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PART A
IONOSPHERIC DATA

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NOVEMBER 1960

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
CENTRAL RADIO PROPAGATION LABORATORY
BOULDER, COLORADO

CRPL-F195
PART A

NATIONAL BUREAU OF STANDARDS
CENTRAL RADIO PROPAGATION LABORATORY
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Issued
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IONOSPHERIC DATA

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SYMBOLS, TERMINOLOGY, CONVENTIONS

Beginning with data reported for January 1952, and continuing through December 1956, the symbols, terminology, and conventions for the determination of median values used in this report (CRPL-F series) conform as far as practicable to those adopted at the Sixth Meeting of the International Radio Consultative Committee (C.C.I.R.) in Geneva, 1951. Excerpts concerning symbols and terminology from Document No. 626-E of this Meeting are given on pages 2-7 of the report CRPL-F89, "Ionospheric Data," issued January 1952. Reprints of these pages are available upon request.

Beginning with data for January 1957, the symbols used are given in NBS Report 5033, "Summary of Changes in Ionospheric Vertical Soundings, Observing and Scaling Procedures - Effective 1 January 1957," which draws upon the First Report of the Special Committee on World-Wide Ionospheric Soundings (URSI/AGI), Brussels, Sept. 2, 1956. A list of these symbols is available upon request.

In the Second Report of the Special Committee on World-Wide Ionospheric Soundings of the URSI/AGI Committee, May 1957, a new descriptive letter was introduced:

M Measurement questionable because the ordinary and extraordinary components are not distinguishable.

There was an expansion in meaning of the following:

Z (1) (qualifying letter) Measurement deduced from the third magnetoionic component.
(2) (descriptive letter) Third magnetoionic component present.

Beginning with data for January 1945, median values are published wherever possible. Where averages are reported, they are, at any hour, the average for all the days during the month for which numerical data exist.

The following conventions are used in determining the medians for hours when no measured values are given because of equipment limitations and ionospheric irregularities. Symbols used are those given above.

a. For all ionospheric characteristics:

Values missing because of A, C, F, H, L, N or R are omitted from the median count.

b. For critical frequencies and virtual heights:

Values of foF2 (and foE near sunrise and sunset) missing because of E are counted as equal to or less than the lower limit of the recorder. Values of h'F (and h'E near sunrise and sunset) missing for this reason are counted usually as equal to or greater than the median. Other characteristics missing because of E are omitted from the median count.

Values missing because of G are counted:

1. For foF2, as equal to or less than foF1.
2. For h'F2, as equal to or greater than the median.

The symbol W is included in the median count only when it replaces a height characteristic; the descriptive symbol D, only when it replaces a frequency characteristic.

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

c. For MUF factor (M-factors):

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

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

d. For sporadic E (Es):

Values of fEs missing because of E or G are counted as equal to or less than the median foE, or equal to or less than the lower frequency limit of the recorder.

B for fEs is counted on the low side when there is a numerical value of a higher layer characteristic; otherwise it is omitted from the median count.

S for fEs is counted on the low side at night; during the day it is omitted from the median count (beginning with data for November 1957).

Values of fEs missing for any other reason, and values of h'Es missing for any reason at all are omitted from the median count.

Beginning with CRPL-F188, Part A, issued April 1960, the count is given for foF2 in the tables of medians. It is regretted that space limitations prevent including detailed counts for other characteristics.

To indicate further in a general manner the relative reliability of the data, for the F2 layer, h^*F or foEs, if the count is from five to nine, or, for all layers, if more than half of the data used to compute the medians are doubtful (either doubtful or interpolated), the median is enclosed in parentheses. Medians are computed for less than five values for foF2 only.

Ordinarily, a blank space in the fEs or foEs column of a table is the result of the fact that a majority of the readings for the month are below the lower limit of the recorder or less than the corresponding values of foE. Blank spaces at the beginning and end of columns of h'F2 or h'F1, foF1, h'E, and foE are usually the result of diurnal variation in these characteristics. Complete absence of medians of h'F1 and foF1 is usually the result of seasonal effects.

There is no indication on the graphs of the relative reliability of the observed data; it is necessary to consult the tables for such information.

The tables may contain median values of either foEs or fEs. The graph of median Es corresponds to the table. Percentage curves of fEs are estimated from values of foEs when necessary.

The latest available information follows concerning the smoothed observed Zürich numbers beginning with the minimum of April 1954. Final numbers are listed through June 1959.

Smoothed Observed Sunspot Number

WORLD-WIDE SOURCES OF IONOSPHERIC DATA

The ionospheric data given here in tables 1 to 72 and figures 1 to 144 were assembled by the Central Radio Propagation Laboratory for analysis and correlation, incidental to CRPL prediction of radio propagation conditions. The data are median values unless otherwise indicated. The following are the sources of the data in this issue:

Republica Argentina, Ministerio de Marina:
Buenos Aires, Argentina
Deception I.

Commonwealth of Australia, Ionospheric Prediction Service of the Commonwealth Observatory:
Canberra, Australia

Meteorological Service of the Belgian Congo and Ruanda-Urundi:
Bunia, Belgian Congo
Elisabethville, Belgian Congo
Leopoldville, Belgian Congo

Belgian Royal Meteorological Institute:
Dourbes, Belgium

Escola Politecnica, University of Sao Paulo:
Sao Paulo, Brazil

British Department of Scientific and Industrial Research, Radio Research Board:
Falkland Is.
Inverness, Scotland
Port Lockroy
Singapore, British Malaya
Slough, England

Defence Research Board, Canada:
Churchill, Canada
Eureka, Canada
Frobisher, Canada
Ottawa, Canada
Resolute Bay, Canada
St. John's, Newfoundland
Winnipeg, Canada

Radio Wave Research Laboratories, National Taiwan University,
Taipeh, Formosa, China:
Formosa, China

General Direction of Posts and Telegraphs, Helsinki, Finland:
Nurmijarvi, Finland

The Finnish Academy of Sciences and Letters:
Sodankyla, Finland

French National Center for Telecommunications Studies:
Dakar, French West Africa
Djibouti, French Somaliland
Poitiers, France
Rabat, Morocco
Tahiti, Society Is.
Tamanrasset, French West Africa
Tananarive, Madagascar

Heinrich Hertz Institute, German Academy of Sciences, Berlin:
Juliusruh/Rügen, Germany

Institute for Ionospheric Research, Lindau Über Northeim, Hannover,
Germany:
Lindau/Harz, Germany
Tsumeb, South West Africa

Ionospheric Institute, Breisach, Germany:
Freiburg, Germany

The Royal Netherlands Meteorological Institute:
De Bilt, Holland
Paramaribo, Surinam

Geophysical and Geodetic Institute, Genoa, Italy:
Genoa (Monte Capellino), Italy

Ministry of Postal Services, Radio Research Laboratories, Tokyo, Japan:
Akita, Japan
Tokyo (Kokubunji), Japan
Wakkai, Japan
Yamagawa, Japan

General Directorate of Telecommunications, Mexico:
El Cerillo, Mexico

Norwegian Defence Research Establishment, Kjeller per Lillestrom,
Norway:
Tromso, Norway

Telecommunication Administration, Oslo, Norway:
Svalbard, Norway

Research Institute of National Defence, Stockholm, Sweden:
Kiruna, Sweden
Lycksele, Sweden

Royal Board of Swedish Telegraphs, Radio Department, Stockholm,
Sweden:
Lulea, Sweden

Post, Telephone and Telegraph Administration, Berne, Switzerland:
Sottens, Switzerland

United States Army Signal Corps:
Adak, Alaska
Ft. Monmouth, New Jersey

National Bureau of Standards (Central Radio Propagation Laboratory):
Anchorage, Alaska
Huancayo, Peru (Instituto Geofisico de Huancayo)
Maui, Hawaii
Point Barrow, Alaska
Pole Station, Antarctica
Talara, Peru (Instituto Geofisico de Huancayo)

TABULATIONS OF ELECTRON DENSITY DATA

Reduction of hourly ionospheric vertical soundings to electron density profiles has become a part of the systematic ionospheric data program of the Central Radio Propagation Laboratory, National Bureau of Standards. Scalings of ionograms for this purpose are being provided by ionosphere stations operated by CRPL and the U. S. Army Signal Corps. For the present, the hourly profile data from one CRPL station, Puerto Rico, are appearing in the monthly CRPL-F Reports, Part A. These data are in place of the standard ionogram reductions formerly provided by this Station. The very considerable task of scaling the ionograms for this purpose is being undertaken by T. R. Gilliland, Engineer in Charge, Puerto Rico Ionosphere Sounding Station; the computations are performed at the NBS Boulder Laboratories by a group headed by J. W. Wright. Basic conversion of virtual to true heights uses the well-known matrix method developed by K. G. Budden of the Cavendish Laboratory, Cambridge University, programmed for an IBM 704 computer.

The tabulations provide the following basic electron density profile data for each hour of each day of the month:

<u>Quantity</u>	<u>Units</u>	<u>Remarks</u>
Electron Density (N)	$\times 10^3 = \text{electrons/cm}^3$	Body of table; given at each 10 km of height.
NMAX	$\times 10^3 = \text{electrons/cm}^3$	Always the highest value of N at each hour. To maintain this rule, the electron density at the next 10 km increment above HMAX is always given as exactly equal to NMAX (unless HMAX coincides with a 10 km level).
QUALification	(Alphabetic)	A standard scaling letter qualifying the observation when necessary.
HMIN	Kilometers	The height of zero or very low electron density, obtained by linear extrapolation of the electron density vs. height curve.
SCAT	Kilometers	One half of the half-thickness of the parabola best fitting the upper portion of the F region profile. Approximates the scale height near the level HMAX.
HMAX	Kilometers	The height of maximum electron density, determined by fitting a parabola to the upper portion of the profile.
SHMAX	$\times 10^{10} = \text{electrons/cm}^2$ column.	Obtained by integration of the profile between the limits HMIN and HMAX.

Tabulations of the average electron densities each hour, at each 10 km level, for the quiet ionosphere, are also given. These averages include the profiles obtained when the magnetic character figure Kp is less than 4+. The number of profiles entering the average for each hour is given by CNT. The other parameters of the layer, HMIN, SCAT, HMAX, SHMAX, are averaged in a similar way.

Before the averaging process, the individual profiles are extrapolated above HMAX by a Chapman distribution of 100 km scale height. This assumed model seems to agree well with the few published measurements dealing with the topside profile of the F-region.* Extrapolation is necessary in order to calculate homogeneous averages near HMAX and the average profiles are, in fact, given up to 950 km. Also given are the average estimated integrated electron densities to infinity, SHINF (same units as SHMAX); this is an approximation to the total electron content in a column of the ionosphere.

*See Wright, J.W. "A Model of the F-Region Above HMAX F2" J.Geophys.Res. V.65 pp 185-191.

ELECTRON DENSITY

PUERTO RICO		60 W		1 JULY 1960								
TIME	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
QUAL												
HMIN	260	263	228	221	257	263	211	110	110	109	109	108
SCAT	60.1	66.6	56.7	69.8	69.1	59.8	70.7	56.1	62.0	60.9	108	86.1
HMAXF	406	411	371	334	418	412	388	342	320	286	338	327
SHMAX	606	683	539	517	444	434	479	605	719	619	842	827
KM												
420		735			461	516						
410	735	735			460	516						
400	734	731			453	511						
390	725	718			441	496	469					
380	703	694	670		424	478	467					
370	673	666	670		404	452	461					
360	635	629	664		378	419	450					
350	587	583	648		347	377	433	540				
340	524	533	618	661	310	329	414	540			500	
330	452	477	582	660	271	274	389	534	643		499	
320	371	417	537	654	227	216	162	519	643		497	
310	286	348	483	641	182	163	328	494	639		492	599
300	198	273	417	624	140	117	292	462	626	485	598	
290	124	192	341	605	105	80.5	254	422	606	557	475	592
280	76.?	112	262	566	74.4	54.8	219	379	578	555	460	583
270	46.6	49.6	191	508	47.9	31.0	176	337	544	547	446	58.6
260		127	423	12.4		139		302	494	530	429	550
250			81.0	310		104		292	430	510	413	529
240			49.6	161		74.9		364	310	47.7	39.6	59.1
230			12.4	67.1		54.3		226	331	404	381	475
220						34.5		209	294	399	368	440
210								194	272	362	357	405
200								179	256	333	349	376
190								162	242	310	341	354
180								143	223	294	330	335
170								122	202	276	312	323
160								101	174	254	288	311
150								84.8	154	227	261	297
140								80.7	136	198	233	278
130								77.0	123	178	205	238
120								73.3	115	167	187	207
110								40.2	40.2	127	127	14.3

ELECTRON DENSITY

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ELECTRON DENSITY												
PUERTO RICO			60 W									
TIME	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
QUAL	S											
HMIN	237	239	213	230	254	240	196	109	111	105	105	109
5CAT	442.2	550.0	604.6	703.3	551.1	652.5	714.8	857.7	779.9	904.6	824.4	874.5
HMAX	379	364	329	383	368	382	385	361	337	338	369	394
SHMAX	576	661	521	539	388	362	668	1029	1483	1551	1834	2123
KM												
400												1420
390												1419
380	834											1411
370	826	806										1316 1393
360	797	905										1312 1366
350	742	893										1298 1266
340	679	865										1275 1220
330	593	827	679	511	486	345	372	730	1339	1188	1240	1220
320	508	769	675	469	446	317	346	710	1326	1178	1194	1161
310	409	688	662	417	382	282	317	684	1302	1161	1143	1096
300	310	586	639	352	305	240	286	655	1267	1136	1083	1013
290	219	469	608	286	230	198	255	623	1219	1104	1015	931
280	152	335	566	219	161	152	221	588	1165	1064	938	851
270	105	206	514	161	89.6	112	187	551	1096	1019	860	776
260	71.4	112	446	108	45.4	71.4	156	513	1010	968	781	705
250	47.4	60.0	353	71.4			45.8	127	473	897	910	702
240	12.4	4.5	254	45.8				102	431	763	846	628
230		143						77.8	389	616	769	563
220		60.0						54.9	347	483	679	503
210								42.4	305	379	552	467
200								12.4	262	316	464	432
190								22.2	272	374	403	385
180								184	235	325	372	362
170								152	203	288	332	331
160								127	174	255	299	301
150								108	148	219	256	261
140								96.0	131	187	217	210
130								90.0	122	163	195	194
120								83.8	115	152	172	164
110								12.4	134	161	162	147

ELECTRON DENSITY												
PUERTO RICO		60 W					5 JULY 1960					
TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
QUAL	A	S	S	C	A	R						
HMIN	108	109	108	107	111	110	229	228	223	257	289	
SCAT	65.4	71.4	62.3	52.1	71.9	64.5	b2.0	55.0	56.0	64.7	59.8	
HMAXF	36	359	329	316	344	360	381	377	396	411	428	
SHMAX	1964	2066	1817	1550	1321	1158	988	923	916	1029	978	
XFM												
430												1191
420												1185
410												1191
400												1050
390												1182
380												1123
370	1612						1038	1133	1162	996	1069	912
360	1605	1697					1038	1109	1130	937	1004	807
350	157	1690					1119	1032	1068	1091	875	917
340	1531	1665					1118	1014	1016	1035	799	803
330	1471	1612					1108	979	947	954	716	672
320	1393	1560					1084	936	863	854	628	540
310	128	1487					1771	1727	1672	1521	774	595
300	1188	1407					1735	1721	1522	487	771	417
290	1180	1397					1676	1671	1604	819	667	537
280	960	1178					1593	1616	1616	743	648	500
270	880	1050					1496	1426	901	560	417	362
260	716	932					1240	1229	762	501	174	148
250	610	808					1061	1050	685	430	97.2	91.6
240	540	697					897	851	608	370	544.8	544.8
230	490	608					716	676	523	322	545	12.4
220	456	571					592	540	462	286		
210	435	477					487	466	389	256		
200	410	431					423	396	330	230		
190	398	396					393	352	282	206		
180	373	370					356	335	244	179		
170	348	345					335	312	212	153		
160	320	316					310	288	177	129		
150	286	284					288	253	147	109		
140	22	254					262	219	130	93.4		
130	198	225					227	191	121	81.9		
120	188	207					206	185	114	75.3		
110	166	127					143	127	124			

