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National Bureau of Standards

AUG 21 1947

NOMOGRAPHIC PREDICTIONS OF F2-LAYER FREQUENCIESTHROUGHOUT THE SOLAR CYCLE, FOR FEBRUARY.

The accompanying nomograms present predictions of f^oF_2 and F2-4000 muf throughout the solar cycle, for each ten degrees of latitude in each of the three zones of Fig. 1.

These were derived in the manner described in the reports IRPL-R11, "A Nomographic Method for Both Prediction and Observation Correlation of Ionosphere Characteristics", and IRPL-R16, "Predicted F2-layer Frequencies Throughout the Solar Cycle, for Summer, Winter, and Equinox Season". The method of their use in obtaining f^oF_2 and F2-4000 muf is illustrated by the example shown on Fig. 6. The use of these quantities in obtaining the muf for high-frequency radio propagation is discussed in the report IRPL-R16, cited above, and in the IRPL Radio Propagation Handbook, Part 1, p.47 et seq. It is to be noted that the values of f^oF_2 and F2-4000 muf obtained by means of these nomograms must be complemented by values of E-layer muf, in the case of transmission paths under 4000 km and by sporadic-E transmission frequencies for all paths, especially those passing near the auroral zones shown in Fig. 1. This is particularly important during times of minimum solar activity.

Values of f^oF_2 obtained by means of these nomograms should be fairly accurate in the proximity of ionosphere observing stations which have been in operation for a long time, such as those at Washington, D.C., Watheroo, W. Australia, and Huancayo, Peru. Inaccuracy of prediction is most likely in equatorial regions, where the latitude gradient of f^oF_2 is particularly high, and in the W zone south of Huancayo, Peru ($12^\circ S$), where few ionospheric observations have been made and thus the prediction is based upon observations in other zones.

The small convolutions of the central curves, A, which show the variation of f^oF_2 , are frequently of doubtful significance, since many of them may be less than the error or prediction. No attempt was made to smooth these out, however, because of lack of exact knowledge of the extent of this error.

Values of F2-4000 muf obtained from these nomograms are likely to be slightly too high during periods of high sunspot number, since the values of F2-M4000 used in their computation, the average of all available data, were those obtained during years of low solar activity, and there is a slight decrease in these values with increase of sunspot number. It is estimated that the amount of this error, at a sunspot number of 100, is about 5%.

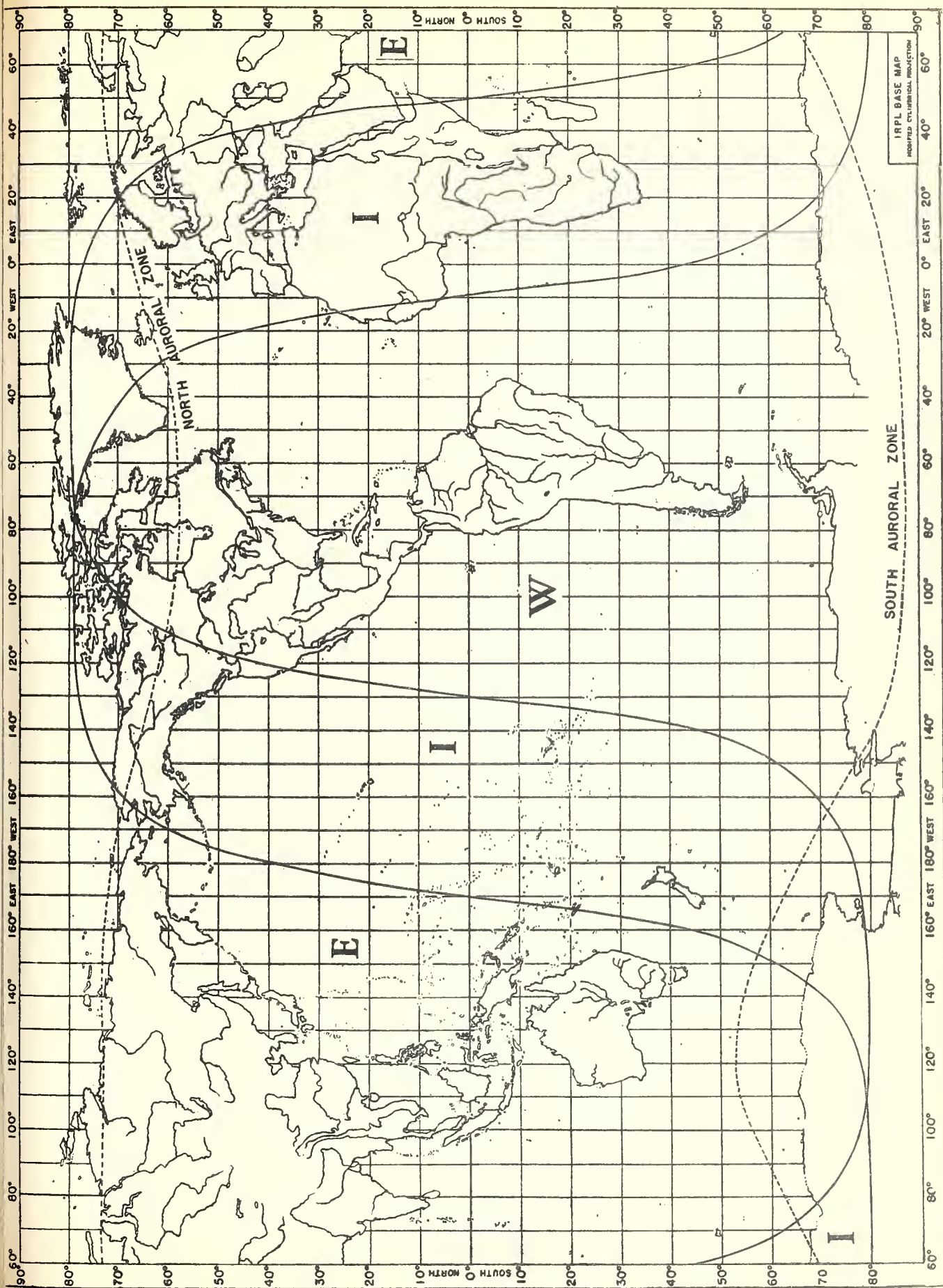
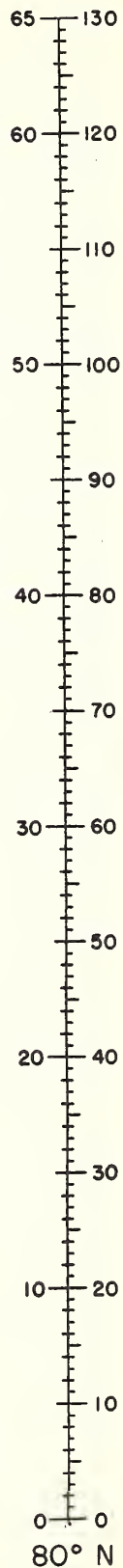


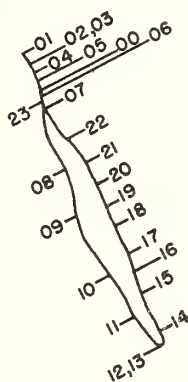
Fig. 1. WORLD MAP SHOWING ZONES COVERED BY PREDICTED CHARTS, AND AURORAL ZONES.

$f^{\circ}F_2$,
Mc

F2-4000 MUF, SUNSPOT
Mc NUMBER



A
LOCAL TIME
OF DAY



B
LOCAL TIME
OF DAY

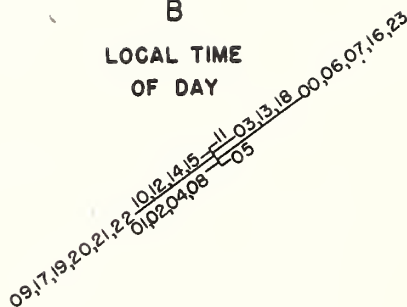
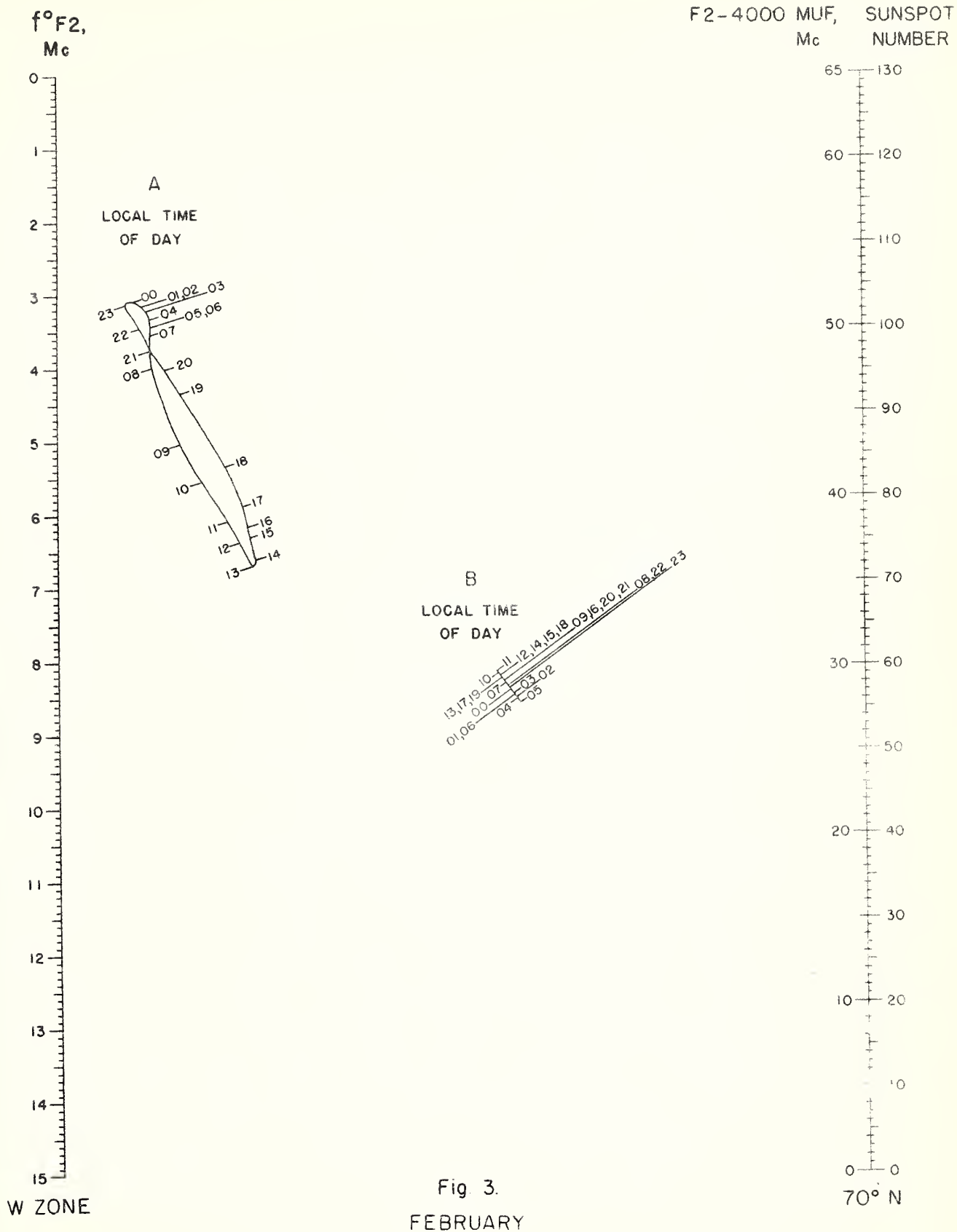
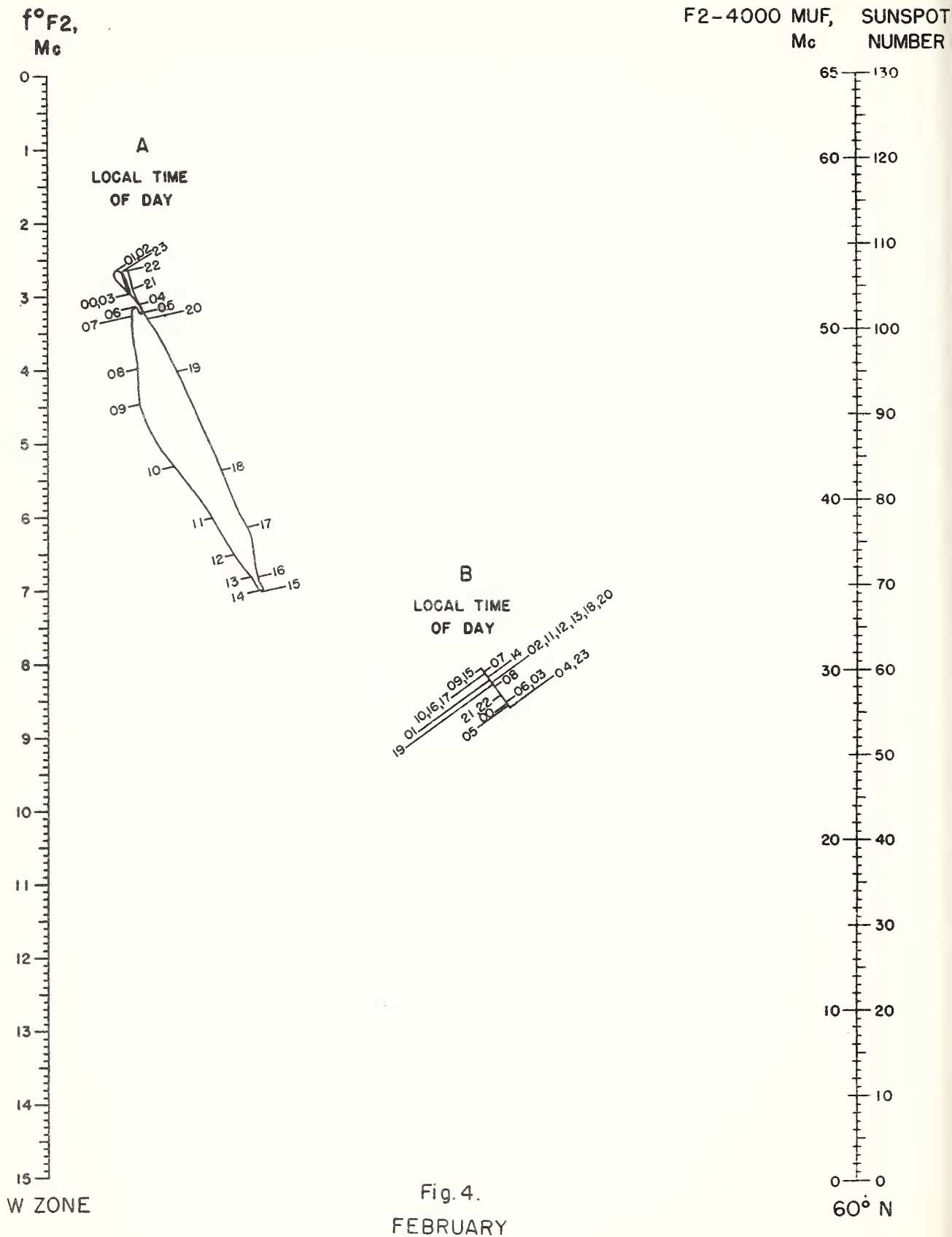


