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IONOSPHERIC DATA IN JAPAN

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COMMUNICATIONS RESEARCH LABORATORY
MINISTRY OF POSTS AND TELECOMMUNICATIONS
TOKYO, JAPAN

PREFACE

July, 1988

Ionospheric sounding in Japan dates back to 1931. Results of the work have been published monthly as "Ionospheric Data in Japan" since 1946. Observation, data coordination, and publication have been carried out successively by various organizations as dictated by reorganizations of government offices. Several progressive changes have been made in the observing system and data processing method.

Communications Research Laboratory, formerly Radio Research Laboratory, which has been operating ionospheric observatories since 1952, has just completed a new full-automatic system attached to traditional ionosondes for data collecting and processing of ionospheric observation. After extensive comparison of automatically-scaled parameters with manually-scaled values, it was decided to publish monthly reports based on the data processed with the new system beginning June 1988.

At present, the number of ionospheric parameters to be published is restricted to five because values of other parameters processed by the new system are not reliable. New daily plots called Summary Plots, made from quarter-hourly digital ionograms are published to present general ionospheric conditions. With respect to data obtained at Kokubunji, fourteen manually-scaled parameters are, as heretofore, being inserted along with *f*-plots to supplement those automatically-scaled.

We intend to improve the system to extend the ability of automatic scaling and to provide, on request, various digital data including ionograms in computer-readable form.

Jouji SUZUKI
Director General
Communications Research Laboratory
Ministry of Posts and Telecommunications

INTRODUCTION

This Series contains data on ionosphere (I), solar radio emission (S) and radio propagation (P) obtained at the following stations under the Communications Research Laboratory, Ministry of Posts and Telecommunications of Japan.

Station	Geographic		Geomagnetic		Technical Method
	Latitude	Longitude	Latitude	Longitude	
Wakkanai	45°23.5′N	141°41.2′E	35.3°N	206.5°	Vertical Sounding (I)
Akita	39°43.5′N	140°08.0′E	29.5°N	205.9°	″ (I)
Kokubunji	35°42.4′N	139°29.3′E	25.5°N	205.8°	″ (I)
Yamagawa	31°12.1′N	130°37.1′E	20.4°N	198.3°	″ (I)
Okinawa	26°16.9′N	127°48.4′E	15.3°N	196.0°	″ (I)
Hiraiso	36°22.0′N	140°37.5′E	26.3°N	206.8°	Radio Receiving (S, P)
Inubo	35°42.2′N	140°51.5′E	25.6°N	207.0°	″ (P)

A. IONOSPHERE

Ionospheric observations are carried out at the above five stations in Japan by means of vertical sounding using ionosondes. The ionosonde produces ionograms, which are recorded digitally on computer storage medium as well as graphically on 35 mm photographic film. The digitally-recorded ionograms are collected from each station by the central computer and reduced to numerical values and Summary Plots by the automatic processing system. The ionograms obtained at Kokubunji are manually scaled as well by experienced specialists to supplement automatically-scaled parameters.

A1. Automatic Scaling

Digital ionograms are automatically scaled by the pattern recognition method. The following five factors of ionospheric characteristics are published for the present. The reliability of these factors has been ascertained by comparison of the automatically-scaled parameters with the manually-scaled values of large amounts of test ionograms.

The published data consist of tabulations of hourly values of three factors (*foF2, fEs, fmin*) and monthly medians of two factors (*h′Es, h′F*), daily Summary Plots and monthly medians plot of *foF2*.

a. Characteristics of Ionosphere

foF2	Ordinary wave critical frequency for the *F2* layer
fEs	Highest frequency of the *Es* layer whether it may be ordinary or extraordinary
fmin	Lowest frequency which shows vertical ionospheric reflections
h′Es *h′F*	Minimum virtual height on the ordinary wave for the *Es* and *F* layers, respectively

b. Descriptive Letters

The following descriptive letters are used in the tables.

A Impossible measurement because of the presence of a lower thin layer, for example *Es* (for *foF2*).

B Impossible measurement because of absorption in the vicinity of *fmin*.

C Impossible measurement because of any failure in observation.

G Impossible automatic scaling because of too small ionization density of the layer (for *fEs*).

N Impossible automatic scaling because of complex echoes.

Blank No digital record because of trouble in the automatic data processing system, but existence of film record.

c. Definitions of the CNT, MED, UQ and LQ

Median count (CNT) is the number of numerical values from which the median has been computed. In addition to numerical values, the count may include a descriptive letter G.

Median (MED) is defined as the middle value when the numerical values are arranged in order of magnitude, or the average of the two middle values if there is an even number of values.

Upper quartile (UQ) is the median value of the upper half of the values when they are ranked according to magnitude; the *lower quartile* (LQ) is the median value of the lower half.

If CNT is less than 10, there are blank spaces left.

d. Reliability of Automatic Scaling

The results of the comparison between automatically-scaled values and manually-scaled ones showed that hourly values of *foF2, fEs* and *fmin* were scaled within a difference of 1 MHz from about 90, 90 and 99 %, respectively of the test ionograms.

e. Summary Plot

Daily Summary Plots which are made from quarter-hourly digital ionograms are published to present general ionosphere conditions. The upper and middle parts of a Summary Plot show the diurnal variation of the frequency range of the echoes reflected from the *F* and *E* regions, respectively. The two solid arcing lines indicate the predicted values of *fxE* and *foE* calculated by the method described in the CCIR report 340. The lower part shows the diurnal variation of the virtual height where the echo traces become horizontal.

A2. Manual Scaling

The published data consist of tabulations of hourly values of the ionospheric characteristics and figures of daily *f*-plot.

All symbols and terminology in the tables or figures of ionospheric data are used in accordance with the "URSI Handbook of Ionogram Interpretation and Reduction (Second Edition) 1972" and its revision of chapters 1-4, published in July 1978.

a. Characteristics of Ionosphere

fxI	Top frequency of spread *F* trace
foF2 *foF1* *foE* *foEs*	Ordinary wave critical frequency for the *F2, F1, E* and *Es* including particle *E* layers, respectively.
fbEs	Blanketing frequency of the *Es* layer, e.g. the lowest ordinary wave frequency visible through *Es*
fmin	Lowest frequency which shows vertical ionospheric reflections
M(3000)F2 *M(3000)F1*	Maximum usable frequency factor for a path of 3000 km for transmission by *F2* and *F1* layers, respectively
h′F2 *h′F* *h′E* *h′Es*	Minimum virtual height on the ordinary wave for the *F2*, whole *F, E* and *Es* layers, respectively
Types of *Es*	See below b. (iii)

b. Symbols

(i) Descriptive Letters

The following letters are entered after, or used to replaced a numerical value on the monthly tabulation sheets, if necessary.

A Measurement influenced by, or impossible because of, the presence of a lower thin layer, for example *Es*.
B Measurement influenced by, or impossible because of, absorption in the vicinity of *fmin*.
C Measurement influenced by, or impossible because of, any non-ionospheric reason.
D Measurement influenced by, or impossible because of, the upper limit of the normal frequency range in use.
E Measurement influenced by, or impossible because of, the lower limit of the normal frequency range in use.
F Measurement influenced by, or impossible because of, the presence of spread echoes.
G Measurement influenced or impossible because the ionization density of the layer is too small to enable it to be made accurately.
H Measurement influenced by, or impossible because of, the presence of a stratification.
K Presence of particle *E* layer.
L Measurement influenced or impossible because the trace has no sufficiently definite cusp between layers.
M Interpretation of measurement questionable because the ordinary and extraordinary components are not distinguishable.
N Conditions are such that the measurement cannot be interpreted.
O Measurement refers to the ordinary component.
P Man-made perturbations of the observed parameter; or spur type spread *F* present.
Q Range spread present.
R Measurement influenced by, or impossible because of, attenuation in the vicinity of a critical frequency.
S Measurement influenced by, or impossible because of, interference or atmospherics.
T Value determined by a sequence of observations, the actual observation being inconsistent or doubtful.
V Forked trace which may influence the measurement.
W Measurement influenced or impossible because the echo lies outside the height range recorded.
X Measurement refers to the extraordinary component.
Y Lacuna phenomena, severe layer tilt.
Z Third magneto-electronic component present.

(ii) Qualifying Letters

The following letters are entered in the first column before a numerical value on the monthly tabulation sheets, if necessary.

A Less than. Used only when *fbEs* is deduced from *foEs* because total blanketing of higher layer is present.
D Greater than.
E Less than.
I Missing value has been replaced by an interpolated value.
J Ordinary component characteristic deduced from the extraordinary component.
M Mode interpretation uncertain.
O Extraordinary component characteristic deduced from the ordinary component. (Used for x-characteristics only.)
T Value determined by a sequence of observations, the actual observation being inconsistent or doubtful.
U Uncertain or doubtful numerical value.
Z Measurement deduced from the third magneto-electronic component.

(iii) Description of Types of *Es*

When more than one type of *Es* trace are present on the ionogram, the type for the trace used to determine *foEs* must be written first. The number of multiple trace is indicated after the type letter.

The types are:

f An *Es* trace which shows no appreciable increase of height with frequency.
l A flat *Es* trace at or below the normal *E* layer minimum virtual height or below the particle *E* layer minimum virtual height.
c An *Es* trace showing a relatively symmetrical cusp at or below *foE*. (Usually a daytime type.)
h An *Es* trace showing a discontinuity in height with the normal *E* layer trace at or above *foE*. The cusp is not symmetrical, the low frequency end of the *Es* trace lying clearly above the high frequency end of the normal *E* trace. (Usually a daytime type.)
q An *Es* trace which is diffuse and non-blanketing over a wide frequency range.
r An *Es* trace showing an increase in virtual height at the high frequency end similar to group retardation.
a An *Es* trace having a well-defined flat or gradually rising lower edge with stratified and diffuse traces present above it.
s A diffuse *Es* trace which rises steadily with frequency and usually emerges from another type *Es* trace.
d A weak diffuse trace at heights below 95 km associated with high absorption and large *fmin*.
n The designation 'n' is used to denote an *Es* trace which cannot be classified into one of the standard types.
k The designation 'k' is used to show the presence of particle *E*. When *foEs* > *foE* (particle *E*) the *Es* type precedes k.

c. Definitions of the CNT, MED, UQ and LQ

Median count (CND) is the number of values from which the median has been computed. In addition to numerical values, the count may include certain descriptive letters.

Median (MED) is the middle value when the numerical values are arranged in order of magnitude, or the average of the two middle values if there is an even number of values.

Upper quartile (UQ) is the median value of the upper half of the values when they are ranked according to magnitude; the *lower quartile* (LQ) is the median value of the lower half.

B. SOLAR RADIO EMISSION

Solar radio observations at 100, 200 and 500 MHz are carried out at Hiraiso. The observation equipment consists of two parabolic antennas, one with 10-meter diameter for 100 and 200 MHz measurements and one with 6-meter diameter for 500 MHz measurements, each being equipped with a pair of crossed doublet antennas as a primary radiator, and three appropriate receivers. Each pair of the crossed doublet antennas is used as a polarimeter. Observations are continuously carried out almost from sunrise to sunset.

B1. Daily Data at Hiraiso

The three-hourly mean and daily mean values of the solar radio emission intensities at the base-level are tabulated separately for 200 and 500 MHz measurements. Here, the base-level intensity is defined as the intensity recorded during the time when no radio emission burst is taking place. The intensities are expressed by the flux density in 10^{-22} Wm^{-2} Hz^{-1} unit.

The table for 200 MHz measurements also presents the variability indices defined by the number of impulsive radio bursts within the three-hour intervals as follows:

0 quiet or no burst,
1 a few bursts,
2 many bursts,
3 very many bursts.

The daily variability index is defined as the daily mean of three-hourly indices.

The following symbols are used in the tables, when interference or radio bursts prevented measuring the base-level flux densities or determining the variability indices:

* Measurement impossible because of interference.
B Measurement impossible because of bursts.

Daily data within parentheses mean that the observation time does not exceed one third of the period.

B2. Outstanding Occurrences at Hiraiso

The table is a list of outstanding occurrences of solar radio emission bursts observed at Hiraiso during a month. Listed in the table are the date, frequencies, the type of event, the start time and the time of maximum, both in U.T. expressed in hours, minutes and tenths of a minute, the duration in minutes, the peak and mean flux densities in 10^{-22} Wm^{-2} Hz^{-1} unit, and the polarization.

The type of event is expressed by a combination of a numerical code and a letter symbol in accordance with the "Descriptive Text of Solar Geophysical Data, NOAA" as defined by H. Tanaka in the "Instruction Manual for Monthly Report of Solar Radio Emission, WDC-C2" in January 1975:

SGD Code	Letter Symbol	Morphological Classification
1	S	Simple 1
2	S/F	Simple 1F
3	S	Simple 2
4	S/F	Simple 2F
5	S	Simple
6	S	Minor
7	C	Minor$^+$
8	S	Spike
20	GRF	Simple 3
21	GRF	Simple 3A
22	GRF	Simple 3F
23	GRF	Simple 3AF
24	R	Rise
25	R	Rise A
26	FAL	Fall
27	RF	Rise and Fall
28	PRE	Precursor
29	PBI	Post Burst Increase
30	PBI	Post Burst Increase A
31	ABS	Post Burst Decrease
32	ABS	Absorption
40	F	Fluctuations
41	F	Group of Bursts
42	SER	Series of Bursts
43	NS	Onset of Noise Storm
44	NS	Noise Storm in progress
45	C	Complex
46	C	Complex F
47	GB	Great Burst
48	C	Major
49	GB	Major$^+$

The polarization is expressed by the polarization degree and sense as follows:

R or L right- or left-handed polarization,
W, M or S weak, moderate or strong polarization,
0 almost zero or unable to detect polarization due to small increase of flux,
00 polarization degree of less than 1 percent.

One of the following symbols may be attached after numerical values, if necessary.

D greater than, or later than,
E less than or earlier than,
U approximate, or uncertain.

C. RADIO PROPAGATION

C1. H.F. Field Strength at Hiraiso

Field strength observation of 15 MHz standard waves transmitted from WWV and WWVH stations which are located respectively at Fort Collins, Colorado and Kauai, Hawaii, is carried out at Hiraiso. In order to avoid interference among the same frequency waves, the upper sideband of WWV or WWVH with the audio tone 660 Hz is picked up by the use of a narrow band-pass filter with 80 Hz bandwidth. Particulars of the transmitters and the receiver are summarized in the following table.

The tabulated *field strength* expressed in dB above one microvolt per meter is the average of quasi-peak values of the incident upper sideband field intensity in 45 seconds after the universal time indicated on the table. Abbreviated symbols are as follows:

CNT number of observed values,
MED median,
UD value of the uppermost decile when they are ranked according to magnitude,
LD value of the lowest decile when they are ranked according to magnitude,
U uncertain,
E less than,
C influenced by, or impossible because of, any artificial accident,
S influenced by, or impossible because of, interferences or atmospherics.

C2. Radio Propagation Quality Figures at Hiraiso

The tabulated six-hourly quality figures are calculated for standard waves WWV transmitted from Fort Collins and WWVH transmitted from Kauai.

Quality figures expressing radio propagation conditions range over five grades as follows:

1 very poor (very disturbed),
2 poor (disturbed),
3 rather poor (unstable),
4 normal,
5 good.

Whole day quality figure ranged in grades of 1o, 1+, 2–, 2o, 2+, 3–, 3o, 3+, 4–, 4o, 4+, 5–, 5o stands for an average of six-hourly quality figures of the two circuits. Abbreviated symbols are as follows:

C artificial accident,
S propagational accident,
U inaccurate.

The column of conditions presents a record of the forecast of *radio propagation conditions* which is applicable to forthcoming 12 hours and broadcast six times per hour from JJY (Japan Standard Wave) station. The conditions are denoted as follows:

N normal,
U unstable,
W disturbed.

Characteristics	Transmitter		Receiver
Station Call	WWV	WWVH	
Location	Fort Collins, Colorado	Kauai, Hawaii	Hiraiso, Ibaraki
latitude	40°41′N	22°00′N	36°22′N
longitude	105°02′W	159°46′W	140°38′E
Distance	9150 km	5910 km	
Carrier Power	10 kW	10 kW	—
Power in each sideband	625 W	625 W	—
Modulation	50 %	50 %	—
Antenna	λ/2 vertical	λ/2 vertical	4.5 m vertical rod
Bandwidth	—	—	80 Hz for upper sideband
Calibration	—	—	Every hour

Data on *geomagnetic storms* which are often correlated with radio propagation disturbances are tabulated based on reports from observation at Kakioka Magnetic Observatory, Japan Meteorological Agency. *Time* (U.T.) is expressed in hours and minutes (or tenths of an hour), and *range* in nanotesla. When they are uncertain quantitatively, /'s are used to replace the numerical values. Continuation of a geomagnetic storm is denoted by ---.

C3. Phase Variation in OMEGA Radio Waves at Inubo

The phase values of eight OMEGA radio signals as received at Inubo are depicted for an interval of one month, along with the phase deviation defined as a deviation from a value averaged over the six quietest day within the month. Particulars of the received signals are given in the table below.

In each of the four panels of the figure, the phase (ϕ) is shown in the lower part and the phase deviation ($\Delta\phi$) is shown in the upper part. The phase data are sampled every 30 min, so the curves of the phase and phase deviation are composed of 48 data points per day. The phase delay is measured as a positive value.

The polar cap phase anomaly (PCPA) caused by the solar protons are well detected on the Norway signal. The start, end and maximum times of the PCPA are listed in the table next to the figure, where the times are expressed as day/hour & minute in U.T.. The maximum phase deviation in the list is defined as a phase advance (negative values in the figure) in degrees.

C4. Sudden Ionospheric Disturbances

a. Short Wave Fade-out (SWF) at Hiraiso

The table of short wave fade-out (SWF) is prepared from the record of field intensities measured at Hiraiso.

Drop-out intensities of the 10 MHz, the 20 MHz, and the 25 MHz waves are respectively distinguished by marks ′, ″, and ‴ from those of the 15 MHz wave for WWV and WWVH. Values of *start, duration, type,* and *importance* are obtained from data of the circuit whose drop-out intensity in dB is underlined as xx. When these quantities could not be determined accurately, they are accompanied by one of the following symbols.

D	greater than,
E	less than,
U	uncertain or doubtful.

Types of fade-out are as follows:

S	sudden drop-out and gradual recovery,
SL	slow drop-out taking 5 to 15 minutes and gradual recovery,
G	gradual and irregular in both drop-out and recovery.

Importance of fade-out is scaled according to its amplitude into nine ascending grades as 1–, 1, 1+, 2–, 2, 2+, 3–, 3, 3+.

Correspondence of solar optical flare, solar radio burst, and geomagnetic crochet to SWF is marked by X, being determined with data from interchange messages of IUWDS and observations at Hiraiso.

In table (a) SWF, *date* indicates the day to which the *start-time* of the event belongs.

b. Sudden Phase Anomaly (SPA) at Inubo

Data of sudden phase anomaly (SPA) are prepared from the records of phase measurement of VLF radio waves received at Inubo. The transmitting stations are listed in the following table.

Phase advance is shown in unit of degree at its maximum stage. No transmission or no reception during the period is indicated by —, an indistinguishable record is spaced out, and a multi-peak event is marked by *. The most remarkable or distinct phase advance is underlined and listed in the column of *Time*.

In table (b) SPA, *date* indicates the day to which the *start-time* of the event belongs.

The following letters may be attached to the value, if necessary.

D	greater than,
E	less than,
U	uncertain or doubtful.

Transmitting Stations

Name	Location (Geographic Coordinates)		Call Sign	Frequency (kHz)	Radiation Power (kW)	Arc Distance from Inubo (km)
Norway	66°25′N	013°08′E	Ω/N	13.6	10	7820
Liberia	06°18′N	010°40′W	Ω/L	13.6	10	14480
Hawaii	21°24′N	157°50′W	Ω/H	13.6	10	6100
North Dakota	46°22′N	098°20′W	Ω/ND	13.6	10	9140
La Reunion	20°58′S	055°17′E	Ω/LR	13.6	10	10970
Argentina	43°03′S	065°11′W	Ω/AR	13.6	10	17640
Australia	38°29′S	146°56′E	Ω/AU	13.6	10	8270
Japan	34°37′N	129°27′E	Ω/J	13.6	10	1040
North West Cape	21°49′S	114°10′E	NWC	22.3	1000	6990

HOURLY VALUES OF FOF2 AT WAKKANAI

DEC.1988

LAT. 45.4N LON. 141.7E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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				N	25	34		50	98	112	128	123	101	97	100	N	80	55	40	41		28	30	32
2	32	34	34	29	32	36		66		97	96	110	111	98	97	91	87	64	44	A	38	34		27
3	26	A	31	32	25	A		50	90	108	102	93	97	94	91	72	75	48	44	46	43	31	31	
4	30	28	29		29		31	71	91	95	113	122	111	100	97	93	67	62	36	37	32	24	30	27
5	A		27	31	31	31	42	58	82	102		108	99	91	79	74	78	67	48	35	A		30	31
6		26	32	30	32	32	38	58	80	90	110	97		92	100	83	67	55	37	31	29		26	25
7		30	30	34	30	32	28	60	82	91	92	101	96	97	91	83	62	51	42	40		26	26	28
8	32	34	32	32	38		32	49	80		100	97	98	92	92	77	61	A	38	35	30	A	A	30
9	28	31	28	31	N	27		67	88	91	94	114		90	90	74	66	46	38	28			26	32
10	31		31		36	30	38	57	80	95	103	112	100	98	89		82	55				29		26
11		32	32			31	38		86	97	116	119	112	92	91	91	66	48	44	44	30		A	
12		28	N	31	30			59	76	124	125	110	102	94		87	80	82	56	44	32	32	32	35
13	40	38	41	38	31	31	31	84	87	114	119	131	94	98	94	94	86	76	60		40	28	32	34
14	32	34	35	40	44			72	78	123	124	116	100	102	97	97	92	65	47		31	32	34	28
15	31	30	28	28	31	30		53	97	127	122	122	127	100	104	102	97	65	62	58	40	31	40	44
16	38	39	38		44	39	34	84	86	94	120	120	92	89	100	93	71	64	45	38	39	44	34	30
17	27			26	25	34	32	66	81	126		119	123	113	106	110	91	78	60		36	33	33	34
18	38	38	38	36	35	32	24	72	96	123	138	131	134	121	120	119	113	86	63	36	40	43	40	43
19	36	38	46	42	38	33	31	69	96	135	134	133	137	119	110		100	87	78	61	51	40	38	42
20	38	38		34	36	32	31	54	84	112	133	137	111	100		95	74	64	57	55	33	A	32	32
21	30	37	36	30	N	38	40		88	97	119	114	118	93	98	100	93	73	49	36			28	37
22	38	31		23	34	32	43	66	85	117	134	118	98	102	113	108	91	66	51	50	34	34	48	35
23		37	33	34	28	32	24	51	96	136	140	138	123	125	120	114	108	81	65		40	37	46	37
24		34	36	36	40	40	33	81	84	122	130	120	92	110	118	88	76	67	61	50	37	35	38	38
25	37	36	37	29	32		35		93	106	118	118	110	85	103		78	72			26	26	23	30
26	31	38					32	61	90	127	137	140	128	106	134	114	90	69	59	44	31	32		34
27	43	42		40	35	38	42	75	96	141	148	141	119		116	94	88	78	70	45	30	32		
28			29	28	28	25		66	85	112	130	133	99	100	114	103	91	63	60	44		26		28
29	34					A	A	58	89	90	92		88	102		97	87	68		53	43	37	38	40
30	35	34	35	35		33	34	58	80	114	120	118	96	79	92	110	89	59	58	43			32	32
31	30	30	31	32	32		26	59	82	102	112	125	97	86	100	100	81	70	63	44	31		28	27
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	22	24	23	24	25	22	22	28	30	30	29	30	29	30	28	27	31	30	28	24	23	22	24	28
MED	32	34	32	32	32	32	32	60	86	112	120	119	101	98	100	94	82	66	54	44	34	32	32	32
U Q	38	38	36	35	36	34	38	70	91	123	131	131	118	102	111	103	91	73	60	48	40	35	38	36
L Q	30	30	30	29	29	31	31	57	82	97	106	112	97	92	92	87	74	59	44	36	31	28	29	28

HOURLY VALUES OF FES AT WAKKANAI

DEC.1988

LAT. 45.4N LON. 141.7E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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				G	G	G	G	G	41	G	G	G	45	G	G	G	G	G	28	28		G	G	G
2	30	27	G	G	G	29	37	49		G	G	G	G	G	G	G	G	45	41	58	35	31		G
3	41	37	G	G	34	37		G	G	G	G	G	G	G	G	G	G	G	G	24	28	28	G	G
4	G	G	G	27	G		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	58	39
5	38	27	G	24	G	26	G	34	G	G	G	G	G	G	G	35	32	31	34	G	36	28	G	G
6		G	G	G	G	G	32	G	G	G	G	G	46	39	53	G	46	G	G	G	G		G	G
7		G	G	G	G	G	27	G	G	G	G	G	G	G	G	38	34	31	G	G		G	G	G
8	G	G	G	G	G		G	G	G	G	G	G	G	G	G	40	37	69	31	G	26	40	30	G
9	G	G	G	G	G	G		G	G	G	G	G	G	G	35	37	G	30	36	G	31	G	G	G
10	G		G	29	G	G	G	G	G	G	G	G	G	G	G	33	G	32				G		G
11	G	G	G	G		37	32	G	G	G	G	G	G	G	G	G	43	G	G	G	G	G	33	
12		G	G	G	G		27	G	G	49	50	G	50	G		G	G	48	50	31	G	G	G	G
13	G	G	G	G	G	G	G	G	48	G	G	G	G	G	G	G	G	G	G		G	G	G	G
14	28	G	G	G	G			G	G	G	G	G	G	G	G	G	G	G	40		30	G	G	G
15	G	G	G	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
16	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
17	G		G	G	G	G	26	G	G	G		G	G	G	G	G	45	29	G		G	G	G	G
18	G	G	G	G	G	G	G	G	G	G	G	55	G	G	G	G	G	G	G	28	40	33	G	G
19	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	29	54	G	G
20	G	G	G	G	G	G	G	G	G	71	G	G	G	G		G	G	G	G	G	G	59	34	G
21	G	G	G	G	G	G	G		G	G	G	G	G	G	G	G	55	38	29	G			G	G
22	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	30	36	40	G	G	G	G	G
23		G	30	G	G	G	31	G	G	G	G	G	G	G	G	G	G	G	27		G	32	38	G
24		G	G	G	G	G	G	35	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
25	G	G	31	G	G		G	57	60	61	G	G	G	G	G		G	G	G		G	G	G	G
26	G	G				30	G	27	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
27	G	G		G	G	G	29	G	G	G	G	G	G		G	G	G	G	G	G	G	G		
28	G		G	G	G	G		G	G	G	G	G	G	G	G	G	81	G	G	G		G		G
29	G		G			60	60	34	G	G	G		G	G		G	G	G		40	G	G	G	G
30	G	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G			G	G
31	G	G	G	G	G		G	G	G	40	G	G	G	G	G	G	G	G	G	G	G		29	G
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	25	26	27	28	27	25	26	30	30	31	30	30	31	30	28	30	31	31	29	25	25	27	27	29
MED	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
U Q	G	G	G	G	G	13	27	G	G	G	G	G	G	G	G	G	32	31	30	12	28	28	G	G
L Q	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G

HOURLY VALUES OF FMIN AT WAKKANAI

DEC.1988

LAT. 45.4N LON. 141.7E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D\H	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						15	16	18	20	22	21	21	27	23	40	17	18	15	16	16		17	17	16
2	17	18	18	20	16	15	18	17		21	23	24	26	26	28	24	18	18	16	18	18	15		17
3	16	17	15	17	16	16		21	27	32	26	27	33	24	28	26	16	16	15	16	17	21	20	23
4	20	17	18	17			17	22	22	20	22	23	38	23	21	27	17	20	17	21	18	17	17	16
5	18	20	15	18	18	17	16	18	27	22	23	33	22	21	29	17	23	15	20	16	16	20	17	22
6		17	17	17	18	16	16	21	27	29	34	33	23	27	22	26	17	21	21	15	18			20
7		20		20	17	18	17	20	26	32	32	23	22	32	27	22	18	20	15	16			20	21
8	18	18	17	23	16		16	20	27	30	34	38	41	35	30	23	17	21	22	17	17	18	20	18
9	18	15	18	20	18	16		20	27	29	24	23	39	44	24	18	17	22	18	20	20		26	18
10	20		23	26	20	20	18	18	27	38	38	39	40	36	39	20	22	16				22		
11		20	18			18	18		26	39	34	38	38	36	42	21	20	20	18	18	21	70	20	
12		20		23	16		20	20	28	26	23	26	28	24		28	47	18	18	18	21	20	21	18
13	20	17	18	18	16	18	18	20	26	33	42	44	43	34	34	27	21	18	15		18	21	20	18
14	21		18	17	17			20	26	44	35	39	35	42	32	27	20	20	20		22	16	20	17
15	22			20	18	18		18	27	45	36	42	41	45	33	30	20	17	17	16	22	20	17	17
16	18	15	15		15	15	17	20	30	40	50	49	50	48	39	29	22	17	21	16	17	17	20	17
17				18		18	20	18	30	33		44	35	41	34	27	18	17	15		21	20	20	20
18	17	16	17	17	17	15		18	28	32	44	34	51	34	44	27	18	18	15	16	17	17	16	16
19	18	17		15	16	17	15	17	26	22	38	36	43	35	39	33	32	17	18	17	18	16	16	16
20	17	17	70		17	17	18	20	27	47	40	44	49	46		27	22	20	16	16	18	16	18	16
21	17	16	16	16	15	17	15		27	33		36	50	42	36	28	21	17	16	15			17	18
22	17	22			20	16	18	21	26	34	34	35	36	35	33	29	17	17	17	17	18	20	18	16
23		16	15	15	16	16	15	20	26	44	34	46	48	35	48	26	24	16	15		18	17	16	16
24		15	16	17	17	18	15	24	27	46	35	49	44	54	43	29	20	15	17	17	14	20	17	15
25	16	16	16	16	18		17	17	23	32	35	40	35	45	30		21	18			21			17
26	20	17				21	17	17	27	33	36	33	35	43	35	29	18	16	15	16	21	20	22	16
27	20	16		16	16	15	18	22	28	34	39	48	50			34	20	20	18	18	20	17		
28			22	20	18			17	29	47	52	58	53	50	30	34	23	17	17	17				
29	17					17	17	18	26	35			42	55		33	20	20		21	18	20	17	18
30	20	18	16	20		18	17	20	39	46	49	49	48	52	50	33	22	16	18	17				22
31	17	16	18	24	17		15	22	28	38	39	49	54	48	39	29	21	16	21	17	16		15	
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	22	24	21	24	24	24	25	29	30	31	28	30	31	30	27	30	31	31	28	25	25	23	24	26
MED	18	17	17	18	17	17	17	20	27	33	35	38	40	36	34	27	20	17	17	17	18	20	18	17
U Q	20	18	18	20	18	18	18	20	28	40	39	44	48	45	39	29	22	20	18	18	21	20	20	18
L Q	17	16	16	17	16	16	16	18	26	29	29	33	35	32	29	24	18	16	15	16	17	17	17	16

HOURLY VALUES OF FOF2 AT AKITA

DEC.1988

LAT. 39.7N LON. 140.1E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	85			30	22	31	29	66	101		122	121	112	106	90	90	84	52	54	30	46	N		A
2	30	32	30	29	32	31	31	71	86	88	102	113	98	108	106	92	78	70	51	47	47	36		C
3		A	A		A	A	22	52	88	117	112	101	91	106		84	77	50	A	31	43		32	34
4	31	30	A	A	28	27	35	66	88	104	121	110		122	113	84	86	66	53	44	40	31	31	
5		N	N	26	A	31	34	73	88	98	116	101	96		90	75	70	64	54		26	A		31
6	N	31	N	28	A	34	40	66	80	88	102	113	106	99	89	91	66	66	52	40	30			31
7		32	31	37	34	31	31	63	84	88	97	97	90	88	103	88	68	52	54	44	34	A	27	28
8	32	32	31		30	32	34	64	84	85	103	104	94	101	98	86	67	60			31	N		30
9	30	28	30	N	22	30	36	67	85	108	111	116	114	104	86	90	75		52	40	29	31		
10	30	32	N	31	31	A		67	84	88	90	115	110	112	101	90	76	63	56	38	N	28	A	34
11	30	32	32	31	29	41	48	76	88	111	121	123	118	102	86	78	80	56	46	44	42	34		31
12	30	29		32	32	33	30	64	78	116	133	112	101	86	96	86	85	79	57	51	43	30	A	32
13	28	31	44	35	31	31	36	66	96	114	124	121	114		100	99	90	80	66	53	39	31	A	33
14	A	32	31	44	32	N	24	56	104	112	112	121	110	95	102	105	85	83	61	53	39	N	32	35
15	31	A	22		32	28	30	66	100	106	117	118	115	110	108	107	102	86	53	58	44	40	46	45
16	33	32	38	39	40	37	41	62	91	97	118	123	111	98	90	108	84	54	46	44	46	44	40	
17		N	23	32	30	33	38	60	110	130	135	117	113	114	110	101	99	83	64	52	48	46	32	40
18	32	46	40	41	34	32			103	108	121	129	120	124	121	115	117	96	78		30	A	A	32
19	38	34	44	30	32	36	41	73	102		137	130	116	122	112	110	110	86	80	65	51	34	40	A
20	A	34	33		30	32	30	52	87	88	134	127	111	94	108	N	87	62	66		35		32	30
21	29	36	42	40	32	31	38	68	87	91	122	128	116	111	104	104	86	78	51	32	A	A	32	A
22	36	32	32	31		34	40	66	97	88	124	120	112	108	108	115	96	64	52	26	34	38	39	35
23	30	32	40	32	36	32		62	85	120	136	126	114	114	121	110	106	85	67	54	31	28	38	45
24	38		44	40	36	39	40	62	84	97	121	130	114	88	108	112	82	64	66	53	28	28	32	34
25	34	32	38	32	32		38	70	85	113	112	111	111	102	101	104	102	63	61	51	A	A	30	38
26		47	22	25		30	A	52	102	116	121	131	129	115	115	115	96	72	64	66	46	35	40	34
27	34	31		40	36	40	42	68	120	140	142	144	134		114	132	116	86	86	72	47	N		
28		31		N	N	N	32	56	88	102	121	121	124	108	102	115	86	66	55	52	30	30	30	28
29		34	34				24	58	82	99	108	120	114	108	108	104		67	66	52		40	A	
30	A	A	34	36	35			63	72	95	132	128	112	103	108	109	101	66	63	60	31		31	32
31	30	N	N	26	30	29	30	52	77	87	120	114	116	100	91	120	90	65	52	50	40	26	31	30
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	20	23	21	23	24	24	26	30	31	29	31	31	30	28	30	30	30	30	29	27	27	18	18	22
MED	31	32	33	32	32	32	34	65	88	102	121	120	112	106	104	104	86	66	56	51	39	32	32	32
U Q	34	34	40	39	34	34	40	67	100	113	124	127	116	111	108	110	99	80	66	53	46	38	39	35
L Q	30	31	30	30	30	31	30	60	84	88	112	113	110	99	96	90	78	63	52	40	31	30	31	31

HOURLY VALUES OF FES AT AKITA

DEC.1988

LAT. 39.7N LON. 140.1E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	G			G	G	G	G	G	40		60	96	50	43	42	34	G	33	37	28	G	G	29	29
2	G	G	G	26	G	G	G	G	G	G	56	G	43	G	43	37	G	G	28	G	G	G		C
3		39	68	29	30	29	29	G	G	37	G	G	G	41	G	G	48	34	57	48	29		G	G
4	G	G	33	28	25	G	G	G	36	G	G	G		45	39	37	G	G	G	G	G	26	G	
5		G	G	G	44	G	39	G	G	37	40	45	54		43	55	40	47	39		30	30	33	36
6	G	G	G	G	30	G	G	29	G	G	G	G	46	56	59	40	36	G	46	30	G			G
7		G	G	G	G	G	G	32	G	G	G	41	G	G	G	43	34	32	G	G	26	28	G	G
8	G	G	G	G	G	G	G	G	G	G	G	G	G	48	42	38	32	32	46		G	30	G	G
9	G	G	G	G	G	G	29	31	G	G	G	G	G	46	G	G	36	32	G	G	G	24	34	30
10	28	G	G	G	47	36	36	28	G	G	G	G	G	45	51	G	36	G	G	28	25	G	34	G
11	G	G	G	G	31	G	G	G	58	92	G	G	G	G	G	G	58	G	33	35	G	G		G
12	G	G		G	G	G	G	G	G	37	39	40	G	41	39	G	G	30	43	G	G	24	30	30
13	26	G	G	G	G	G	G	G	40	42	G	G	G		G	G	G	G	G	G	G	G	59	55
14	58	34	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	38	32	29	30	25	25
15	G	29	G		G	G	G	G	48	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
16	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	
17		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	30	37	G	G	G	G	G	G
18	G	G	G	24	G	G			48	58	G	G	G	G	44	G	G	29	G	95	33	91	68	34
19	G	G	G	32	29	G	G	G	33		G	G	G	G	38	G	G	G	G	G	G	G	30	46
20	44	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	29	33	38	24		G	30
21	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	48	49	36	37	69	46	36	34
22	G	G	G	G	28	G	G	G	G	G	G	G	G	G	G	G	48	41	32	36	28	25	24	26
23	G	G	G	27	G	G		30	61	G	G	G	G	G	G	36	29	30	29	G	G	G	G	G
24	31	33	29	28	30	24	26	32	G	G	40	G	G	G	G	G	G	G	G	G	G	G	24	G
25	G	29	G	G	G		G	G	G	56	44	77	G	G	G	G	G	G	G	28	56	34	G	27
26	26	24	G	G		G	34	26	G	G	52	G	G	G	G	G	G	28	G	G	G	G	G	G
27	G	G		25	31	G	25	G	37	G	G	G	G		G	G	G	32	G	G	G	G		
28	28	G		G	G	G	G	G	G	G	G	G	G	G	G	G	34	29	31	G	24	G	G	30
29	28	G	G		G		27	36	G	43	G	G	G	G	G	G		35	27	G		37	35	33
30	44	36	G	G	G			29	G	G	G	G	G	G	G	G	G	G	G	G	G		G	G
31	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	27	30	27	28	30	28	28	30	31	29	31	31	30	28	31	31	30	31	31	29	30	27	27	27
MED	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	29	G	G	G	G	G	25
U Q	28	G	G	24	29	G	25	28	36	37	G	G	G	41	39	34	36	32	36	31	26	30	33	30
L Q	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G

HOURLY VALUES OF FMIN AT AKITA

DEC.1988

LAT. 39.7N LON. 140.1E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	17				18	18	16	20	16		18	17	18	21	17	16	21	17	18	17	16	23	21	17
2	18	15	17	20	17	16	17	22	18	17	20	21	18	18	18	21	17	18	16	15	17	18		C
3		17	16	17	17	17	17	20	18	17	20	21	21	22	18	16	20	16	16	16	17		15	18
4	18	17	16	16	16	17	15	23	17	20	21	18		20	16	16	16	16	16	17	16	17	17	
5		18	17	17	16	17	16	24	18	17	18	20	18		16	17	17	16	16		17	17	16	17
6	16	16	17	16	17	18	16	16	24	18	20	21	20	20	21	17	21	17	16	17	21			16
7		15	16	16	17	18	16	17	21	20	20	21	23	21	20	18	17	16	17	17	16	18	20	17
8	17	16	16		17	16	16	22	17	18	22	24	22	22	21	18	16	16	16		17	18		18
9	21	18	22	18	16	20	16	16	17	20	21	22	23	23	21	32	16	16	16	17	16	18	16	18
10	18	16	20	16	15	16	16	21	18	20	18	20	22	24	22	26	16	17	16	18	22	22	16	18
11	18	17	17	16	18	17	16	21	17	18	23	22	21	23	23	18	22	16	16	16	17	17		20
12	16	20		16	16	16	21	21	17	20	18	21	23	21	18	17	22	17	16	16	18	18	16	18
13	18	17	16	15	15	18	17	20	18	18	21	18	24		20	20	22	16	16	16	16	18	20	16
14	16	17	16	15	15		20	22	18	20	22	22	26	23	20	18	15	16	16	15	16	17	17	17
15	18	21			18	16	20	16	26	21	23	26	24	26	24	32	24	20	17	16	16	18	16	17
16	20	20	16	16	16	17	16	21	28	33	35	38	45	35	34	38	22	16	15	16	16	17	17	
17				17	20	16	16	20	29	34	37	38	26	35	23	30	17	16	16	16	16	16	16	16
18	18	16	17	16	15	18			28	18	24	21	23	23	21	23	22	17	16	16	16	16	15	16
19	18	20	16	17	17	21	16	20	17		35	23	23	26	21	28	22	16	17	16	16	24	18	16
20	16	17	17		15	16	16	20	27	21	26	37	23	24	21	18	22	16	15	16	15		18	16
21		17	15	15	15	16	16	21	20	23	24	24	28	24	22	32	22	16	16	16	16	16	16	16
22	16	16	16	15	16	16	16	20	18	23	24	35	23	23	21	20	16	15	16	15	16	16	16	17
23	16	16	17	16	16	15		16	16	35	23	22	23	24	23	17	15	16	17	15	21	20	15	17
24	16	15	16	18	15	15	16	16	16	18	20	24	24	24	21	18	18	18	16	15	15	16	15	16
25	21	16	15	15	16		15	20	17	17	18	20	26	24	22	17	22	22	16	16	15	15	16	16
26	17	15	17				15	18	18	45	22	23	24	26	22	18	22	16	16	16	16	16	16	18
27	16	17		18	15	17	18	18	20	23	36	40	35		33	27	23	16	20	17	16			
28	17	21		17	21	18	17	18	26	32	39	40	36	36	35	30	16	18	17	16	16	18	16	16
29		17	17				16	17	27	21	23	38	39	36	38	26		16	16	17		16	16	16
30	16	16	18	16	22			20	33	37	39	43	40	46	36	35	24	17	17	18	16		16	16
31	17	22	17	17	15	18	17	17	28	35	46	36	35	38	35	30	22	18	15	16	16	18	16	18
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	25	29	25	25	29	26	28	30	31	29	31	31	30	28	31	31	30	31	31	29	30	26	26	27
MED	17	17	17	16	16	17	16	20	18	20	22	22	23	24	21	20	21	16	16	16	16	18	16	17
U Q	18	18	17	17	17	18	17	21	26	27	26	36	26	26	23	30	22	17	17	17	17	18	17	18
L Q	16	16	16	16	15	16	16	17	17	18	20	21	22	22	20	17	16	16	16	16	16	16	16	16

COMMUNICATIONS RESEARCH LABORATORY, JAPAN

HOURLY VALUES OF FOF2 AT KOKUBUNJI

DEC.1988

LAT. 35.7N LON. 139.5E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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			36	38	59	58		84		118	115	115	120		103	102	89		57	58	48			32
2	28		32	32	34	34	36	73	90	108	106	110	114	111	112	98	86			62	61	54		
3	24		31	A	A	A	A	70	99		108	102	100	101	110	92	84	73	55	51	49	38	39	28
4	N	41	49	38				78	96	114	126	128	140	134	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C		106	106	91	95	95	74			55	50			32
6		33	35			32	48	78	76	95	107	122	112	116	106		101	54	57	52	46		32	38
7	36	40		35	32	41		67		100	106	95	95	94	97	98	81		59		44	41	31	36
8	34	32	31	31	31	31		74	99	97			99	106	98	90	90	72	68	52	52	42		
9	32	32	40		35	31	41	77	97	117	127	117	118	117	107	93	78	71			44	38	33	
10		35	31	38	30	31	32	78	103	105	109		127	112	106	93	80	73	54	52	36	41	42	40
11	39	38	50	37	36	45	51	86	115	126	126	123	127	116	106	94	92	71	53		70	50	40	44
12		38	34	40	38	30	32	71	101	121	141	117	97	106	92	92	90	93		53	53	46	36	38
13	38	46	42		37	30	32	80	104	122	132		122	106	107	102	96	78	81	58	43	42	33	33
14		44	40	66	34	23	32	68	117	120	108	116	114	109	110	112	103	82	81	57	58	47	38	A
15				29	31	30	36	70				118	128	115	116		104	92	76	60	57	43	44	
16	35		38	42	37		37	79	101	102	110	132	120	102	102	104	105		52	52	57	58	42	32
17	31		28	28	31	34	48	82		130	120	129	122	118	117	101	108	87	68	66	59	59	56	45
18	44	43			40	34	35	68	112	104		138	123	122	133	124	123	105			54	40	36	37
19			38				49	78	108	127	138	124	135	126			115	104	84	87	50	41	38	40
20	31			33	41	42	34		88	106	121	122	127	122	108	107	91	86	66		44	31	34	
21		31	40	36		32	38	78	97	106	119	131	137	132	114	112	102	82		44		43	36	42
22	37	35	28	32	35	40	43	80	105	114			132	113	113	132	106	78		60	49	47		
23	37	37		35	30	30	36		88	107	142	126	120	121	117	118			60	54	48		38	40
24	43	39	47		40	38	41	78	96	102	118	128	129	116	102	114	99	78	74	71	46	30	41	42
25	35	36	37	42	28			81	115	105	120	110	114		113	114	112	84		67	60	44		
26	55	55	42	32	36	34	39		107		143	122	125		115	121	100	83		73		47	40	36
27	48	49	38	31	36	29		78	135	145	152		147	138	144		148	137	128	121	94		43	36
28	32	36	30	34	31	N	46	60	92	106	118	117	130	114	111	128	115	76	70	54	54	29	36	41
29	34	32	28		25	28		66	81	98	120	118	132	127		112	104	84	70	53	56	53		46
30		42		36	31	32		68	90	86	128		128	116	121	127	110	88	72			41		45
31	38	35	28	28	26	31			84	91	111	140	126	105	99	116	119	83	57	68	44	42	32	32
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	20	22	24	22	25	24	20	26	26	27	26	25	31	28	28	26	29	24	21	24	27	25	22	22
MED	36	38	36	35	34	32	38	78	99	106	120	122	123	116	109	106	101	82	68	58	50	42	38	38
U Q	38	42	40	38	37	36	44	79	107	120	128	128	129	121	114	116	109	87	75	66	57	47	41	42
L Q	32	35	31	32	31	30	34	70	90	102	110	115	114	106	102	95	89	74	57	52	46	40	34	33

HOURLY VALUES OF FES AT KOKUBUNJI

DEC.1988

LAT. 35.7N LON. 139.5E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	30	32	G	G	G	24	G	G		49	55	63	73	93	48	G	G	G	G	26	24	G	G	G
2	G	G	G	G	G	G	G	G	G	G	G	G	57	48	G	36	G	G		G	G	G	G	G
3	G	G	G	79	70	46	33	36	58	G		G	G	43	42	G	36	30	30	30	G	23	G	G
4	G	G	G	G	53	30	38	G		G	G	G	72	50	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C		44	47	46	51	46	44	38	29	33	36	31	31	26
6	G	G	G	G	G	G	31	G	G	G	G	48	47	54	50	60	60	61	44	30	G		G	G
7	G	G	G	G	G	G	G	28	35	41	G	G	G	G		42	33		28	G	G	G	G	G
8	G	G	G	G	G	G	G	G	G	43	G	47	48		G	44	41	30	32	G	25	G	G	G
9	G	G	G		G	G	G	G	G	G	G	G	43	54	44	38	G	26	29	117	G	G	G	G
10	30	G	G	24	G	G	G	49	34	G	G	G	49	49	45	38	G	G	G	G	G	G	G	G
11	24	28	29	G	G	G	G	G	34	G	54	44	G	47	G	G	32	34	G	G	27	G	129	G
12	G	G	G	G	G	G	G	G	34	38	41	43	43	41	39	G	G	28	26	24	11	G	24	G
13	G	G	G	G	23	G	G	G	G	G	G		G	G	G	G	38	41	29	G	G	G	G	G
14	G	G	31	26	28	G	G	G	G	G	42	46	48	44	42		G	G	25	33	28	G	G	34
15	39	31		G	G	G	G	G	G	G	G		G	G	G	G	31	G	G	G	G	G	G	G
16	G		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
17	G	G	G	G	26	G	G	G	G	G		G	G	G	G	G	31	27	54	G	G	G	G	G
18	G	G	G	G	G	25	G	G	G	G	G	G	G			G	32	25	24	34		29	30	23
19		34	33	30	G		G	G	40	43	G	G	57	G	G		G	27	28	24	G	G	G	G
20	G	G		G	G	G	G	49	G	G	G	G	G	G	G	G	G	G	G	G	G	34	34	48
21	36	24	48	G	G	G	G	G	52	G	G	G	G		G	G	32	34	G	34	37	G	G	G
22	G	G	G	G	G	G	G	G	35		G		55	43	G	G	33	58	48	40	30	G	G	G
23	G	G	G	G	G	G	G	G	G	G	45	G	G	G	G	G		26	28	30	31	29	24	G
24	G	G	G	G	G	G	G	G	37	G	G	G	G	41	G	G		G	G	G	G	G	G	G
25	G	G	G	G	G	G	G	G	35	G	G			G	G	41	30	G	32	46	38	48	60	30
26	31	35	29	G	G	G	G	30	G			G	43	G	G	G	G	29	24			G		
27	G	G	G	G	G	G	G	32	61	40	G		G	G	G	G	35	40	35		30		24	G
28	30	G	G	G	G	G	G		G	G	G	G	G	G	56	58	G	48	40	G	G	28	33	
29	G	G	G		G	G	G		40	62	45	44	G	G	G	G	G	37	30	G				
30	41	48		33	G	G	G		G	G	G		G	G	G	G	G	G		G				
31		G	G	G	G		G			G	G		G	G	G	G								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	28	29	27	28	30	28	30	26	27	28	27	24	30	28	28	28	27	28	27	27	25	25	26	25
MED	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	30	27	28	G	G	G	G	G
U Q	27	12	G	G	G	G	G	G	35	19	G	44	48	46	42	38	33	35	32	33	29	25	24	G
L Q	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G