ELECTRON DENSITY												
PUERTO RICO						60 W						6 JULY 1960
TIME	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
DUAL										A	A	A
HMIN	.269	.214	.188	.230	.276	.251	.227	.108	.110	.109	.109	.109
SCAT	58.5	48.0	60.7	43.1	48.9	41.3	70.1	71.7	66.7	75.5	63.9	
HMAXF	385	313	329	334	407	359	390	317	333	327	327	
SHMAX	916	667	455	251	311	223	357	774	1248	1694	1599	
KM												
410								362				
400								361		362		
390	1252							356		362		
380	1250							346		360		
370	1226							332		354		
360	1183							316	362	345		
350	1130							295	357	331		
340	1066				414		266	342	314		1228	
330	960			540	414		231	314	294		1227	1528 1487
320	818	1107		537	404		191	278	270	707	1216	1525 1483
310	643	1106		527	382		150	235	255	705	1190	1505 1461
300	477	1083		508	350		112	188	211	697	1151	1480 1417
290	262	1039		483	310	71.4	143	179	681	1096	1435 1366	
280	97.2	975		453	254	26.8	103	147	657	1030	1374	1297
270	12.4	881		410	191		68.1	117	630	943	1304	1200
260		739		358	127		44.1	89.9	595	840	1220	1081
250		552		299	78.8		64.3	549	724	1132	960	
240		310		240	46.8		44.9	493	604	1018	826	
230		143		186			12.4	430	508	875	704	
220		45.6		146				170	425	731	608	
210		103						113	362	581	531	
200		62.6						268	310	458	477	
190		12.4						230	271	379	429	
180								198	237	326	383	
170								171	207	283	335	
160								145	184	247	289	
150								121	161	216	245	
140								102	146	186	206	
130								82.9	123	161	191	
120								66.8	111	150	169	
110								50.9	80	110	133	

ELECTRON DENSITY														
PUERTO RICO											6 JULY 1960			
TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		
QUAL								A	A	A				
HMIN	109	100		110	111	110		187	238	260	279	258		
SCAT	6541	6527		6742	6143	6248		5642	5049	5840	4471	5046		
HMAXF	345	345		358	340	321		366	370	405	320	374		
SHMAX	1736	1831		2131	1947	1552		956	892	1014	755	856		
XH														
410											1265			
400											1263	1215		
390											1244	1215		
380											1167	1196	1201	1240
370	1466							1061	1158	1145	1157	1238		
360	1484			1907				1058	1124	1073	1082	1215		
350	1460	1421		1900	1960			1034	1012	987	974	1168		
340	1458	139		1873	1962			996	995	875	834	1096		
330	1441	1354		1824	1955	1612		947	894	754	679	1024		
320	1392	1291		1752	1916	1610		888	787	608	477	883		
310	1357	1217		1669	1842	1593		817	667	446	310	734		
300	1229	1126		1555	1755	1555		739	540	294	179	560		
290	1227	1038		1416	1635	1493		654	396	175	83.8	349		
280	1143	941		1255	1494	1421		566	276	83.8	124	240		
270	1035	846		1026	1324	1325		477	181	12.4	104			
260	917	754		917	1143	1206		281	120					
250	804	665		754	917	1075		291	77.9					
240	696	590		624	716	907		212	49.6					
230	608	529		528	573	730		153	12.4					
220	545	481		466	467	573		109						
210	495	445		423	407	420		74.2						
200	455	427		393	338	335		48.4						
190	420	401		372	328	281		12.4						
180	38	374		352	305	248								
170	35	335		331	282	219								
160	327	270		303	250	196								
150	28	240		267	224	170								
140	256	221		235	207	143								
130	222	210		206	188	126								
120	200	201		185	167	117								

ELECTRON DENSITY																											
PUERTO RICO				60 W				7 JULY 1960				PUERTO RICO				60 W				7 JULY 1960							
TIME	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		
QUAL													A														
HMIN	234	253	215	203	230	190	249	107	108	109	110	113	A														
SCAT	62.0	51.0	45.8	52.0	36.5	66.5	61.0	70.6	79.3	71.4	89.5	69.1	A														
HMAXF	377	360	313	327	318	317	358	312	343	335	366	365	A														
SHMAX	963	836	709	653	358	430	346	704	1248	1557	1929	1891	A														
KM																											
380	1191													1354	1555												
370	1187	1257												1352	1554												
360	1169	1244												1352	1554												
350	1135	1200												1343	1538												
340	1090	1151												1313	1506												
330	1022	1073												1280	1457												
320	936	960	1215	770	707	508	402	643	934	1366	1247	1386		422	928	1317	1280	1457									
310	812	803	1214	754	698	507	378	643	962	1339	1204	1302		446	1004	1343	1230	1457									
300	679	621	1190	722	661	500	346	638	930	1292	1158	1205		444	1004	1343	1230	1457									
290	540	434	1136	679	600	487	305	627	893	1245	1107	1105		436	1004	1343	1230	1457									
280	381	253	1057	617	516	468	253	610	847	1178	1045	994		434	1004	1343	1230	1457									
270	240	119	930	540	404	446	191	585	794	1096	976	883		434	1004	1343	1230	1457									
260	132	424	6	754	446	270	417	112	555	725	998	906	777		427	928	1317	1280	1457								
250	75	540	345	143	378	124	519	653	887	838	679			427	928	1317	1280	1457									
240	40	*	310	240	60	0	329	477	580	771	767	595		427	928	1317	1280	1457									
230		135	148		269			427	504	658	693	530		427	928	1317	1280	1457									
220		49	6	81	8	198		377	446	554	617	480		427	928	1317	1280	1457									
210			43	4	127			329	389	469	540	443		427	928	1317	1280	1457									
200				60	0			283	346	405	467	412		427	928	1317	1280	1457									
190					24	0	10	340	407	467	382			230	647	549	621	561	589	508							
180						27	27	326	324	349				220	541	541	545	477	489	442							
170						167	24	326	324	310				210	489	489	487	423	417	391							
160						137	203	252	290	271				200	437	417	447	372	371	349							
150							114	172	212	257	233			190	396	390	402	352	345	313							
140							99	4	146	179	226	206			180	366	366	368	325	310	280						
130							84	6	129	159	179	190			170	343	343	338	300	280	254						
120							77	9	118	149	167	168			160	324	324	310	273	265	226						
110							71	4	83	97	97	92			150	305	294	289	234	238	198						
														140	276	264	269	194	207	170							
														130	22	23	238	176	183	146							
														120	20	20	21	156	168	134							
														110	97	49	6	127	94	83	87	97	2				

ELECTRON DENSITY

PUERTO RICO

60 W

9 JULY 1960

TIME	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	A	A
DUAL														
HMIN	241	231	228	234	218	211	211	110	109	109	109	109		
SCAT	60.3	52.8	50.5	55.6	52.7	50.7	68.1	43.5	95.1	53.0	118			
HMAXF	376	331	343	348	333	324	348	281	341	309	384			
SHMAX	974	785	642	635	591	492	633	666	1527	1161	1855			
KM														
390								1072						
380	1290							1072						
370	1287							1068						
360	1268							1061						
350	1230	960	906					1050						
340	1178	1215	960	902	854	752	1167							
330	1115	1215	945	882	854	745	741							
320	1004	1207	911	849	842	744	722							
310	834	1167	860	803	813	731	696							
300	662	1112	788	732	772	702	664							
290	477	1033	691	637	716	662	619							
280	298	917	573	515	631	608	551							
270	167	754	432	362	529	522	467							
260	91.3	540	262	219	407	417	362							
250	49.6	310	143	105	277	293	240							
240	83.6	64.6	49.6	161	179	148	765							
230		12.4			76.9	92.3	81.8							
220					23.0	49.6	47.5							
210								460						
200								669						
190								513						
180								502						
170								440						
160								43.3						
150								48.6						
140								188						
130								300						
120								153						
110								310						

ELECTRON DENSITY

PUERTO RICO

60 W

9 JULY 1960

TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	A	A	A
DUAL															
HMIN	109	107	108	109	109	109	110	218	217	262	246	246			
SCAT	83.5	65.6	69.9	72.5	63.1	79.8	62.6	63.5	70.0	52.5	53.1				
HMAXF	378	367	365	357	338	349	373	376	408	372	380				
SHMAX	2089	1922	1934	1971	1666	1632	1204	1249	1193	864	792				
KM															
380								410							
370								400							
360	1528							390							
350	1524	1420						380							
340	1486	141						370							
330	1402	1382	1240					370							
320	1283	1325	1236					360							
310	1210	1251	1206					350							
300	897	1153	1129	890	970	577	568	967	1491	1250	1055	960			
290	670	1004	1025	794	928	517	425	921	1446	1207	1020	890			
280	417	794	875	667	857	446	335	859	1320	1161	980	816			
270	232	556	665	540	754	379	240	788	1333	1109	934	742			
260	107	335	417	401	622	310	133	702	1251	1046	883	671			
250	49.6	143	198	262	463	248	674.8	608	1155	971	826	604			
240	66.5	71.4	143	286	188	12.4	518	1020	887	765	547				
230								270							
220		12.4	68.3	89.4				270							
210			12.4	54.4				270							
200				12.4				270							
190								270							
180								270							
170								270							
160								270							
150								270							
140								270							
130								270							
120								270							
110								270							

ELECTRON DENSITY

PUERTO RICO

60 W

10 JULY 1960

TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	A	A	A
DUAL															
HMIN	107	108	109	109	109	110	218	217	262	246	246				
SCAT	83.5	65.6	69.9	72.5	63.1	79.8	62.6	63.5	70.0	52.5	53.1				
HMAXF	378	367	365	357	338	349	373	376	408	372	380				
SHMAX	2089	1922	1934	1971	1666	1632	1204	1249	1193	864	792				
KM															
380								410							
370								400							
360								390							
350								380							
340								370							
330								360							
320								350							
310								340							
300								330							
290								320							
280								310							
270								300							
260								290							
250								280							
240								270							
230								270							
220								270							
210								270							
200								270							
190								270							
180								270							
170								270							
160								270							
150								270							
140								270							
130								270							
120								270							
110								270							

ELECTRON DENSITY

PUERTO RICO

60 W

11 JULY 1960

TIME 0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100

	A	A	A		A	A	A
QUAL	234	208	214	229	224	230	249
HMIN	234	208	214	229	224	230	249
SCAT	52.9	66.5	55.3	51.4	41.3	63.0	76.9
HMAXF	355	355	356	353	332	343	383
SHMAX	762	777	637	495	415	467	647
KM							
390							697
380							697
370							692
360	1096	917	804	697	608	665	854
350	1093	916	801	697	607	643	852
340	1073	906	784	687	697	607	1107
330	1032	885	754	664	697	601	643
320	974	854	716	626	683	588	579
310	892	817	668	578	643	565	533
300	778	762	608	516	591	509	472
290	643	688	526	462	523	506	395
280	477	589	330	243	333	351	310
270	320	477	534	252	330	379	198
260	186	355	272	165	228	298	97.2
250	97.2	242	105	97.2	131	179	12.4
240	46.5	14.1	116	53.9	71.4	78.1	55.1
230	91.1	67.6	54.5	40.7			433
220	53.4	40.2					438
210	12.4						411
200							468
190							276
180							405
170							232
160							295
150							357
140							193
130							252
120							315
110							157

ELECTRON DENSITY

PUERTO RICO

60 W

11 JULY 1960

	A	A	S	A	A	A	
QUAL	108	110	108	109	109	110	215
HMIN	61.0	54.1	57.2	55.4	61.8	67.0	55.5
SCAT	359	356	344	327	375	389	355
HMAXF	2070	2060	2065	1775	1068	1176	873
SHMAX							770
KM							875
410							875
400							390
380							370
360							1937
350							2048
340							1937
330							2042
320							2144
310							1919
300							1989
290							2142
280							1096
270							1162
260							1194
250							933
240							694
230							1030
220							1082
210							1156
200							917
190							623
180							1688
170							1947
160							1923
150							864
140							849
130							431
120							768
110							680
							900
							319
							669
							524
							745
							732
							212
							1341
							870
							1189
							1314
							830
							1178
							1215
							939
							797
							1143
							1226
							1213
							939
							754
							694
							623
							162
							623
							536
							536
							643
							127
							457
							219
							389
							540
							78.8
							246
							47.4
							4.0
							20.3
							77.9
							30.0

ELECTRON DENSITY

PUERTO RICO

60 W

12 JULY 1960

TIME 0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100

	F	F	F	F	F	F		A	A	A	A	A
QUAL	267	260	231	219	241	199	233					
HMIN	267	260	231	219	241	199	233					
SCAT	44.0	51.5	51.4	59.4	51.6	64.6	73.9					
HMAXF	387	380	354	353	352	309	392					
SHMAX	537	652	708	836	530	465	620					
KM								625				
400								625				
390	814	949						625				
380	801	949						621				
370	780	941						611				
360	732	914	1004	1072	794			594				
350	672	868	1003	1072	793			575				
340	599	807	987	1059	782			549				
330	517	728	950	1027	754			515				
320	417	628	896	984	716			477				
310	311	508	824	928	659	608		427				
300	198	367	742	857	584	604		427				
290	117	210	647	765	486	594		319				
280	63.0	117	518	651	367	576		262				
270	19.0	54.8	335	508	219	550		198				
260	170	348	449	520	150	130						
250	89.4	170	49.6	479	75.8							
240	49.4	97.4			420	42.5						
230		52.2			335							
220		6.3			206							
210					78.9							
200					12.4							

ELECTRON DENSITY

PUERTO RICO

60 W

12 JULY 1960

	A	R	A	A	A	A	
QUAL	109	109	109	108	109	109	110
HMIN	77.5	70.0	71.8	87.1	60.5	71.4	61.7
SCAT	372	368	360	366	344	356	342
HMAXF	1803	1818	1749	1889	1430	1488	1253
SHMAX							909
KM							795
410							896
400							906
390							888
380							1328
370							1446
360							1446
350							1405
340							1328
330							1439
320							1367
310							1367
300							1326
290							1341
280							984
270							952
260							964
250							904
240							777
230							886
220							860
210							4.94
200							143
190							127
180							53.5
170							53.6
160							1.76
150							1.76
140							1.76
130							1.76
120							1.76
110							1.76

ELECTRON DENSITY

PUERTO RICO		60 W		15 JULY 1960	
TIME	0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100	DUAL	F	HMIN	254 272 276 279 295 273 275 101 103 103 105 100
SCAT	52.4 58.6 73.2 42.9 54.9 53.8 50.3 77.9 76.5 70.4 83.0 88.2	HMAXF	364 397 430 378 417 391 359 401 362 337 360 347	SHMAX	562 590 671 446 574 600 486 857 797 872 1018 1090
KM	716	440	716	420	713 784
440	716	420	703 780	410	590
420	713 784	410	703 780	400	590
400	734 686	400	734 834	390	590
390	733 656	390	734 834	380	580
380	720 608	380	693 826	370	580
370	814 692 586 729 637 803	370	565 557	360	661
360	812 658 547 699 573 763	360	546 557	350	661
350	799 616 482 654 477 716	350	553 658	340	735
340	767 563 408 592 371 648	340	548 754 498	330	545 652 651 734
330	725 504 335 516 262 559	330	511 650 638 729	320	538 665 436
320	667 440 257 426 151 446	320	514 643 620 718	310	514 621 600 699
310	589 362 179 310 77.7 335	310	594 402 492 498	300	599 573 679
300	487 251 108 189 33.1 240	300	498 367	290	573 654
290	378 143 62.1 97.2 127 362	290	413 573 542	280	627
280	262 65.6 264.2 12.4 60.0	280	332 632 322	270	597
270	143	270	513 473	260	643 608 656 620 12.4
260	55.1	260	439 562	250	581 551 596 544
250	228 299 444 407 522	250	520 490 540 466	240	213 406 378 477
240	213 275 406 378 477	240	463 454 485 394	230	201 257 371 354 429
230	191 242 342 334 389	230	417 417 435 335	220	181 235 316 319 358
220	168 227 299 306 334	220	381 385 389 289	210	168 227 299 306 334
210	156 220 285 298 324	210	355 359 352 251	200	156 220 285 298 324
200	139 209 269 289 313	200	334 335 319 219	190	121 214 289 192
190	123 196 251 277 300	190	321 314 289 192	180	109 178 229 262 286
180	109 178 229 262 286	180	309 272 239 147	170	95.7 157 201 242 261
170	95.7 157 201 242 261	170	260 227 177 107	160	140 236 167 211 235
160	85.2 136 167 211 235	160	246 205 149 01.7	150	78.7 121 143 174 183
150	78.7 121 143 174 183	150	219 177 129 75.1	140	72.9 109 135 155 159
140	55.9 90.5 123 143 150	140	193 151 115 75.1	130	120
130	55.9 90.5 123 143 150	130	174 138 105 66.4	120	161 130 97.2 12.4
110		110		100	