Fig. 2.
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W ZONE

80° N



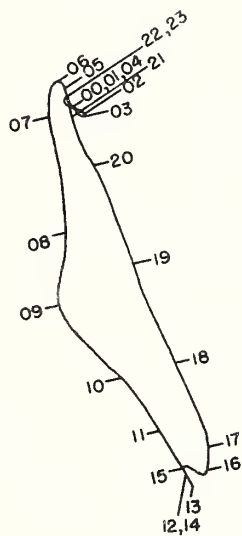


f^oF_2 ,
Mc

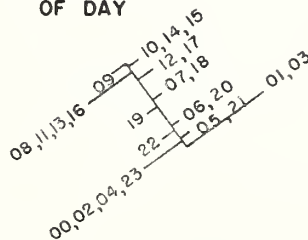
F2-4000 MUF,
Mc

SUNSPOT
NUMBER

A
LOCAL TIME
OF DAY



B
LOCAL TIME
OF DAY



65 130

60 120

50 110

40 100

30 90

20 80

10 70

0 60

50

40

30

20

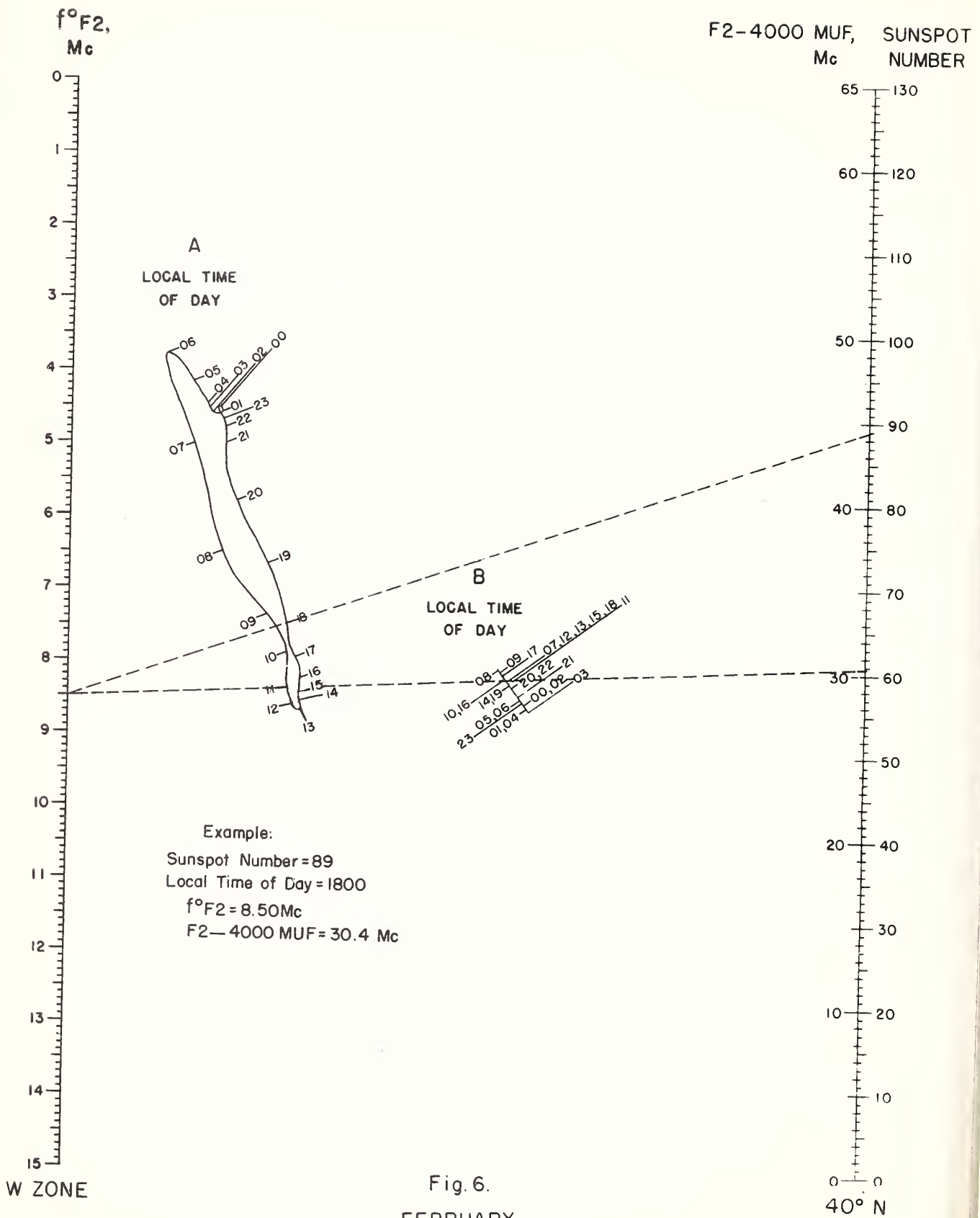
10

0

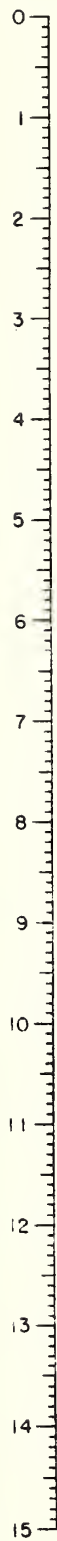
50° N

Fig. 5.
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W ZONE

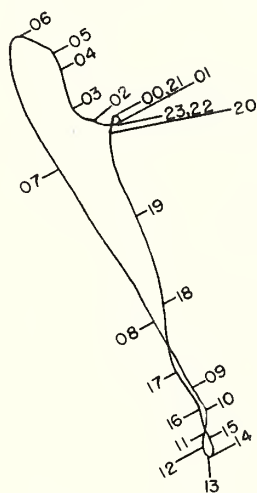


$f^{\circ}F_2$,
Mc

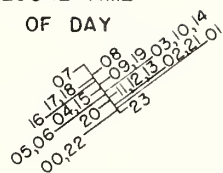


W ZONE

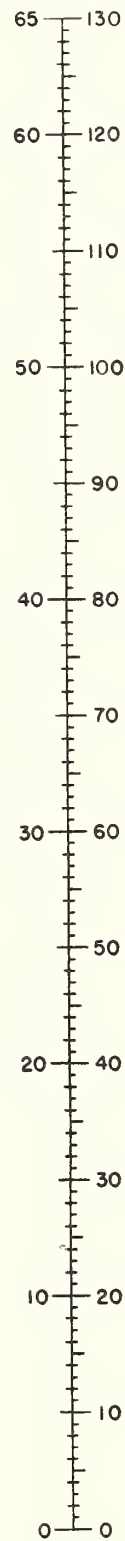
A
LOCAL TIME
OF DAY



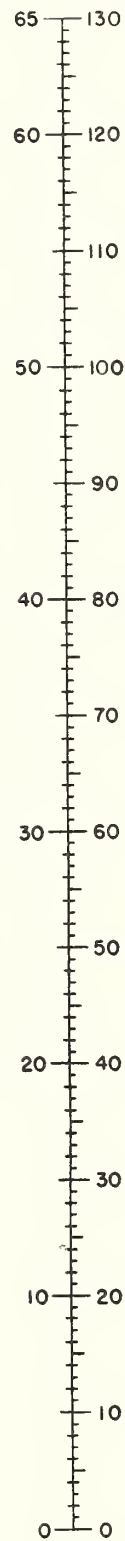
B
LOCAL TIME
OF DAY



2 - 4000 MUF,
Mc



SUNSPOT
NUMBER



30° N

Fig. 7.
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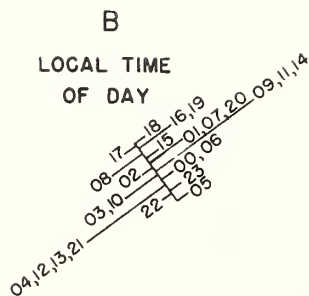
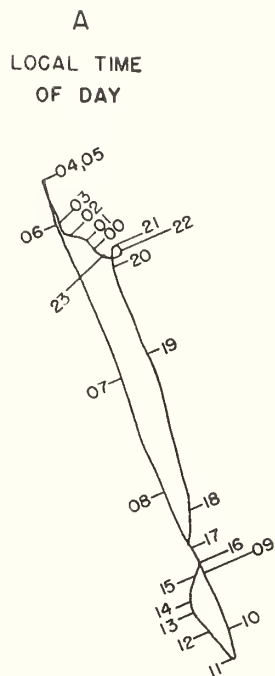
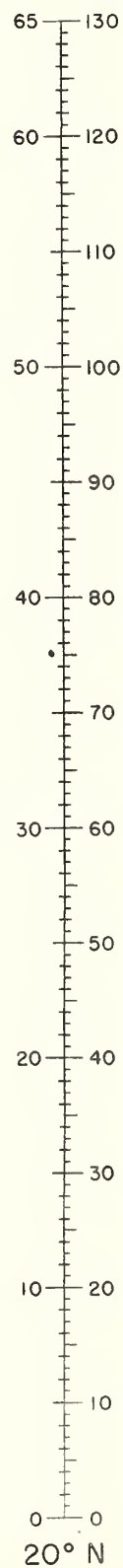


Fig. 8.
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F2-4000 MUF, SUNSPOT
Mc NUMBER



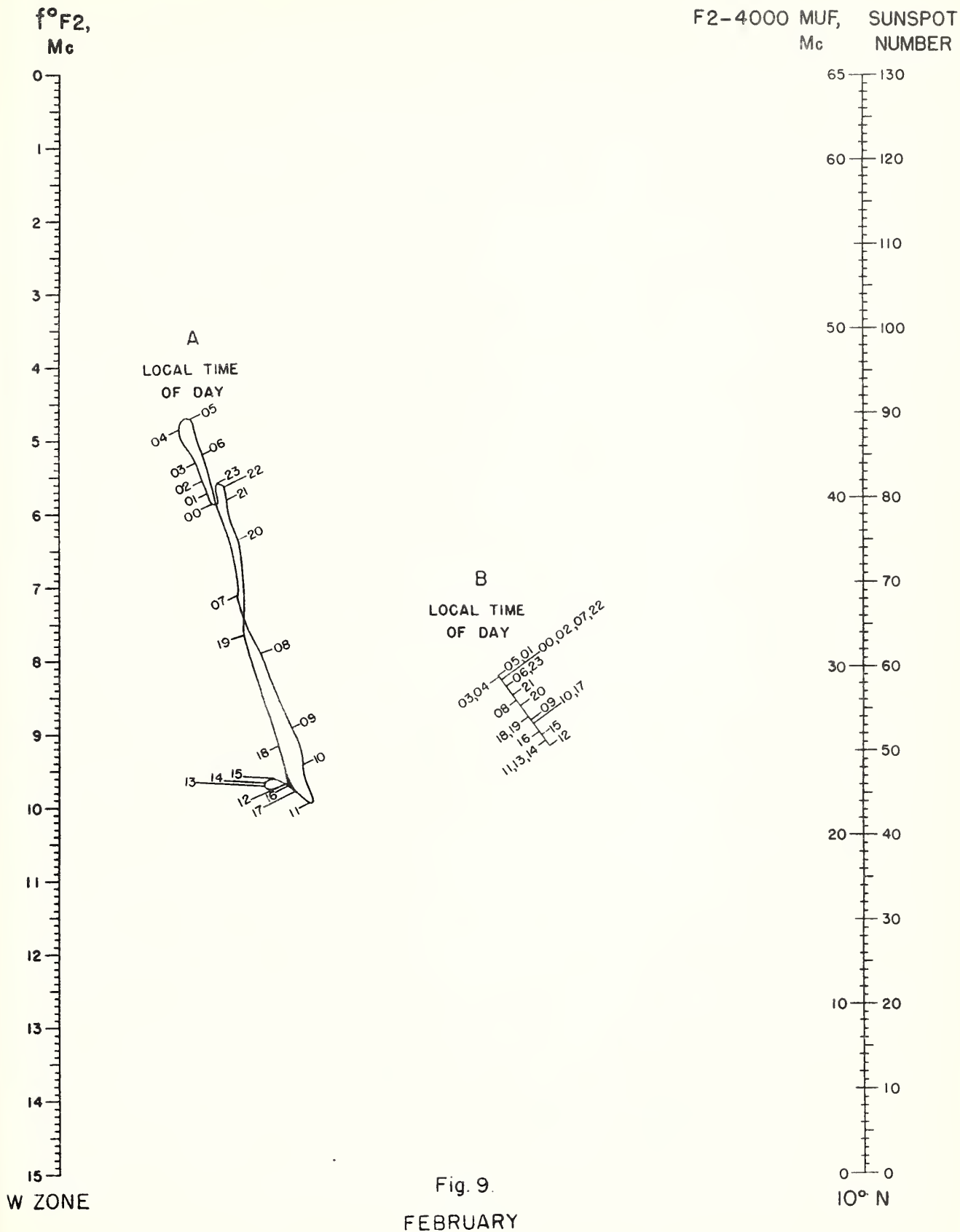
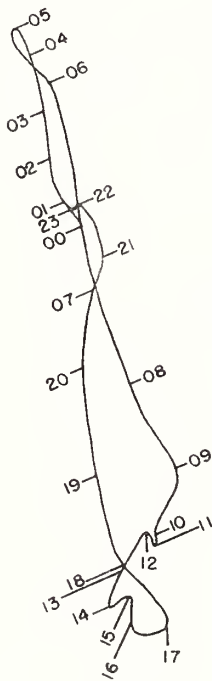


Fig. 9.
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A
LOCAL TIME
OF DAY



B
LOCAL TIME
OF DAY

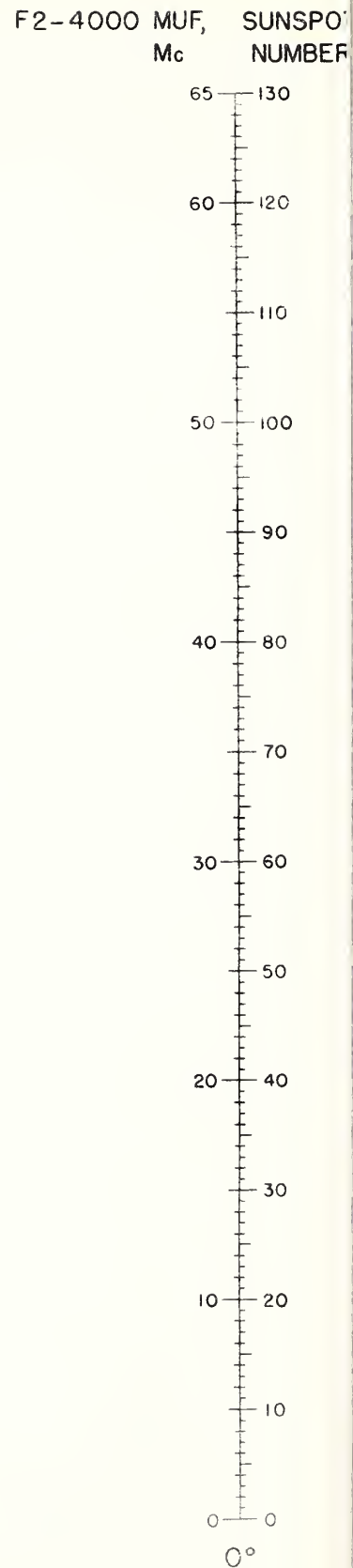
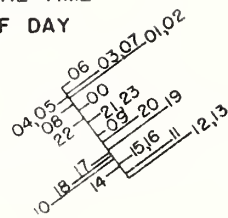


Fig. 10
FEBRUARY

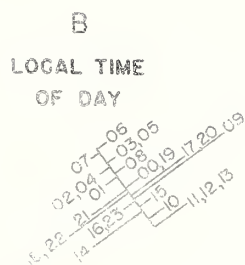
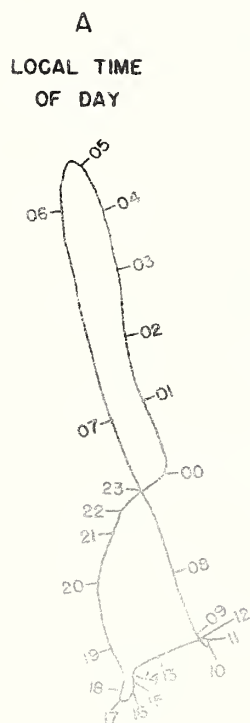
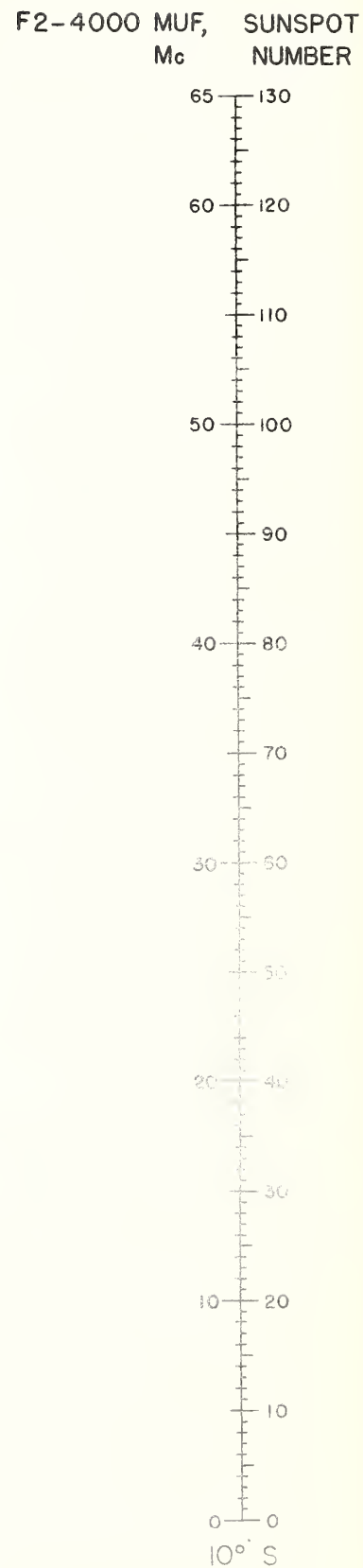