COMMUNICATIONS RESEARCH LABORATORY, JAPAN

HOURLY VALUES OF FMIN AT KOKUBUNJI

DEC.1988

LAT. 35.7N LON. 139.5E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	15	14		15	15	14	14	18		16	16	20	20	39	27	16	22	14	15	15	15	15	15	14
2	15	15	15	15	17	14	16	17	15	17	14	43	18	18	18	18	23	15		14	15	15	15	24
3	15	18	14	14	16	15	15	15	15	16	38	22	21	21	18	16	15	15	14	15	14	16	15	15
4	15	15	16	15	14	15	14	16	16	16	17	14	17	16	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C		21	17	14	16	15	15	14	18	14	15	15	15	14
6	15	14	15	15	14	15	15	15	15	17	16	18	20	18	17	16	15	16	15	15	15		17	16
7	15	15	20	14	15	15	15	15	15	17	21	23	22	18	14	17	15		15	15	15	15	18	15
8	15	15	15	14	14	14	14	16	17	17	20	23	14	15	34	17	16	15	14	15	14	14	15	21
9	15	15	14		15	14	15	16	17	20	23	26	18	20	17	17	15	14	14	14	14	15	15	16
10	15	15	14	15	15	15	15	15	15	18	22	18	17	36	24	16	16	15	16	15	14	16		15
11	15	14	14	14	14	15	14	18	16	18	20	20	26	24	20	17	15	15	18	14	14	14	15	15
12	16	15	14	16	15	16	15	18	16	17	20	22	21	23	20	15	22	15	17	15	14	15	15	15
13	15	14	14	16	14	16	15	16	16	17	18		26	27	32	39	14	15	15	14	15	15	16	15
14	15	16	18	18	14		16	17	16	20	21	26	23	23	21	17	15	15	15	15	14	16	15	15
15	15	16		17	21	15	15	15	17	14	14	27	28	27	35	24	17	18	14	15	14	15	16	15
16	15		15	14	14	14	15	15	21	35	35	39	38	38	34	30	23	15	16	17	15	15	14	15
17	14			15	15	15	15	21	17	14	41	22	36	27	36	20	16	15	14	15	15	16	15	15
18	15	15	14	14	20	16	17	15	16	17	20	20	24	28	21	17	16	14	15	14	21	14	16	15
19		14	14	14	14		15	18	17	18	27	21	24	26	14		23	15	14	15	15	14	14	15
20	17	14		15	14	15	14	14	16	22	26	39	28	35	33	18	16	15	14	14	15	15	15	14
21	15	14	15	14	15	14	14	15	17	21	38	39	26	23	20	22	17	15	14	16	15	15	14	15
22	15	16	14	14	14	15	15	18	17	20	23		15	24	20	16	16	15	14	15	15	14	15	24
23	16	14	14	14	14	15	14	17	32	36	23	20	39	21	18	18		15	15	15	15	14	16	15
24	17	14	14	15	14	14	15	15	15	18	21	21	23	15	21	17	18	15	15	15	15	16	15	16
25	15	15	14	14	14	15	18	15	14	17	18	21	23	20	18	16	15	14	14	14	15	15	15	15
26	15	14	15		15	15	15	15	21		21	22	22	18	17	17	23	14	15	16		14	18	15
27	15	15	16	15	14	15	14	16	16	18	27		29	26	32	38	17	14	15	15	16		16	15
28	15	14	15	15	16	14	14	18	27	21	35	34	22	14	24	17	17	15	15		15	15	14	15
29	14	16	15			17	15	17	17	20	28	28	33	34	34	33	18	16	15	26	16	14		16
30	15	14		15	17	14	14	34	30	38	34		36	36	33	29	17	14	14	16		16		15
31	14	14	14	15	20	15	15		15	33	30	37	39	35	32	32	33	18	15	15	15	15	15	14
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	29	28	25	27	29	28	30	29	29	29	30	27	31	31	30	29	29	29	29	29	28	28	27	30
MED	15	15	14	15	15	15	15	16	16	18	22	22	23	23	21	17	16	15	15	15	15	15	15	15
U Q	15	15	15	15	15	15	15	18	17	20	28	28	28	28	32	23	20	15	15	15	15	15	16	15
L Q	15	14	14	14	14	14	14	15	15	17	20	20	20	18	18	16	15	14	14	14	14	14	15	15

HOURLY VALUES OF FOF2 AT YAMAGAWA

DEC.1988

LAT. 31.2N LON. 130.6E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	116	110	66	66	68	66	66	87	118	127	124	133	121	128	120	110	114	92	86	83	82	64	52	41
2	34	32	32	26	30	31		55	90	100	104	112	118	118	122	136	131	122	121	111	111	110	110	56
3	37	39	54	59		A	A	47	94	127	124	104	110	108	105	108	98	100	74	66	59	53	47	31
4	N	26	N	N	25			65	99	135	148	158	139	158	162	170	161	144	133	132	121	63	79	43
5	43	42	31	29	30	29	28	63	88	112	121	109	103	103	108	120	104	87	A	84	86	59	42	39
6	32	32	37	30	33	25	32	54	88	104	109	109	125	121	119	122	126	101	86	81	64	62	35	59
7	53	29	30	40	35	26	A	54	88	104	102	103	111	107	92	111	105	91	73	63	66	61	42	31
8	32	38	N	32	31		N	50	90	111	109	114	118	120	112	121	102	96	77	75	73		52	38
9	35	32	45	34	29	28	26	51	98	128	138	131	144	147	152	135	121	96	75	80	64	59	53	56
10	53	48	32	30	32	26	26	50	88	120	127	112	126	130	130	111	103	86	81	74	58	54	44	52
11	46	52	54	44	44	32	31	59	116	150	140	142	146	142	134	126	108	101	90	84	75	70	52	42
12	N	38	38	39	48	N		52	107	122	141	114	122	122	113	108	104	106	83	76	71	70	53	42
13	41	34	43	37	37	34		48	100	130	140	121	132	126	124	125	124	112	87	85	70	60	34	42
14	38	30	32	54	44	29	A	50	112			102	132	128	129	128	130	117	94	88	88	86	65	42
15	33	34	30	30	29	26	N	54	113	127	101	108	137	126	127	118	122	106	86	84	77	53	34	34
16	32	34	28	29	40	32	25			119	121	122	135	133	136	136	137	137	133	108	103	90	57	43
17	36	28	25	28	35	31	43	63	98	129	135	129	141	131	127	118	120	115	97	88	86	81	54	28
18	38	42	48	45	37	30	N	53	116	86	101	145	128	124	131	138	128	123	103	83	73	58	50	
19	A	32	30	35	35	28	35	64	90	122	131	116	132	138	125	129	130	124	106	104	65	62	51	40
20	34	33	34	36	37	30	31	53	101	124	124	104	131	126	124	114	108	105	88	57	55	53	42	32
21	31	28	38	40	41		29	54	100	113	128	130	142	136	134	136	138	110	81	71	64	66	42	34
22	32	34	25	35	36	36	A	29	107	120	115	122	135	126	112	126	126	106	86	80	80	65	53	34
23	42	38	45	41	45	28	34	52	88	108	121	118	126	127	123	124	121	105	77	58	53	65	56	34
24	40	36	N	40	37	31	26	53	104	121	114	106	140	140	131	131	129	106	84	83	68	55	34	30
25	26	31	29	N	34		N	52	106	128	104	117	131	126	138	142	141	125		90	104	88	83	74
26	81	88	64	38	29	66	52	77	104	141	132	134	124	119	114	120	116	104	84	78	78	44	34	31
27	42	31	34	40	31	34	34	54	115	153	156	150	158	162	162	166	175	170	170	164	144	88	42	42
28	46	43	36	31	26	30	31	46	89	98	106	116	134	134	118	130	125	109	80	78	82	63	43	43
29	50	37	31	31	A	26	30	53	71	93	121	137	151	141	150	134	147	143	122	80	90	79	47	31
30	29	38	34	36	35	35	32	54	89	111	90	124	142	136	143	150	153	145	127	107	108	83	72	63
31	66	47	34	34	26	26	N	42	88	100	104	124	136	95	128	120	145	144	111	91	78	88	68	23
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	28	31	28	29	29	25	18	30	30	30	30	31	31	31	31	31	31	31	29	31	31	30	31	30
MED	38	34	34	36	35	30	31	53	98	120	121	118	132	127	127	126	125	106	86	83	77	64	51	40
U Q	46	42	44	40	38	33	34	55	107	128	132	131	140	136	134	136	137	124	108	90	88	81	56	43
L Q	32	32	30	30	30	27	28	50	89	108	106	109	124	121	118	118	108	101	81	76	65	59	42	32

COMMUNICATIONS RESEARCH LABORATORY, JAPAN

HOURLY VALUES OF FES AT YAMAGAWA

DEC.1988

LAT. 31.2N LON. 130.6E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	24	30	28	G	26	32	32	G	G	38	46	84	76	62	68	60	G	G	G	G	G	G	G	G
2	G	29	G	G	G	G	G	G	G	G	44	44	45	44	45	40	35	G	26	G	G	G	11	G
3	24	G	G	G		28	39	32	G	59	G	G	53	50	57	58	44	71	36	G	G	G	G	G
4	G	G	G	G	G	27	24	38	38	47	61	G	G	42	45	42	41	32	26	29	39	28	29	24
5	28	G	G	G	G	G	24	G	G	39	46	50	50	47	59	44	40	48	66	66	38	30	G	G
6	G	G	G	G	G	G	24	G	G	38	G	42	45	51	74	42	38	G	G	24	G	G	G	G
7	G	G	G	G	G	26	32	G	G	G	G	42	44	G	G	61	39	G	G	G	G	G	G	G
8	G	G	G	G	G	G	G	G	32	38	G	G	48	G	44	G	42	31	G	30	G		G	G
9	G	G	G	G	G	G	G	G	G	38	44	50	44	44	42	G	G	G	32	24	G	G	G	G
10	G	G	G	G	G	G	G	25	G	42	43	42	G	43	51	42	G	G	G	G	G	G	G	G
11	G	G	G	G	G	G	G	G	G	G	G	G	48	G	G	G	G	G	26	30	G	G	G	G
12	G	G	G	G	G	G		G	G	38	G	43	44	45	42	G	G	G	G	28	G	G	G	G
13	G	G	G	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
14	G	G	G	G	G	G	29	G	32			45	45	44	42	40	G	G	24	25	G	G	G	G
15	G	G	G	G	G	G	G	G	32	43	G	G	G	43	G	G	G	G	G	G	G	G	G	G
16	G	G	G	G	G	G	G			G	G	G	G	G	41	G	G	G	G	G	G	G	G	G
17	24	G	G	G	G	G	G	G	32	G	52	42	G	G	G	G	G	G	32	G	G	G	G	G
18	G	G	25	G	G	G	G	G	G	G	41	G	56	G	G	G	42	30	G	G	G	G	G	41
19	33	28	26	G	G	G	G	G	G	37	G	46	49	46	52	G	G	29	32	30	26	24	G	G
20	G	G	G	G	G	G	G	24	31	40	42	G	G	G	G	40	37	G	G	G	G	G	G	G
21	28	G	G	31	31		G	G	G	G	G	G	G	G	G	40	G	G	24	24	G	G	G	G
22	G	G	G	G	26	34	36	33	G	41	43	46	G	44	42	39	G	G	G	G	24	27	24	G
23	G	G	G	G	G	28	G	23	33	G	G	54	G	G	43	40	G	30	24	25	23	24	G	G
24	G	G	G	G	G	G	G	G	32	41	57	49	46	46	41	G	G	G	G	G	G	G	G	G
25	G	G	G	G	G		G	G	G	G	40	G	G	44	42	40	G	G		34	28	23	G	24
26	26	24	35	26	28	29	G	G	G	37	42	87	56	51	G	G	G	34	30	26	G	G	G	24
27	G	G	G	G	G	G	G	G	G	38	G	G	G	G	51	G	G	43	36	30	38	24	G	26
28	G	G	G	G	G	G	G	G	33	G	G	G	G	G	59	51	70	59	39	31	36	24	G	G
29	G	G	G	30	30	G	G	G	G	G	G	G	G	G	G	G	G	G	G	36	34	G	G	G
30	33	29	26	G	26	24	G	24	G	G	G	G	G	G	G	G	G	G	24	G	G	G	G	G
31	G	31	G	G	G	G	G	G	G	G	44	43	47	G	G	40	G	28	24	G	G	G	G	G
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	31	31	31	31	30	29	29	30	30	30	30	31	31	31	31	31	31	31	30	31	31	30	31	31
MED	G	G	G	G	G	G	G	G	G	37	G	42	44	42	42	39	G	G	24	24	G	G	G	G
U Q	24	G	G	G	G	25	24	G	32	39	44	46	48	45	51	42	38	30	30	30	24	23	G	G
L Q	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G

COMMUNICATIONS RESEARCH LABORATORY, JAPAN

HOURLY VALUES OF FMIN AT YAMAGAWA

DEC.1988

LAT. 31.2N LON. 130.6E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	15	15	15	15	15	15	15	16	16	16	17	18	21	18	18	16	15	20	15	15	15	15	15	15
2	15	15	15	15	15	15	15	18	16	16	20	20	18	16	21	17	16	21	16	15	15	15	15	15
3	15	15	15	15		16	15	15	15	16	16	20	18	17	18	17	15	15	15	15	15	15	16	15
4	16	16	16	15	15	16	15	15	15	16	17	17	17	15	16	16	15	15	15	15	15	15	15	16
5	15	15	15	16	15	15	15	17	15	16	17	18	18	15	18	16	16	15	15	15	15	15	15	15
6	15	15	15	16	15	15	15	17	15	17	17	21	18	21	18	16	16	15	15	15	15	15	15	15
7	15	15	15	15	15	16	15	17	16	17	20	23	21	18	18	18	15	20	15	16	15	15	15	15
8	15	15	15	15	16	15	16	17	16	16	20	21	24	21	21	20	20	16	15	15	15		15	15
9	15	15	15	15	15	15	15	16	16	18	20	21	24	24	22	17	17	20	15	15	15	15	15	15
10	15	15	15	15	15	15	16	16	16	15	20	22	16	22	34	16	16	21	15	15	15	15	15	15
11	15	15	15	15	15	15	15	16	17	17	20	27	22	20	23	20	17	23	15	15	15	15	15	15
12	15	15	15	15	15			16	15	16	23	21	24	22	21	18	16	21	15	15	16	15	15	15
13	15	15	15	15	15	15		15	16	18	21	38	38	24	23	21	20	17	14	15	15	15	15	15
14	16	16	15	15	15	15	15	17	18			22	24	24	23	20	16	21	15	15	15	14	15	15
15	15	15	15	15	15	15	15	16	17	18	21	38	26	29	39	35	18	16	15	15	15	15	15	15
16	15	15	15	15	15	15	15			33	35	39	40	38	39	34	21	23	15	15	15	15	15	15
17	16	15			15	15	15	17	15	18	20	21	39	38	40	23	17	16	15	15	15	15	15	15
18	15	15	15	15	15	15	65	16	15	15	18	23	24	23	22	17	16	15	15	15	15	15	15	15
19	15	15	15	15	15	15	15	16	15	15	29	24	22	22	18	18	17	16	15	15	15	17	15	15
20	15	15	15	15	15	16	15	16	15	17	21	38	24	26	21	21	16	16	15	15	15	15	15	15
21	15	16	15	15	15		15	16	15	16	21	20	22	22	17	21	20	15	15	16	15	15	15	16
22	15	15	15	15	15	15	15	15	15	16	20	24	27	27	22	20	16	23	15	15	15	15	15	15
23	15	15	15	15	15	16	15	16	16	36	22	26	26	39	22	18	16	15	15	15	15	16	15	15
24	15	15	15	15	15	16	15	16	16	16	17	21	26	27	22	18	16	22	15	15	15	15	15	15
25	15	15	15	15	15		15	15	15	15	17	21	22	21	18	17	16	15		15	15	15	15	15
26	15	15	15	15	15	14	15	16	15	16	17	20	22	21	18	16	15	15	15	15	15	15	15	15
27	15	15	15	15	15	15	15	15	16	16	23	22	29	26	21	20	20	16	15	15	15	16	15	15
28	15	15	15	15	17	15	15	15	16	16	36	36	21	20	18	17	15	15	15	15	15	15	15	15
29	15	15	15	15	15		15	15	16	18	27	35	38	38	35	33	38	23	15	15	15	15	15	15
30	15	15	15	15	15	15	15	15	15	16	18	22	38	26	34	22	17	22	15	15	15	15	15	15
31	15	15	15	15	15	15	15	15	16	16	20	21	28	32	29	24	23	15	16	15	15	15	15	17
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	31	31	30	30	30	27	29	30	30	30	30	31	31	31	31	31	31	31	30	31	31	30	31	31
MED	15	15	15	15	15	15	15	16	16	16	20	22	24	22	21	18	16	16	15	15	15	15	15	15
U Q	15	15	15	15	15	15	15	16	16	17	21	26	27	27	23	21	18	21	15	15	15	15	15	15
L Q	15	15	15	15	15	15	15	15	15	16	17	21	21	20	18	17	16	15	15	15	15	15	15	15

COMMUNICATIONS RESEARCH LABORATORY, JAPAN

HOURLY VALUES OF FOF2 AT OKINAWA

DEC.1988

LAT. 26.3N LON. 127.8E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	106	108	86	80	88	62	66	88	111	130	141	142	141	124	102	130	128	140	145	140	170	164	108	88
2	68	66	50	44	44	43	31	54	100	104	120	83	118	134	140	145	146	175	178	187	181	165	145	90
3	79	77	88	86	54	68		43	90	142	138	106	111	130	121	108	121	108	91	88	90	83	78	62
4	34	33	31	32	27	26	43	65	84	128	164	164	158	162	164	170	168	164	145	165	166	144	108	N
5	66	64	54	43	44	43	32	62	90	109	128	101	98	112		128	127	113	88	86	91	90	66	52
6	52	32	46	47	38	31		50	90	111	120	118	119	138	133	146	157	147	130	124		90	90	88
7	87	66	54	46		28	30	52	92	118	117	107	113	116	101	103	136	112	91	78	88	88	85	62
8	52	52	50	54		34	28	40	99	117	137	134	124	145	122	136	120	121	121	87	102	90	86	66
9	60	60	63	43	36		N	37	90	131	145	146	160	171	170	164	159	147	108	107	105	88	88	88
10	85	50	69	51	40			53	91	111	124	118	124	138	146	142	113	112	92	90	77	78	78	66
11	65	62	62	48	49	44	39	54	89	147	162	159	158	164	153	145	145	128	107	117	85	85	84	58
12	48		43	45	51	28	N	42	108	123	136	123	100	126	128	123	117	108	102	82	86	85	80	74
13	64	61	50	38	38			40	86	120	137	124	142	162	158	167	160	160		111	130	108	86	84
14	60	54	64		47		N	54	107	136	147	111	137		147	154	N	165	162	146	167	177	146	88
15	81	63	49	54	50	38		60	118	112	122	94	124	142	130	142	139	129	110	107	103	88	63	54
16	49	47	52	38	44	32		43	102	117	149	132		162	178	168	168	170	176	164	145	144	107	81
17	78	63	70	51	66	63	72	84	104	140	145	131	141	146	145	138	126	136	122	110	131	109	88	47
18	64	62	62	50	39	31		51	121	88	95	134	127	122	144	144	137	131	124	89	85	82	87	34
19	59	60	37	A	31	28	32	52	90	121	139	107	123	145	144	148	159	145	143	130	111	88	85	42
20	42	44	43	36	33	36		53	110	137	128	115	118	145	142	143	135	132	108	77	80	82	76	66
21	53	52	44	42	41	24			90	129	136	119	146	158	168	170	171	164	138	107	N	106	83	53
22	41	35	38	30	39	43	31	50	108	141	118	113	130	139	143	126	136	110	108	109	102	86	70	65
23	43	53	55	47	44	26	30	54	111	119	111	118	119	130	137	138	137	111	106	85	78	88	88	62
24	34	44	53	43	40	29	26	49	88	136	138	120	145	176	179	170	174	172	143	107	108	104	66	N
25	54	54	44	54	44	31	27	54	110	128	137	112	136	144	162	168	172	162	146	145	145	163	171	165
26	165	110	104	66	54	78	53	87	129	141	139	120	108	121	121	111	121	107	91	80	85	66	62	52
27	35	51	61	54	40	44	32	66	121	143	145	153	158	164		154	152	167	161	142	141	124	90	75
28	84	83	82	64	65	N	31	52	50	103	113	107	121	141	146	140	138	138	128	103	102	108	89	66
29	66	60	35	33	34	28	N	54	83	101	143	152	157	156	176	164	165	172	162	126	127	127	105	53
30	52	55	50	44	40	32	35	42	89	142	140	118	144	169	180	178	178	184	179	149		128	103	85
31	66	66	58	51	44	32		50	90	103	122	102	130	145	157			N	182	164	128	138	123	78
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	31	30	31	29	29	26	17	30	31	31	31	31	30	30	29	30	29	30	30	31	28	31	31	29
MED	60	60	53	47	44	32	32	52	92	123	137	118	128	144	145	144	139	139	126	109	104	90	87	66
U Q	78	64	63	54	49	43	41	54	110	137	143	134	144	162	163	164	162	164	146	142	136	128	105	84
L Q	49	51	44	42	38	28	30	49	90	111	122	107	119	130	131	136	127	113	107	88	87	86	78	53

COMMUNICATIONS RESEARCH LABORATORY, JAPAN

HOURLY VALUES OF FES AT OKINAWA

DEC.1988

LAT. 26.3N LON. 127.8E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	45	37	66	40	31	G	25	29	46	57	G	47	54	60	58	50	68	38	59	34	29	G	G	G
2	G	G	G	G	G	G	G	G	33	G	G	G	47	44	G	42	40	30	G	G	G	G	G	G
3	G	G	G	G	G	G		G	33	40	44	45	57	52	46	50	47	32	G	24	G	G	G	G
4	G	G	G	G	G	G	G	G	G	G	G	G	G	G	48	43	36	G	29	G	G	28	G	30
5	32	32	G	G	G	G	G	G	G	G	G	G	G	44	G	G	40	37	G	29	28	G	G	G
6	G	G	G	G	24	G		G	G	G	G	G	44	52	56	52	38	G	25	28	G	G	G	G
7	G	G	G	G	G	G	G	28	G	G	G	47	G	G	48	51	52	49	50	30	G	G	G	G
8	G	G	G	G		G	G	G	G	G	G	G	G	G	G	45	39	36	G	22	G	G	G	G
9	G	G	G	G	G		G	G	33	40	G	G	57	50	53	48	38	57	G	22	G	28	G	G
10	G	G	G	G	G	G	G	G	G	G	41	G	44	45	76	G	G	32	27	23	G	G	G	G
11	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	40	G	34	G	G	G	26	G	G
12	G	G	G	G	G	G	G	G	G	G	G	G	G	G	42	G	G	G	G	G	G	25	G	G
13	G	G	G	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	41	24	23	G
14	25	G	G	G	G	G	G	G	39	G	41	48	58	46	42	41	G	G	G	G	G	G	G	G
15	G	G	G	G	G	G	G	G	G	42	43	G	G	G	G	G	38	G	G	G	G	G	G	G
16	G	G	G	G	G	G		G	G	37	G	G	G	G	G	G	G	33	37	32	24	G	G	G
17	G	G	G	G	34	32	G	G	G	G	48	G	83	G	G	G	38	31	44	G	G	G	G	G
18	26	G	G	G	G	G		G	G	G	G	G	61	G	G	G	37	32	23	G	G	G	G	G
19	G	G	40	36	G	G	G	G	31	38	G	47	45	44	44	67	45	33	37	30	G	G	G	G
20	G	G	G	G	G	G		11	G	40	46	G	51	G	G	G	39	32	26	G	G	G	G	G
21	G	G	G	G	G	G	30	32	38	43	G	G	G	G	G	42	40	G	32	33	39	36	G	24
22	25	G	G	G	G	G	26	23	31	42	44	48	49	G	44	G	G	34	24	G	G	G	31	G
23	G	G	G	32	G	G	G	24	34	43	51	72	48	48	G	41	38	33	32	G	G	G	G	G
24	G	G	G	G	G	G	G	G	32	40	56	69	73	54	66	44	37	32	G	G	G	G	G	G
25	G	G	G	G	G	G	G	G	32	G	42	69	G	G	G	55	66	67	47	25	G	G	G	36
26	29	24	G	G	26	26	G	G	G	44	67	65	84	73	65	67	72	48	44	40	30	26	G	G
27	G	G	G	G	G	G	G	G	G	G	G	43	65	G	G	54	G	34	60	72	42	29	G	34
28	28	30	29	27	G	G	G	G	G	G	40	43	G	67	68	69	73	50	47	38	40	29	G	G
29	28	G	G	29	G	G	25	G	32	G	45	G	G	G	46	41	43	49	G	24	26	24	32	28
30	24	G	G	G	G	G	G	G	33	G	G	G	G	G	G	64	38	32	38	27		25	G	G
31	G	G	G	G	G	G		G	33	40	43	46	44	G	G	68	G	G	G	G	G	G	28	34
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	31	31	31	31	30	30	24	31	31	31	31	31	31	31	31	31	31	31	31	31	30	31	31	31
MED	G	G	G	G	G	G	G	G	G	G	G	G	44	G	G	42	38	32	25	22	G	G	G	G
U Q	25	G	G	G	G	G	G	G	33	40	44	47	57	48	48	52	43	37	38	30	26	25	G	G
L Q	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G

COMMUNICATIONS RESEARCH LABORATORY, JAPAN

HOURLY VALUES OF FMIN AT OKINAWA

DEC.1988

LAT. 26.3N LON. 127.8E SWEEP 1MHz TO 25MHz AUTOMATIC SCALING

D \ H	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	14	15	14	16	15	15	15	15	15	18	22	23	24	23	23	21	16	15	15	15	14	15	15	15
2	15	15	15	15	16	15	15	17	15	22	23	26	23	24	23	18	14	17	14	15	15	15	15	15
3	15	15	15	15	15	15		16	15	21	21	24	23	21	22	17	15	15	15	15	15	15	15	15
4	15	15	15	15	16		15	17	15	20	22	26	20	20	20	24	17	22	15	15	14	15	15	15
5	14	14	14	15	15	15	15	24	15	17	21	26	23	24	26	21	20	16	15	15	15	15	14	15
6	15	15	15	15	15	15		17	15	18	21	17	24	23	26	23	20	15	15	15	15	15	16	18
7	15	15	15	15	15	15	15	15	16	20	21	23	23	24	24	22	15	15	15	15	15	15	15	15
8	15	15	15	15		15	15	18	15	20	21	23	27	26	21	18	16	20	15	15	15	15	15	15
9	15	15	15	15	15		15	15	24	20	22	23	26	28	27	23	20	16	14	14	16	15	15	15
10	15	14	15	15	15	15	15	16	15	24	22	24	24	23	42	23	18	15	14	15	16	16	15	15
11	15	15	15	15	15	15	15	16	26	21	24	28	29	27	28	22	23	23	17	15	14	14	14	14
12	14	14	14	14	14	14	16	14	14	16	18	20	23	22	21	21	14	14	14	14	14	14	14	14
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14	15	15	15	14	14	15	16	15	17	18	22	27	24	26	23	23	17	15	15	15	15	15	14	15
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16	15	15	15	15	15	15		17	15	21	22	29	32	29	27	26	22	20	14	15	15	15	16	15
17	15	15	15	18	14	15	16	16	15	18	20	21	29	30	44	27	15	14	14	15	15	15	15	15
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21	15	15	15	15	14	15	15	15	14	15	20	23	26	24	26	21	15	15	14	15	16	15	15	16
22	15	16	15	17	15	15	15	16	15	17	22	26	22	26	22	20	15	15	14	15	14	15	15	15
23	15	15	15	15	15	16	15	17	17	34	26	23	26	32	27	22	16	15	14	15	15	15	15	15
24	15	15	15	15	15	15	15	15	16	17	18	23	24	26	24	18	17	15	15	15	15	15	15	15
25	15	15	15	15	15	15	15	15	15	17	21	27	26	24	22	21	16	15	14	15	15	15	15	16
26	15	14	15	15	15	15	15	15	15	17	17	21	23	23	22	17	17	14	14	14	15	15	15	15
27	15	15	15	15	15	15	15	15	14	14	22	27	27	24	22	21	21	18	15	14	15	15	15	15
28	15	15	17	16	15	14	15	15	27	20	27	27	26	27	24	23	15	14	14	15	15	15	15	16
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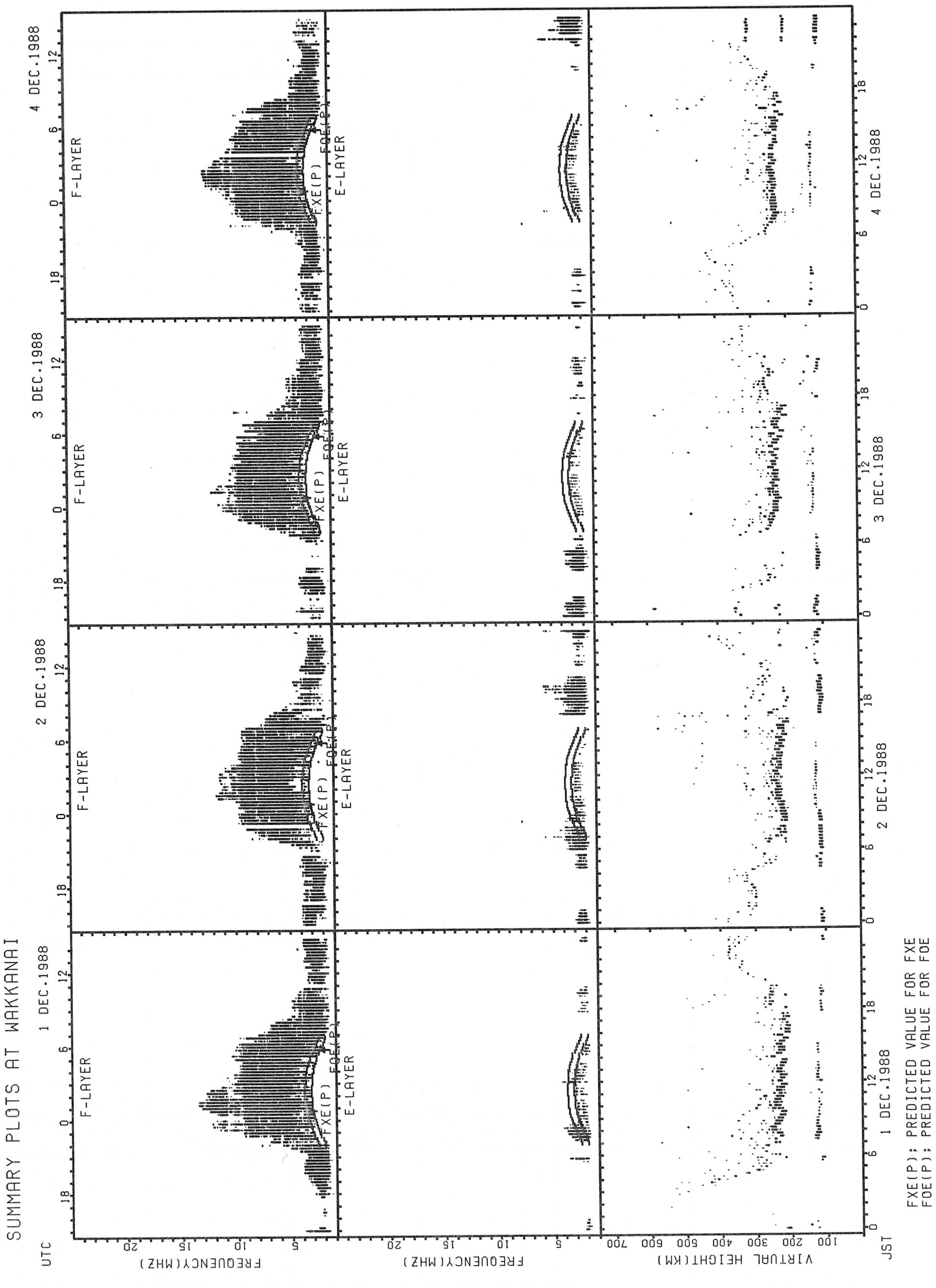
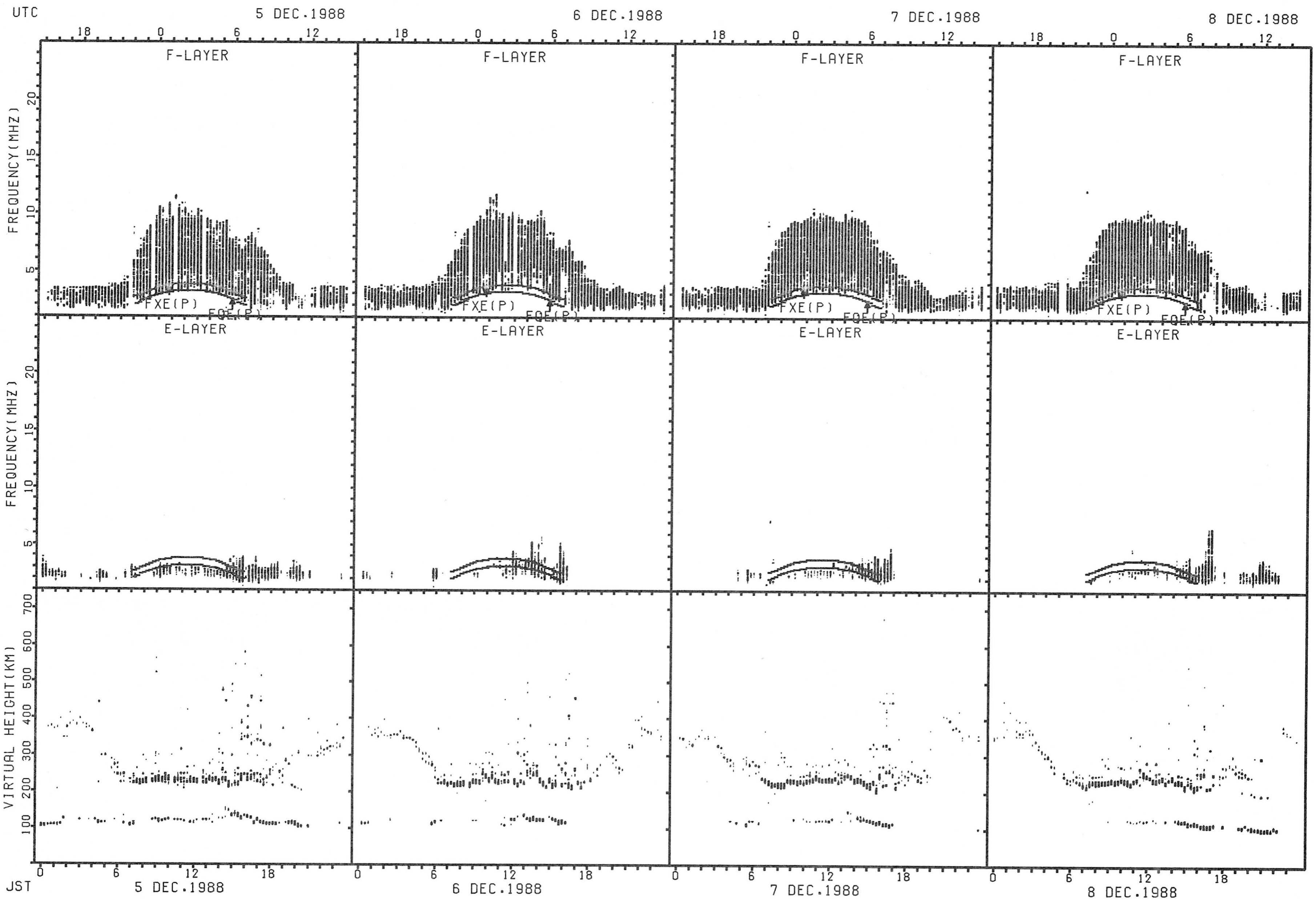
30	15	15	15	15	15	14	15	15	15	15	17	22	27	27	20	17	17	14	15	14		15	15	15
31	15	15	15	15	15	15		15	17	22	18	23	26	27	27	21	20	26	15	15	15	16	15	15
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	31	31	31	31	30	29	24	31	31	31	31	31	31	31	31	31	31	31	31	31	30	31	31	31
MED	15	15	15	15	15	15	15	15	15	18	21	23	24	26	24	21	17	15	15	15	15	15	15	15
U Q	15	15	15	15	15	15	15	17	17	21	22	27	27	27	27	23	20	16	15	15	15	15	15	15
L Q	15	15	15	15	15	15	15	15	15	17	20	23	23	23	22	18	15	15	14	15	15	15	15	15

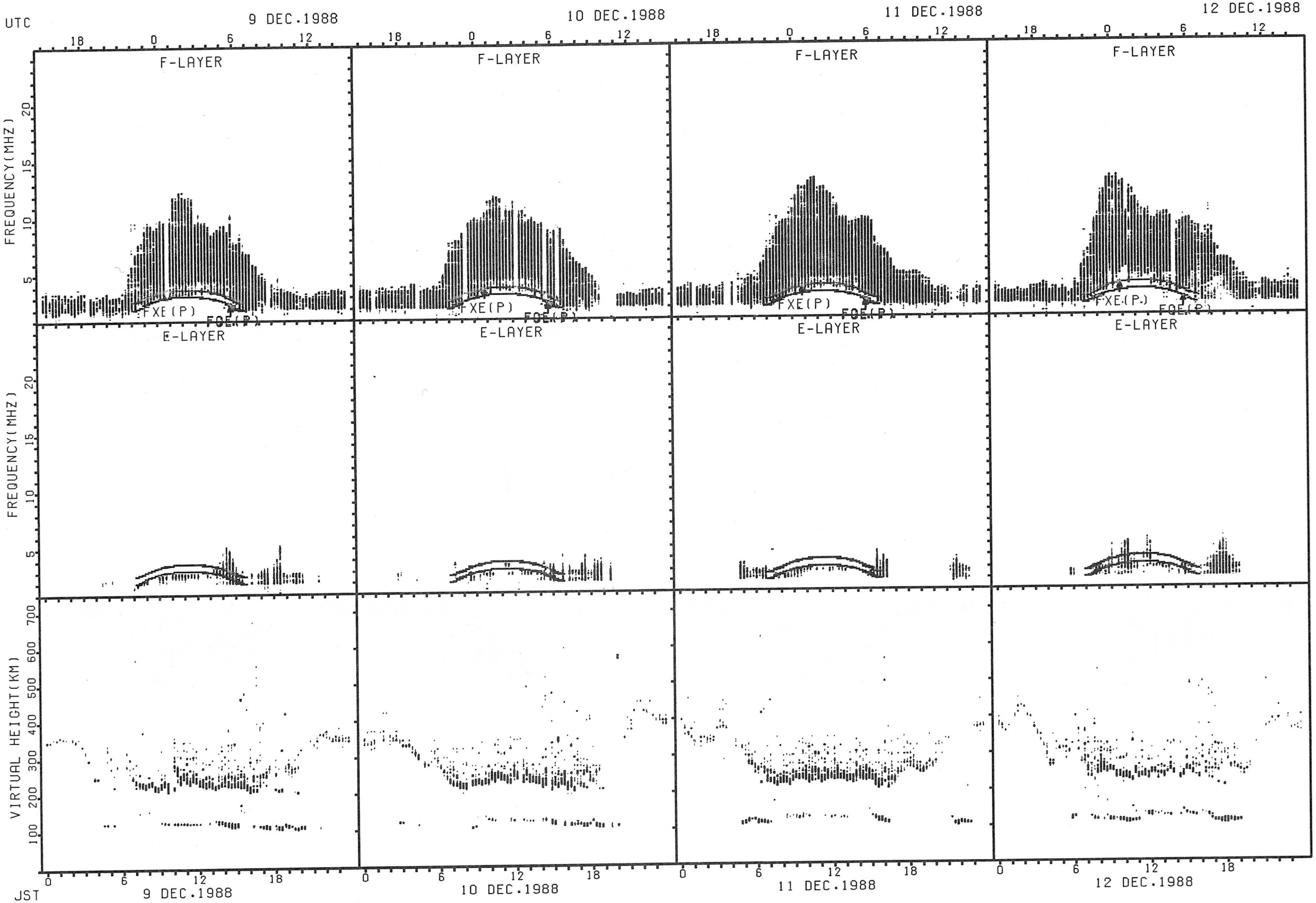

SUMMARY PLOTS AT WAKKANAI
UTC
1 DEC.1988
2 DEC.1988
3 DEC.1988
4 DEC.1988
F-LAYER
E-LAYER
FXE(P)
FOE(P)
FREQUENCY(MHZ)
VIRTUAL HEIGHT(KM)
JST
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT WAKKANAI



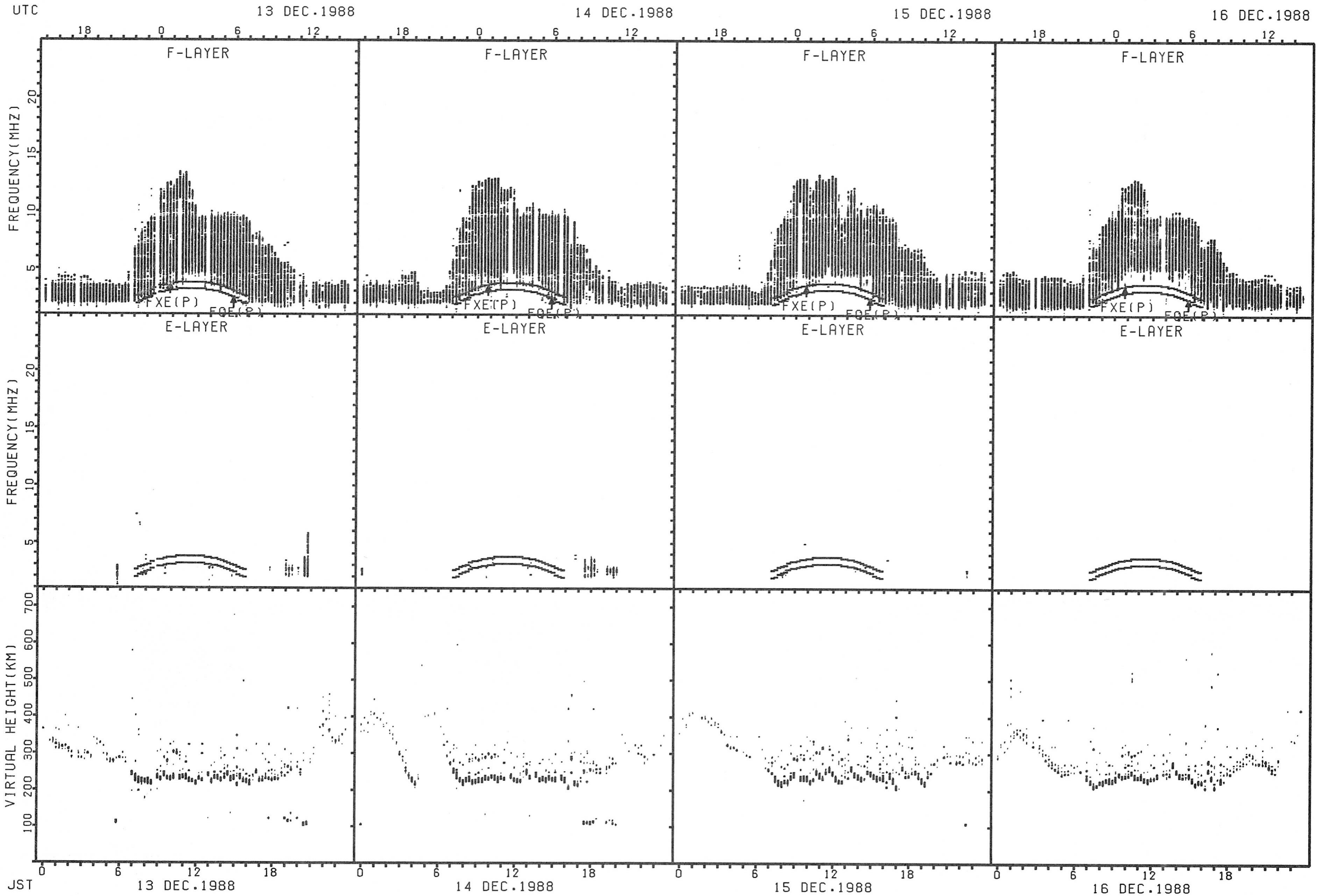
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT WAKKANAI



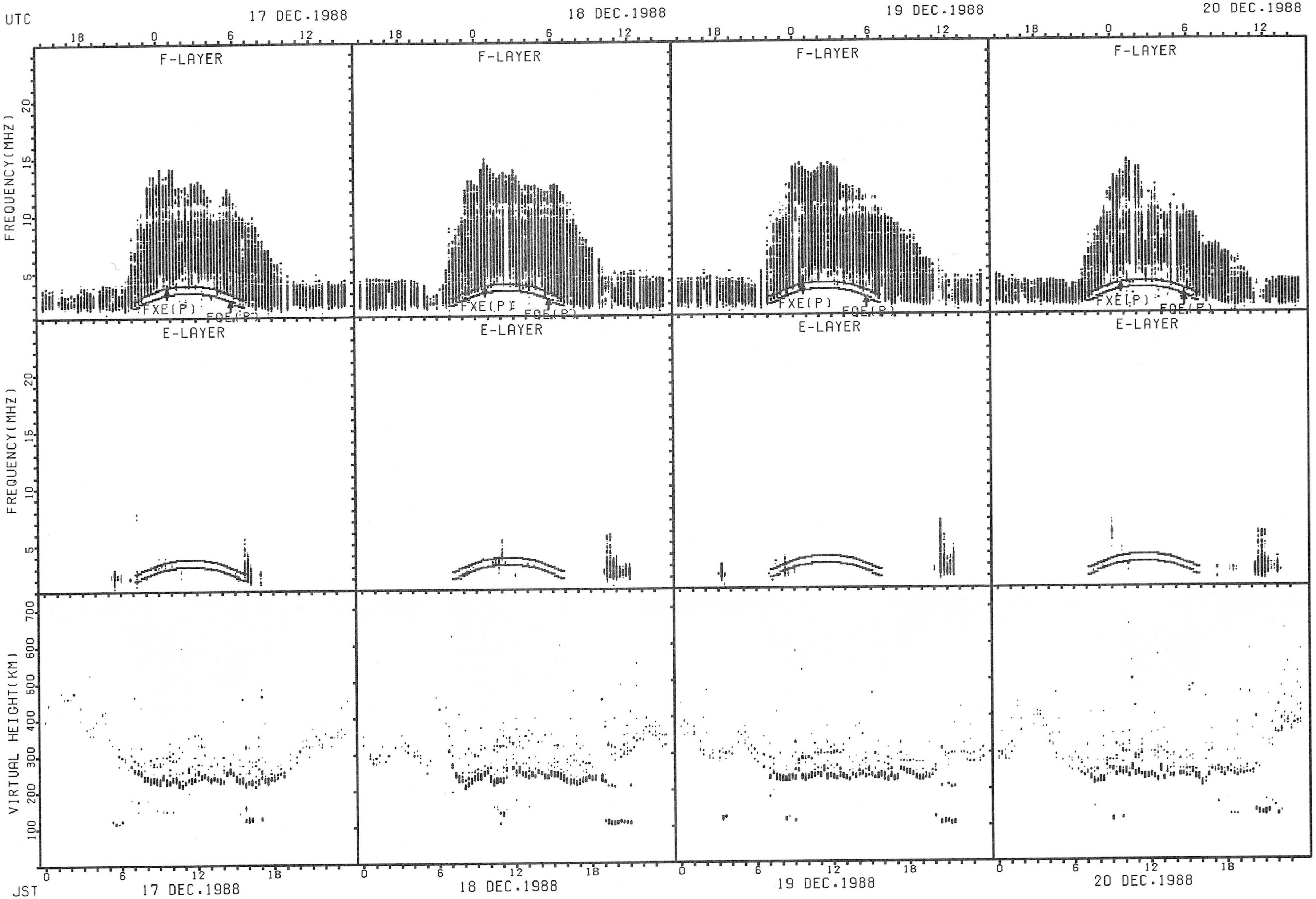
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT WAKKANAI