ELECTRON DENSITY

PUERTO RICO		60 W		15 JULY 1960	
TIME	1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300	DUAL	A	A	A
SCAT	110	HMIN	109 220 242 310 299	HMAXF	52.5 57.9 56.2 46.4 55.1
HMAXF	31.9	SCAT	290 353 385 407 414	SHMAX	507 361 436 352 407
SHMAX	104.8	KM	557 347 247 12.4		
KM	634	634	557 556		
360	634	634	540 548		
350	632	632	537 548		
340	640	640	532 548		
330	627	627	542 529		
320	590	590	541 493 544		
310	618	618	532 452 469		
300	605	605	439 515 401 426		
290	588	588	439 489 343 375		
280	360	360	434 455 279 304		
270	570	350	434 455 279 304		
260	546	340	422 411 219 219		
250	519	330	402 358 143 137		
240	490	320 906	378 304 12.4 74.4		
230	460	310 901	557 347 247 12.4		
220	432	300 888	557 313 186		
210	406	290 862	552 275 132		
200	385	280 828	536 232 91.8		
190	367	270 786	509 186 60.0		
180	355	260 730	477 135 36.4		
170	345	250 659	432 86.2		
160	334	240 573	379 49.6		
150	308	230 493	325		
140	275	220 427	274		
130	240	210 380	234		
120	215	200 352	203		
110	198	190 332	179		
100	187	180 321	158		
	174	170 310	138		
	83.8	160 291	119		
		150 270	103		
		140 241	91.5		
		130 211	70.9		
		120 190	12.4		
		110 127			

PUERTO RICO		60 W		16 JULY 1960	
TIME	0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100	DUAL	F	F	F
SCAT	94.6	HMIN	110	HMAXF	31.9
HMAXF	35.0	SCAT	67.0	SHMAX	104.8
SHMAX	102.7	KM	634		
KM	634	634	620		
360	634	634	610		
350	632	632	600		
340	640	640	590		
330	627	627	580		
320	590	590	570		
310	618	618	550		
300	605	605	530		
290	588	588	510		
280	360	360	490		
270	570	350	480		
260	546	340	450		
250	519	330	420		
240	490	320 906	410 310		
230	460	310 901	400 291		
220	432	300 888	420 281		
210	406	290 862	410 271		
200	385	280 828	400 251		
190	367	270 786	380 231		
180	355	260 730	360 211		
170	345	250 659	350 191		
160	334	240 573	340 171		
150	308	230 493	320 151		
140	275	220 427	300 131		
130	240	210 380	280 111		
120	215	200 352	260 91.5		
110	198	190 332	240 70.9		
100	187	180 321	220 12.4		
	174	170 310			
	83.8	160 291			

PUERTO RICO		60 W		16 JULY 1960	
TIME	1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300	DUAL	A	A	A
SCAT	110	HMIN	109 220 242 310 299	HMAXF	52.5 57.9 56.2 46.4 55.1
HMAXF	31.9	SCAT	290 353 385 407 414	SHMAX	507 361 436 352 407
SHMAX	104.8	KM	557 347 247 12.4		
KM	634	634	557 556		
360	634	634	540 548		
350	632	632	537 548		
340	640	640	532 548		
330	627	627	542 529		
320	590	590	541 493 544		
310	618	618	532 452 469		
300	605	605	439 515 401 426		
290	588	588	439 489 343 375		
280	360	360	434 455 279 304		
270	570	350	422 411 219 219		
260	546	340	402 358 143 137		
250	519	330	378 304 12.4 74.4		
240	490	320 906	557 347 247 12.4		
230	460	310 901	557 313 186		
220	432	300 888	552 275 132		
210	406	290 862	536 232 91.8		
200	385	280 828	509 186 60.0		
190	367	270 786	477 135 36.4		
180	355	260 730	432 86.2		
170	345	250 659	379 49.6		
160	334	240 573	325		
150	308	230 493	274		
140	275	220 427	234		
130	240	210 380	203		
120	215	200 352	179		
110	198	190 332	158		
100	187	180 321	138		
	174	170 310	119		
	83.8	160 291	103		
		150 270	91.5		
		140 241	70.9		
		130 211	12.4		
		120 190			
		110 127			

ELECTRON DENSITY

PUEERTO RICO 60 W 17 JULY 1960

TIME	0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100	A A A A
QUAL	F	
HMIN	367	268 289 245 310 308 105
SCAT	45.0	51.1 58.8 58.7 43.6 63.1 59.0
HMAXF	466	381 398 377 394 436 346
SHMAX	376	317 356 361 219 347 554
KM		
470	590	
460	588	
450	573	
440	561	
430	501	
420	446	
410	384	
400	317	
390	231	
380	120	
370	40.0	
360	427 420 437 316 256	
350	404 391 423 278 206 492	
340	373 352 401 232 143 491	
330	335 305 374 175 88.8 483	
320	290 253 342 104 60.0 467	
310	240 190 303 12.4 12.4 449	
300	188 103 259 420	
290	121 12.4 209	
280	64.0 153	
270	12.4 94.3	
260	60.0	
250	31.4	
240	197	
230	181	
220	173	
210	166	
200	157	
190	145	
180	130	
170	112	
160	95.5	
150	82.7	
140	73.0	
130	68.4	
120	64.3	
110	60.0	

ELECTRON DENSITY

PUEERTO RICO 60 W 17 JULY 1960

TIME	1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300	A A A A
QUAL	F	
HMIN	110	105
SCAT	97.4 76.8	96.5 63.0
HMAXF	306	321
SHMAX	661	849
KM		
420	420	
410	400	
390	380	
380	370	
360	350	
350	340	
340	330	
330	320	
320	310	
310	300	
300	290	
290	280	
280	270	
270	260	
260	250	
250	240	
240	230	
230	220	
220	210	
210	200	
200	190	
190	180	
180	170	
170	160	
160	150	
150	140	
140	130	
130	120	
120	110	
110	100	

ELECTRON DENSITY

PUEERTO RICO 60 W 18 JULY 1960

TIME	0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100	F A A
QUAL		
HMIN	321 237 249 230 289 309 277 109 10% 100 110 105	
SCAT	40.1 28.3 46.5 52.2 41.6 48.4 47.2 44.2 33.8 43.3 75.4 62.3	
HMAXF	403 301 339 363 380 405 387 299 269 262 338 345	
SHMAX	340 370 304 326 271 300 313 587 676 644 1177 1489	
KM		
410	625	
400	624	
390	608	
380	570	
370	517	
360	446	
350	362	
340	254	
330	117	
320	478	
310	96.0 452 170 173 12.4 222	
300	96.0 413 270 93.8	
290	92.5 355 229 12.4	
280	83.4 206 189	
270	67.0 211 151	
260	47.7 112 114	
250	19.8 12.4 79.3	
240	4.9.6 47.7	
230		
220		
210		
200		
190		
180		
170		
160		
150		
140		
130		
120		
110		

ELECTRON DENSITY

PUEERTO RICO 60 W 18 JULY 1960

TIME	1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300	S A A A A
QUAL	F	
HMIN	110 100	
SCAT	60.5 60.7	
HMAXF	356 33%	
SHMAX	1770 1801	
KM		
380	370	
360	1528	
350	1524	
340	1502 1654	
330	145 1551	
320	1383 1628	
310	1291 1583	
300	1191 1510	
290	1087 1423	
280	974 1307	
270	861 1184	
260	754 1064	
250	657 931	
240	580 810	
230	479 774	
220	478 794	
210	441 694	
200	417 620	
190	392 600	
180	367 371	
170	344 347	
160	323 320	
150	299 297	
140	262 277	
130	219 247	
120	192 205	
110	143 181	
100	127 71.4	

ELECTRON DENSITY												ELECTRON DENSITY																															
PUERTO RICO						60 W						19 JULY 1960						PUERTO RICO						60 W						19 JULY 1960													
TIME	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100		A	A	C	A	TIME	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		A	A	A	A	A	A	A	A	A	A	A	A
QUAL	F													A	A	C	A	QUAL	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A					
HMIN	290	239	240	250	290	320					100							HMIN	100	100																							
SCAT	39.2	44.9	38.3	54.9	53.4	54.1					60.7							SCAT	61.2	60.2																							
HMAXF	364	331	312	363	398	407					291							HMAXF	305	318																							
SHMAX	450	503	341	381	388	342					602							SHMAX	1045	1226																							
KM																	KM																										
410											519							400																									
400											540	517						390																									
390											537	506						380																									
380											525	486						370																									
370	854										500	494	459					360																									
360	85^										500	473	422					350																									
350	824										493	433	371					340																									
340	771	854									478	383	303					330																									
330	69^	854									453	323	219					320																									
320	58^	840									423	257	60+0					310																									
310	46^	804									384	184					300																										
300	310	754									669	334	97.2					290																									
290	97.0	667									633	286	124.4					280																									
280		565									234						270																										
270		446									17^						260																										
260		286									362	120					250																										
250		112									198	40+7					240																										
240		124.4									49+6						230																										
230																220																											
220																210																											
210																200																											
200																190																											
190																180																											
180																170																											
170																160																											
160																150																											
150																140																											
140																130																											
130																120																											
120																110																											
110																100																											
100																71.4																											

71.4 83.8 97.2

100

ELECTRON DENSITY

PUERTO RICO 60 W 23 JULY 1960
TIME 0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100

		A	A									
DUAL				100	110	100						
HMIN	260	239	220	239	249	229	250	410	58.9	51.7		
SCAT	38.0	39.7	33.9	41.1	40.9	52.5	36.1					
HMAXF	360	329	294	333	337	332	315	275	312	330		
SHMAX	480	527	356	352	298	322	186	813	1096	1450		
KM	370	896									982	982
	360	896									976	975
	350	881									1004	936
	340	834		608	532	469		1420			989	794
	330	754	982		607	528	469		1420	350	875	875
	320	656	968		592	508	462	403		370		
	310	527	922		558	474	448	401				
	300	382	847	754	508	423	425	386				
	290	226	737	751	446	357	394	355				
	280	97.2	595	720	362	281	351	310				
	270	12.4	431	653	278	190	295	240				
	260	219	566	179	97.2	231	161					
	250	84.7	462	92.5	12.4	164	12.4					
	240	12.4	310	12.4	87.1							
	230	127		12.4								
	220	12.4										
	210											
	200											
	190											
	180											
	170											
	160											
	150											
	140											
	130											
	120											
	110											
	100											

ELECTRON DENSITY

PUERTO RICO 60 W 23 JULY 1960
TIME 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300
A A B A
DUAL HMIN SCAT HMAXF SHMAX KM
100 50.3 55.6 54.1 40.0 50.4 55.8 41.0 41.1
1922 1669 1786 1341 960 696 679
1807 1662 1786 1583 1335 910 573 563
1837 1631 1771 1570 1304 849 446 389
1752 1572 1726 1492 1247 775 286 219
1632 1475 1647 1382 1159 690 143 60.0
1485 1363 1541 1240 1050 593 40.2
1327 1240 1404 1071 917 498
1170 1081 1240 859 754 400
1015 926 1050 573 560 299
863 772 808 240 310 191
716 629 608 12.4 143 102
601 508 446 40.2 1244
508 425 330
446 362 259
355 359 344
325 325 320
298 290 300
258 255 277
226 225 231
195 222 231
169 192 193
153 172 173
136 143 161
40.2 49.6
100 12.4
TIME 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300
A A A B A A A B
DUAL HMIN SCAT HMAXF SHMAX KM
110 55.1 47.8 40.7 51.0 42.1 40.0
2024 331 306 362 375 381
980 659 765 516 490
TIME 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300
A A A A A B
DUAL HMIN SCAT HMAXF SHMAX KM
1528 1528 905 608 540
1509 1509 834 508 446
1456 1456 1191 754 399 310
1366 1366 1185 661 286 170
1247 1247 1146 564 179 12.4
1056 1056 1059 463 87.7
917 917 960 366 12.4
692 692 818 273
417 417 660 179
198 198 466 40.2
12.4 12.4 198 40.2
40.2

ELECTRON DENSITY

PUERTO RICO 60 W 24 JULY 1960
TIME 0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100

		A	A	A								
DUAL					DUAL	A	A	A	A	A	B	
HMIN	268	260	259	239	239	229	220	99	99			834
SCAT	36.1	38.5	47.7	41.8	36.9	35.3	51.9	36.2	96.7			834
HMAXF	146	33.0	358	333	323	314	302	253	301			819
SHMAX	44.	484	484	440	393	326	353	422	741			1004
KM	360	776										1004
	350	896	768									834
	340	890	894	743	764							834
	330	948	881	706	763	774						819
	320	776	834	649	742	773	652					1004
	310	679	766	565	705	750	649	573				776
	300	552	679	459	643	701	623	573	571			991
	290	387	564	345	559	621	573	566	572			709
	280	219	437	219	465	508	498	548	567			1528
	270	60.0	262	97.2	346	389	399	518	559			627
	260	60.0	12.4	198	240	286	481	609	548			1528
	250	83.8	112	179	429	608	532					905
	240	12.4	12.4	80.3	362	580	513					540
	230	12.4	12.4	219	540	493						1509
	220	40.2	484	471								1446
	210			413	446							1332
	200			343	417							1509
	190			276	382							1456
	180			223	335							1191
	170			184	280							754
	160			153	228							399
	150			131	190							310
	140			112	159							1366
	130			96.2	134							1185
	120			86.5	121							661
	110			72.4	112							286
	100			12.4	12.4							170

ELECTRON DENSITY

PUERTO RICO 60 W 24 JULY 1960
TIME 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300
A A A A A B
DUAL HMIN SCAT HMAXF SHMAX KM
110 55.1 47.8 40.7 51.0 42.1 40.0
2024 331 306 362 375 381
980 659 765 516 490
TIME 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300
A A A A A B
DUAL HMIN SCAT HMAXF SHMAX KM
1528 1528 905 608 540
1509 1509 834 508 446
1456 1456 1191 754 399 310
1366 1366 1185 661 286 170
1247 1247 1146 564 179 12.4
1056 1056 1059 463 87.7
917 917 960 366 12.4
692 692 818 273
417 417 660 179
198 198 466 40.2
12.4 12.4 198 40.2
40.2

ELECTRON DENSITY

PUERTO RICO 60 W 25 JULY 1960
TIME 0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100
QUAL A A A A A

QUAL								
HMIN	280	270	239	239	210	230	240	
SCAT	41.2	37.6	46.2	33.9	44.4	33.5	40.4	
HMAXF	361	337	336	316	306	297	306	
SHMAX	480	407	435	346	355	241	203	

210 12.4

ELECTRON DENSITY

PUERTO RICO 60 W 25 JULY 1960
TIME 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300

DUAL	P	A								
HMIN	100	100	100	110	109	240	219	220	259	290
SCAT	54.0	54.1	57.1	46.4	46.7	43.8	42.7	42.2	48.7	45.0
HMAXF	350	335	330	334	346	338	321	325	369	349
SHMAX	1895	1765	1652	1458	1398	1036	922	733	660	621

KM
400 960

ELECTRON DENSITY

PUERTO RICO 60 W 26 JULY 1960
TIME 0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100

KM
360

F E L C T R O N D E N S I T Y

PUERTO RICO 60 W 26 JULY 1960
TIME 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300

QUAL	A	A	A	S	A	A	A	S	
HMIN				97			219	239	229
SCAT				55			52.0	49.1	52.2
HMAXF				337			363	351	365
SHMAX				1555			1063	931	846

KM 380 1050

350		516	
340		515	461
330		504	460
320	1240	484	443
310	1237	455	410
300	1207	716	414
290	1143	716	362
280	103	705	300
270	875	677	226
260	643	621	143
250	362	540	75+7
240	142	454	54
230	12 ^a	4	35
220		179	
210		12 ^a	
200			
190			
180			
170			
160			
150			
140			
130			
120			
110			
100			

ELECTRON DENSITY												
PUERTO RICO						29 JULY 1960						
TIME	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
QUAL					A	A	A	A	A	A	A	A
HMIN	307	270	249	249	280	230	200		99	100		
SCAT	37.0	39.3	42.4	44.8	45.6	34.5	41.6		70.5	74.9		
HMAXF	397	359	352	352	403	323	288		334	370		
SHMAX	624	677	696	745	721	701	647		1078	1901		
KM												
410		1094								420		885
400	1131		1083							410		834
390	1130		1062							400		829
380	1102		1014							390		803
370	1028		940							380		771
360	928	1240	1191	1215	845					370		721
350	794	1227	1190	1215	735					360		658
340	657	1175	1168	1195	608					350		594
330	477	1083	1110	1143	477	1473				340		445
320	310	951	1022	1063	335	1471				330		482
310	141	794	894	949	206	1416				320		769
300	124	604	739	805	931	1309				310		1215
290		362	573	643	124	1143	1131			300		770
280		143	362	446		917	1120			290		424
270		124	188	249		643	1074			280		262
260		283	8	112		349	999			270		532
250		124	124			112	898			260		1215
240					124	776				270		345
230						621				280		394
220						496				290		32
210						417				300		58
200						198				310		60
190										320		77
180										330		225
170										340		255
160										350		119
150										360		127
140										370		1067
130										380		573
120										390		124
110										400		
100										410		