Fig. 11.
FEBRUARY





W ZONE

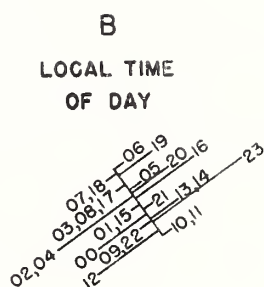
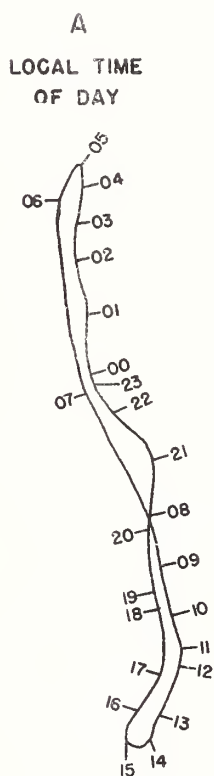
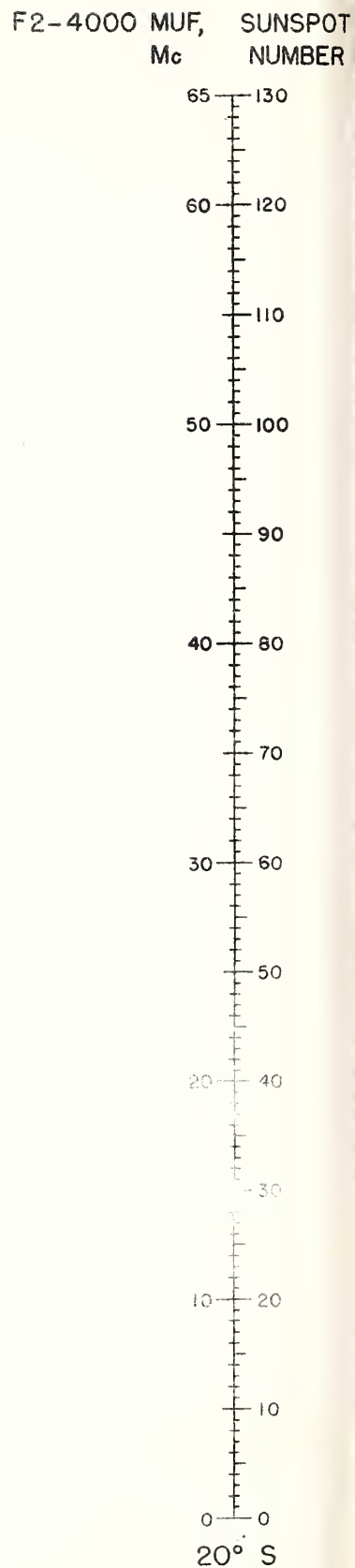
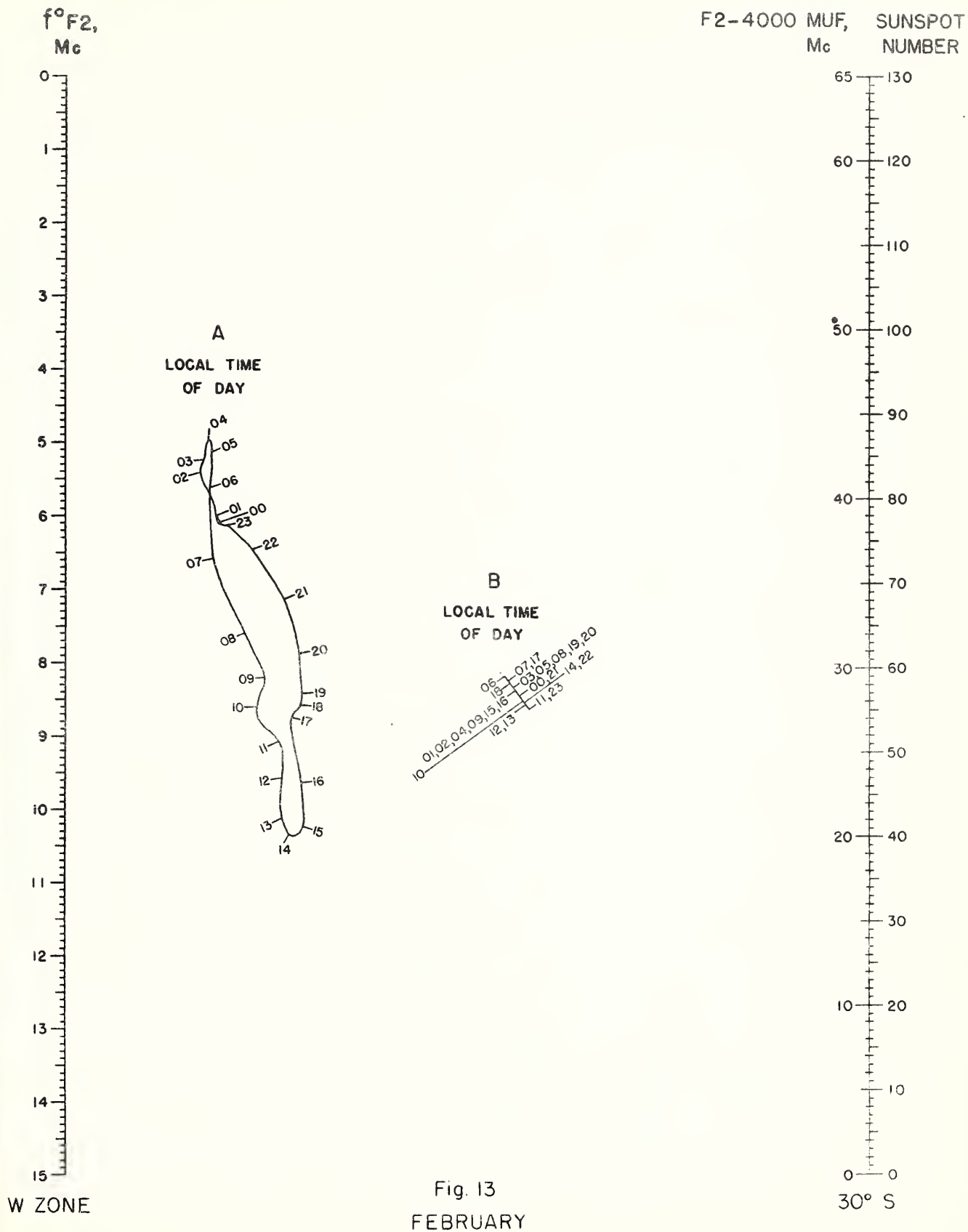


Fig. 12.
FEBRUARY



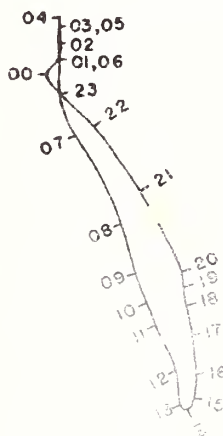


$f^{\circ}F_2$,
Mc

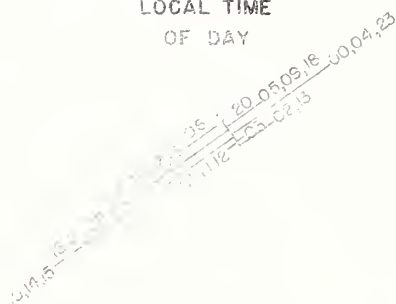
F2-4000 MUF, SUNSPOT
Mc NUMBER



A
LOCAL TIME
OF DAY



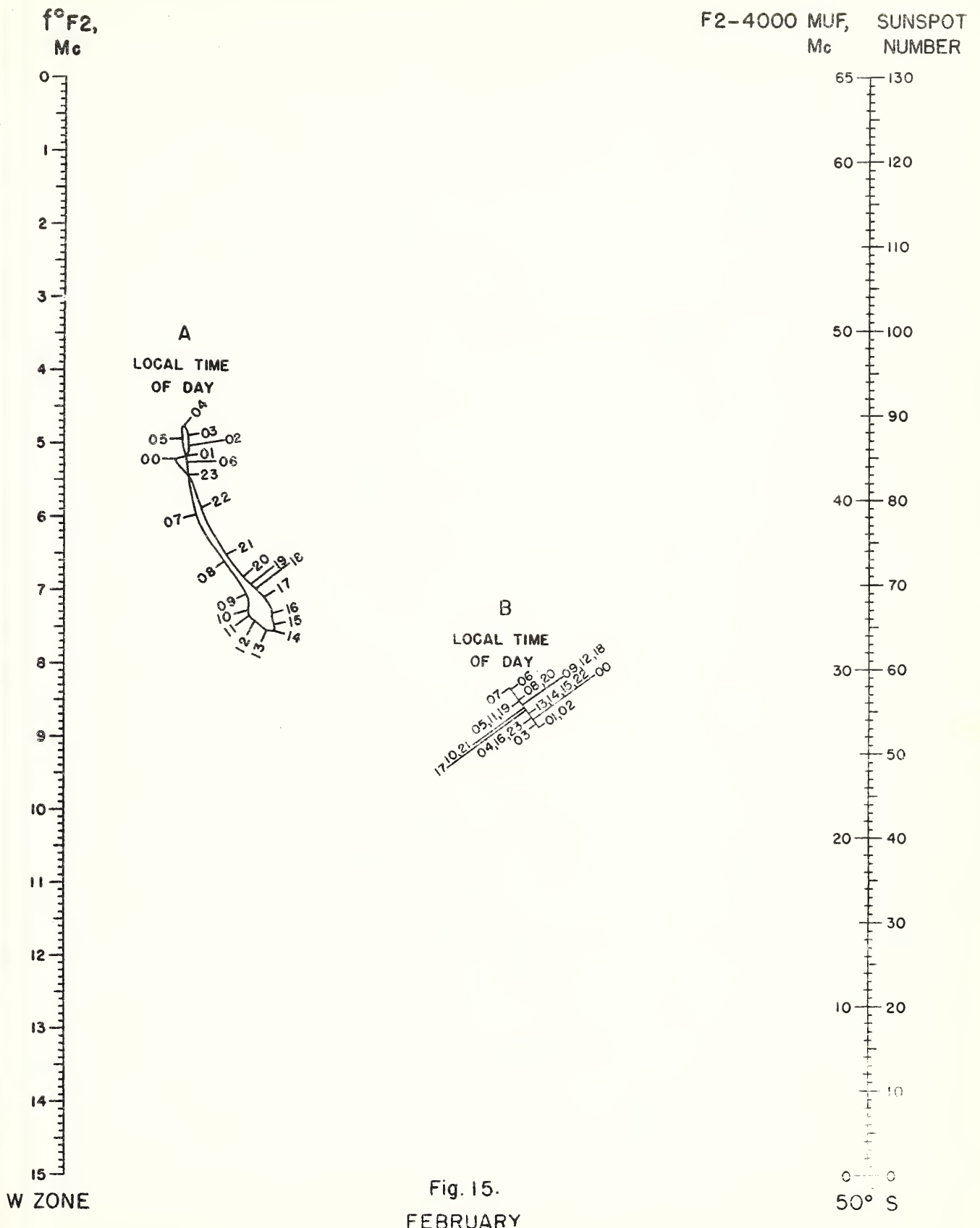
B
LOCAL TIME
OF DAY



W ZONE

Fig. 14.
FEBRUARY

40° S



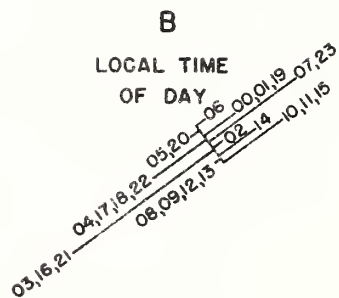
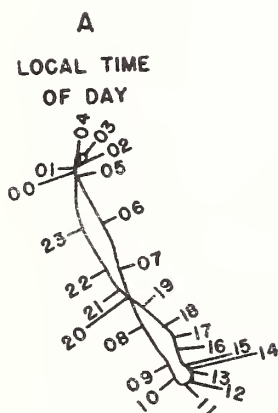
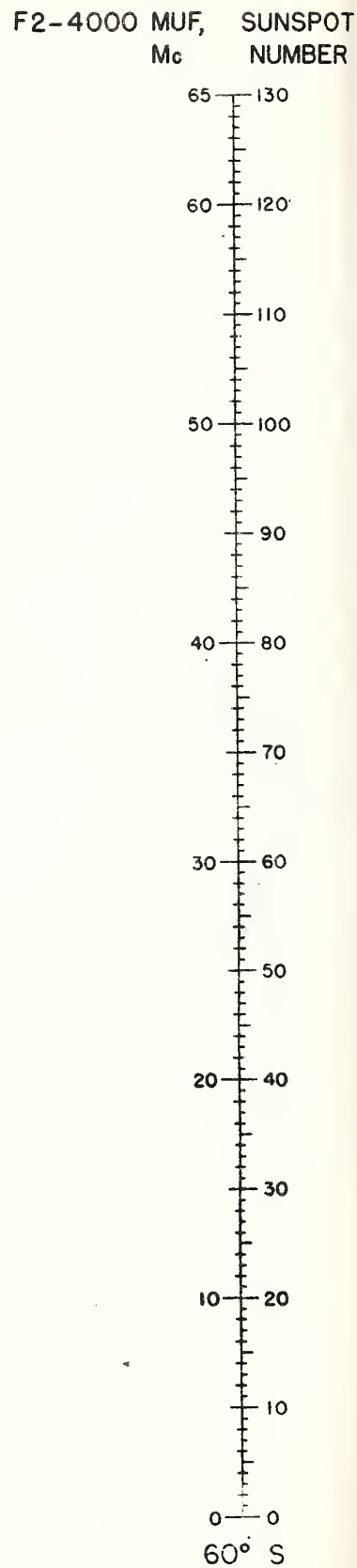
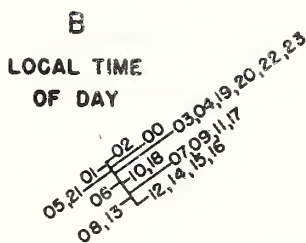
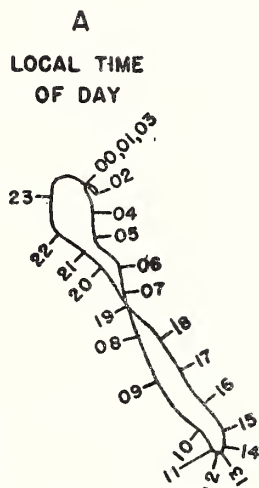


Fig. 16.
FEBRUARY

$f^{\circ}F_2$,
Mc



F2-4000 MUF, Mc SUNSPOT
NUMBER

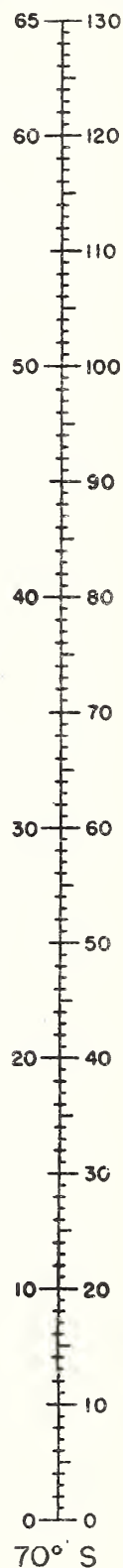
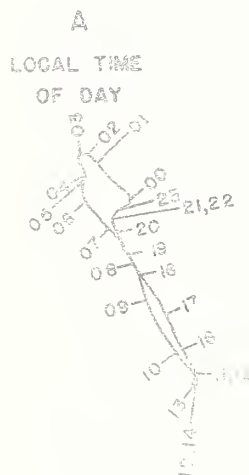


