critical frequency.

For a more detailed explanation of the meaning and use of these symbols, see the report CRPL-7-1, "Preliminary Instructions for Obtaining and Reducing Manual Ionospheric Records."

MONTHLY AVERAGE AND MEDIAN VALUES OF WORLD-WIDE IONOSPHERIC DATA

The ionospheric data given here in tables 1 to 38 and figures 1 to 75 were assembled by the Central Radio Propagation Laboratory for analysis and correlation, incidental to CRPL predictions of radio propagation conditions. The data are median values unless otherwise indicated. The following are the sources of the data in this issue:

Australian Council for Scientific and Industrial Research,
Radio Research Board:

Canberra, Australia
Hobart, Tasmania

Canadian Radio Wave Propagation Committee:

Ottawa, Canada
St. John's, Newfoundland

New Zealand Radio Research Committee:

Christchurch, New Zealand (Canterbury University College Observatory)
Rarotonga I.

South African Council for Scientific and Industrial Research:

Capetown, Union of S. Africa

Japanese Physical Institute for Radio Waves (under supervision of
Supreme Commander, Allied Powers):

Fukaura, Japan
Shibata, Japan
Tokyo (Kokobunji), Japan
Wakkanai, Japan
Yamakawa, Japan

United States Army Signal Corps:

Okinawa I.

National Bureau of Standards (Central Radio Propagation Laboratory):

Baton Rouge, Louisiana (Louisiana State University)
Boston, Massachusetts (Harvard University)
Guam I.
Huancayo, Peru (Instituto Geofisico de Huancayo)
Maui, Hawaii
Palmyra I.
San Francisco, California (Stanford University)
San Juan, Puerto Rico (University of Puerto Rico)
Trinidad, British West Indies
Washington, D. C.
White Sands, New Mexico
Wuchang, China (National Wuhan University)

Radio Wave Research Laboratory, Central Broadcasting Administration:

Chungking, China
Lanchow, China
Nanking, China
Peiping, China

National Laboratory of Radio-Electricity (French Ionospheric Bureau):

Bagneux, France

The tables and graphs of ionospheric data are correct for the values reported to the CRPL, but, because of variations in practice in the interpretation of records and scaling and manner of reporting of values, may at times give an erroneous conception of typical ionospheric characteristics at the station. Some of the errors are due to:

- a. Differences in scaling records when spread echoes are present.
- b. Omission of values when f^0F2 is less than or equal to f^0F1 , leading to erroneously high values of monthly averages or median values.
- c. Omission of values when critical frequencies are less than the lower frequency limit of the recorder, also leading to erroneously high values of monthly average or median values.

These effects were discussed on pages 6 and 7 of the previous F-series report IRPL-F5.

The dashed-line prediction curves of the graphs of ionospheric data are obtained from the predicted zero-muf contour charts of the CRPL-D series publications. The following points are worthy of note:

- a. Predictions for individual stations used to construct the charts may be more accurate than the values read from the charts since some smoothing of the contours is necessary to allow for the longitude effect within a zone. Thus, inasmuch as the predicted contours are for the center of each zone, part of the discrepancy between the predicted and observed values as given in the F series may be caused by the fact that the station is not centrally located within the zone.
- b. The final presentation of the predictions is dependent upon the latest available ionospheric and radio propagation data, as well as upon predicted sunspot number.
- c. There is no indication on the graphs of the relative reliability of the data; it is necessary to consult the tables for such information.

The following predicted smoothed 12-month running-average Zurich sunspot numbers were used in constructing the contour charts:

| <u>Month</u> | <u>Predicted Sunspot No.</u> | | | |
|--------------|------------------------------|------|------|------|
| | 1948 | 1947 | 1946 | 1945 |
| December | 126 | 85 | 38 | |
| November | 115 | 124 | 83 | 36 |
| October | 116 | 119 | 81 | 23 |
| September | 117 | 121 | 79 | 22 |
| August | 123 | 122 | 77 | 20 |
| July | 125 | 116 | 73 | |
| June | 129 | 112 | 67 | |
| May | 130 | 109 | 67 | |
| April | 133 | 107 | 62 | |
| March | 133 | 105 | 51 | |
| February | 133 | 90 | 46 | |
| January | 130 | 88 | 42 | |

IONOSPHERIC DATA FOR EVERY DAY AND HOUR AT WASHINGTON, D. C.

The data given in tables 39 to 50 follow the scaling practices given in the report IRPL-C61, "Report of International Radio Propagation Conference," pages 36 to 39, and the median values are determined by the conventions given above under "Terminology and Scaling Practices."

IONOSPHERE DISTURBANCES

Table 51 presents ionosphere character figures for Washington, D. C., during November 1948, as determined by the criteria presented in the report IRPL-R5, "Criteria for Ionospheric Storminess," together with Cheltenham Maryland, geomagnetic K-figures, which are usually covariant with them.

Table 52 lists for the stations whose locations are given the sudden ionosphere disturbances observed on the continuous field intensity recordings made at the Sterling Radio Propagation Laboratory during November 1948.

Table 53 lists for the stations whose locations are given the sudden ionosphere disturbances observed at the Brentwood and Somerton, England, receiving stations of Cable and Wireless, Ltd., for October 22, November 7 and 14, 1948.

Table 54 gives provisional radio propagation quality figures for the North Atlantic and North Pacific areas, for 01 to 12 and 13 to 24 GCT, October 1948, compared with the CRPL daily radio disturbance warnings, which are primarily for the North Atlantic paths, the CRPL weekly radio propagation forecasts of probable disturbed periods, and the half-day Cheltenham, Maryland, geomagnetic K-figures.

The radio propagation quality figures are prepared from radio traffic and ionospheric data reported to the CRPL, in a manner basically the same as that described in IRPL-R31, "North Atlantic Radio Propagation Disturbances, October 1943 through October 1945," issued February 1, 1946. The scale conversions for each report are revised for use with the data beginning January 1948, and statistical weighting replaces what was, in effect, subjective weighting. Separate master distribution curves of the type described in IRPL-R31 were derived for the part of 1946 covered by each report; data received only since 1946 are compared with the master curve for the period of the available data. A report whose distribution is the same as the master is thereby converted linearly to the Q-figure scale. Each report is given a statistical weight which is the reciprocal of the departure from linearity. The half-daily radio propagation quality figure, beginning January 1948, is the weighted mean of the reports received for that period.

These radio propagation quality figures give a consensus of opinion of actual radio propagation conditions as reported by the half day over the two general areas. It should be borne in mind, however, that though the quality may be disturbed according to the CRPL scale, the cause of the disturbance is not necessarily known. There are many variables that must be considered. In addition to ionospheric storminess itself as the cause, conditions may be reported as disturbed because of seasonal characteristics, such as are particularly evident in the pronounced day and night contrast over North Pacific paths during the winter months, or because of improper frequency usage for the path and time of day in question. Insofar as possible, frequency usage is included in rating the reports. Where the actual frequency is not shown in the report to the CRPL, it has been assumed that the report is made on the use of optimum working frequencies for the path and time of day in question. Since there is a possibility that all the disturbance shown by the quality figures is not due to ionospheric storminess alone, care should be taken in using the quality figures in research correlations with solar, auroral, geomagnetic, or other data. Nevertheless, these quality figures do reflect a consensus of opinion of actual radio propagation conditions as found on any one half day in either of the two general areas.

AMERICAN AND ZÜRICH PROVISIONAL RELATIVE SUNSPOT NUMBERS

Table 55 presents the daily American relative sunspot number, R_A , computed from observations communicated to CRPL by observers in America and abroad. Beginning with the observations for January 1948, a new method of reduction of observations is employed such that each observer is assigned a scale-determining "observatory coefficient," ultimately referred to Zürich observations in a standard period, December 1944 to September 1945, and a statistical weight, the reciprocal of the variance of the observatory coefficient. The daily numbers listed in the table are the weighted means of all observations received for each day. Details of the procedure will be published shortly. The American relative sunspot number computed in this way is designated R_A . It is noted that a number of observatories abroad, including the Zürich observatory, are included in R_A . The scale of R_A was referred specifically to that of the Zürich relative sunspot numbers in the standard comparison period; since that time, R_A is influenced by the Zürich observations only in that Zürich proves to be a consistent observer and receives a high statistical weight. In addition, this table lists the daily provisional Zürich sunspot numbers, R_Z .

SOLAR CORONAL INTENSITIES OBSERVED AT CLIMAX, COLORADO

In tables 56a and 56b are listed the intensities of the green (5303A) line of the emission spectrum of the solar corona as observed during November 1948 by the High Altitude Observatory of Harvard University and the University of Colorado at Climax, Colorado, for east and west limbs, respectively, at 5° intervals of position angle north and south of the solar equator at the limb computed to the nearest 5° . A correction, P , as listed, has been applied to the position angles of the actual observations which were on astronomical coordinates. The time of observation is given to the nearest tenth of a day, GCT. The tables of coronal observations in CRPL-F29 to F41 listed the data on astronomical coordinates; the present format on solar rotation coordinates is in conformity with the tables of CRPL-1-4, "Observations of the Solar Corona at Climax, 1944-46."

Tables 57a and 57b give similarly the intensities of the first red (6374A) coronal line; tables 58a and 58b list the intensities of the second red (6704A) coronal line. The following symbols are used in tables 56, 57, and 58: a, observation of low weight; -, corona not visible; and x, position angle not included in plate estimates.

ERRATUM

1. CRPL-F51, p. 18, table 32: f^0E column at 06 should read "E." Correspondingly, no point should be plotted at that hour on the graph.

INDEX OF IONOSPHERIC DATA PUBLISHED IN 1948 (CRPL-F41 THROUGH F52)

The following index of tables and graphs of ionospheric data published in the CRPL-F series in 1948 is divided into three parts. Part I is an index of data observed in 1947 and 1948. Part II is an index of data observed prior to 1947. Part III is an index to errata published in 1948 concerning numerical data from ionospheric stations.

Both table and graph for the given station for a given month appear in the same issue. When data for the same station and month have been published in two issues of the F series, both issue numbers are given in the index, even though one issue was published prior to 1948.

Indexes of ionospheric data published prior to 1948 are in IRPL-F17, CRPL-F28 and F40.

PART II

Index of Tables and Graphs of Ionospheric Data Observed Prior to 1947
and Published in 1948 (CRPL-F41 through F52)

| Station | Month and year of data | F issue |
|---------------------------|------------------------------------|---------|
| Burghead, Scotland | March 1942 through December 1942 | 43 |
| Canberra, Australia | January 1940 through December 1940 | 43 |
| | January 1939 through December 1939 | 42 |
| | January 1938 through December 1938 | 44 |
| | March 1937 through December 1937 | 45 |
| Christchurch, New Zealand | August 1942 through October 1942 | 44 |
| Delhi, India | January 1942 through December 1942 | 42 |
| Fribourg, Germany | October 1946 through December 1946 | 41 |
| Great Baddow, England | January 1942 through December 1942 | 43 |
| Tromso, Norway | June 1944 through April 1945 | 45 |
| | August 1943 | 45 |

PART III

Index of Errata Published in 1948* Concerning Numerical Data
from Ionosphere Stations

| Station | Month and year of data | F issue | Page | Erratum No. |
|-------------------------|------------------------------------|---------|------|-------------|
| Adak, Alaska | January 1948 | 44 | 9 | 1 |
| Bagneux, France | December 1947 | 51 | 10 | 3 |
| | November 1947 | 49 | 8 | 2 |
| Chungking, China | July 1948 | 51 | 10 | 2 |
| Churchill, Canada | April 1948 | 47 | 10 | 1 |
| Clyde, Baffin I. | January 1948 | 49 | 8 | 1 |
| Fribourg, Germany | March 1948 | 52 | 9 | 1 |
| Nanking, China | December 1947 | 46 | 9 | 1 |
| Okinawa I. | February 1948 | 50 | 9 | 1 |
| Peiping, China | July 1948 | 51 | 10 | 1 |
| | July 1946 through November 1947 | 46 | 9 | 3 |
| San Juan, Puerto Rico | November 1947 | 42 | 9 | 1 |
| Tromso, Norway | August 1943 | 46 | 9 | 2 |
| White Sands, New Mexico | November 1947 | 42 | 9 | 2 |

*An individual erratum may refer to issues prior to CRPL-F41.

Table 37

Bagneux, France (48.8°N, 2.3°E)

April 1948

| Time | h'F2 | f°F2 | h'Fl | f°F1 | h'E | f°E | fEs | F2-M3000 |
|------|------|-------|------|------|-----|-------|-----|----------|
| 00 | | | | | | | | |
| 01 | | | | | | | | |
| 02 | | | | | | | | |
| 03 | | | | | | | | |
| 04 | | | | | | | | |
| 05 | | | | | | | | |
| 06 | 270 | 6.6 | | | | 3.0 | | |
| 07 | 250 | 8.2 | 230 | | | 3.0 | | |
| 08 | 275 | 9.0 | 230 | | | 2.9 | | |
| 09 | 300 | 9.0 | 220 | | | 4.3 | 2.8 | |
| 10 | 320 | 10.0 | 210 | | | 4.2 | 2.7 | |
| 11 | 310 | 10.3 | 210 | | | 4.2 | 2.7 | |
| 12 | 340 | 10.2 | 210 | | | 4.1 | 2.7 | |
| 13 | 320 | 10.4 | 230 | | | 4.1 | 2.7 | |
| 14 | 320 | 9.8 | 230 | | | 4.1 | 2.7 | |
| 15 | 340 | 9.7 | 235 | | | 4.1 | 2.8 | |
| 16 | 310 | 9.5 | 240 | | | | 2.8 | |
| 17 | 260 | 9.5 | 260 | | | | 2.9 | |
| 18 | 260 | 9.6 | 250 | | | | 2.8 | |
| 19 | 260 | 8.8 | 260 | | | | 2.8 | |
| 20 | 285 | (8.4) | | | | (2.8) | | |
| 21 | 300 | 8.4 | | | | (2.7) | | |
| 22 | 315 | (8.0) | | | | (2.6) | | |
| 23 | | | | | | | | |

Time: 0.0°.

Sweep: 3.9 Mc to 6.8 Mc and 7.8 Mc to 13.5 Mc in 12 minutes.

Table 38

Bagneux, France (48.8°N, 2.3°E)

March 1948

| Time | h'F2 | f°F2 | h'Fl | f°F1 | h'E | f°E | fEs | F2-M3000 |
|------|------|-------|------|------|-----|-----|-----|----------|
| 00 | | | | | | | | |
| 01 | | | | | | | | |
| 02 | | | | | | | | |
| 03 | | | | | | | | |
| 04 | | | | | | | | |
| 05 | | | | | | | | |
| 06 | 280 | 5.7 | | | | | | 3.0 |
| 07 | 260 | 7.5 | | | | | | (3.2) |
| 08 | 250 | 9.0 | | | | | | (3.1) |
| 09 | 250 | 9.9 | 230 | | | | | 3.0 |
| 10 | 270 | 10.7 | 230 | | | | | 3.0 |
| 11 | 260 | 10.9 | 225 | | | | | (3.0) |
| 12 | 260 | 10.8 | 220 | | | | | 2.9 |
| 13 | 250 | 10.6 | 235 | | | | | (3.0) |
| 14 | 250 | 10.6 | 220 | | | | | (3.0) |
| 15 | 240 | 10.6 | | | | | | 3.2 |
| 16 | 250 | 10.5 | | | | | | (3.0) |
| 17 | 250 | 10.6 | | | | | | 3.1 |
| 18 | 240 | 9.1 | | | | | | (3.0) |
| 19 | 240 | 8.0 | | | | | | (3.0) |
| 20 | 280 | (7.7) | | | | | | |
| 21 | 310 | 6.0 | | | | | | (2.8) |
| 22 | 340 | 5.7 | | | | | | 3.0 |
| 23 | | | | | | | | |

Time: 0.0°.

Sweep: 3.9 Mc to 6.8 Mc and 7.8 Mc to 13.5 Mc in 12 minutes.

*Medians in this column were obtained from observed values of f°F2 and values derived from f°F2.

TABLE 39
 Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D.C.
IONOSPHERIC DATA

hF2, Km
 (Characteristic)
 Observed at **Washington, D.C.**

Lat 39.0°N., Long 77.5°W.

November, 1948
 (Month)

National Bureau of Standards
 Scaled by **E.J.W., J.J.S., J.M.C.**
 Calculated by **A.G.J., K.L.B., J.J.S.**

| Day | 75°W Mean Time | | | | | | | | | | | |
|--------|---------------------|---------------------|-----------------------|---------------------|---------------------|---------------------|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 |
| 1 | 2.50 ^f | 2.50 ^f | 2.60 ^f | 2.60 ^f | 2.30 | (2.50) ^f | 2.30 | 2.10 ^f | 2.30 | 2.50 | 2.40 | 2.40 |
| 2 | 2.50 ^x | 2.60 ^x | [2.40] ^x | (2.30) ^x | 3.10 ^f | 2.60 ^f | 2.80 ^f | 2.90 ^x | 3.70 ^f | 4.00 ^x | 4.50 ^x | 4.50 ^x |
| 3 | 2.60 ^f | 2.50 ^f | 2.50 | [3.60] ^x | (2.80) ^f | (3.30) ^x | 2.40 | 2.30 | 2.50 | 2.50 | 2.50 | 2.50 |
| 4 | 2.40 | 2.30 | (2.50) ^x | 2.50 | 2.70 | 2.50 ^f | 2.30 | 2.30 | 2.40 | 2.30 | 2.30 | 2.30 |
| 5 | 2.50 | 2.50 | (2.60) ^x | 2.50 ^f | 2.60 | (2.70) ^x | 2.40 | 2.40 | 2.50 | 2.40 | 2.30 | 2.30 |
| 6 | 2.60 | 2.50 | 2.50 | 2.40 | (2.30) ^f | 2.50 | 2.60 | 2.20 | 2.40 | 2.50 | 2.50 | 2.50 |
| 7 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 ^f | 2.30 | 2.20 | 2.50 | 2.60 | 2.60 | 2.60 |
| 8 | 2.60 | 2.50 | (2.40) ^x | 2.30 | 2.50 | 2.60 ^f | 2.70 | 2.40 | 2.30 | 2.40 | 2.40 | 2.40 |
| 9 | 2.40 | 2.50 | 2.70 | 2.70 | 2.60 | 2.60 ^f | 2.50 | 2.40 | 2.30 | 2.30 | 2.30 | 2.30 |
| 10 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.40 | 2.60 | 2.40 | 2.20 | C | 2.50 | 2.50 |
| 11 | 2.40 | 2.30 | 2.30 | 2.40 | 2.40 | 2.60 ^f | 2.50 | 2.20 | 2.20 | 2.40 | 2.40 | 2.40 |
| 12 | 2.50 | 2.40 | 2.50 | 2.40 | 2.30 | 2.50 | 2.30 | 2.20 | 2.30 | 2.30 | 2.30 | 2.30 |
| 13 | 2.50 | 2.50 | 2.50 | 2.50 | 2.40 | 2.40 | 2.30 | 2.30 | 2.20 | 2.20 | 2.20 | 2.20 |
| 14 | 2.30 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.20 | 2.10 | 2.10 | 2.50 | (2.20) ^a | 2.50 |
| 15 | 2.50 | 2.50 | 2.50 | 2.60 | (2.30) ^f | 2.40 | 2.10 | 2.20 | 2.20 | 2.50 | 2.50 | 2.50 |
| 16 | 2.40 | 2.60 | (2.60) ^x | (2.60) ^f | 2.30 | 2.30 | 2.30 | 2.10 | 2.30 | 2.30 | 2.30 | 2.30 |
| 17 | 2.70 | 2.70 | 3.00 | 2.80 | 2.60 | 2.70 | 2.40 | 2.40 | 2.30 | 2.40 | 2.40 | 2.40 |
| 18 | 2.70 | 3.20 | 3.00 | 2.80 | 2.70 | 3.40 | 2.50 | 2.30 | 2.40 | 2.50 | 2.30 | 2.30 |
| 19 | 3.00 | 3.00 | 3.00 | (3.10) ^f | 3.00 | 2.90 | 2.80 | 2.60 | (1.60) ^a | 2.30 | 2.30 | 2.30 |
| 20 | 2.90 | 3.00 | 3.00 | (3.10) ^f | (2.70) ^x | (2.50) ^f | 2.50 | 2.50 | 2.50 | 2.30 | 2.30 | 2.30 |
| 21 | * 3.10 ^f | 3.00 ^f | K (2.70) ^x | (2.50) ^f | 2.50 ^x | (2.60) ^x | 2.40 ^f | 2.40 | 2.20 | (2.10) ^a | (2.30) ^f | (2.30) ^f |
| 22 | 2.40 | 2.40 | 2.30 | 2.50 | 2.60 | 3.10 | 3.00 | 2.30 | 2.30 | 2.40 | 2.40 | 2.40 |
| 23 | 2.80 | 2.70 | 2.70 | 2.50 | 2.50 | 2.50 | 2.50 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 |
| 24 | 2.50 | 2.90 | 2.70 | 2.50 | 2.50 | 2.90 | 2.10 | 2.30 | 2.10 | 2.40 | 2.40 | 2.40 |
| 25 | 2.60 | 2.80 | 2.70 | 2.50 | 2.40 | 2.50 | 2.20 | 2.30 | 2.30 | 2.30 | 2.20 | 2.20 |
| 26 | 2.30 | 2.50 | 2.50 | 2.50 | (2.50) ^x | (2.70) ^x | 2.80 | 2.30 | 2.30 | 2.30 | (2.20) ^f | (2.10) ^f |
| 27 | 2.50 | 2.70 | 2.60 | 2.80 | 2.70 | 2.40 | 2.50 | 2.30 | 2.30 | 2.30 | 2.10 | 2.10 |
| 28 | 2.50 | 2.70 | 2.80 | 2.40 | 2.30 | 2.50 | 2.30 | 2.30 | 2.50 | 2.30 | 2.20 | 2.20 |
| 29 | 2.70 | 3.00 | 2.90 | 2.60 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.40 | 2.30 | 2.30 |
| 30 | 2.60 | (2.50) ^f | 2.80 | 2.60 | 2.40 | 2.30 | 2.30 | (2.30) ^c | 2.30 | [2.20] ^c | 2.30 | 2.30 |
| 31 | | | | | | | | | | | | |
| Median | 2.60 | 2.50 | 2.50 | 2.50 | 2.50 | 2.65 | 2.40 | 2.30 | 2.30 | 2.35 | 2.30 | 2.30 |
| Count | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 29 | 30 | 30 | 30 |

Sweep 1.0—Mc to 2.50 Mc in 2.5 sec—min
 Manual Automatic

TABLE 43
Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D.C.
IONOSPHERIC DATA

f^oF₁ — **Mc** — **November, 1948**
(Characteristic) (Unit) (Month)

Observed at **Washington, D.C.**

Lat. **39.0°N**, Long. **77.5°W**

| Day | 75°W | | | | | | | | | | | | | | | | | | | | | | | | Mean Time | | |
|-----|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----------|--|--|
| | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Swept 1.0 Mc to 25.0 Mc in 0.25 min
Manual Automatic

Median
Count

TABLE 44
 Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D. C.
IONOSPHERIC DATA
 Observed at **Washington, D. C.** **Lat. 39.0°N., Long. 77.5°W.**
Km **November, 1948**
 (Characteristic) **(Unit)**

| Day | 75°W | | Mean Time | | | | | | | | | | | | | | | | | | | | | |
|-----|--------|-------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Median | Count | | | | | | | | | | | | | | | | | | | | | | |
| | 110 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| | 11 | 23 | 25 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | |

Form adopted June 1946

National Bureau of Standards
Institution J.M.C.