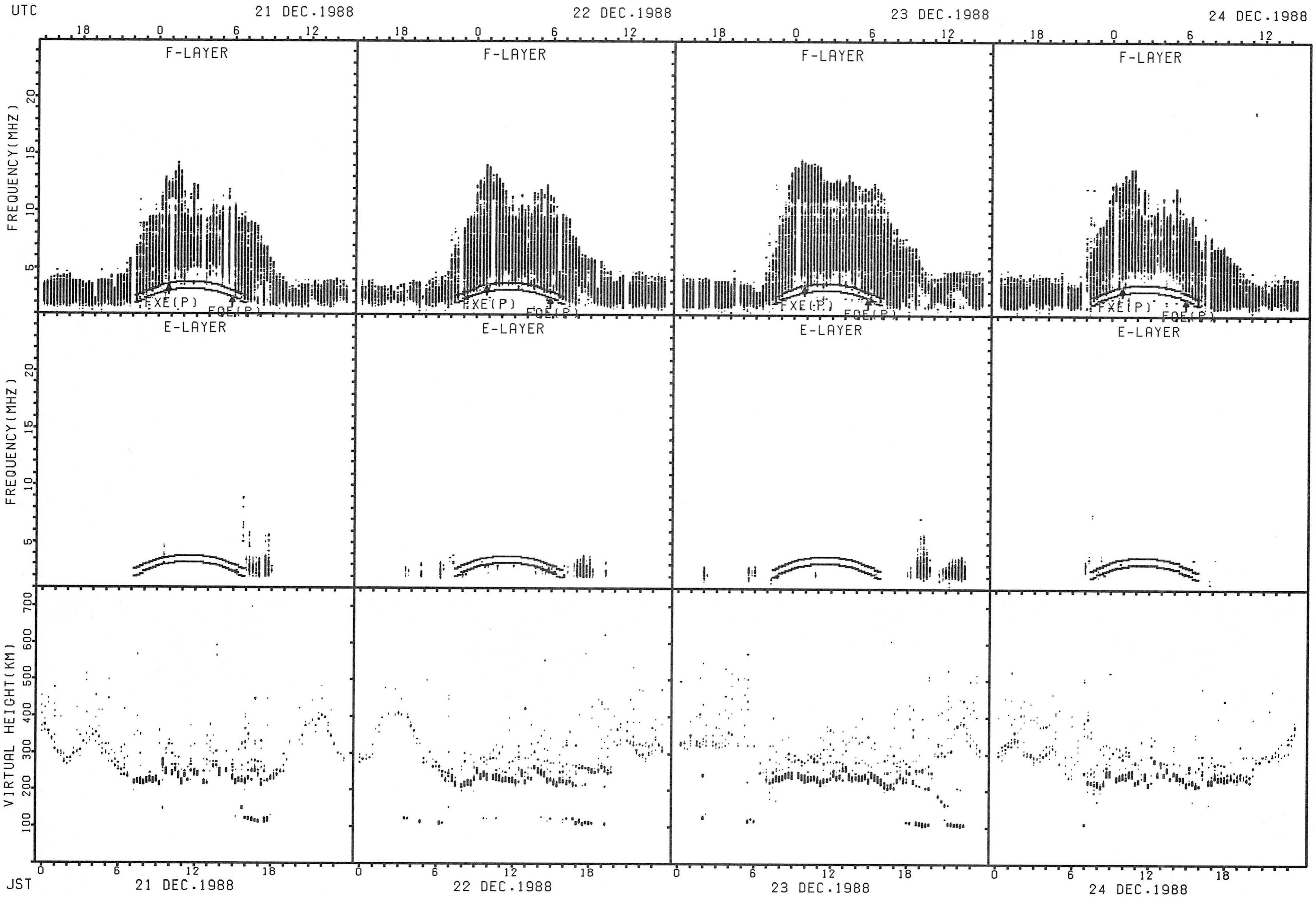
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT WAKKANAI

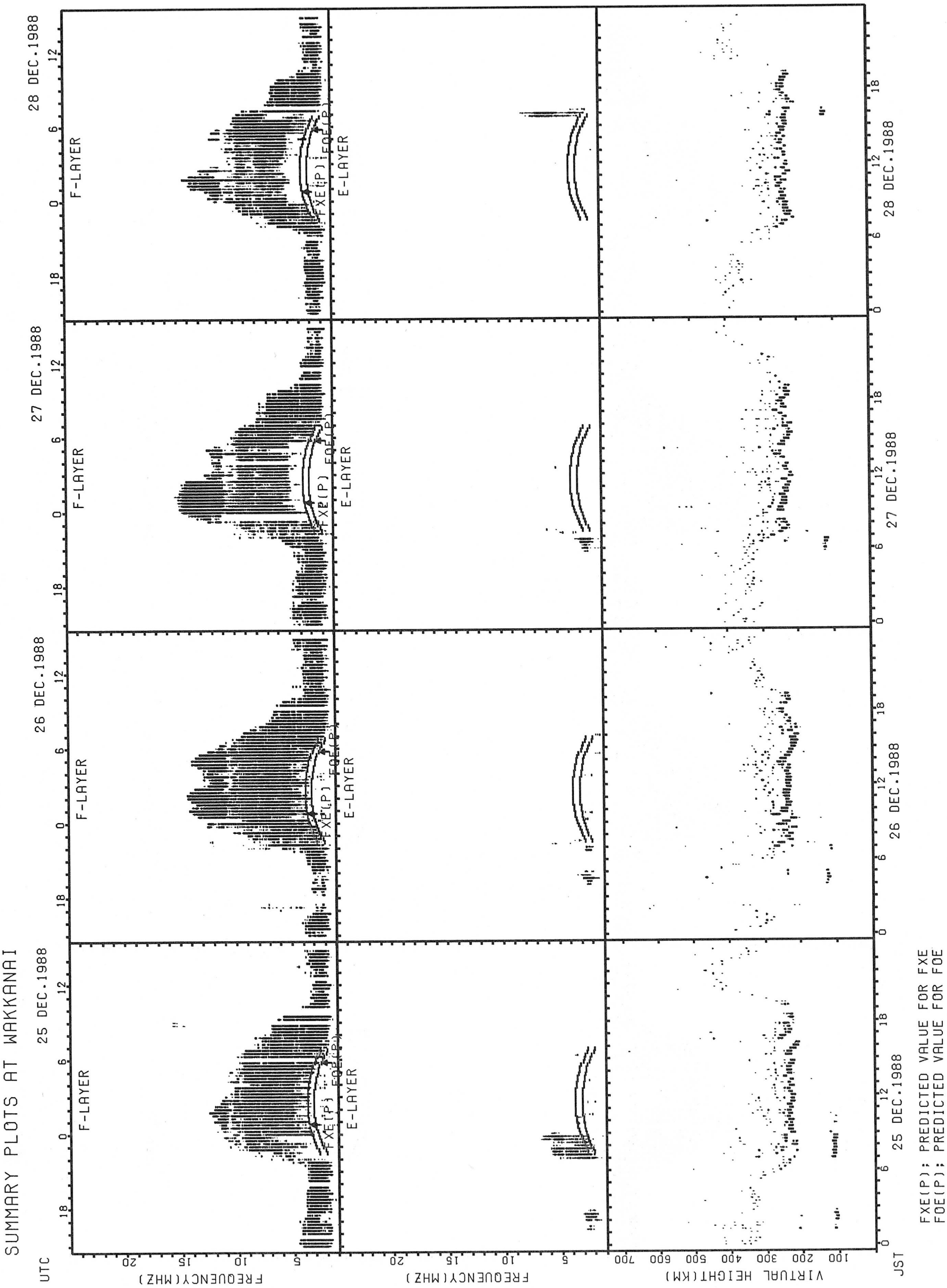


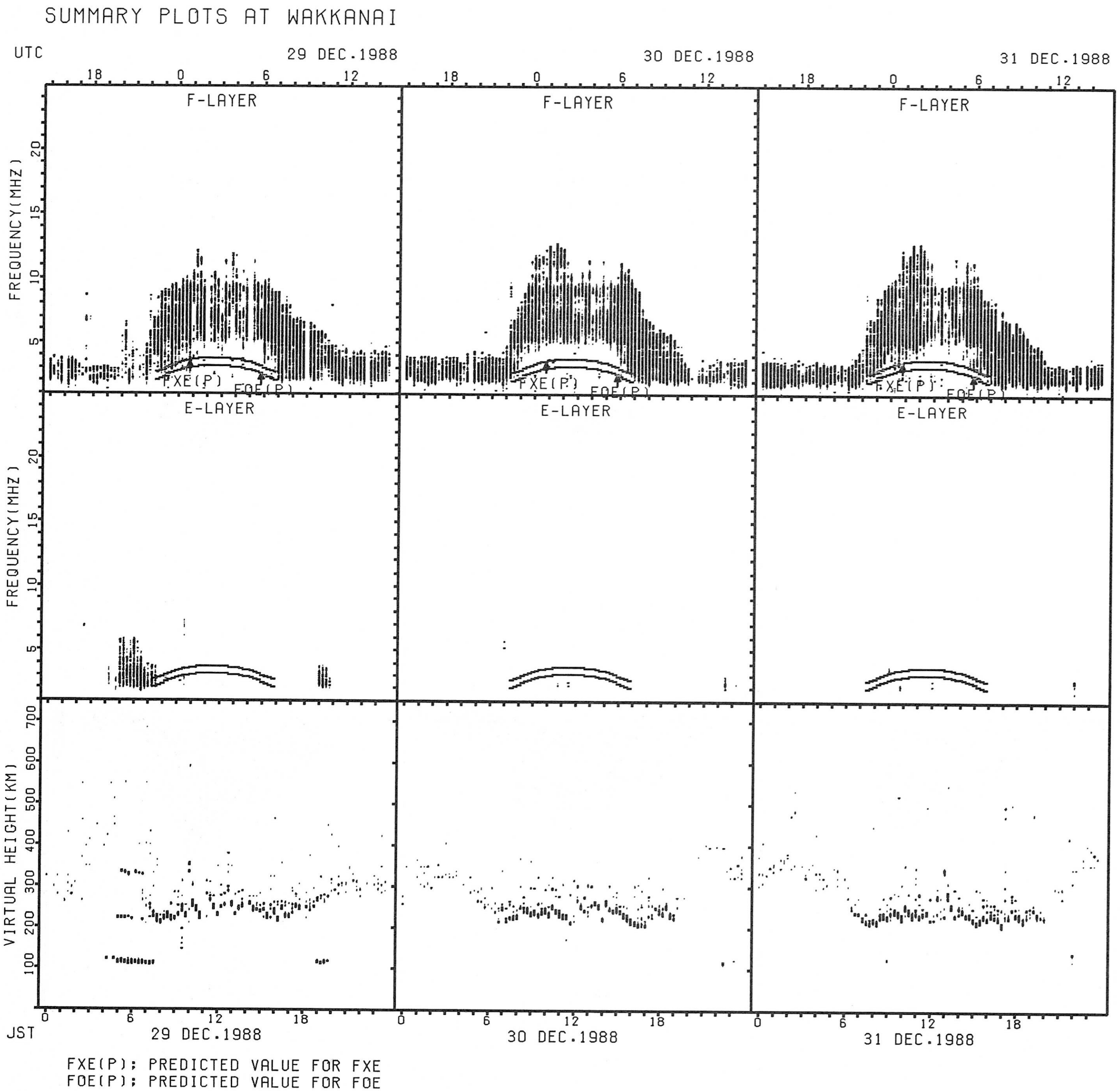
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT WAKKANAI

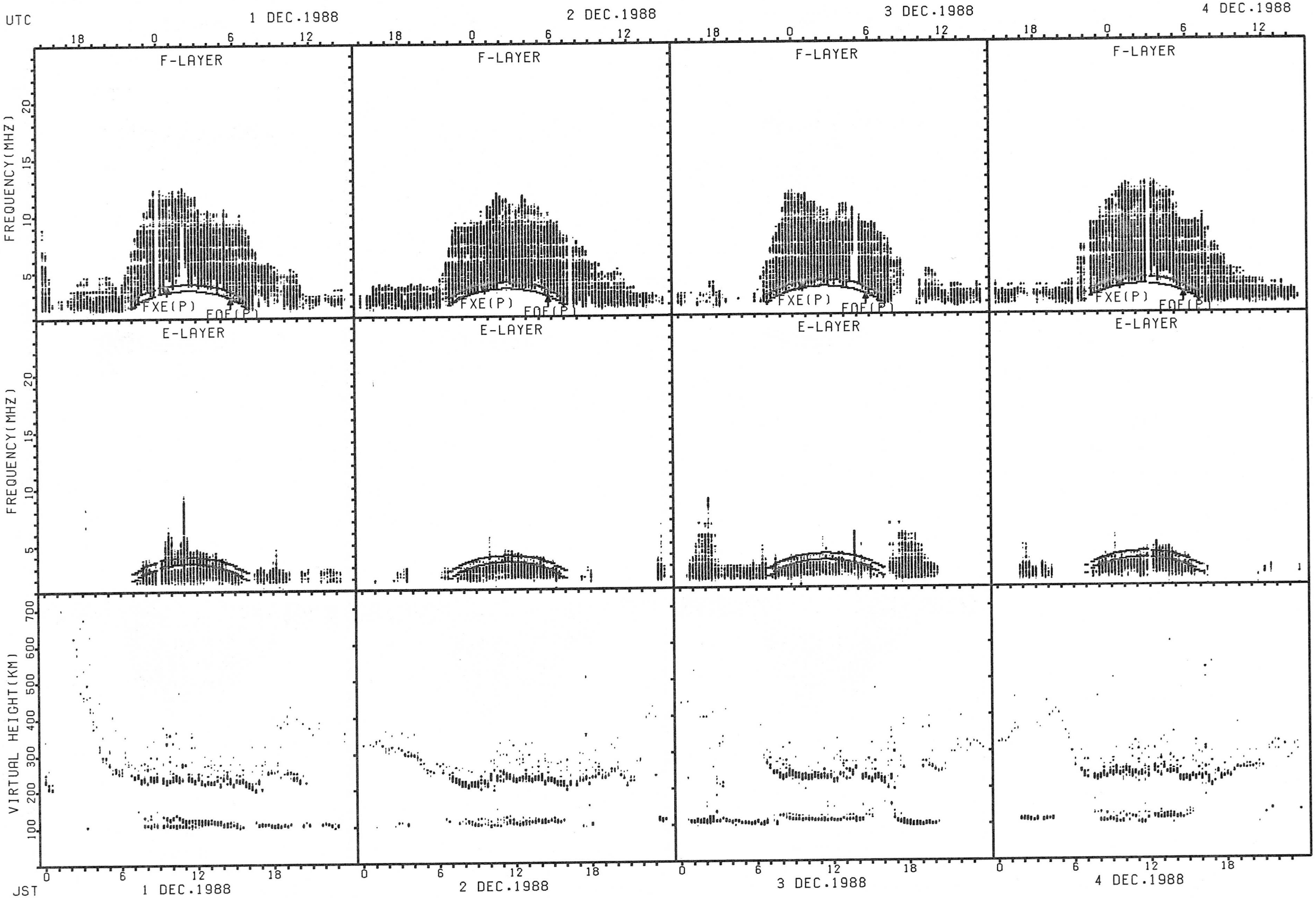


FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE


SUMMARY PLOTS AT WAKKANAI
UTC
25 DEC.1988
26 DEC.1988
27 DEC.1988
28 DEC.1988
F-LAYER
E-LAYER
FXE(P)
FOE(P)
FREQUENCY(MHZ)
VIRTUAL HEIGHT(KM)
JST
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

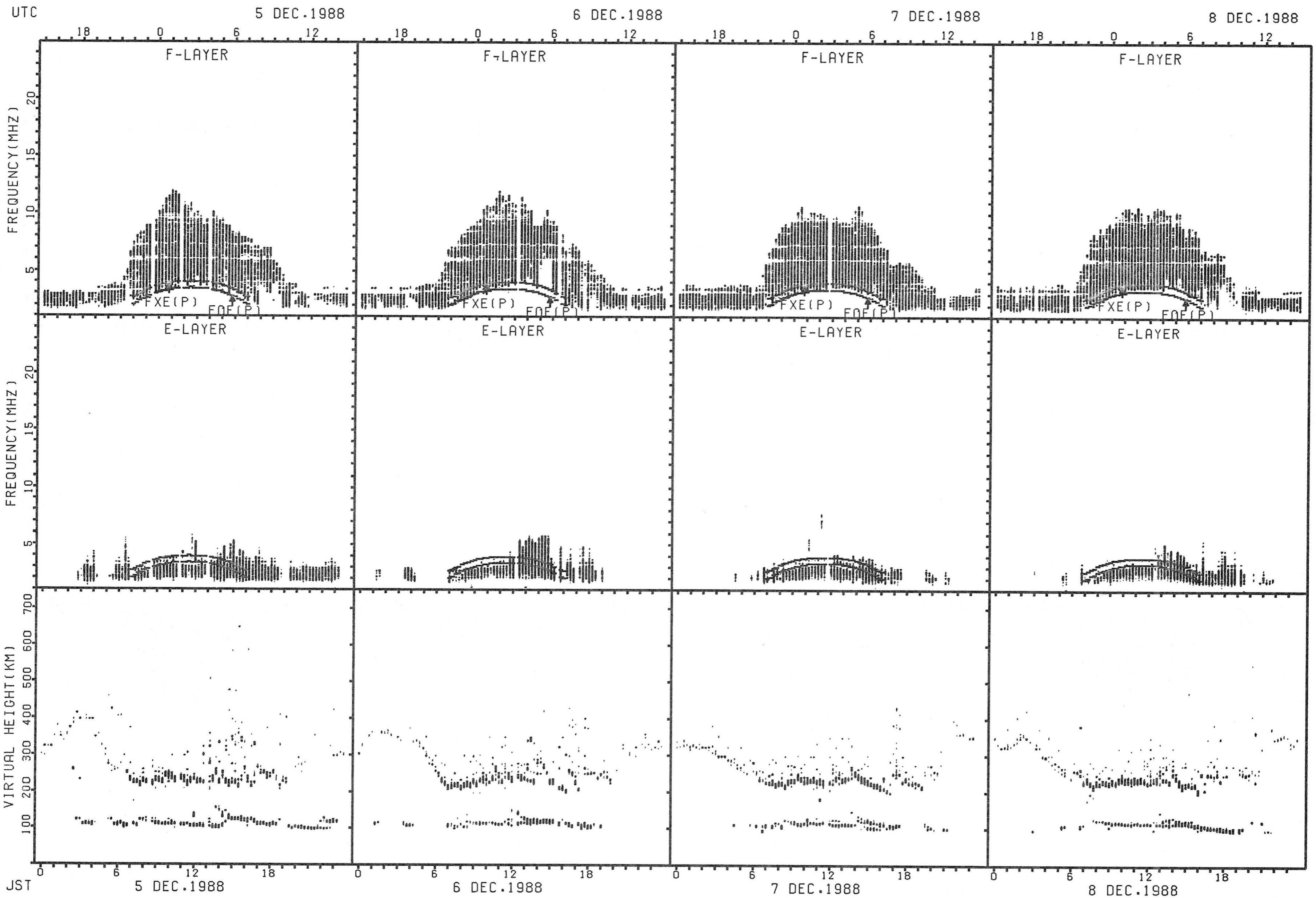

SUMMARY PLOTS AT WAKKANAI
UTC
29 DEC.1988
30 DEC.1988
31 DEC.1988
F-LAYER
E-LAYER
FXE(P)
FOE(P)
FREQUENCY(MHZ)
VIRTUAL HEIGHT(KM)
JST
29 DEC.1988
30 DEC.1988
31 DEC.1988
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT AKITA



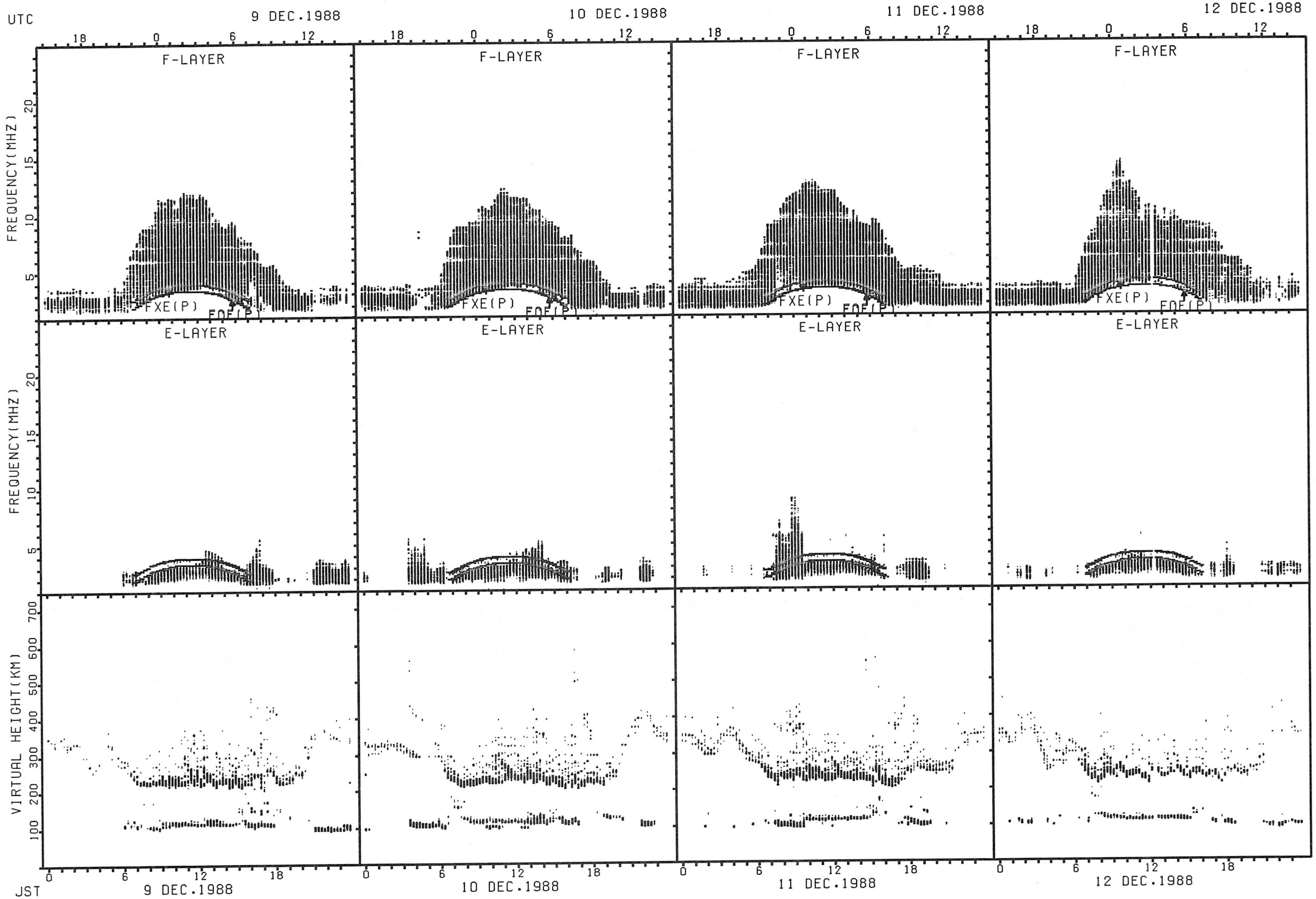
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT AKITA



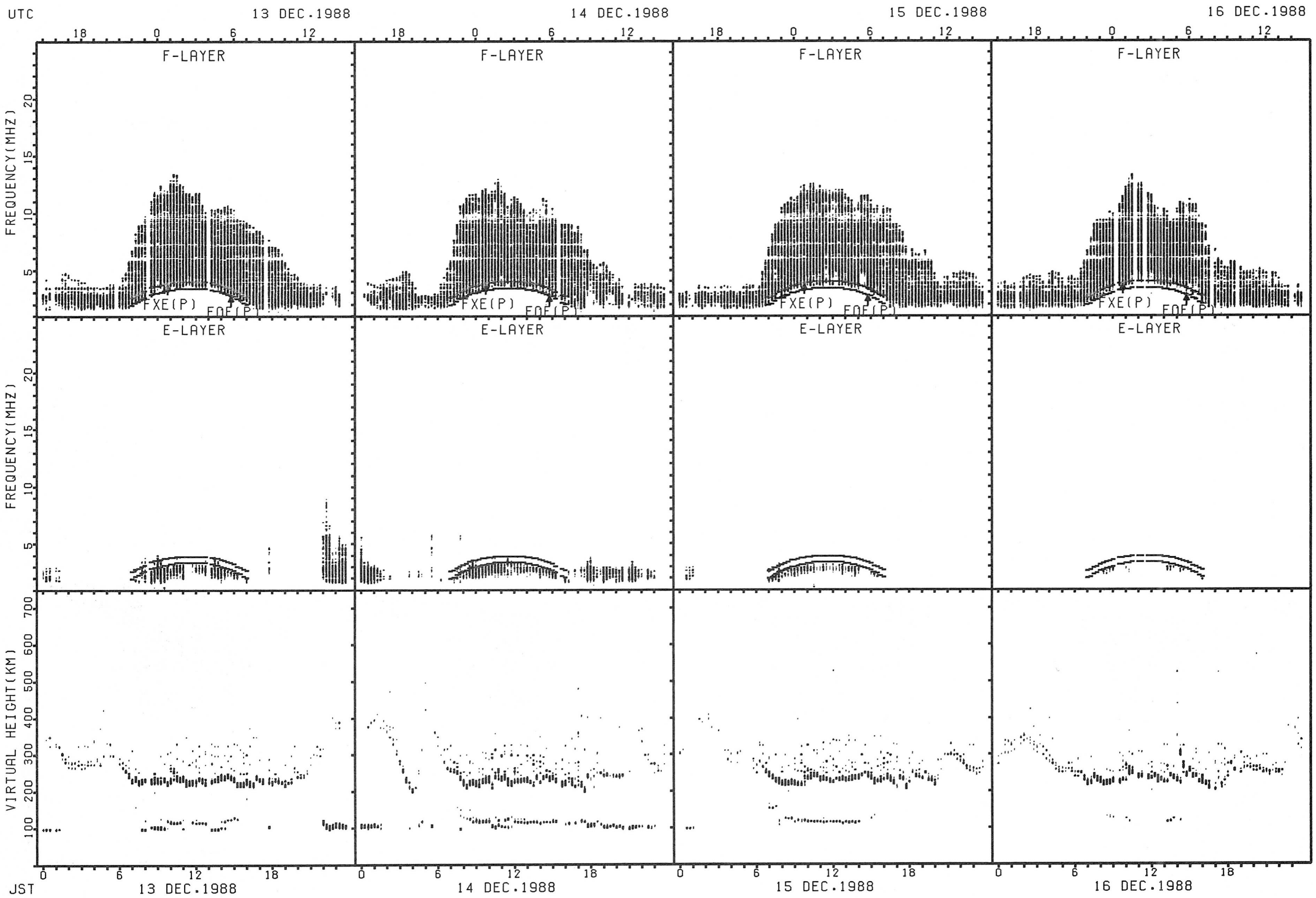
FXE(P): PREDICTED VALUE FOR FXE
FOE(P): PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT AKITA



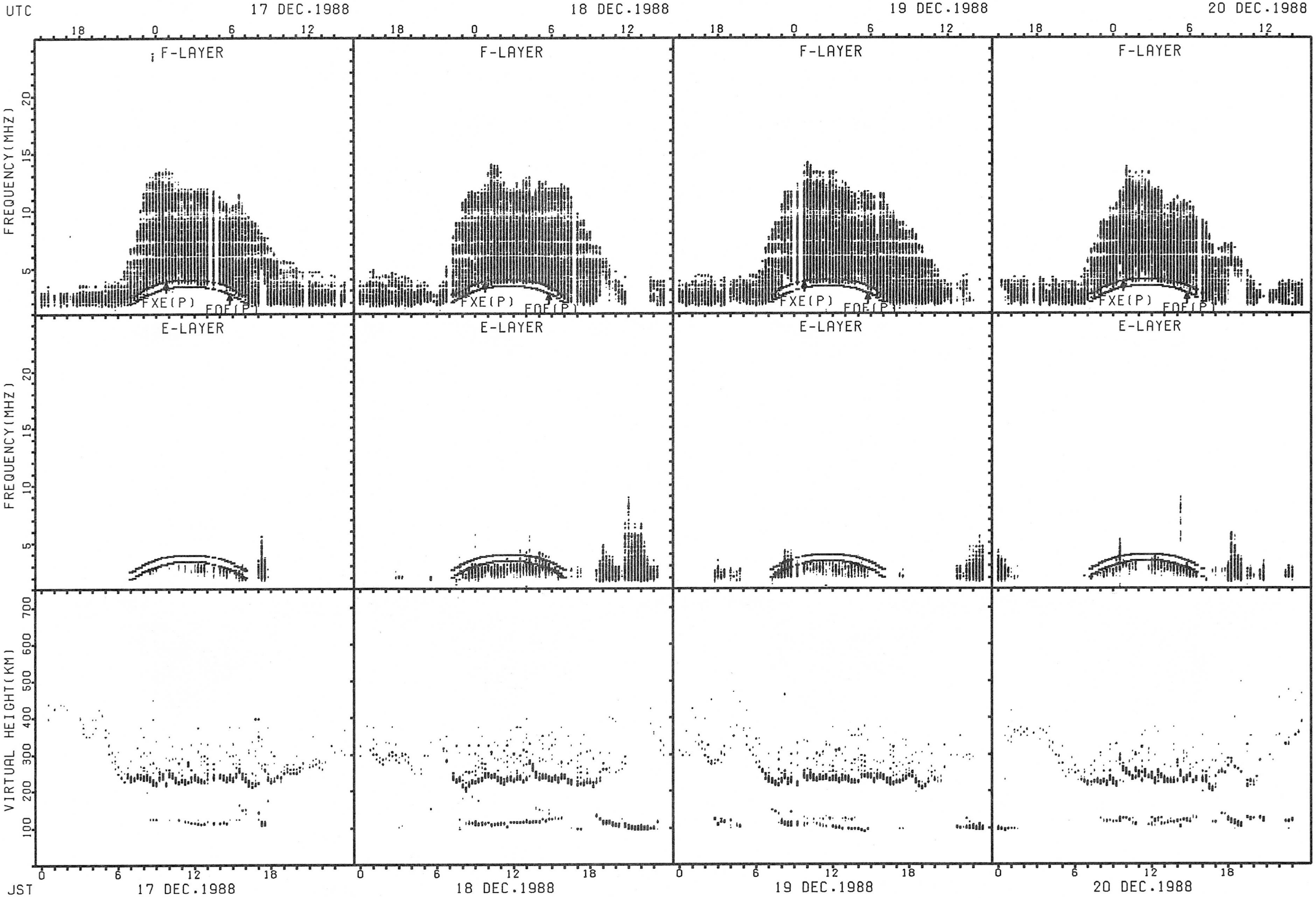
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT AKITA



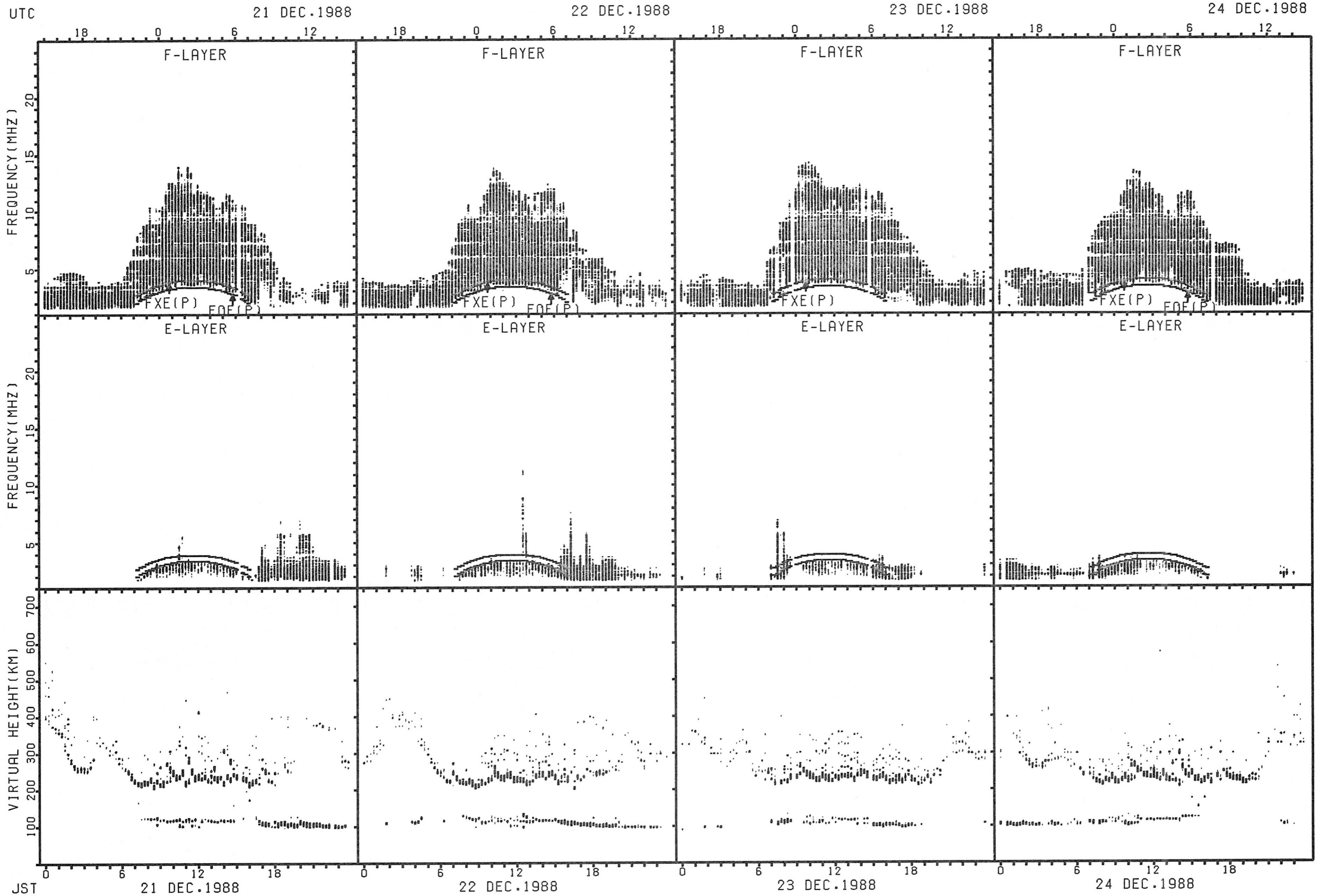
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT AKITA



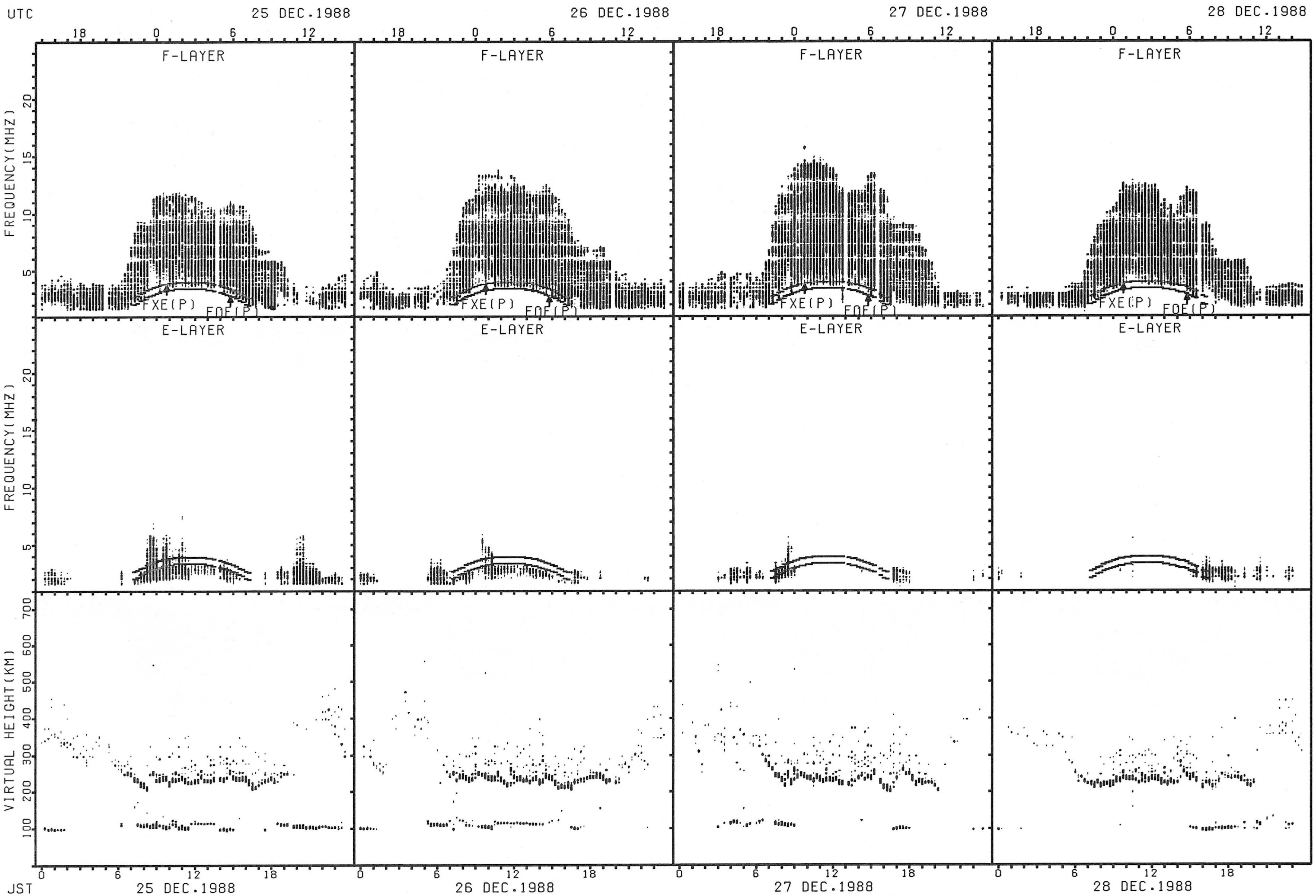
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT AKITA



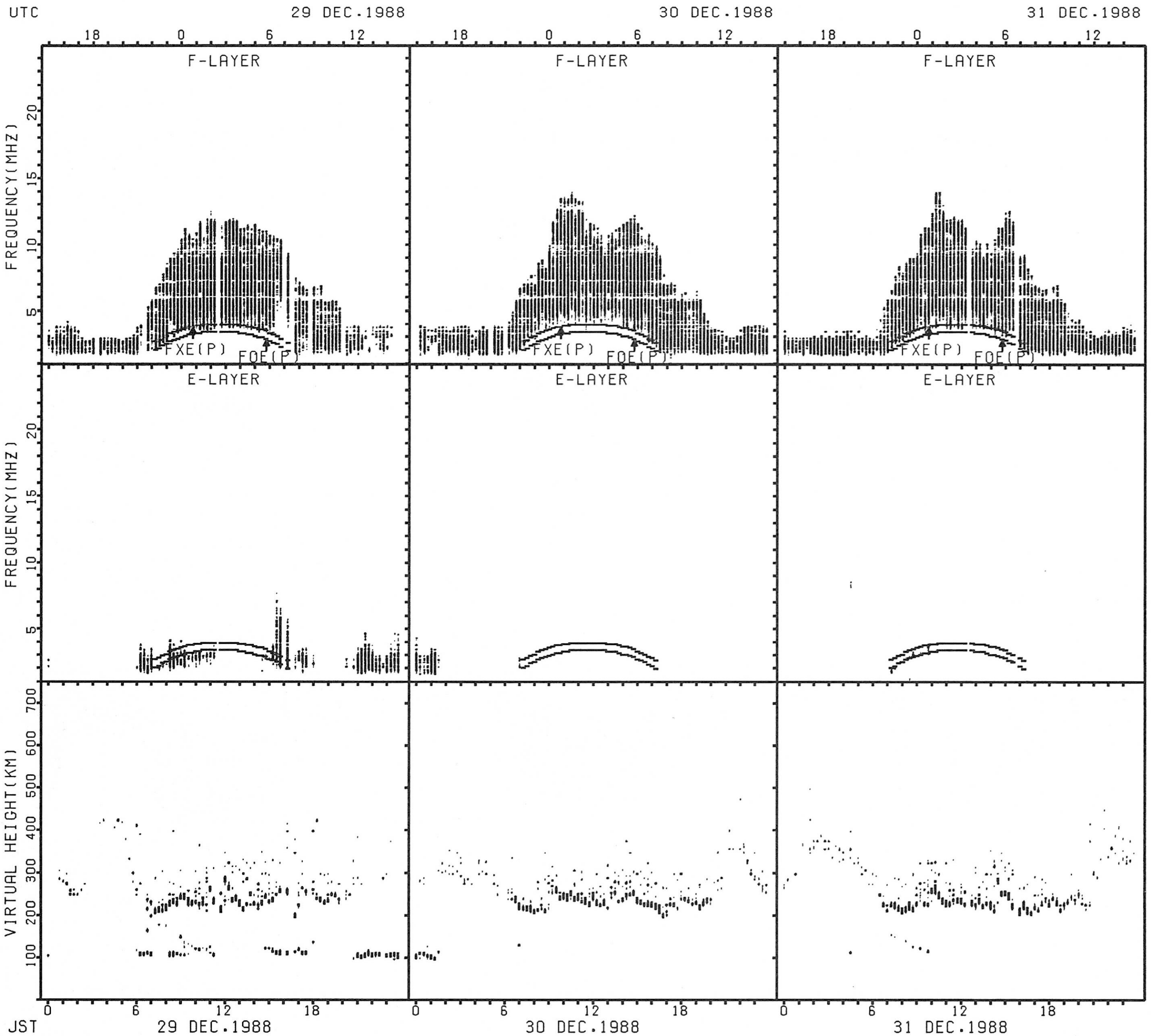
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT AKITA



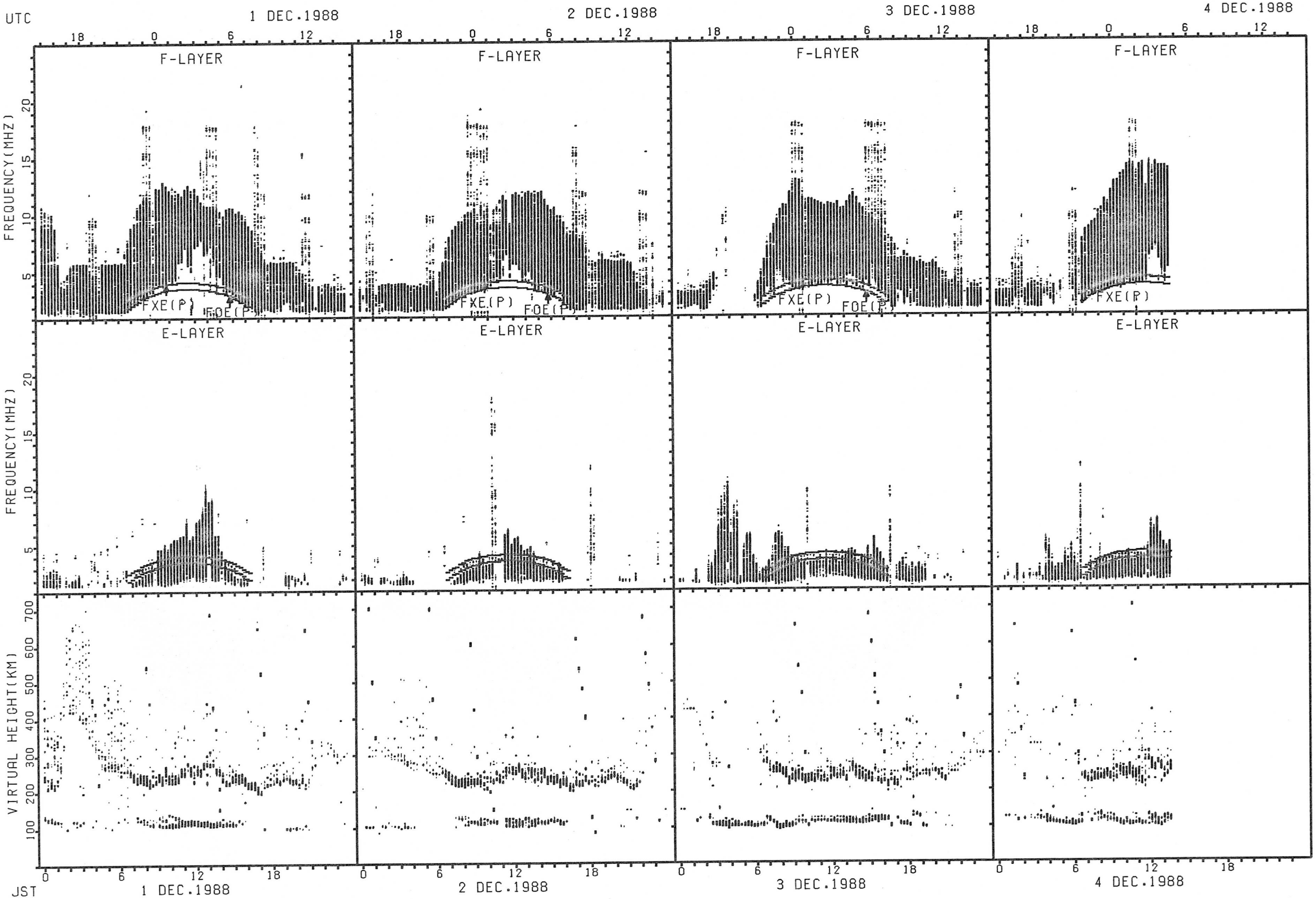
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT AKITA



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

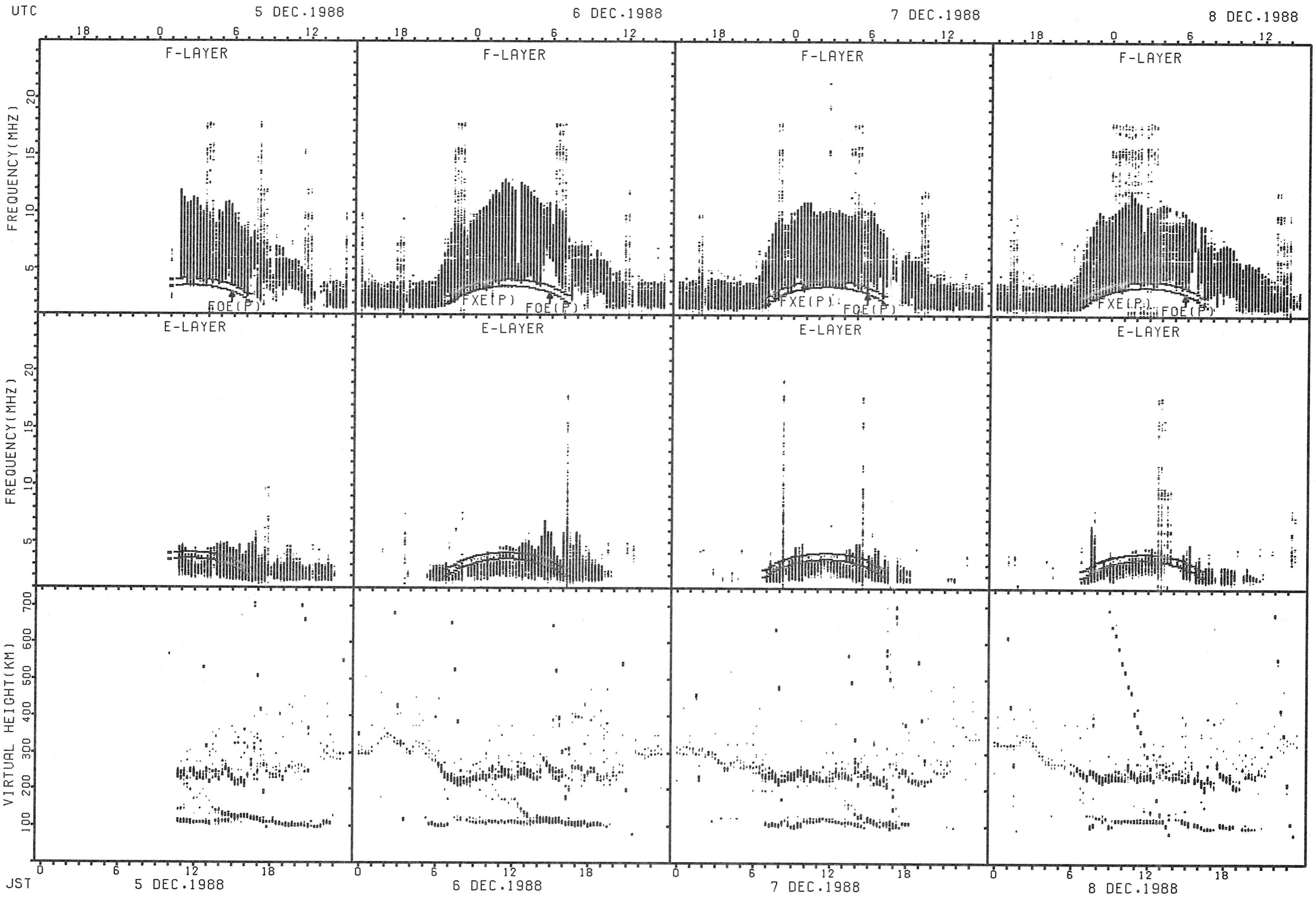
SUMMARY PLOTS AT KOKUBUNJI TOKYO



FXE(P): PREDICTED VALUE FOR FXE
FOE(P): PREDICTED VALUE FOR FOE

NOTE: THESE PLOTS SUFFERED CONTAMINATION DUE TO OCCASIONAL MALFUNCTION OF THE IONOSONDE AT KOKUBUNJI.