Fig. 17.
FEBRUARY

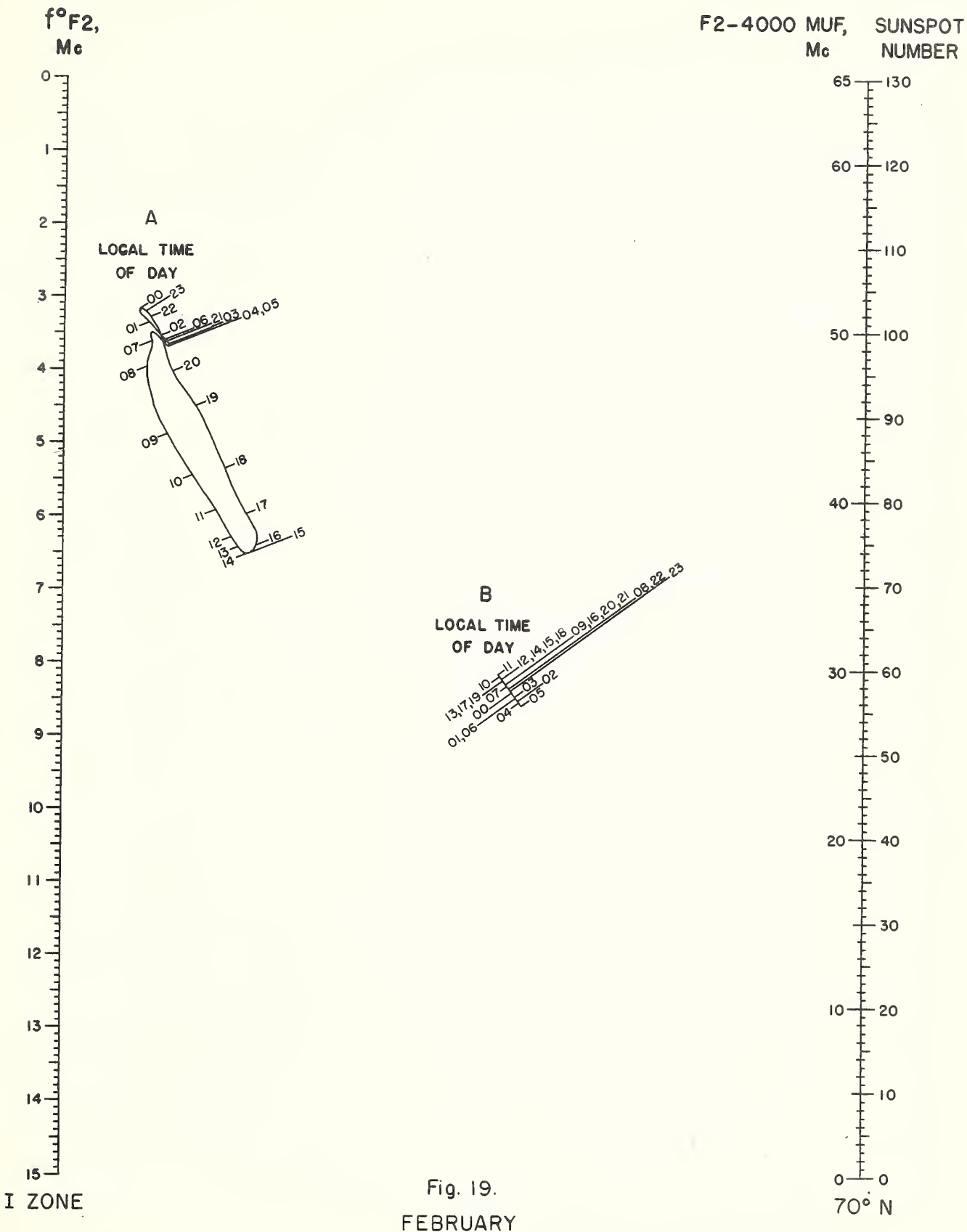
f_oF_2
 MUF_{3000}

F2-4000 MUF, SUNSPOT
 Me NUMBER



W ZONE,
 I ZONE

Fig. 18.
 FEBRUARY



f^oF_2 ,
Mc



I ZONE

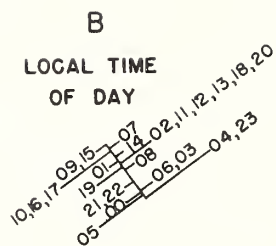
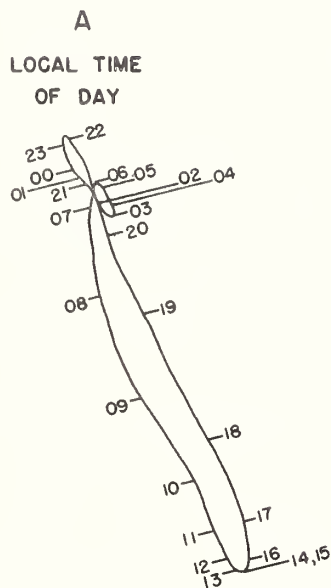
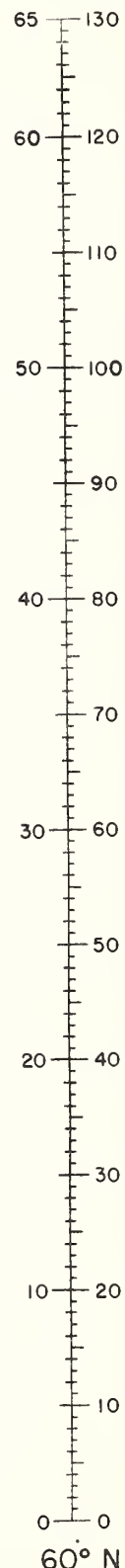
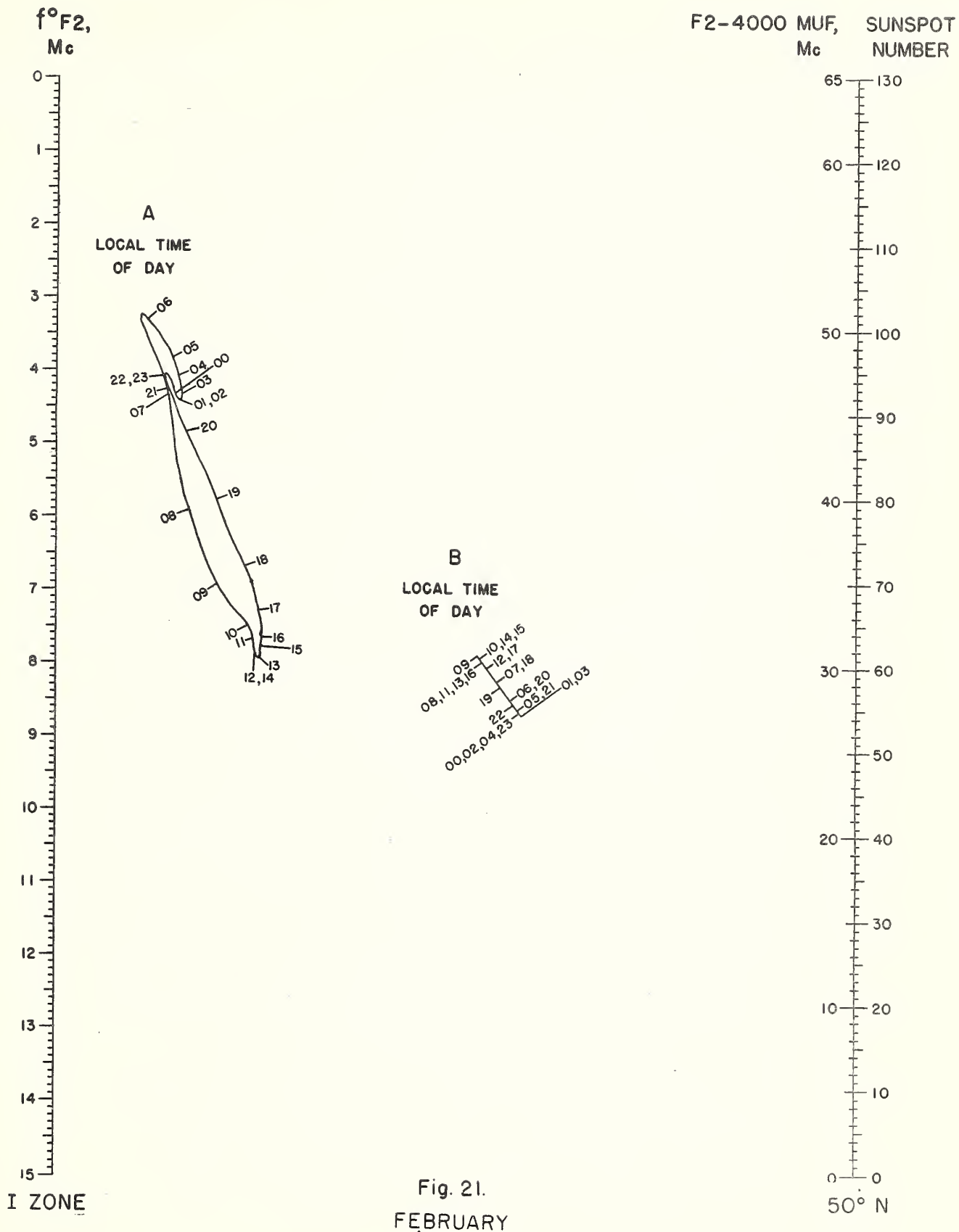


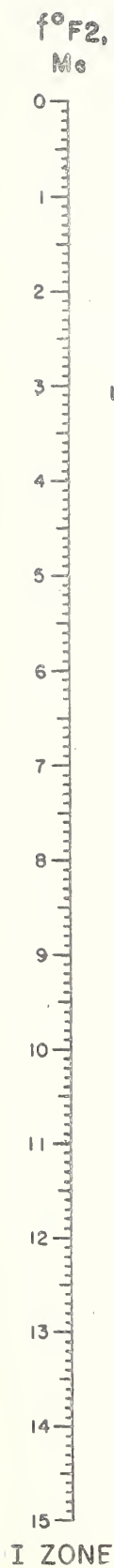
Fig. 20.
FEBRUARY

F2-4000 MUF, SUNSPOT
Mc NUMBER



60° N





I ZONE

A
LOCAL TIME
OF DAY

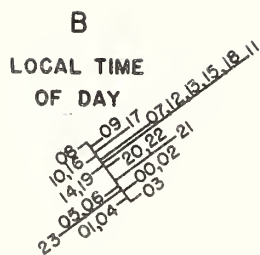
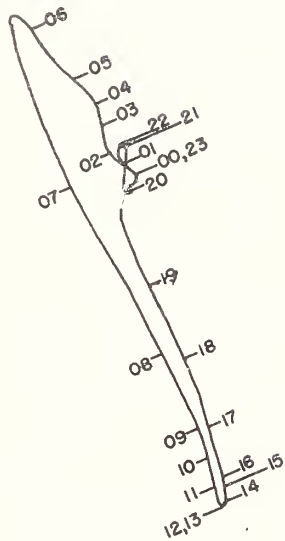
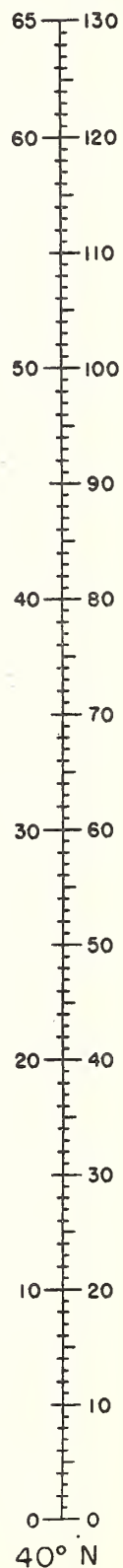


Fig. 22.
FEBRUARY

F2-4000 MUF, SUNSPOT
Mc NUMBER



f_oF_2 ,
Mc

F2-4000 MUF, SUNSPOT
Mc NUMBER

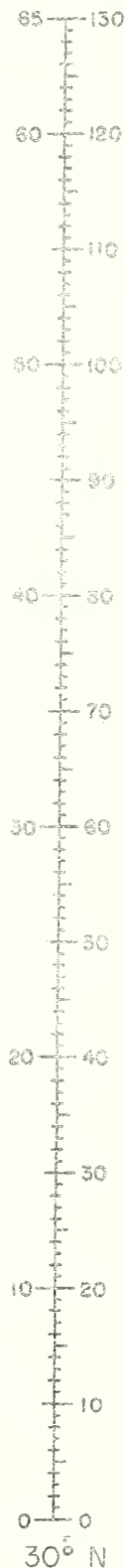
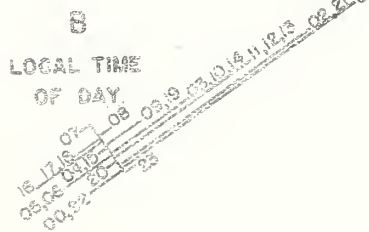
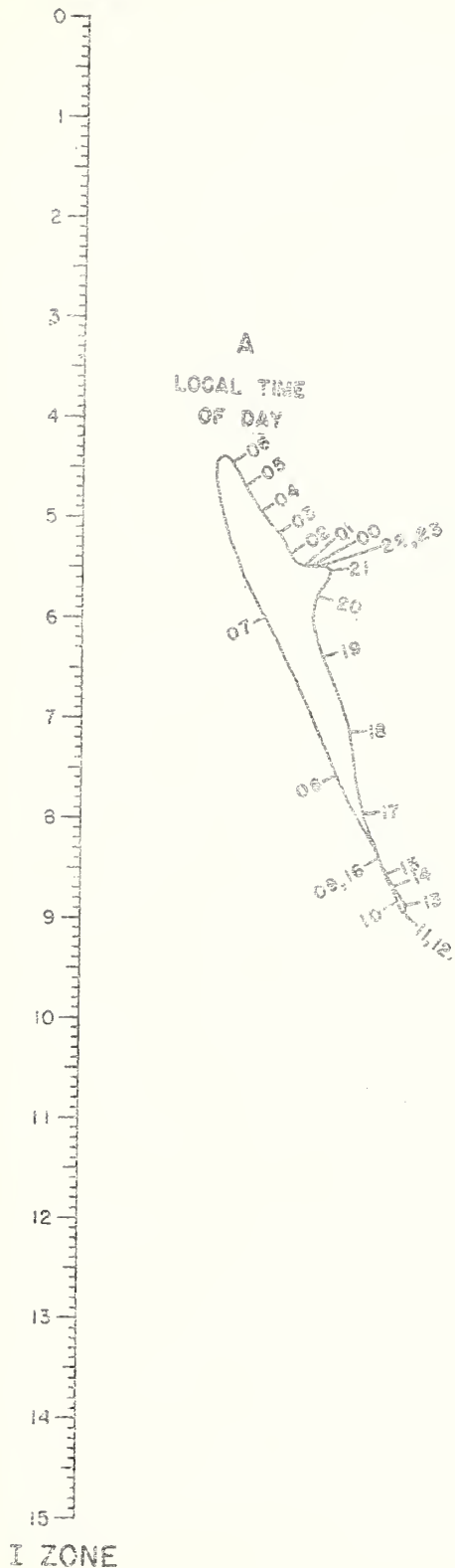
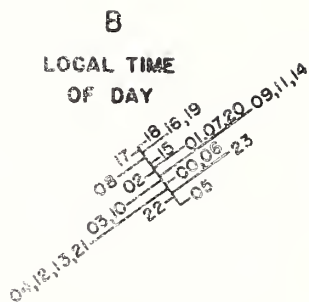
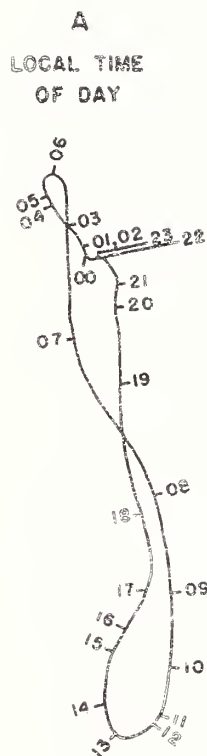
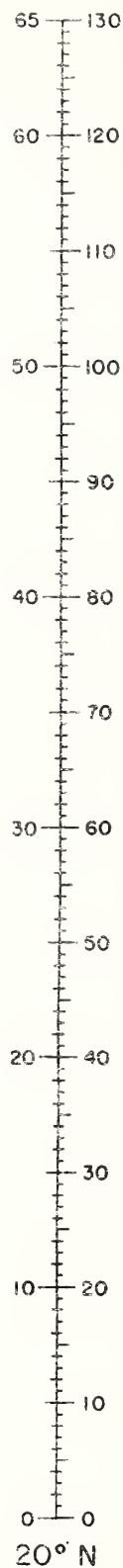


Fig. 23.
FEBRUARY

f^oF₂,
Mc

F2-4000 MUF, SUNSPOT
Mc NUMBER



I ZONE

Fig. 24.
FEBRUARY

0° N

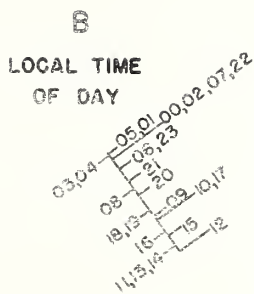
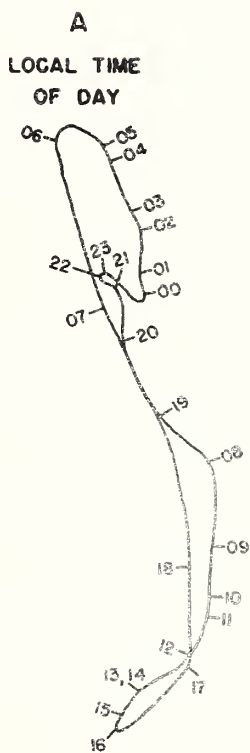
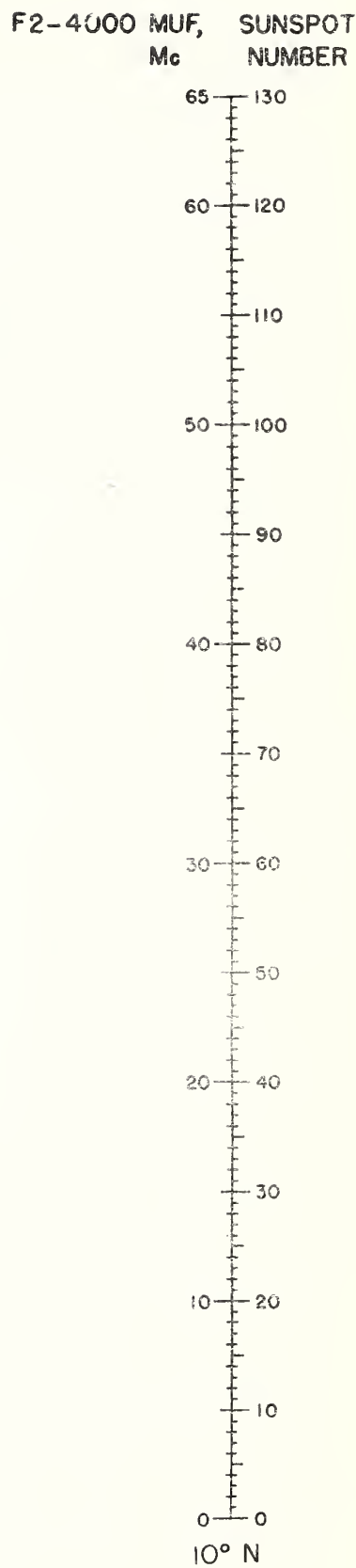
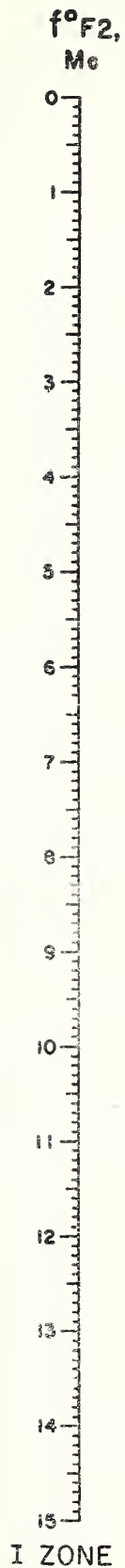
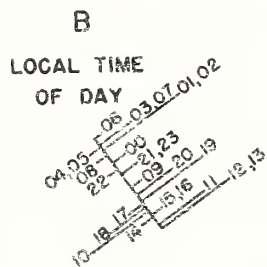
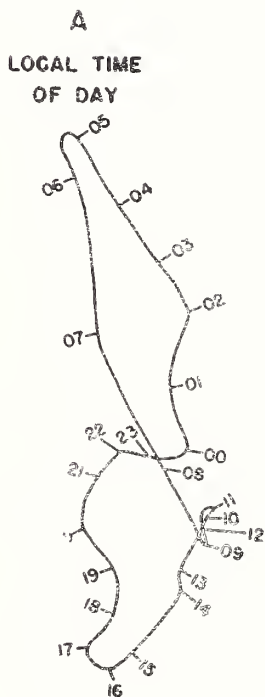