Scaled by E.J.W., J.J.S., K.L.B., J.J.S.

Calculated by A.G.J., K.L.B., J.J.S.

U. S. GOVERNMENT PRINTING OFFICE 1946 O-12821

Sweep-10 Mc to 25.0 Mc in 0.25 min

Manual □ Automatic ■

TABLE 45
Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D.C.

Form adopted June 1946

f_E Mc (Characteristic) f_M Mc (Unit) November, 1948 (Month)

Observed at Washington, D.C.

Lat 39.0°N., Long 77.5°W.

IONOSPHERIC DATA

National Bureau of Standards
(Institution) J.M.C.

Scaled by E.J.W., J.S.

Calculated by A.G.J., K.L.B., J.J.S.

| Day | 75°W Mean Time | | | | | | | | | | | |
|--------|----------------|-------|-----|-----|-----|-----|-----|-----|-----------|-----------|-----------|-----------|
| | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 |
| 1 | | | | | | | | | S | A | $(3.1)^A$ | 3.4^F |
| 2 | | | | | | | | | 2.0^K | 2.3^K | $(2.7)^S$ | 3.0^K |
| 3 | | | | | | | | | $(2.1)^S$ | $[2.5]^A$ | 2.9^H | $(3.1)^F$ |
| 4 | | | | | | | | | A | A' | $(3.1)^S$ | 3.3^F |
| 5 | | | | | | | | | $(2.0)^S$ | $(2.5)^S$ | 2.9^F | 3.2^F |
| 6 | | | | | | | | | 1.9^F | $(2.5)^S$ | $[2.9]^A$ | 3.3 |
| 7 | | | | | | | | | 2.0 | $(2.5)^S$ | 2.9 | 3.1 |
| 8 | | | | | | | | | 2.0 | $(2.6)^H$ | $(2.8)^A$ | $[3.0]^A$ |
| 9 | | | | | | | | | 1.9 | 2.4 | 3.0 | 3.1 |
| 10 | | | | | | | | | A | $(2.5)^S$ | 3.0 | C |
| 11 | | | | | | | | | A | $(2.5)^H$ | $(3.0)^A$ | 3.2 |
| 12 | | | | | | | | | A | 2.5 | 3.0 | 3.3 |
| 13 | | | | | | | | | $(1.9)^C$ | $(2.4)^H$ | 3.1 | 3.1 |
| 14 | | | | | | | | | $(2.0)^F$ | 2.5 | 3.1 | 3.5 |
| 15 | | | | | | | | | A | $(2.5)^C$ | 3.0 | $(3.3)^A$ |
| 16 | | | | | | | | | 1.9^H | $[2.4]^A$ | 3.0^H | $(3.2)^S$ |
| 17 | | | | | | | | | 2.0 | $(2.3)^H$ | $(2.8)^S$ | $(3.2)^S$ |
| 18 | | | | | | | | | 2.5 | 3.0^H | $(3.1)^H$ | 3.4^H |
| 19 | | | | | | | | | $(2.0)^H$ | 2.4 | $(2.5)^A$ | 3.1^H |
| 20 | | | | | | | | | 1.9 | 2.4 | 3.0 | 3.1 |
| 21 | | | | | | | | | $(2.1)^H$ | 2.7 | 3.2 | 3.4 |
| 22 | | | | | | | | | 1.9 | 2.6 | $(2.9)^S$ | 3.2 |
| 23 | | | | | | | | | A | 2.3^H | 2.7 | $(3.1)^A$ |
| 24 | | | | | | | | | 2.2 | $(2.6)^H$ | $(3.0)^H$ | 3.2 |
| 25 | | | | | | | | | $(1.9)^S$ | 2.4^H | $(2.8)^C$ | 3.1^H |
| 26 | | | | | | | | | A | 2.7 | 2.9 | 3.1 |
| 27 | | | | | | | | | 2.3^H | 2.7 | 3.0^H | 3.1 |
| 28 | | | | | | | | | $(2.2)^H$ | 2.7^H | 3.1^H | 3.3^H |
| 29 | | | | | | | | | $(2.1)^H$ | 2.7^H | 3.1^H | 3.2 |
| 30 | | | | | | | | | 2.3^H | $(2.6)^C$ | 2.9^H | $[3.0]^C$ |
| 31 | | | | | | | | | | | | |
| Median | 2.0 | (2.4) | 2.9 | 3.1 | 3.3 | 3.4 | 3.4 | 3.2 | 2.9 | 2.3 | | |
| Count | 15 | 27 | 28 | 29 | 29 | 30 | 30 | 28 | 26 | 26 | 3 | |

Sweep 1.0 Mc to 25.0 Mc in 0.25 min
Manual Automatic

TABLE 46
Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D.C.
IONOSPHERIC DATA

Form adopted June 1946
National Bureau of Standards
(Institution) J.M.C.
Scaled by: E.J.W., J.J.S., K.L.B., A.G.J.

| Day | 75°N Mean Time | | | | | | | | | | | | Calculated by: J.J.S., K.L.B., A.G.J. | | | | | |
|--------|----------------|--------|--------|--------|--------|-------|-------|-------|-------|-------|--------|--------|---------------------------------------|---------|--------|--------|--------|--------|
| | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | | | | | | |
| 1 | | | | | | | | | | | 54/00 | 39/000 | 27/90 | 30/000 | | | | |
| 2 | | | | | | | | | | | 30/000 | | | | | | | |
| 3 | 32/20 | 39/20 | 36/20 | 34/20 | 30/00 | 29/00 | 28/00 | 27/00 | 26/00 | 25/00 | 24/00 | 23/00 | 38/90 | 21/90 | 20/90 | 20/90 | 20/90 | |
| 4 | | | | | | | | | | | 21/00 | 31/000 | 31/000 | 29/000 | 32/90 | 39/90 | | 20/100 |
| 5 | | | | | | | | | | | 28/000 | 35/100 | 31/100 | 36/90 | 32/90 | | | 20/100 |
| 6 | | | | | | | | | | | 39/100 | 23/100 | | | | | | |
| 7 | | | | | | | | | | | 56/100 | 56/100 | 44/100 | 34/000 | | | | |
| 8 | 25/30 | 20/30 | | | | | | | | | 29/100 | 24/100 | 36/110 | 45/110 | 56/100 | | | |
| 9 | | | | | | | | | | | 19/110 | 31/110 | 29/90 | | | | | |
| 10 | | | | | | | | | | | 19/110 | 31/110 | 29/90 | | | | | |
| 11 | | | | | | | | | | | 56/100 | 31/110 | 38/110 | 30/100 | 35/110 | | | |
| 12 | | | | | | | | | | | 27/110 | 31/100 | 29/100 | 30/90 | | | | |
| 13 | 31/100 | | | | | | | | | | 31/100 | 30/100 | 39/100 | 39/100 | | | | |
| 14 | | | | | | | | | | | 33/90 | 39/100 | 37/100 | 32/5/00 | 42/90 | 56/90 | 31/100 | 19/00 |
| 15 | 33/100 | 57/100 | 19/100 | | | | | | | | 33/110 | 29/100 | 34/100 | 37/100 | 52/100 | 57/100 | 50/90 | 41/90 |
| 16 | | | | | | | | | | | 39/100 | 40/100 | | | | | | |
| 17 | 39/100 | | | | | | | | | | 19/100 | 19/100 | 18/110 | 18/110 | | | | |
| 18 | | | | | | | | | | | 27/100 | 37/100 | 21/100 | 45/110 | 42/200 | 39/100 | 31/100 | 29/100 |
| 19 | | | | | | | | | | | 38/100 | 19/100 | 20/100 | | | | | |
| 20 | | | | | | | | | | | 47/120 | | | | | | | |
| 21 | | | | | | | | | | | | 65/100 | | | | | | |
| 22 | 15/100 | | | | | | | | | | | 20/20 | | | | | | |
| 23 | | | | | | | | | | | 27/100 | 35/100 | 32/100 | 53/100 | 56/100 | 40/100 | 30/100 | 19/00 |
| 24 | 32/100 | | | | | | | | | | 29/100 | 23/100 | 31/100 | 30/100 | | | | |
| 25 | | | | | | | | | | | 31/10 | 20/100 | 23/110 | 29/100 | 31/100 | | | |
| 26 | 19/110 | 17/100 | | | | | | | | | 43/100 | 54/100 | 84/100 | 50/100 | 21/100 | 30/130 | 31/100 | 42/200 |
| 27 | 3/100 | 30/100 | 30/100 | | | | | | | | 29/100 | 29/100 | 30/100 | 31/100 | 30/100 | 30/100 | 30/100 | 30/100 |
| 28 | | | | | | | | | | | 30/100 | 19/100 | 19/100 | 56/100 | 32/100 | 35/100 | 32/100 | 36/90 |
| 29 | 30/100 | 31/100 | 32/100 | 30/100 | 29/100 | | | | | | 30/100 | 21/100 | | | | | | |
| 30 | | | | | | | | | | | 21/100 | 35/100 | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | |
| Median | | | | | | | | | | | | | | | | | | |
| Count | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 29 | 28 | 30 | 30 | 30 | 30 | 30 | 30 |

** MEDIAN FEWER THAN MEDIAN 10⁶ MC OR LESS THAN LOWER FREQUENCY LIMIT OF RECORDER.

U.S. GOVERNMENT PRINTING OFFICE 1946 O - 122519

Manual Automatic

Sweep 1.0 Mc to 25.0 Mc in 0.25 min

TABLE 47
Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D.C.
F2-MI500, November, 1948
(Characteristic) (Month)
Washington, D.C.
Observed at Lat. 39.0°N., Long. 77.5°W.

| Day | 75°W Mean Time | | | | | | | | | | | | | | |
|--------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | |
| 1 | (2.1)S | (2.0)F | 1.9F | 2.0F | (2.0)F | 2.1F | 2.2 | (2.3)S | 2.1 | 2.1 | 2.0 | (2.1)S | (2.1)S | 2.0K | |
| 2 | (2.0)K | 1.9F | F | K | 1.7F | 1.8F | 2.0F | (1.9)S | 1.8F | 1.7F | 1.7F | 1.7F | 1.7F | 1.8K | |
| 3 | (2.0)S | (2.1)F | 2.0F | (2.0)F | 2.1F | 1.9F | 1.9F | 2.1 | 2.1 | 2.1 | 2.0K | (2.0)S | 1.9F | A.K. | |
| 4 | (2.1)S | (2.1)F | (2.1)F | (2.0)F | 1.8F | 1.8F | 1.8F | (2.0)F | 2.2 | 2.2 | (2.1)S | (2.1)S | 2.1 | 1.9 | |
| 5 | (2.1)F | F | S | (1.9)S | 1.9F | 1.9F | 1.9F | (2.0)S | 2.3 | 2.2 | 2.1 | 2.1 | 2.1 | 2.0F | |
| 6 | (1.9)S | (2.0)F | F | S | (2.0)S | 1.9F | 1.9F | (2.0)F | 2.4 | 2.3 | 2.1 | 2.1 | 2.1 | (2.0)S | |
| 7 | 2.0F | (2.0)F | (2.0)S | 1.9F | 1.9F | (2.0)F | 2.2 | 2.2 | 2.1 | 2.0 | 2.0 | (2.0)S | (2.0)S | 2.0 | |
| 8 | (1.9)S | (1.9)F | (2.0)S | (2.0)F | (2.0)S | (2.0)F | (2.0)F | (2.0)S | 2.2 | 2.1 | 2.0 | (2.0)S | (2.0)S | 1.9 | |
| 9 | 2.1 | 1.9 | 1.9 | 1.8F | 1.9 | 1.9 | 2.1 | 2.1 | (2.0)F | (2.1)F | (2.0)F | 2.0 | (2.0)S | 2.0 | 2.0 |
| 10 | 1.9 | 1.9 | 1.8 | 1.9 | 1.9 | 1.8 | 1.9 | 2.2 | 2.2 | C | (1.9)S | 2.0 | (2.1)S | 2.0 | 1.9 |
| 11 | (2.1)S | (2.1)S | 2.1F | 1.9F | 1.9F | 2.1F | 2.2 | 2.2 | 2.2 | 2.1 | 2.0 | (2.1)S | (2.1)S | 2.0 | 2.0 |
| 12 | (2.0)S | 2.0 | (2.0)S | 2.0 | 2.0 | (2.0)S | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 | (2.0)S | (2.0)S | 2.1 | 2.0 |
| 13 | 4.9 | 1.9 | 2.0 | 2.1 | 1.9 | 2.1 | 2.1 | (2.1)S | (2.1)S | 2.1 | 2.0 | (2.1)S | (2.1)S | 2.0 | 2.1 |
| 14 | 2.0 | 1.9 | 2.0 | 2.0 | 1.8 | (2.1)S | 2.0 | 2.1 |
| 15 | 2.1 | (2.0)F | (1.9)S | 2.0F | (1.7)F | (2.0)F | 2.1F | 2.2 | (2.1)S | (2.1)S | (2.1)S | (2.1)S | (2.1)S | 2.1 | 2.1 |
| 16 | 1.9 | (1.8)J | (1.8)F | F | S | (1.8)S | (2.0)F | (2.0)S | (2.1)S | (2.1)S | (2.1)S | (2.1)S | (2.1)S | 2.0 | 2.0 |
| 17 | 1.8 | (1.8)S | (1.7)F | (1.7)F | (1.7)F | (1.8)S | (1.8)F | (2.0)F | (2.1)S | (2.1)S | (2.1)S | (2.1)S | (2.1)S | 2.1 | 2.1 |
| 18 | 1.9 | (1.6)S | (1.5)F | (1.6)F | (1.6)F | (1.7)F | (1.8)F | (2.0)F | (2.1)S | (2.1)S | (2.1)S | (2.1)S | (2.1)S | 2.0 | 1.9 |
| 19 | (1.9)S | (1.6)S | (1.7)S | F | C | (2.0)F | (2.1)S | 2.1 | 2.0 |
| 20 | 1.8F | 1.7F | (1.7)S | F | F | (1.8)F | (1.9)F | 1.7F | 2.0 | 2.1 | 2.0 | 1.9 | S | 2.0 | 1.9 |
| 21 | (2.0)F | (1.9)F | (1.8)F | (1.8)F | F | K | F | 1.9F | 3.20F | 2.1F | 2.2 | (2.1)S | (2.1)S | 2.1 | 2.2 |
| 22 | (2.1)S | (2.0)F | (2.0)F | (2.0)F | 1.9 | 1.9 | 1.9 | (2.1)S | 2.1F | 2.6 | 2.2 | (2.1)S | (2.0)S | d.1 | 2.2 |
| 23 | (1.9)F | (2.0)F | (1.9)F | (1.9)F | 1.9 | 1.8 | 2.0 | (2.1)S | (2.3)S | 2.1 | 2.1 | (2.1)S | (2.1)S | 2.1 | 2.1 |
| 24 | 1.9F | (1.8)F | (2.0)F | (2.0)F | (1.9)F | (1.8)F | (2.0)F | (2.1)S | 2.4 | 2.3 | 2.3 | 2.2 | (2.2)S | 2.0 | 2.1 |
| 25 | (1.9)S | (1.8)S | (1.8)S | (1.8)S | 1.9 | 1.9 | (1.9)F | (2.1)F | 2.2 | 2.8 | 2.4 | 2.1 | (2.1)S | (2.1)S | 2.0 |
| 26 | (2.3)S | (2.0)F | 2.0F | 2.3 | 2.3 | 2.2 | (2.2)S | (2.2)S | 2.2 |
| 27 | 2.2Z | 1.9F | 2.0F | 1.9F | 1.9F | 2.0F | 2.1F | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | (2.2)S | (2.2)S | 2.1 |
| 28 | 2.0 | 1.9 | 1.9 | 2.1S | 2.1F | 2.1F | 2.1F | 2.4 | 2.4 | 2.1 | 2.1 | 2.1 | (2.3)S | 2.1 | 2.1 |
| 29 | 2.0F | 1.9F | 1.9F | (2.1)S | (2.1)F | (2.1)F | (2.2)F | (2.4)F | 2.4 | 2.3 | 2.2 | 2.3 | (2.3)S | 2.0 | 2.0F |
| 30 | C | (1.9)S | C | (3.0)C | 2.0 | 2.1 | 2.1 | (2.4)C | (2.3)C | C | 2.2 | (2.1)C | (2.1)C | 2.1 | 2.1 |
| 31 | | | | | | | | | | | | | | | |
| Median | (2.0) | 1.9 | 1.9 | (1.9) | 2.0 | 2.0 | 2.2 | 2.3 | 2.4 | 2.1 | 2.1 | 2.1 | (2.2)C | 2.1 | 2.0 |
| Count | 29 | 29 | 26 | 27 | 49 | 27 | 26 | 30 | 30 | 29 | 29 | 29 | 28 | 30 | 30 |

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Sweep 10 Mc to 25.0 Mc in 0.25 min

Manual □ Automatic □

TABLE 49
Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D.C.
November, 1948
(month)

Fi-M 3000, (Characteristic)
Observed at Washington, D.C.
Lat 39°0'N, Long 77.5°W

Form adopted June 1946

National Bureau of Standards
(Institution)

Scaled by: E.J.W., J.J.S., J.M.G.
Calculated by: J.J.S., A.G.J., K.L.B.

| Day | 75°W Mean Time | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|----------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | | | | |

Median
Count

Sweep - 0 Mc to 25.0 Mc in 0.25 min

Manual Automatic

TABLE 50
IONOSPHERIC DATA
E-M1500 (Unit)
Washington, D.C. (Month)
Observed at Lat. **39.0°N**, Long. **77.5°W**

Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D.C.

November, 1948

(Month)

National Bureau of Standards

(Institution) **J.M.C.**

Scaled by

E.J.W., J.J.S., K.L.B., J.J.S.