ELECTRON DENSITY												
PUERTO RICO						30 JULY 1960						
TIME	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
QUAL					A	A	A	A	A	A	A	A
HMIN	220	280	259	260	320	329	320					
SCAT	40.5	33.5	33.7	44.1	35.5	52.1	36.8					
HMAXF	326	361	337	351	388	426	389					
SHMAX	531	336	365	346	289	435	365					
KM												
430					643				420			477
420					641				410			473
410					627				400			458
400					601				390			492
390				596	564	735			380			491
380				587	516	723			370			481
370		645		556	457	682			360			458
360		645		657	504	389	617		350			608
350		619	557	431	302	535			340			661
340		573	774	648	349	161	446		330			660
330		960	517	765	522	251	124	294		320		649
320		956	444	722	686	604	499	6		310		619
310		925	367	649	437				477			573
300		865	278	540	381				476			512
290		775	179	417	319				471			428
280		654	124	262	248				280			424
270		526		127	168				70			125
260		324		124	124				67			188
250		161							59			124
240		714							51			78
230		124							50			124

FLEXTION DENSITY

PUERTO RICO

60 W

31 JULY 1960

TIME 0000 0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100

QUAL	A							
HMIN	320	280	260	240	240	289	289	
SCAT	45.1	43.7	48.1	40.7	49.5	53.6	58.3	
HMAX	421	367	347	330	336	388	407	
SHMAX	357	377	349	282	277	259	262	

430	557	
420	557	
410	548	
400	527	
390	486	
380	440	
370	377	634
360	314	630
350	240	611
340	170	573
330	97.7	523
320	127.4	456
310		511
300		485
290		371
280		473
270		462
260		381
250		161
240		105
230		70.7
220		100
210		71.4
200		12.4
190		22.4
180		12.4
170		27.4
160		17.2
150		17.2
140		11.2
130		11.2
120		12.4
110		12.4
100		12.4

ELECTRON DENSITY

PUERTO RICO

60 w

31 JULY 1960

TIME 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300

	QUAL	A	A	A	A	A	A	A	A	A	A	
100	100	HMIN	100	100	100	110	110	260	259	270	300	289
105	81.4	SCAT	87.5	67.7	61.2	70.3	46.9	48.2	48.4	41.0	43.2	39.5
308	318	HMAXF	330	317	303	316	303	345	382	356	384	384
593	701	SHMAX	74	732	713	682	544	338	453	381	334	301

Table 49

Eureka, Canada (80.0° N, 85.9° W)							December 1958		
Time	h'F2	foF2-Count	h'F	foF1	h'E	foE	fEs	(M3000)F2	
00	5.2	30	270						
01	5.0	31	270						
02	5.1	31	270						
03	4.8	31	270						
04	5.0	31	200						
05	5.2	30	280						
06	4.7	31	270						
07	5.0	31	270						
08	4.8	30	270						
09	5.6	30	270						
10	5.4	30	260						
11	6.2	29	250						
12	6.2	31	260						
13	6.5	30	260						
14	6.6	29	250						
15	7.0	29	250						
16	6.8	30	260						
17	6.0	31	260						
18	6.2	31	260						
19	6.2	30	280						
20	5.8	30	270						
21	5.4	29	260						
22	5.6	31	270						
23	5.6	30	270						

Time: 75.0°W.

Sweep: 1.8 Mc to 20.0 Mc in 15 seconds.

Table 51

Ourthes, Belgium (50.1° N, 4.6° E)							April 1958		
Time	h'F2	foF2-Count	h'F	foF1	h'E	foE	fEs	(M3000)F2	
00	7.2	30	340			<1.6	2.35		
01	6.9	29	320				2.35		
02	6.4	29	320				2.40		
03	5.8	29	320			<1.2	2.35		
04	5.6	29	325			<1.60	2.40		
05	5.9	29	285			<119	1.80		
06	6.9	29	250			111	2.55	2.05	
07	7.8	29	235			105	3.00	2.80	
08	8.7	29	230			105	3.35	2.70	
09	(415)	9.6	28	230	(5.6)	105	3.65	2.65	
10	(430)	10.6	27	220	5.8	107	3.80	2.60	
11	(435)	11.0	28	220	6.0	107	3.00	2.55	
12	430	11.2	29	225	6.2	107	3.00	2.55	
13	405	11.2	29	230	6.2	109	(3.80)	2.60	
14	390	11.0	28	230	(6.3)	(109)	3.70	2.60	
15	370	10.6	28	230	6.1	111	3.55	2.60	
16	---	10.2	28	240	---	111	3.15	2.60	
17	10.4	29	250			113	2.70	2.70	
18	10.4	27	260			<127	2.15	2.75	
19	(9.6)	27	260			<1.60	<1.6	(2.75)	
20	8.5	29	<260			<1.6	2.65		
21	8.0	29	275			<1.6	2.50		
22	7.4	29	310			<1.6	2.45		
23	7.3	29	340			<1.6	2.35		

Time: 0.0°.

Sweep: 1.0 Mc to 25.0 Mc in 30 seconds.

Table 52

Paramaribo, Surinam (5.8° N, 55.2° W)							April 1958		
Time	h'F2	foF2-Count	h'F	foF1	h'E	foE	fEs	(M3000)F2	
00	15.5	28	340			3.8	2.50		
01	15.3	28	300			3.6	2.65		
02	14.3	28	275			3.1	2.75		
03	12.6	28	250			3.1	2.65		
04	11.6	28	260			3.0	2.75		
05	10.5	27	250			2.6	2.80		
06	10.0	27	250			2.6	2.80		
07	8.9	27	250			3.0	2.85		
08	7.6	27	245			2.7	2.75		
09	7.6	27	275			3.1	2.60		
10	10.1	27	260			130	2.2	4.5	
11	12.4	27	250			100	3.2	2.90	
12	13.5	28	240			100	3.8	2.85	
13	14.4	27	235			100	4.0	2.70	
14	(370)	15.0	28	240		100	4.4	4.6	
15	400	15.0	26	250	8.6	110	4.5	2.55	
16	400	15.0	26	245	8.5	100	4.5	2.55	
17	400	15.1	26	250	8.0	110	4.4	4.8	
18	415	14.5	27	<250	8.0	100	4.1	5.2	
19	440	14.0	27	240	7.6	100	3.8	4.9	
20	435	13.6	28	250	7.4	100	3.2	4.7	
21	---	13.2	28	270	150	2.6	5.0	2.30	
22	---	13.1	27	340	---	---	4.8	2.30	
23	---	14.0	28	390	---	4.4	2.35		

Time: 0.0°.

Sweep: 1.4 Mc to 20.0 Mc in 40 seconds.

Table 53

Frobisher, Canada (63.8° N, 68.6° W)							December 1958		
Time	h'F2	foF2-Count	h'F	foF1	h'E	foE	fEs	(M3000)F2	
00			5.2	24	290			3.8	
01			5.1	25	300			3.6	
02			4.9	25	300				
03			4.4	26	300			4.5	
04			4.7	25	290			3.1	
05			4.6	25	290			3.6	
06			4.6	23	290			3.0	
07			5.0	24	300			3.7	
08			5.4	24	290			3.0	
09			7.4	26	280			2.1	
10			10.4	27	260			2.3	
11			11.6	26	250			2.3	
12			9.0	25	250				
13			8.2	22	250			2.3	
14			7.1	23	270			2.1	
15			7.8	22	270			1.50	
16			5.5	21	290			2.8	
17			6.8	23	280			2.0	
18			6.2	25	280			3.6	
19			6.4	25	280			3.9	
20			6.0	26	280			4.6	
21			5.6	23	290			3.5	
22			5.3	23	290			4.4	
23			5.1	24	300			4.6	

Time: 75.0°W.

Sweep: 1.6 Mc to 20.0 Mc in 15 seconds.

Table 54

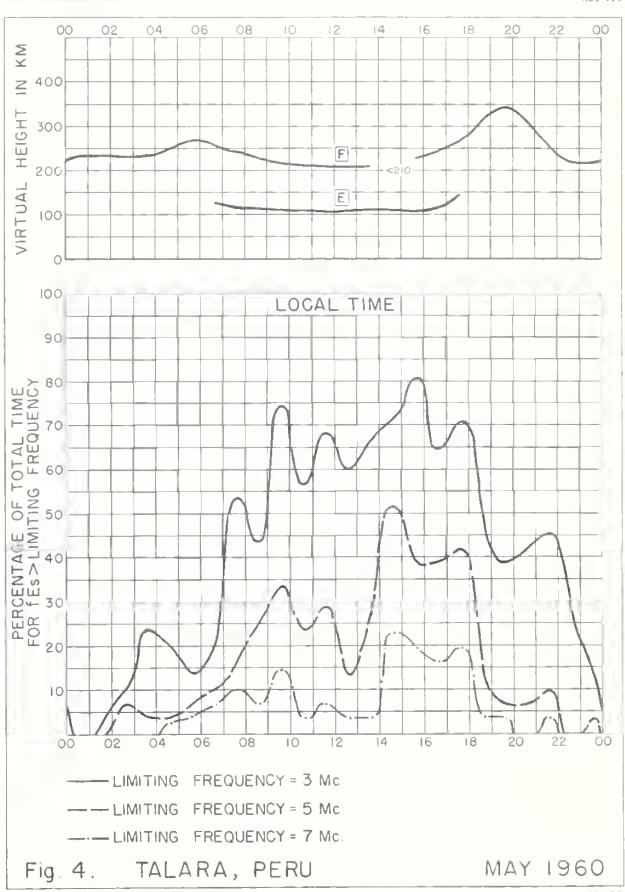
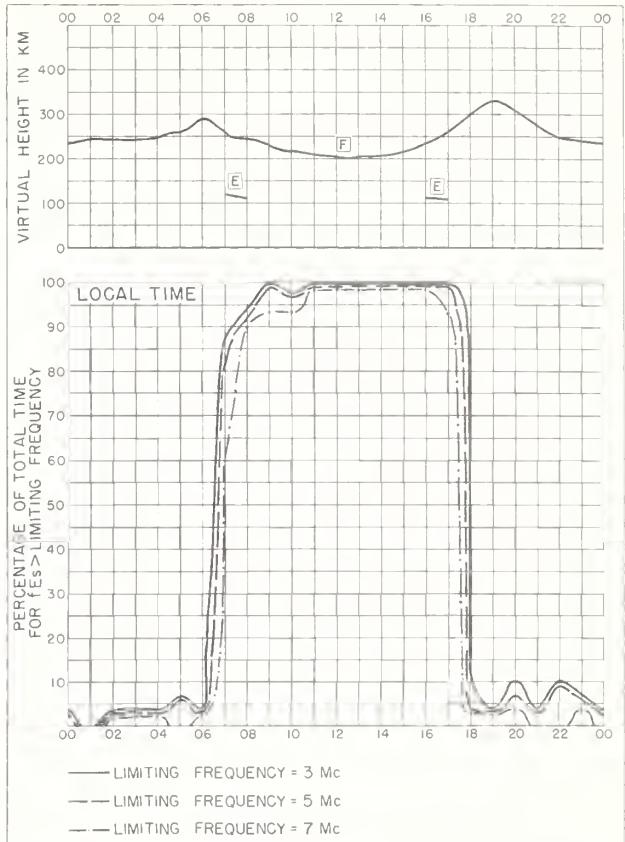
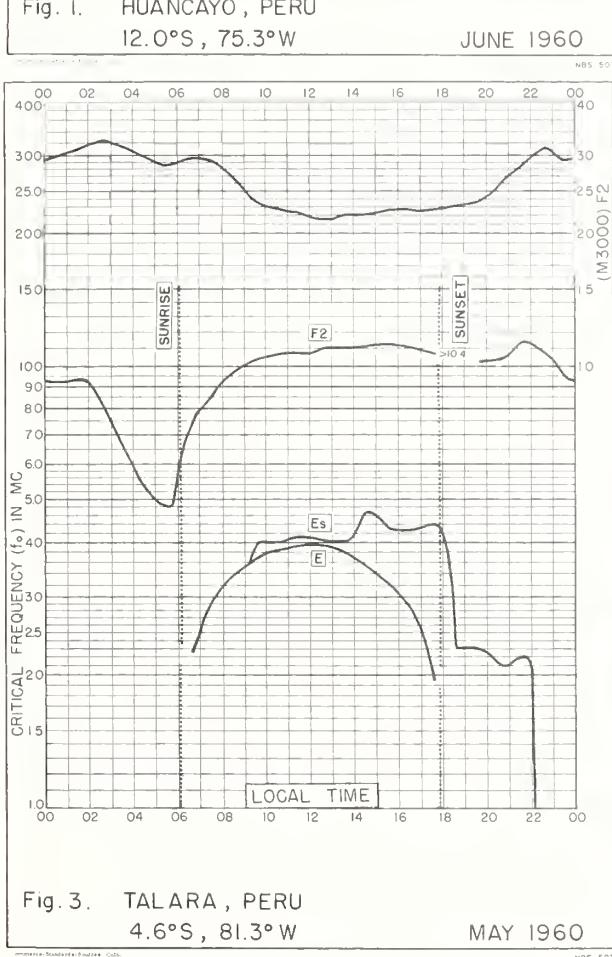
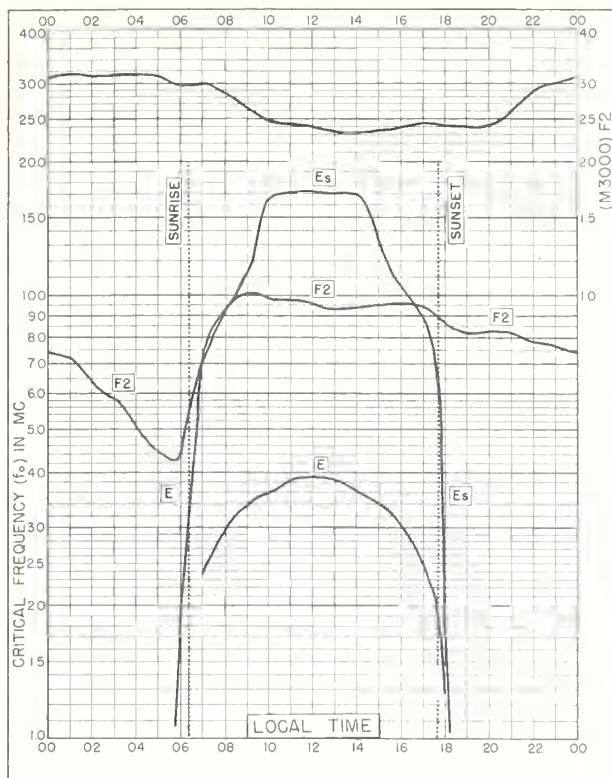
Freiburg, Germany (48.1° N, 7.6° E)							April 1958		
Time	h'F2	foF2-Count	h'F	foF1	h'E	foE	fEs	(M3000)F2	
00			7.4	30	335			2.30	
01			7.4	30	315			2.30	
02			6.8	30	315			2.40	
03			6.2	30	320			2.30	
04			6.1	30	320			2.40	
05			6.7	30	275			2.65	
06			7.8	30	245			2.75	
07			8.7	30	240			2.70	
08			9.8	29	230			2.65	
09			(430)	10.7	30	230	6.00	105	
10			440	11.4	30	225	6.00	105	
11			(440)	11.0	29	230	5.80	105	
12			405	12.0	29	230	6.00	105	
13			(435)	11.8	29	230	5.90	105	
14			(420)	11.4	30	240	6.60	106	
15			11.1	30	240			2.55	
16			11.0	29	245			2.55	
17			10.9	30	250			2.65	
18			10.6	30	255			2.70	
19			10.0	30	260			1.5	
20			8.8	30	260			2.55	
21			8.3	30	280			2.40	
22			7.9	30	310			2.40	
23			7.7	30	340			2.30	