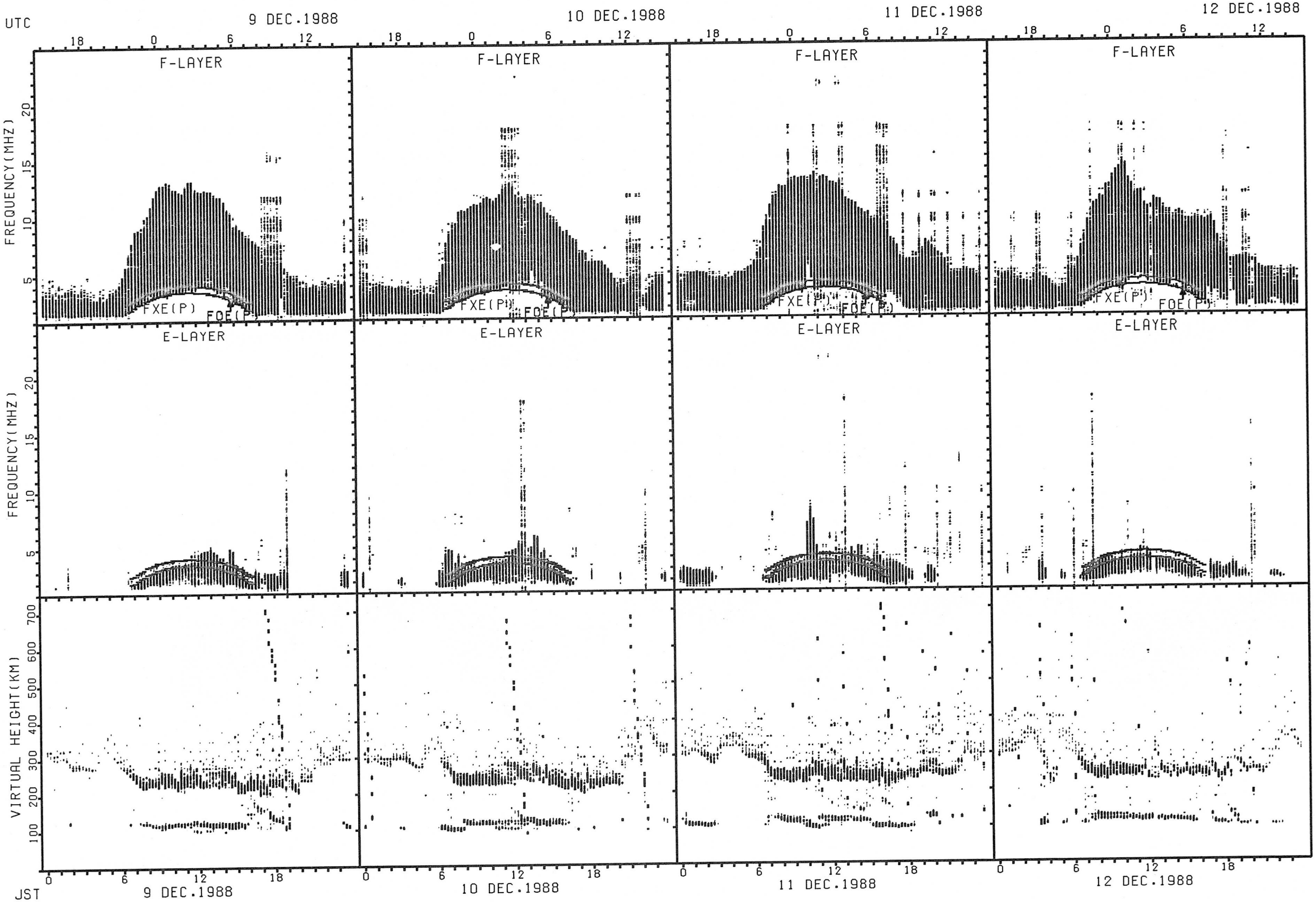
SUMMARY PLOTS AT KOKUBUNJI TOKYO



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

NOTE: THESE PLOTS SUFFERED CONTAMINATION DUE TO OCCASIONAL MALFUNCTION OF THE IONOSONDE AT KOKUBUNJI.

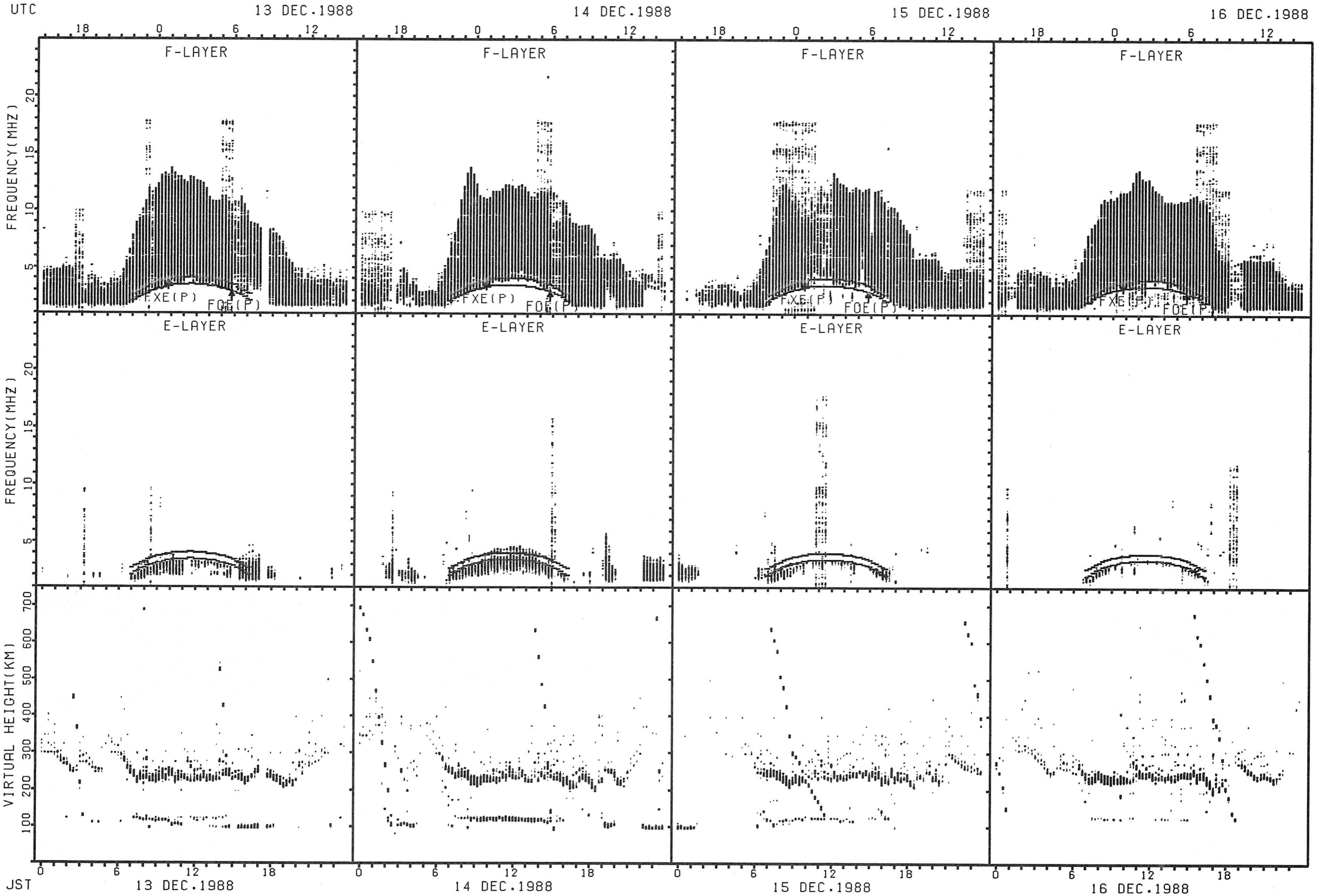
SUMMARY PLOTS AT KOKUBUNJI TOKYO



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

NOTE: THESE PLOTS SUFFERED CONTAMINATION DUE TO OCCASIONAL MALFUNCTION OF THE IONOSONDE AT KOKUBUNJI.

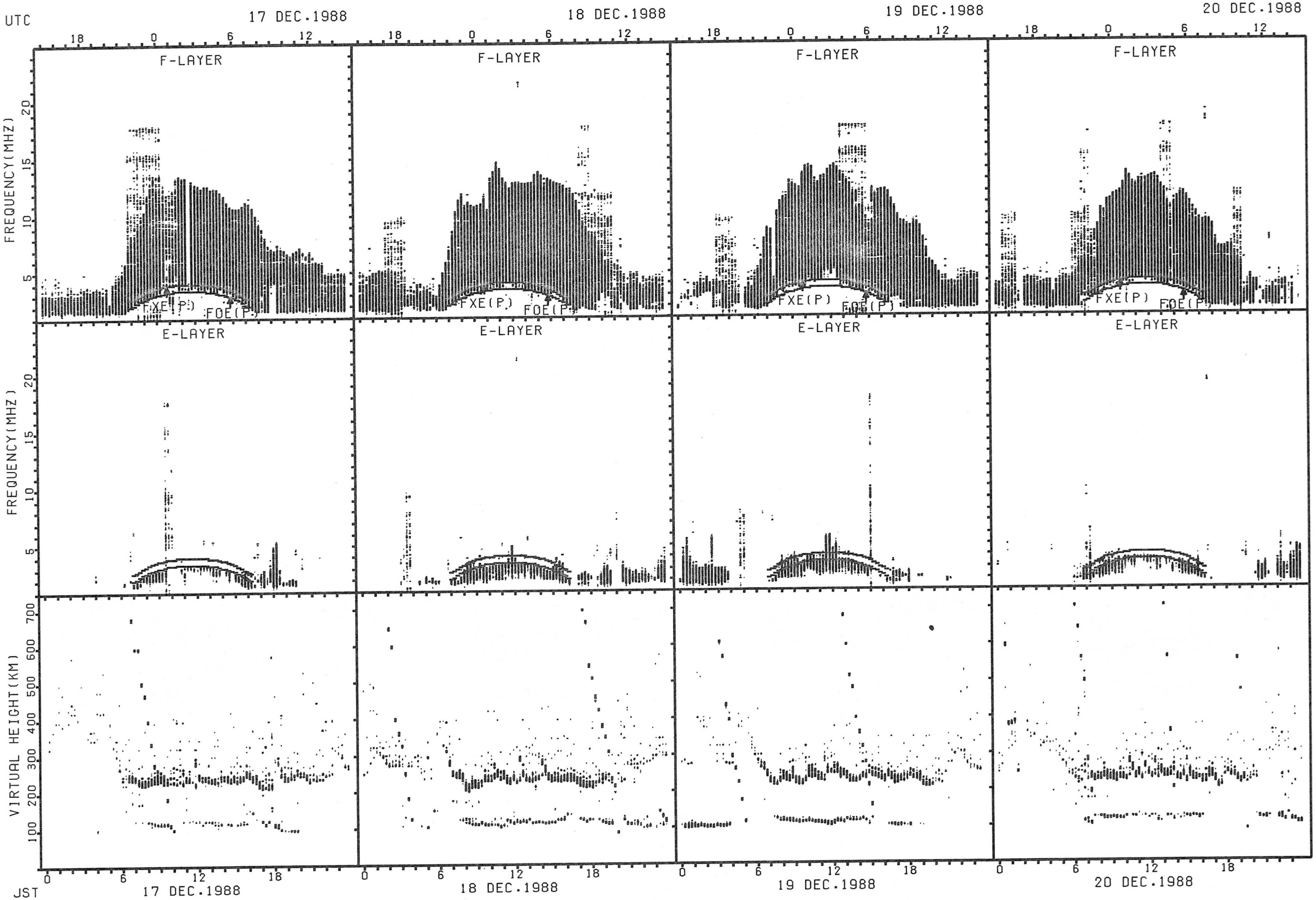
SUMMARY PLOTS AT KOKUBUNJI TOKYO



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

NOTE: THESE PLOTS SUFFERED CONTAMINATION DUE TO OCCASIONAL MALFUNCTION OF THE IONOSONDE AT KOKUBUNJI.

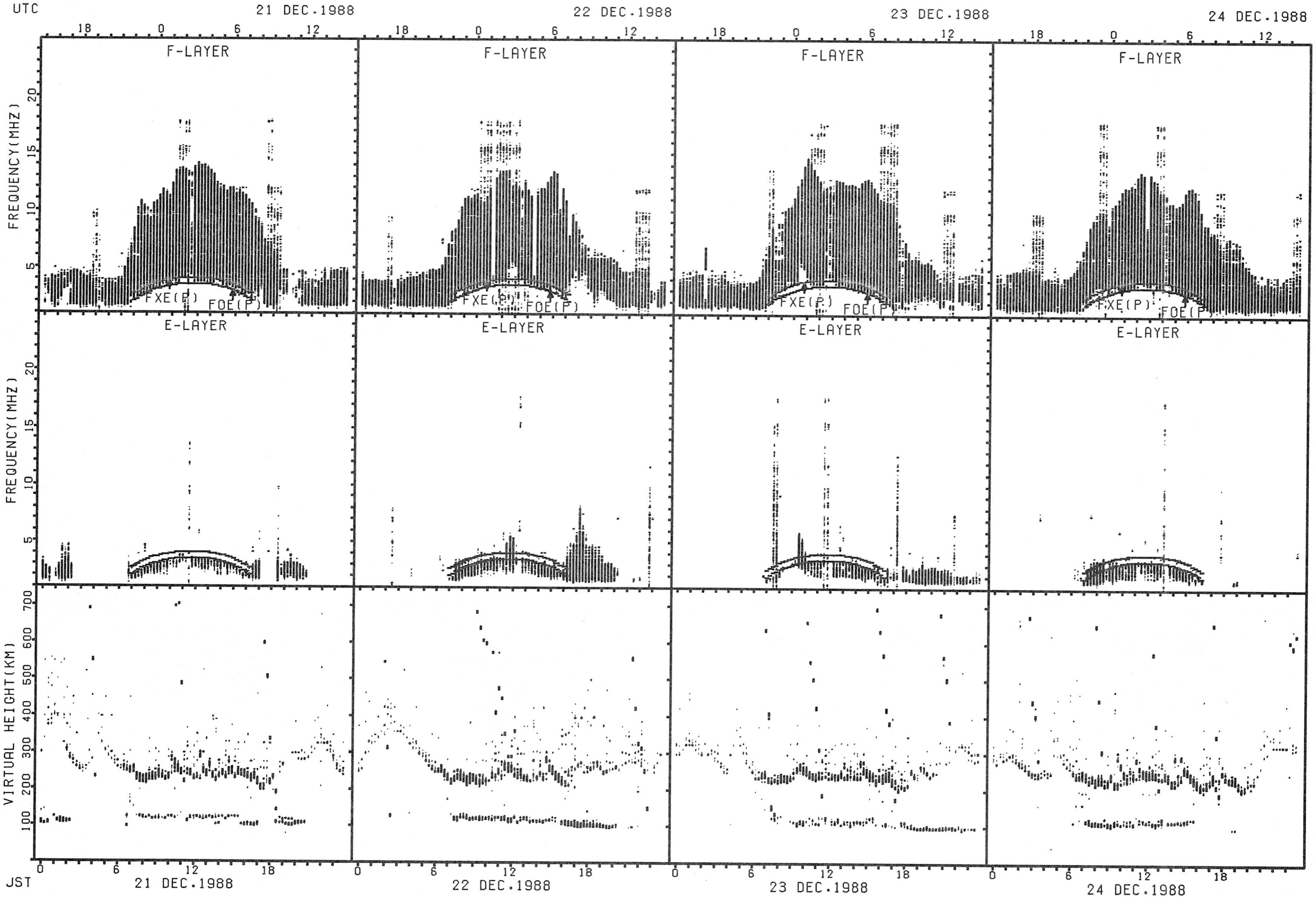
SUMMARY PLOTS AT KOKUBUNJI TOKYO



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

NOTE: THESE PLOTS SUFFERED CONTAMINATION DUE TO OCCASIONAL MALFUNCTION OF THE IONOSONDE AT KOKUBUNJI.

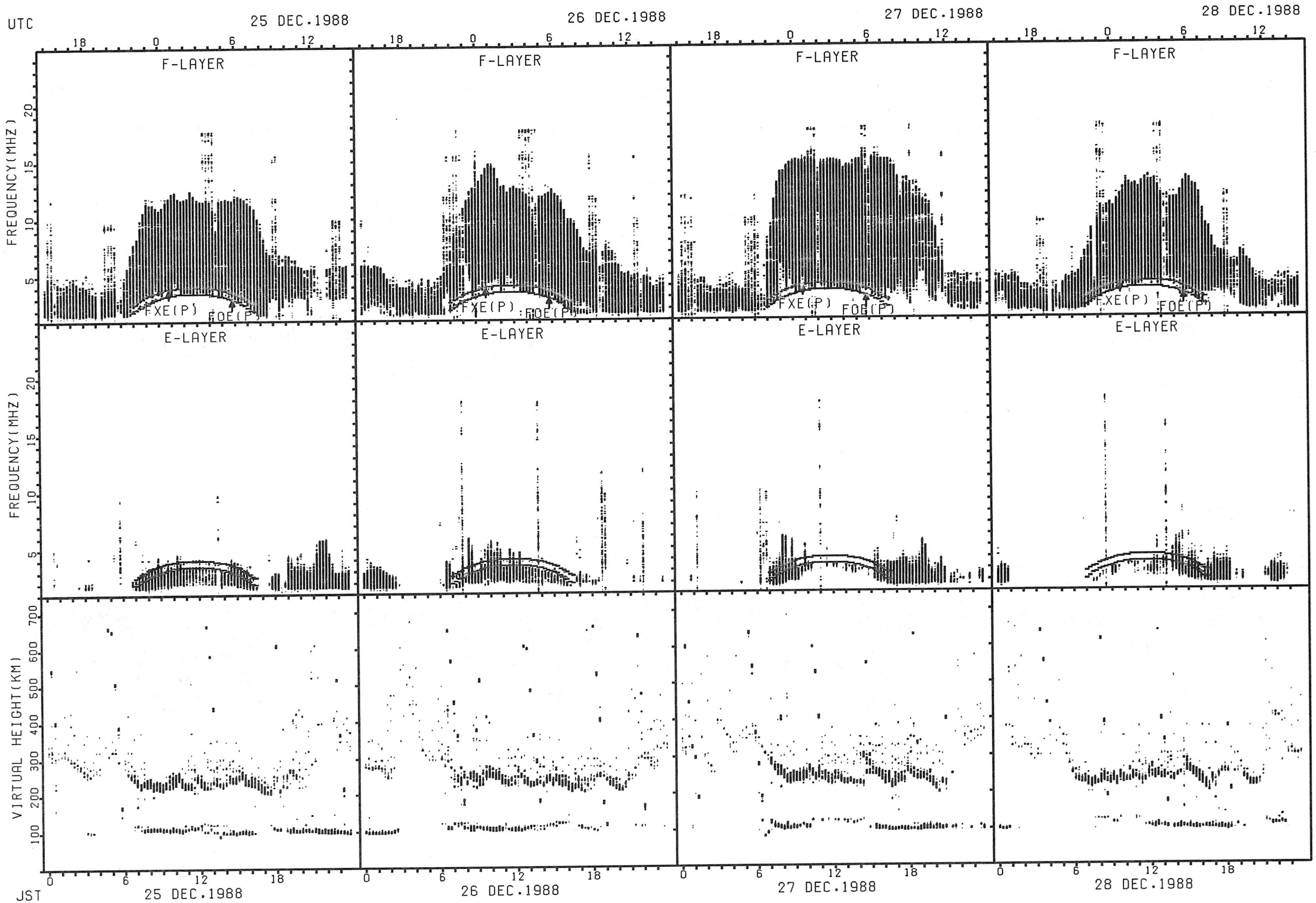
SUMMARY PLOTS AT KOKUBUNJI TOKYO



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

NOTE: THESE PLOTS SUFFERED CONTAMINATION DUE TO OCCASIONAL MALFUNCTION OF THE IONOSONDE AT KOKUBUNJI.

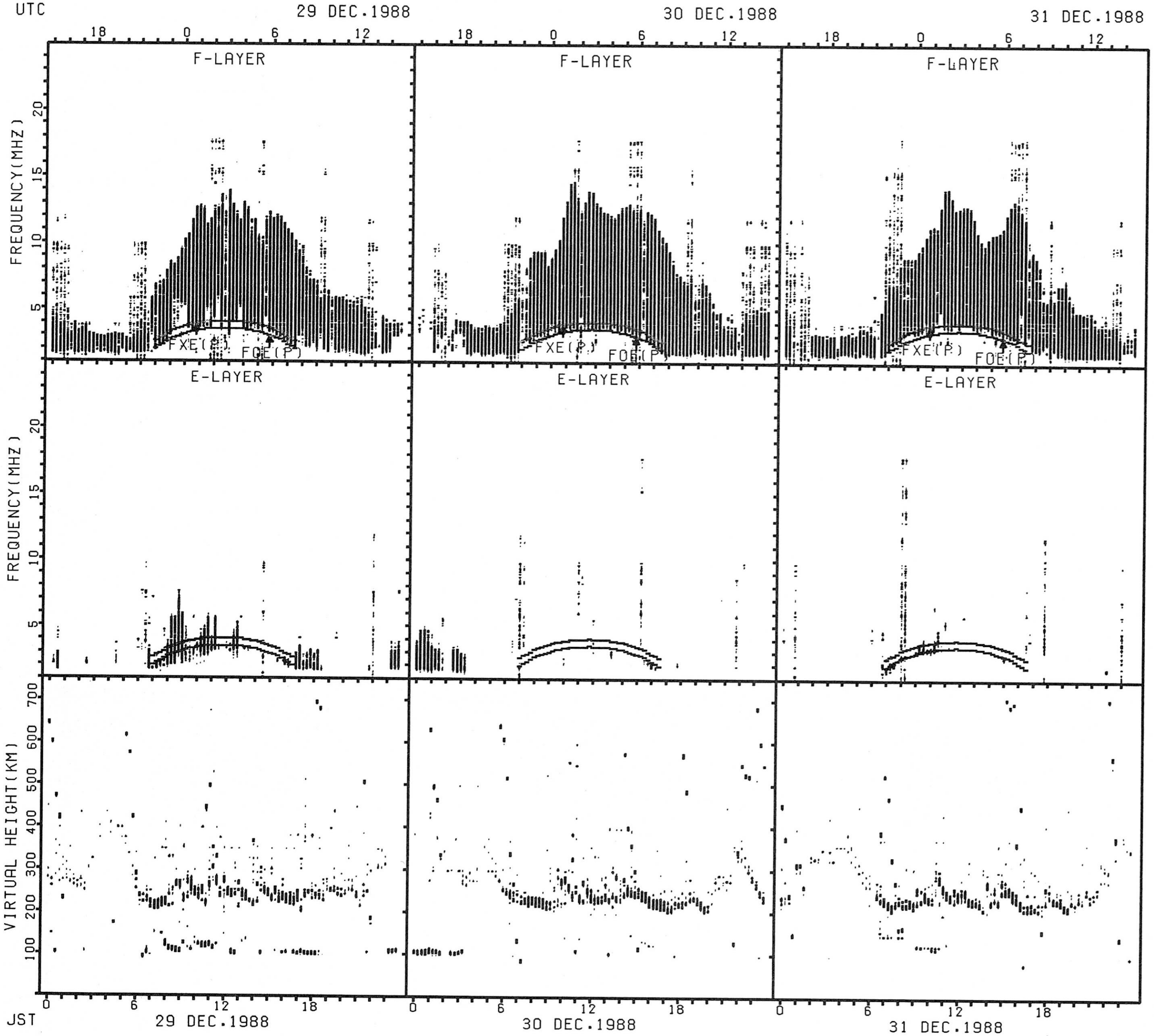
SUMMARY PLOTS AT KOKUBUNJI TOKYO



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

NOTE: THESE PLOTS SUFFERED CONTAMINATION DUE TO OCCASIONAL MALFUNCTION OF THE IONOSONDE AT KOKUBUNJI.

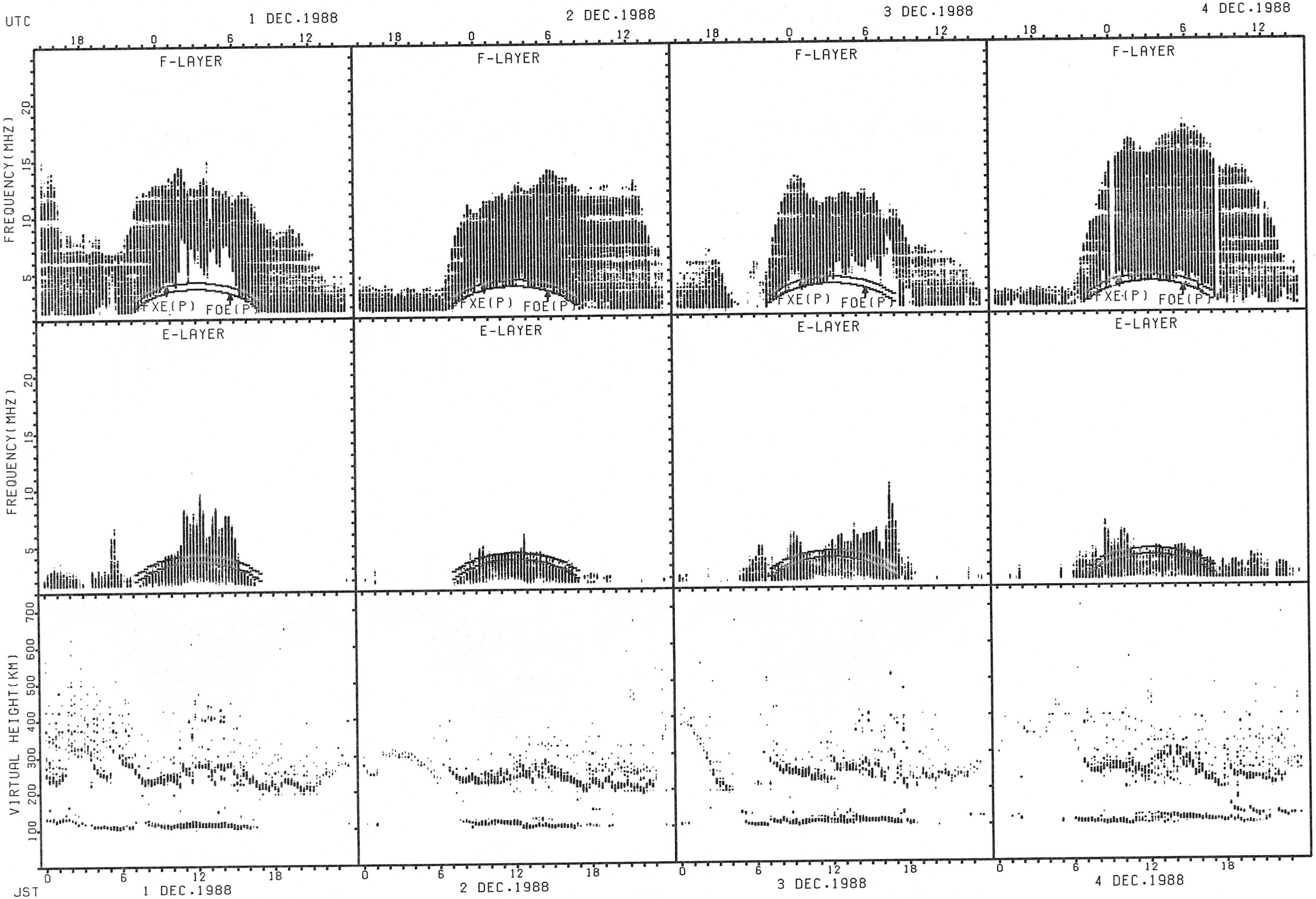
SUMMARY PLOTS AT KOKUBUNJI TOKYO



FXE(P): PREDICTED VALUE FOR FXE
FOE(P): PREDICTED VALUE FOR FOE

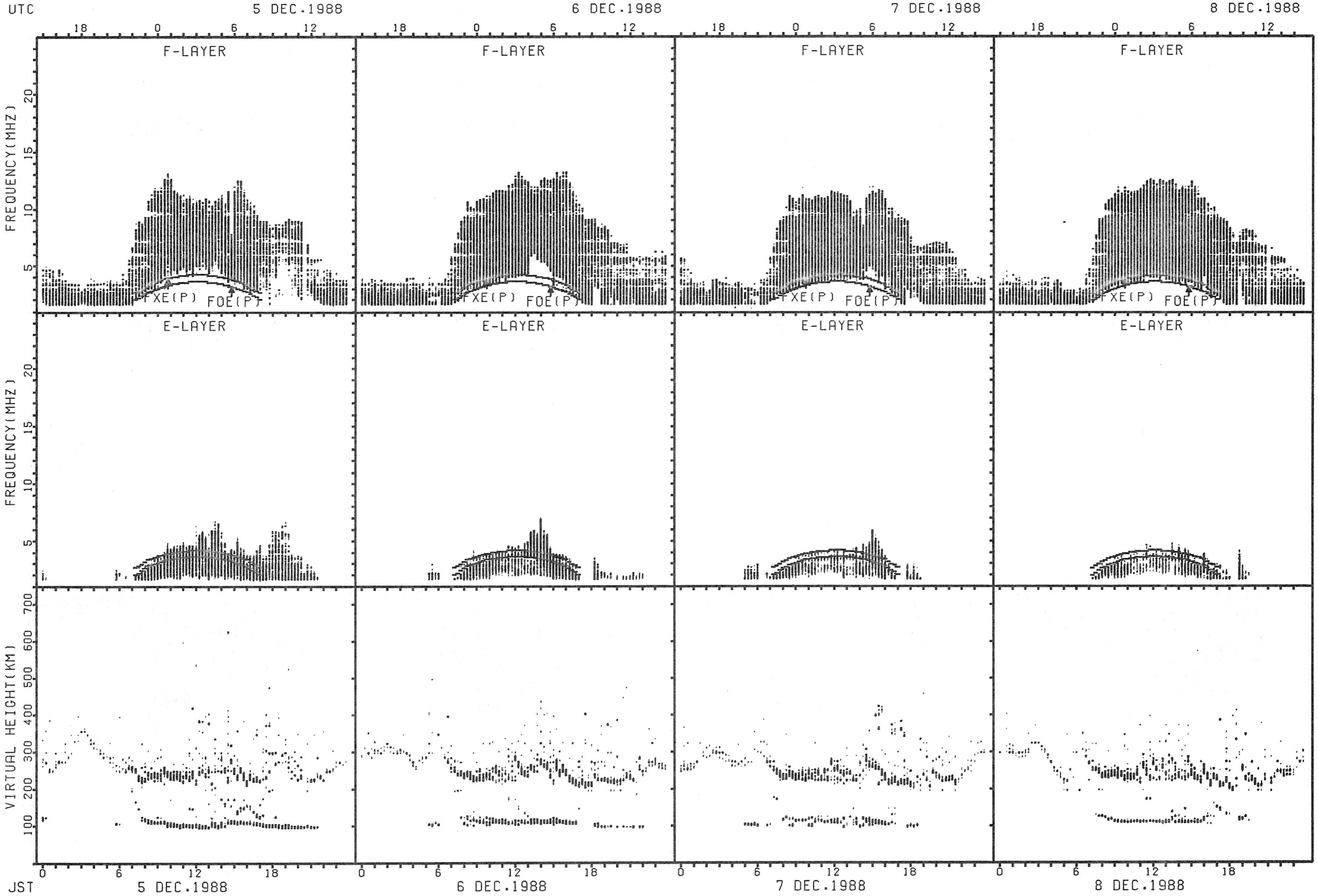
NOTE: THESE PLOTS SUFFERED CONTAMINATION DUE TO OCCASIONAL MALFUNCTION OF THE IONOSONDE AT KOKUBUNJI.

SUMMARY PLOTS AT YAMAGAWA

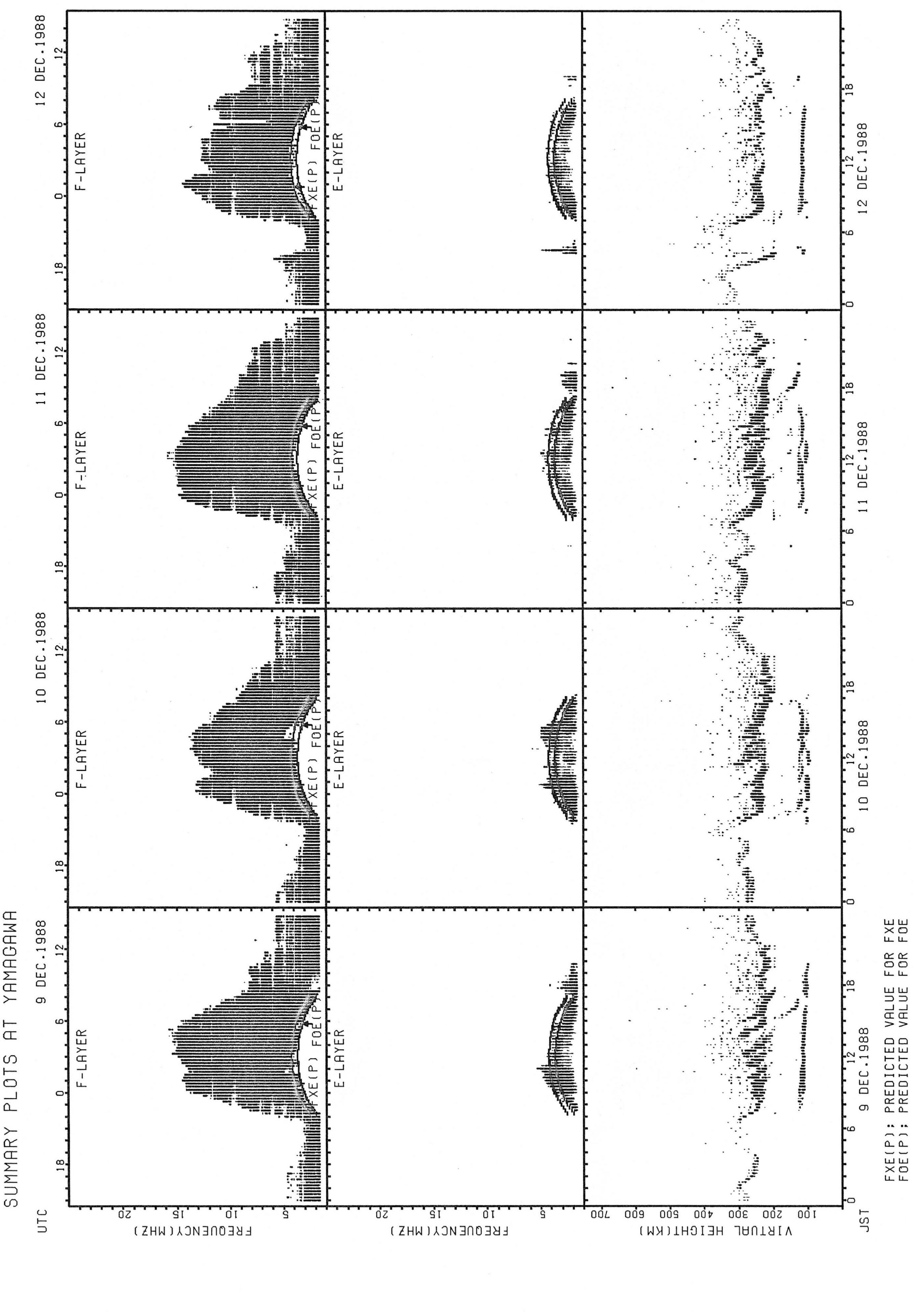


FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

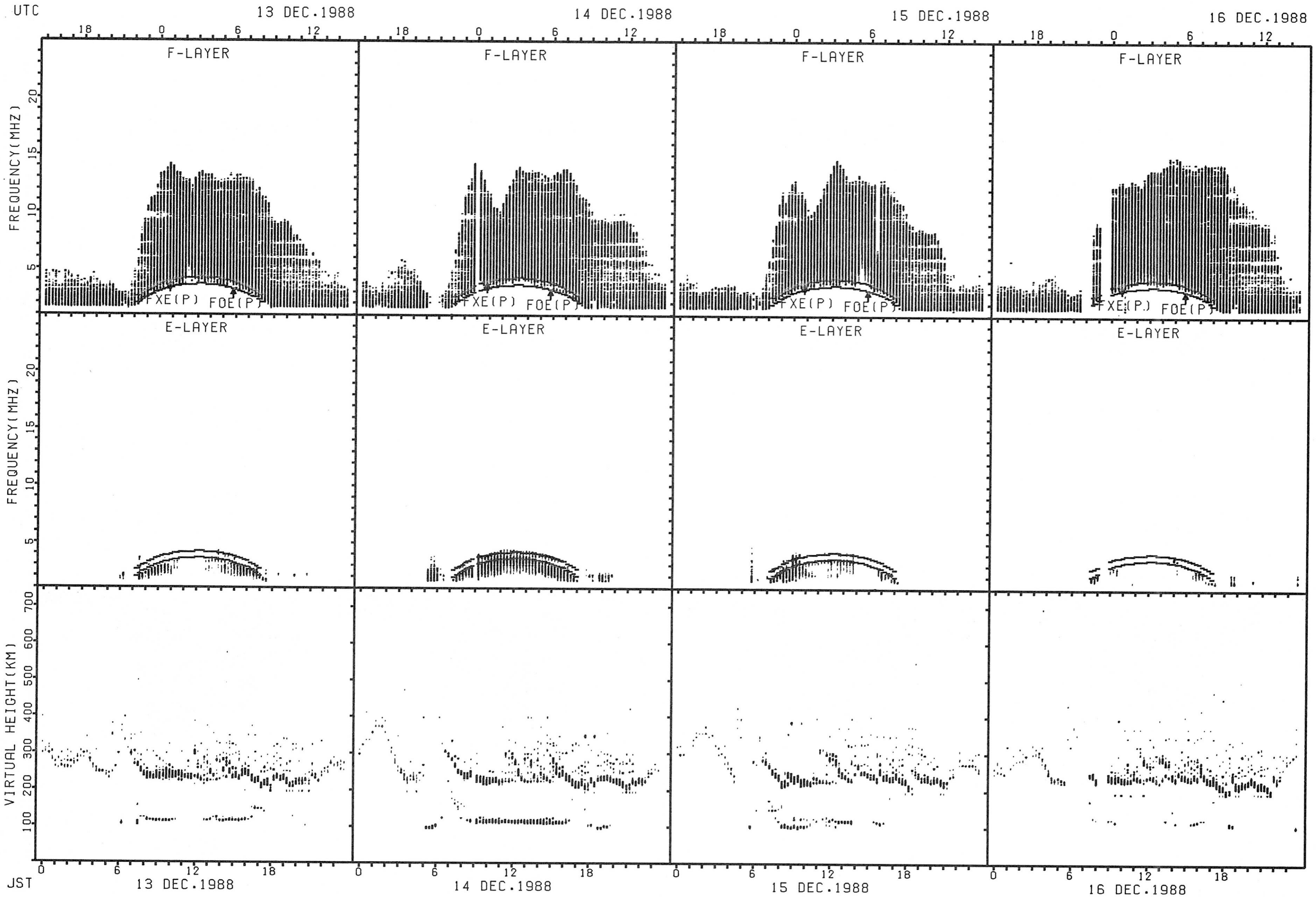
SUMMARY PLOTS AT YAMAGAWA



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

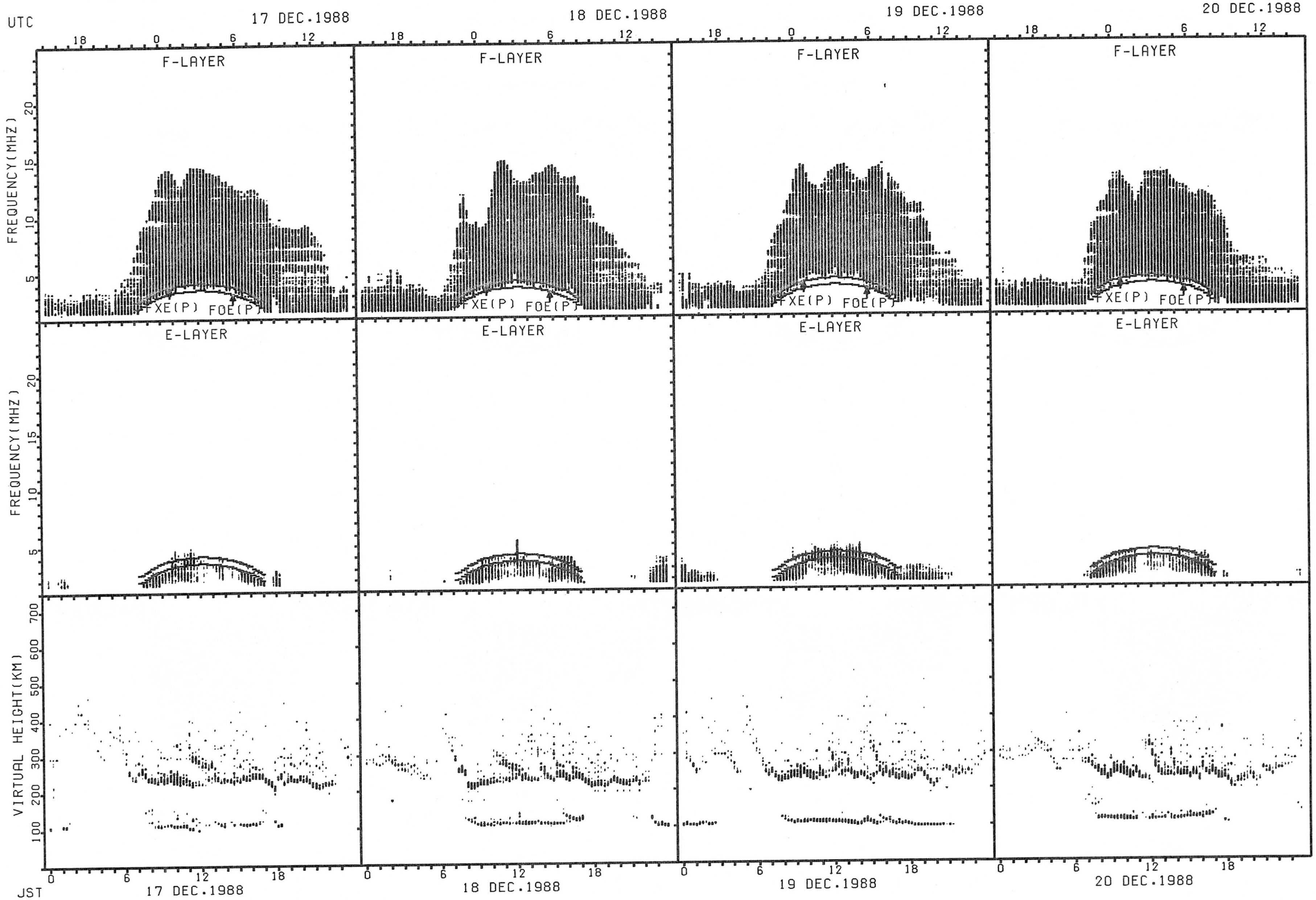

SUMMARY PLOTS AT YAMAGAWA
UTC
9 DEC.1988
10 DEC.1988
11 DEC.1988
12 DEC.1988
F-LAYER
E-LAYER
FXE(P) FOE(P)
FREQUENCY(MHZ)
VIRTUAL HEIGHT(KM)
JST
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT YAMAGAWA



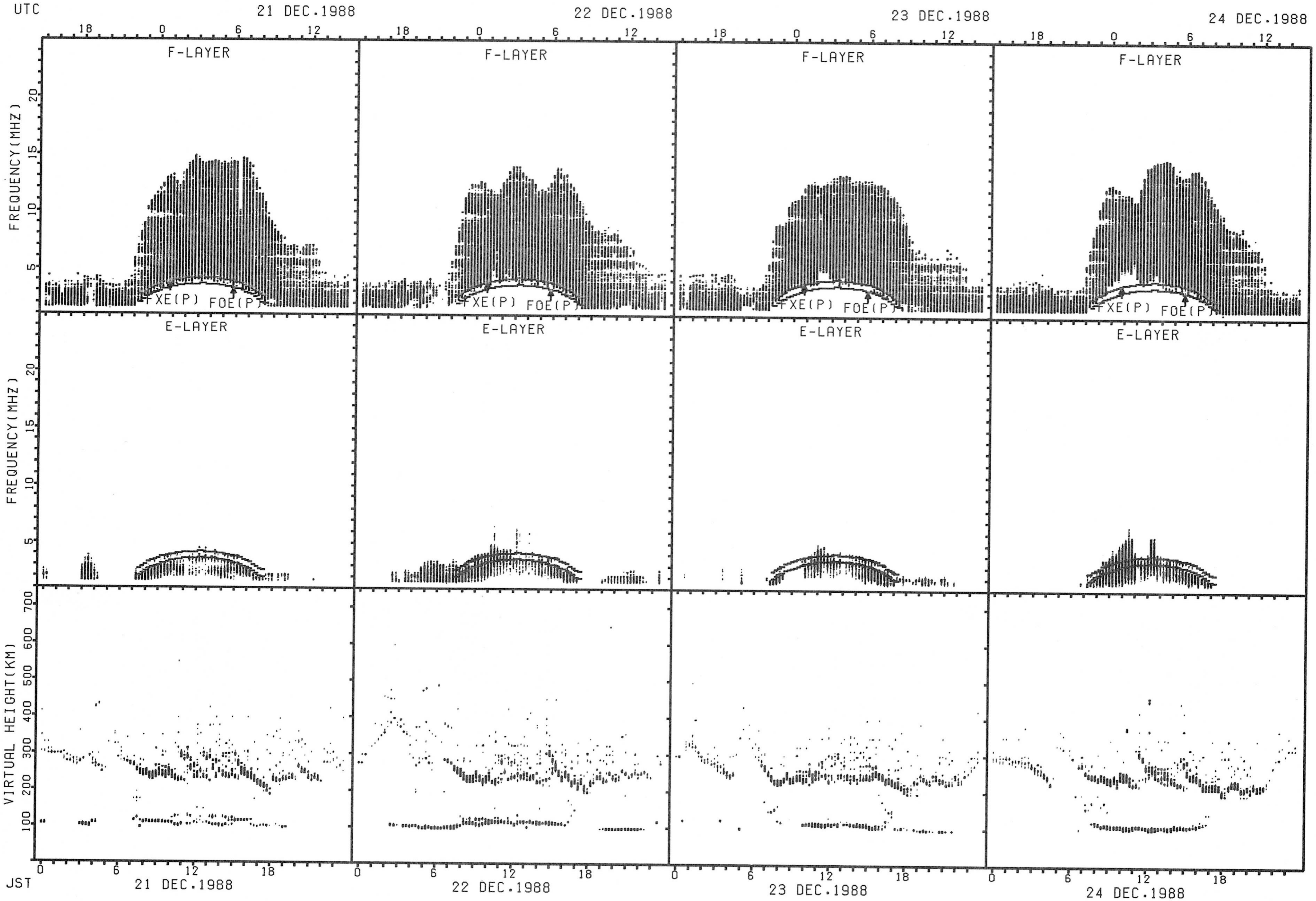
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT YAMAGAWA