75°W

Mean Time

| Day | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | | | |
| Median | 4.2 | 4.0 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.2 | 4.2 | 4.2 | 4.3 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | 4.2 | |
| Count | 14 | 25 | 27 | 28 | 27 | 26 | 27 | 26 | 27 | 27 | 27 | 27 | 25 | 25 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | |

Sweep 1.0 Mc to 25.0 Mc in 0.25 min
 Manual Automatic

U.S. GOVERNMENT PRINTING OFFICE 1946 O - 1118

Form adopted June 1946

Table 51Ionospheric Storminess at Washington, D. C.November 1948

| Day | Ionospheric character* | | Principal storms | | Geomagnetic character** | |
|-----|------------------------|-----------|------------------|---------|-------------------------|-----------|
| | 00-12 GCT | 12-24 GCT | Beginning GCT | End GCT | 00-12 GCT | 12-24 GCT |
| 1 | 2 | 1 | | | 1 | 3 |
| 2 | 4 | 7 | 0000 | ---- | 5 | 3 |
| 3 | 3 | 1 | 0300 | | 3 | 2 |
| 4 | 2 | 2 | | | 0 | 0 |
| 5 | 2 | 1 | | | 1 | 1 |
| 6 | 2 | 2 | | | 1 | 1 |
| 7 | 2 | 1 | | | 3 | 2 |
| 8 | 1 | 1 | | | 3 | 3 |
| 9 | 2 | 1 | | | 3 | 3 |
| 10 | 1 | 1 | | | 2 | 1 |
| 11 | 1 | 1 | | | 2 | 1 |
| 12 | 1 | 1 | | | 0 | 0 |
| 13 | 1 | 1 | | | 0 | 2 |
| 14 | 1 | 1 | | | 1 | 1 |
| 15 | 1 | 1 | | | 2 | 3 |
| 16 | 1 | 1 | | | 3 | 2 |
| 17 | 3 | 2 | | | 3 | 3 |
| 18 | 3 | 1 | | | 3 | 3 |
| 19 | 3 | 1 | | | 4 | 2 |
| 20 | 3 | 1 | | | 4 | 4 |
| 21 | 4 | 1 | 0000 | 1400 | 5 | 3 |
| 22 | 1 | 1 | | | 4 | 3 |
| 23 | 3 | 1 | | | 3 | 2 |
| 24 | 2 | 1 | | | 3 | 3 |
| 25 | 2 | 1 | | | 3 | 3 |
| 26 | 1 | 1 | | | 2 | 3 |
| 27 | 2 | 2 | | | 3 | 2 |
| 28 | 2 | 2 | | | 3 | 2 |
| 29 | 3 | 2 | | | 2 | 1 |
| 30 | 2 | 2 | | | 1 | 0 |

*Ionosphere character figure (I-figure) for ionospheric storminess at Washington, D. C., during 12-hour period, on an arbitrary scale of 0 to 9, 9 representing the greatest disturbance.

**Average for 12 hours of Cheltenham, Maryland, geomagnetic K-figures on an arbitrary scale of 0 to 9, 9 representing the greatest disturbance.

----Dashes indicate continuing storm.

Table 52Sudden Ionosphere Disturbances Observed at Washington, D. C.November 1948

| Day | GCT | | Location of transmitters | Relative intensity at minimum* | Other phenomena |
|-----|-----------|------|------------------------------------|--------------------------------|---------------------------------|
| | Beginning | End | | | |
| 8 | 1748 | 1815 | Ohio, D.C. | 0.2 | |
| 13 | 1649 | 1715 | Ohio, D.C., England, New Brunswick | 0.0 | |
| 14 | 1211 | 1230 | England | 0.1 | |
| 18 | 1839 | 1910 | Ohio, D.C., England, New Brunswick | 0.0 | Terr. mag. pulse** 1838-1900 |
| 22 | 1747 | 1810 | Ohio, D.C., New Brunswick | 0.1 | |

*Ratio of received field intensity during SID to average field intensity before and after, for station W8XAL, 6080 kilocycles, 600 kilometers distant, for all SID except the following: Station GLH, 13525 kilocycles, 5800 kilometers distant, was used for the SID on November 14.

**As observed on Cheltenham magnetogram of the United States Coast and Geodetic Survey.

Table 53Sudden Ionosphere Disturbances Reported by Engineer-in-Chief.Cable and Wireless, Ltd., as Observed in England

| 1948 Day | GCT | | Receiving station | Location of transmitters |
|-------------|-----------|------|-------------------|---------------------------------------------------------------------------------------------------------------------------|
| | Beginning | End | | |
| October 22 | 0922 | 0950 | Brentwood | Austria, Belgian Congo, Greece, India, Iran, Kenya, Malta, Palestine, Portugal, Southern Rhodesia, Trans-Jordan, Zanzibar |
| November 7 | 0955 | 1015 | Brentwood | Austria, Bahrein I., Belgian Congo, Greece, Palestine, Syria |
| 14 | 1215 | 1235 | Brentwood | Austria, Greece, Iran, Trans-Jordan, Turkey |

Note: Observers are invited to send to the CRPL information on times of beginning and end of sudden ionosphere disturbances for publication as above. Address letters to the Central Radio Propagation Laboratory, National Bureau of Standards, Washington 25, D. C.

Table 54

Provisional Radio Propagation Quality Figures
 (Including Comparisons with CRPL Warnings and CRPL Probable Disturbed Period Forecasts)
October 1948

| Day | North Atlantic | | | | | North Pacific | | | | |
|-----|---------------------|---------------------|---------------------------------------|------------------------------|--|---------------------|---------------------|---------------------------------------|------------------------------|--|
| | Quality figure | CRPL* Warning | Forecast of probable disturbed period | Geo-magnetic K _{Ch} | | Quality figure | CRPL* Warning | Forecast of probable disturbed period | Geo-magnetic K _{Ch} | |
| | 01-12 GCT 1 1 | 01-12 GCT 1 1 | 01-12 GCT 1 1 | 01-12 GCT 1 1 | | 01-12 GCT 1 1 | 01-12 GCT 1 1 | 01-12 GCT 1 1 | 01-12 GCT 1 1 | |
| 1 | (4) | 6 | X | 5 4 | | 6 7 | X | | 5 4 | |
| 2 | (4) | 5 | X X | 5 3 | | 6 6 | X X | X | 5 3 | |
| 3 | (4) | 5 | X | 3 3 | | 6 6 | X | X | 3 3 | |
| 4 | 5 | 6 | | 3 3 | | 6 6 | | | 3 3 | |
| 5 | 5 | 5 | | 4 1 | | 6 6 | | | 4 1 | |
| 6 | 6 | 6 | | 1 1 | | 6 7 | | | 1 1 | |
| 7 | 6 | 6 | | 1 2 | | 7 7 | | | 1 2 | |
| 8 | 6 | 6 | | 2 2 | | 6 7 | | | 2 2 | |
| 9 | 6 | 6 | | 1 1 | | 7 7 | | | 1 1 | |
| 10 | 6 | 7 | | 4 3 | | 7 7 | | | 4 3 | |
| 11 | 5 | 5 | X | 3 3 | | 7 7 | X | | 3 3 | |
| 12 | 5 | 6 | X | 3 2 | | 7 6 | X | | 3 2 | |
| 13 | 7 | 6 | | 2 3 | | 7 6 | | | 2 3 | |
| 14 | 5 | 6 | | 2 5 | | 6 (4) | | | 2 5 | |
| 15 | (4) | 5 | X X | 5 4 | | 7 6 | X X | | 5 4 | |
| 16 | 5 | 5 | X | 1 2 | | 6 7 | X | X | 1 2 | |
| 17 | 6 | 6 | X | 2 2 | | 7 6 | | X | 2 2 | |
| 18 | 5 | 6 | X X | 5 4 | | 7 7 | X X | X | 5 4 | |
| 19 | (3) (4) | X X | X | 7 3 | | 5 (4) | X X | X | 7 3 | |
| 20 | 5 | 5 | X X | 1 3 | | 6 (4) | X X | | 1 3 | |
| 21 | (4) | 5 | X X | 5 4 | | 5 (4) | X X | X | 5 4 | |
| 22 | (4) | 5 | X X | X | | 3 4 | 5 (4) | X X | 3 4 | |
| 23 | (4) | 5 | X X | X | | 4 3 | 5 (4) | X X | 4 3 | |
| 24 | (4) (4) | X X | | 3 3 | | 5 5 | X X | X | 3 3 | |
| 25 | 5 | (4) | X X | 2 3 | | 6 5 | X X | | 2 3 | |
| 26 | (4) | 5 | X X | 3 3 | | 6 5 | X X | | 3 3 | |
| 27 | (4) (4) | X X | X | 4 4 | | 6 5 | X X | X | 4 4 | |
| 28 | (4) | 5 | X | 3 2 | | 7 6 | X | X | 3 2 | |
| 29 | 5 | 6 | X | 3 2 | | 7 8 | | X | 3 2 | |
| 30 | 5 | 6 | | 2 1 | | 6 8 | | | 2 1 | |
| 31 | 5 | 6 | | 3 1 | | 5 5 | | | 3 1 | |

Score:

| | | | | |
|-----|----|----|--|--|
| H | 12 | 7 | | |
| M | 0 | 6 | | |
| G | 13 | 14 | | |
| (S) | 6 | 3 | | |
| S | 0 | 1 | | |

| | | | |
|----|----|--|--|
| 5 | 3 | | |
| 1 | 3 | | |
| 12 | 17 | | |
| 4 | 1 | | |
| 9 | 7 | | |

Quality Figure Scale:

- 1 - Ueelens
- 2 - Very poor
- 3 - Poor
- 4 - Poor to fair
- 5 - Fair
- 6 - Fair to good
- 7 - Good
- 8 - Very good
- 9 - Excellent

Symbols:

- X Warning given or probable disturbed date
- H Quality 4 or worse on day or half day of warning
- M Quality 4 or worse on day or half day of no warning
- G Quality 5 or better on day of no warning
- (S) Quality 5 on day of warning
- S Quality 6 or better on day of warning
- () Quality 4 or worse (disturbed)

Geomagnetic K_{Ch} on the standard scale of 0 to 9, 9 representing the greatest disturbance

*Broadcast on WWV, Washington, D.C. Times of warnings recorded to nearest half day as broadcast.

Table 55American and Zürich Provisional Relative Sunspot NumbersNovember 1948

| Date | R _A * | R _Z ** | Date | R _A * | R _Z ** |
|------|------------------|-------------------|-------|------------------|-------------------|
| 1 | 106 | 85 | 17 | 147 | 118 |
| 2 | 106 | 100 | 18 | 196 | 123 |
| 3 | 142 | 85 | 19 | 215 | 147 |
| 4 | 110 | 88 | 20 | 183 | 141 |
| 5 | 135 | 88 | 21 | 162 | 123 |
| 6 | 112 | 88 | 22 | 157 | 95 |
| 7 | 126 | 70 | 23 | 115 | 90 |
| 8 | 120 | 69 | 24 | 107 | 83 |
| 9 | 134 | 79 | 25 | 134 | 70 |
| 10 | 123 | 84 | 26 | 102 | 70 |
| 11 | 137 | 107 | 27 | 92 | 68 |
| 12 | 159 | 110 | 28 | 82 | 71 |
| 13 | 150 | 127 | 29 | 75 | 73 |
| 14 | 129 | 102 | 30 | 74 | 73 |
| 15 | 126 | 85 | Mean: | | 129.9 |
| 16 | 140 | 83 | | | 93.2 |

*Combination of 43 observers; see page 8.

**Dependent on observations at Zürich Observatory and its stations at Locarno and Arosa.

GRAPHS OF IONOSPHERIC DATA

40

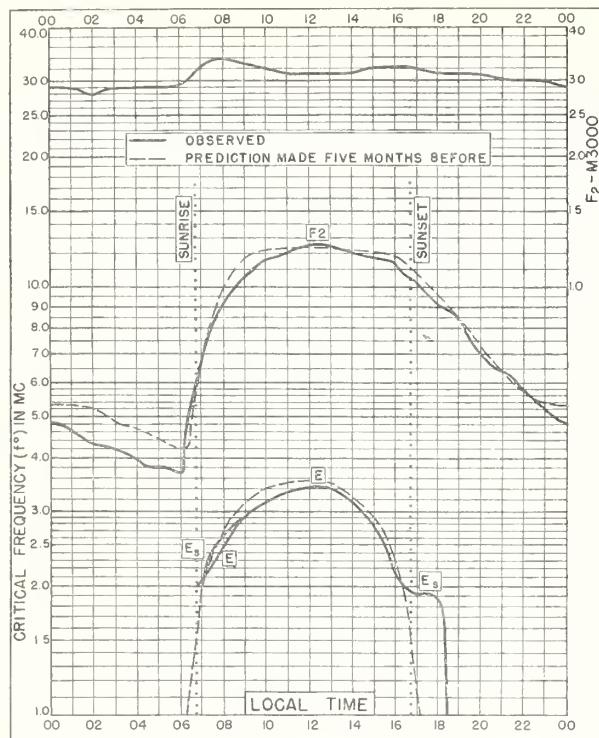


Fig. 1. WASHINGTON, D. C.
39.0°N, 77.5°W NOVEMBER 1948

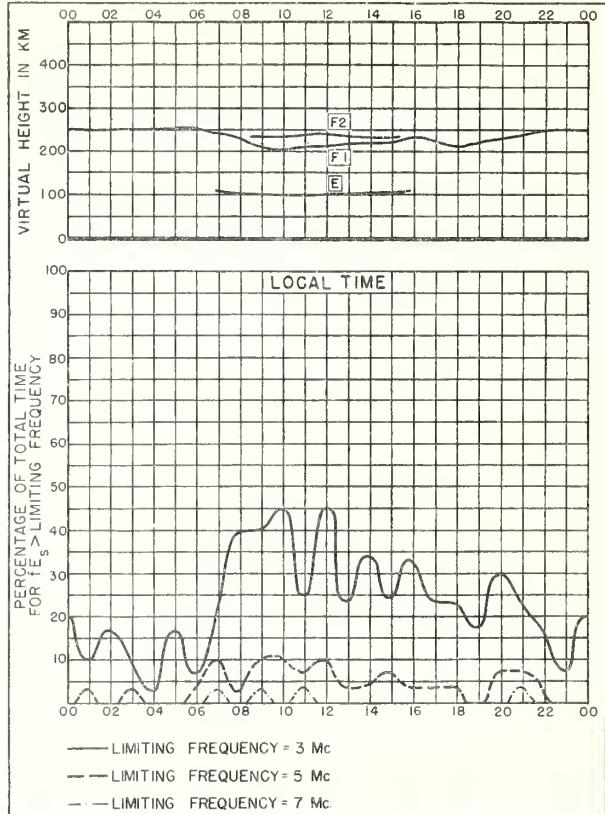


Fig. 2. WASHINGTON, D. C. NOVEMBER 1948

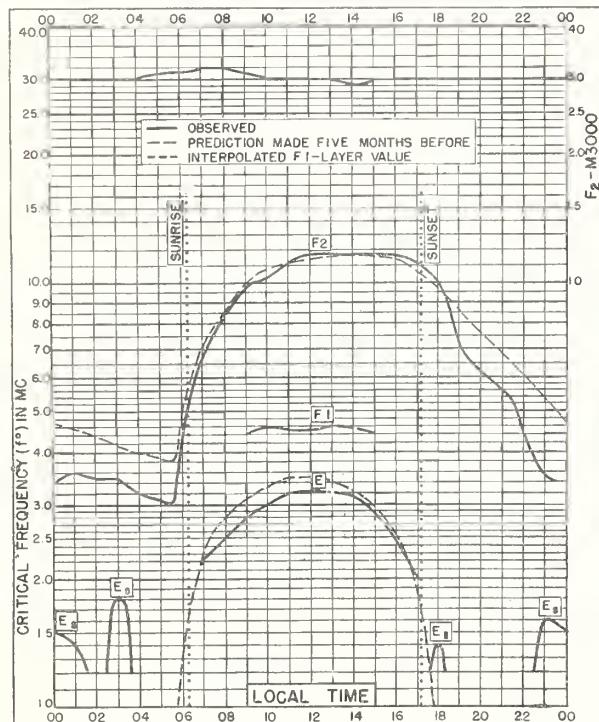


Fig. 3. ST. JOHN'S, NEWFOUNDLAND
47.6°N, 52.7°W OCTOBER 1948

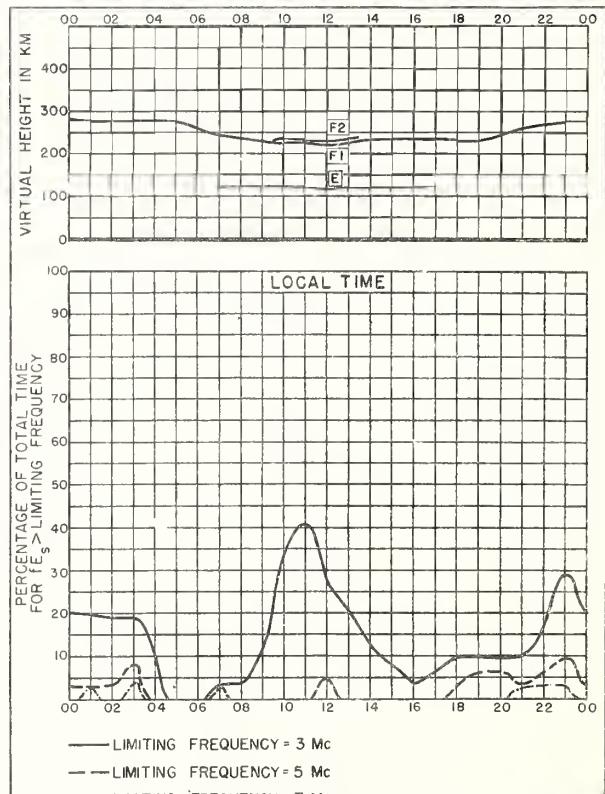
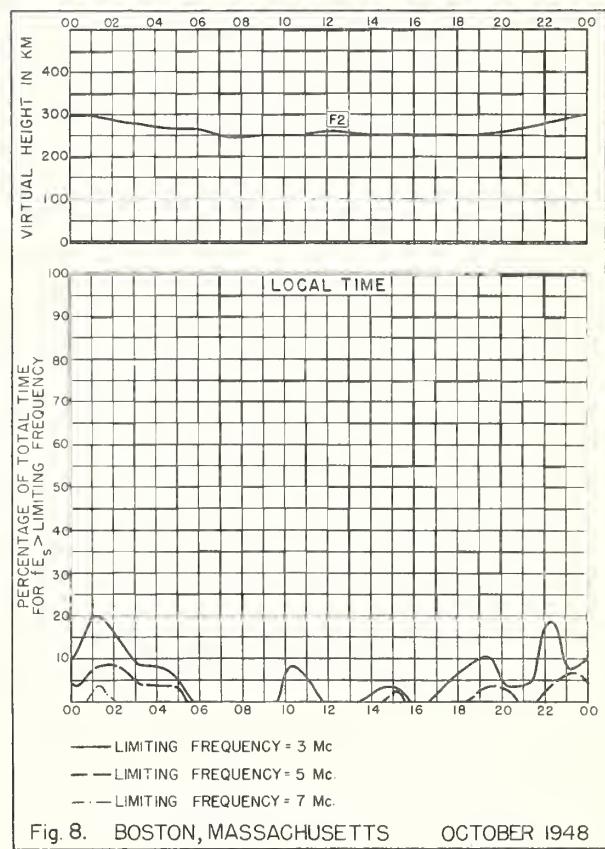
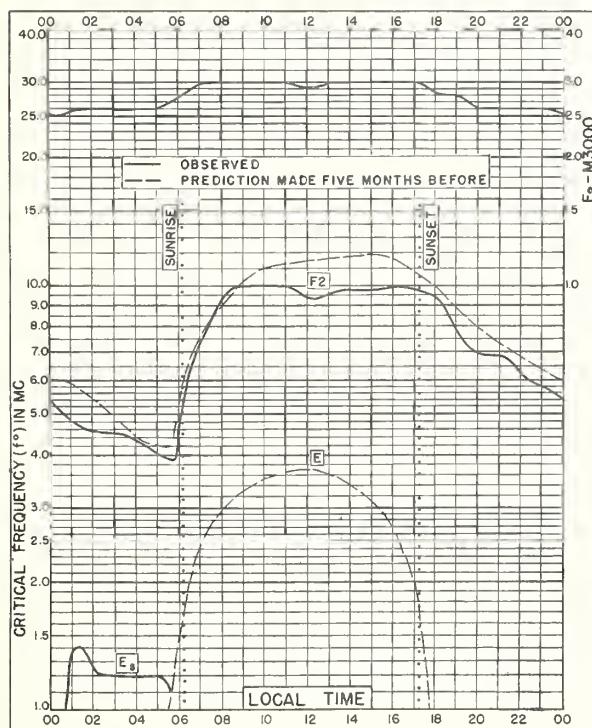
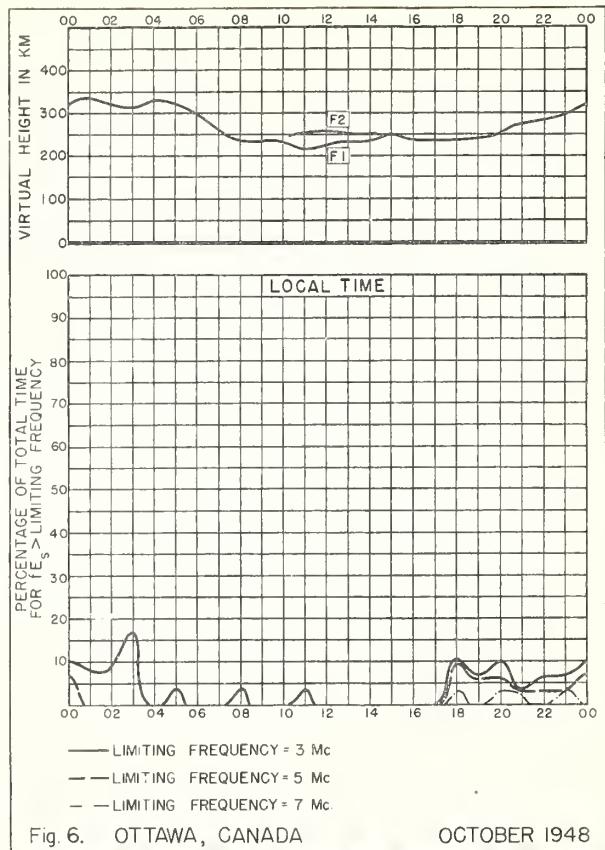
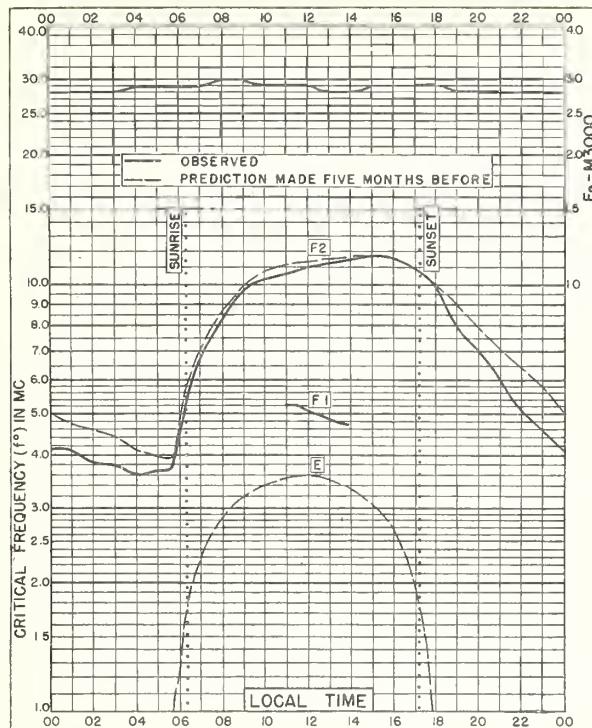