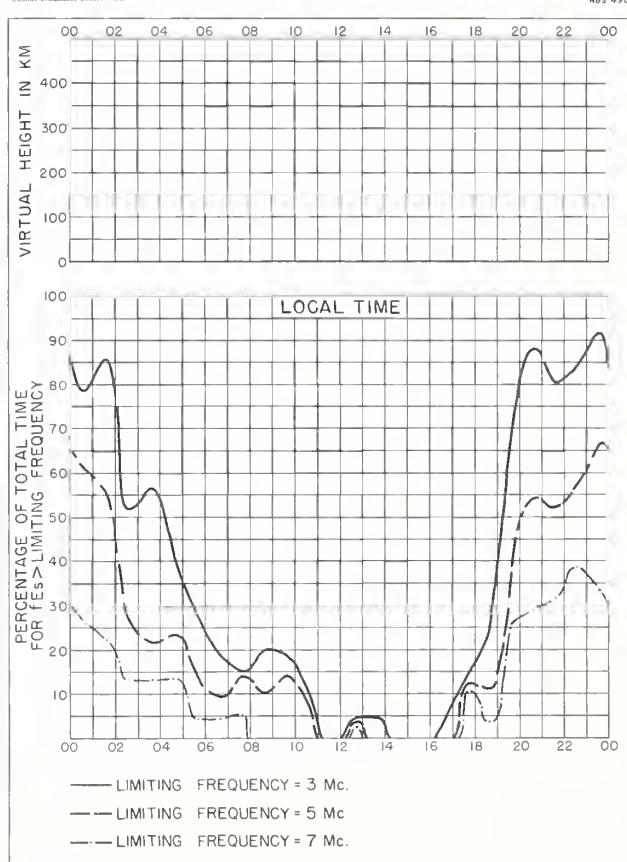
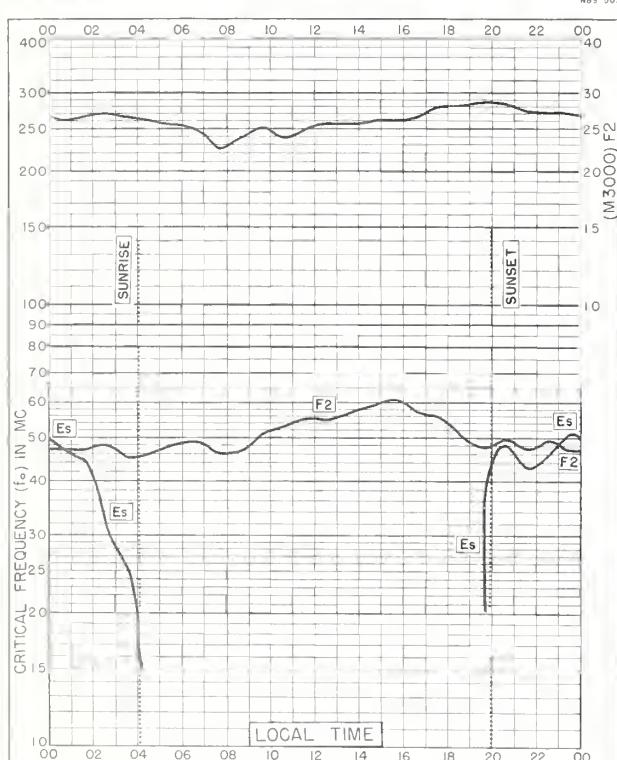
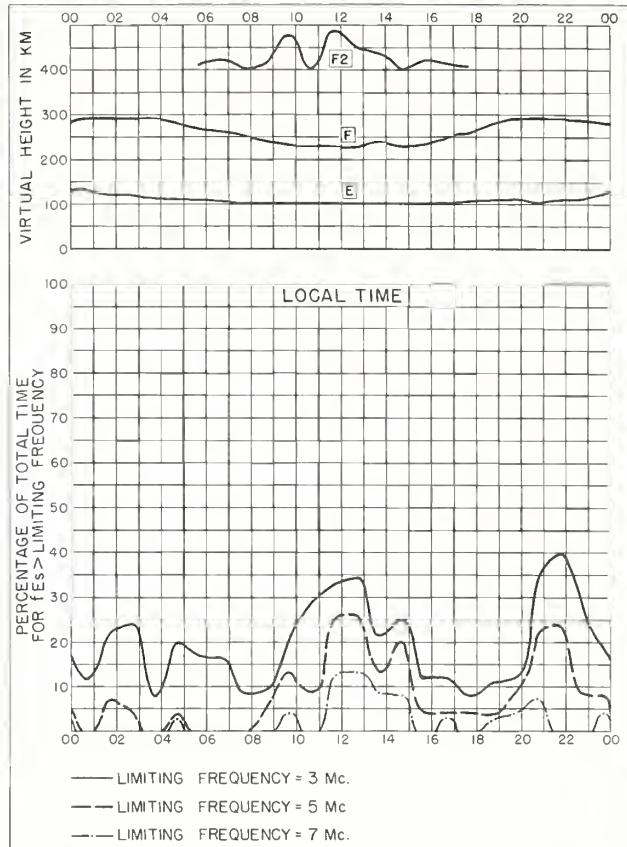
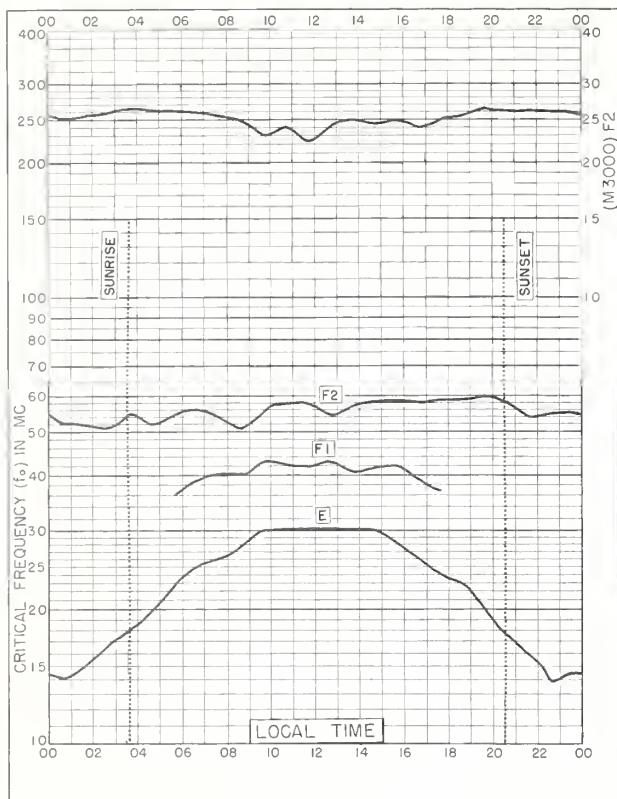
Time: 0.0°.

Sweep: 1.3 Mc to 18.0 Mc in 30 seconds.