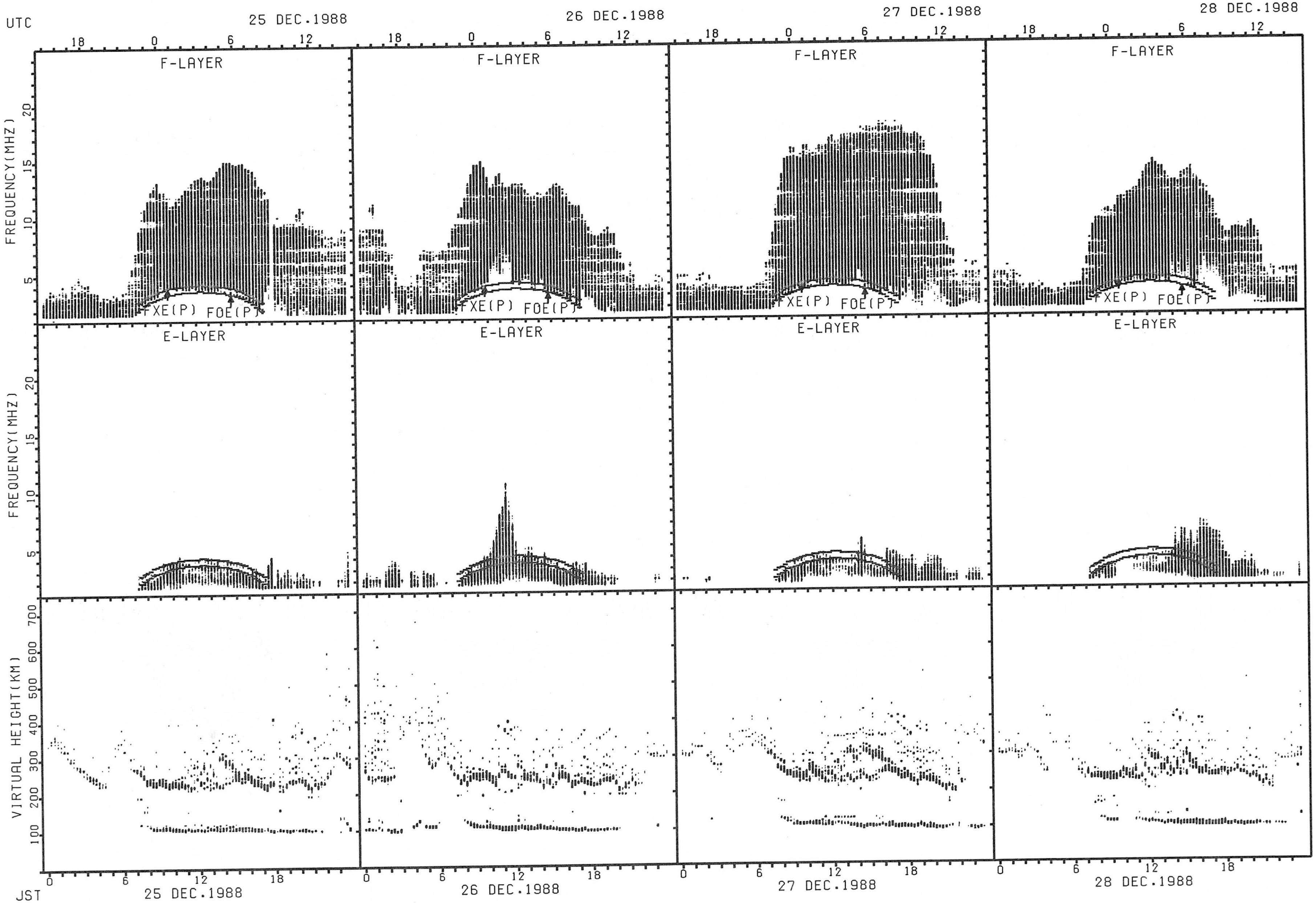
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT YAMAGAWA



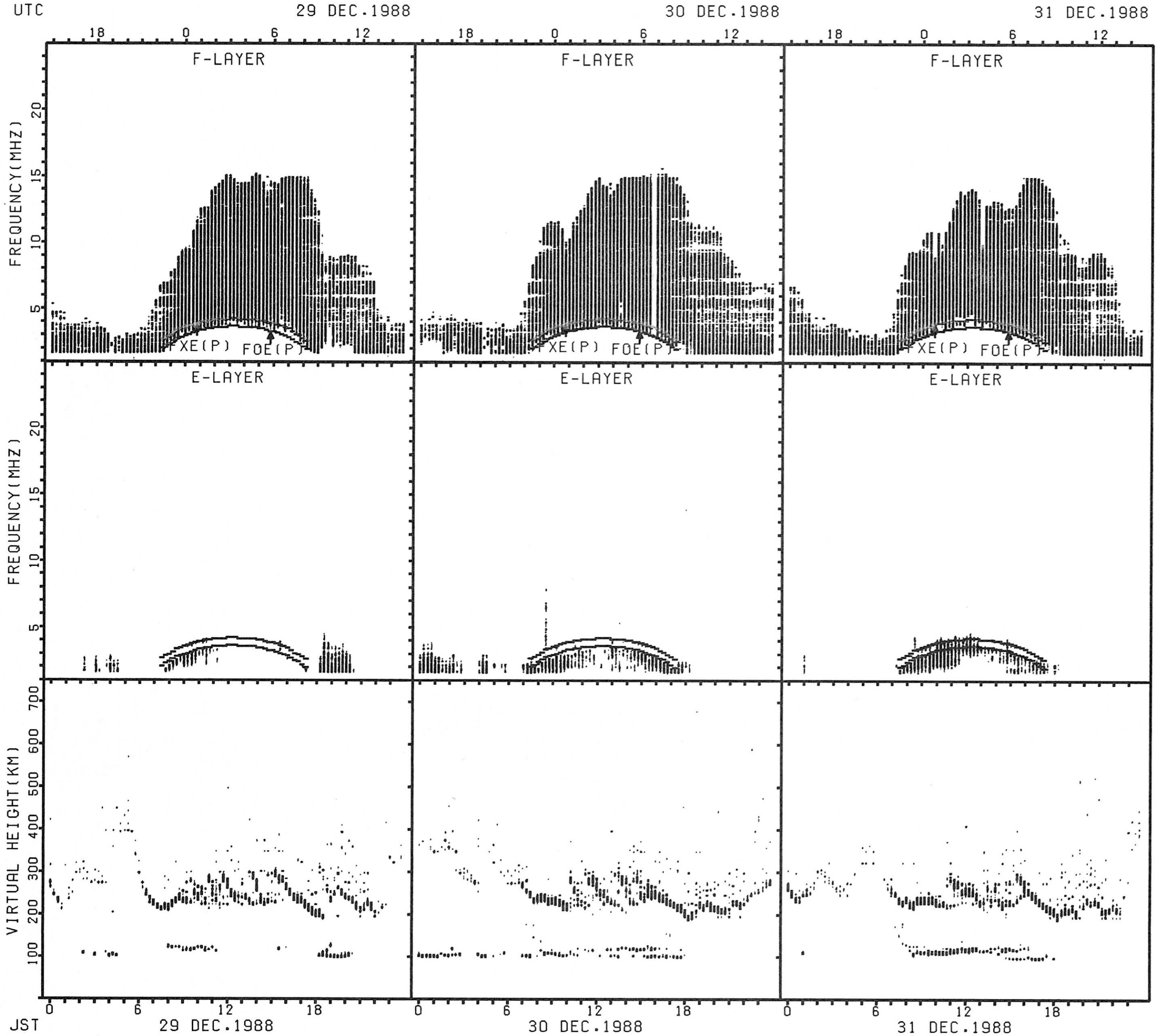
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT YAMAGAWA



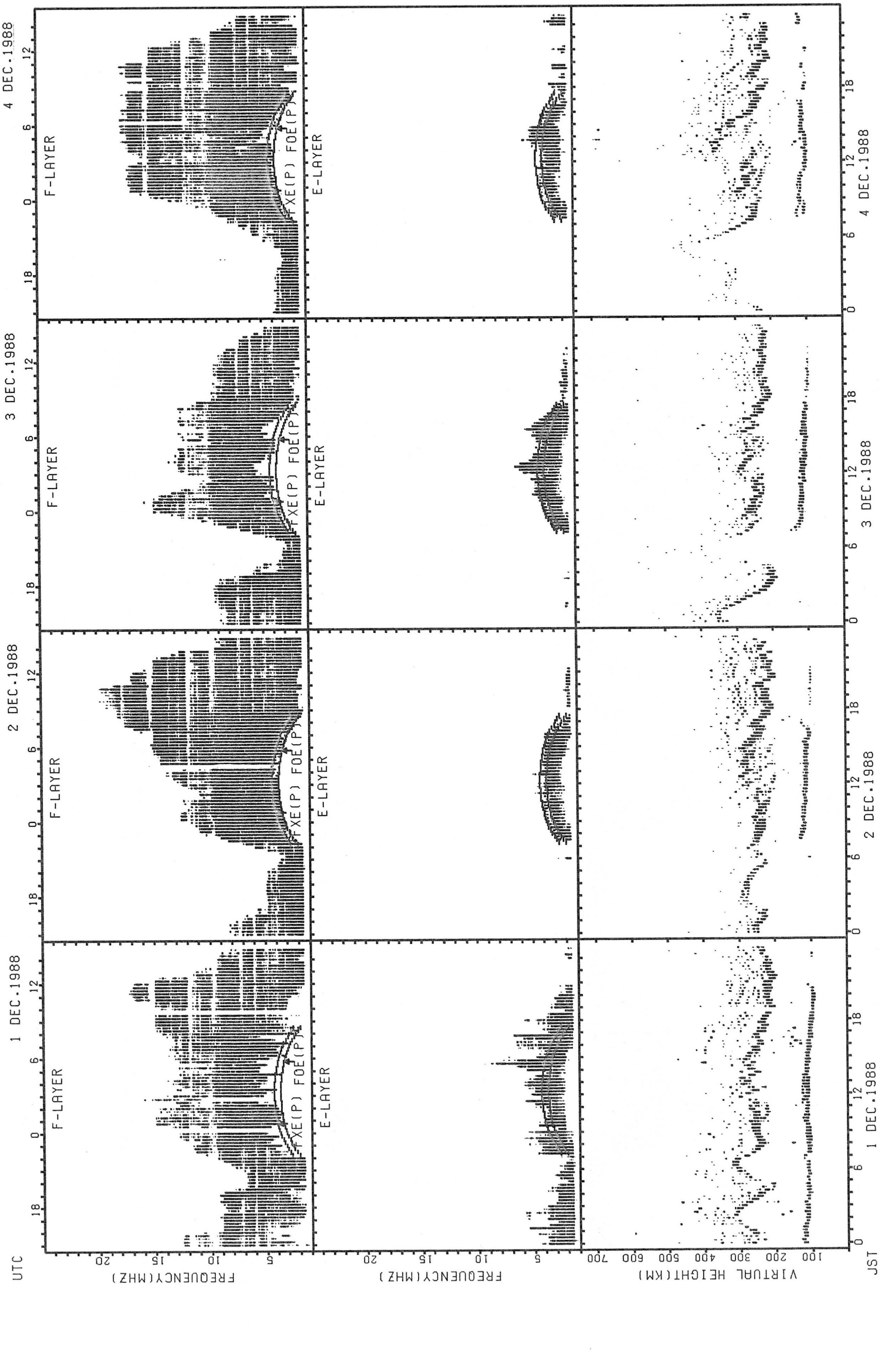
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT YAMAGAWA



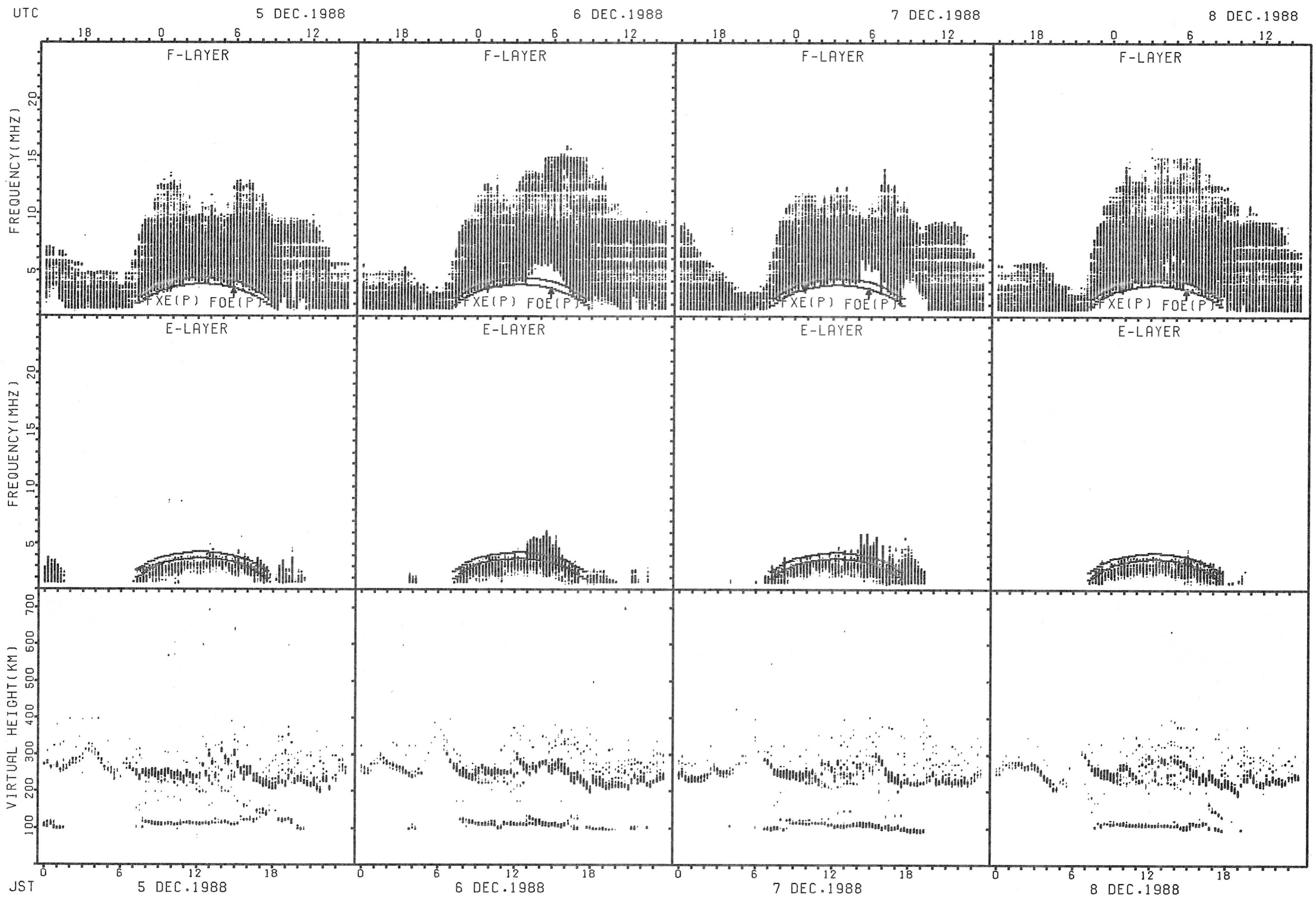
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT OKINAWA



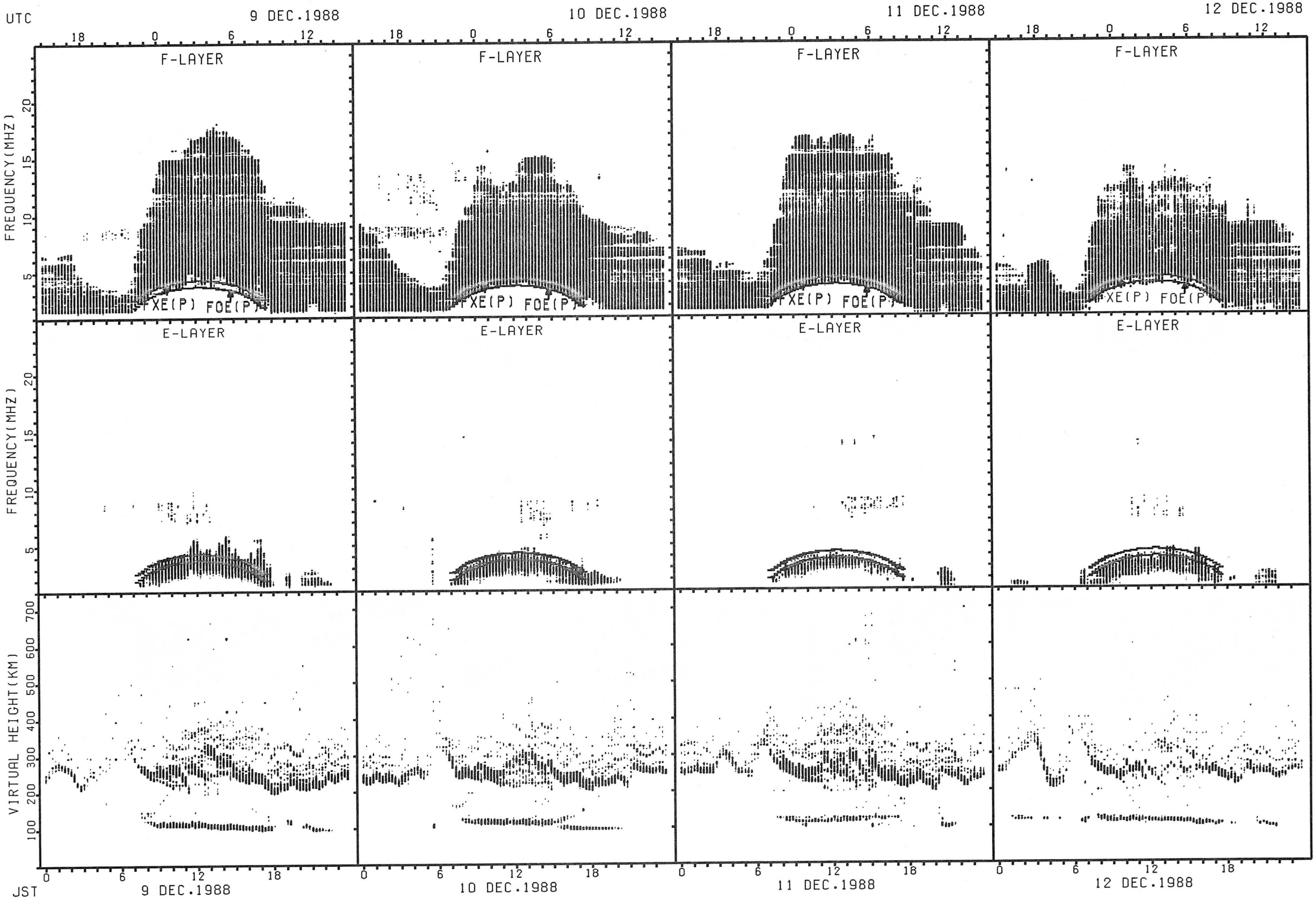
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT OKINAWA



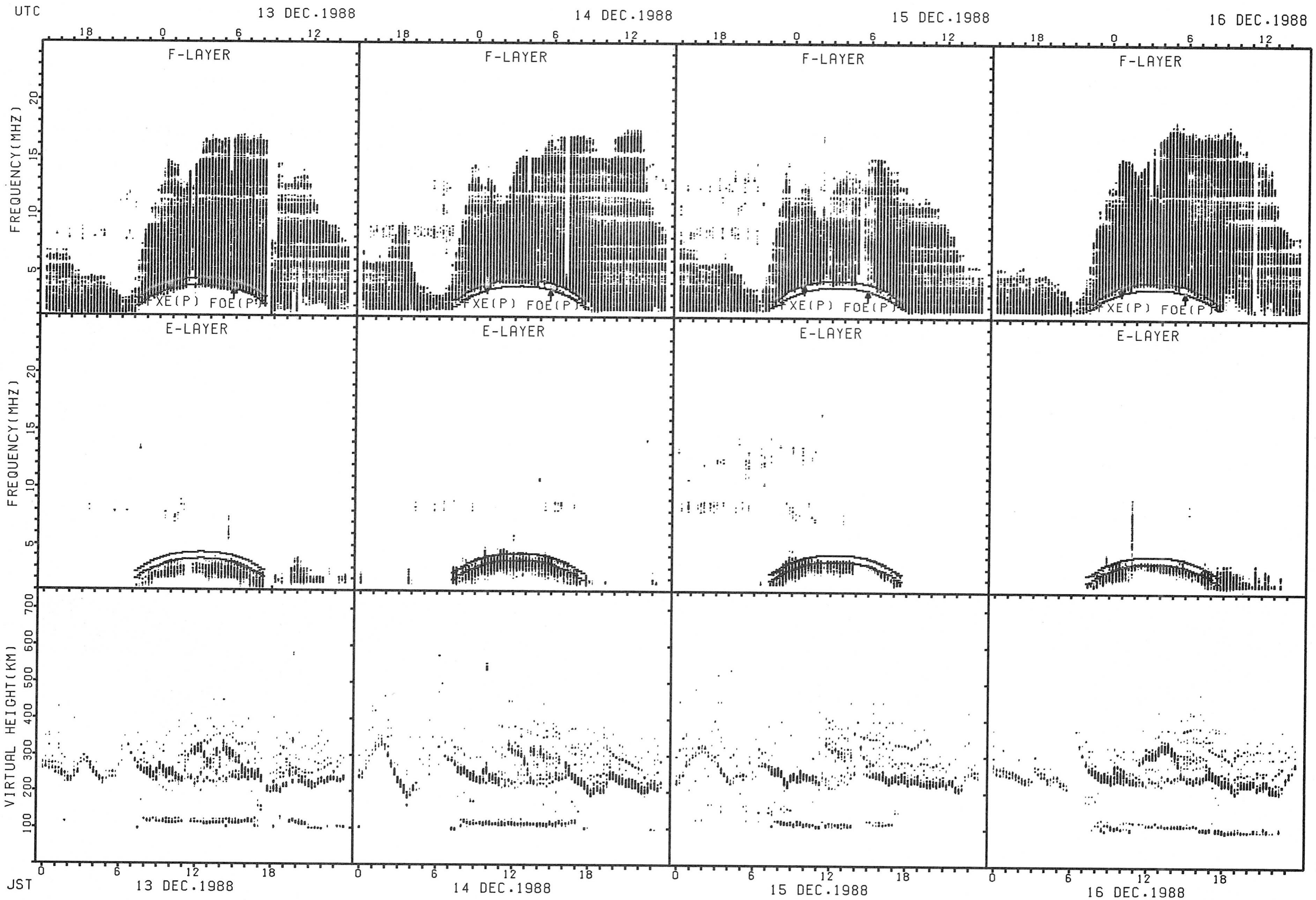
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT OKINAWA



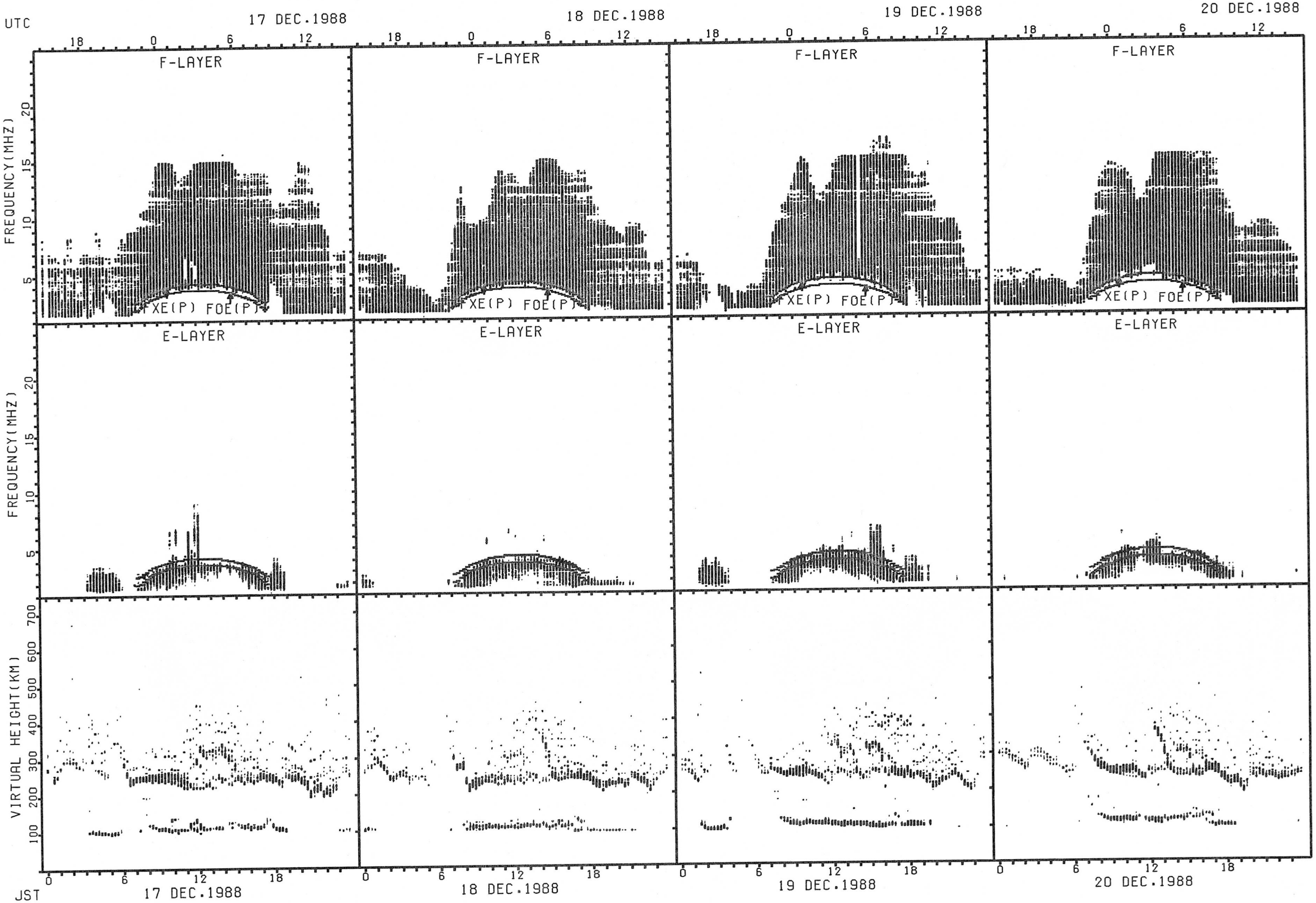
FXE(P): PREDICTED VALUE FOR FXE
FOE(P): PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT OKINAWA



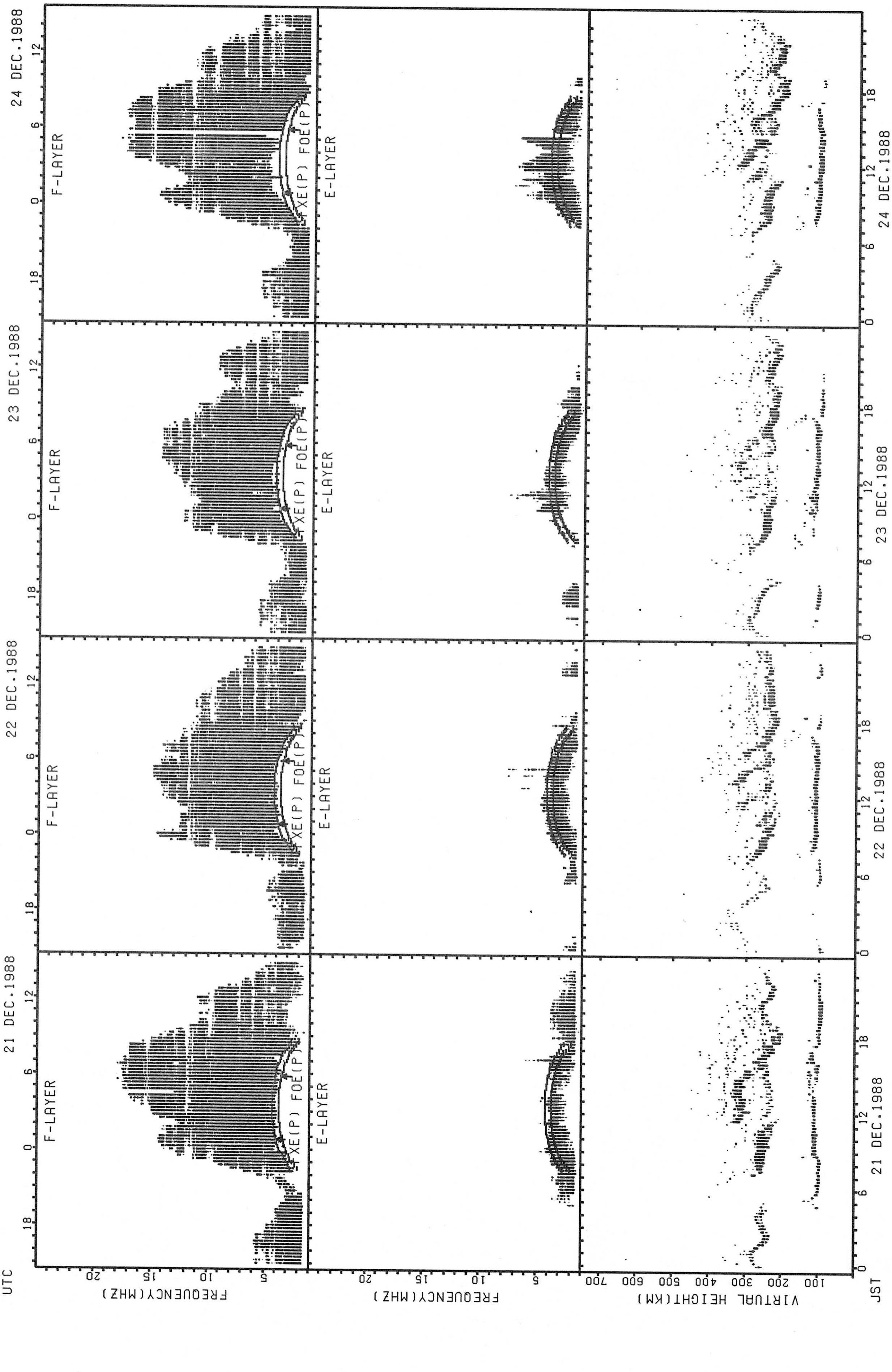
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT OKINAWA



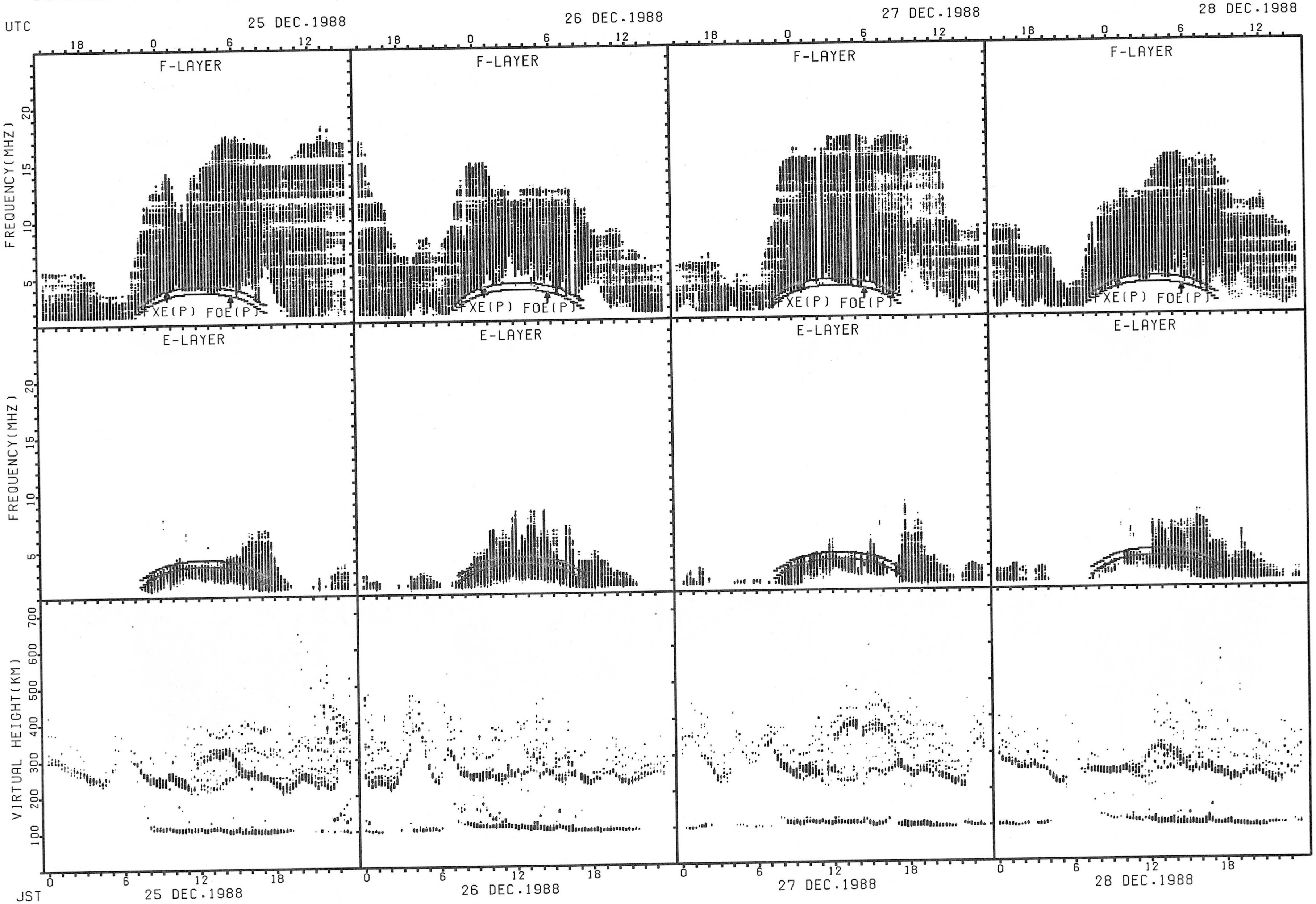
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT OKINAWA



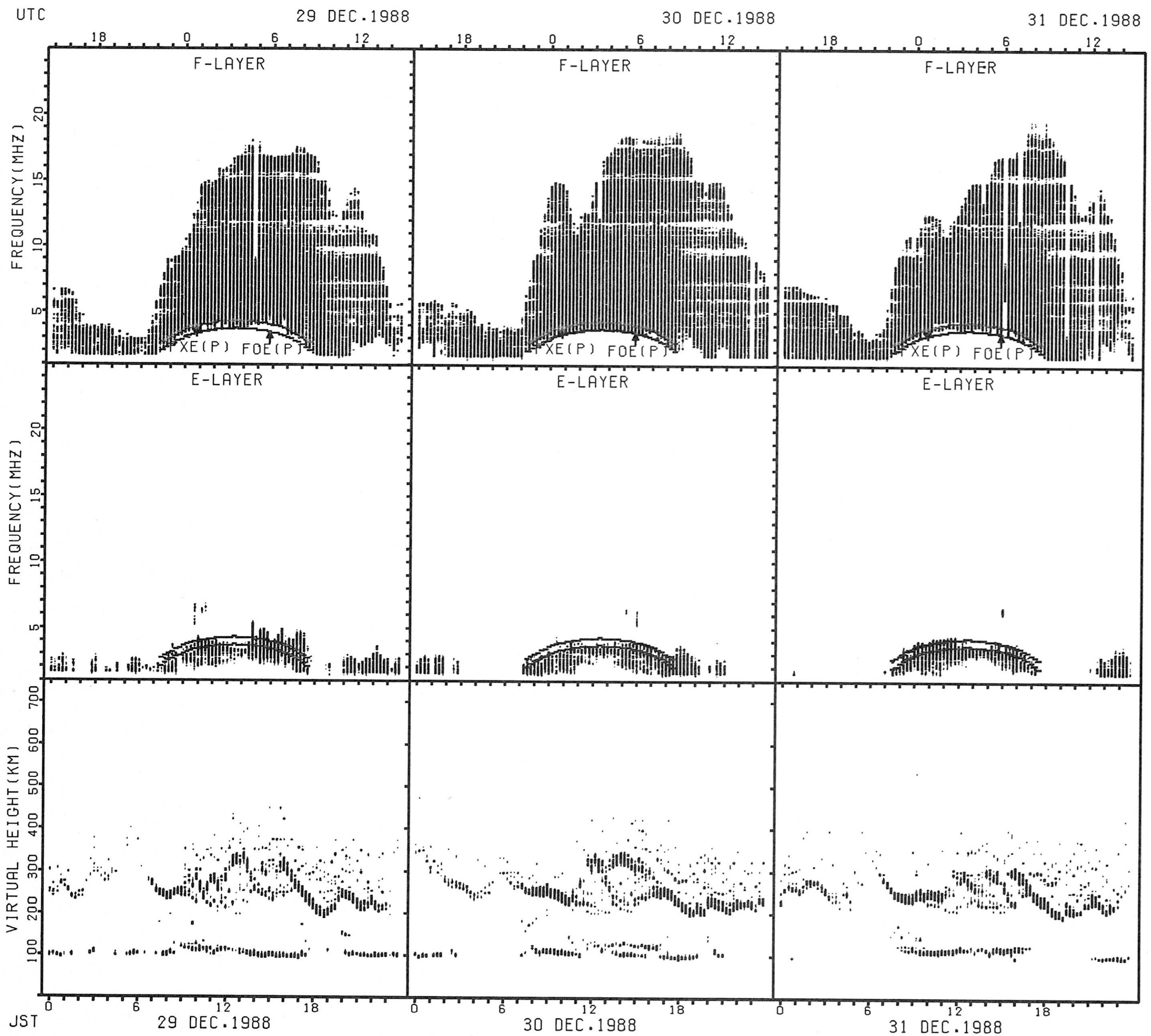
FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT OKINAWA



FXE(P); PREDICTED VALUE FOR FXE
FOE(P); PREDICTED VALUE FOR FOE

SUMMARY PLOTS AT OKINAWA



FXE(P): PREDICTED VALUE FOR FXE
FOE(P): PREDICTED VALUE FOR FOE

MONTHLY MEDIANS OF H'F AND H'ES

DEC.1988 135E MEAN TIME(UTC+9H) AUTOMATIC SCALING

STATION WAKKANAI LAT. 45.4N LON. 141.7E

H'F

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									30	31	30	30	30	30	28	30	27	12						
MED									238	238	238	234	240	245	252	246	250	287						
U Q									246	244	244	240	250	254	271	256	274	296						
L Q									232	232	230	228	230	240	240	236	238	273						

H'ES

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT										12	11	11	12	10		11		10	10					
MED										127	127	125	130	128		129		117	114					
U Q										129	131	131	135	137		137		119	117					
L Q										121	125	123	125	127		123		113	111					

STATION AKITA LAT. 39.7N LON. 140.1E

H'F

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									31	29	31	31	30	29	30	30	27	11						
MED									244	240	244	238	250	250	257	250	248	282						
U Q									250	250	252	246	258	257	270	260	268	290						
L Q									232	229	236	232	238	236	246	242	238	268						

H'ES

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	10				10			11	25	25	25	23	24	25	25	23	15	17	15	11	11	12	14	15
MED	101				110			113	119	119	119	119	118	119	119	121	123	107	107	107	105	105	107	105
U Q	107				113			125	125	122	119	121	123	127	125	125	167	115	109	115	115	107	111	107
L Q	97				109			109	113	113	113	113	116	117	114	113	105	103	103	105	103	100	103	101

STATION KOKUBUNJI LAT. 35.7N LON. 139.5E

H'F

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT								22	29	30	30	27	31	31	30	29	29	22	10					
MED								260	236	236	246	244	252	248	257	250	244	263	266					
U Q								270	242	248	258	260	262	256	270	259	257	270	326					
L Q								244	230	228	236	242	244	238	250	242	233	246	260					

H'ES

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT								13	29	28	27	25	26	27	23	25	21	18	19	16	12	10	10	
MED								121	121	119	119	123	120	121	119	121	117	109	107	106	105	106	109	
U Q								127	131	123	125	136	125	125	125	131	147	123	115	113	108	119	121	
L Q								109	118	115	115	119	115	115	115	117	106	105	103	103	102	101	101	

MONTHLY MEDIANS OF H'F AND H'ES

DEC.1988 135E MEAN TIME(UTC+9H) AUTOMATIC SCALING

H'F STATION YAMAGAWA LAT. 31.2N LON. 130.6E

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									30	31	30	31	31	31	31	31	31	31	29	23	15	10		
MED									245	238	238	240	266	252	258	260	246	238	260	270	268	267		
U Q									252	244	246	256	274	268	274	276	258	248	284	286	284	298		
L Q									236	230	232	232	256	246	248	248	238	234	248	262	244	246		

H'ES

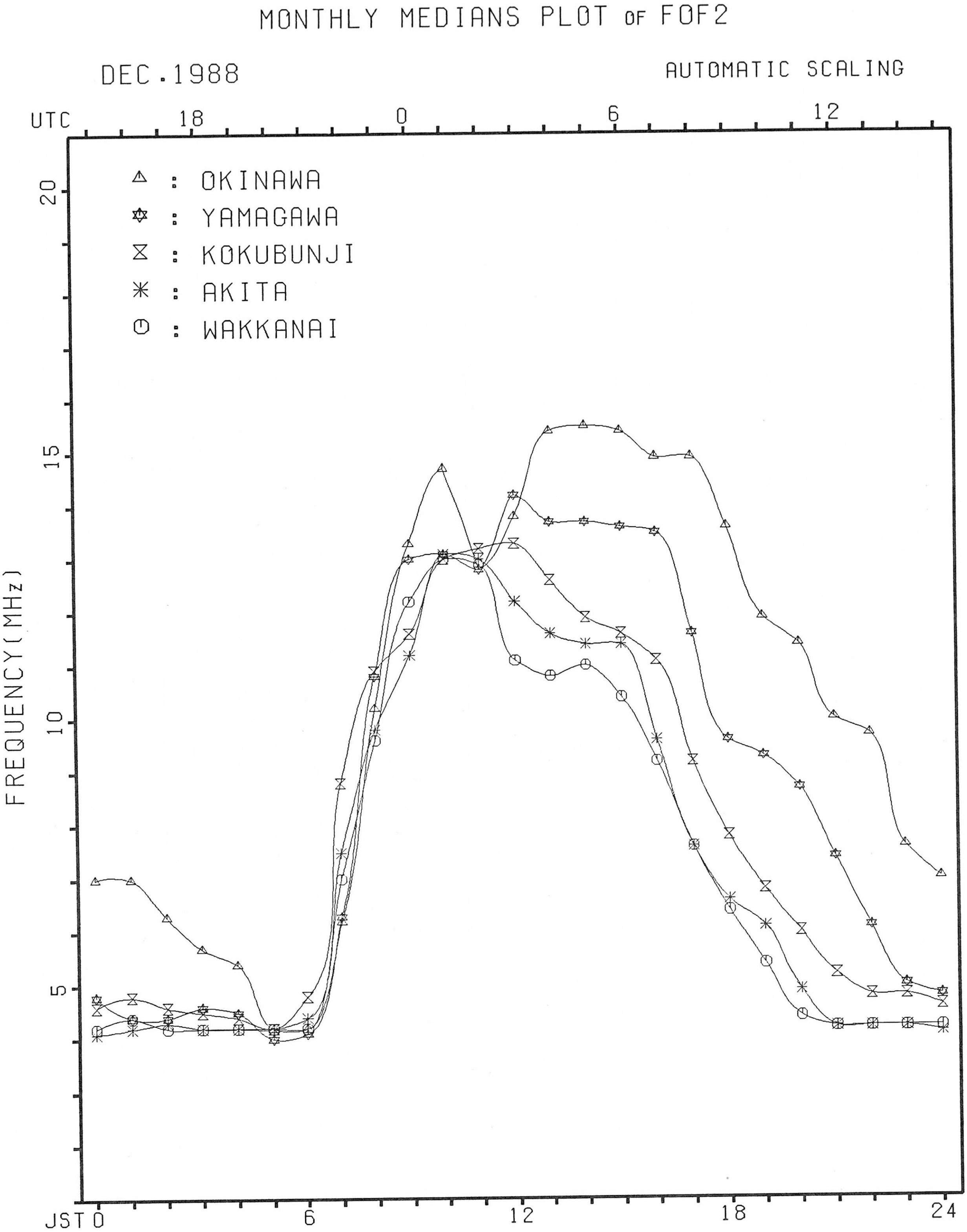
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									31	30	29	28	26	27	28	28	31	16	16	16				
MED									125	116	113	115	114	115	115	113	115	121	105	103				
U Q									161	125	119	118	119	121	118	117	119	145	110	114				
L Q									119	113	113	112	113	111	113	110	109	104	102	99				

H'F STATION OKINAWA LAT. 26.3N LON. 127.8E

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									31	31	31	31	31	31	30	31	30	31	30	29	31	29	26	
MED									260	248	248	244	280	300	296	284	280	246	244	256	266	262	261	
U Q									270	256	256	258	312	336	314	312	304	256	256	274	276	283	278	
L Q									246	242	242	238	260	270	268	266	256	238	232	241	248	246	248	

H'ES

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									29	31	31	30	31	31	29	30	31	30	18	17	10	11		
MED									125	119	115	117	115	115	113	114	113	119	102	101	101	101		
U Q									156	125	119	121	117	119	118	123	119	157	105	111	117	103		
L Q									120	115	113	113	113	111	109	111	105	105	99	99	95	99		


MONTHLY MEDIANS PLOT OF FOF2
DEC.1988
AUTOMATIC SCALING
UTC
18
0
6
12
△ : OKINAWA
✡ : YAMAGAWA
⧖ : KOKUBUNJI
✳ : AKITA
⦶ : WAKKANAI
FREQUENCY(MHz)
20
15
10
5
JST 0
6
12
18
24

IONOSPHERIC DATA

DEC. 1988 | FXI (0.1 MHZ) | 135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35° 42'.4 N, Long. 139° 29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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	120	102	60	68	60	60X	60											72X	64X	65X	55X	42X	40X	41X
2	38X	37X	40X	43	38X	38X	41X											83X	81X	67X	65X	60X	38X	36X
3	34X	35X	39X	45X	A	A	33X											76X	63X	57X	56X	45X	40X	38X
4	37X	37X	37X	38X	37X	36X	46X											C	C	C	C	C	C	C
5	C	C	C	C	C	C	C											75X	S	64X	55X	42X	43X	42X
6	41X	39X	40X	40X	40X	42X	47X											73X	65X	60X	49X	42 O X	42X	42X
7	43X	43X	42 O X	44X	41X	42X	39X											63X	68X	58X	46X	43X	37X	39X
8	40X	41X	40X	40X	40X	39X	42X											70X	76X	58X	56X	48X	39X	39X
9	41X	40X	42X	37X	35X	37X	44X											76X	62X	57X	46X	39X	42X	43X
10	42X	43X	42X	39X	38X	36X	40X											79X	64X	61X	46X	44X	42X	48X
11	49X	48X	51X	45X	45X	50X	58X											77X	62X	68X	74X	62X	51X	51X
12	47X	46X	43X	44X	42X	37X	40X											97X	71X	61X	60X	50X	47X	47X
13	47X	49X	51X	43X	44X	38X	43X											86X	34X	66X	46X	45X	42X	43X
14	43X	41X	42X	51X	39X	32X	36X											39X	87X	65X	64X	44X	43X	44X
15	37X	37X	37X	38X	38X	36X	41X											100X	80X	65X	63X	49X	52X	48X
16	41X	42X	46X	46X	44X	44X	43X											65X	59X	63X	65X	64X	48X	39X
17	37X	38X	36X	38X	40X	40X	46X											95X	73X	70X	67X	65X	57X	54X
18	49X	50X	51X	47X	39X	43X	35X											115X	86X	71X	57X	47X	46X	44X
19	47X	39X	45X	42X	37X	40X	47X											108X	92X	90X	59X	45X	46X	48X
20	40X	40X	41X	42X	42X	44X	43X											90X	72X	61X	47X	36X	39X	38X
21	43X	44	47X	43X	38X	40X	43X											87X	66X	48X	44X	44X	45X	50X
22	43X	41X	40X	40X	43X	47X	50X											85X	66X	63X	55X	50X	48 O X	44X
23	42X	43X	43X	43X	40X	38X	42X											101X	67X	56X	50X	C	C	C
24	C	C	50X	49X	46X	43X	49X											85X	77X	77X	50X	42X	43X	44X
25	44X	45X	46X	43X	39X	41X	46X											92X	67X	68X	58X	53X	55X	54X
26	63X	59X	47X	40X	41X	42X	47X											90X	70X	80X	65X	50X	48X	44X
27	48X	42X	43X	40X	43X	40X	43X											147X	135X	126X	104X	52X	49X	46X
28	44X	44X	40X	38X	35X	40X	46X											81X	67X	70X	56X	39X	42X	44X
29	42X	41X	38X	32X	32X	31X	46 O X											91X	74X	64X	58X	55X	42X	44X
30	46X	43X	43X	44X	38X	39X	45X											96X	75X	76 O X	56X	45X	42X	51X
31	46X	32X	34X	35X	35X	37X	39X											91X	68X	76X	51X	45X	42X	39X
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	29	29	30	30	29	29	30											30	29	30	30	29	29	29
MED	43X	42X	42X	42X	40X	40X	43X											86X	70X	65X	56X	45X	43X	44X
UQ	47X	44X	46X	44X	42X	42X	46X											95X	77X	70X	63X	50X	48X	48X
LQ	41X	39X	40X	39X	38X	37X	41X											76X	66X	61X	50X	43X	42X	41X

DEC. 1988 | FXI (0.1 MHZ)

IONOSPHERIC DATA

DEC. 1988 | FOF2 (0.1 MHZ)