Fig. 4. ST. JOHN'S, NEWFOUNDLAND OCTOBER 1948



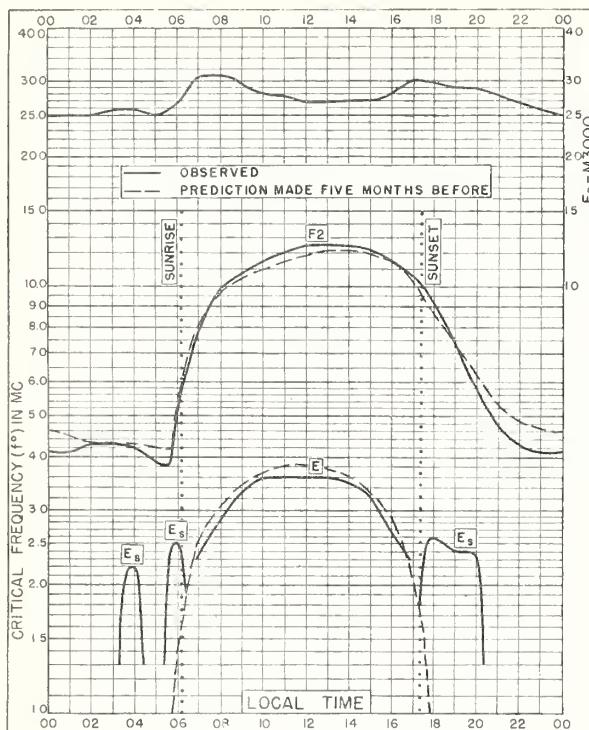


Fig. 9. SAN FRANCISCO, CALIFORNIA
37.4°N, 122.2°W OCTOBER 1948

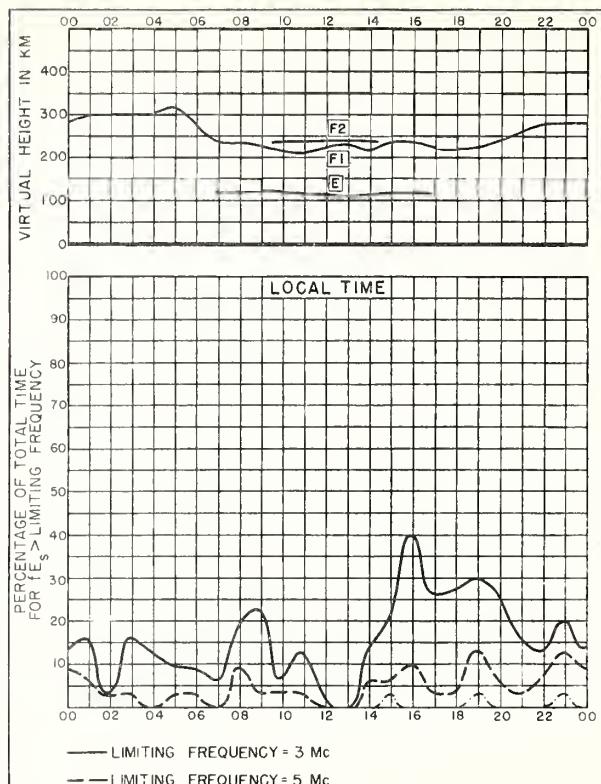


Fig. 10. SAN FRANCISCO, CALIFORNIA OCTOBER 1948

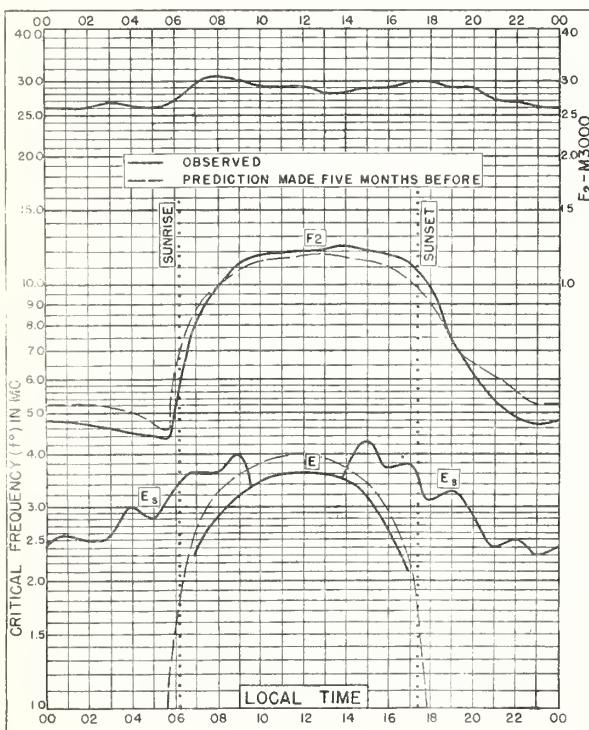


Fig. 11. WHITE SANDS, NEW MEXICO
32.3°N, 106.5°W OCTOBER 1948

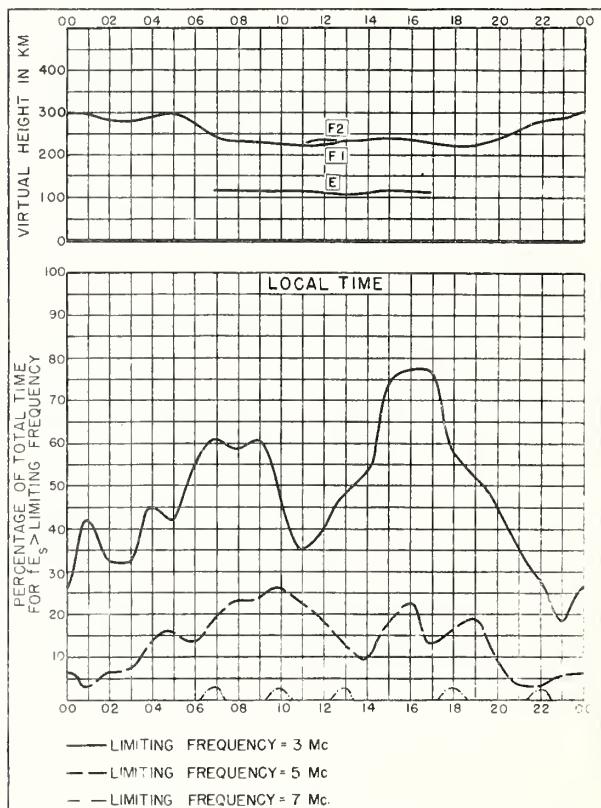


Fig. 12. WHITE SANDS, NEW MEXICO OCTOBER 1948

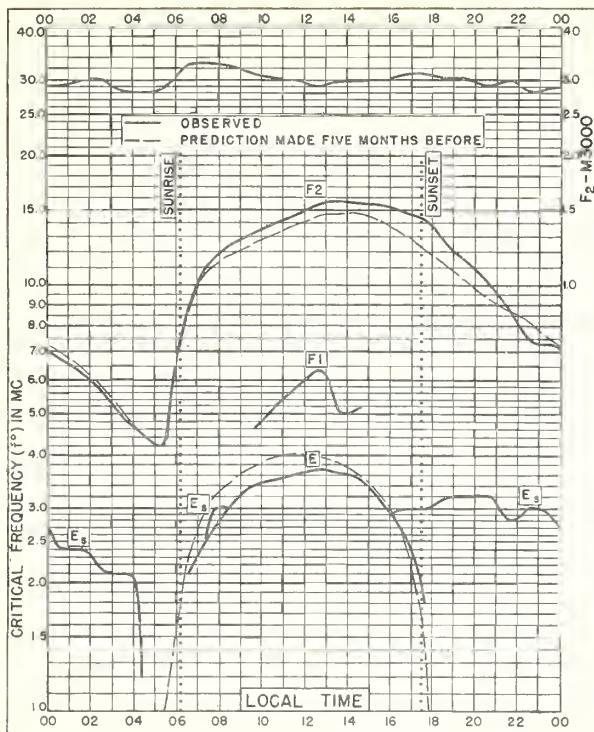


Fig. 13. WUCHANG, CHINA
30.6°N, 114.4°E

OCTOBER 1948

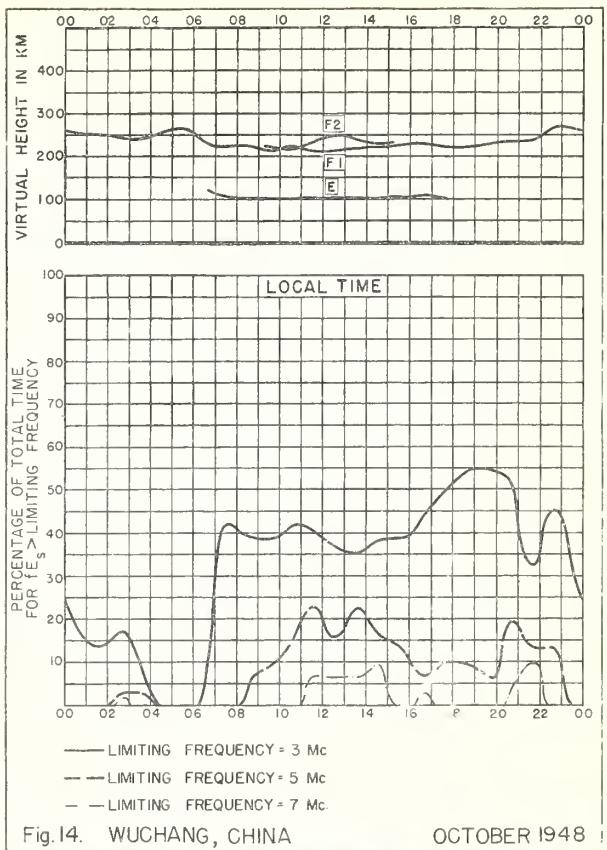


Fig. 14. WUCHANG, CHINA

OCTOBER 1948

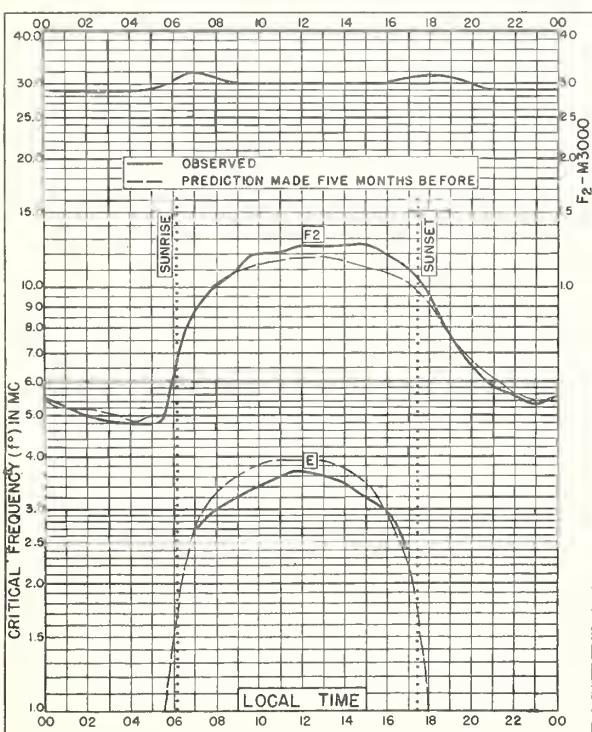


Fig. 15. BATON ROUGE, LOUISIANA

30.5°N, 91.2°W

OCTOBER 1948

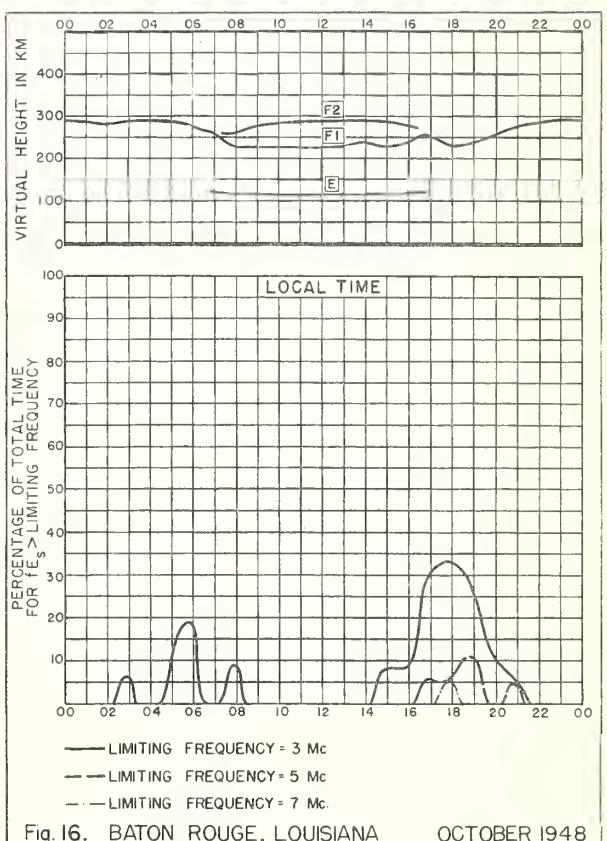


Fig. 16. BATON ROUGE, LOUISIANA

OCTOBER 1948

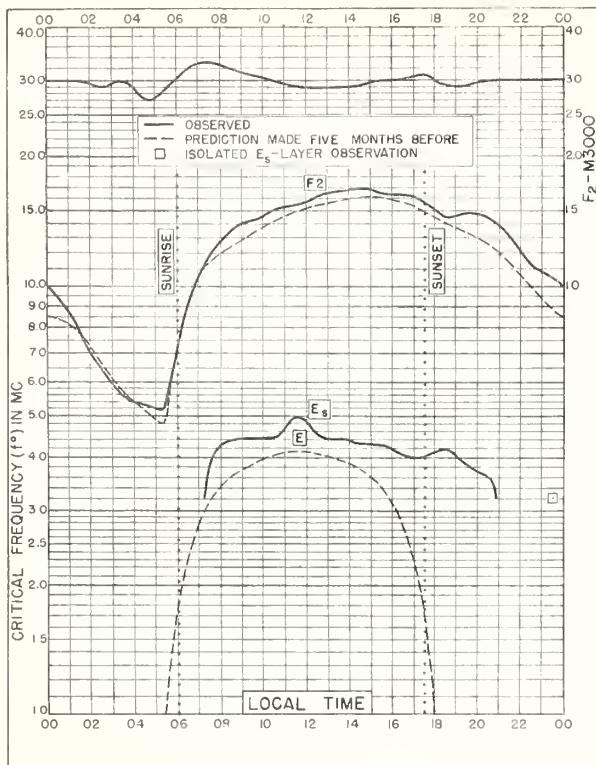


Fig. 17. OKINAWA I.
26.3°N, 127.7°E

OCTOBER 1948

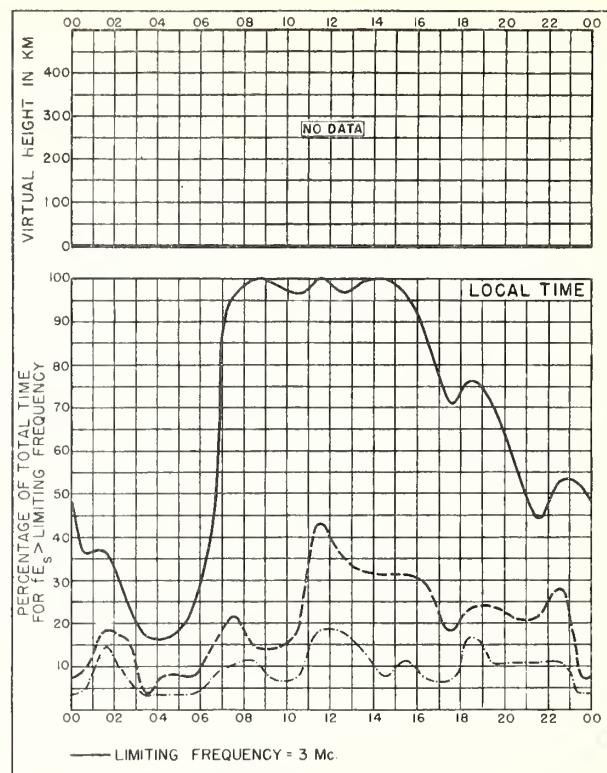


Fig. 18. OKINAWA I. OCTOBER 1948

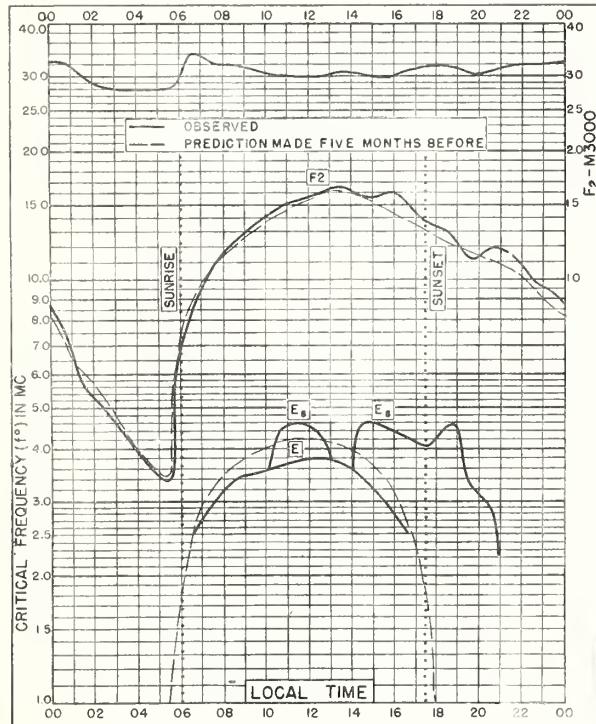


Fig. 19. MAUI, HAWAII

20.8°N, 156.5°W

OCTOBER 1948