GRAPHS OF IONOSPHERIC DATA

13





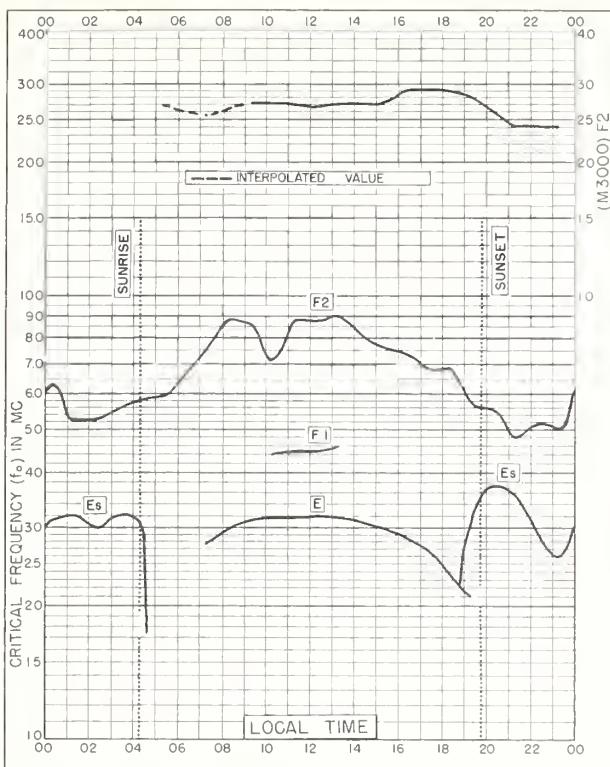


Fig. 9. TROMSO , NORWAY

69.7°N , 19.0°E

APRIL 1960

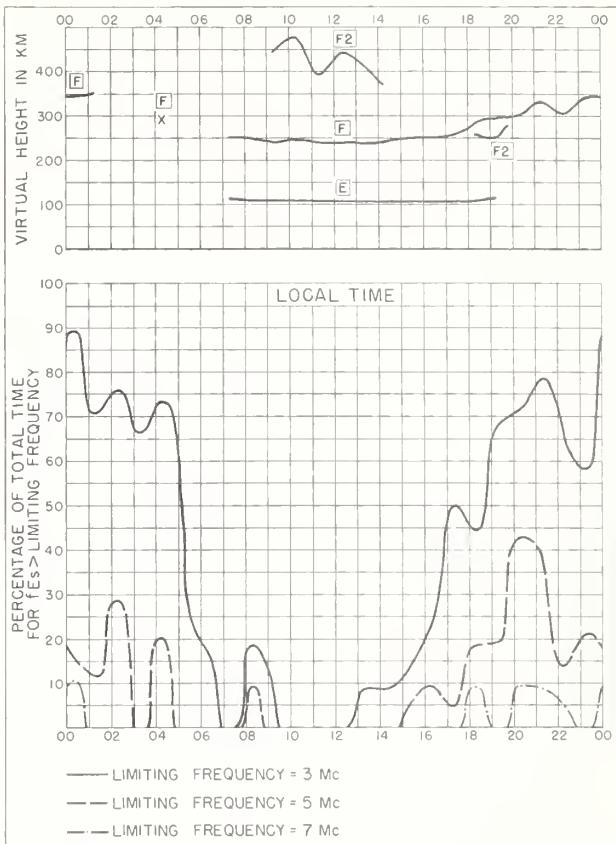


Fig. 10. TROMSO , NORWAY

APRIL 1960

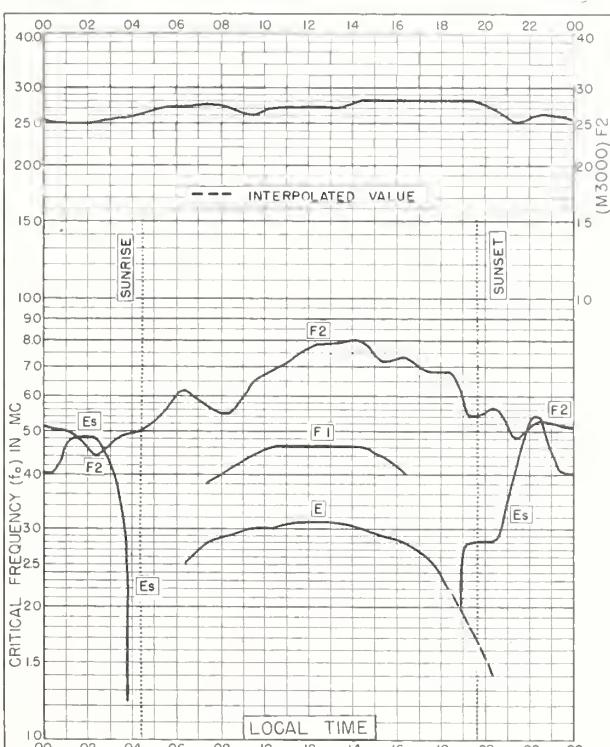


Fig. 11. KIRUNA , SWEDEN

67.8°N , 20.3°E

APRIL 1960

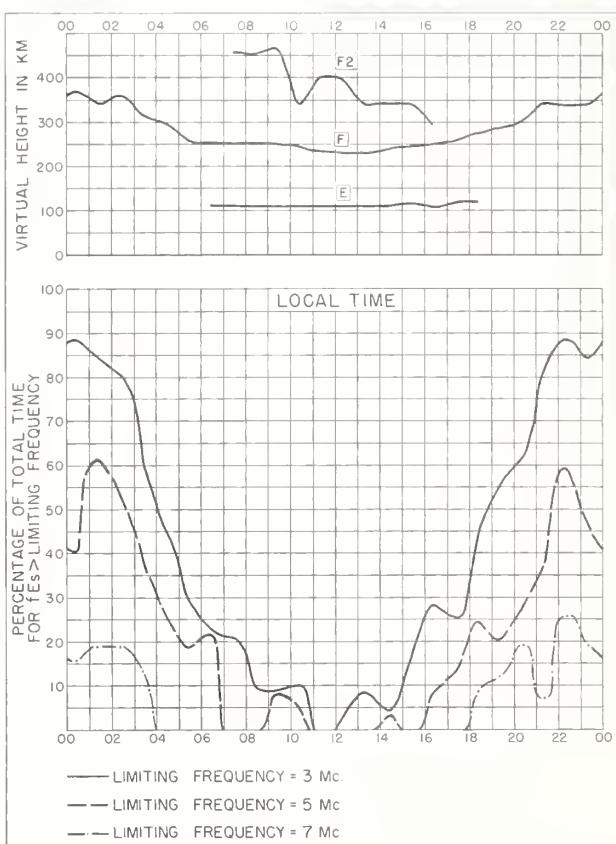
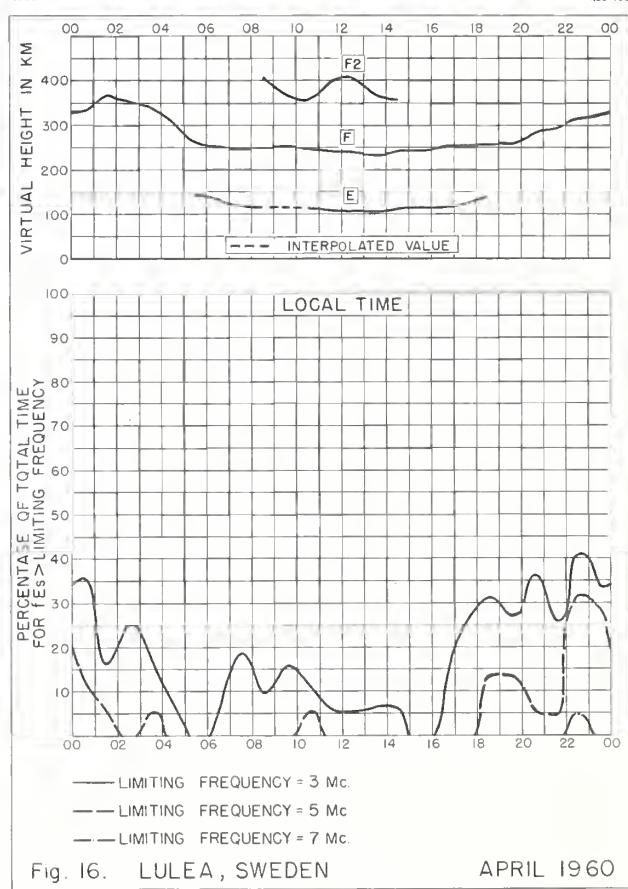
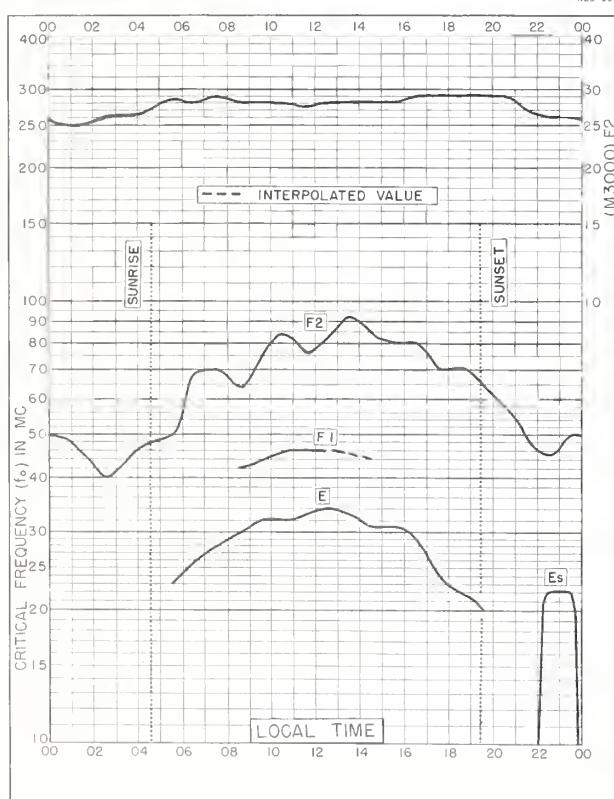
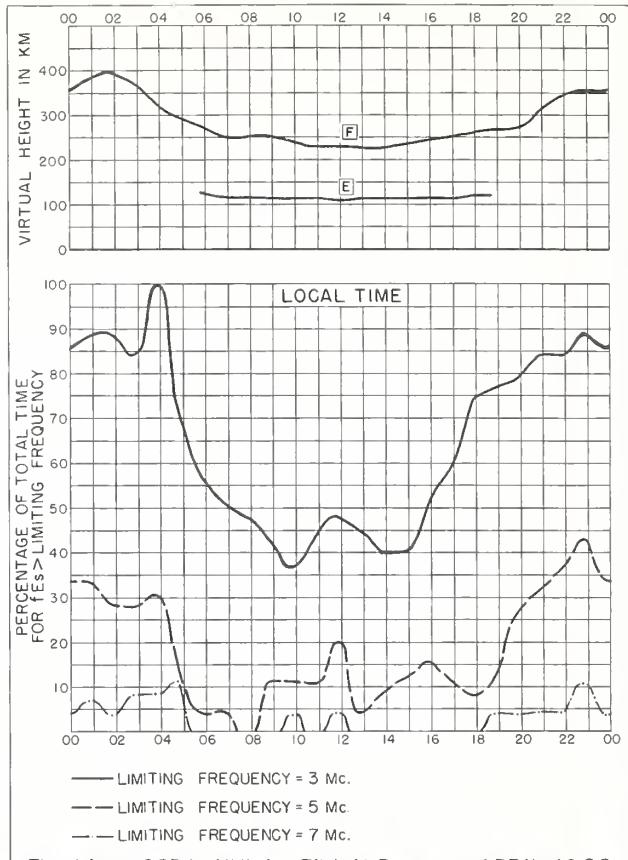
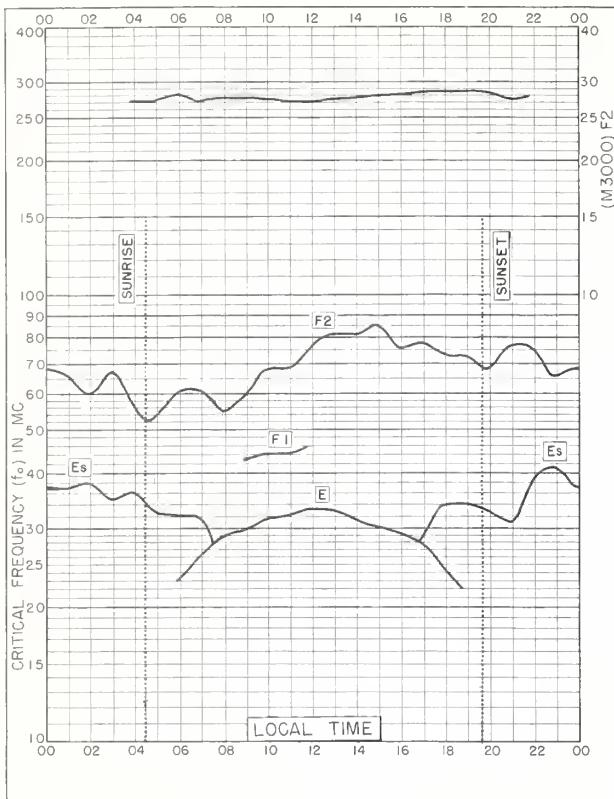
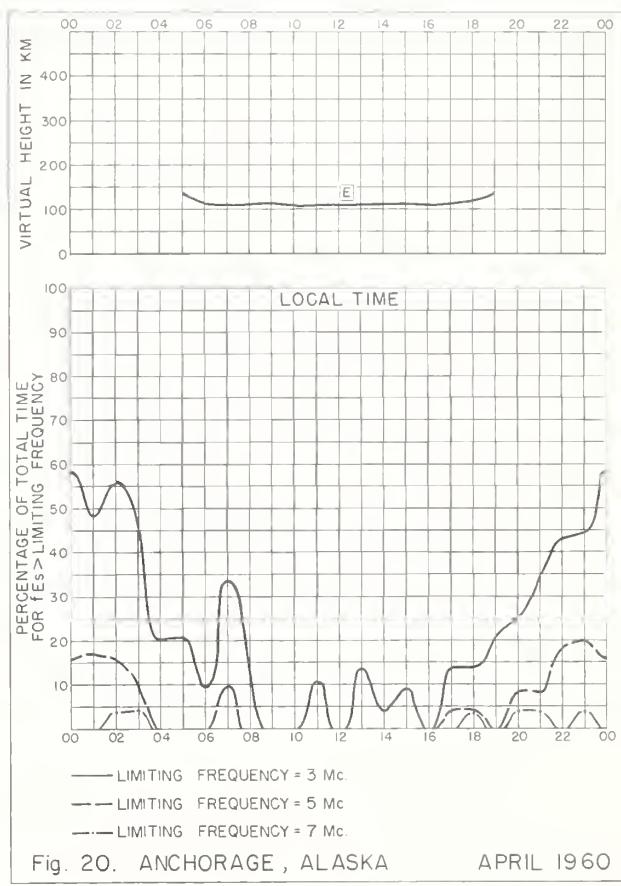
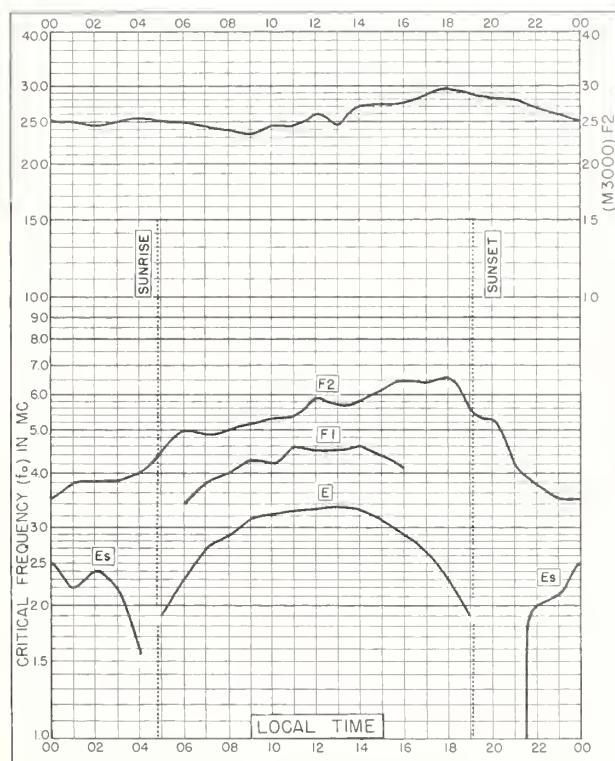
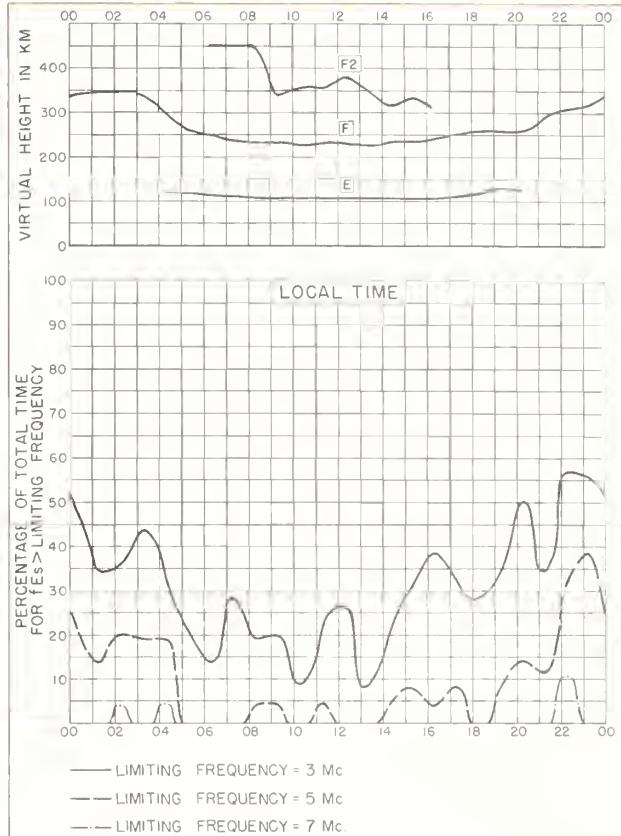
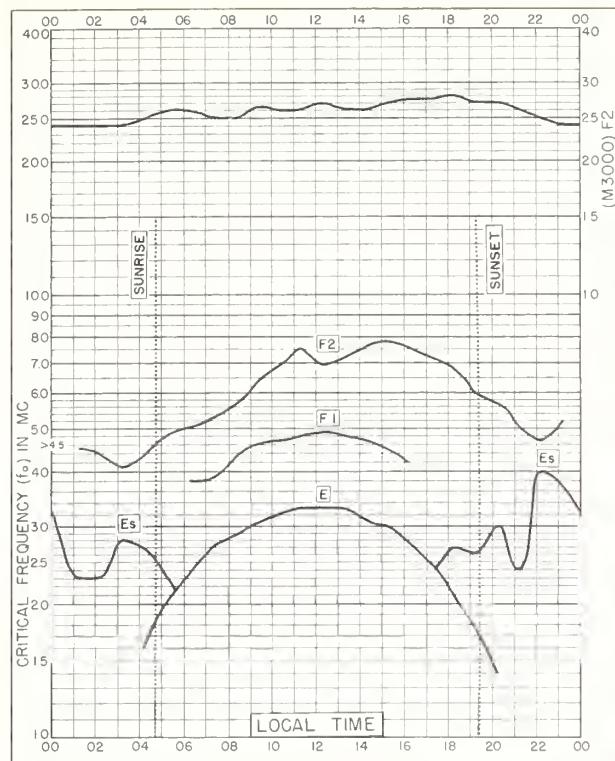
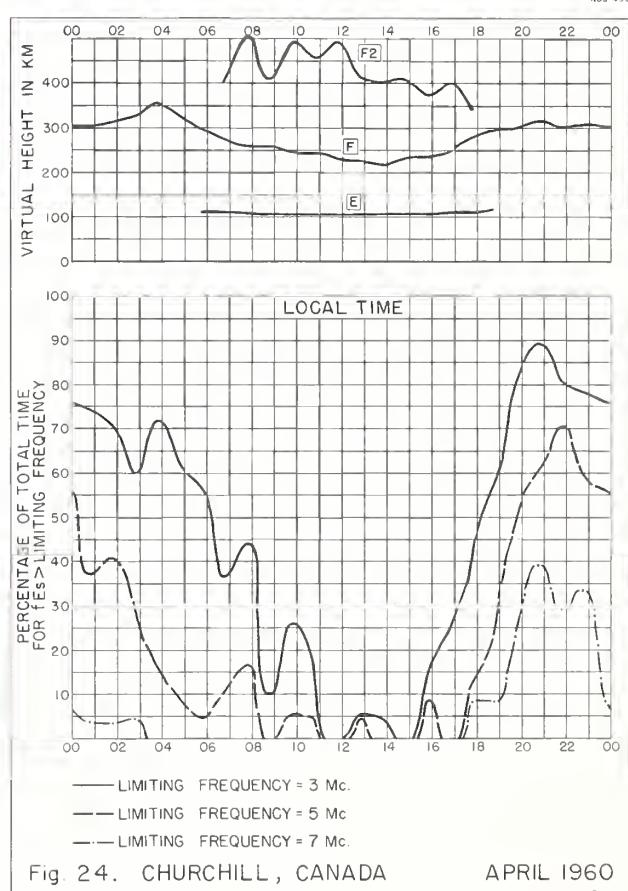
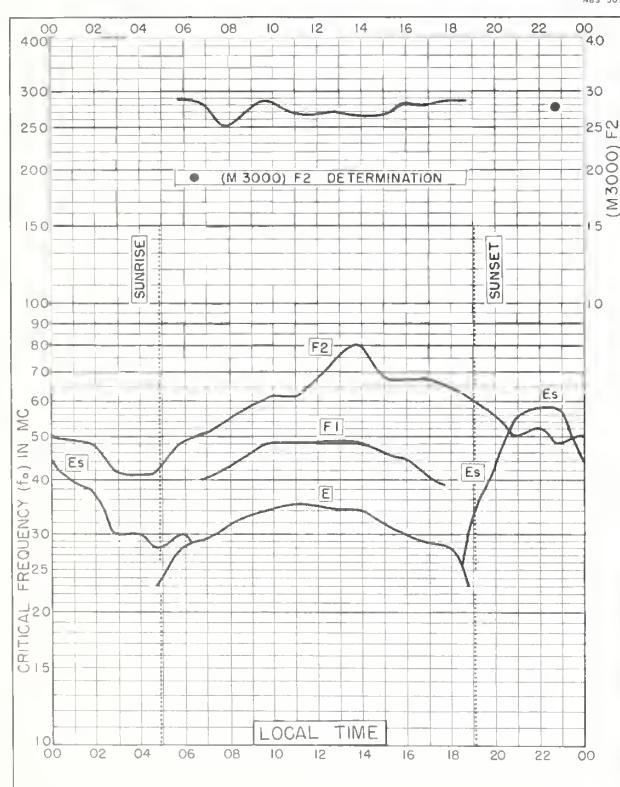
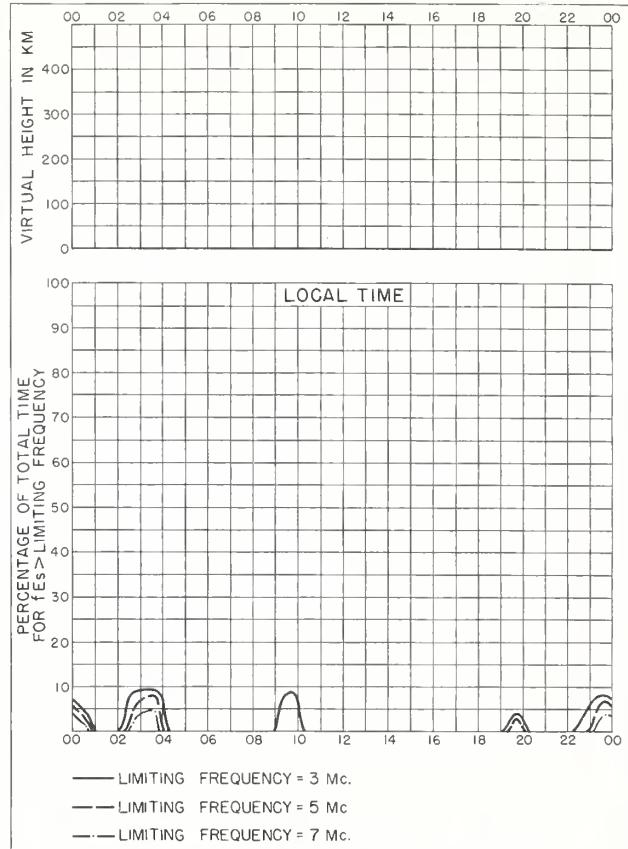
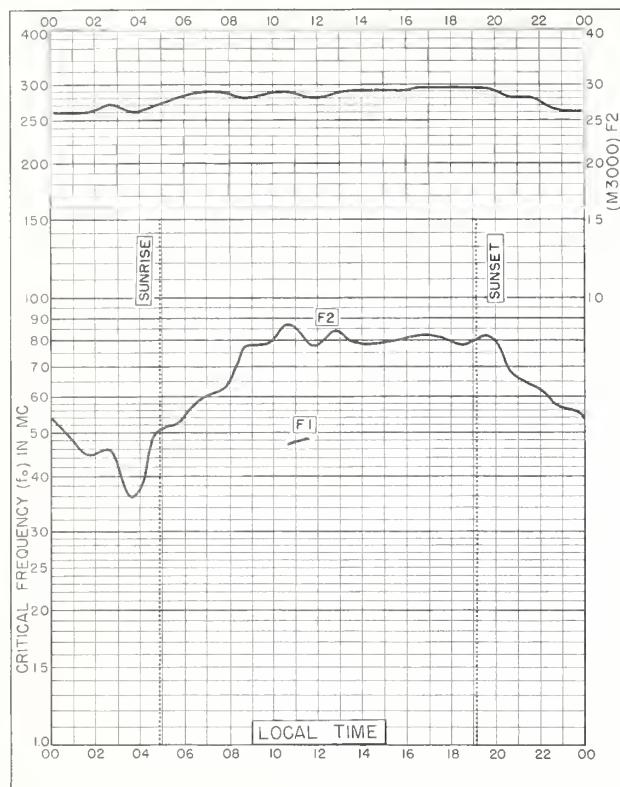