135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N , Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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	80	54	F 33	F 39	F	J R 54	36	80	109	119	117	113	118	104	101	102	91	66	58	59	49	36	34	35
2	32	31	34	F 35	32	32	35	77	90	R 106	108	113	113	114	116	98	89	77	75	61	59	54	32	30
3	28	29	33	39	A	A	27	68	98	121	110	105	103	102	102	91	82	70	57	51	50	39	34	32
4	31	31	31	32	31	30	40	31	97	114	130	132	143	137	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	110	107	92	94	95	73	69	I S 69	58	49	36	37	36
6	35	33	34	34	34	36	41	79	82	94	107	121	115	117	103	103	93	67	59	54	43	S 36	36	36
7	37	37	S 36	38	35	36	33	68	87	93	107	93	97	96	J R 101	92	80	57	62	52	40	37	31	33
8	34	35	34	34	34	33	36	70	97	95	105	106	102	107	101	93	87	64	70	52	50	42	33	33
9	35	34	36	31	29	31	38	75	96	117	127	118	124	119	110	89	81	70	56	51	40	33	36	37
10	36	37	36	33	32	30	34	77	102	106	111	113	122	112	105	96	82	73	58	55	40	38	36	42
11	43	42	45	39	39	44	52	89	118	124	128	129	122	124	103	96	92	71	56	62	68	56	Z 45	45
12	41	40	37	38	36	31	34	70	101	120	143	114	99	107	94	90	91	91	65	55	54	44	41	41
13	41	43	45	37	38	32	37	74	104	119	132	123	121	108	108	107	94	80	78	60	40	39	36	37
14	37	35	36	45	33	26	30	67	119	120	109	117	117	113	112	114	101	83	81	59	58	38	37	33
15	31	31	31	32	32	30	35	72	119	111	116	124	129	118	115	114	103	94	74	59	57	43	46	42
16	35	36	40	40	38	38	37	72	103	106	112	132	119	105	104	109	108	59	53	57	50	58	42	33
17	31	32	30	32	34	34	40	77	101	134	129	132	126	123	117	103	108	89	67	64	61	59	51	48
18	43	44	45	41	33	37	29	69	115	105	122	139	125	125	135	127	122	109	80	65	51	41	40	38
19	41	33	39	36	31	34	41	83	107	123	139	129	135	129	118	119	118	102	86	84	53	39	40	42
20	34	34	35	36	36	33	37	67	89	109	125	124	128	121	110	111	92	84	66	55	41	30	33	32
21	37	F 36	41	37	32	34	37	79	97	110	119	133	137	131	116	113	103	81	60	42	38	38	39	44
22	37	35	34	34	37	41	44	76	107	109	117	132	133	115	115	131	105	79	60	57	49	44	S 42	38
23	36	37	37	37	34	32	36	68	95	110	144	127	122	121	117	121	106	S 95	61	50	44	C	C	C
24	C	C	44	43	40	37	43	74	94	102	117	131	130	J R 117	103	118	97	79	71	71	44	36	37	38
25	38	39	40	37	33	35	40	R 75	111	103	121	113	112	112	113	117	111	86	61	62	52	V 47	49	48
26	57	53	41	34	35	36	41	68	106	123	143	125	125	118	117	122	103	84	64	74	59	44	42	38
27	42	36	37	34	37	34	37	77	135	150	158	148	147	143	150	R 161	159	141	129	120	98	46	43	40
28	38	38	34	32	29	34	40	62	94	106	121	123	130	119	110	128	113	75	61	64	50	33	36	33
29	36	35	32	26	26	25	U S 40	65	78	98	125	H 123	136	126	112	114	106	85	68	58	52	49	36	33
30	40	37	37	38	32	33	39	71	90	H 86	H 131	132	127	117	123	128	112	90	69	S 70	H 50	39	36	45
31	40	26	V 28	29	29	31	33	68	89	93	110	136	125	103	103	118	122	85	62	70	45	39	36	33
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	29	29	30	30	28	29	30	30	30	30	30	31	31	31	30	30	30	30	30	30	30	29	29	29
MED	37	36	36	36	34	34	37	73	100	110	121	124	124	117	113	112	102	80	64	59	50	39	37	38
UQ	41	38	40	38	36	36	40	77	107	120	130	132	130	122	116	119	108	89	71	64	57	44	42	42
LQ	35	33	34	33	32	31	35	68	94	103	111	114	116	108	103	98	91	70	60	55	44	37	36	35

DEC. 1988 | FOF2 (0.1 MHZ)

IONOSPHERIC DATA

DEC. 1988 | FOF1 (0.01 MHZ) | 135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N, Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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													A	A										
2									L	L		L		L	L									
3										L	L	L		L										
4										L	L	L	L		C	C	C							
5								C	C	C	C	L	L	L										
6												L	L		L	A								
7										L	L		L	L	L									
8											L	L			L									
9										L	L	L	L	L	L									
10										L	L	L	L	L										
11										L	L	L	L	L	L									
12											L													
13									UL 410		L	L	L		L									
14												L	L		L									
15												L	L	L										
16												L	L		L									
17												L	L											
18													L	L	L									
19											L		L											
20											L	L	L			L								
21										L		L		L	L									
22												L	L	L	L	L								
23											L													
24											L 490	L	L	L	L									
25											L		L	L	L	L								
26											L	L	L	L	L									
27											L	L	L	L	L	L								
28												L	L	L										
29											L	L	L	L	L									
30											L	L	L	L	L	L								
31										L	L	L	L	L	L	L								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									1		1													
MED									UL 410		L 490													
UQ																								
LQ																								

IONOSPHERIC DATA

DEC. 1988 | FOE (0.01 MHZ)

135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35° 42'.4 N, Long. 139° 29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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								195	265	315	335	350	345	B	A	255	195							
2								185	280	315	345	350	350	335	A	A	210							
3								A	A	310	330	345	340	325	285	265	185							
4								185	270	305	335	340	345	330	C	C	C							
5								C	C	C	C	U A 340	340	340	320	275	205							
6								180	270	310	330	350	350	330	310	A	A							
7								170	A	310	340	350	355	340	315	260	205							
8								185	275	320	345	360	360	360	325	265	A							
9								165	U A 275	315	340	350	360	A	315	250	H 200							
10								A	270	300	345	355	350	345	325	260	A							
11								190	275	320	340	355	360	355	325	275	A							
12								190	270	320	A	U A 350	U A 350	A	R 325	255	175							
13								195	270	310	335	350	350	345	315	S	A							
14								195	H 260	315	A	A	A	A	A	295	210							
15								185	250	310	355	360	360	345	325	295	190							
16								B	275	315	350	B	U S 370	360	330	280	220							
17								B	265	320	B	360	360	345	325	290	200							
18								B	260	310	335	355	360	350	325	275	215							
19								185	A	A	355	370	A	365	335	295	210							
20								185	280	325	350	365	370	355	325	300	220							
21								H 180	275	325	345	365	365	355	325	295	A							
22								B	A	320	350	360	A	355	320	235	A							
23								160	270	R	A	360	360	355	325	290	205							
24								B	A	320	345	355	365	355	325	290	205							
25								B	260	315	345	360	365	345	320	A	A							
26								A	A	320	A	355	350	340	320	275	210							
27								A	A	300	A	B	355	345	320	B	A							
28								B	250	310	355	355	A	A	A	A	A							
29								B	255	A	A	A	R	335	B	B	240							
30								195	B	B	335	B	B	325	B	235	A							
31								180	S	315	A	A	A	345	325	235	B							
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT								18	21	26	22	25	24	26	24	23	18							
MED								185	270	315	345	355	358	345	325	280	205							
UQ								190	275	320	350	360	360	355	325	290	210							
LQ								180	260	310	335	350	350	340	320	265	200							

DEC. 1988 | FOE (0.01 MHZ)

IONOSPHERIC DATA

DEC. 1988 | FOES (0.1 MHZ) | 135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N, Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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	22JA	24JA	18	20	15EB	18JA	14EB	G	G	41	47JA	55JA	65JA	88JA	42JA	G	G	13EB	14EB	19JA	23	15EB	15EB	19JA
2	21JA	20	49JA	22JA	17JA	13EB	16EB	G	20G	36	39JA	40	51JA	40	34	29	22	15EB	25JA	13EB	15EB	15JA	15EB	15EB
3	19	14JA	19	61JA	78JA	48JA	30JA	29JA	53JA	34	G	37	36	38	34	31	29	25JA	29JA	23JA	21	22	14EB	15EB
4	14EB	16EB	22	19JA	47JA	28	31JA	G	G	41JA	34	28G	67JA	46JA	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	41	31G	39	45JA	38	37JA	32JA	26JA	29JA	29JA	24JA	25JA	20JA
6	15EB	13EB	15EB	15EB	20JA	18JA	24JA	20JA	G	G	35	39	39	46JA	41	53JA	54JA	52JA	38JA	23JA	14EB	18ES	20	14EB
7	14EB	13EB	18ES	17	18	18	17JA	25JA	29JA	36JA	G	37	G	G	46JA	35	27	41JA	22JA	14EB	14EB	14EB	19	15EB
8	15EB	15EB	13EB	14EB	13EB	13EB	20JA	G	G	41JA	G	39	41	46	G	36	42JA	26JA	27JA	20JA	18JA	20JA	14EB	17ES
9	15EB	15EB	13EB	18	21	15EB	15EB	G	28	G	35	37	46JA	48JA	36	31JA	G	26	23JA	24JA	14EB	15EB	14EB	15EB
10	26JA	15EB	13EB	23JA	13EB	15EB	20JA	42JA	G	G	52JA	37	43	43	41JA	33	22	15EB	15EB	24JA	15EB	23JA	15EB	16EB
11	15EB	22JA	22JA	16JA	14EB	15EB	14EB	G	G	G	33G	27G	G	39	37	31	28	30JA	17EB	13EB	22JA	13EB	51JA	15EB
12	15EB	14EB	14EB	15EB	15EB	16JA	18	21JA	27G	G	36	38	38	36	30G	23G	G	22JA	20JA	22	16EB	25JA	22JA	17JA
13	14EB	14EB	20	15EB	18JA	13EB	14EB	G	G	G	G	38	G	G	23G	25	40JA	35JA	24JA	14EB	18	15EB	19	15EB
14	14EB	15EB	15EB	25	27	19	13EB	21JA	G	G	37	38	41	39	36	28G	G	14EB	17	28JA	23JA	15EB	28JA	30JA
15	34JA	25JA	17EB	15EB	16EB	13EB	15EB	22JA	G	33	G	G	G	G	G	G	30JA	17	15EB	13EB	14EB	15EB	16EB	14EB
16	15EB	16EB	14EB	14EB	14EB	13EB	15EB	20JA	G	G	G	39EB	G	G	G	G	G	15EB	16EB	16EB	14EB	16EB	14EB	15EB
17	14EB	16EB	16EB	15EB	22JA	15EB	15EB	14EB	G	G	38EB	G	G	G	G	41JA	25JA	21JA	47JA	20	19JA	15EB	15EB	15EB
18	14EB	14EB	13EB	20	14EB	19JA	19	16EB	G	38JA	35	G	39	G	G	32	26	19	16	30JA	16EB	24JA	24JA	21
19	42JA	39JA	27JA	24JA	19	17ES	15EB	G	34JA	40JA	39JA	36G	53JA	G	G	G	G	19JA	21JA	22	15EB	14EB	14EB	15EB
20	15EB	13EB	19ES	13EB	14EB	14EB	15EB	25JA	G	G	38	G	G	G	G	34	22	14EB	14EB	13EB	14EB	30JA	31JA	40JA
21	35JA	19JA	41JA	13EB	24JA	13EB	14EB	21JA	51JA	G	G	38	G	G	27G	G	25	29JA	21JA	29JA	31JA	19	14EB	15EB
22	14EB	15EB	14EB	14EB	13EB	15EB	14EB	16EB	28	G	G	G	47JA	G	G	G	27JA	51JA	41JA	33JA	22JA	13EB	19	18ES
23	15EB	13EB	14EB	14EB	13EB	16EB	14EB	G	G	32G	41JA	25G	G	28G	G	G	21JA	21JA	23JA	23JA	26JA	C	C	C
24	C	C	13EB	14EB	14EB	18	16JA	19JA	31JA	30G	27G	35G	G	G	34	G	24	15EB	14EB	19	14EB	15EB	15EB	16EB
25	16EB	14EB	15EB	23	13EB	14EB	17EB	21JA	30JA	G	G	G	G	25G	30G	36JA	27	15EB	24JA	39JA	31JA	33JA	55JA	24JA
26	26JA	29JA	26JA	13EB	13EB	15EB	24	24JA	30	29G	52JA	G	39JA	G	G	G	G	25JA	22JA	14ES	14EB	14EB	23JA	15EB
27	20	16EB	14EB	22	13EB	15EB	15EB	25JA	54JA	37JA	36	38EB	G	G	G	35	31JA	27JA	29JA	52JA	28JA	18EB	25	16EB
28	25JA	23JA	18JA	14EB	14EB	14EB	14EB	16EB	G	29G	G	29G	39JA	44JA	50JA	42JA	27	30JA	41JA	19ES	14EB	26JA	26JA	19
29	14EB	15EB	13EB	16EB	20JA	14EB	15EB	16EB	42JA	58JA	49JA	41JA	30G	27G	34EB	29EB	25	29JA	23JA	26JA	14EB	15EB	16EB	16EB
30	40JA	45JA	16ES	31JA	15EB	13EB	13EB	G	27EB	29EB	G	38EB	35EB	32G	33EB	G	22	14EB	15EB	17EB	15EB	14EB	15EB	16EB
31	15EB	15EB	14EB	14EB	15EB	16EB	15EB	G	26	35	36	35	37	G	G	G	35EB	22	14EB	14EB	15EB	14EB	15JA	17EB
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	29	29	30	30	30	30	30	30	30	30	30	31	31	31	30	30	30	30	30	30	30	29	29	29
MED	15EB	15EB	16EB	16EB	15EB	15EB	15EB	16	20EG	29G	34	36	36	27G	28UG	29	25	22JA	22JA	21	16EB	15EB	16	16EB
UQ	22JA	20JA	19	22	20JA	18	18	21JA	30JA	36	38	38	41	40	36	35	28JA	29JA	26JA	26JA	22JA	22JA	24JA	18
LQ	14EB	14EB	14EB	14EB	14EB	14EB	14EB	G	G	G	G	26G	G	G	G	G	21	15EB	16EB	14EB	14EB	15EB	15EB	15EB

DEC. 1988 | FOES (0.1 MHZ)

IONOSPHERIC DATA

DEC. 1988 | FBES (0.1 MHZ) | 135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N, Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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	EB 14	17	EB 14	EB 14	EB 15	EB 14	EB 14	G	G	37	42	44	55	61	42	G	G	EB 13	EB 14	19	16	EB 15	EB 15	EB 13
2	EB 14	EB 14	EB 14	EB 14	EB 15	EB 13	EB 16	G	G 19	G	G	38	40	38	33	28	G 19	EB 15	EB 15	EB 13	EB 15	EB 13	EB 15	EB 15
3	EB 15	EB 14	EB 14	30	AA 78	AA 43	17	27	35	32	G	36	36	37	34	30	28	EB 14	EB 14	16	EB 13	16	EB 14	EB 15
4	EB 14	EB 16	17	EB 14	15	18	20	G	G	G	G	G 24	38	39	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	37	G 31	37	37	34	25	22	EB 17	19	18	17	17	EB 13
6	EB 15	EB 13	EB 15	EB 15	EB 14	EB 15	EB 15	G 16	G	G	35	39	39	41	34	53	23	24	22	EB 15	ER 14	FS 18	EB 15	EB 14
7	EB 14	EB 13	ES 18	EB 14	EB 14	EB 14	EB 14	G 15	26	G 26	G	37	G	G	39	32	G 18	20	17	EB 14	EB 14	EB 14	EB 14	EB 15
8	EB 15	EB 15	EB 13	EB 14	EB 13	EB 13	EB 14	G	G	G 20	G	39	39	41	G	32	23	17	17	EB 15	EB 14	EB 14	EB 14	ES 17
9	EB 15	EB 15	EB 13	EB 14	EB 13	EB 15	EB 15	G	G 27	G	G	37	38	37	35	28	G	EB 14	19	19	EB 14	EB 15	EB 14	EB 15
10	EB 14	EB 15	EB 13	EB 13	EB 13	EB 15	EB 15	24	G	G	G	37	38	38	38	30	22	EB 15	EB 15	EB 15	EB 15	EB 14	EB 15	EB 16
11	EB 15	15	17	EB 13	EB 14	EB 15	EB 14	G	G	G	G 29	G 26	G	39	36	30	26	21	EB 17	EB 13	EB 14	EB 13	EB 14	EB 15
12	EB 15	EB 14	EB 14	EB 15	EB 15	16	EB 15	EB 15	G	G	36	37	37	36	G 29	G 23	G	16	18	EB 15	FR 16	EB 13	EB 15	EB 15
13	EB 14	EB 14	EB 14	EB 15	EB 14	EB 13	EB 14	G	G	G	G	38	G	G	G 22	25	22	16	EB 14	EB 14	EB 14	EB 15	EB 15	EB 15
14	EB 14	EB 15	EB 15	EB 16	19	EB 14	EB 13	G	G	G	35	36	38	36	34	G 25	G	EB 14	16	EB 13	EB 13	EB 15	EB 14	22
15	19	20	EB 17	EB 15	EB 16	EB 13	EB 15	G 16	G	33	G	G	G	G	G	G	24	17	EB 15	EB 13	EB 14	EB 15	EB 16	EB 14
16	EB 15	EB 16	EB 14	EB 14	EB 14	EB 13	EB 15	EB 16	G	G	G	EB 39	G	G	G	G	G	EB 15	EB 16	EB 16	EB 14	EB 16	EB 14	EB 15
17	EB 14	EB 16	EB 16	EB 15	EB 15	EB 15	EB 15	EB 14	G	G	EB 38	G	G	G	G	G	G	16	21	EB 15	EB 14	EB 15	EB 15	EB 15
18	EB 14	EB 14	EB 13	EB 14	EB 14	EB 17	EB 15	EB 16	G	G 21	G	G	G	G	G	31	23	EB 15	15	22	EB 16	19	EB 16	EB 14
19	EB 14	19	18	18	EB 13	ES 17	EB 15	G	27	32	G 29	G 29	38	G	G	G	G	19	EB 15	EB 13	EB 15	EB 14	EB 14	EB 15
20	EB 15	EB 13	ES 19	EB 13	EB 14	EB 14	EB 15	G	G	G	37	G	G	G	G	G	19	EB 14	EB 14	EB 13	EB 14	16	EB 14	30
21	20	EB 15	16	EB 13	EB 13	EB 13	EB 14	G 15	G 23	G	G	38	G	G	G 23	G	25	16	EB 14	EB 15	17	EB 15	EB 14	EB 15
22	EB 14	EB 15	EB 14	EB 14	EB 13	EB 15	EB 14	EB 16	28	G	G	G	40	G	G	G	23	30	16	20	EB 15	EB 13	EB 16	ES 18
23	EB 15	EB 13	EB 14	EB 14	EB 13	EB 16	EB 14	G	G	G 32	37	G 24	G	G 27	G	G	G 16	EB 14	EB 14	20	18	C	C	C
24	C	C	EB 13	EB 14	EB 14	EB 14	EB 14	EB 15	27	G 26	G 26	G 25	G	G	G	G	24	EB 15	EB 14	EB 15	EB 14	EB 15	EB 15	EB 16
25	EB 16	EB 14	EB 15	EB 15	EB 13	EB 14	EB 17	EB 16	G 19	G	G	G	G	G 25	G 27	30	23	EB 15	22	21	17	16	27	17
26	16	23	16	EB 13	EB 13	EB 15	EB 15	20	28	G 27	35	G	G 30	G	G	G	G	EB 14	EB 12	ES 14	EB 14	EB 14	EB 16	EB 15
27	EB 14	EB 16	EB 14	EB 15	EB 13	EB 15	EB 15	19	28	G 27	36	EB 38	G	G	G	32	25	21	24	28	20	EB 18	17	EB 16
28	17	EB 13	EB 14	EB 14	EB 14	EB 14	EB 14	EB 16	G	G 23	G	G 28	38	37	36	30	23	EB 15	21	ES 19	EB 14	EB 15	16	EB 14
29	EB 14	EB 15	EB 13	EB 16	EB 15	EB 14	EB 15	EB 16	G 22	35	36	38	US 29	G 25	EB 34	EB 29	G 20	20	18	ES 17	EB 14	EB 15	EB 16	EB 16
30	22	16	ES 16	19	EB 15	EB 13	EB 13	G	EB 27	EB 29	G	EB 38	EB 35	G 26	EB 33	G	22	EB 14	EB 15	EB 17	EB 15	EB 14	EB 15	EB 16
31	EB 15	EB 15	EB 14	EB 14	EB 15	EB 16	EB 15	G	26	33	35	35	36	G	G	G	EB 35	17	EB 14	EB 14	EB 15	EB 14	EB 14	EB 17
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	29	29	30	30	30	30	30	30	30	30	30	31	31	31	30	30	30	30	30	30	30	29	29	29
MED	EB 15	EB 15	EB 14	EB 14	EB 14	EB 14	EB 15	EG 15	G	EG 20	G	U 32	30	G 25	G 24	24	22	16	EB 16	EB 15	EB 14	EB 15	EB 15	EB 15
UQ	EB 15	EB 16	EE 16	EB 15	EB 15	EB 15	EB 15	16	27	G 29	35	38	38	37	34	30	24	19	18	19	EB 16	EB 16	EB 16	EB 16
LQ	EB 14	EB 14	EB 14	EB 14	EB 13	EB 14	EB 14	G	G	G	G	G 24	G	G	G	G	G	EB 14	EB 14	EB 14	EB 14	EB 14	EB 14	EB 15

DEC. 1988 | FBES (0.1 MHZ)

IONOSPHERIC DATA

DEC. 1988 | FMIN (0.1 MHZ) | 135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35° 42'.4 N, Long. 139° 29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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	14	14	14	14	15	14	14	14	16	16	17	18	19	35	17	16	15	13	14	15	14	15	15	13
2	14	14	14	14	15	13	16	15	15	16	18	18	18	17	17	16	16	15	15	13	15	13	15	15
3	15	14	14	13	16	15	13	14	14	16	ES 24	18	18	17	17	15	14	14	14	13	13	14	14	15
4	14	16	14	14	13	14	13	14	14	16	17	16	17	16	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	18	16	16	15	15	15	13	17	14	14	14	14	13
6	15	13	15	15	15	15	15	14	15	17	15	18	17	18	15	15	14	16	14	15	14	ES 18	15	14
7	14	13	ES 18	14	14	14	14	13	15	15	18	18	18	18	15	17	14	13	15	14	14	14	14	15
8	15	15	13	14	13	13	14	14	17	16	20	22	21	21	24	17	15	15	14	15	14	14	14	ES 17
9	15	15	13	14	13	15	15	14	16	17	18	19	17	19	17	15	15	14	13	13	14	15	14	15
10	14	15	13	13	13	15	15	14	15	15	18	17	16	25	20	15	15	15	15	14	15	14	15	16
11	15	13	13	13	14	15	14	15	15	17	17	18	18	19	18	14	14	13	17	13	14	13	14	15
12	15	14	14	15	15	14	15	15	16	17	18	21	19	21	18	14	13	13	15	15	16	13	15	15
13	14	14	14	15	14	13	14	14	16	16	17	18	18	23	18	22	14	14	14	14	14	15	15	15
14	14	15	15	16	13	14	13	14	13	16	19	20	20	20	19	17	14	14	12	13	13	15	14	14
15	14	14	17	15	16	13	15	13	15	18	21	22	20	19	30	19	14	13	15	13	14	15	16	14
16	15	16	14	14	14	13	15	16	18	24	25	39	28	28	25	17	18	15	16	16	14	16	14	15
17	14	16	16	15	15	15	15	14	15	19	38	24	23	24	26	18	14	14	13	15	14	15	15	15
18	14	14	13	14	14	17	15	16	14	18	18	18	19	22	19	17	15	15	13	12	16	14	16	14
19	14	14	12	13	13	ES 17	15	16	17	16	24	23	21	22	19	18	16	14	15	13	15	14	14	15
20	15	13	ES 19	13	14	14	15	14	15	19	18	24	23	23	21	17	15	14	14	13	14	14	14	14
21	14	15	14	13	13	13	14	13	16	20	22	21	25	20	17	18	16	13	14	15	14	15	14	15
22	14	15	14	14	13	15	14	16	16	20	23	20	21	21	19	16	16	14	13	15	15	13	16	ES 18
23	15	13	14	14	13	16	14	15	19	23	22	19	ES 26	20	18	15	14	14	14	14	14	C	C	C
24	C	C	13	14	14	14	14	15	14	17	18	18	20	23	19	18	16	15	14	15	14	15	15	16
25	16	14	15	15	13	14	17	16	14	15	18	20	20	19	18	17	15	15	13	13	15	14	15	15
26	14	14	13	13	13	15	15	14	19	17	17	17	20	18	17	16	15	14	12	ES 14	14	14	16	15
27	14	16	14	15	13	15	15	14	15	17	24	38	25	22	23	30	15	14	13	14	16	18	15	16
28	13	13	14	14	14	14	14	16	17	20	26	20	22	20	19	16	17	15	14	ES 19	14	15	13	14
29	14	15	13	16	15	14	15	16	17	16	23	23	24	22	34	29	17	14	14	ES 17	14	15	16	16
30	14	14	ES 16	14	15	13	13	17	27	29	31	38	35	25	33	24	17	14	15	17	15	14	15	16
31	15	15	14	14	15	16	15	14	ES 25	23	25	30	32	30	23	22	35	15	14	14	15	14	14	17
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	29	29	30	30	30	30	30	30	30	30	30	31	31	31	30	30	30	30	30	30	30	29	29	29
MED	14	14	14	14	14	14	15	14	16	17	18	20	20	21	19	17	15	14	14	14	14	14	15	15
UQ	15	15	14	15	15	15	15	16	17	19	24	22	22	23	23	18	16	15	15	15	15	15	15	16
LQ	14	14	13	14	13	14	14	14	15	16	18	18	18	19	17	15	14	14	13	13	14	14	14	14

DEC. 1988 | FMIN (0.1 MHZ)

IONOSPHERIC DATA

DEC. 1988 | M(3000)F2 (0.01) | 135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N, Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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	315	325	F 250	F 260	F	J R 320	325	320	330	315	315	310	315	310	325	320	335	325	320	330	345	305	285	305
2	285	295	310	F 310	325	320	325	340	335	R 320	315	315	295	295	305	320	335	315	325	325	315	340	335	275
3	255	265	300	360	A	A	285	320	320	315	320	310	310	305	320	325	330	335	325	315	315	325	315	295
4	300	285	280	290	280	275	305	335	320	300	305	305	305	295	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	315	320	320	305	325	350	325	I S 335	345	340	340	300	305
6	300	295	280	285	300	295	300	330	345	315	300	295	290	300	305	315	335	315	330	335	325	S 300	305	300
7	290	295	S 305	300	325	315	325	325	340	320	320	315	310	305		320	335	340	325	335	335	330	285	280
8	290	290	290	290	315	315	320	325	335	320	310	315	310	310	305	315	320	340	325	340	320	320	295	295
9	290	295	310	320	320	295	315	320	320	315	315	295	305	290	305	340	320	315	325	330	320	320	300	290
10	295	300	305	300	320	300	290	320	325	315	305	285	300	300	310	320	325	330	330	325	350	295	275	280
11	285	235	300	285	280	285	290	310	315	310	305	305	295	305	315	315	330	315	260	305	310	315	Z 300	285
12	295	290	285	285	340	295	295	310	315	300	300	315	305	295	325	320	300	310	320	305	315	315	295	270
13	290	295	310	310	320	290	295	320	315	310	310	300	295	305	290	305	325	310	320	335	335	310	305	285
14	280	275	270	305	340	285	295	310	315	325	310	295	300	310	295	305	315	305	325	325	335	335	300	315
15	320	275	275	285	315	300	315	320	325	320	305	285	300	295	295	290	310	295	320	325	325	305	305	320
16	320	300	290	295	325	310	320	325	320	315	305	300	305	300	285	290	300	350	340	300	315	315	330	290
17	295	255	250	265	265	270	330	330	310	315	290	290	290	290	295	295	305	310	305	320	315	310	305	275
18	315	280	295	305	305	310	285	320	325	300	285	300	270	275	285	285	295	305	315	330	330	315	315	295
19	305	330	290	310	310	280	305	340	325	320	295	305	285	290	285	295	290	310	305	325	325	305	290	315
20	320	285	275	290	295	305	335	335	320	315	290	295	285	295	300	310	300	325	310	335	325	320	295	285
21	300	F 265	290	325	320	290	315	315	335	305	285	280	285	285	290	300	310	330	330	325	285	295	270	295
22	320	285	270	270	280	295	320	335	325	320	290	290	300	295	275	290	320	315	315	320	305	300	S 295	320
23	295	280	290	300	330	285	320	325	325	295	300	285	285	280	280	300	300	S 325	335	325	340	C	C	C
24	C	C	305	320	320	285	310	320	335	305	305	270	300	J R 315	270	305	335	315	320	350	335	305	280	285
25	285	280	295	330	315	280	305	R 330	335	325	315	300	315	300	295	300	310	325	325	325	335	V 275	255	270
26	295	305	310	255	260	295	295	320	325	300	300	300	295	285	285	295	315	320	305	315	335	305	285	300
27	285	265	305	255	290	280	280	295	320	300	300	300	285	275	270	R 290	295	285	295	320	335	335	275	270
28	280	285	285	305	300	285	340	335	325	330	300	295	300	305	295	300	325	330	325	315	345	285	270	290
29	300	315	325	315	265	280	U S 315	350	335	315	315	H 295	305	305	290	300	305	325	320	320	325	325	315	290
30	295	305	290	310	320	295	325	335	335	H 335	H 295	315	315	300	290	305	325	320	325	S 325	H 345	315	285	305
31	345	310	V 290	285	285	295	325	335	335	285	315	315	305	325	305	290	325	320	320	335	320	335	305	290
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	29	29	30	30	28	29	30	30	30	30	30	31	31	31	29	30	30	30	30	30	30	29	29	29
MED	295	290	290	300	315	295	315	325	325	315	305	300	300	300	295	305	320	320	322	325	325	315	295	290
UQ	305	300	305	310	320	300	325	335	335	320	315	310	305	305	305	320	330	325	325	335	335	325	305	300
LQ	290	280	280	285	288	285	295	320	320	305	300	295	292	292	285	295	305	310	315	320	315	305	285	285

DEC. 1988 | M(3000)F2 (0.01)

IONOSPHERIC DATA

DEC. 1988 M(3000)F1 (0.01)

135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35° 42'.4 N , Long. 139° 29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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													A	A										
2									L	L		L		L	L									
3										L	L	L		L										
4										L	L	L	L		C	C	C							
5								C	C	C	C	L	L	L										
6												L	L		L	A								
7										L	L		L	L										
8											L	L			L									
9										L	L	L	L	L	L									
10										L	L	L	L	L										
11										L	L	L	L	L	L									
12											L													
13									U L 390		L	L	L		L									
14												L	L		L									
15												L	L	L										
16												L	L		L									
17												L	L											
18													L	L	L									
19											L		L											
20											L	L	L			L								
21										L		L		L	L									
22												L	L	L	L	L								
23											L													
24											L 380	L	L	L	L									
25											L		L	L	L	L								
26											L	L	L	L	L									
27											L	L	L	L	L	L								
28												L	L	L										
29											L	L	L	L	L									
30											L	L	L	L	L	L								
31										L	L	L	L	L	L	L								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									1		1													
MED									U L 390		L 380													
UQ																								
LQ																								

DEC. 1988 M(3000)F1 (0.01)

IONOSPHERIC DATA

DEC. 1988 | H'F2 (KM)

135°E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N, Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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													260	265EA										
2									220	245L		240		260	255									
3										245	230	245L		265L										
4										265L	245	240	260		C	C	C							
5								C	C	C	C	235	255	255										
6												275	265L		265	260A								
7										240	240		250	265	280									
8											240	250			255									
9										265	235	250	240	265H	260									
10										240	260	290L	270	240										
11										240	260	270	265	270	245									
12											260													
13									235		255	240	255		290									
14												270	260		275L									
15												285L	270	285L										
16												270	260		300L									
17												245H	255											
18													305L	310L	285									
19											260		285L											
20											265	250	295L			250								
21										250		260		265	275									
22												260	260	230H	240H	265								
23											265													
24											270	260H	265	240	355L									
25											250		245	270L	275	270L								
26											260	245	265	235	285L									
27											270	245	260H	240H	310L	270								
28												230H	270	260										
29											250	270	275	260	290L									
30											275	250	240	265	265	265								
31										300L	240	260	250	230	270	275								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT									2	9	19	24	25	20	19	7								
MED									228	245	260	250	260	261	275	265								
UQ										265L	262	270	270	265	283L	270								
LQ										240	242	245	255	240	262	262								

DEC. 1988 | H'F2 (KM)

IONOSPHERIC DATA

DEC. 1988 | H'F (KM) | 135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N, Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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	240	230	420	380	325	270	265	240	230	245	235	245	A	A	240 A	230 H	215	200	230	235	215	270	310	275
2	310	315	295	285	260	260	255	230	225	215 H	230	220	235	230	230	225	220	220	225	225	235	210	240	380
3	420	390	310	245 EA	A	A	340	255	240	230	215	230	240	230	235	225	230	215	235	250	255	240	265	310
4	300	335	345	310	355	380 A	390	225	230	225	230	215	225	235 H	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	220	175 H	235	230	235	210	230	235	230	225	235	290	290
6	295	305	340	320	305	310	280	225	220	215 H	225	235	235	245	235	A	230	240	230 A	220	235	310	300	290
7	300	305	310	285	255	265	250	235	220	230	230	235	215	215 H		240	220	220	240	220	220	235	320	340
8	320	315	325	325	275	265	260	245	235	230	215	235	235	240	235	240	235	210	225	205	245	250	305	320
9	320	310	275	275	290	310	275	245	235	210 H	225	235	240	225	230	225	220	210	225	215	240 H	255	285	310
10	295	290	285	295	270	300	305	255	235	230	230	235	235	250 EB	240	235	215	215	210	230	225	290	355	330
11	310	310	305	305	330	310	290	260	245	230	220 H	240 H	240 H	230	235	235	230	210	230	250	250	245	265	290
12	295	310	325	325	230	305	305	245	235 H	240	240	245	230 H	240	230	240	240	235	255	265	250	245	300	340
13	305	300	265	270	260	285	295	255	220	210 H	205 H	225	220	230	235	230	225	230	235	210	225	270	230	310
14	325	345	355	280	250 A	345	310	260	240	220	225	225	235	230	230	240	220	215	220	225	230	235	305	300 A
15	290	380 EA	385	345	285	320	270	245	240	225	240	235	230	230	240	235	220	225	230	235	230	270	230	250
16	255	305	305	295	255	270	260	245	245 H	225	230	240	245	245	235	245	245	200	225	275	250	240	230	310
17	305	400	415	380	360	365	250	245	235	245	235	240	240	235	245	235	255	215	245 A	235	255	240	250	310
18	255	310	280	280	275	300	340	260	215	220	235 H	245	230	230	245	240	230	225	210	240 A	230	265	265	295
19	280	265 A	330	285	275	340	285	225	240	225	240	235	245	240	230	245	230 H	220	235	210	220	270	305	260
20	255	315	355	310	310	275	235	230	230	230	225	230	235	235	230	230	225	225	245	215	235	275	305	A
21	315	370	305	250	260	305	265	250	225	225	235	245	235	235	235	245	240	215	220	235	295	290	330	285
22	255	320	355	360	320	295	260	235	230	230	220 H	245	240	230	230	255	225	250 A	225	250	255	275	290	265
23	295	325	305	290	250	325	255	245	230	235	245	235	235	240	240	245	230	220	205	230	225	C	C	C
24	C	C	275	245	255	310	265	240	220	225	220	240	245	220	220	250	215	215	240	220	215	255	320	320
25	315	305	285	245	255	320	275	235	225	220	235	225 H	230	225	235	235	230	205	245	250	230	305	405 EA	345
26	280	265	245	375	385	300	305	245	235	235	245	230	220	225	230	240	220	215	225	245	215	250	310	275
27	315	370	275	365	310	345	335	280	245	235	240	235	230	225	230	250	230	220	250	235	210	220	340	345
28	340	325	325	290	305	325	235	220	225 H	230	230	215	240	240	235	260	225	205	240	250	220	305	355	310
29	285	275	260	310 EB	410	370	265	220	220	245	245	240	215 H	215	220	240	230	225	235	255	235	240	265	310
30	330 A	275	310	290	265	305	255	235	225	215 H	220	245	230	210 H	230	240	220	210	220	235	210	260	330	275
31	225	290	315	330	350	320	270	230	230	220	235	235	235	225	210	205 H	230	215	220	225	220 H	230	280	340 EB
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	29	29	30	30	29	29	30	30	30	30	30	31	30	30	29	29	30	30	30	30	30	29	29	28
MED	300	310	310	294	275	310	270	245	230	228	230	235	235	230	235	240	228	215	230	235	230	255	300	310
UQ	315	325	340	325	320	325	300	250	235	230	235	240	240	238	235	245	230	225	240	250	245	270	315	322
LQ	280	300	285	280	260	295	260	230	225	220	225	230	230	225	230	235	220	210	225	220	220	240	280	288

DEC. 1988 | H'F (KM)

IONOSPHERIC DATA

DEC. 1988 | H'E (KM) | 135 °E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N, Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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								140	120	120	110	120	120	B	115	115	135							
2								145 EB	125 EA	120	120	125	125 EA	120 A	115	120	170 EA							
3								A	A	110	120 S	120	120	120	120 A	130 A	125 EB							
4								130	120	120	120 EA	125 EA	120 EA	120	C	C	C							
5								C	C	C	C	A	A	135 EA	125 EA	120	130							
6								150 EA	120	120	115	120	120	115	130 A	120	A							
7								A	A	135 EA	120	115	115	115	130 EA	120	155 EA							
8								155 EB	130	120 A	120	120	120	120	130	120	A							
9								160 EB	A	120	120	120	120 EA	105	120 A	120	145							
10								A	120	115	120	115 A	115	120	125	125	A							
11								180 EB	125	120	130 EA	125	120	120	120	120	A							
12								160 EB	130	120	A	A	A	A	135 EA	A	135							
13								165 EB	120	120	115	115 EA	120	120	120 EA	120 S	A							
14								170 EB	120	120	A	120	120	120	120	140 EA	125							
15								145 EA	120	120	120	120	120	120	155 EB	120	125							
16								B	130	135 EB	125	B	125	125	130 B	125	145							
17								B	125	120	B	125	125	125	125	115	130							
18								B	120	130 EA	120	115	120	120	120	120	135 B							
19								175 EB	A	A	135 EA	135 EA	A	120	120	120	110							
20								165 EA	130	125	115	125	120	120	125	130	150 EA							
21								160 EA	160 EA	120	125	125	125	125	125 A	125	A							
22								B	A	125	125	125	115	120	120	120	A							
23								155 EB	130	115 S	A	125 A	125 S	120 EA	115	120	130 A							
24								B	A	130 EA	125 EA	130 EA	120	110	120	120	130							
25								B	130 EA	120	120	115	115	115	120 EA	A	A							
26								A	A	140 EA	A	120	130 EA	115	115	115	140							
27								A	A	140 EA	A	B	130	120	125	B	A							
28								B	130	125 EA	130	120 EA	A	A	A	A	A							
29								B	150 EA	A	A	125	A	125 EA	B	B	120							
30								170 EB	B	B	150 EB	B	B	135 EA	B	135 EB	A							
31								120	S	135	130	A	A	130 EB	130 B	125	B							
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT								17	20	27	23	25	24	28	27	25	18							
MED								160 EB	122	120	120	120	120	120	120	120	131							
UQ								165 EB	130	124	122	125	122	121	126	122	140							
LQ								145 EE	120	120	120	120	120	120	120	120	125							

DEC. 1988 | H'E (KM)

IONOSPHERIC DATA

DEC. 1988 | H'ES (KM)

135° E Mean Time (G.M.T. + 9 h)

Station KOKUBUNJI TOKYO Lat. 35°42'.4 N, Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

Day \ Hour	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	140	120	135	115	B	115	B	G	G	140	140	125	120	115	115	G	G	B	B	105	105	B	B	105
2	115	110	115	105	110	B	B	G	105	155	140	130	120	120	120	115	115	B	110	B	B	145	B	B
3	155	130	115	110	110	110	105	120	105	130	G	E G 160	140	120	115	140	120	120	105	105	135	125	B	B
4	B	B	120	115	115	110	105	G	G	125	E G 180	110	120	120	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	140	110	165	145	135	130	125	115	105	105	100	105	130
6	B	B	B	B	120	115	105	105	G	G	145	E G 180	E G 170	135	135	110	110	110	105	110	B	S	105	B
7	B	B	S	125	120	120	115	110	105	105	G	E G 170	G	G	140	115	110	110	110	B	B	B	105	B
8	B	B	B	B	B	B	105	G	G	105	G	E G 155	150	135	G	115	110	100	110	110	105	105	B	S
9	B	B	B	120	120	B	B	G	125	G	E G 160	145	130	115	120	120	G	160	135	110	B	B	B	B
10	110	B	B	105	B	B	110	105	G	G	120	E G 175	140	125	125	125	115	B	B	125	B	115	B	B
11	B	110	110	115	B	B	B	G	G	G	105	105	G	155	145	140	165	100	B	B	130	B	125	B
12	B	B	B	B	B	115	110	110	110	G	120	E G 160	155	110	115	110	G	105	105	100	B	110	100	105
13	B	B	115	B	110	B	B	G	G	G	G	E G 190	G	G	105	110	100	100	105	B	105	B	110	B
14	B	B	B	105	105	105	B	105	G	G	120	125	120	120	125	115	G	B	130	130	110	B	110	100
15	100	100	B	B	B	B	B	115	G	E G 165	G	G	G	G	G	G	145	105	B	B	B	B	B	B
16	B	B	B	B	B	B	B	120	G	G	G	B	G	G	G	G	G	B	B	B	B	B	B	B
17	B	B	B	B	105	B	B	B	G	G	B	G	G	G	G	125	125	125	115	100	105	B	B	B
18	B	B	B	110	B	105	160	B	G	115	E G 180	G	E G 155	G	G	E G 160	140	130	120	120	B	115	110	100
19	110	105	105	105	110	S	B	G	120	120	120	115	110	G	G	G	G	105	100	100	B	B	B	B
20	B	B	S	B	B	B	B	110	G	G	145	G	G	G	G	150	125	B	B	B	B	120	125	115
21	105	125	110	B	115	B	B	115	125	G	G	E G 130	G	G	110	G	100	105	130	115	105	110	B	B
22	B	B	B	B	B	B	B	B	125	G	G	G	115	G	G	G	115	105	105	105	105	B	105	S
23	B	B	B	B	B	B	B	G	G	120	115	110	G	105	G	G	105	105	110	100	100	C	C	C
24	C	C	B	B	B	115	115	110	115	115	110	110	G	G	E G 180	G	E G 165	B	B	100	B	B	B	B
25	B	B	B	100	B	B	B	115	110	G	G	G	G	105	105	100	110	B	110	105	110	105	100	105
26	105	105	100	B	B	B	120	115	115	115	110	G	105	G	G	G	G	115	105	S	B	B	120	B
27	110	B	B	105	B	B	B	115	105	110	115	B	G	G	G	115	105	105	105	110	110	B	105	B
28	105	115	105	B	B	B	B	B	G	115	G	105	110	110	105	105	105	105	100	S	B	115	110	115
29	B	B	B	B	115	B	B	B	130	110	130	125	115	110	B	B	105	105	100	110	B	B	B	B
30	105	110	S	105	B	B	B	G	B	B	G	B	B	110	B	G	125	B	B	B	B	B	B	B
31	B	B	B	B	B	B	B	G	155	135	130	125	135	G	G	G	B	110	B	B	B	B	160	B
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT	11	10	10	14	12	9	10	14	14	16	18	21	18	17	16	18	22	21	21	19	13	11	15	8
MED	110	110	112	108	112	115	110	112	115	116	122	U 120	120	120	119	115	114	105	110	105	105	115	110	105
UQ	112	120	115	115	118	115	115	115	125	130	U 138	E G 160	138	125	134	130	125	115	115	110	110	118	115	115
LQ	105	105	105	105	110	110	105	110	105	112	115	115	115	110	112	110	105	105	105	102	105	108	105	102

DEC. 1988 | H'ES (KM)

IONOSPHERIC DATA

DEC. 1988 | TYPES OF ES

135° E Mean Time (G.M.T. + 9 h)

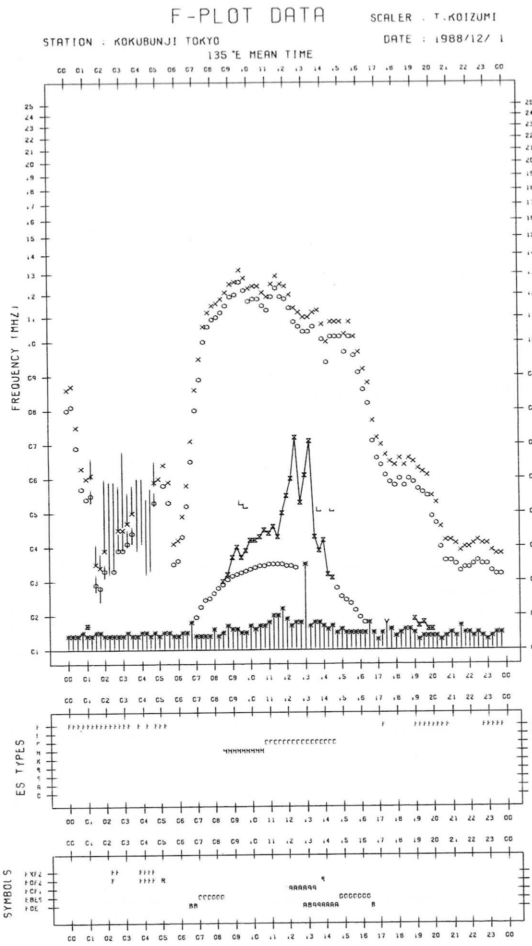
Station KOKUBUNJI TOKYO Lat. 35°42'.4 N , Long. 139°29'.3 E Sweep 1 MHz to 25 MHz in 24 sec in automatic operation

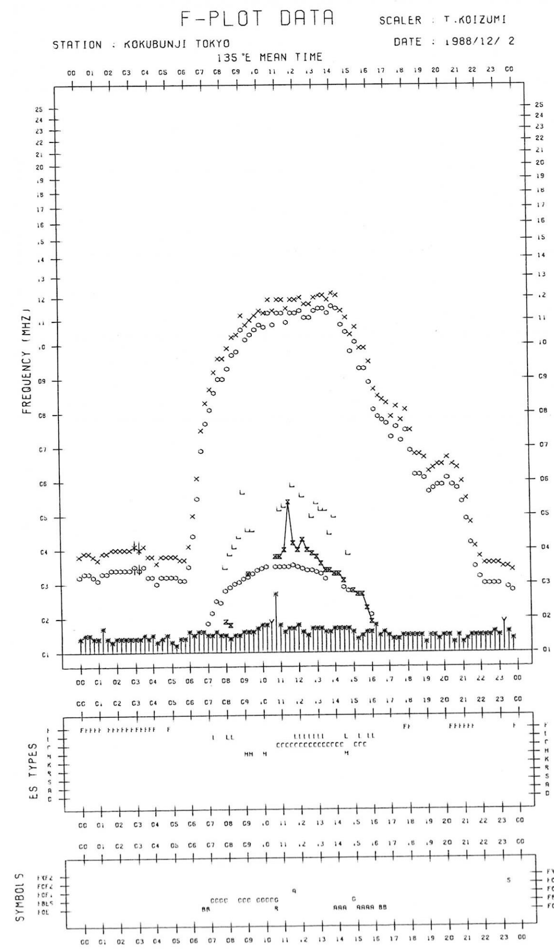
Day \ Hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	F1	F1	F1	F1		F1				H2	H2	C3	C3	C3	C2					F2	F1			F1
2	F2	F1	F1	F2	F1				L1	H1	H1	C1	CL31	CL21	C2	C2	L2		F1			F1		
3	F1	F1	F1	F5	F3	F5	F3	C4	L4	H1		H1	H1	CH21	CL21	CL22	C2	F1	F3	F2	F1	FF11		
4			F2	F2	F3	F3	F4			L1	HL11	L1	CL21	CL22										
5												HL22	L1	HL12	HL21	H3	C3	F4	F1	F3	F3	F2	F2	F1
6					F1	F1	F2	L2			H1	H1	H1	H3	HL21	C4	C2	F4	F3	F1			F1	
7				F1	F1	F1	F1	L1	L3	L2		H1			HL21	C3	L1	F2	F2				F1	
8							F1			LH21		H1	H1	H2		C3	L2	F1	F3	F1	F2	F1		
9				F1	F1				L1		H1	H1	HL11	C2	CL21	C2		FF11	FF21	F1				
10	F2			F2			F1	L3			LH11	HL11	HLC11	H1	C2	C2	L1			F1		F1		
11		F2	F2	F2							L2	L1		H1	H1	HL11	HL12	F3			F1		F1	
12						F1	F1	L1	L1		H1	HL11	HL12	L1	L2	L2		F2	F1	F2		F1	F1	F1
13			F1		F2							HL11			L1	L1	L2	F2	F1		F1		F1	
14				F1	F4	F1		L1			L1	C1	C2	C1	C1	L2			F1	F1	F2		F1	F3
15	F2	F1						L1		H1							H1	F1						
16								L1																
17					F1											L1	L1	F1	F3	F2	F1			
18				F1		F2	F1			L1	H1		H1			H1	H1	F1	F1	F3		F3	FF12	F1
19	F2	F2	F3	F2	F1				L2	L1	L1	L1	L1					F3	F2	F1				
20								L1			H1					H1	L1					F2	F1	F3
21	F3	F2	F2		F1			L1	L1			H1			L1		L2	L2	F1	F1	F2	F1		
22									L1				C1				L2	F3	F3	F3	F2		F1	
23										L1	L2	L1		L1			L1	F1	F1	F2	F2			
24						F1	F1	L1	L2	L2	L1	L1			H1		H1			F1				
25				F1				L1	L2					L2	L2	L2	L2		F2	F4	F3	F2	F4	F2
26	F2	F3	F2				F1	L1	L1	L1	L2		L2					F1	F1				F1	
27	F1			F1				L2	L3	L1	L1					L1	L1	F3	F3	F4	F1		F1	
28	F2	F1	F1							L1		L1	L1	L2	L2	L2	L1	F1	F2			F1	F2	F1
29					F1				LH11	L2	CL11	C1	L1	L1			L1	F2	F2	F1				
30	F3	F2		F2										L1			L1							
31									H1	C1	C1	C1	C1					F1					F1	
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
CNT																								
MED																								
UQ																								
LQ																								