Fig. 25.
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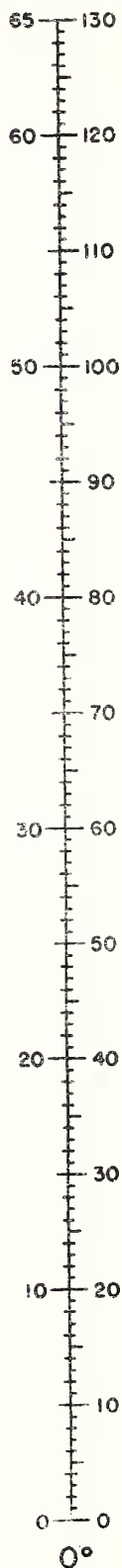
f^oF_2 ,
Mc



I ZONE



F2-4000 MUF, SUNSPOT
Mc NUMBER



0°

Fig. 26.
FEBRUARY

f°F2,
Mc



F2-4000 MUF, SUNSPOT
Mc, NUMBER

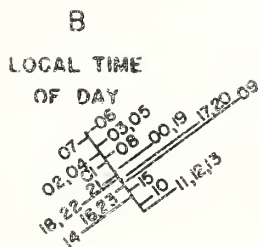
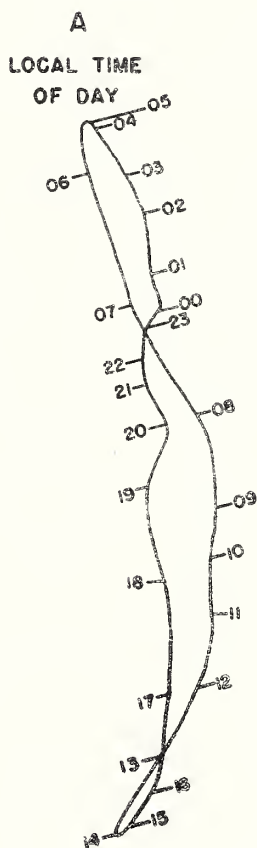
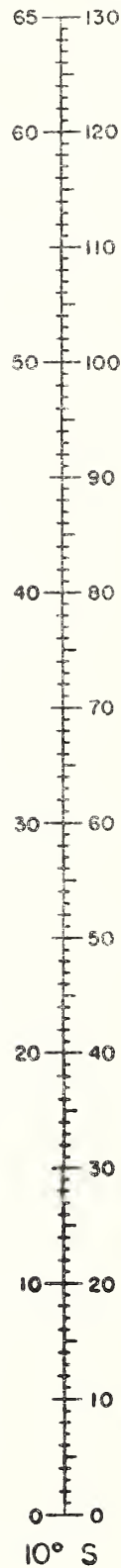


Fig. 27.
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I ZONE

10° S



I ZONE

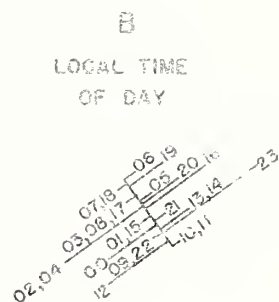
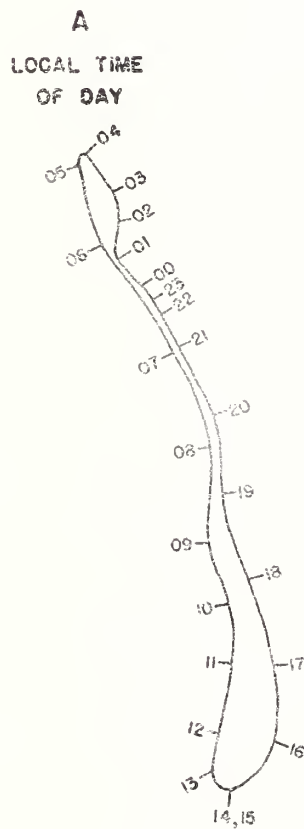
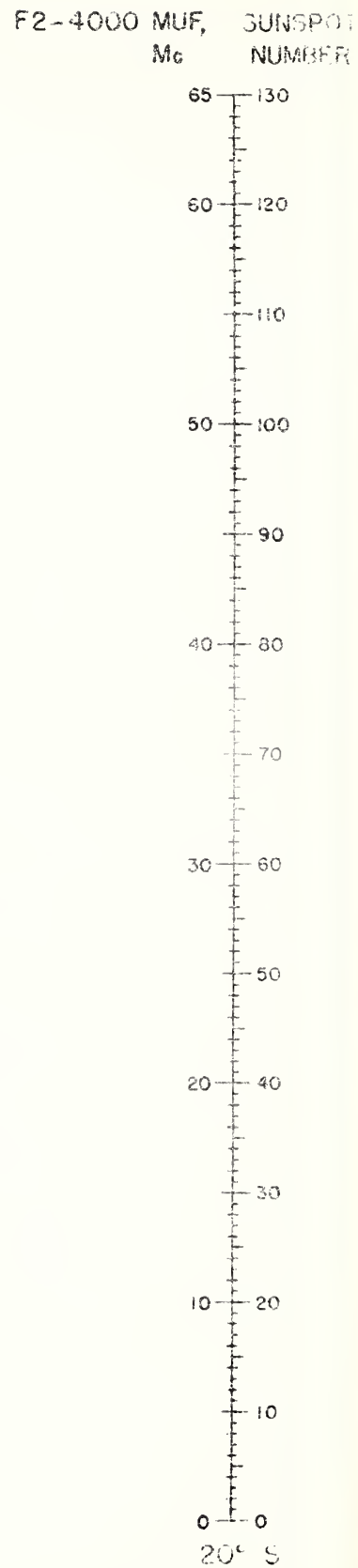


Fig. 28.
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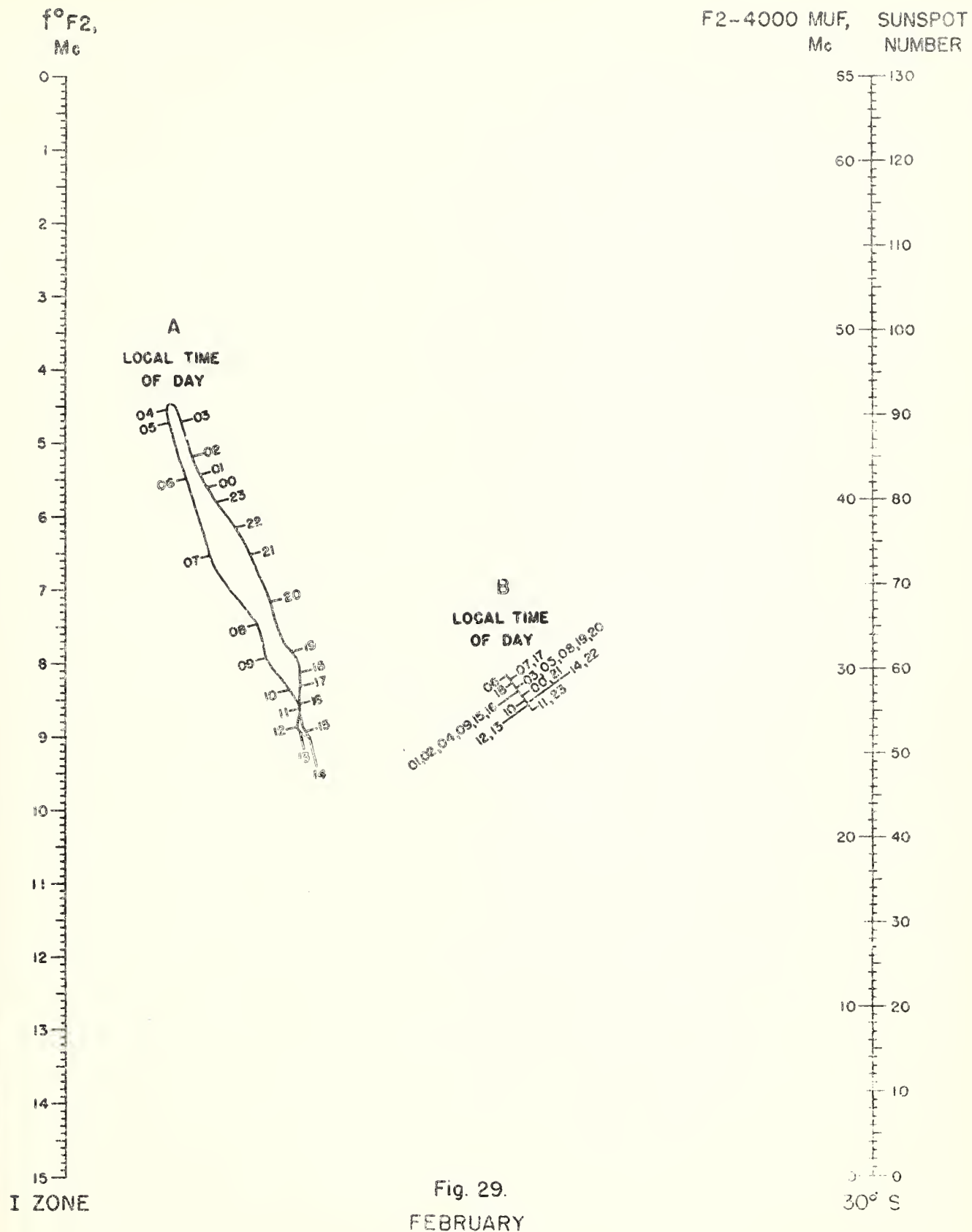
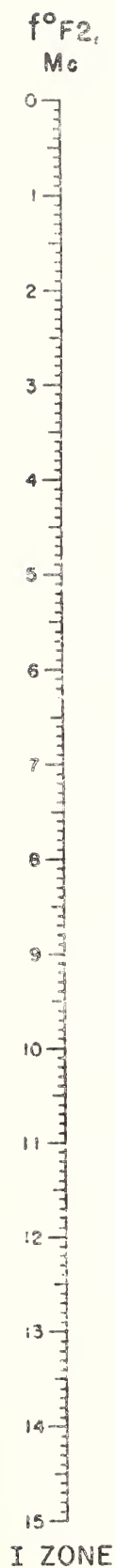


Fig. 29.
FEBRUARY



F2-4000 MUF,
Mc

SUNSPOT
NUMBER

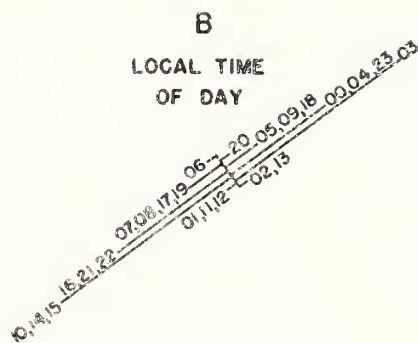
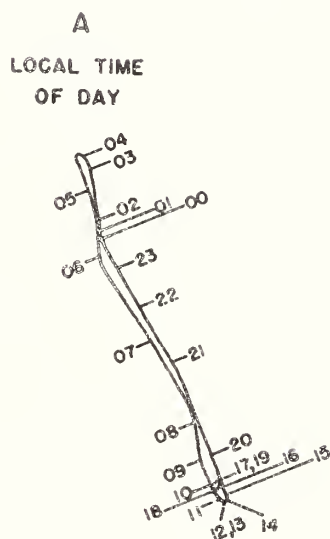
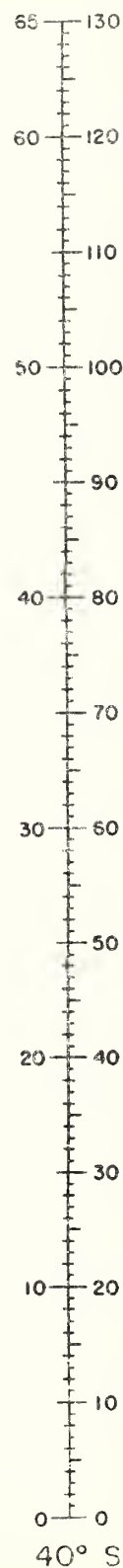
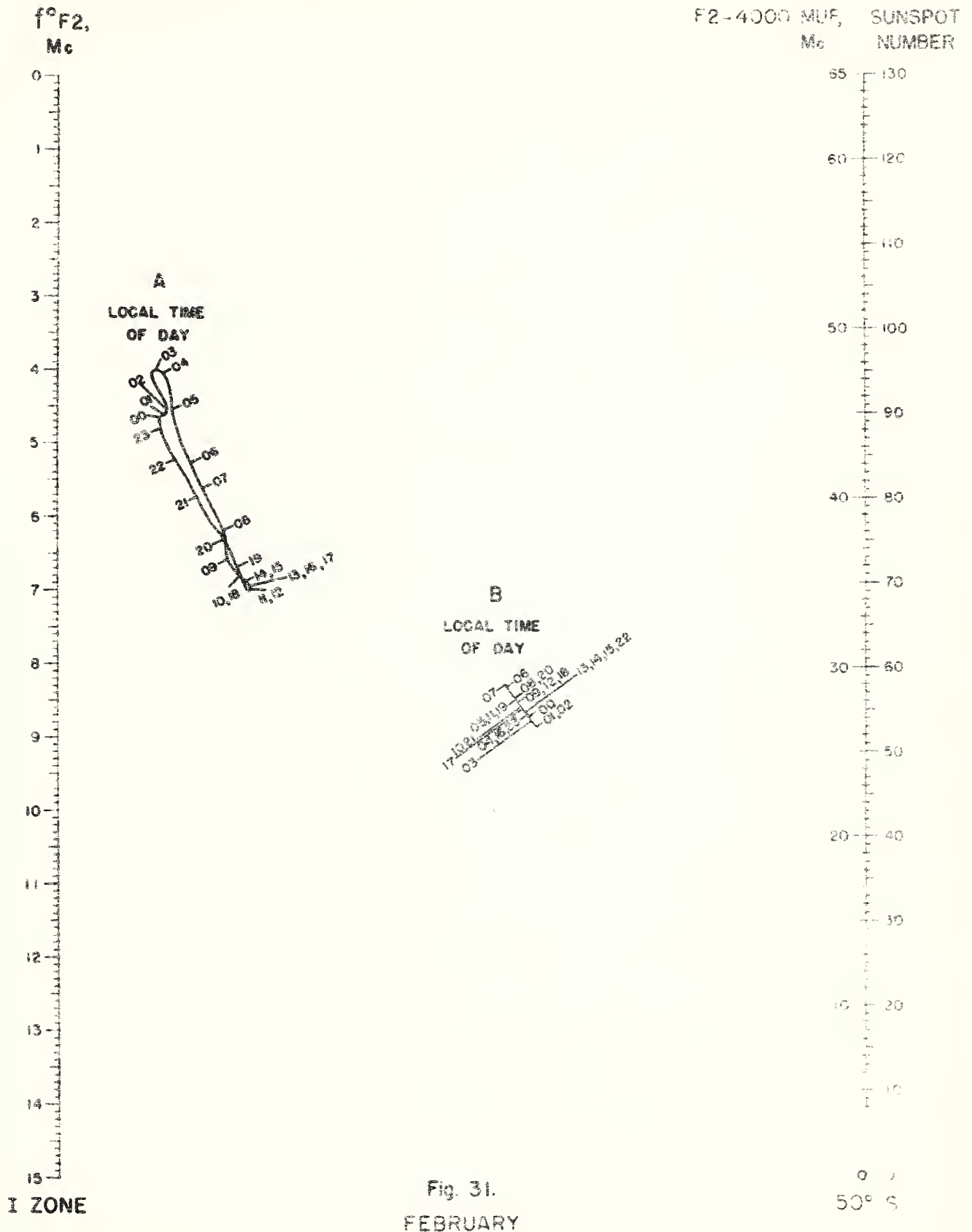
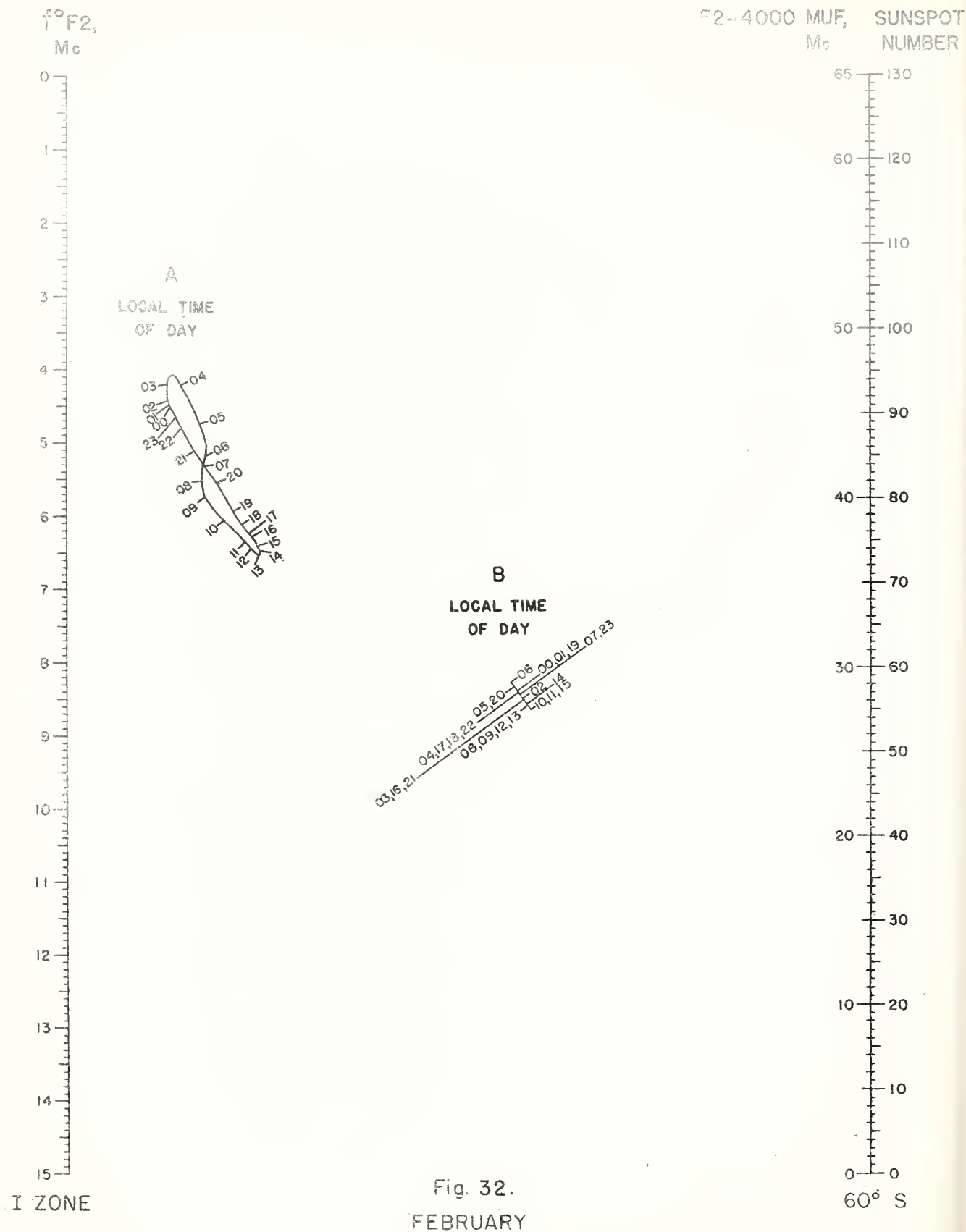