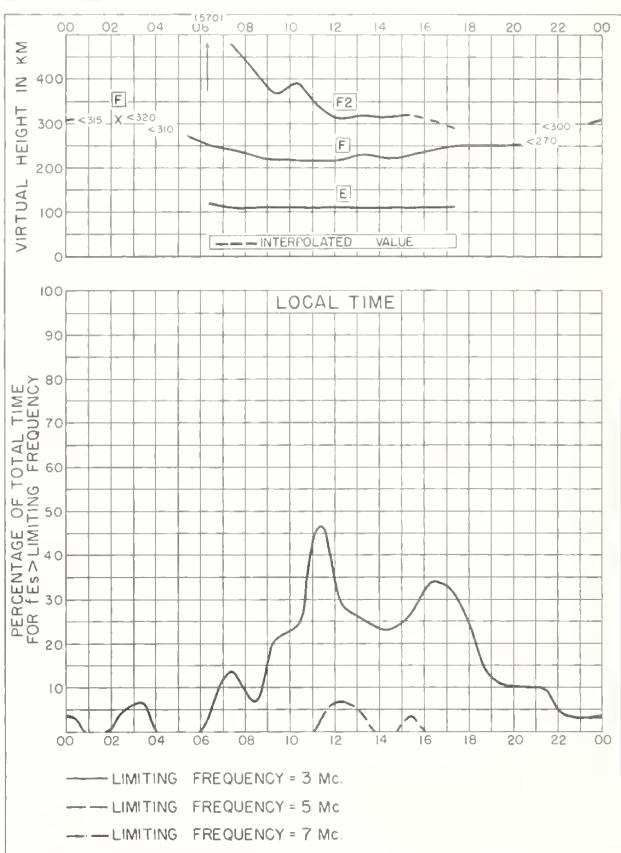
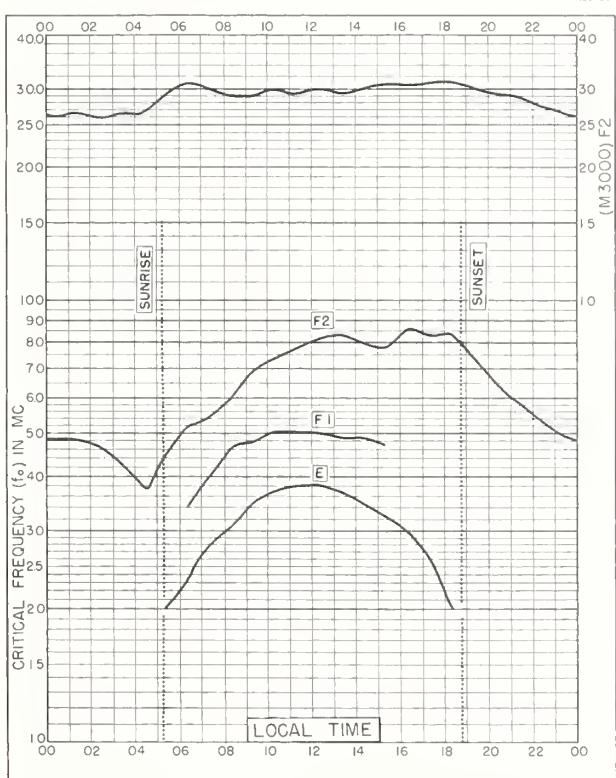
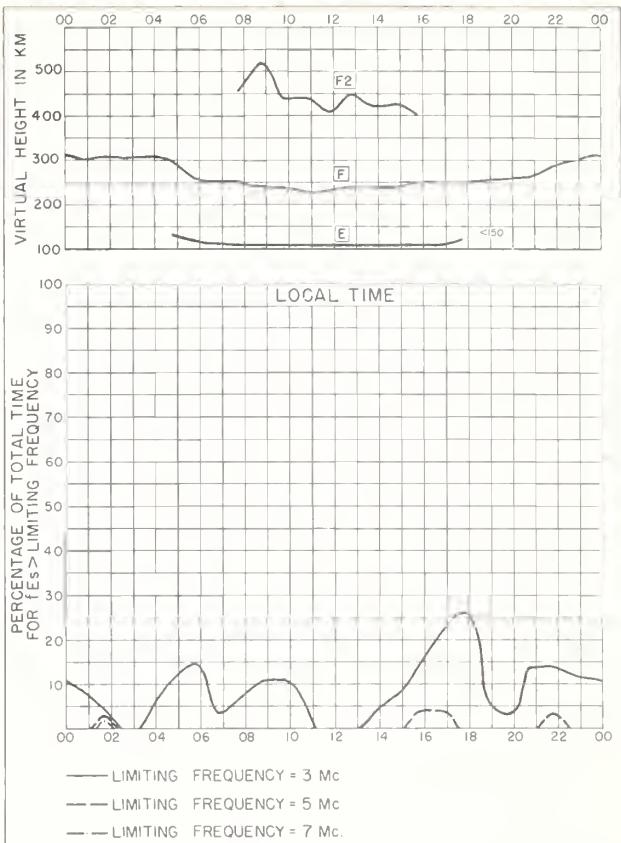
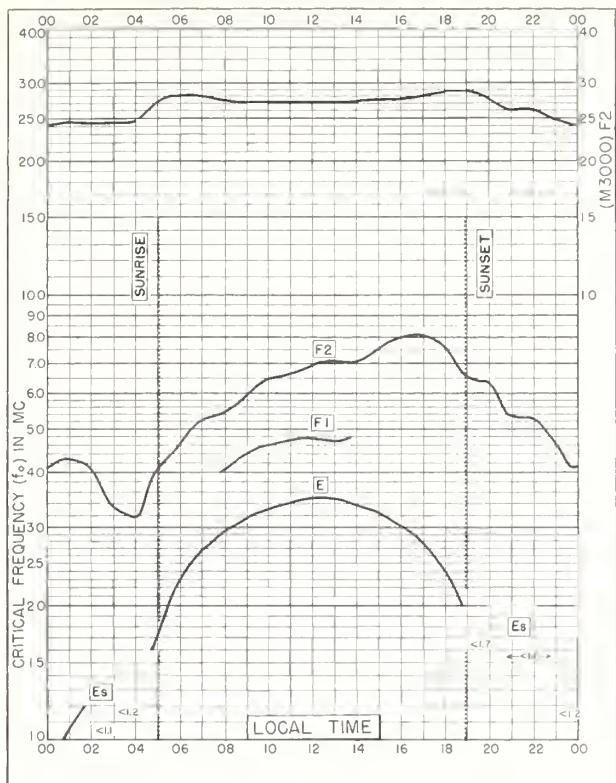
Fig. 12. KIRUNA , SWEDEN

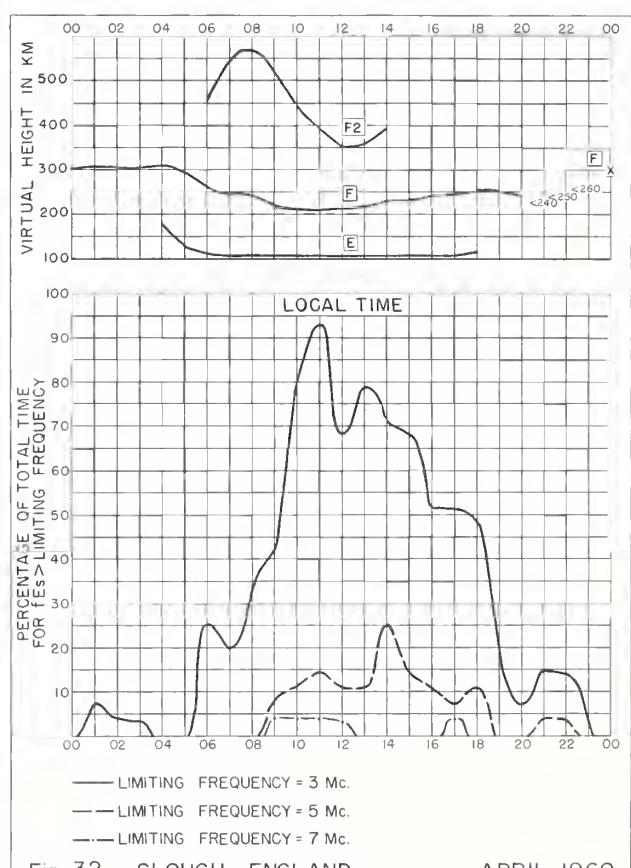
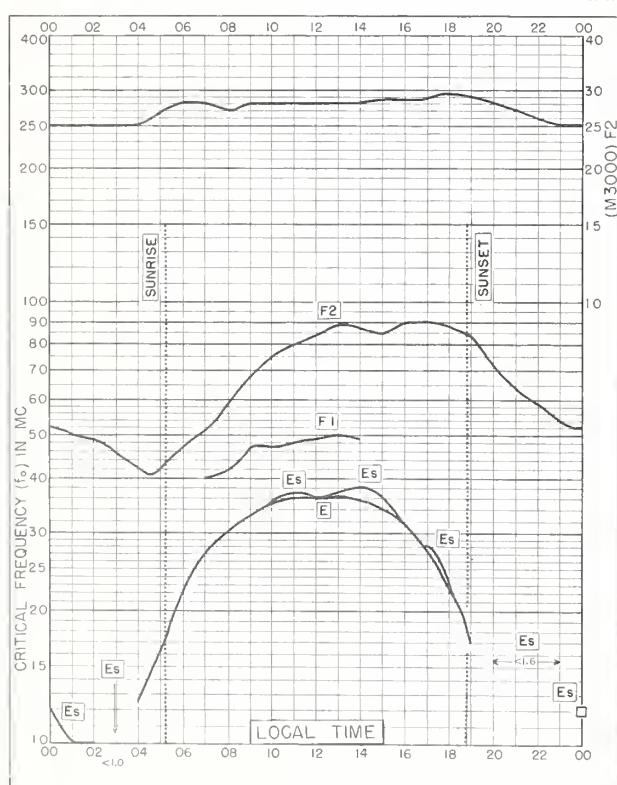
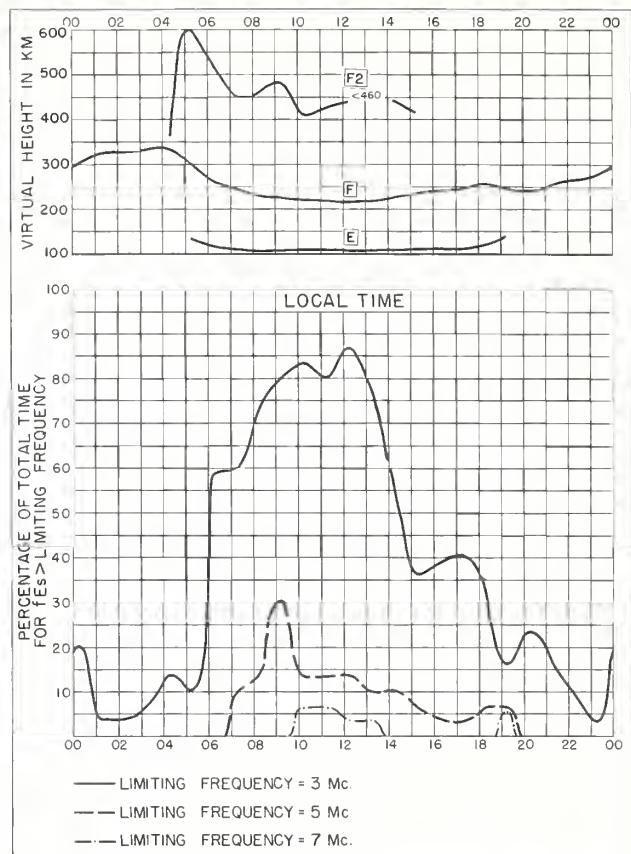
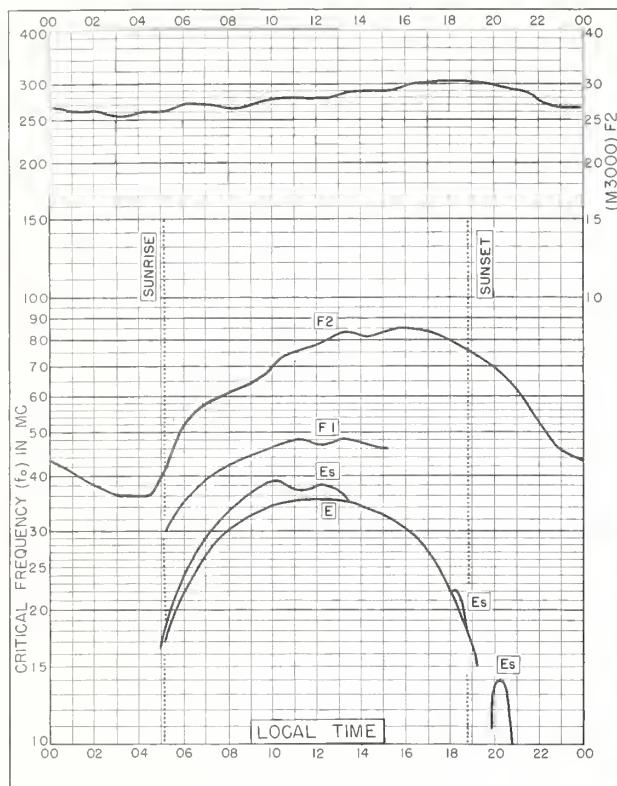
APRIL 1960











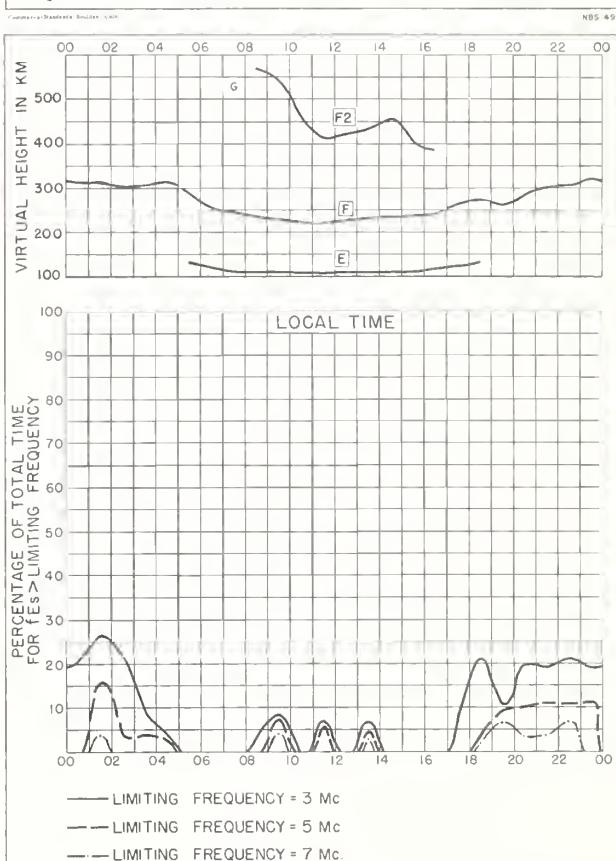
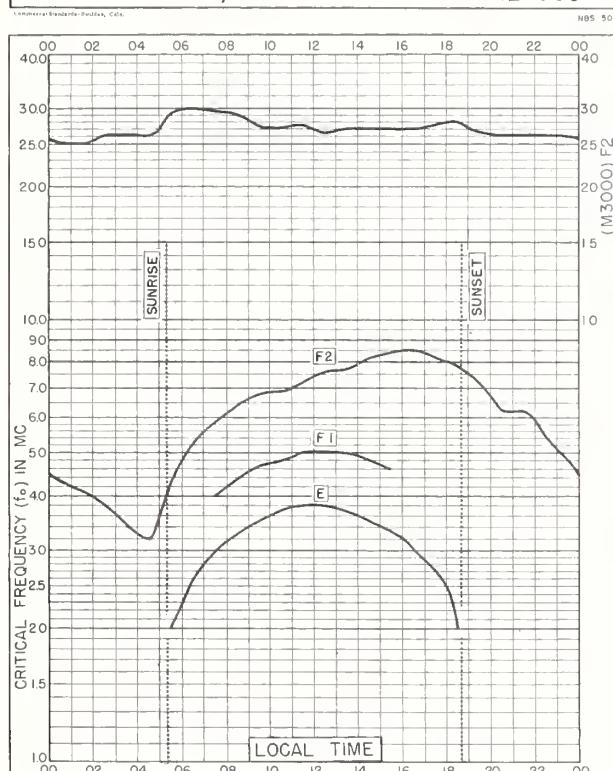
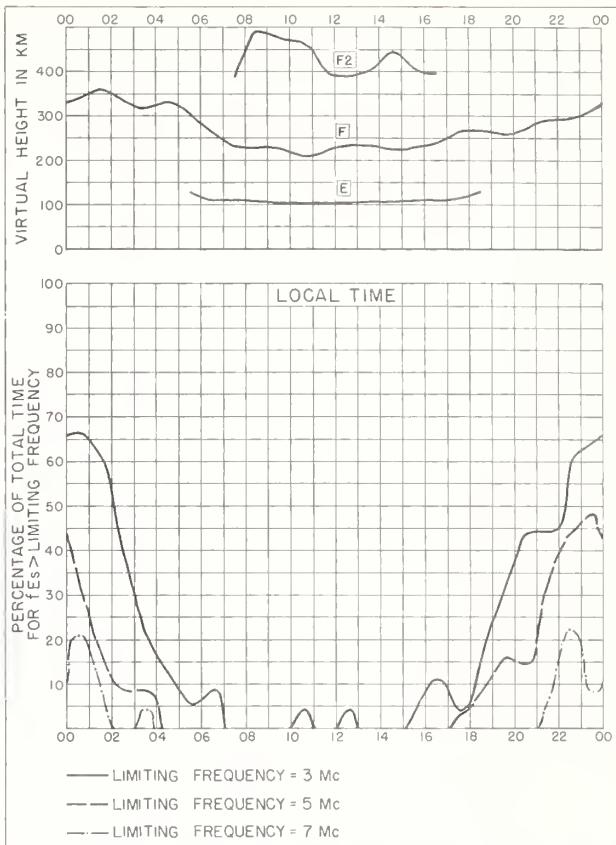
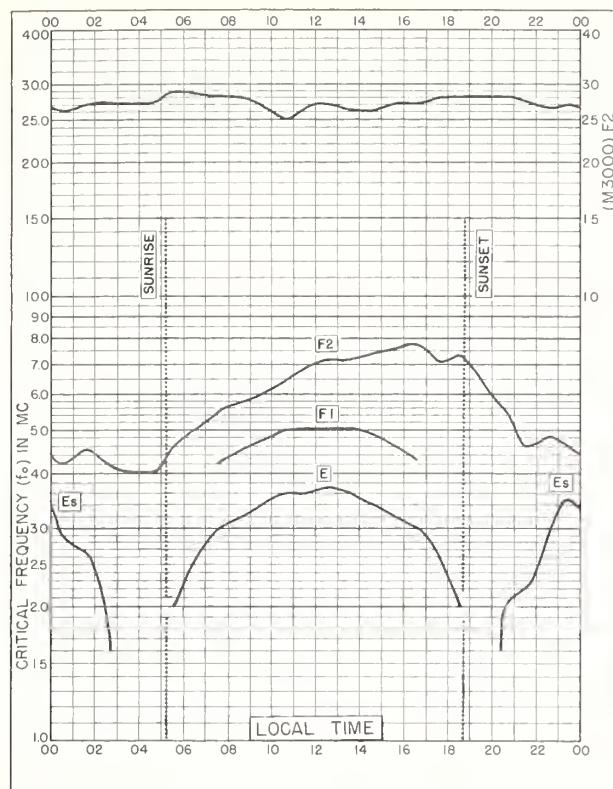