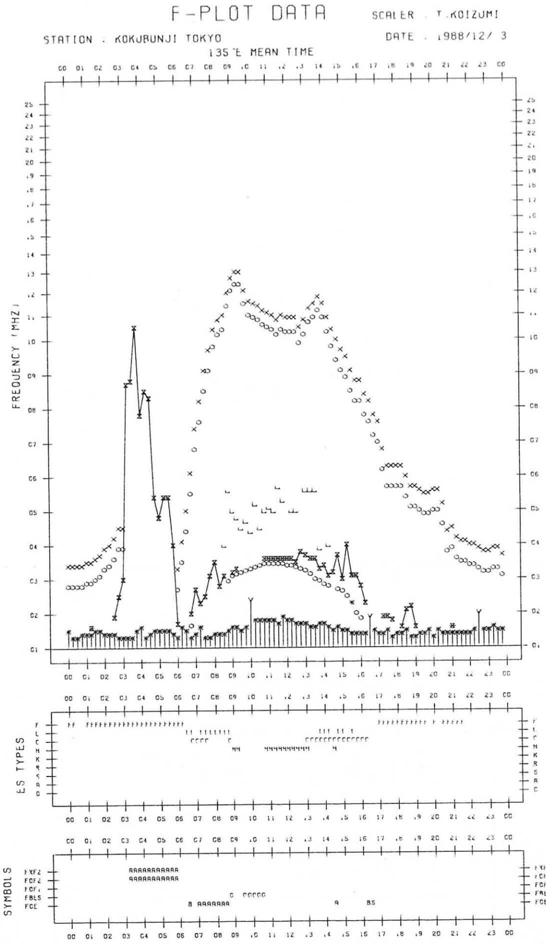
DEC. 1988 | TYPES OF ES

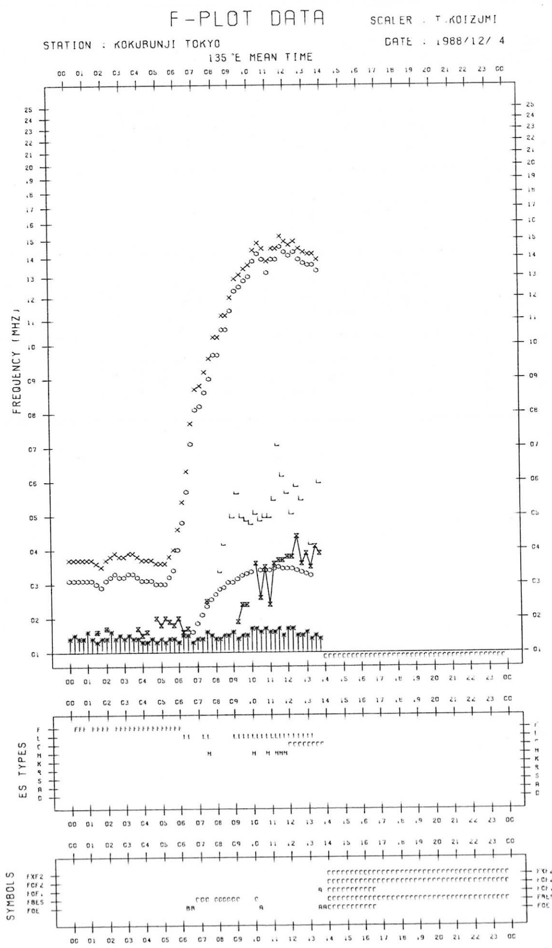
f-PLOTS OF IONOSPHERIC DATA

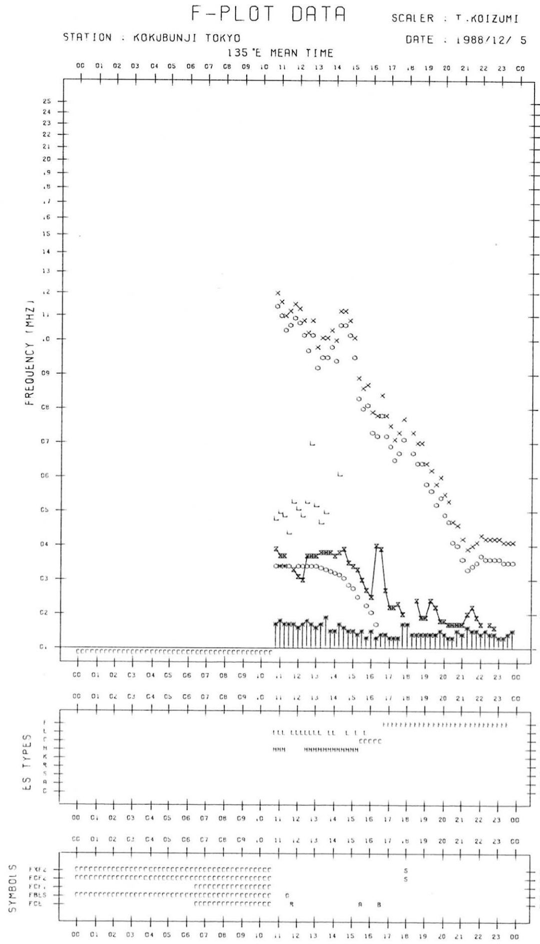
KEY OF F-PLOT	
!	SPREAD
⬡	FOF2,FOF1,FOE
×	FXF2
✳	DOUBTFUL FOF2,FOF1,FOE
⧖	FBES
∟	ESTIMATED FOF1
⍏,Y	FMIN
∧	GREATER THAN
∨	LESS THAN

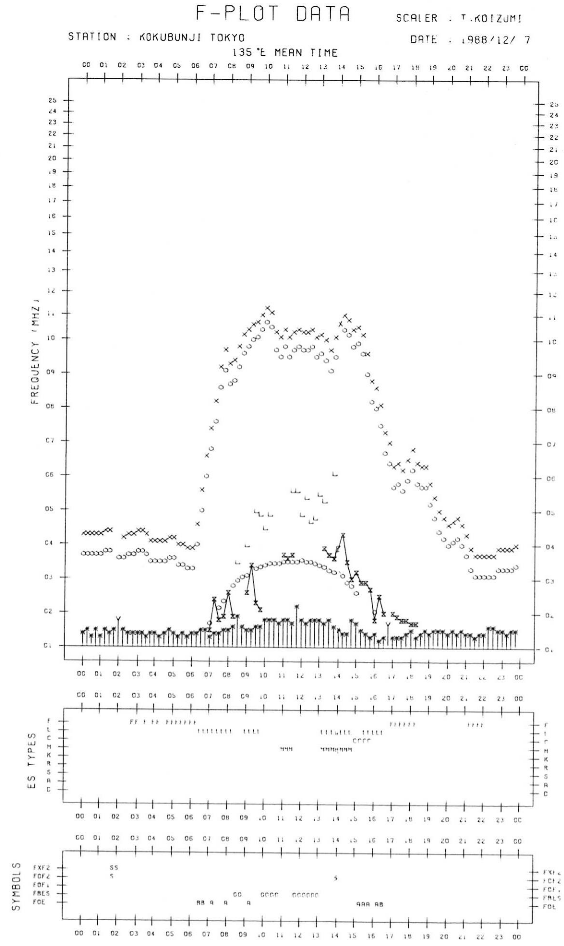

F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/ 1
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS

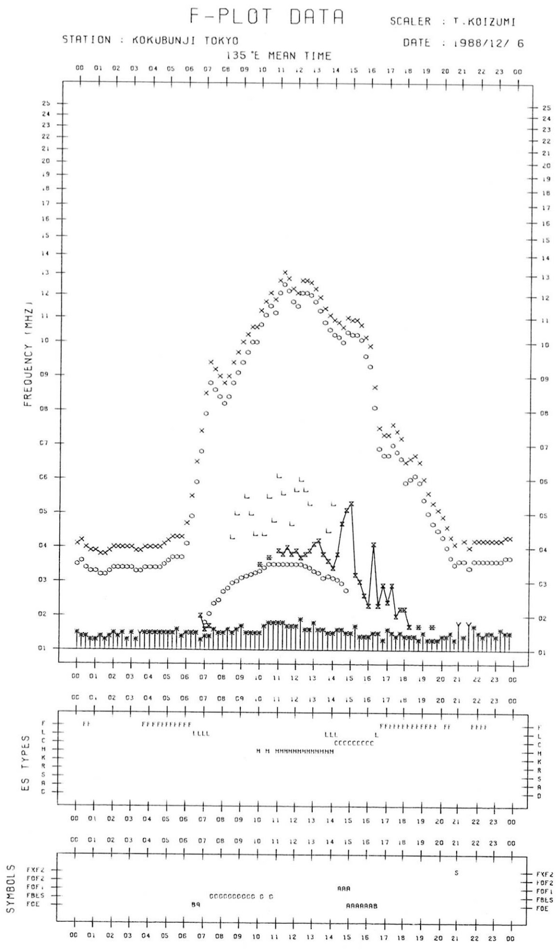

F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/ 2
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS

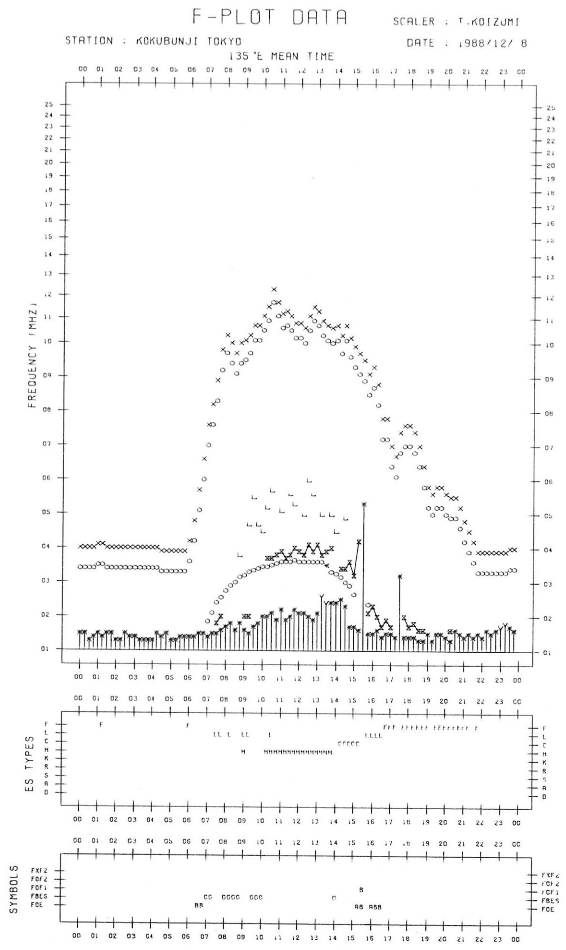

F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/ 3
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS


F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/ 4
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS


F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/ 5
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS


F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/ 7
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS

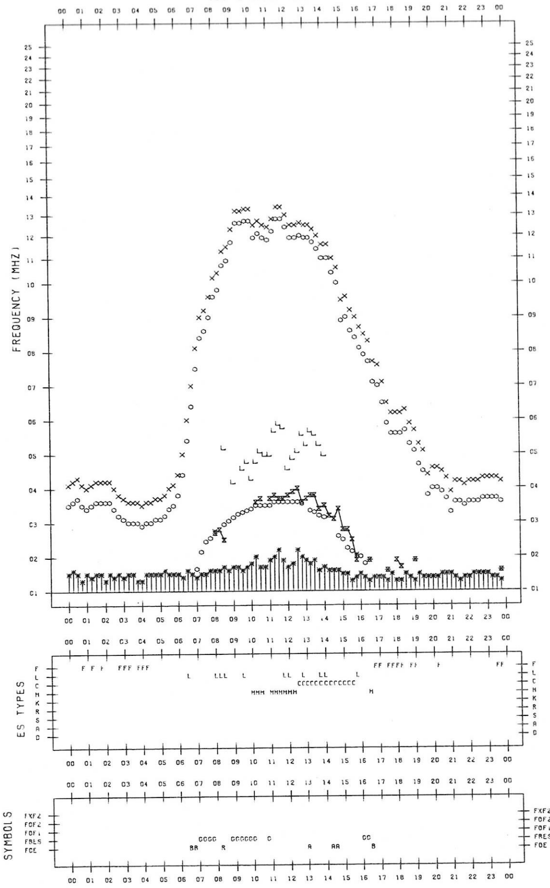

F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/ 6
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS


F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/ 8
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS

F-PLOT DATA SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO DATE : 1988/12/ 9

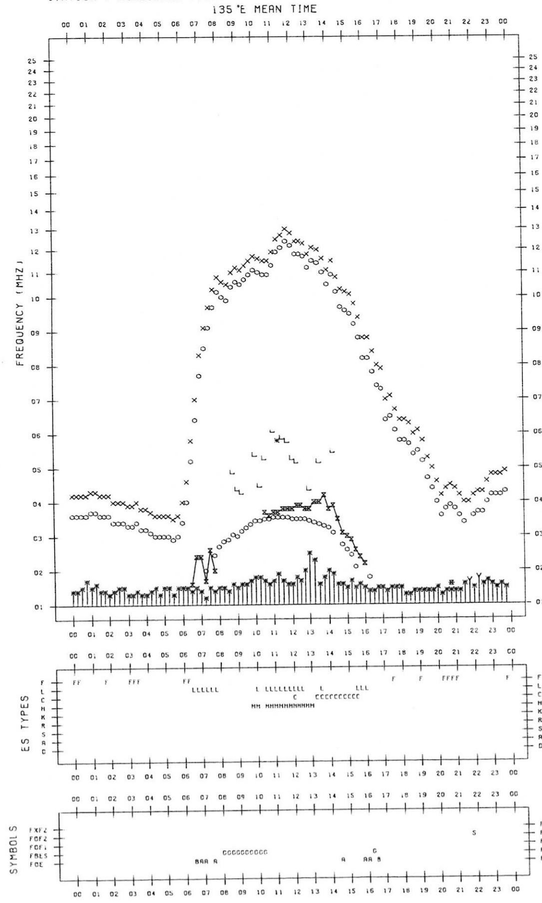
135°E MEAN TIME



F-PLOT DATA SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO DATE : 1988/12/10

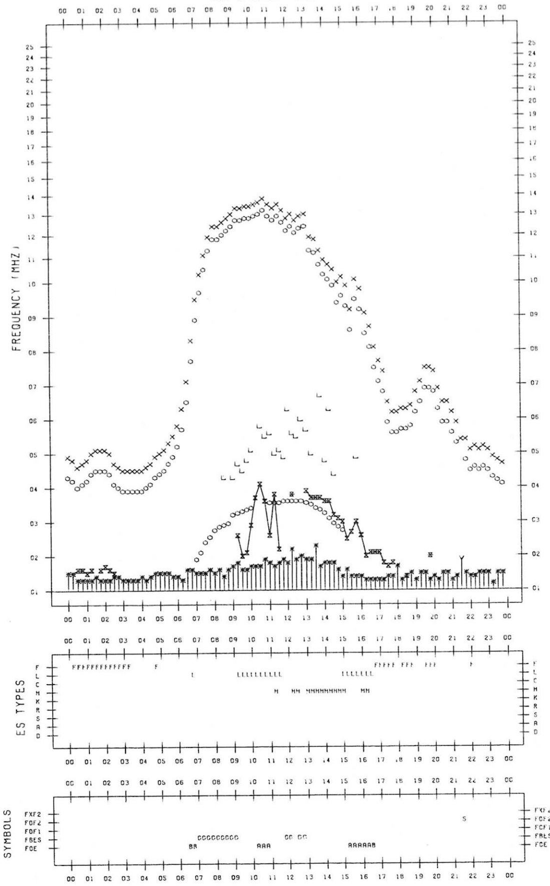
135°E MEAN TIME



F-PLOT DATA SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO DATE : 1988/12/11

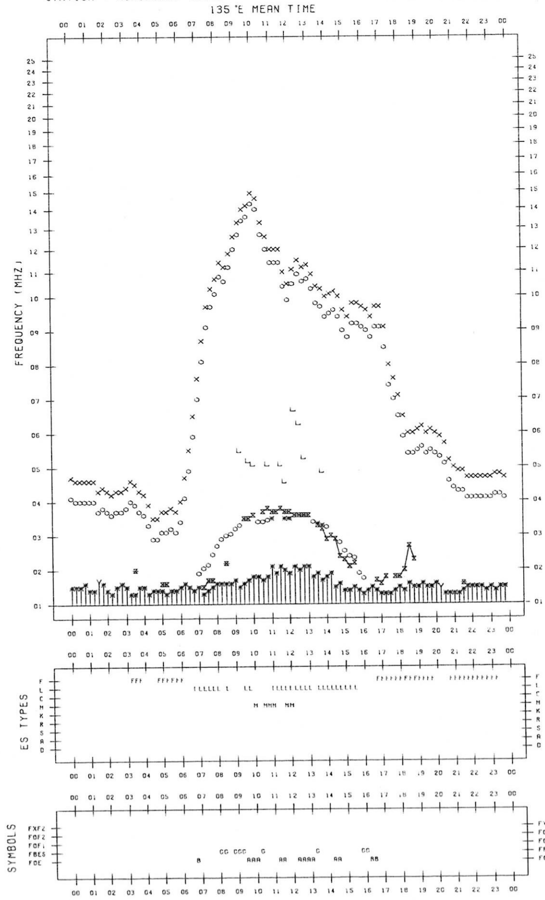
135°E MEAN TIME



F-PLOT DATA SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO DATE : 1988/12/12

135°E MEAN TIME



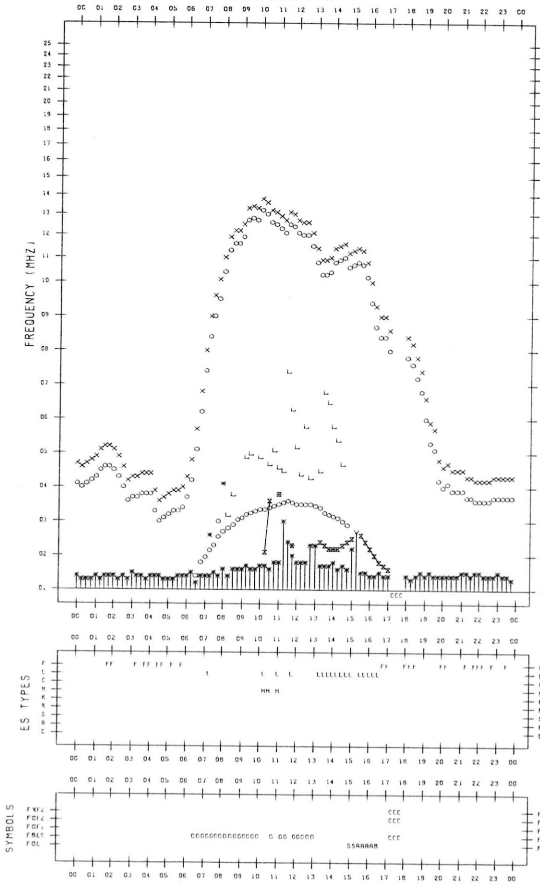
F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO

DATE : 1988/12/13

135 °E MEAN TIME



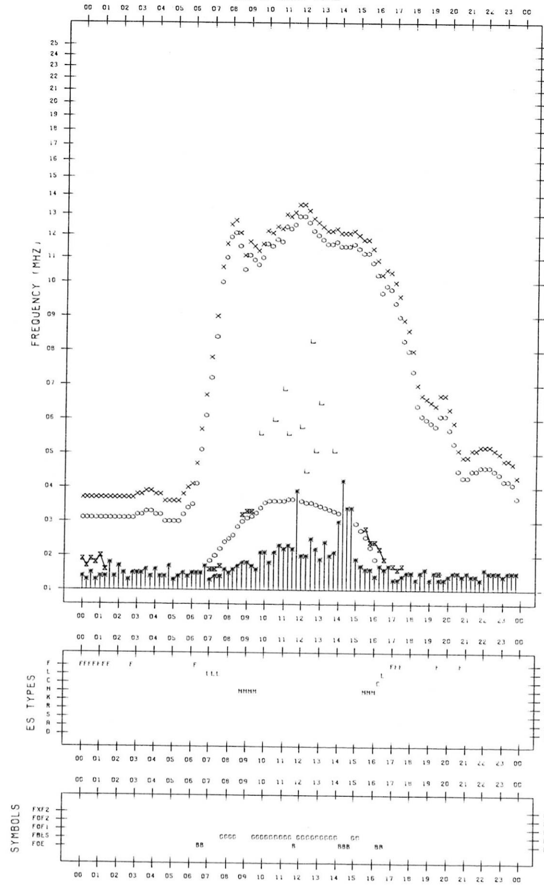
F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO

DATE : 1988/12/15

135 °E MEAN TIME



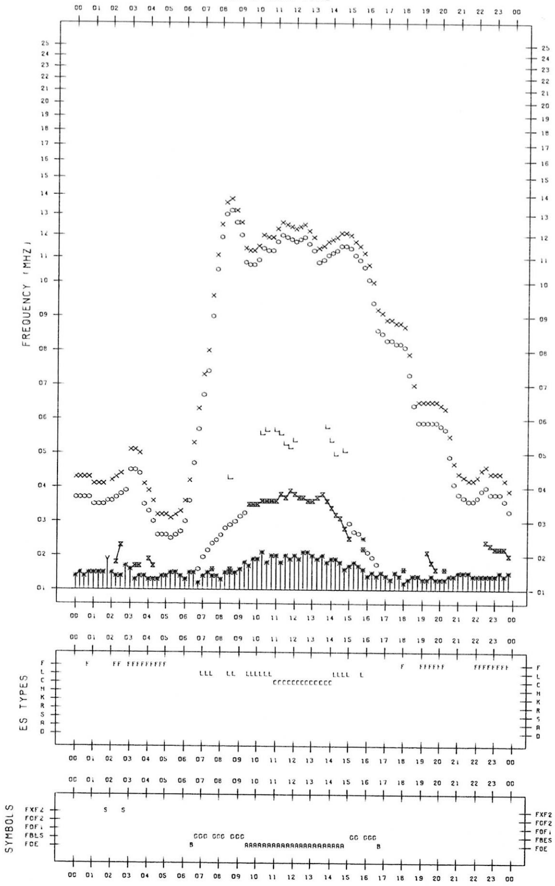
F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO

DATE : 1988/12/14

135 °E MEAN TIME



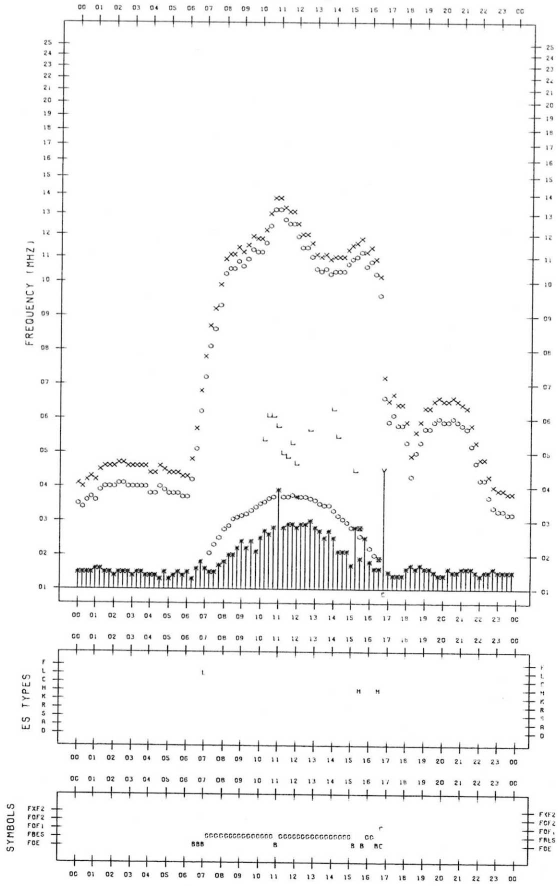
F-PLOT DATA

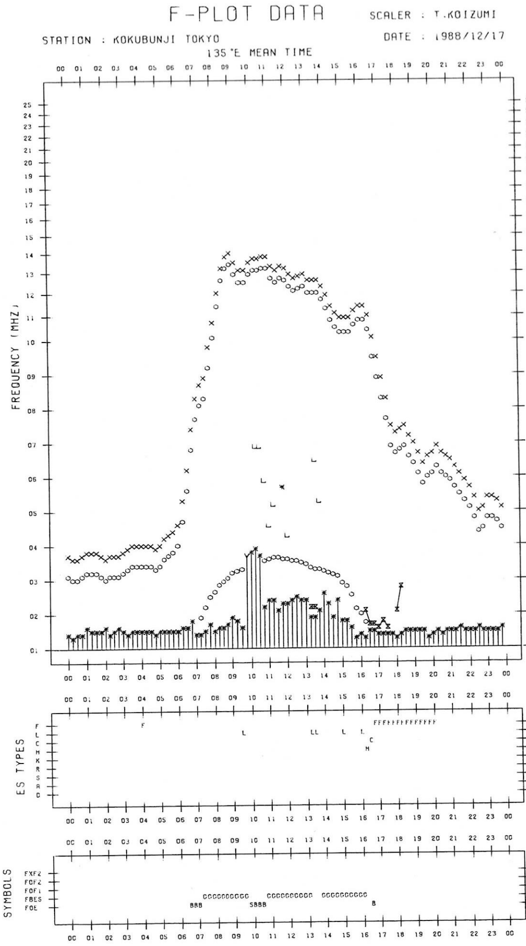
SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO

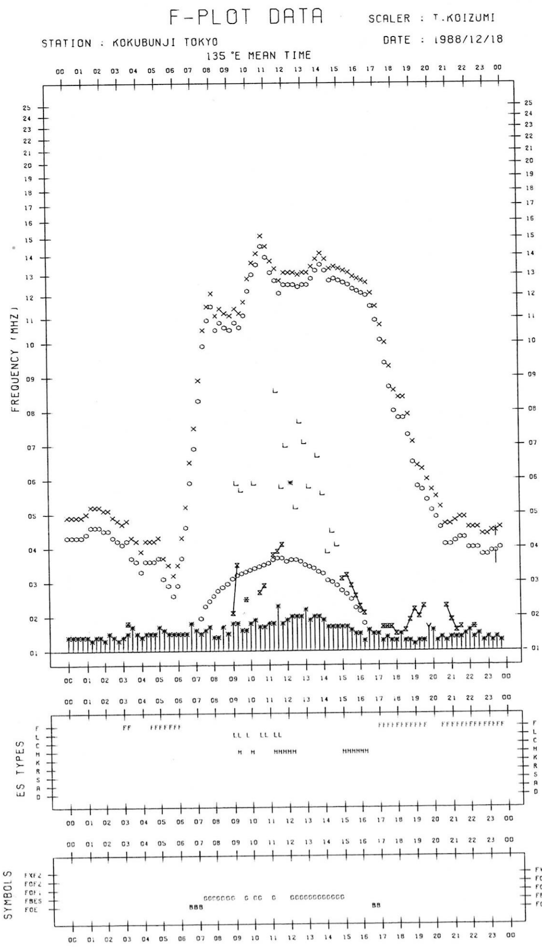
DATE : 1988/12/16

135 °E MEAN TIME

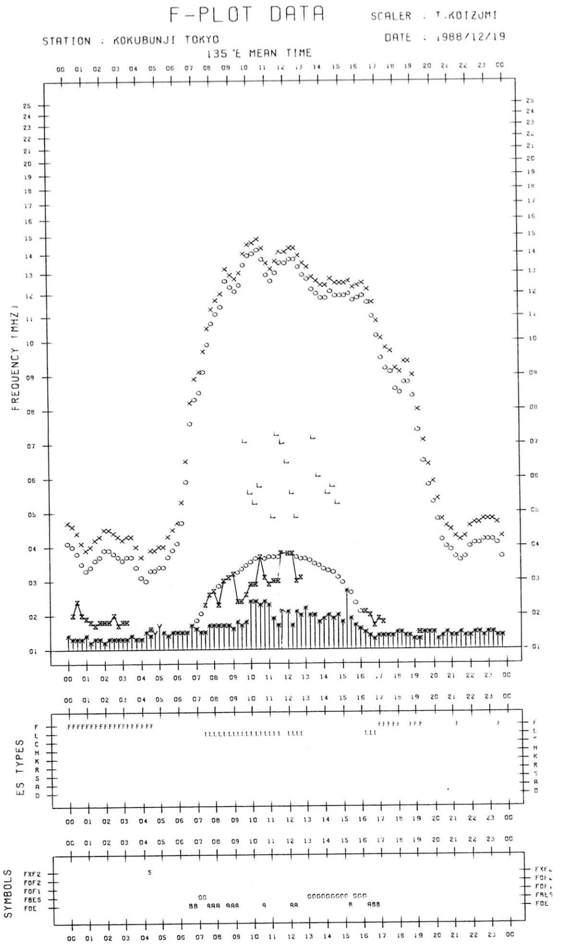




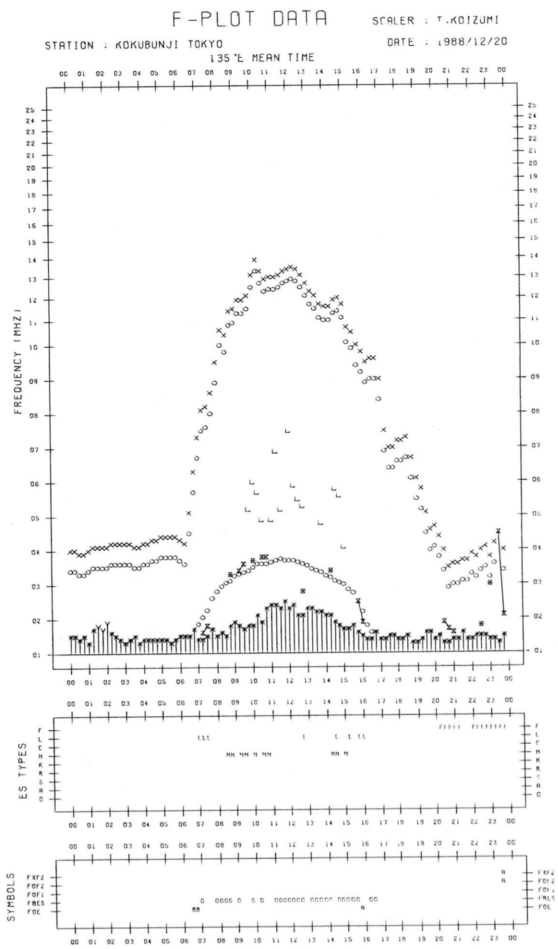
F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/17
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS



F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/18
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS



F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/19
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS



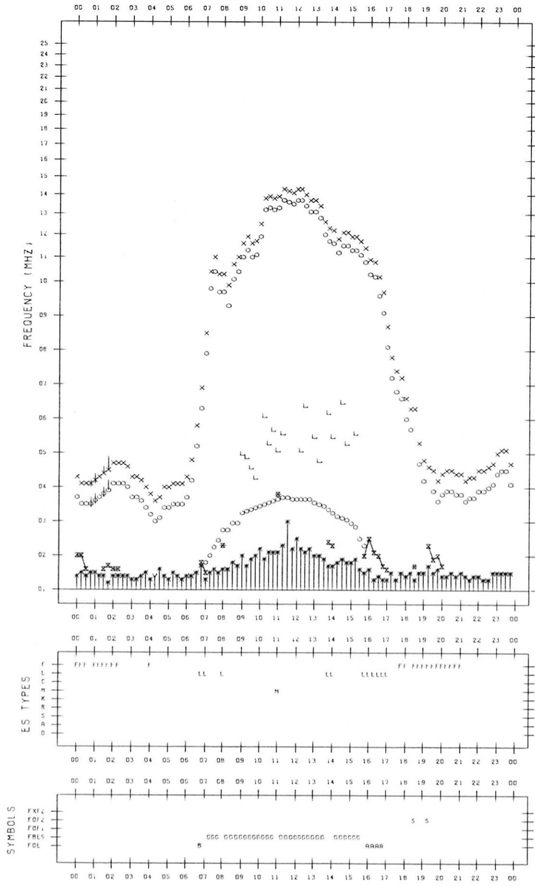
F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/20
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS

F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO DATE : 1988/12/21

135°E MEAN TIME

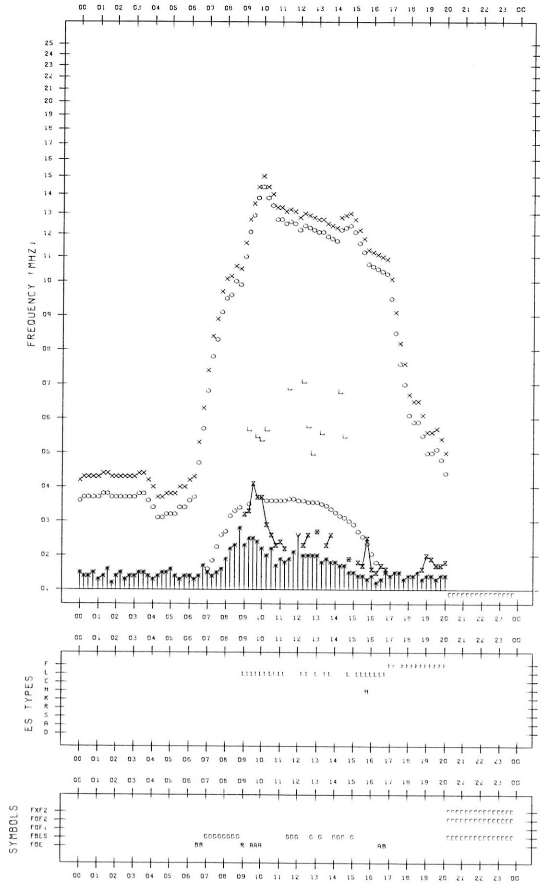


F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO DATE : 1988/12/23

135°E MEAN TIME

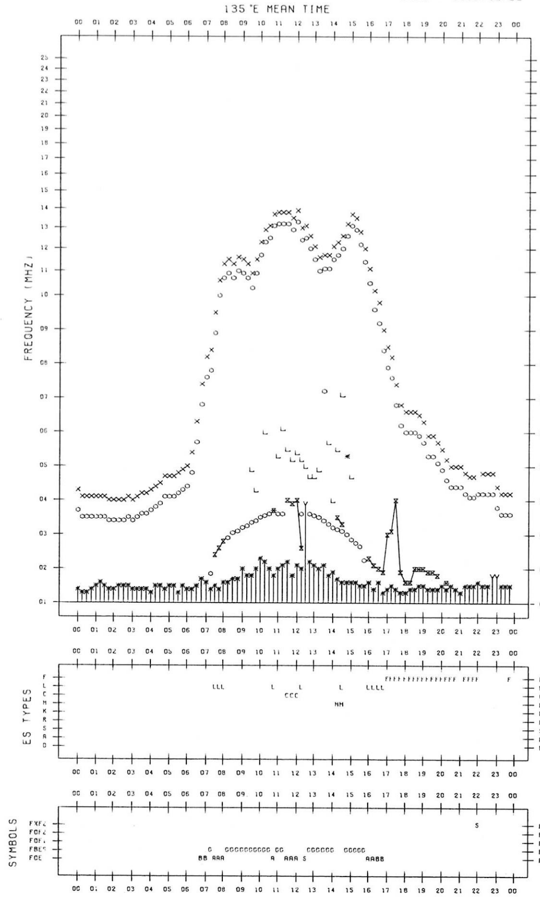


F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO DATE : 1988/12/22

135°E MEAN TIME

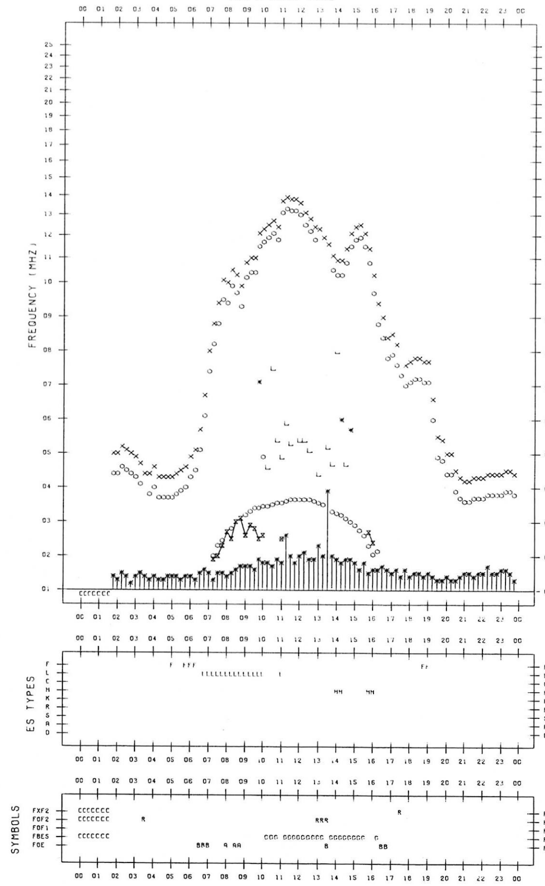


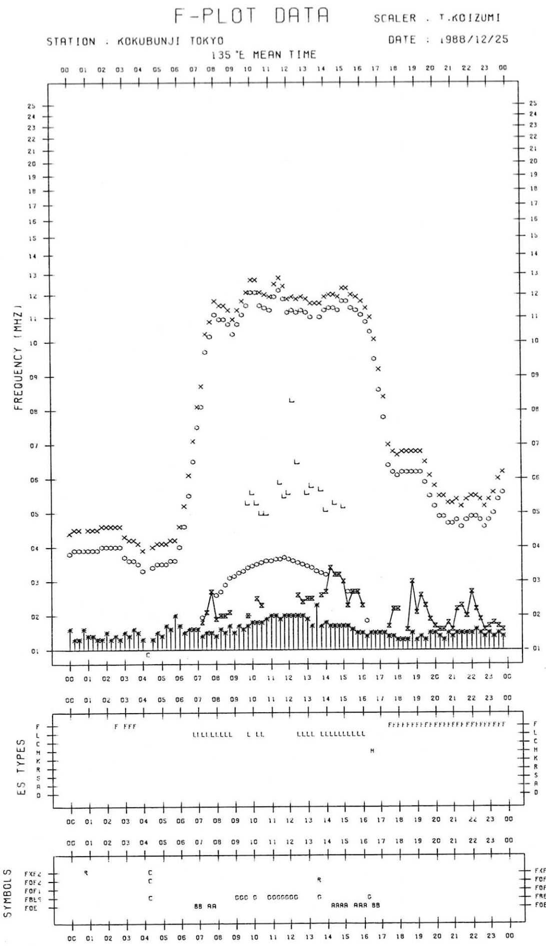
F-PLOT DATA

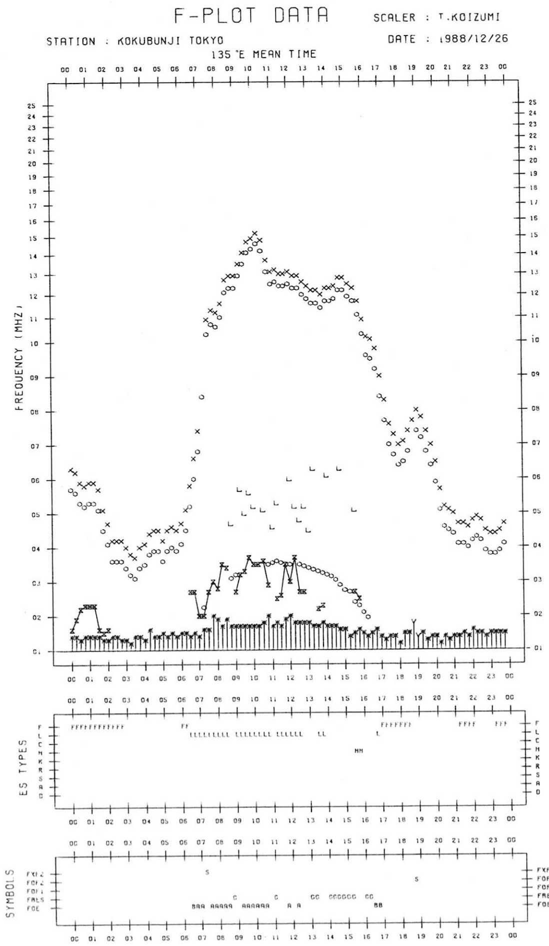
SCALER : T.KOIZUMI

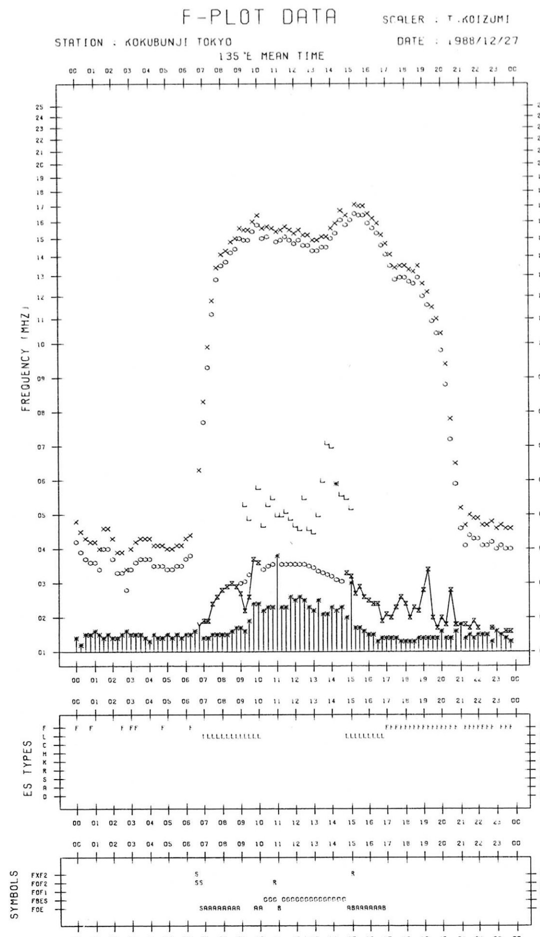
STATION : KOKUBUNJI TOKYO DATE : 1988/12/24

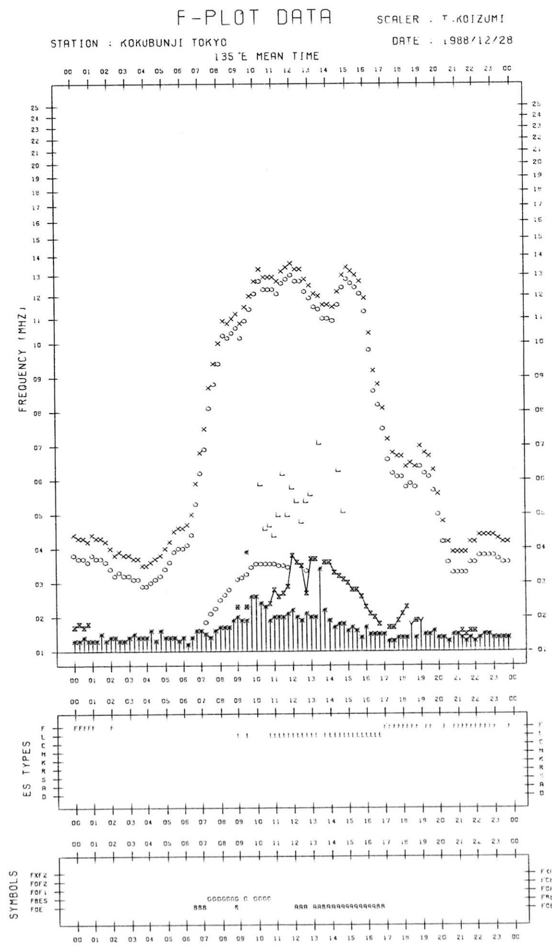
135°E MEAN TIME




F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/25
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS


F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/26
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS


F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/27
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS


F-PLOT DATA
SCALER : T.KOIZUMI
STATION : KOKUBUNJI TOKYO
DATE : 1988/12/28
135°E MEAN TIME
FREQUENCY (MHZ)
ES TYPES
SYMBOLS

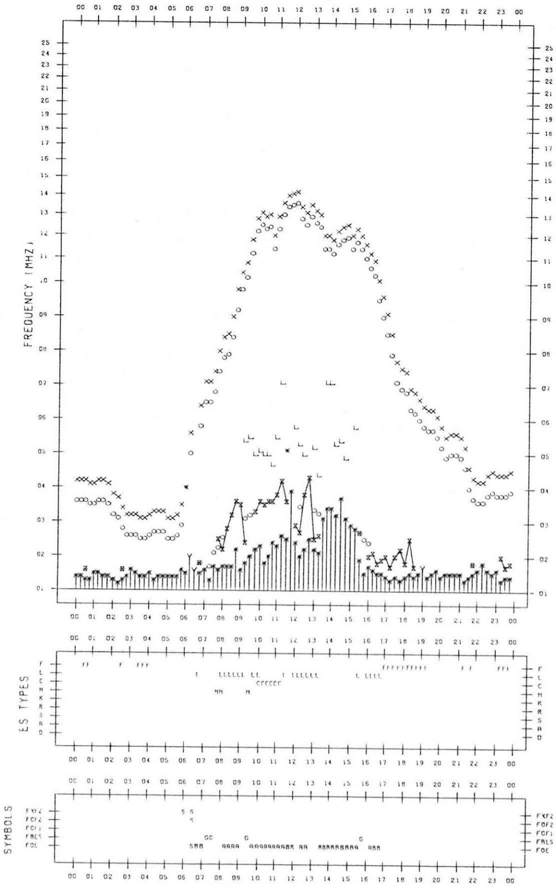
F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO

DATE : 1988/12/29

135°E MEAN TIME



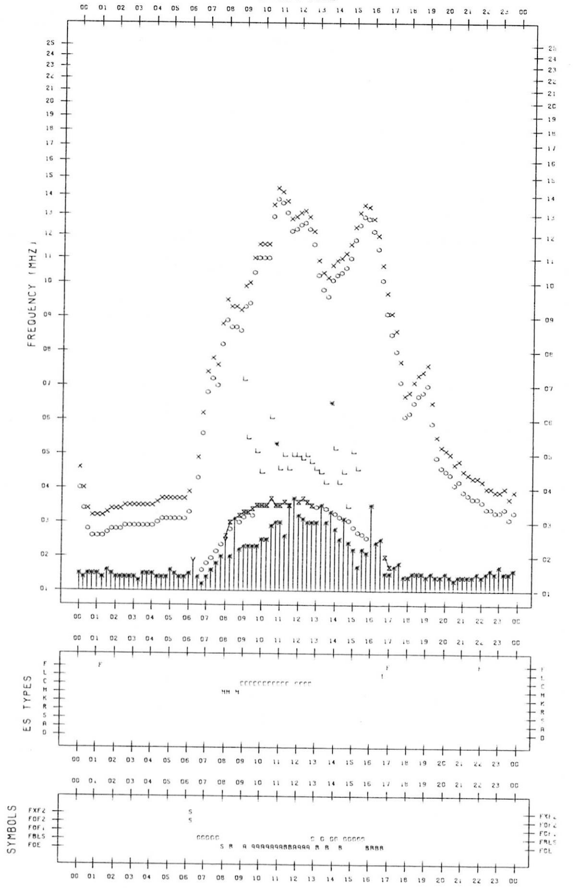
F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO

DATE : 1988/12/31

135°E MEAN TIME



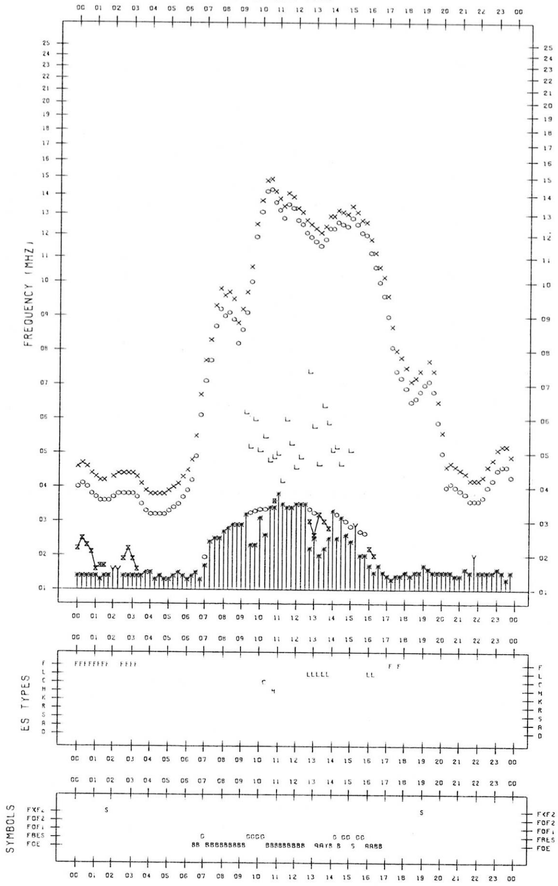
F-PLOT DATA

SCALER : T.KOIZUMI

STATION : KOKUBUNJI TOKYO

DATE : 1988/12/30

135°E MEAN TIME



B.Solar Radio Emission

B1.Daily Data at Hiraiso

200 MHz

Hiraiso

December 1988

Single-frequency total flux observations at 200 MHz

UT / DATE	FLUX DENSITY: $10^{-22}Wm^{-2}Hz^{-1}$ 00-03	03-06	06-09	21-24	DAY	VARIABILITY: 0 TO 3 00-03	03-06	06-09	21-24	DAY
1	B	B	(B)	B	B	3	2	(2)	2	2
2	B	B	(B)	B	B	2	2	(2)	3	2
3	B	11	(11)	B	B	2	1	(1)	3	2
4	B	B	(B)	11	B	2	3	(3)	0	3
5	11	B	(B)	B	B	0	2	(2)	1	2
6	11	11	(11)	10	12	1	1	(1)	2	1
7	B	B	(12)	12	B	1	0	(0)	0	1
8	12	12	(12)	10	12	0	0	(1)	1	0
9	11	11	(12)	B	11	1	1	(2)	2	1
10	B	B	(B)	B	B	3	3	(2)	3	2
11	B	B	(B)	B	B	2	2	(3)	1	2
12	B	B	(B)	B	B	1	0	(0)	1	1
13	(B)	(B)	(B)	B	B	*	(1)	(0)	1	*
14	B	B	(B)	B	B	1	1	(1)	0	1
15	B	B	(B)	B	B	0	0	(1)	2	0
16	B	B	(B)	B	B	2	2	(2)	2	2
17	B	B	(B)	B	B	1	0	(0)	1	1
18	B	B	(B)	B	B	1	2	(2)	2	2
19	B	B	(B)	B	B	1	1	(1)	1	1
20	B	B	(B)	B	B	1	2	(2)	2	1
21	B	B	(B)	B	B	2	3	(2)	3	2
22	B	B	(B)	B	B	3	2	(2)	3	2
23	B	B	(B)	B	B	1	1	(1)	3	2
24	B	B	(B)	B	B	3	2	(1)	3	2
25	B	B	(B)	B	B	3	3	(3)	3	3
26	B	B	(B)	11	B	2	1	(1)	2	2
27	12	11	(12)	B	12	1	1	(2)	1	2
28	B	B	(B)	11	B	1	1	(2)	1	1
29	11	11	(11)	B	11	1	0	(0)	3	1
30	B	B	(10)	10	B	2	1	(0)	0	2
31	10	10	(10)	B	10	0	0	(0)	3	0

Note: No observations

none

B.Solar Radio Emission

B1.Daily Data at Hiraiso

500 MHz

Hiraiso December 1988

Single-frequency total flux observations at 500 MHz

FLUX DENSITY: $10^{-22}Wm^{-2}Hz^{-1}$

UT / DATE	00-03	03-06	06-09	21-24	DAY
1	48	48	(47)	48	48
2	48	49	(49)	50	49
3	49	49	(48)	47	49
4	47	47	(*)	44	47
5	45	(45)	(*)	48	45
6	48	47	(45)	*	47
7	47	46	(*)	45	46
8	46	46	(*)	45	46
9	47	47	(*)	45	46
10	46	47	(46)	44	46
11	46	48	(47)	46	46
12	47	47	(46)	47	46
13	48	48	(47)	47	47
14	48	48	(*)	47	47
15	48	48	(48)	48	48
16	50	51	(51)	49	50
17	51	52	(52)	53	51
18	53	52	(52)	63	52
19	67	55	(51)	50	59
20	54	56	(56)	54	54
21	55	54	(54)	54	54
22	54	54	(52)	51	54
23	52	53	(52)	53	52
24	53	54	(53)	54	53
25	54	55	(60)	54	56
26	54	52	(50)	49	53
27	49	49	(47)	51	48
28	52	53	(54)	46	52
29	47	47	(46)	48	46
30	47	47	(46)	45	47
31	44	44	(43)	44	44

Note: No observations during the following periods:

5th 0200 - 0517

B. Solar Radio Emission

B2. Outstanding Occurrences at Hiraiso

Hiraiso December 1988

Single-frequency observations

Normal observing period; 2145 - 0730 U.T. (sunrise to sunset)

DEC 1988	FREQ. (MHz)	TYPE	START TIME (U.T.)	TIME OF MAXIMUM (U.T.)	DUR. (MIN.)	FLUX DENSITY ($10^{-22}Wm^{-2}Hz^{-1}$) PEAK	MEAN	POLARIZATION REMARKS
1	500	4 S/F	0614.5	0615.0	1.0	7	-	0
	200	44 NS	2130E	0513	590D	7	2	WR
2	500	4 S/F	0326.5	0327.0	1.2	13	-	0
	200	44 NS	2132E	2310	330D	6	4	WR
3	500	41 F	0551.2	0552.2	1.2	65	-	0
	200	44 NS	2130E	0020	590D	6	3	WR
5	200	43 NS	0153	0542	340D	4	2	WR
	200	44 NS	2130E	2245	210D	7	4	WR
6	200	42 SER	0625.7	0627.5	6.1	170	-	WR
	100	46 C	0625.7	0627.7	4.3	910	-	-
	200	27 RF	2255.4	2351.1	141	35	8	MR
7	200	42 SER	0410.0	0411.0	2.0	140	-	0
	100	8 S	0410.7	0410.9	0.6	59	-	0
8	500	41 F	2327	0109.5	200	253	-	WR
9	200	41 F	0033	0109.6	67	1500	-	0
	100	41 F	0100	-	15.2	1000D	-	-
	100	41 F	0226.6	0231.0	19.1	870	-	-
	200	41 F	0228.1	0230.4	17.2	80	-	MR
	100	46 C	0314.5	0316.6	5.2	885	-	-
	500	46 C	0314.8	0318.2	11.5	1400	110	SR
	200	46 C	0316.1	0316.5	4.0	820	-	MR
	200	46 C	0446.2	0446.9	1.8	64	-	0
	200	41 F	0507.0	0602.8	86	270	-	MR
	200	44 NS	2140E	0428	580D	33	11	MR
	500	42 SER	2231.5	2313.8	154	420	-	SR
	100	48 C	2310.9	-	10.6	1000D	-	-
	200	48 C	2312.5	2314.4	11.9	4500	136	WR
				2321.3		240		MR
10	200	42 SER	0000	0009.2	16.5	170	-	MR
	100	42 SER	0005.9	0008.8	11.2	490	-	-
	100	46 C	0047.0	0051.9	6.1	920	230	-
	200	46 C	0048.2	0051.6	5.3	2100	-	MR
	100	42 SER	0125.0	0232.0	68.0	940	-	-
	500	46 C	0152.8	0200.5	13.0	604	65	SR
	200	42 SER	0154.8	0200	46.2	510	-	SR
10	500	2 S	0405.7	0406.3	1.5	31	-	MR
	500	46 C	0426.9	0429.5	5.5	63	-	SR
	100	42 SER	0427.7	0453.5U	75	1000D	-	-
	200	46 C	0451.2	0453.9	12.1	1500	220	SR
	500	46 C	0451.2	0454.5	15.0	260	46	SR
	200	44 NS	2140E	2243	580D	18	9	MR
	100	44 NS	2140E	0540	580D	120	70	-
	500	42 SER	2300	2317.5	19.5	1050	-	WR
	200	42 SER	2303.0	2303.6	15.3	1200	-	0
	100	42 SER	2303.0	2303.8	15.8	680	-	-
11	100	42 SER	0317.8	0343.2	36	630	-	-
	500	42 SER	0340.4	0457.5	26	370	-	0
	500	2 S/F	0427.9	0428.2	0.8	250	-	0
	500	42 SER	0506.8	0517.5	14.0	2400	-	0
	200	24 R	2140E	0050	580D	8	6	WR
	100	44 NS	2140E	0140	580D	140	94	-
	500	42 SER	2244.9	2247.1	4.0	850	-	0
12	200	24 R	2140E	-	580D	-	7	-
	200	42 SER	2225.1	2225.2	16.5	1100	-	0
13	500	46 C	0204.0	0211.6	11.5	8	-	0
	200	44 NS	2140E	0100	580D	19	11	MR
	100	46 C	2351.9	2352.9	2.6	1000D	-	-
	200	46 C	2352.1	2353.5	2.1	820	-	0
14	500	42 SER	0216.8	0217.0	12.5	140	-	0
	100	46 C	0357.8	0358.2	1.3	430	-	-
	500	46 C	0509.5	0511.0	2.6	120	-	WR
	200	24 R	0140E	0609	580D	19	16	WR
	500	2 S/F	2215.3	2215.5	0.7	70	-	0
15	200	41 F	0117.5	0124.0	6.9	125	-	0
	100	46 C	0430.7	0435.5	7.3	490	-	-
	200	46 C	0431.0	0435.2	6.5	25	-	WR
	500	46 C	0500	0503.0	56.5	240	8	0
	200	46 C	0502.6	0504.0	52.1	2400	55	0
				0518.5		42		0
	100	48 C	0502.8	-	18.8	1000D	510D	-
	100	27 RF	0522.2	0531.7	73D	130	50	- SUNSET
	200	44 NS	2140E	0600	580D	15	9	0
16	500	42 SER	0136.7	0220.5	60	4	-	0
	200	44 NS	2140E	0250	380D	24	11	ML
	100	44 NS	2140E	0302.0	580D	70	34	-
	100	46 C	2217.0	2217.3	1.2	740	-	-
	100	42 SER	2244.9	2245.5U	7.5	1000D	-	-
	200	42 SER	2245.5	2245.8	8.6	910	-	0
	500	48 C	2245.8	2247.5	14.3	3400	235	ML
				2250.0		810		SL
17	100	42 SER	0458.0	0458.9U	5.6	1000D	-	-
	200	46 C	0458.1	0501.3	139D	1600	17	0
				0520		18		WR
	500	49 GB	0458.4	0515.3	48.5	5500	320	SL
				0459.8		3100		SL

DEC 1988	FREQ. (MHz)	TYPE	START TIME (U.T.)	TIME OF MAXIMUM (U.T.)	DUR. (MIN.)	FLUX DENSITY ($10^{-22}Wm^{-2}Hz^{-1}$) PEAK	MEAN	POLARIZATION REMARKS
17	100	27 RF	0506.0	0523	37.0	45	16	-
	100	27 RF	0618.4	-	53D	-	30U	- SUNSET
	100	46 C	0621.8	0622.6	2.2	290	-	-
	200	44 NS	2140E	2322	580D	18	11	WL
18	200	44 NS	2140E	-	580D	-	18	-
	100	44 NS	2140E	-	580D	-	30	-
	200	27 RF	2212	2300	318	126	38	WL
	100	27 RF	2238	0203	390	310	91	-
	500	27 RF	2239	2257.5	360	30	14	WL
	100	46 C	2241.0	2242.9	5.3	740	-	-
19	500	42 SER	0015.5	0046.5	64	80	-	ML
	200	46 C	0045.1	0046.9	6.0	240	75	WR
	500	46 C	0215.4	0217.0	5.5	145	-	0
	200	44 NS	2140E	0330	580D	11	8	0
20	500	42 SER	0150	0201.5	31.0	14	-	0
	200	42 SER	0155.4	0217.2	27	28	-	0
	100	42 SER	0200U	0202.0	24.4	720	-	-
	100	44 NS	2145E	0245	580D	85	47	-
	200	44 NS	2145E	0546	580D	43	31	0
21	500	46 C	0611.0	0611.5	2.0	11	-	0
	100	44 NS	2145E	2212	440D	140	37	-
	200	44 NS	2145E	2338	580D	45	23	MR
22	200	44 NS	2145E	0300	580D	19	10	MR
	500	46 C	2253.7	2309.3	35	650	15	0
	200	42 SER	2307.9	2325.4	45.0	51	-	MR
	100	46 C	2320.7	2323.9	41.6	890	67	-
23	100	43 NS	0037	0355	410D	65	21	-
	200	46 C	0349.5	0349.7	1.7	210	-	SR
	200	44 NS	2145E	0009	580D	32	13	MR
24	200	8 S	0441.9	0442.6	0.8	120	-	MR
	200	44 NS	2145E	2310	580D	37	12	WR
25	500	20 GRF	0338.0	0426.5	95	25	7	0
	500	27 RF	0555.0	0605.5	52	20	18	WR
	200	44 NS	2145E	-	580D	-	17	-
	500	46 C	2304.8	2306.3	5.0	17	-	0
26	100	8 S	0205.3	0205.3	0.8	290	-	-
	200	8 S	0205.3	0205.5	0.7	305	-	0
	100	41 F	0503.2	0503.5	2.1	320	-	-
	200	27 RF	2223.0	2240.0	92	18	13	0
27	500	22 GRF	0004	0051.0	84	6	4	0
	200	27 RF	0042.0	0048.8	58	9	3	WR
	500	46 C	0144.1	0145.7	4.5	13	6	0
	200	46 C	0237.0	0258.2	47.5	47	5	WR
	500	27 RF	0245.0	0250.0	50.0	8	3	0
	100	42 SER	0520.9	0529.0U	11.9	1000D	-	-
	500	41 F	0521.0	0523.5	5.5	60	-	SL
	200	42 SER	0521.1	0529.0	12.5	980	-	0
	500	46 C	0528.6	0529.0	4.5	310	-	0
	500	42 SER	0610.7	0612.8	2.7	26	-	0
	200	46 C	0710.0	-	12.0D	-	-	0 SUNSET
27	100	48 C	0710.0	-	12.0D	1000D	-	- SUNSET
	200	44 NS	2145E	-	580D	-	22	-
28	500	49 GB	0018.5	0146.9	175	3500	360	-
				0030.8		120		-
				0056.3		350		-
	100	48 C	0023.0	0137.0	106	830	153	-
				0034.5		550		-
				0120.5		560		-
	200	48 C	0023.8	0154.1	202	1500	260	ML
				0055.4		610		WR
				0120.5		350		0
	200	46 C	0533.0	0539.6	8.6	84	-	WR
	100	41 F	0535.2	0538.3	6.3	230	-	-
	200	48 C	2340.4	2343.2	11.2	21000	1760	0
	500	46 C	2340.7	2342.3	54.5	114	6	0
	100	46 C	2341.0	-	16.5	1000D	370D	-
	200	29 PBI	2351.2	0008.0	92	16	4	0
29	100	46 C	0414.3	0414.8	2.3	270	-	-
	200	44 NS	2145E	2312	440D	140	22	0
31	100	44 NS	2145E	0200	580D	65	15	-
	200	44 NS	2145E	0415	580D	24	8	MR

C. RADIO PROPAGATION

CI. H.F. FIELD STRENGTH (UPPER SIDE-BAND OF WWV)

DEC 1988 FREQUENCY 15 MHZ BANDWIDTH 80 HZ RECEIVING ANTENNA ROD 4.5 M

MEASURED AT HIRAISO

UT DAY	00H 15M	01H 15M	02H 15M	03H 15M	04H 15M	05H 15M	06H 15M	07H 15M	08H 15M	09H 15M	10H 15M	11H 15M	12H 15M	13H 15M	14H 15M	15H 15M	16H 15M	17H 15M	18H 15M	19H 15M	20H 15M	21H 15M	22H 15M	23H 15M
1	11	3	12	6	ES -10	ES -16	ES -5	ES -16	ES -5	ES -16	ES -7	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-5	2	3
2	2	8	3	-1	ES -16	ES -7	ES -6	ES -16	ES -16	ES -25	ES -25	ES -25	ES -26	ES -26	ES -26	-17	-17	ES -26	-13	-13	-17	-6	0	0
3	1	4	5	-2	ES -16	ES 1	ES -4	ES -2	ES -16	-16	ES -16	ES -26	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-5	3	1
4	3	7	12	13	-16	ES -25	ES -12	ES -12	ES -12	ES -2	ES -25	ES -25	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-5	-2	5
5	7	4	10	10	ES -16	ES -16	ES -13	ES -5	ES -13	ES -12	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-3	5	5
6	6	5	8	5	-6	-10	ES -9	ES -17	ES -11	ES -17	ES -17	ES -17	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-13	-1	0
7	6	5	2	7	15	ES -16	ES -12	ES -16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-16	-11	2	-2
8	1	-1	4	12	ES -10	ES -16	ES -16	ES -10	ES -16	ES -25	C	C	C	C	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-10	-2	-2
9	-1	3	5	9	ES -16	ES -16	ES -10	ES -16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-16	3	-1
10	-1	3	4	-1	ES -25	-19	ES -25	ES -10	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-12	0	-7
11	0	0	3	-2	-16	ES -25	ES -25	ES -16	ES -16	-13	ES -25	ES -25	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-15	1	-4
12	-1	0	3	9	6	ES -16	-8	-12	-10	ES -25	ES -25	ES -25	ES -12	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-13	-6	0
13	-2	-1	-7	-1	ES -25	-13	-13	ES -16	ES -16	ES -13	ES -16	ES -16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-12	-2	-3
14	-1	-1	2	7	-12	ES -24	ES -24	ES -24	ES -15	ES -15	ES -24	ES -24	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-12	-4	-4
15	-1	-2	1	11	10	-6	ES -15	-12	ES -12	ES -24	ES -24	ES -24	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-11	-4	-11
16	-13	-13	-13	-12	ES -24	ES -24	ES -24	-15	ES -24	ES -24	ES -24	ES -24	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-4	-10
17	-13	-10	-8	-1	8	ES -25	ES -12	ES -16	ES -10	ES -16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-13	ES -25
18	-14	-11	0	-7	-11	-11	ES -14	ES -14	ES -14	ES -14	ES -26	ES -26	ES -26	ES -26	ES -27	ES -27	ES -27	ES -27	ES -27	ES -27	ES -25	ES -25	-13	-14
19	ES -17	-14	-14	-9	7	-14	-13	-13	-13	ES -17	-13	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-14	-14
20	ES -25	ES -16	-13	-11	-11	ES -25	ES -16	ES -16	ES -25	ES -25	ES -25	ES -25	C	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-11	-11
21	-13	-13	-10	-3	-13	ES -16	-8	ES -16	ES -16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-12	-12
22	ES -25	-10	-5	3	-1	-3	-13	ES -16	ES -16	ES -12	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-12	-13
23	-13	-10	-5	-1	ES -25	ES -24	ES -16	ES -16	-6	ES -16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -16	-3	-12
24	-13	-13	ES -25	ES -13	ES -16	ES -16	-8	ES -16	ES -16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-1	-7
25	-13	-6	-12	-1	ES -25	ES -25	-12	ES -16	ES -7	ES -13	ES -25	ES -25	ES -25	ES -25	ES -26	ES -26	ES -26	ES -26	ES -25	ES -25	ES -25	ES -25	-12	-13
26	-12	-7	-1	0	-2	-1	ES -16	-13	ES -16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-13	-7	-12
27	-4	ES -25	-4	-12	ES -25	ES -25	ES -25	-10	ES -10	ES -16	ES -16	ES -25	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-14	ES -26
28	ES -26	ES -26	ES -17	-13	ES -22	ES -26	ES -26	-13	ES -26	ES -26	ES -26	C	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-14	ES -26
29	ES -26	ES -26	-14	-14	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-14	ES -26
30	ES -26	ES -17	ES -26	ES -25	ES -25	ES -25	ES -25	ES -25	-13	ES -25	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24
31	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -25	ES -25	ES -25	ES -24	-11	-12
CNT	31	31	31	31	31	31	31	31	31	31	30	29	29	30	31	31	31	31	31	31	31	31	31	31
MED	-4	-6	-1	-1	US -16	ES -16	ES -13	ES -16	ES -16	ES -24	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-16	-4	-10
UD	6	5	10	11	8	ES -3	ES -6	ES -10	ES -7	ES -12	ES -16	ES -24	ES -24	ES -25	ES -25	ES -24	ES -24	ES -25	ES -25	ES -25	ES -24	-5	3	3
LD	ES -26	ES -25	ES -24	ES -14	ES -25	ES -25	ES -25	ES -24	ES -25	ES -25	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-14	ES -26

C. RADIO PROPAGATION

C1. H.F. FIELD STRENGTH (UPPER SIDE-BAND OF WWVH)

DEC 1988 FREQUENCY 15 MHZ BANDWIDTH 80 HZ RECEIVING ANTENNA ROD 4.5 M

MEASURED AT HIRAISO

UT DAY	00H 45M	01H 45M	02H 45M	03H 45M	04H 45M	05H 45M	06H 45M	07H 45M	08H 45M	09H 45M	10H 45M	11H 45M	12H 45M	13H 45M	14H 45M	15H 45M	16H 45M	17H 45M	18H 45M	19H 45M	20H 45M	21H 45M	22H 45M	23H 45M
1	12	10	13	18	21	15	7	ES -10	24	-7	ES -5	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	14	17	12	6
2	11	12	12	18	17	20	21	22	19	8	2	-5	ES -26	ES -26	ES -26	ES -26	ES -26	7	-17	3	1	10	9	6
3	7	6	21	18	21	30	16	19	20	-4	-12	-13	-7	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	8	6	7	7
4	7	12	15	20	22	22	19	11	-4	-10	-13	-6	-17	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	4	9	11	15
5	4	11	15	18	19	26	22	20	15	-4	-16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	14	12	11	7
6	10	12	14	17	20	16	23	14	1	-13	ES -17	-15	-17	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	0	4	9	8	5
7	4	1	12	11	16	18	18	17	11	-10	-16	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	7	12	10	-12
8	6	8	12	5	19	17	19	13	21	17	C	C	C	C	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	1	8	12	3
9	1	4	7	11	18	14	17	14	16	3	-10	-10	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	8	11	11	4
10	6	11	8	15	20	15	23	15	17	7	-12	-13	-13	ES -25	-13	ES -25	ES -25	ES -25	ES -25	ES -25	7	16	7	7
11	11	12	9	15	16	16	25	22	13	2	23	-8	-13	-13	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	7	5	8	-3
12	7	5	16	14	21	19	19	25	18	-13	-12	-12	-12	-13	-13	-13	ES -25	ES -25	ES -25	ES -25	-2	11	5	5
13	3	3	10	14	22	18	21	21	17	10	-13	-13	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	4	11	11	7
14	-1	9	17	14	22	25	23	25	17	10	9	-4	-13	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-7	4	5	5
15	1	1	7	16	20	21	27	21	18	3	14	-11	-12	-12	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	5	2	-2	6
16	-1	-10	0	8	16	23	21	6	9	-11	-11	10	9	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	3	4	-7	-3
17	-4	3	2	2	18	15	18	15	20	17	29	17	-3	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-13	3	7	2	3
18	-6	1	10	15	15	19	21	17	15	10	-11	-13	-14	ES -26	ES -27	-15	ES -27	ES -27	ES -27	ES -27	8	12	1	-3
19	-15	-3	4	15	16	15	22	22	20	17	-7	-12	-13	-12	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	6	-3	-2	5
20	-1	0	3	9	22	21	12	5	11	ES -25	ES -25	ES -25	C	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-5	8	-1	0
21	2	1	6	12	17	13	20	20	11	-12	-12	-13	-12	12	-13	ES -25	ES -25	ES -25	ES -25	ES -25	5	8	3	1
22	-2	0	6	12	18	19	23	12	-4	13	12	17	13	-3	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	9	11	1	ES -25
23	-12	-1	6	11	13	24	20	14	-3	-12	ES -25	-13	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-1	10	4	9
24	-1	6	2	11	16	20	23	25	20	6	6	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	4	7	7	5
25	2	6	9	9	17	23	13	18	13	11	-12	ES -25	ES -25	ES -25	-13	-14	ES -26	ES -26	ES -25	ES -25	-2	8	1	3
26	4	6	10	12	17	22	21	22	11	11	16	7	-8	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	-12	5	10	6
27	-2	0	6	13	17	20	17	32	23	21	20	11	-14	ES -26	ES -26	ES -26	ES -26	ES -26	-14	-4	2	4	6	0
28	ES -26	-7	3	10	17	14	24	21	14	9	-12	C	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	6	5	5	-3
29	-2	1	6	10	10	12	10	10	19	13	-14	ES -26	-13	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	11	10	-4	-4
30	0	0	-2	10	14	20	19	14	16	-13	ES -24	ES -24	ES -24	ES -24	-12	ES -24	ES -24	ES -24	ES -24	ES -24	9	2	2	1
31	-9	-9	5	2	9	16	18	18	17	9	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -24	ES -25	ES -25	0	7	3	0
CNT	31	31	31	31	31	31	31	31	31	31	30	29	29	30	31	31	31	31	31	31	31	31	31	31
MED	1	3	8	12	17	19	20	18	16	6	US -12	-13	-14	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	ES -25	4	8	5	4
UD	11	12	16	18	22	25	24	25	21	17	20	11	-3	-12	-13	-15	ES -25	ES -24	ES -24	-4	11	12	11	7
LD	-12	-7	2	5	13	14	12	6	-3	-13	ES -24	ES -25	ES -25	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	ES -26	-5	2	-2	-4

C. Radio Propagation

c2. Radio Propagation Quality Figures at Hiraiso

Hiraiso

Time in U.T

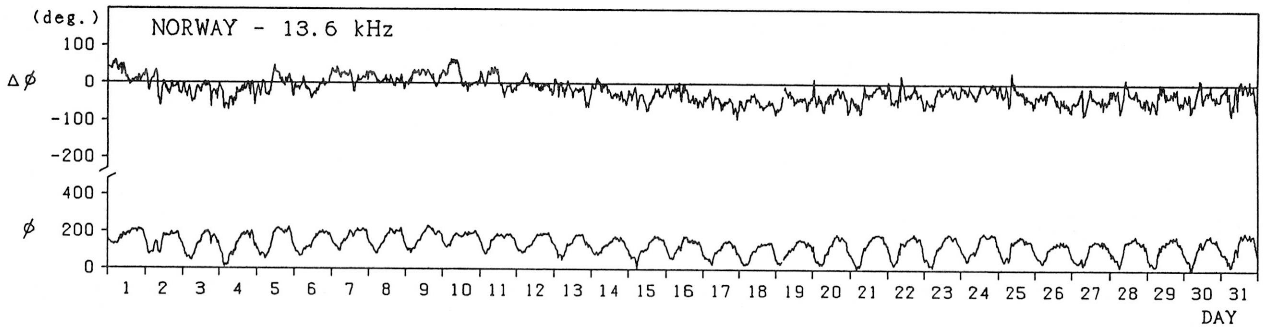
Dec. 1988	Whole Day Figure	W W V				W W V H				Conditions				Princial Geomagnetic Storms		
		00 | 06	06 | 12	12 | 18	18 | 24	00 | 06	06 | 12	12 | 18	18 | 24	00 | 06	06 | 12	12 | 18	18 | 24	Start	Ene	Range
1	4+	5	S	S	5	4	3U	S	5	N	N	N	N			
2	4+	4	S	5U	5	4	4	4U	4	N	N	N	N			
3	4+	4	S	S	5	5	4	S	4	N	N	N	N			
4	4+	5	S	S	5	5	3	S	4	N	N	N	N			
5	5-	5	S	S	5	5	4	S	5	N	N	N	N			
6	4o	5	S	S	4	4	3	S	4	N	N	N	N			
7	4+	5	S	S	5	4	3	S	4	N	N	N	N			
8	4o	4	S	S	4	4	4	S	4	N	N	N	N			
9	4+	5	S	S	4	4	4	S	4	N	N	N	N			
10	4o	4	S	S	4	4	4	4U	4	N	N	N	N			
11	4o	4	4U	S	4	4	4	4U	4	N	N	N	N			
12	4o	4	4U	S	4	4	4	4U	4	N	N	N	N			
13	4o	4	S	S	4	4	4	S	4	N	N	N	N			
14	4o	4	S	S	4	4	4	S	4	N	N	N	N			
15	4o	4	S	S	4	4	4	4U	4	N	N	N	N			
16	3+	3	S	S	3	4	4	S	3	N	N	N	N			
17	4o	4	S	S	3U	4	5	S	4	N	N	N	N	1824	---	97
18	3+	3	S	S	3U	4	4	4U	3	N	N	N	N	---	---	
19	4o	4	4U	S	3U	4	4	4U	4	N	N	N	N	---	21.0	
20	3+	3U	S	S	3U	4	3U	S	4	N	N	N	N			
21	4-	3	S	S	3U	4	4	5U	4	N	N	N	N			
22	4-	4	S	S	3U	4	4	5U	3	N	N	N	N			
23	4-	4	S	S	3U	4	3	S	4	N	N	N	N			
24	4-	3U	S	S	3U	4	4	S	4	N	N	N	N			
25	4-	3	S	S	3U	4	4	4U	4	N	N	N	N	07.5	---	120
26	4o	4	S	S	4	4	4	S	4	N	N	N	N	---	---	
27	4-	3U	S	S	2U	4	5	4U	4	N	N	N	N	---	21.0	
28	3o	2U	S	S	2U	3	4	S	4	N	N	N	N			
29	3+	3U	S	S	2U	4	4	S	4	N	N	N	N			
30	3o	2U	S	S	2U	4	3	4U	4	U	U	U	U			
31	3o	2U	S	S	2U	3	4	S	4	U	U	U	U			

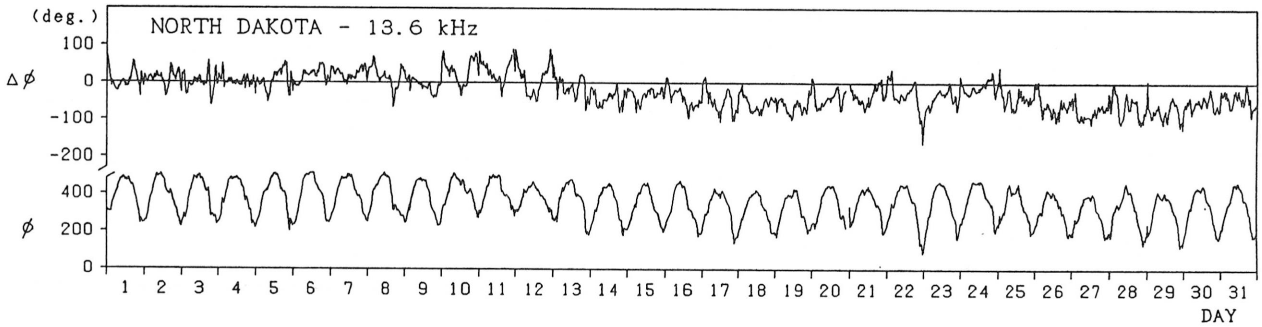
C. Radio Propagation

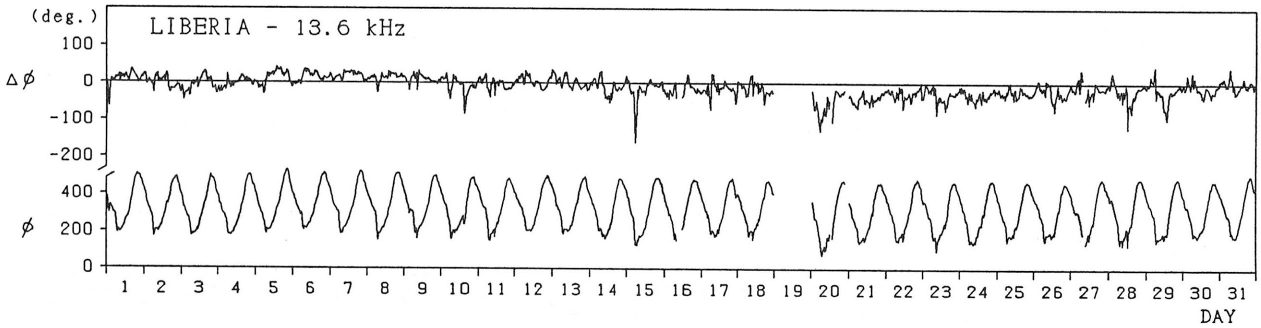
C3. Phase Variations in OMEGA Radio Waves at Inubo

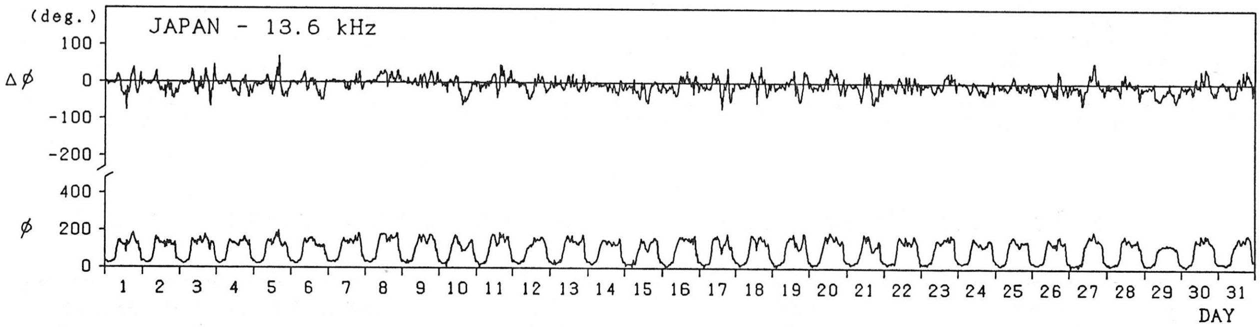
Inubo

December 1988

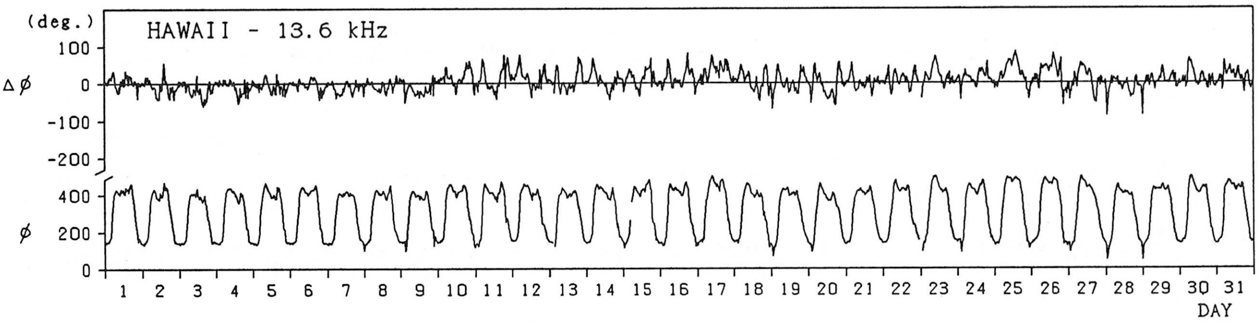


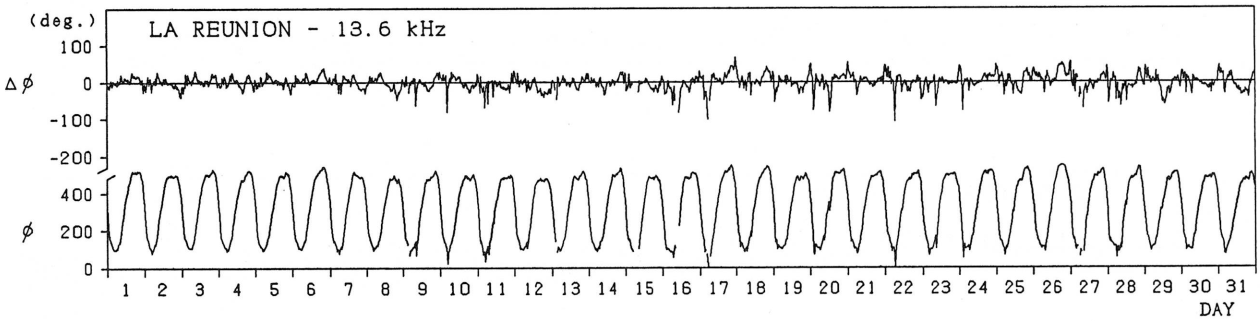


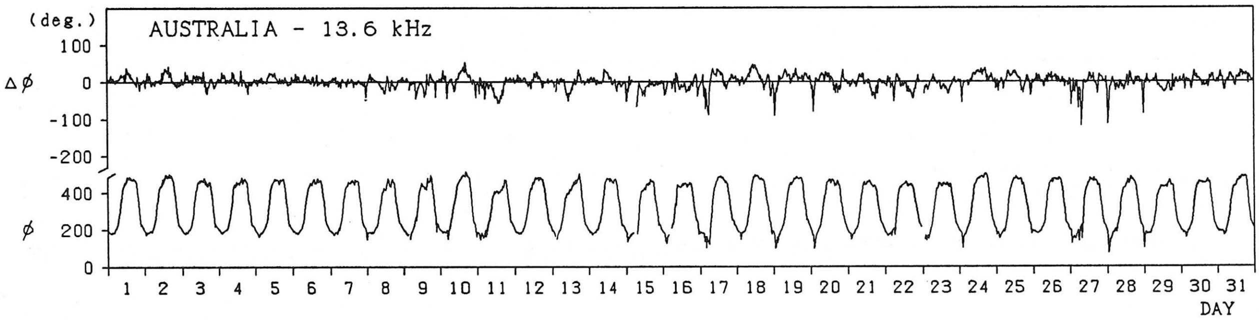


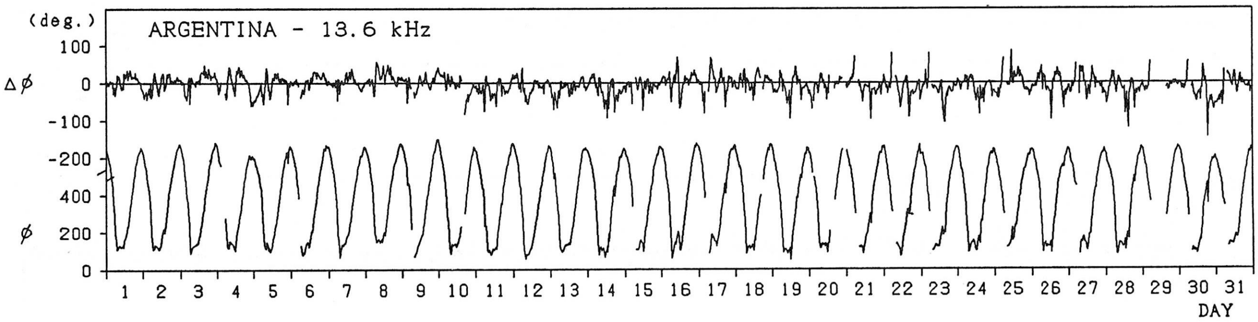


Inubo December 1988









Polar Cap Phase Anomaly (PCPA) on Norway-Inubo Circuit

Start (U.T.)	End (U.T.)	Max. (U.T.)	Max. Phase Deviation (negative value, deg.)
Dec.14/1427	Dec.16/0300	Dec.15/0155	72.0
Dec.16/1439	Dec.20/1030	Dec.17/2223	111.6
Dec.27/1135	Dec.28/0030	Dec.27/1404	45.4
Dec.29/0010	Dec.29/0724	Dec.29/0158	60.1

C. Radio Propagation

C4. Sudden Ionospheric Disturbance

(a) Short Wave Fade-out (SWF) at Hiraiso

Hiraiso — Time in U.T.

Dec. 1988	SWF: Drop-out Intensities (dB) CO	HA	1)	2)	3)	Start	Duration	Type	Imp.	Corresepondence: Solar Flare	Solar Noise	Geomag. Crochet
9	x	x	20			0316	19	S	2-	0316	x	
9			23			0732	24	S	2-	0732		
9	23	34	13			2114	16	S	3+	2117		
10			15			0455	25	S	1	0445	x	
11			10			0518	9	S	1-		x	
13	x	x	15			0210	30	SL	1	0130	x	
14			10			0632	15	SL	1-	0632		
15	x	x	15		x	0500	35	SL	1	0446	x	
16			x		20	0831	29	SL	1+	0838		
17			15			0346	7	S	1	0344	x	
17			20			0500	15	S	2-	0458	x	
17			15			0535	30	SL	1	0540		
20			16			0154	56	SL	1+	0152	x	
21			10			////	//	//	1-	0200		
21		46				0920	32	SL	3+			
27			15			0523	26	SL	1	0523	x	
27			14	x		0710	43	SL	1	0719	x	
28	x	x	18			0028	60	G	1+	0039	x	
28			11			0525	38	G	1-		x	

Notes CO: Colorado(WWV) HA: Hawaii(WWVH) 1): Australia 2): London 3): Moscow

(b) Sudden Phase Anomaly (SPA) at Inubo

Inubo

Dec. 1988 Date	SPA Phase Advance (degrees) Ω/N	Ω/L	Ω/LR	NWC	Ω/H	Ω/ND	Time (U.T.) Start	End	Maximum
1	9		33	22	11	13	0339	0422D	0346
1			12	11			0422E	0502	0430
1		17					1349	1412	1353
1				6	5	12	2342	0021	2346
2				14	10		0042	0116	0049
2			21	15			0451	0600	0457
2		27					1340	1423	1350
3			9	9			0147	0222	0152
4				6			0152	0209	0154
4			14	14			0305	0348	0314
4		8	27	19			0502	0608	0511
5				—	5		0149	0219D	0158
5	8		18	—	9	14	0221	0252	0228
5			6	—			0437	0518	0446
6			11				0746	0828	0800
6		23	10				1109	1140	1119
7				5			0155	0211	0200
7			17	10	5		0226	0258	0232
7	8		28	22			0415	0518	0421
7			31	20			0548	0653	0601
7			41	18			0715	0804	0720
7	23	31	27	70	68	61	2336	0147	2344
8				7			0322	0352	0328
8			14	6			0351	0532	0411
8			6				0625	0708	0630
9			30	26	13	16	0110	0200	0113
9			11	10	6		0237	0301	0241
9	48	46	170	117	65	56	0318	0519	0325
9			32	18			0603	0657	0610
9		155	198	108			0733	1000	0741
9					95	21	2110	2216	2120
9				7	5		2316	2337	2322
10				10			0231	0313	0238
10	21	32	82	72		21	0455	0644	0502
10			9				0730	0806	0737
10		85					1416	1631	1445
10	21	8	24	70	85	71	2257	0024	2306
11		6	37	36	23	18	0106	0145	0115
11		11	34	36	20	17	0155	0232	0158
11			38	42	24	16	0327	0454	0348
11	22	24	86	61		17	0518	0648	0524
11		23	58	31			0725	0825	0730
11		47	34				1026	1103	1031
11		21	9				1229	1307	1234
12		31	46	22			0739	0914	0748
12			8				0944	1002	0946
12					15		2149	2202	2153
13				10			0037	0118	0049
13	32	29	133	112	—	57	0206	0333	0222
13			10	10			0442	0522	0450
13		37	22				1028	1111	1032
13		12					1416	1430	1421
14			12*	—	10*		0204	0254	0225
14			14	10			0512	0545	0517
14		27	55	32			0635	0727	0642
14		12	13				0803	0840	0807
14		25	31	18			0845	0957	0852
14		38	35				1011	1045D	1016
14		22	23				1045E	1101	1048
14		17	10				1122	1142	1131
14		20	8				1254	1312	1303
14		48	8				1335	1428	1342
14					29		2037	2051	2042
14					15		2118	2156	2130
14					6		2330	2352	2334
15				47	33	12	0037	0139D	0055
15			16	24	19		0139E	0223	0150
15			12*	12*	6		0234	0321	0258
15			6	4			0329	0342	0335
15			7				0403	0426	0411
15	73	147	301	177	164	51	0448	0726D	0512
15		44	107	82			0726E	0809	0732
15		20	6				1213	1249	1221
15		15					1403	1426	1410
15		12					1603	1624	1611
15					57		2123	2214	2135
16			37	55	26		0131	0357	0216
16			9*	6			0413	0508	0422
16			25	10		21	0521	0609	0537
16			49	35			0650	0734	0656
16			13				0755	0828D	0806
16		—	359	141			0828E	1244	0845
16					9		2124	2140	2132
16				27*	37		2234	2333	2254
16					11		2350	0025	0001
17		13	51	40	24		0249	0341	0301
17	25	36	130	86	59	—	0343	0456D	0351
17	50	76	207	114	50	31	0456E	0533D	0507
17	49	71	199	117	12	22	0533E	0757	0546
17			9				0959	1019	1004

Inubo

Dec.	S			P			A		
1988	Phase Advance (degrees)						Time (U.T.)		
Date	Ω/N	Ω/L	Ω/LR	NWC	Ω/H	Ω/ND	Start	End	Maximum
18				12	11		0035	0106	0039
18				6	6		0131	0151	0134
18			38	40	25	16	0213	0307	0229
18			15	10			0402	0442	0413
18		15	28	21	12		0455	0545	0503
18			15*	10*			0605	0704	0609
18		59	71	10			0915	1013	0921
18			6				1120	1142D	1123
18		10	7				1142E	1202	1145
18		24	8				1236	1258	1242
18		22					1637	1705	1647
18		36					1710	1812	1719
18					41		2200	2241D	2217
18				8	36		2241E	2354	2251
19	18		49	—	74	29	0024	0216D	0057
19			54	—	40		0216	0344	0228
19			8	—			0733	0759	0742
19			10				0943	1007	0955
19		—	17				1151	1236	1201
19					14		2107	2135	2116
20				—	19		0042	0142	0104
20	19		114	—	78	23	0155	0319	0209
20			26	22			0538	0617	0547
20			6				0621	0655	0625
20			14	8			0720	0801	0727
20		62	81	36			0858	1025	0906
20	40	23					0949	1029	0958
20		15	15				1033	1056	1039
20		28	21				1127	1158	1133
20		141	73				1220	1500	1235
20		—		14	10		2301	2320	2303
21	13	13	52	51	25	29	0203	0306	0214
21			22	16			0609	0725	0617
21			12				0757	0824	0801
21			11				0926	0958	0932
21		26					1555	1634	1600
21					14		2112	2139	2116
22				8	6		0021	0037	0024
22					11		0112	0222	0139
22			33	25			0406	0507	0426
22			12	8			0511	0540	0526
22	21		105	75			0613	0806	0630
22	42	20	13			16	0823	0853	0832
22			12				0941	0956	0946
22		54	45				1104	1227	1117
22				147	123	49	2305	0156	2332
23			46	39	25	13	0223	0312	0235
23			53	38	27		0330	0555	0359
23			13	5			0641	0748	0655
23		85	92	39			0842	1030	0903
23		32					1418	1519D	1430
23		42					1519E	1600	1524
23					9		2215	2302	2228
24	31	41	169	136	108	50	0203	0312	0213
24			22*	14*			0342	0512	0414
24			33	18			0655	0749	0704
24			12				0853	0918	0859
24			15				0928	1000	0933
24			11				1015	1046	1025
24		21	7				1115	1152	1122
24			7				1135	1145	1138
24		47	9				1329	1431	1339
24		21					1514	1554	1530
25				35	27		0002	0115	0016
25			40	46	24		0157	0330	0207
25			40	26			0518	0629	0526
25			22	9			0634	0723	0647
25			13				0818	0851	0827
25			10				0853	0911	0900
25			13				0917	0935	0923
25			15				0957	1023	1006
25		57	42				1111	1209	1121
25				10	36		2232	0002	2243
26			13	8	7		0241	0320	0249
26			81	31			0643	0813	0703
26			10				0825	0855	0834
26			13				1044	1110	1047
26		24	13				1250	1343	1301
26					56		2040	2212	2047
26				14	17		2252	2318	2303
26				6	5		2324	0000	2339
27				68	49		0031	0145D	0100
27			24	40	30		0145E	0240	0151
27			41	43	27		0241	0455	0315
27		27	127	89	26		0523	0635D	0535
27			52	31			0635E	0705D	0648
27		193	243	128			0705E	1008	0726
27		26	18				1051	1125	1055
27		20					1353	1434	1400
27				6	6		2311	2342	2319
28		24		—	95	62	0024	0203D	0050
28			32	—	43		0203E	0406	0209
28			12	—			0425	0457	0432
28		16	70	—			0539	0713	0549
28		37	99	43			0725	0827D	0739
28		57*	85	36*			0827	0954	0853
28		26	19				1015	1107	1031
28		100	44				1221	1346	1232
28		51					1423	1539	1443
28				6	5		2313	2332	2316
28	29	21	49	120	106	55	2342	0110	2349
29			7	8	5		0144	0208	0154
29			9*	10*	5		0334	0413	0343
29			45	38	14		0414	0520	0419
29		70	43				1156	1319D	1203
29		67					1319E	1449	1348
29					32		2042	2100	2047
30			7	12*			0211	0300	0233
30			37	37	12		0321	0427	0330
30			19	32			0626	0659D	0638
30			60	11			0659E	0743	0713
30			13				0833	0906	0839
30		10	12				0912	0939	0916
30		22					1305	1349	1314
30				9	11		2258	2338D	2304
30				8	10		2338E	0033	2346
31				15	11		0035	0114	0039
31			56	39			0356	0437D	0416
31			48	31			0437E	0627	0505
31		23	15	10			0814	0839	0822
31		15					1307	1351	1314
31		24					1400	1441	1403

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Queries about "Ionosperic Data in Japan" should be forwarded to:
Communications Research Laboratory, Ministry of Posts and Telecommunications,
2-1 Nukui-Kitamachi 4-chome, Koganei-shi, Tokyo 184 JAPAN.