Fig. 30.
FEBRUARY





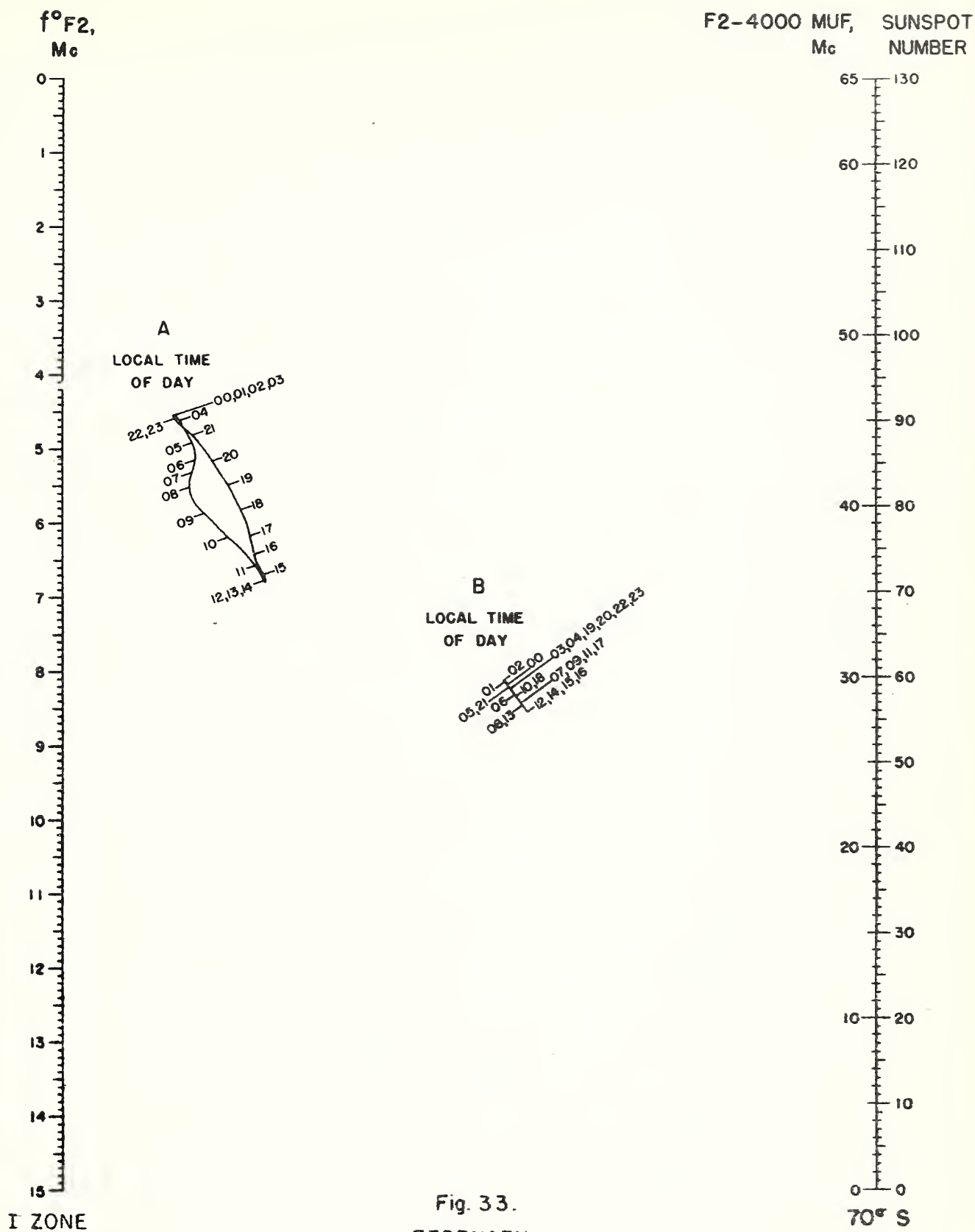


Fig. 33.
FEBRUARY

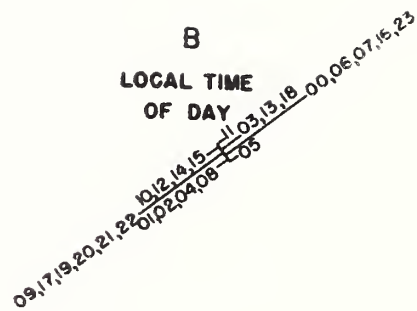
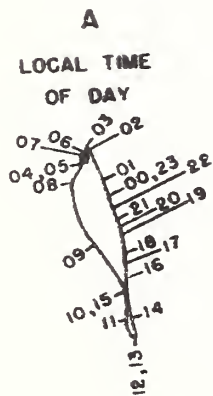
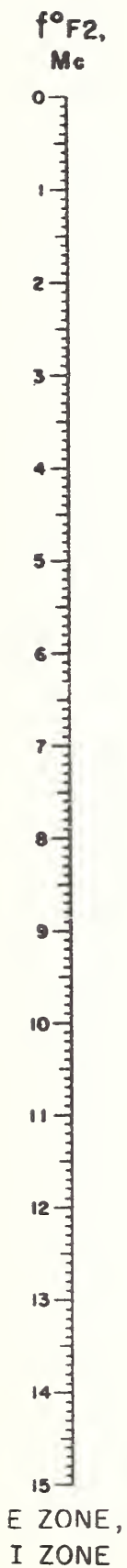
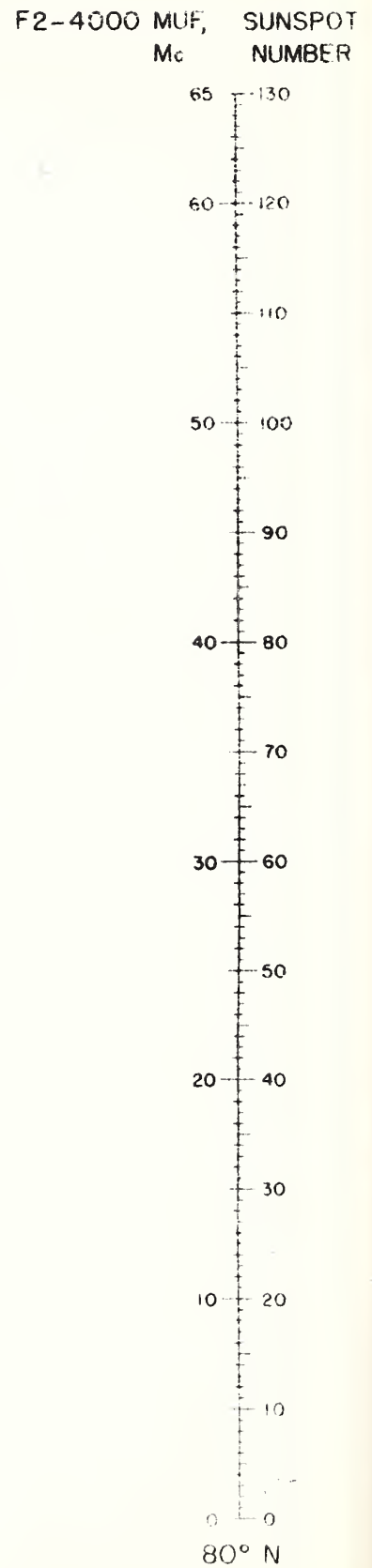


Fig. 34.
FEBRUARY



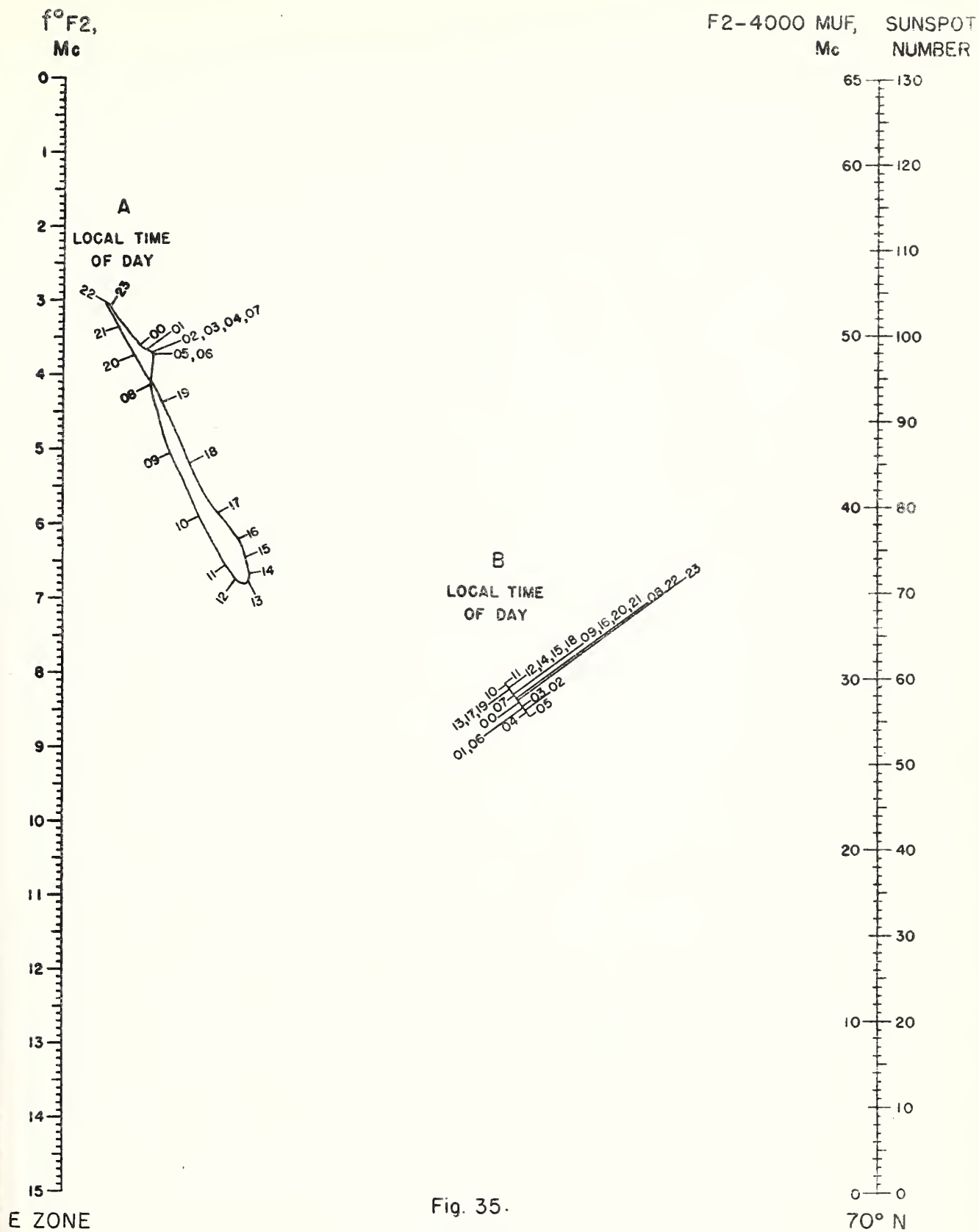
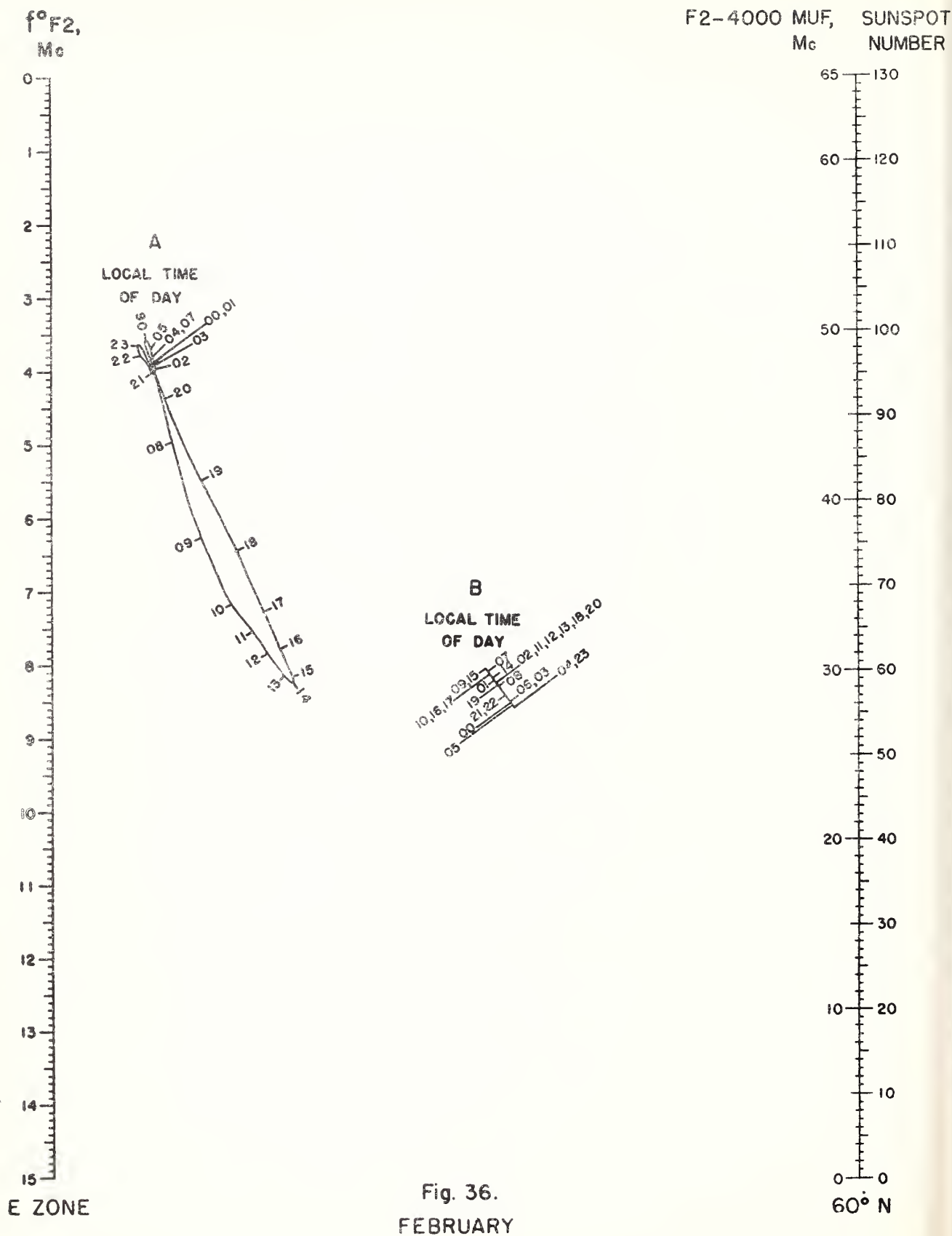
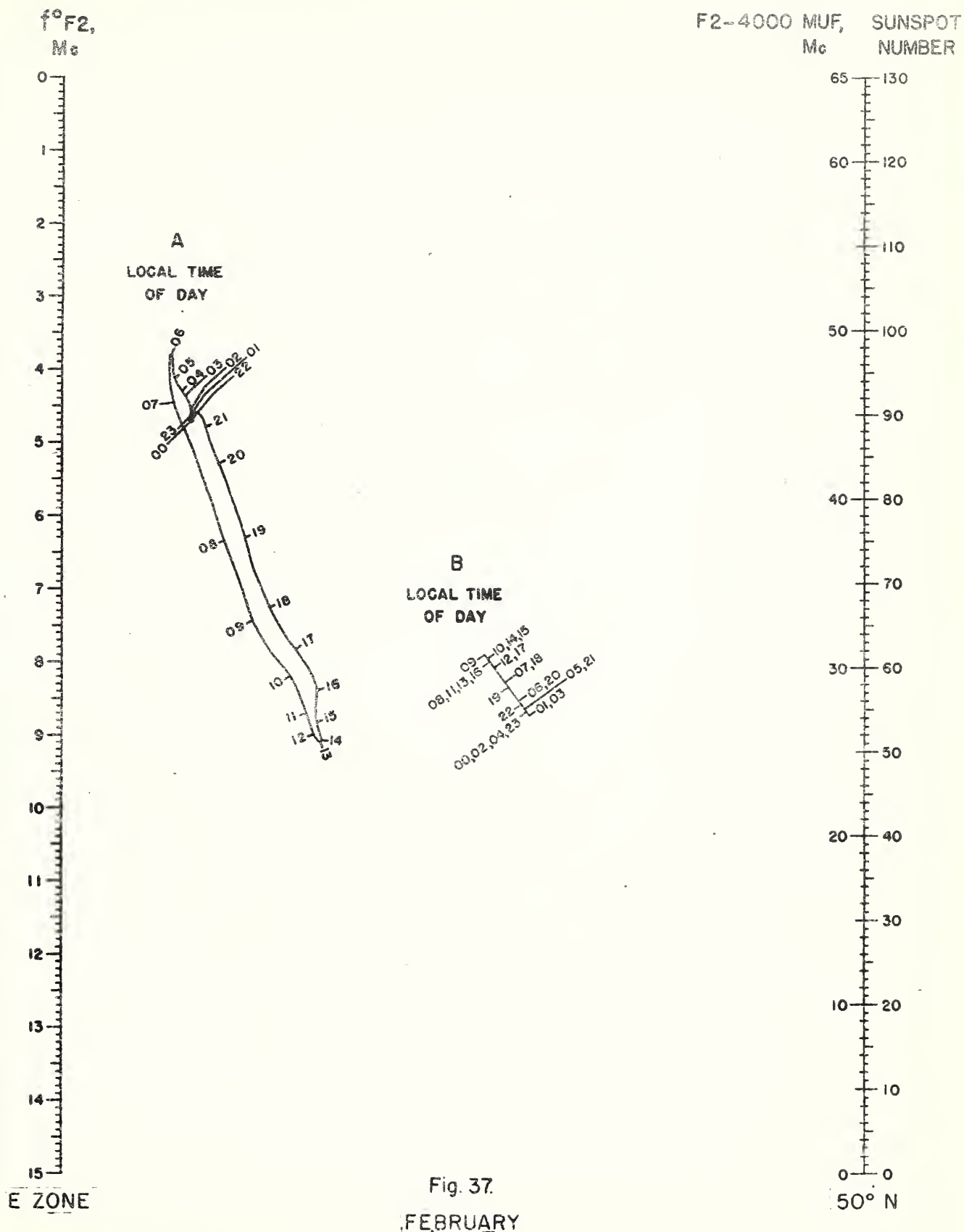
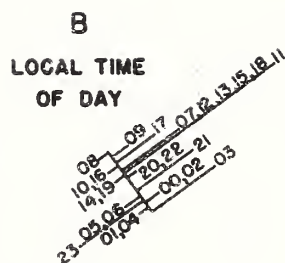
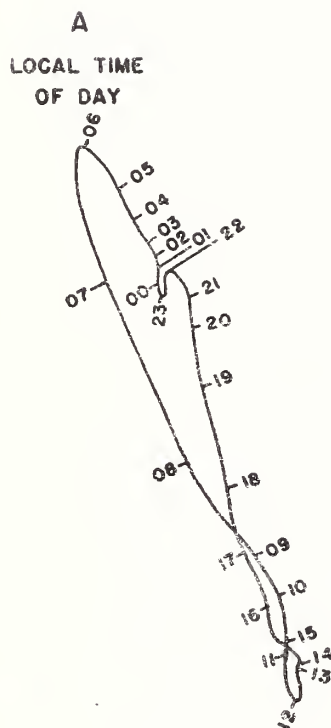
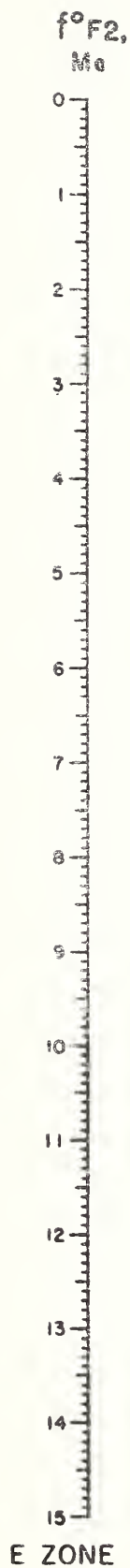