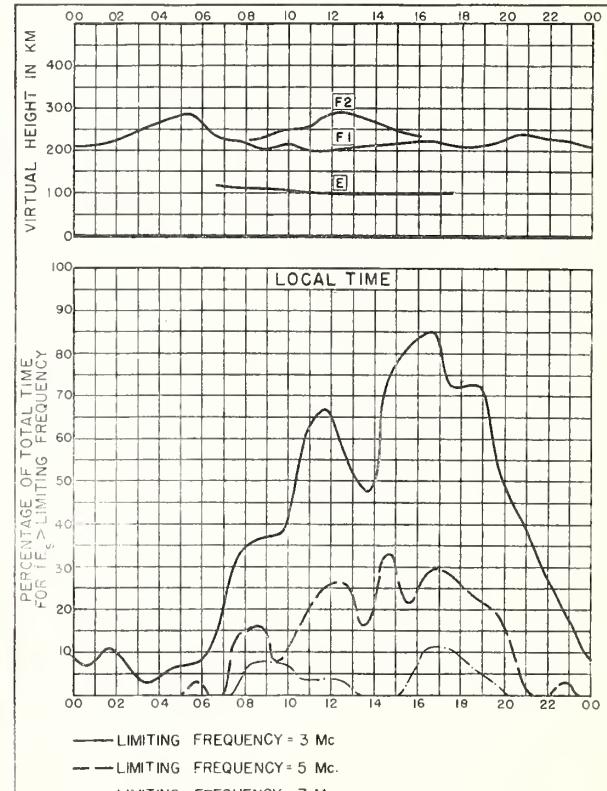
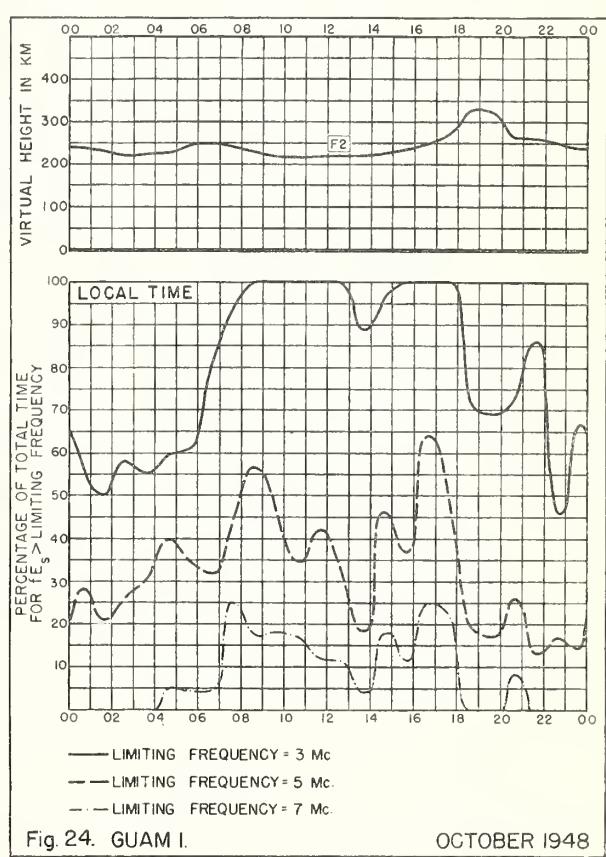
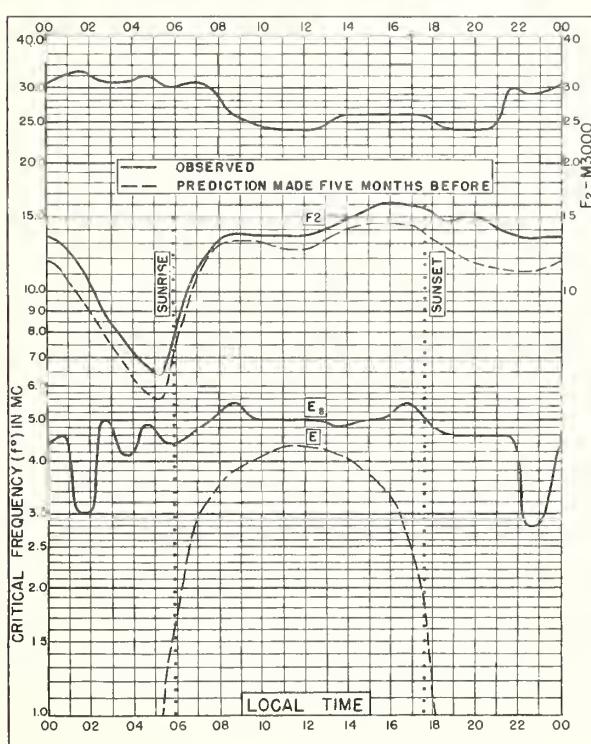
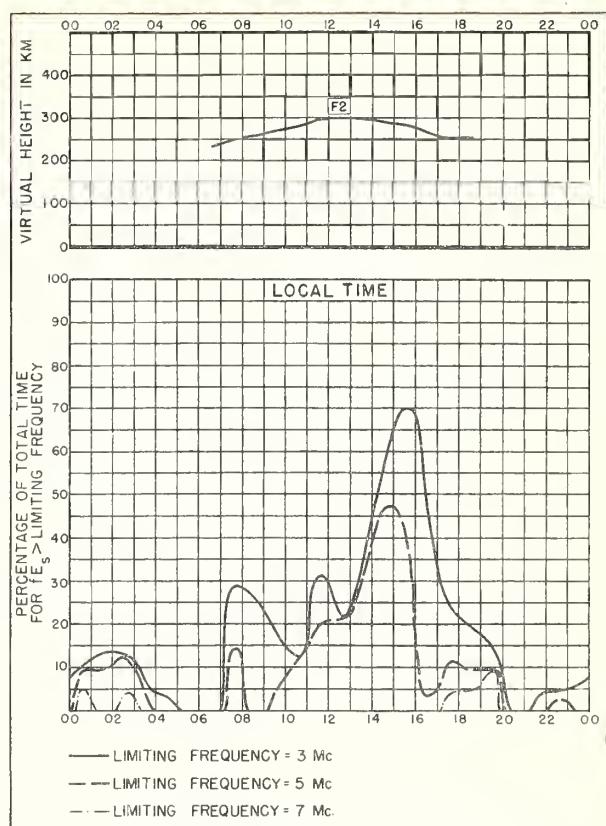
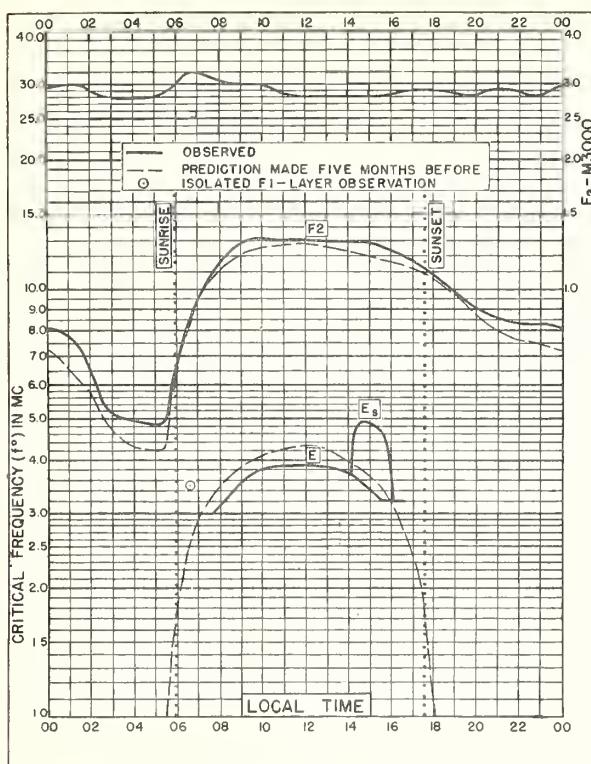


Fig. 20. MAUI, HAWAII

OCTOBER 1948



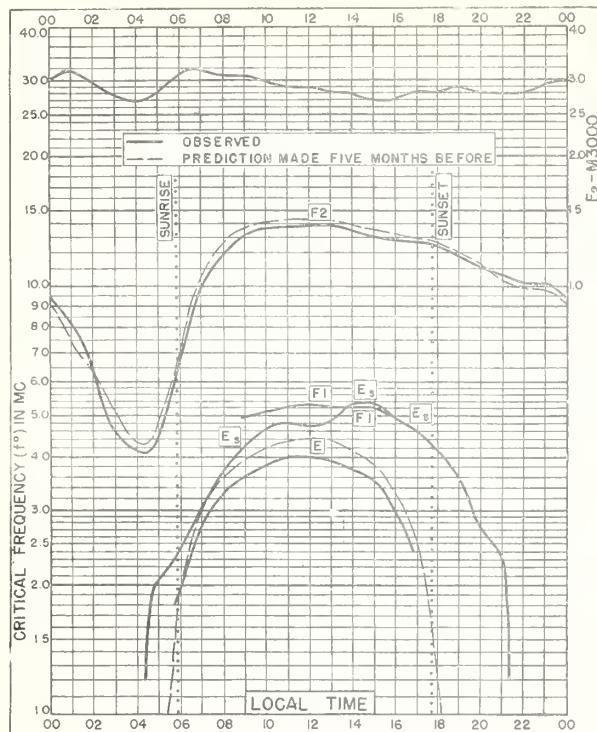


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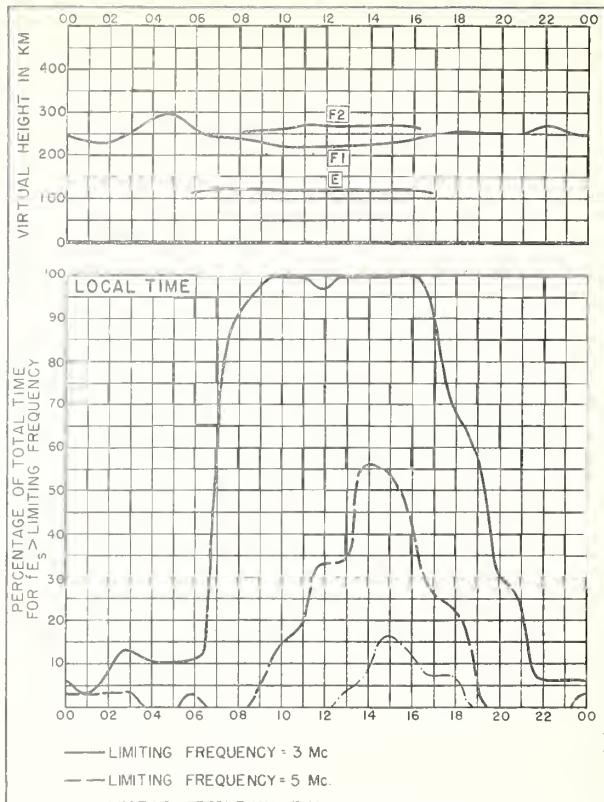


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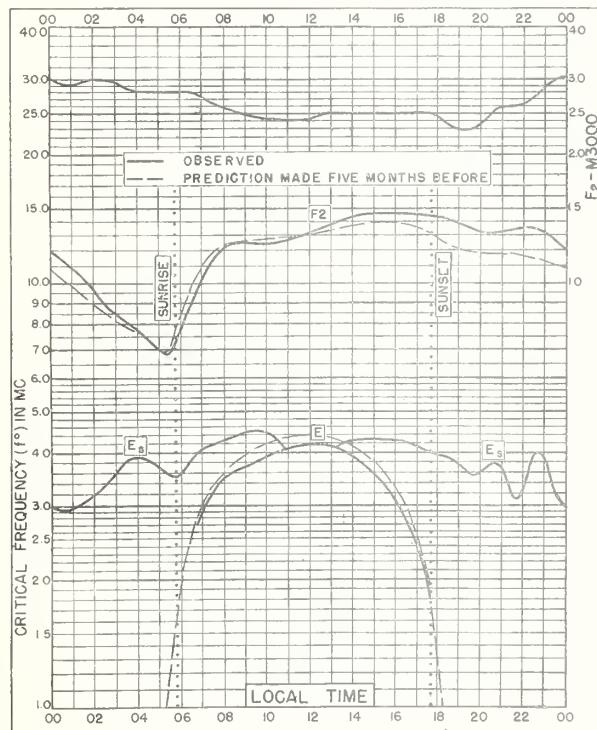


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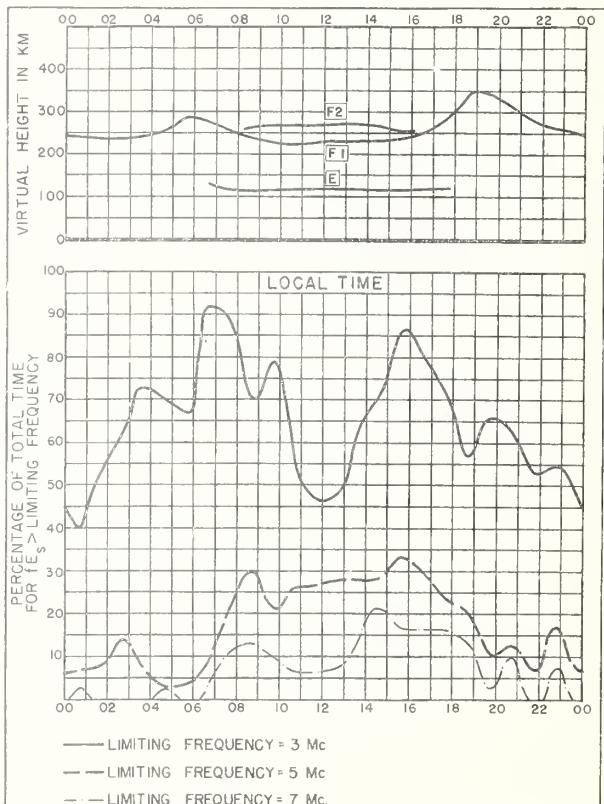


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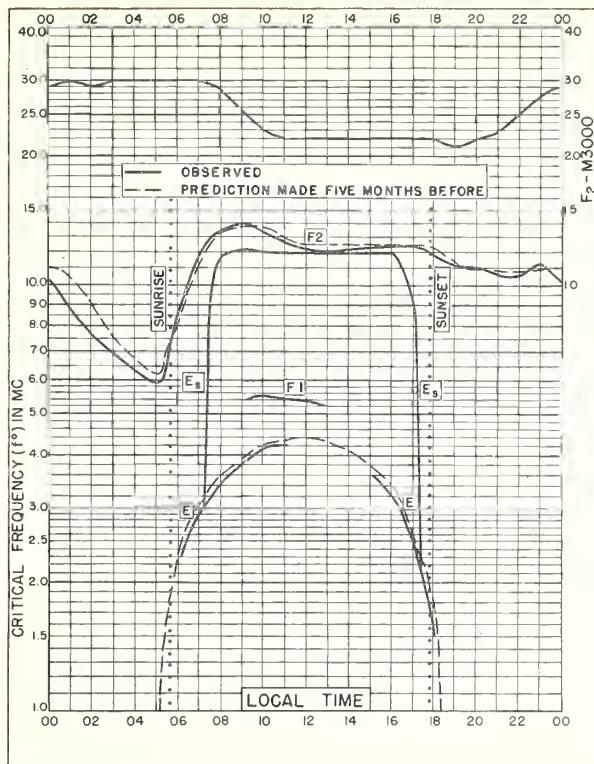


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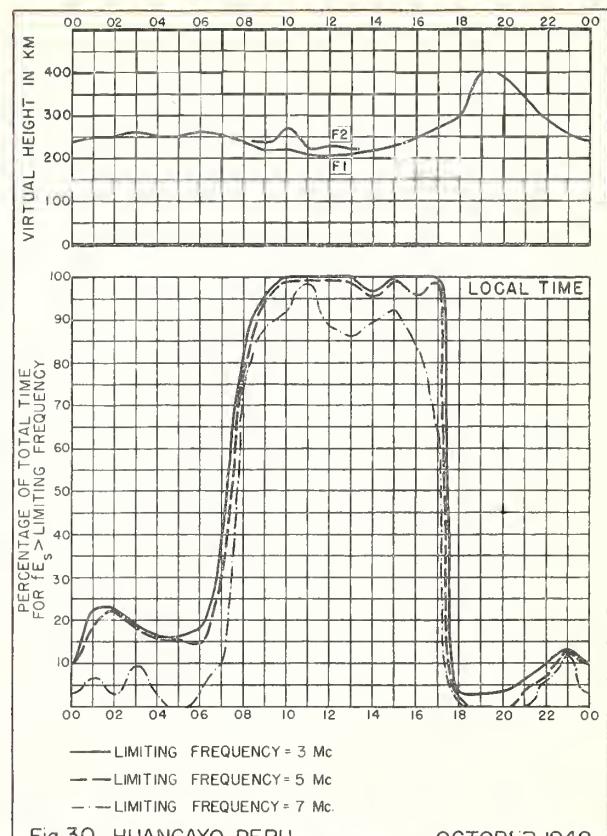


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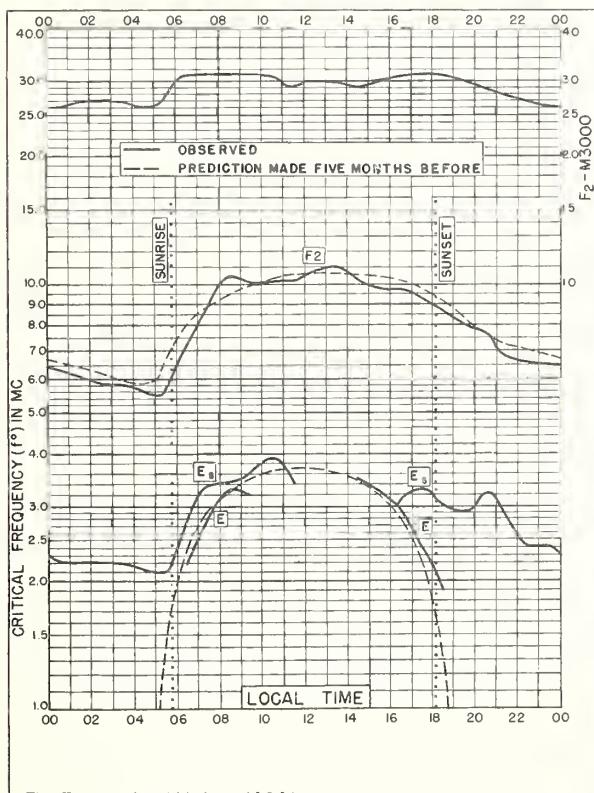


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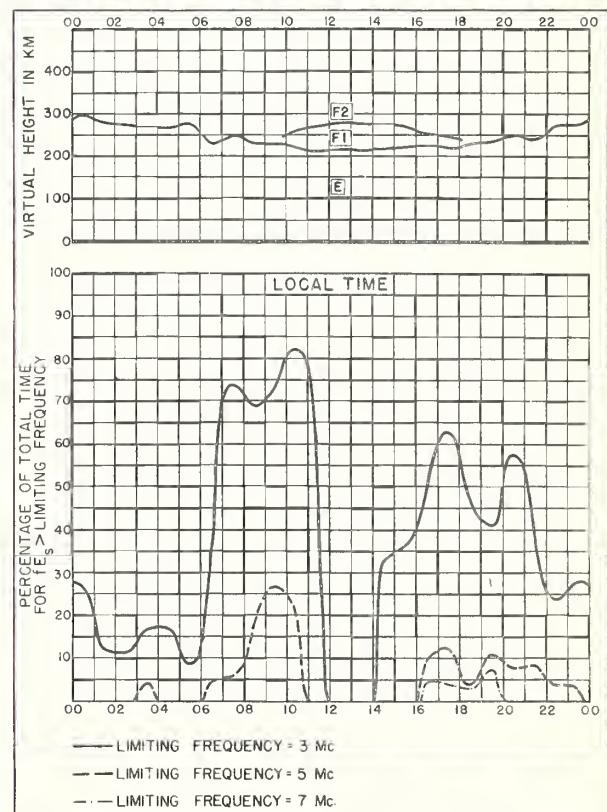
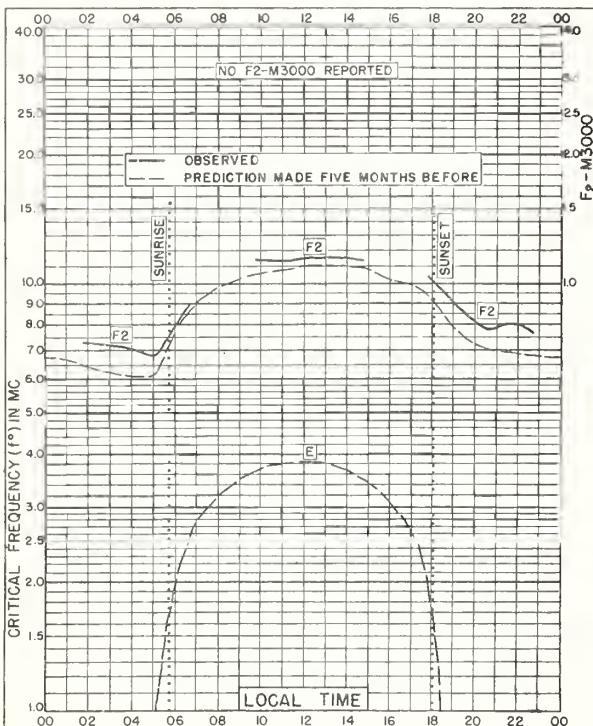
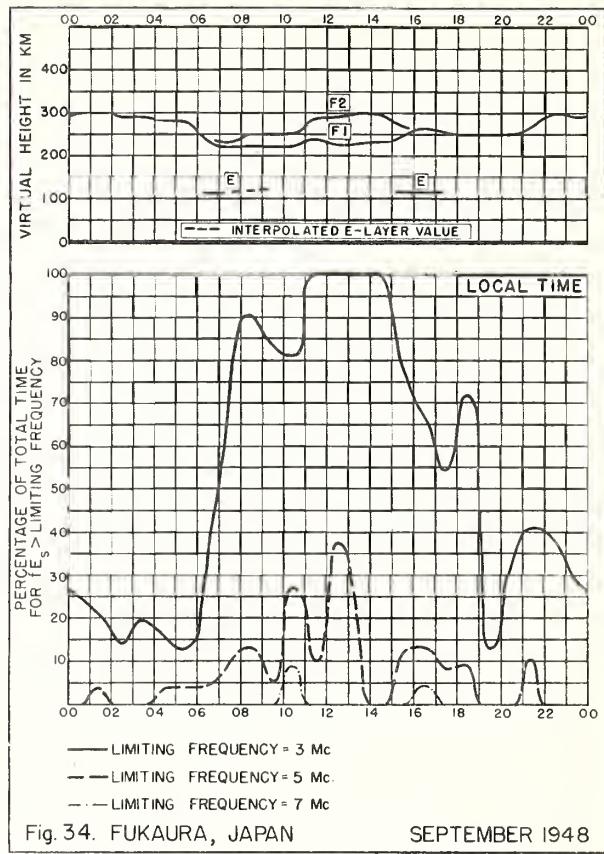
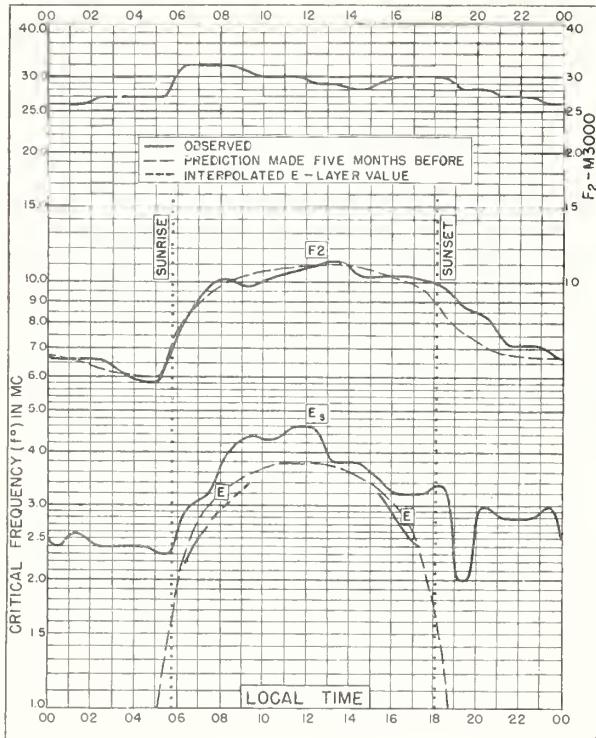