Fig. 35.
FEBRUARY







F2-4000 MUF, SUNSPOT
Mc NUMBER

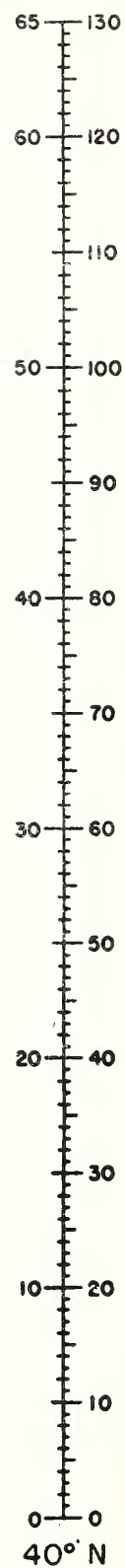


Fig. 38.
FEBRUARY

F2-4000 MUF,	SUNSPOT
Mc	NUMBER

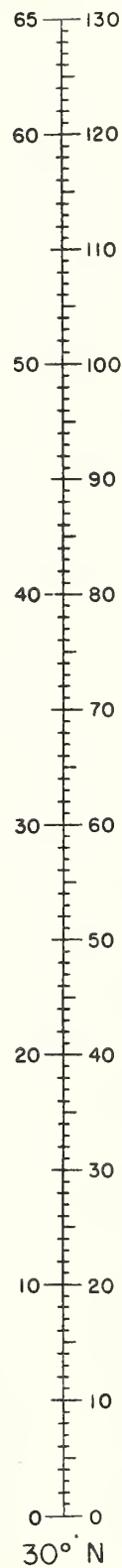
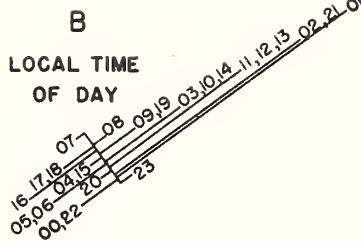
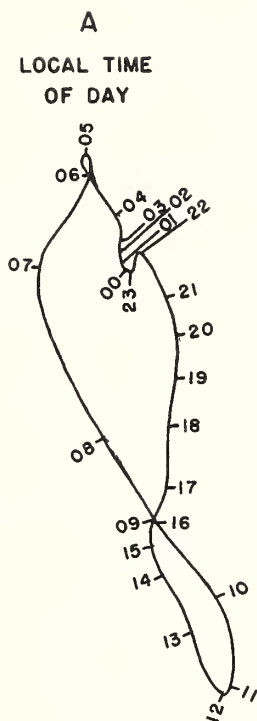


Fig. 39.
FEBRUARY

E ZONE



F2-4000 MUF, SUNSPOT
Mc NUMBER

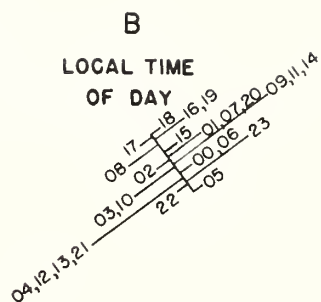
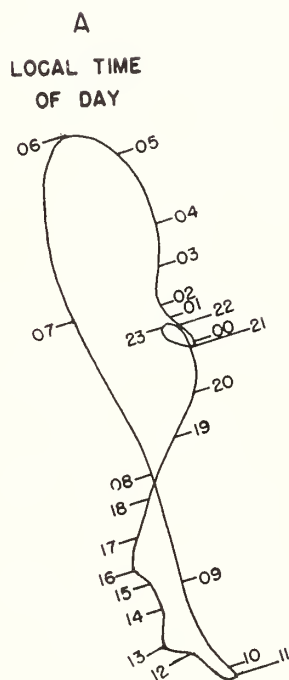
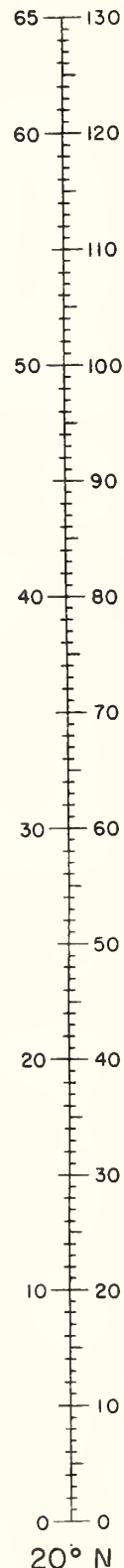


Fig. 40.
FEBRUARY

f_oF_2 ,
Mc

F2-4000 MUF,
Mc

SUNSPOT
NUMBER

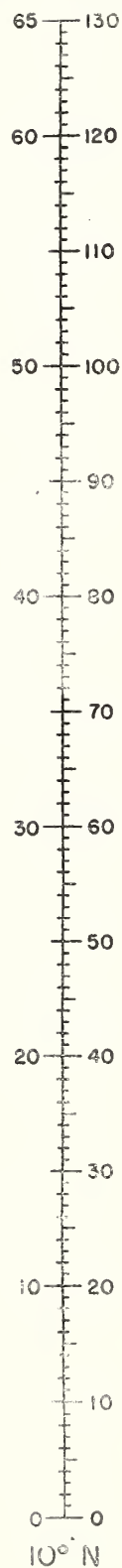
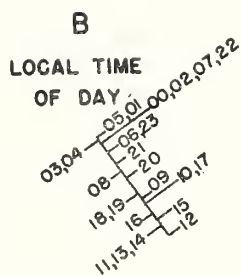
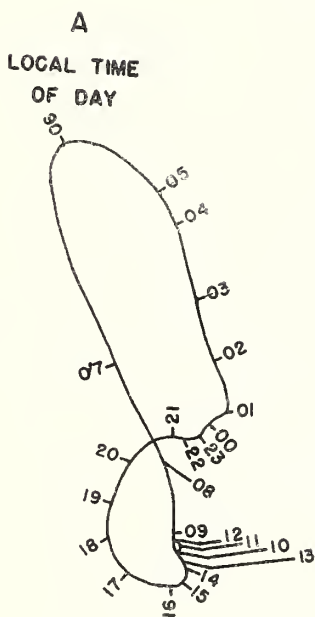
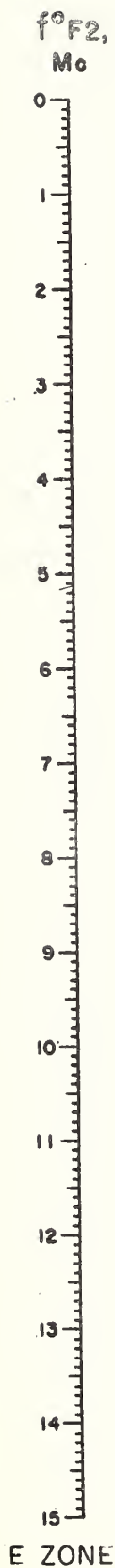


Fig. 41
FEBRUARY

0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
ZONE



E ZONE

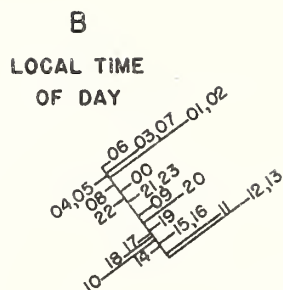
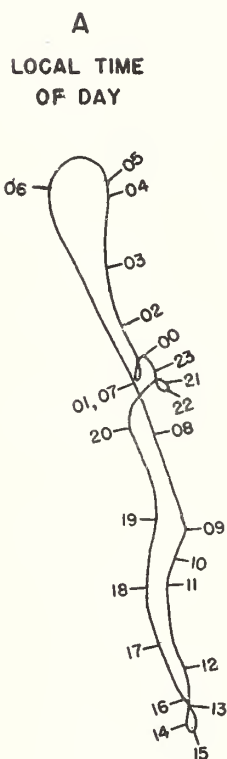
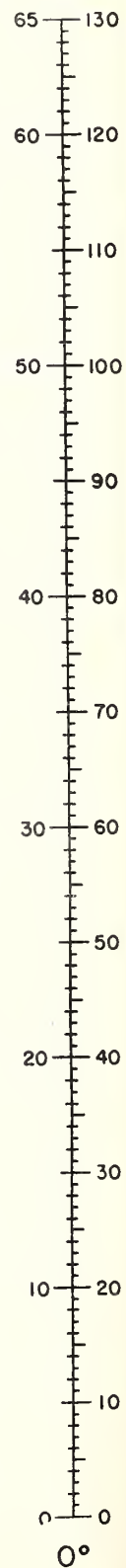
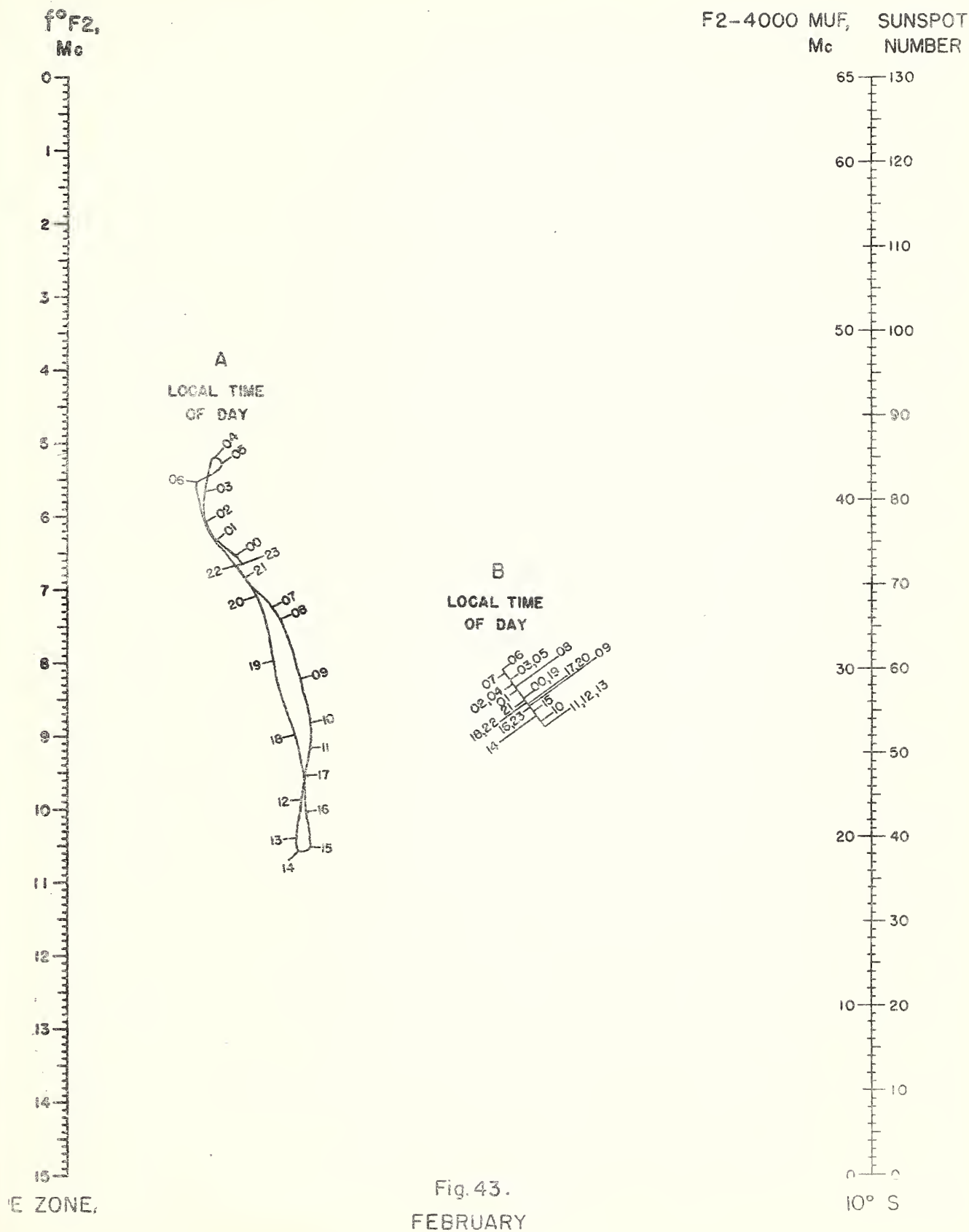