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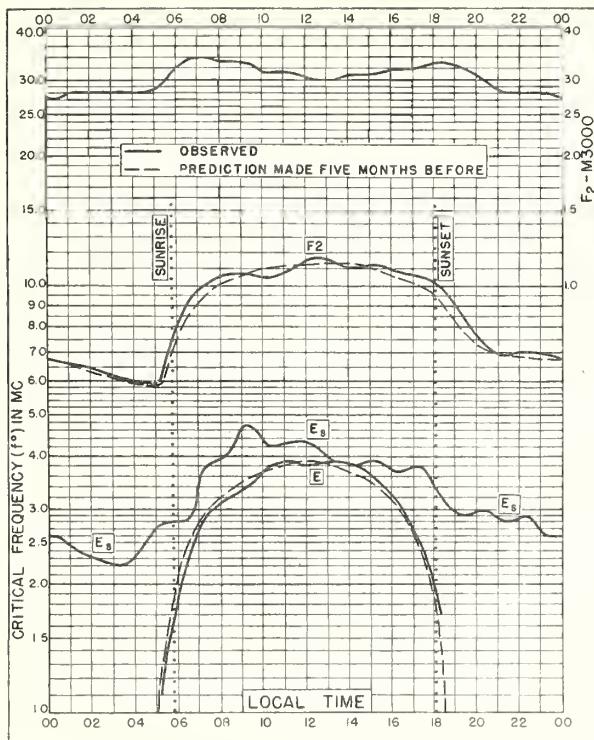


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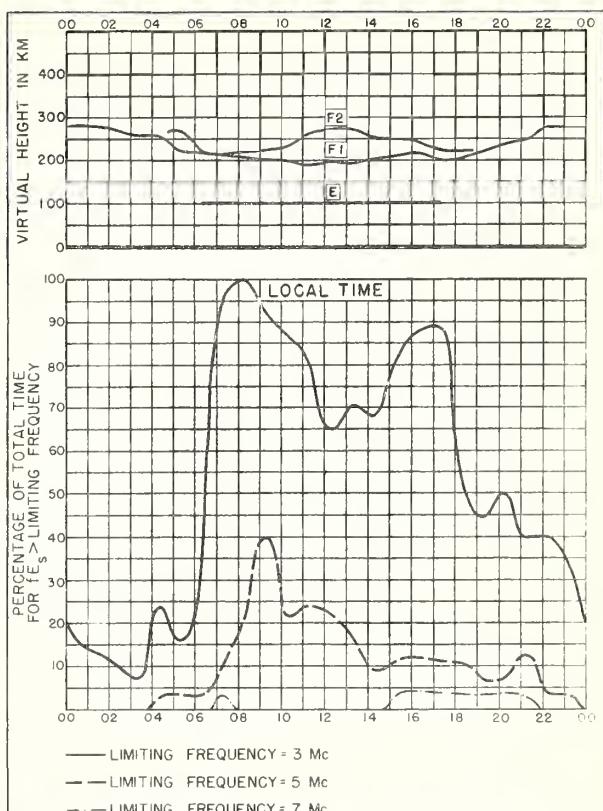


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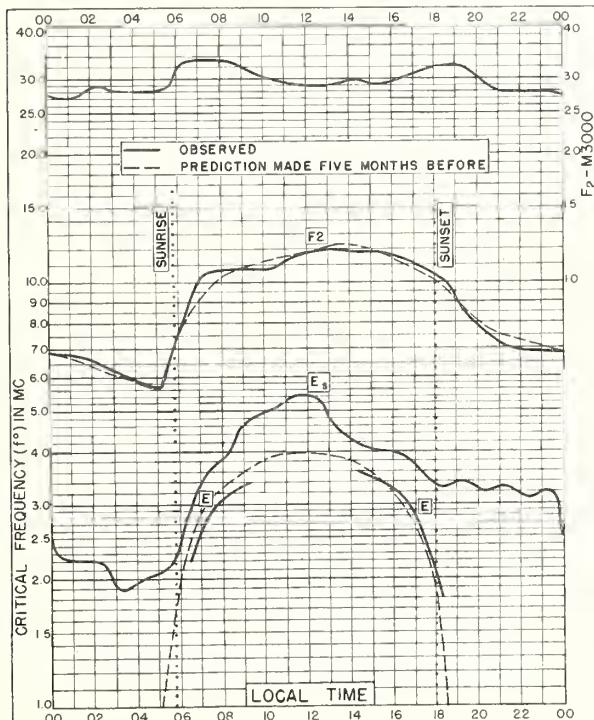


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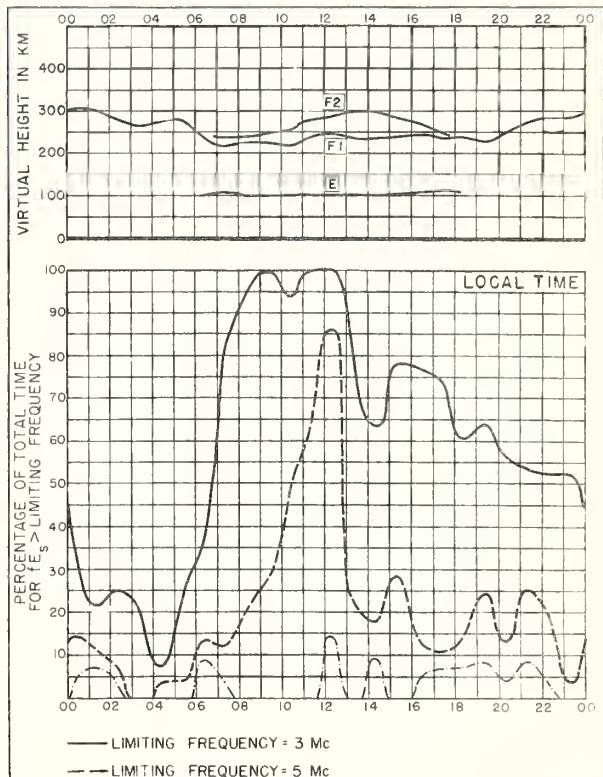


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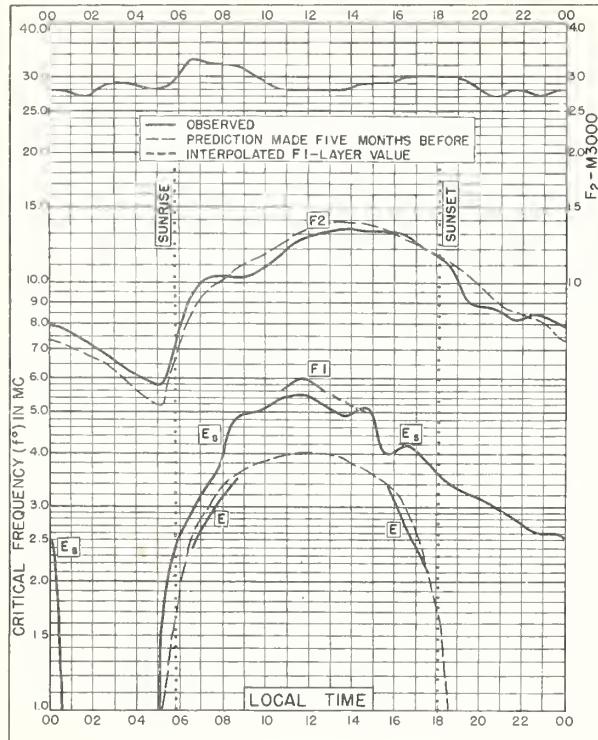


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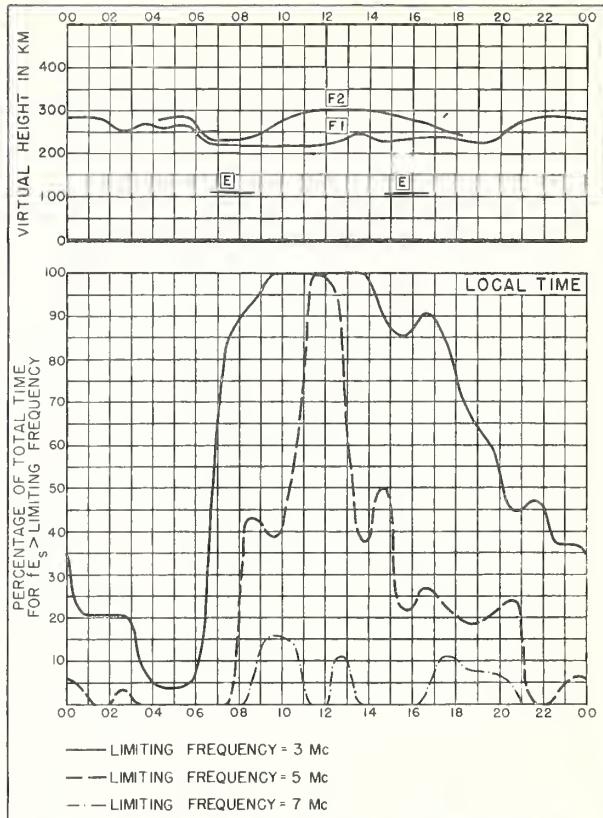


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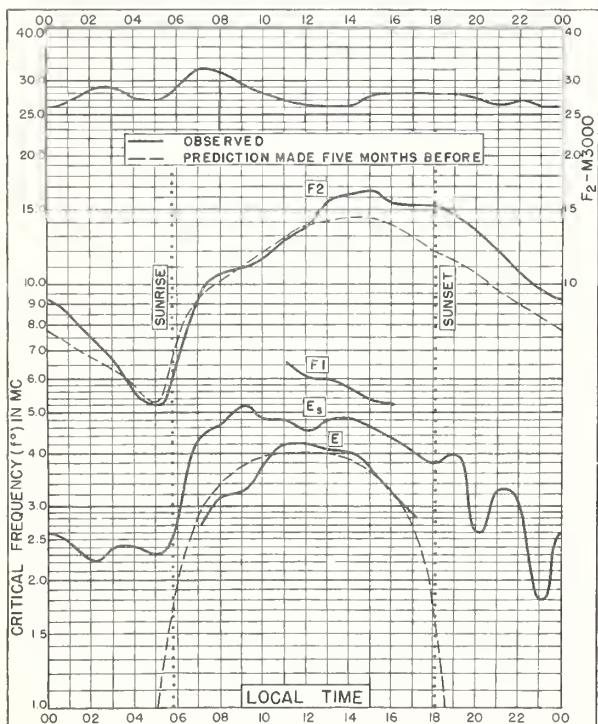


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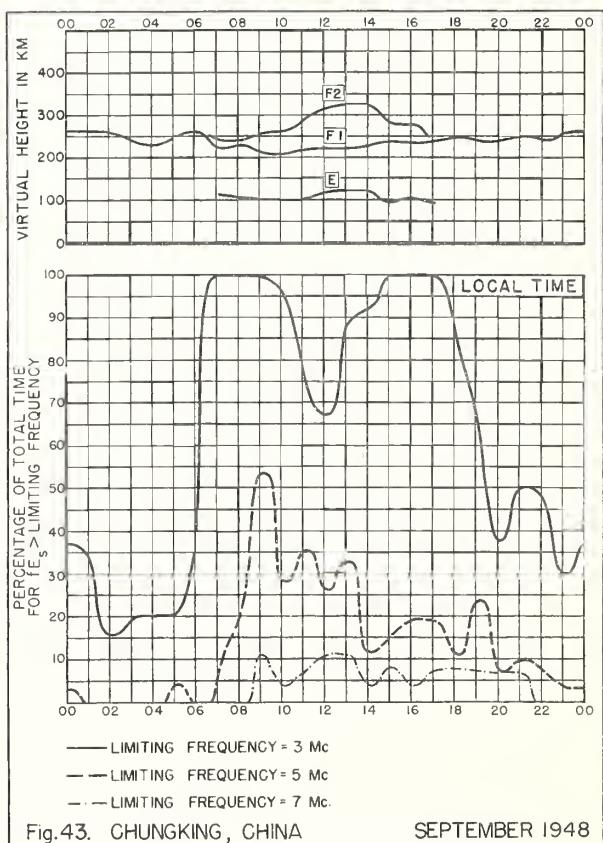
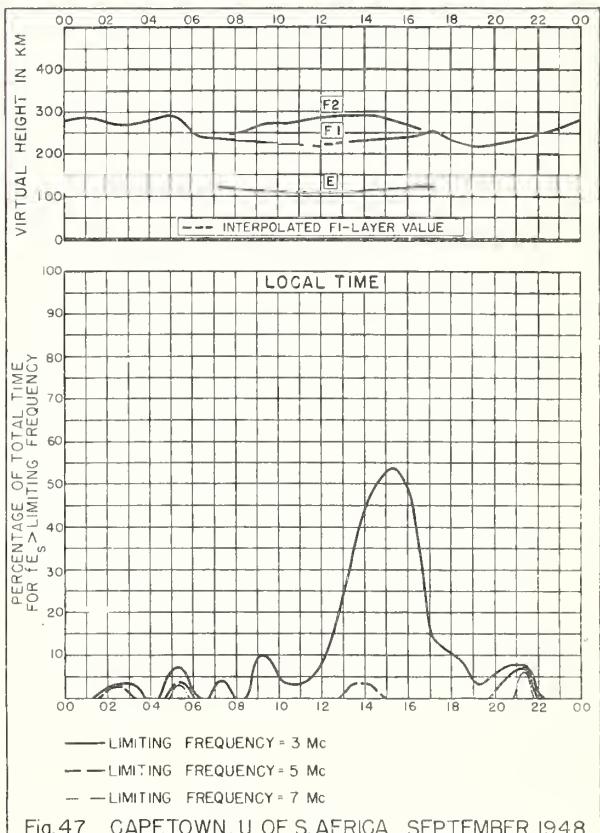
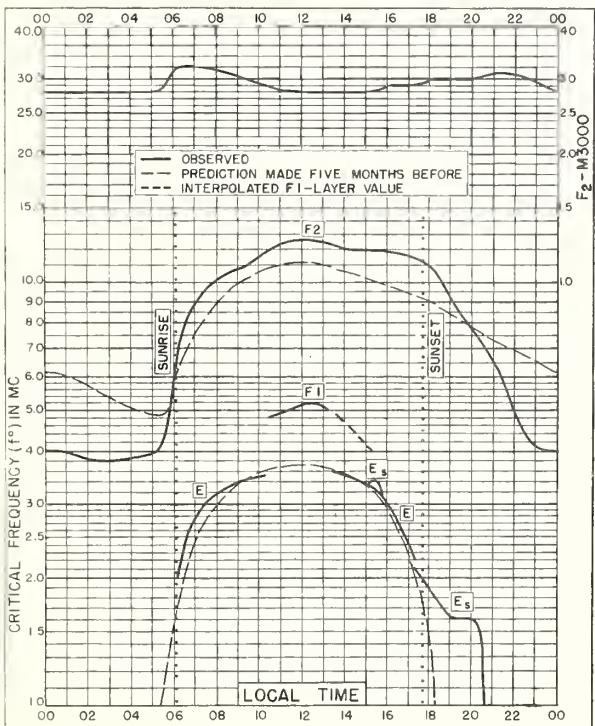
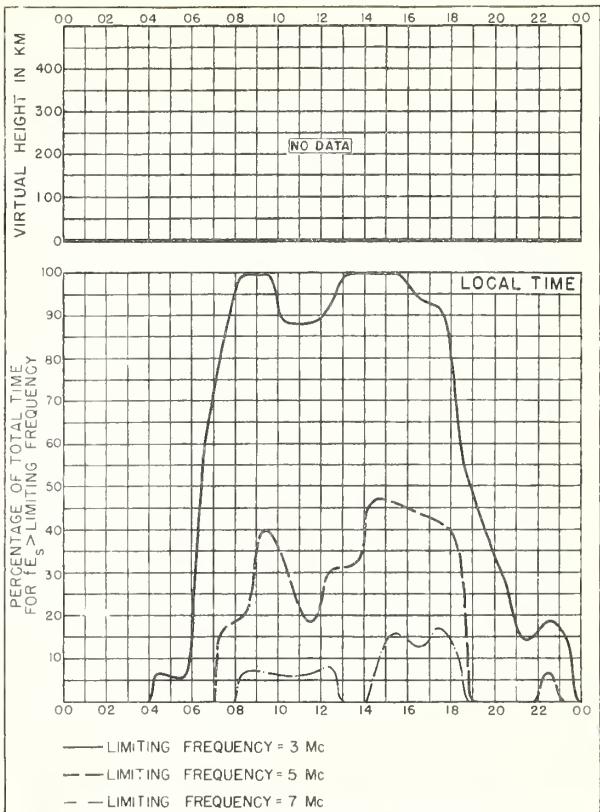
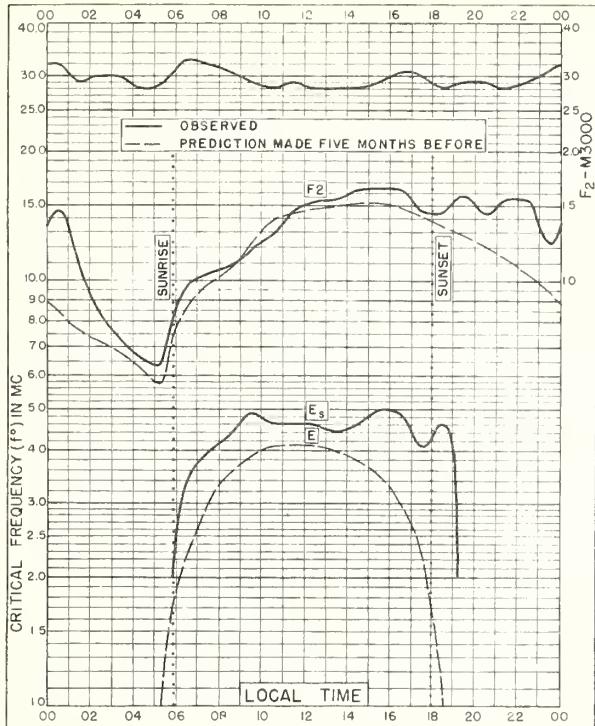


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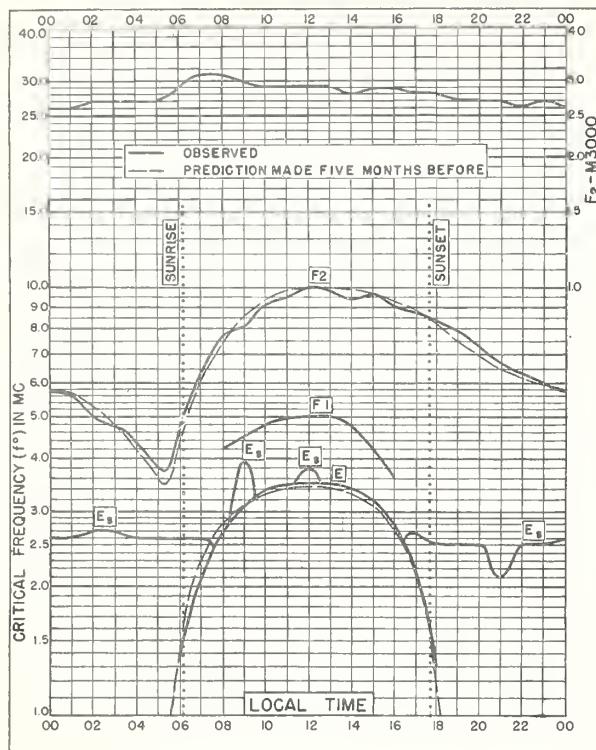


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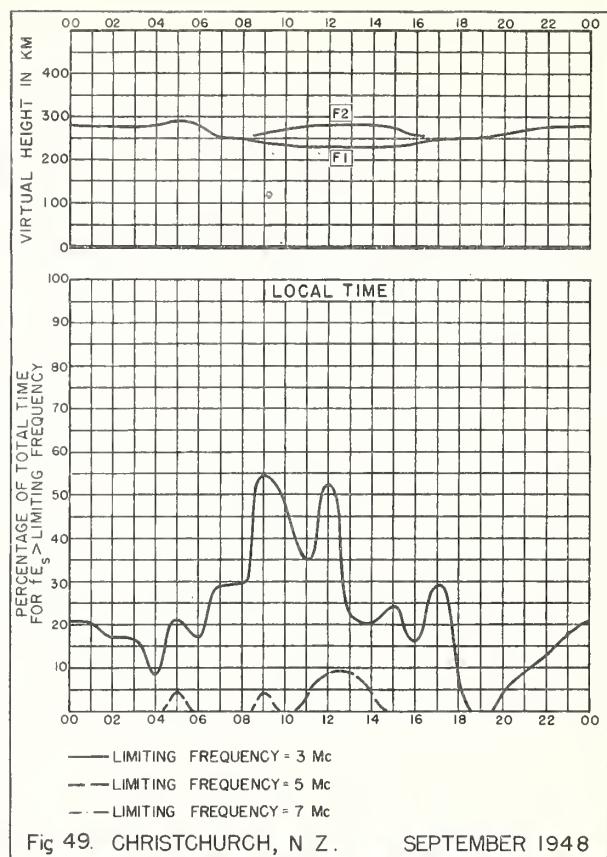


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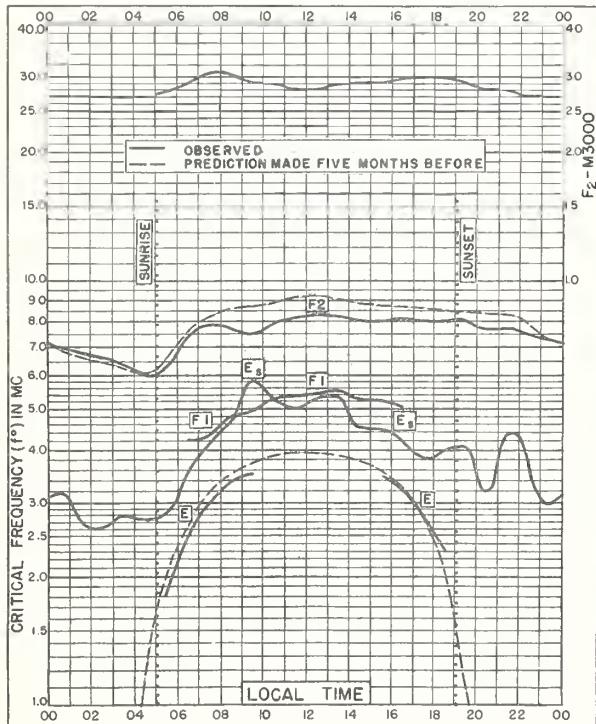


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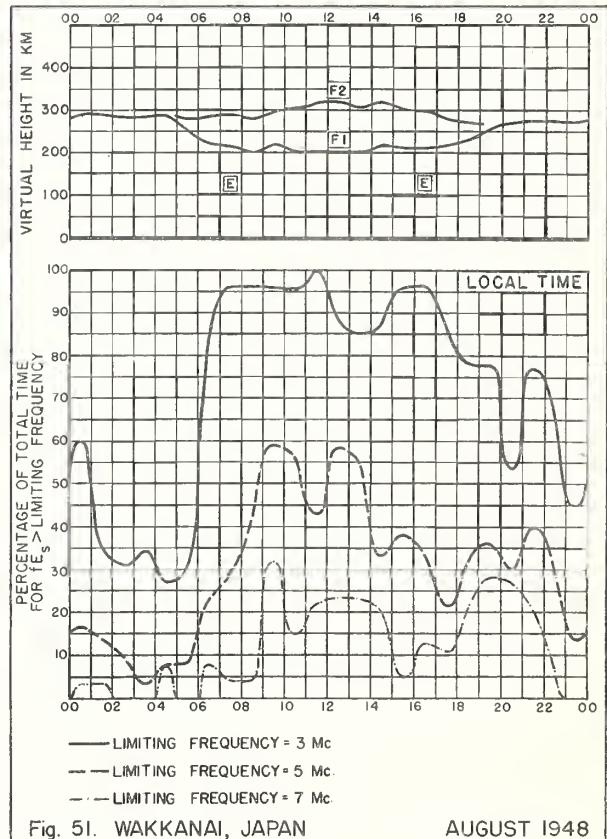
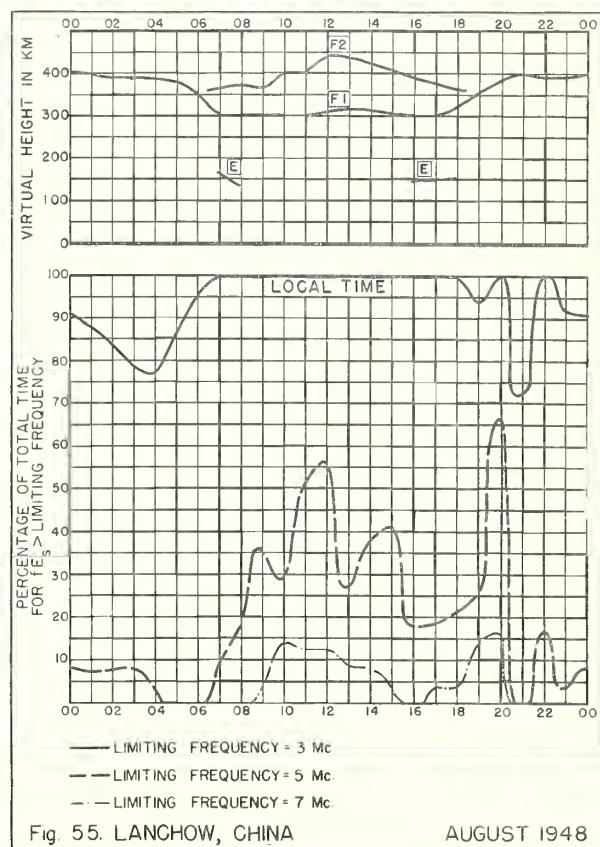
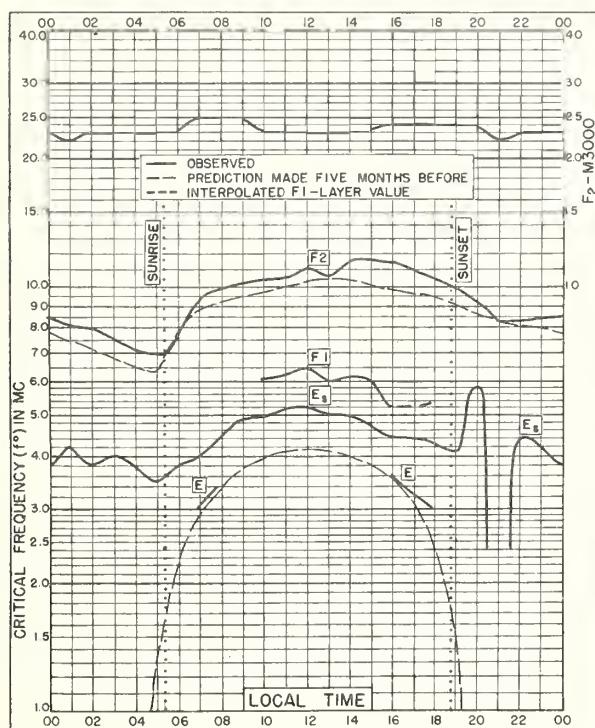
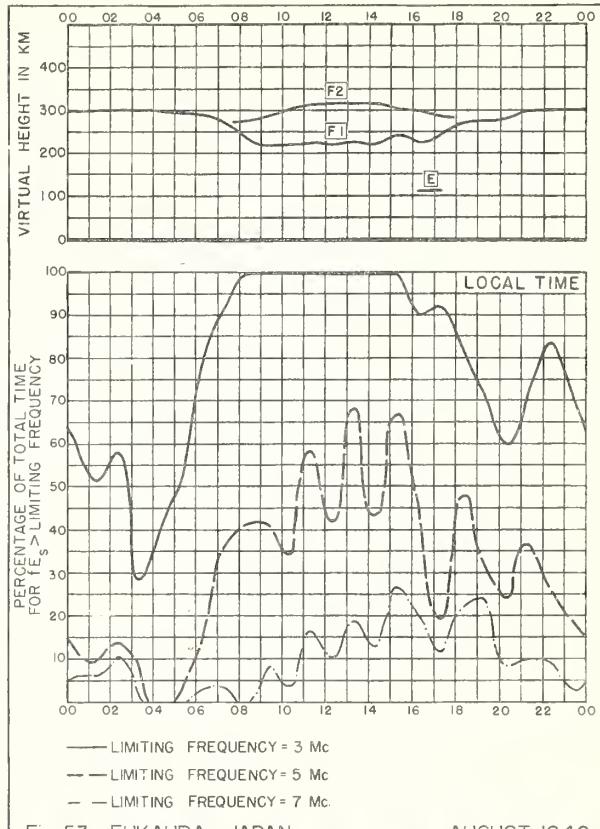
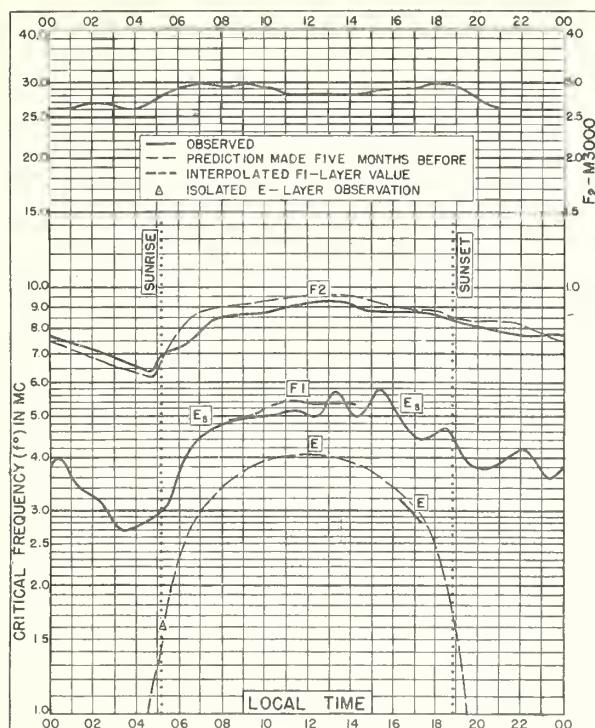
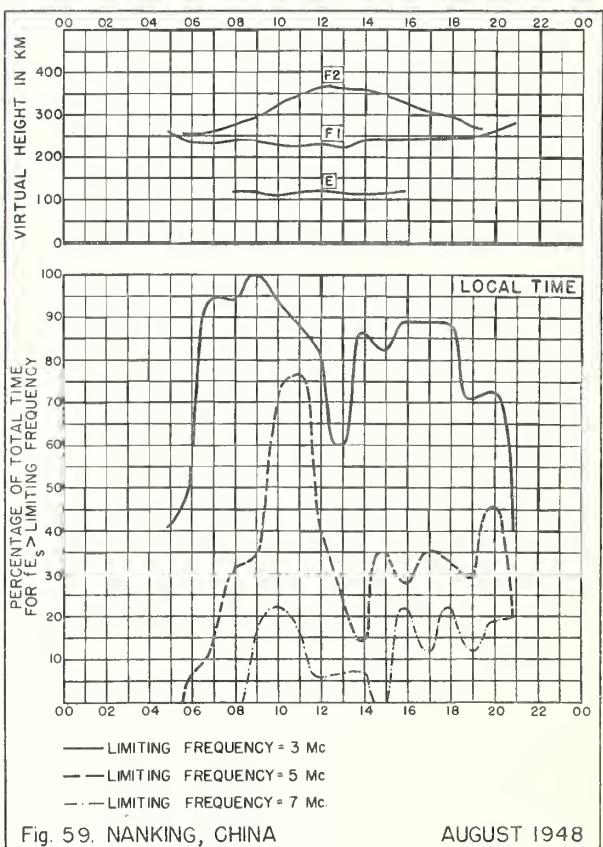
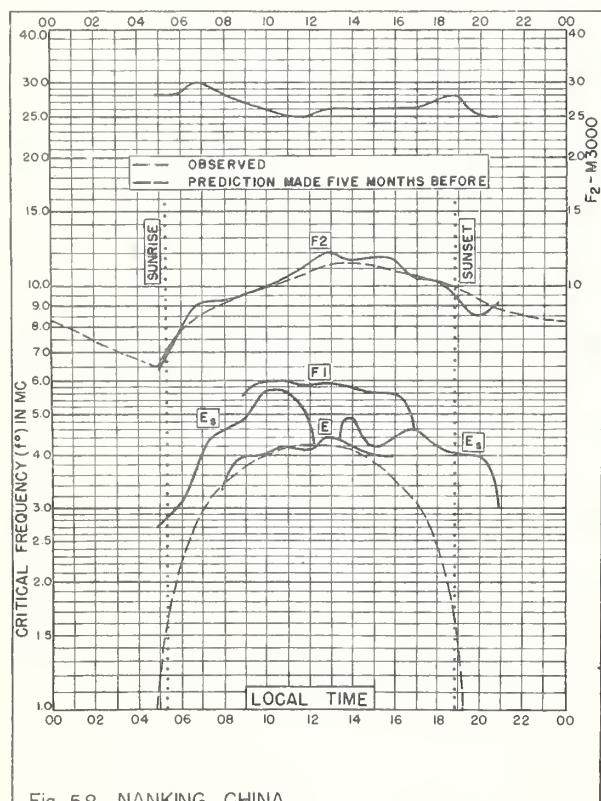
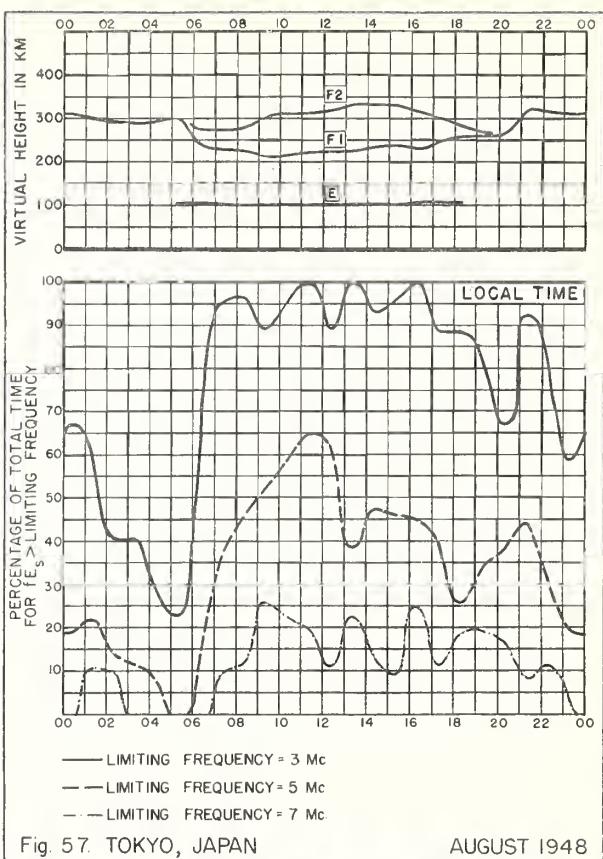
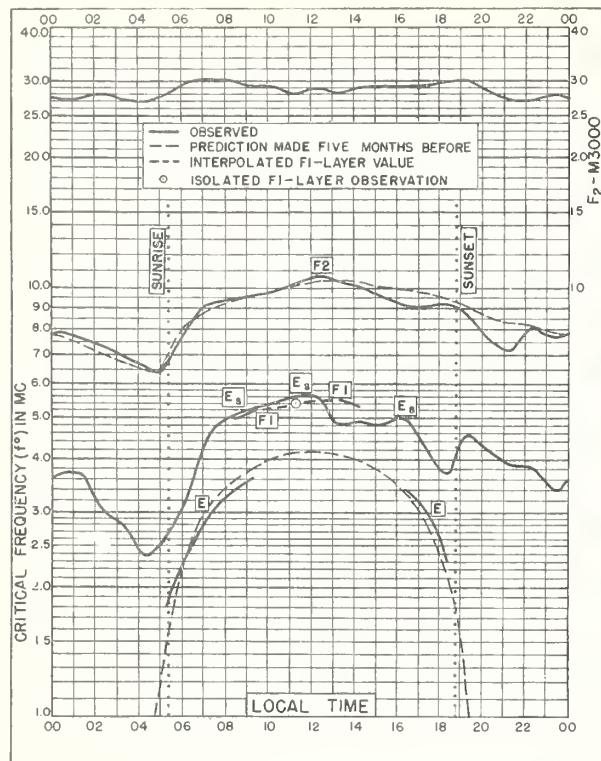


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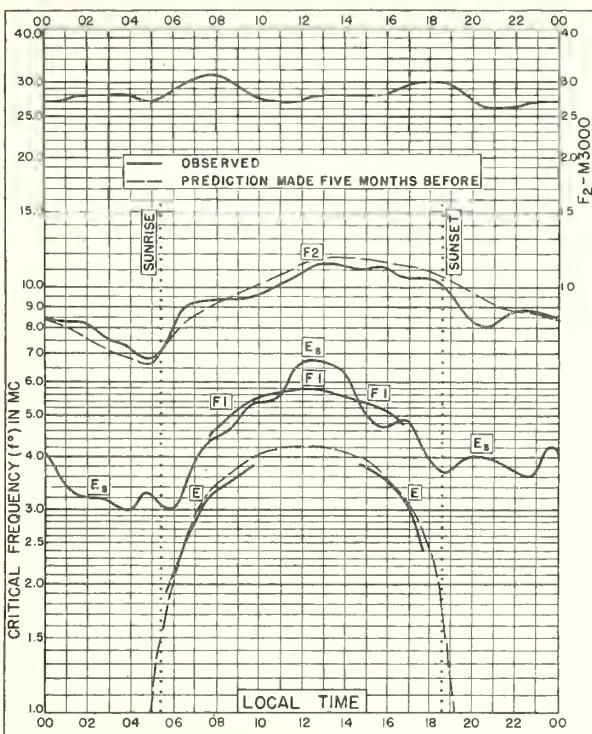


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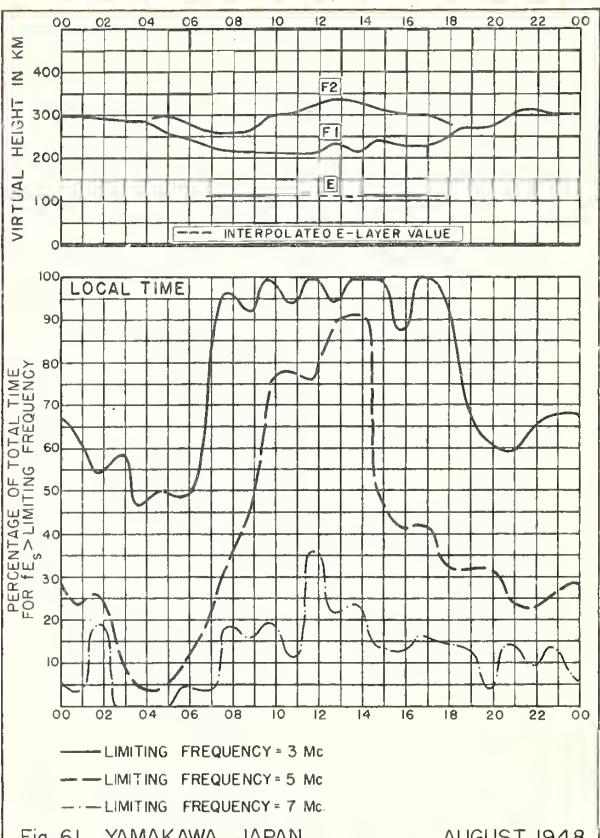


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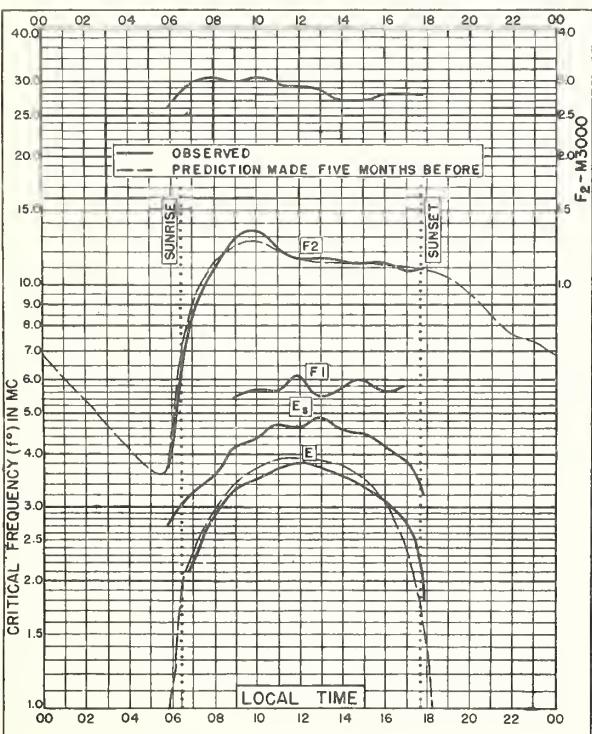