Fig. 42.
FEBRUARY

F2-4000 MUF, SUNSPOT
Mc NUMBER

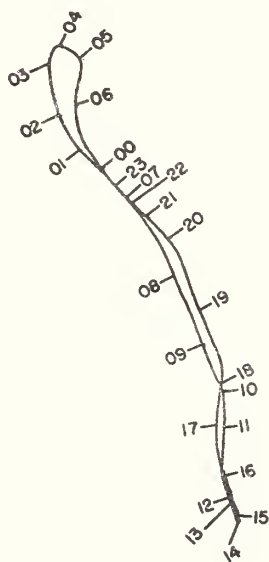




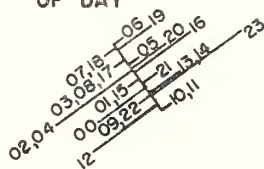
f^oF_2 ,
Mc



A
LOCAL TIME
OF DAY



B
LOCAL TIME
OF DAY



F2-4000 MUF, Mc SUNSPOT
NUMBER

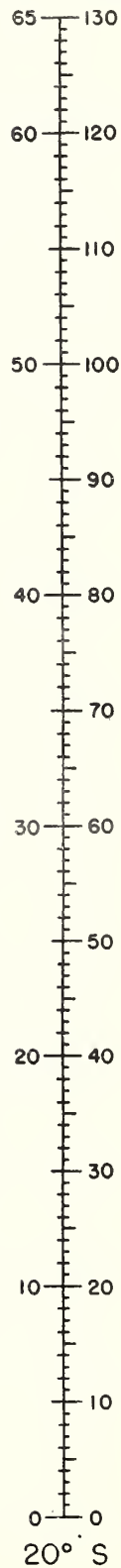
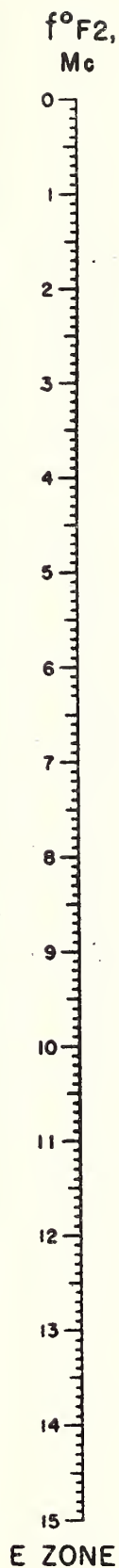


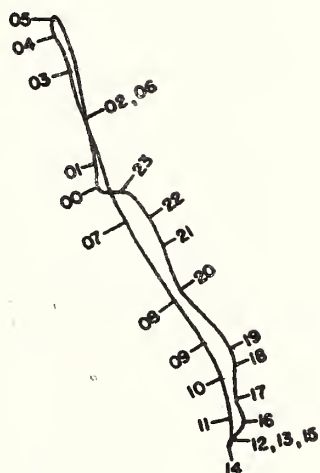
Fig. 44.
FEBRUARY

E ZONE.



E ZONE

A
LOCAL TIME
OF DAY



B
LOCAL TIME
OF DAY

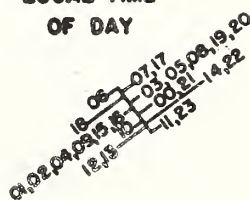
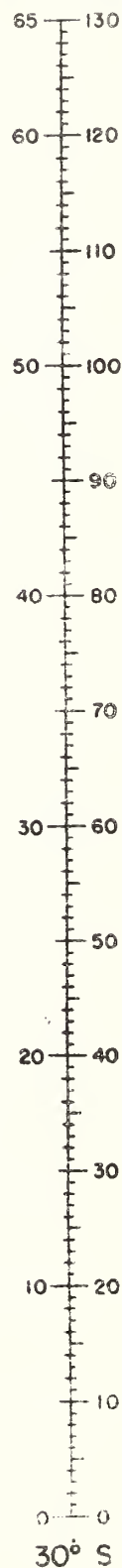


Fig. 45.
FEBRUARY

F2-4000 MUF, SUNSPOT
Mc NUMBER



30° S

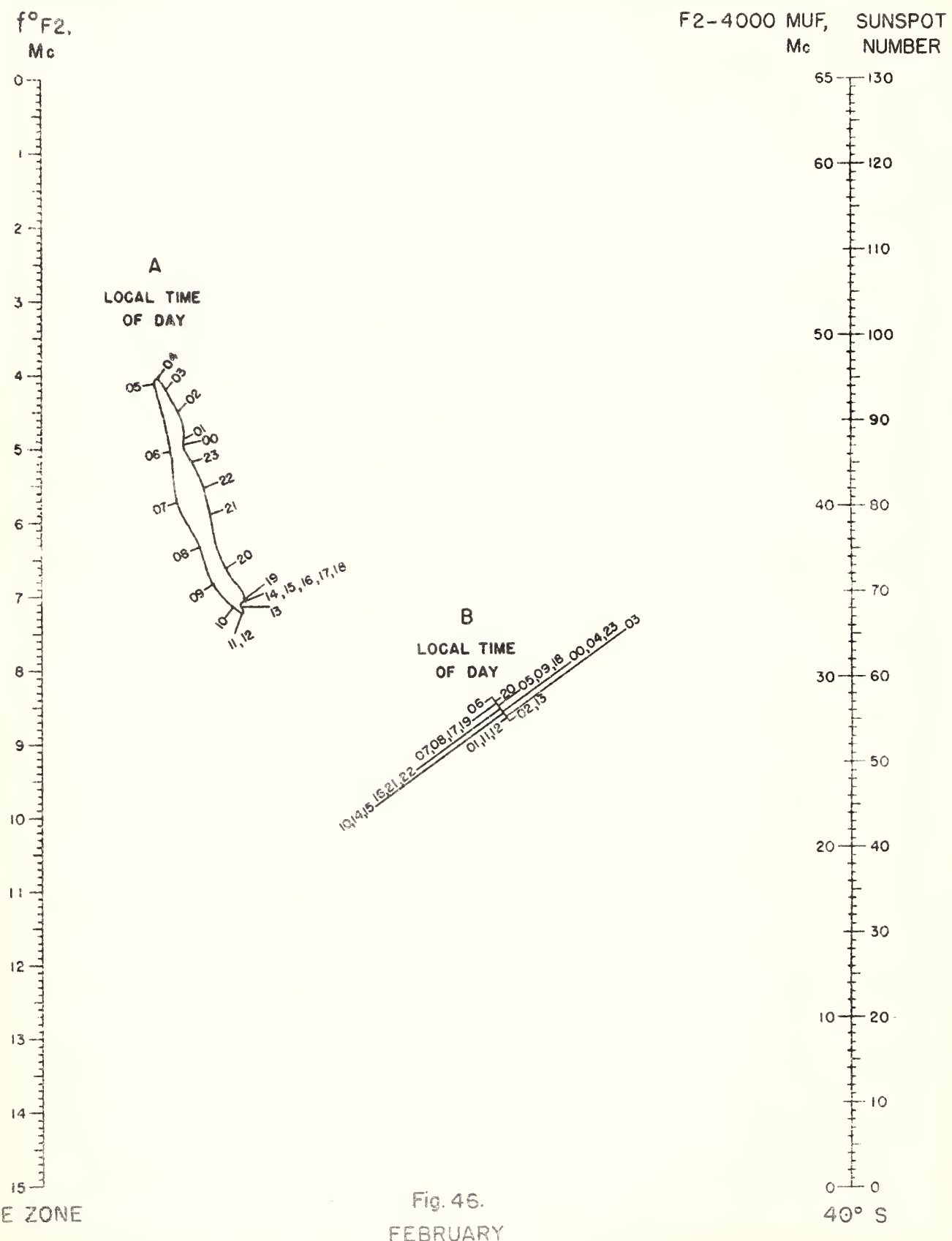


Fig. 46.
FEBRUARY

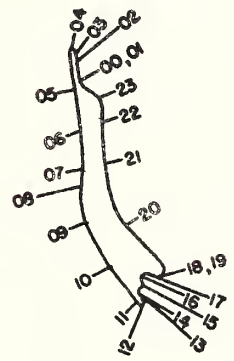
A vertical ruler scale from 0 to 15 cm. The scale is marked with major numbers from 0 to 15 and minor millimeter markings between them. The ruler is oriented vertically with 0 at the top and 15 at the bottom.

E ZONE

F2-4000 MUF, SUNSPOT
 Mc NUMBER

50° S

A
LOCAL TIME
OF DAY



B
LOCAL TIME
OF DAY

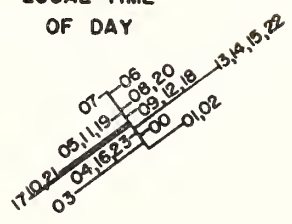
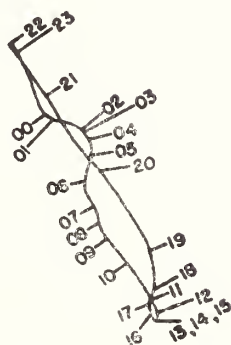


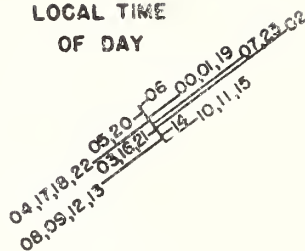
Fig. 47.
FEBRUARY



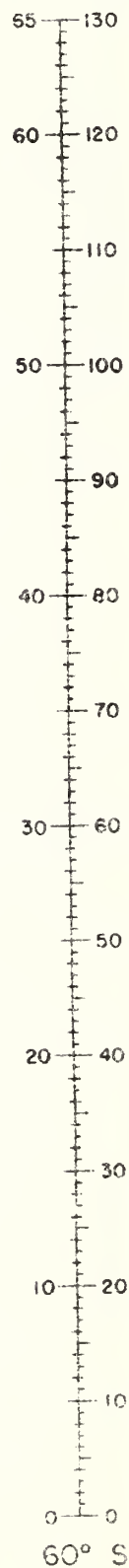
A
LOCAL TIME
OF DAY



B
LOCAL TIME
OF DAY



F2-4000 MUF, Mc SUNSPOT
NUMBER



E ZONE

Fig. 48.
FEBRUARY

60° S

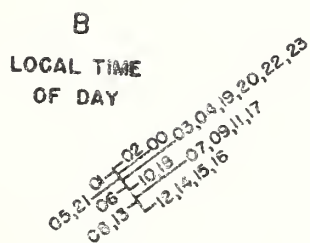
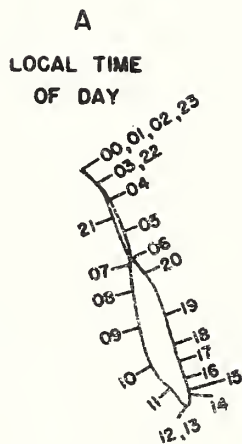
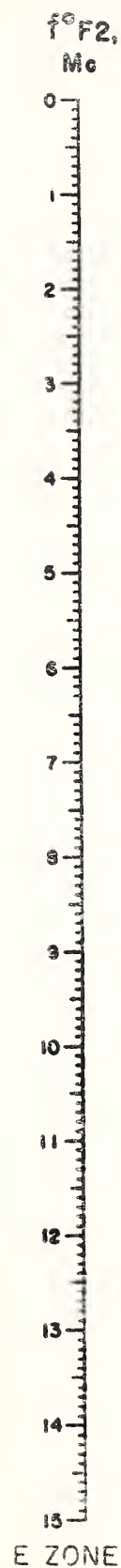
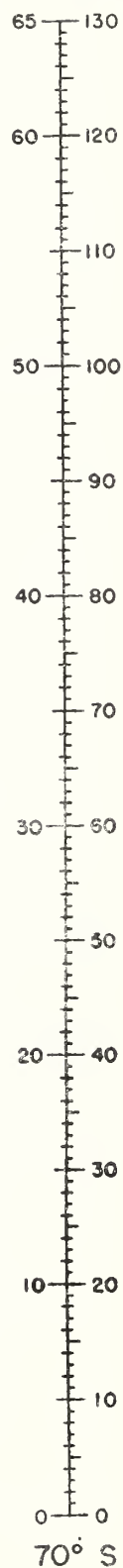


Fig. 49.
FEBRUARY

F2-4000 MUF, SUNSPOT
Mc NUMBER



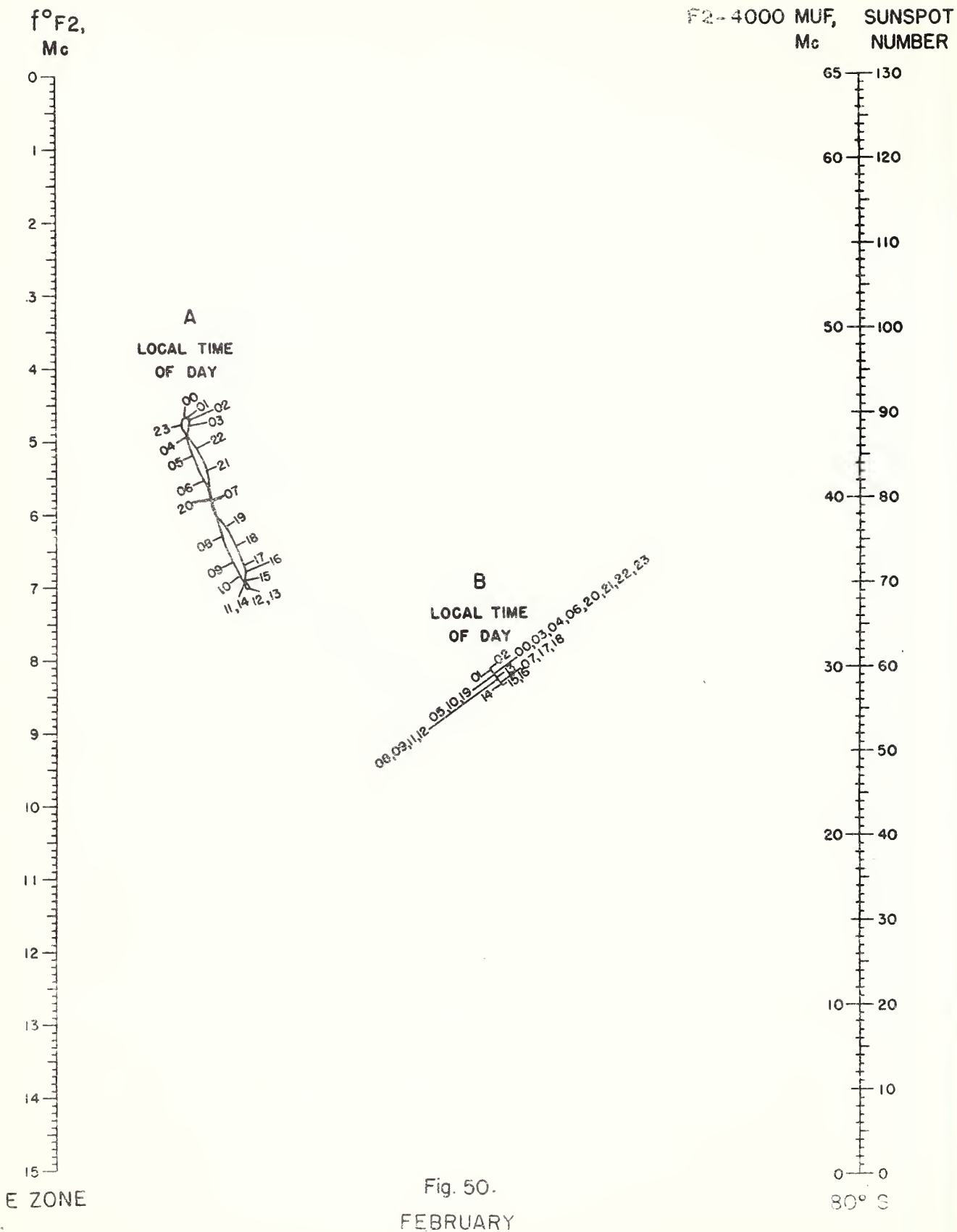


Fig. 50.
FEBRUARY