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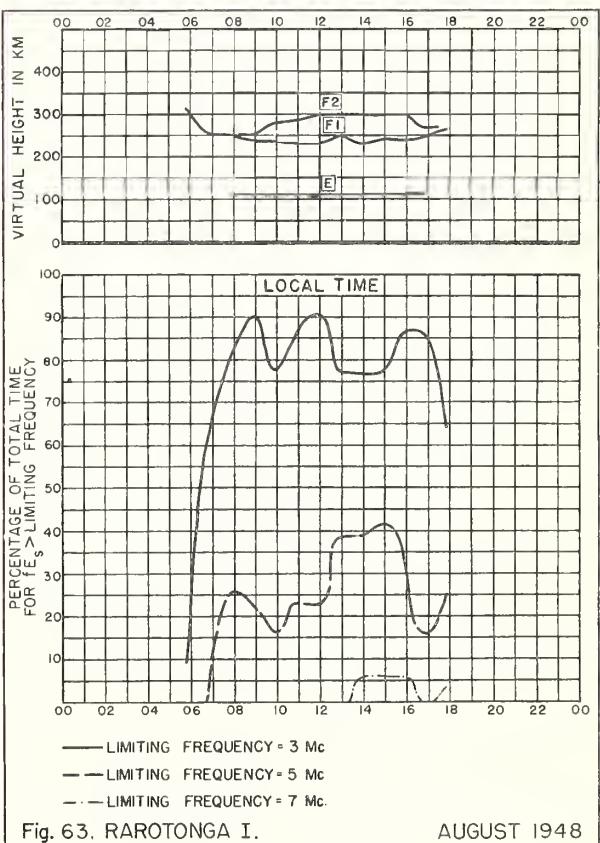


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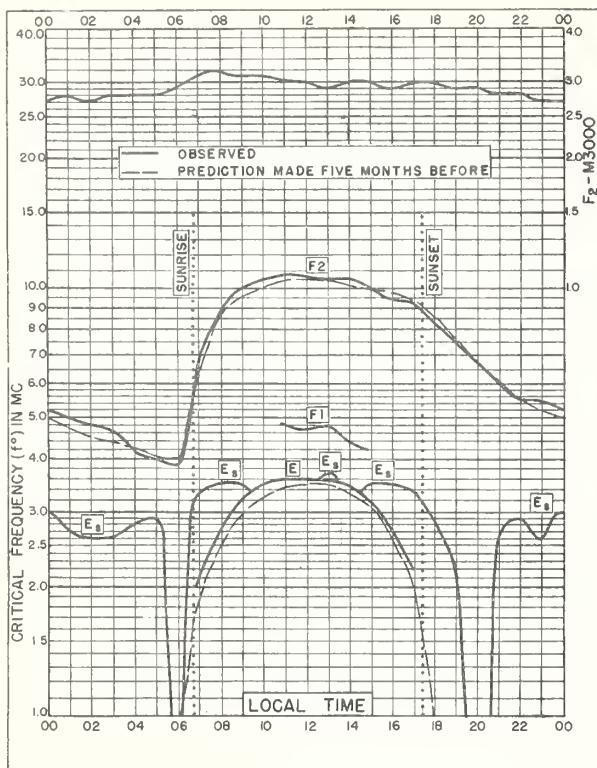


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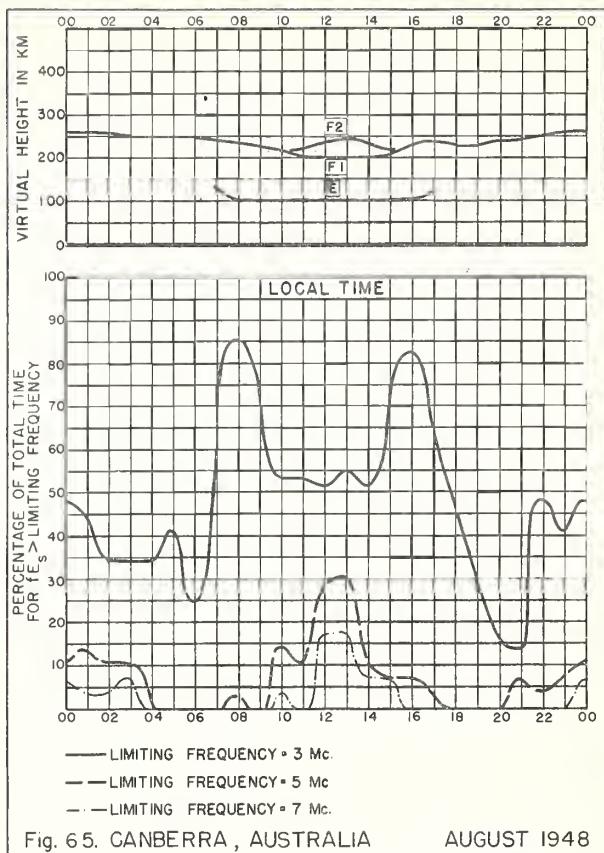


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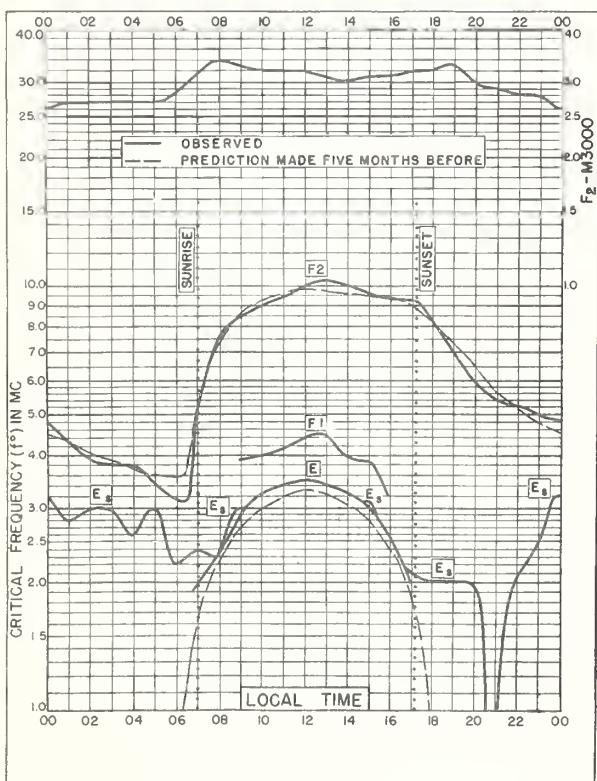


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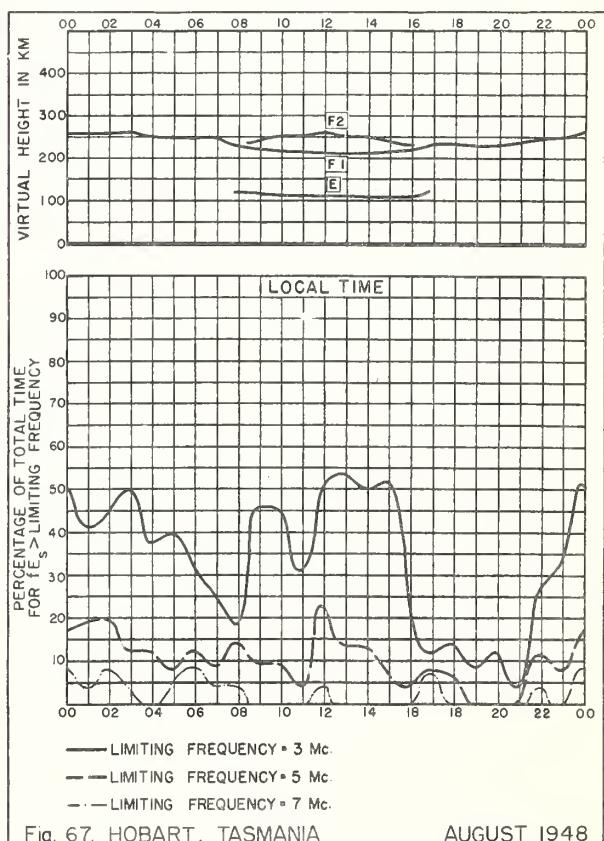


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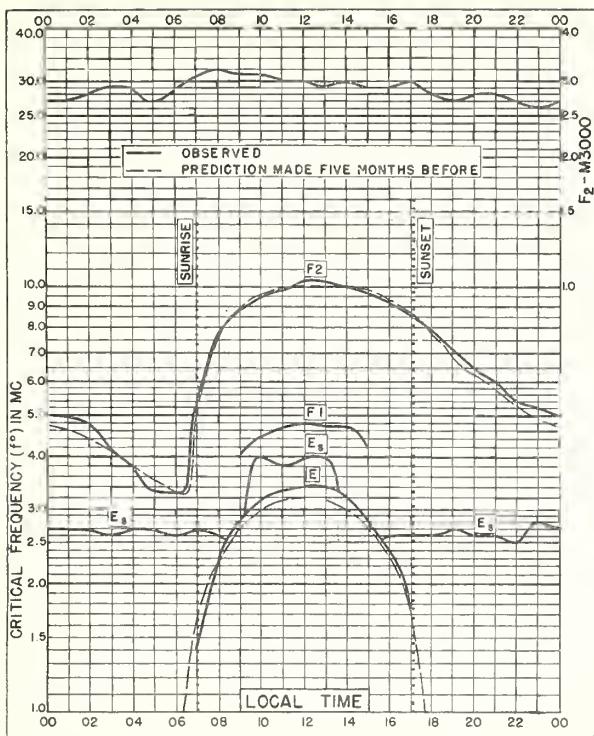


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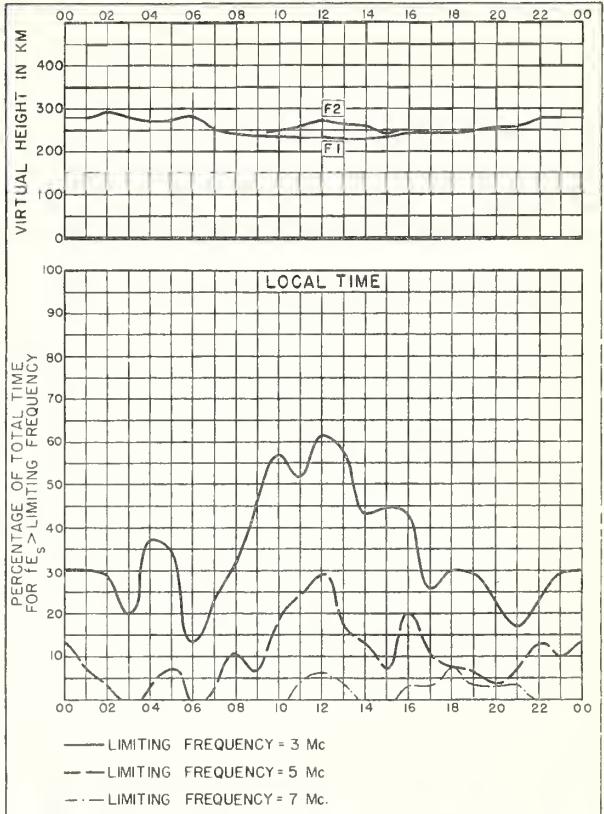


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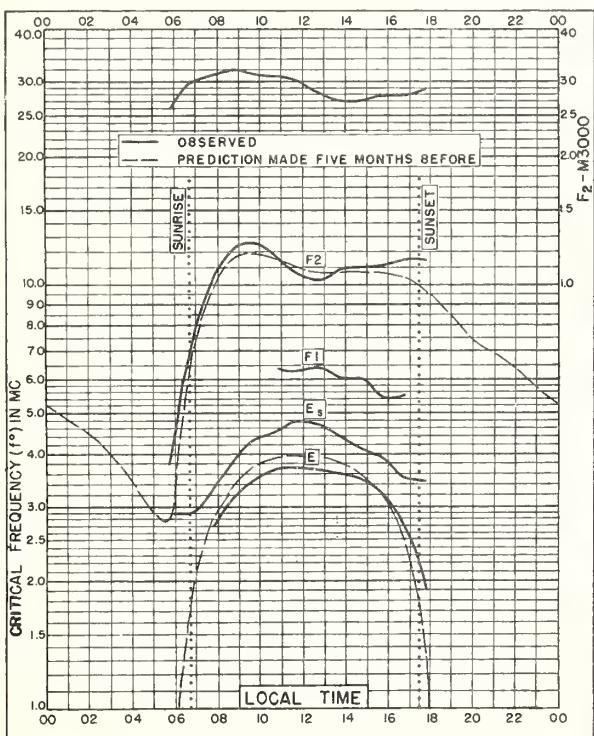


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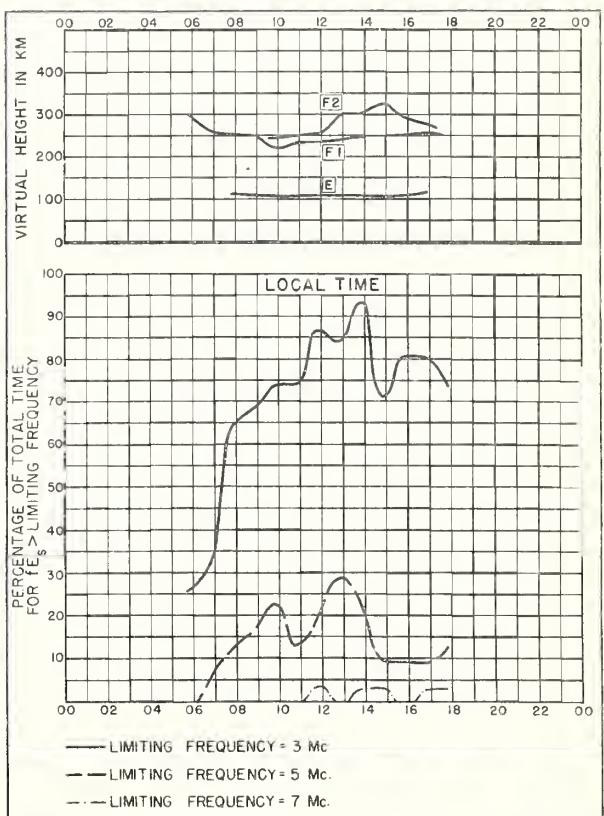


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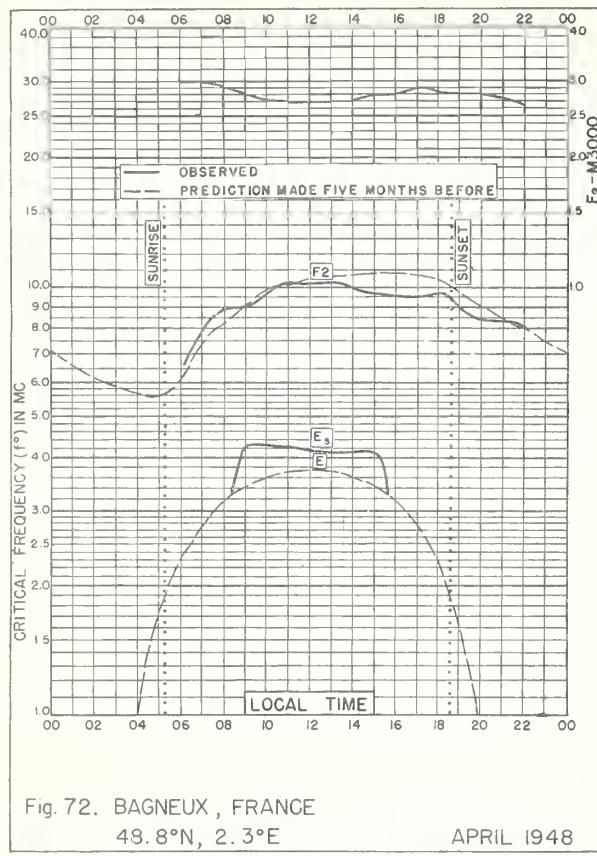


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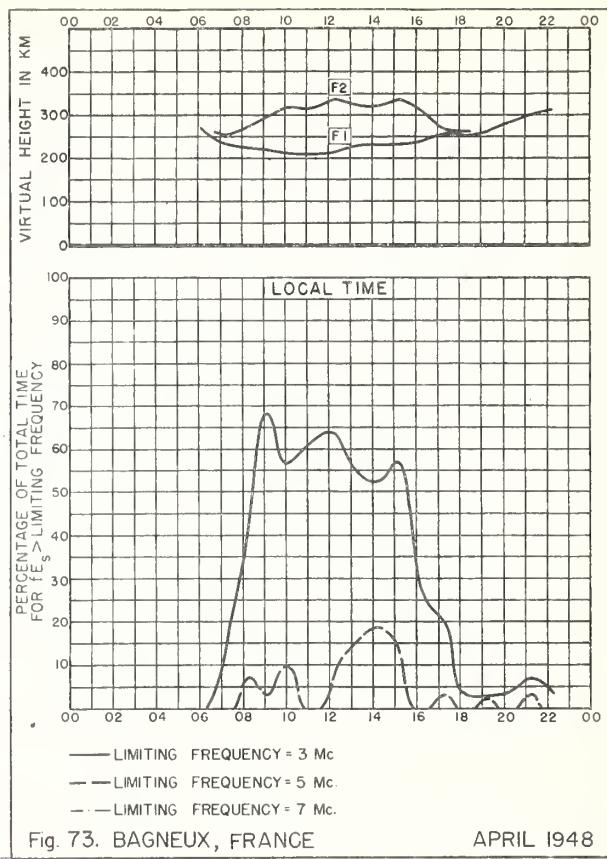


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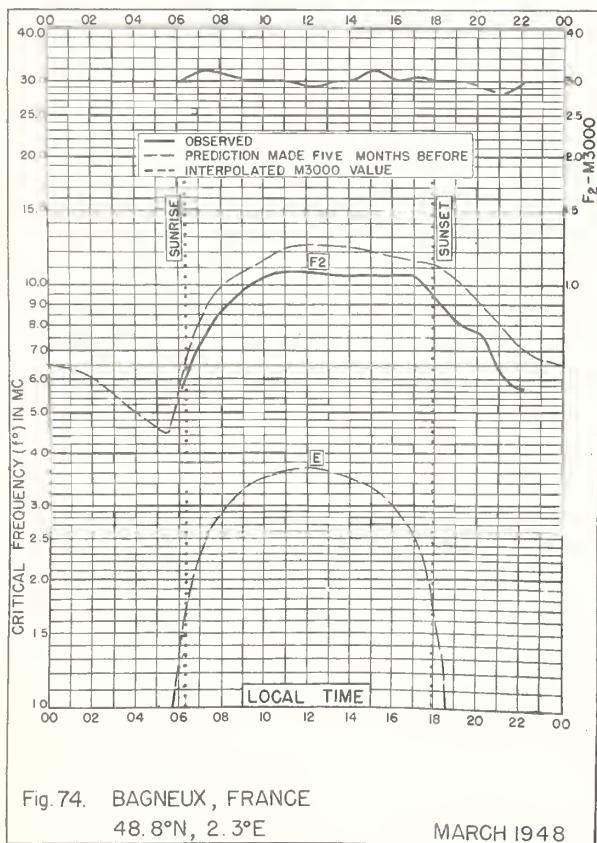


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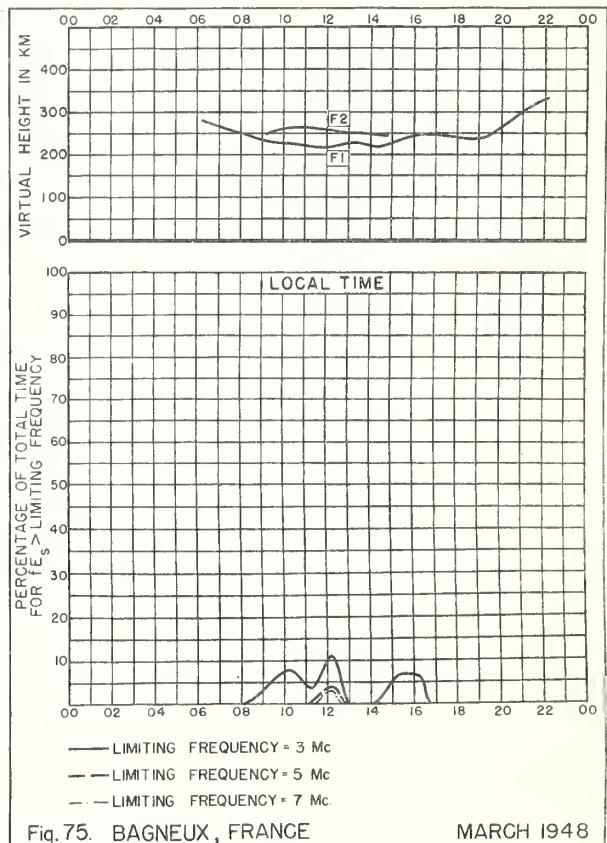


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Monthly:

CRPL-D. Basic Radio Propagation Predictions—Three months in advance. (Dept. of the Army, TB 11-499-, monthly supplements to TM 11-499; Dept. of the Navy, DNC-13-1 (), monthly supplements to DNC-13-1.)

CRPL-F. Ionospheric Data.

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*IRPL-H. Frequency Guide for Operating Personnel.

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NBS Circular 462. Ionospheric Radio Propagation.

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Reports issued in past:

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R7. Second Report on Experimental Studies of Ionospheric Propagation as Applied to the Loran System.

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S. Wilcox