Fig. 37. SOTTENS, SWITZERLAND
46.6°N, 6.7°E APRIL 1960

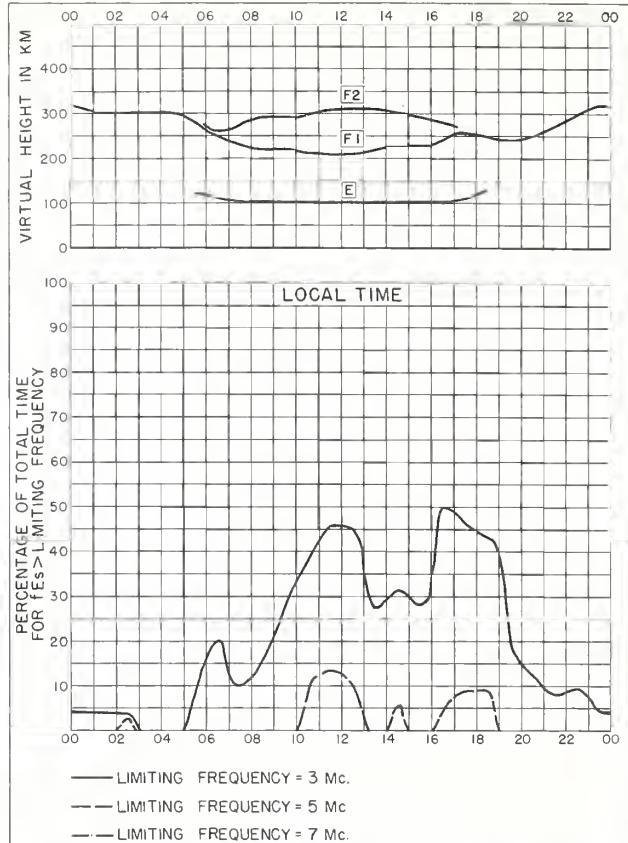


Fig. 38. SOTTENS, SWITZERLAND APRIL 1960

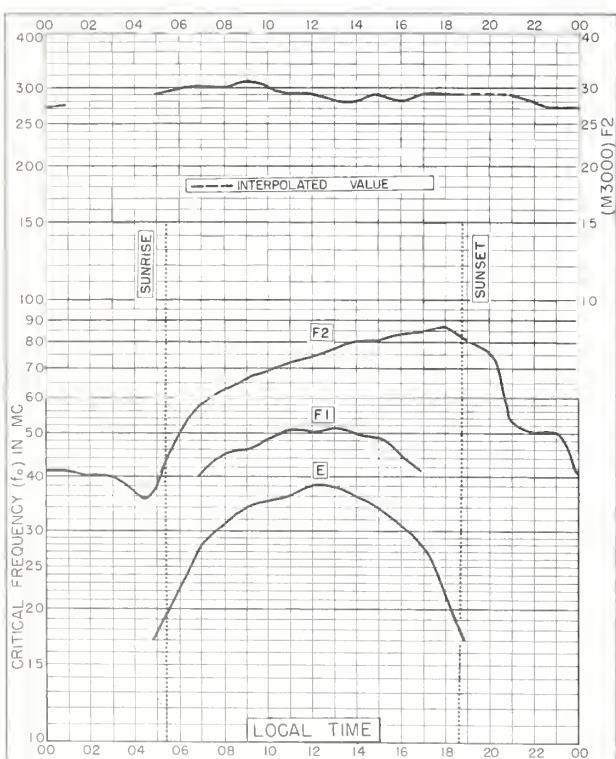


Fig. 39. OTTAWA, CANADA
45.4°N, 75.9°W APRIL 1960

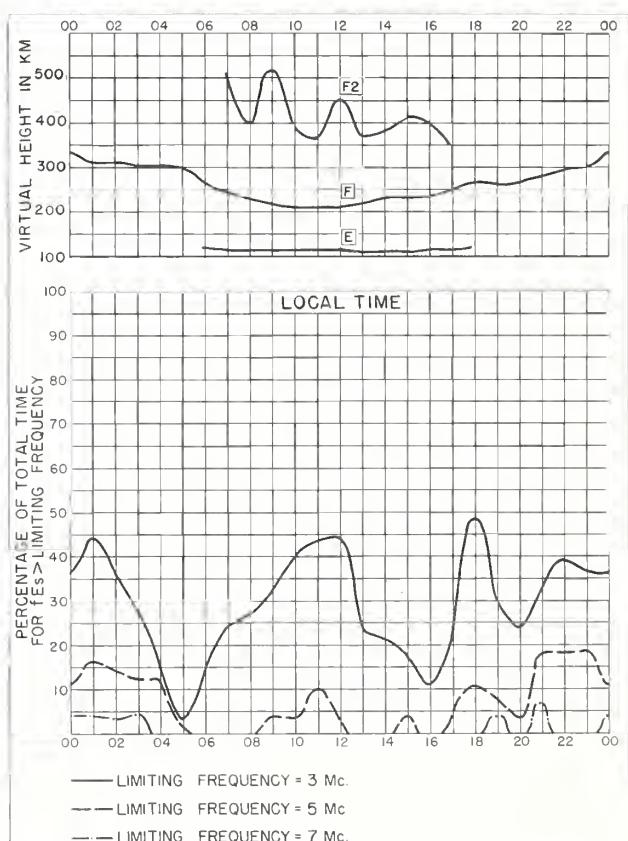


Fig. 40. OTTAWA, CANADA APRIL 1960

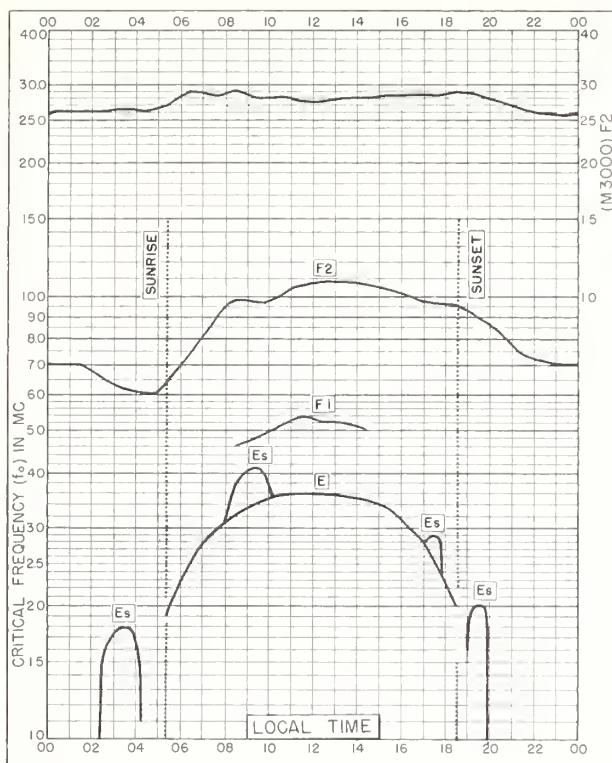


Fig. 41. WAKKANAI, JAPAN

45.4°N, 141.7°E

APRIL 1960

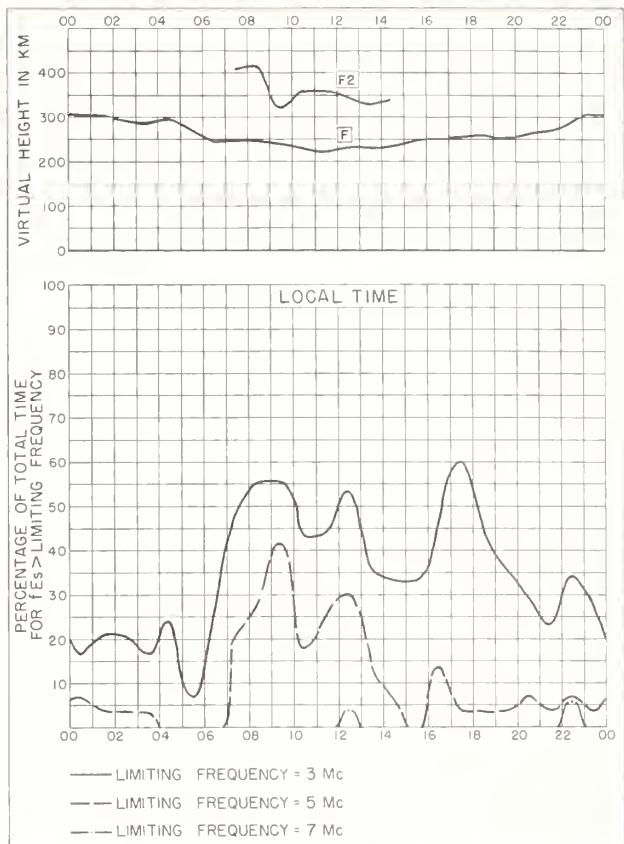


Fig. 42. WAKKANAI, JAPAN

APRIL 1960

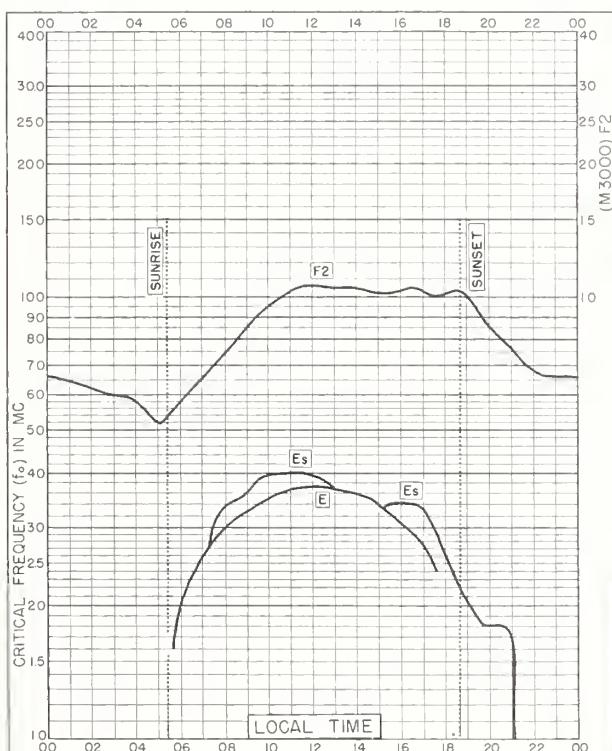


Fig. 43. GENOA (MONTE CAPELLINO), ITALY

44.6°N, 9.0°E

APRIL 1960

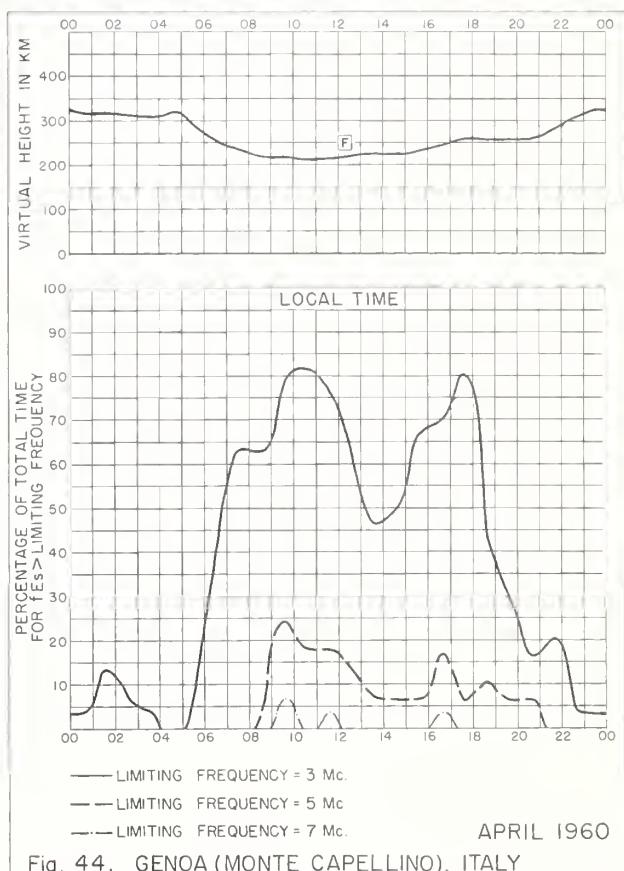
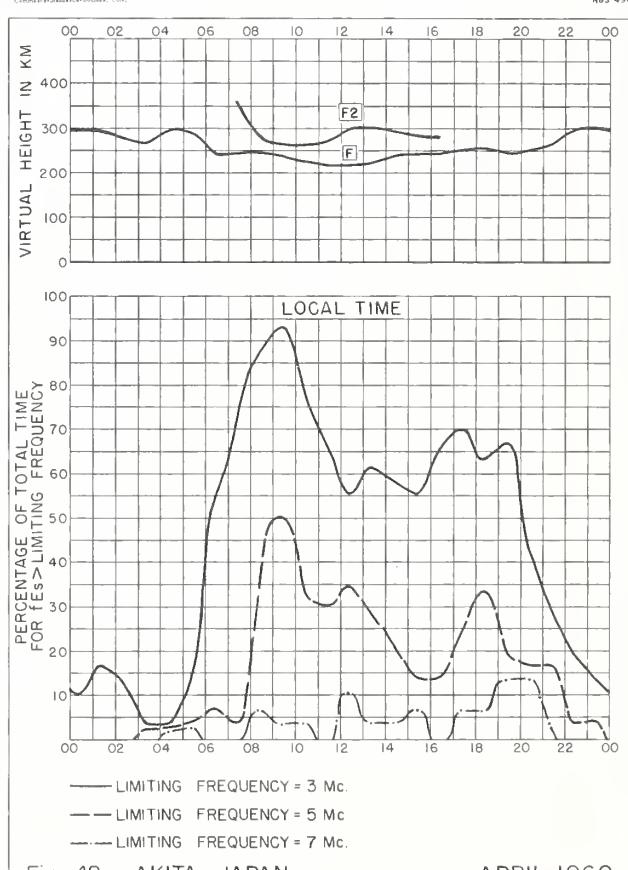
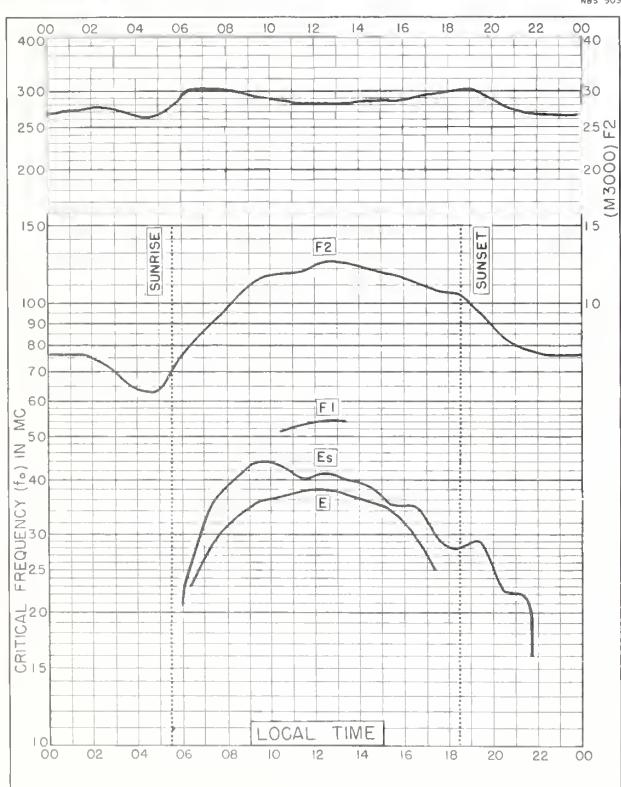
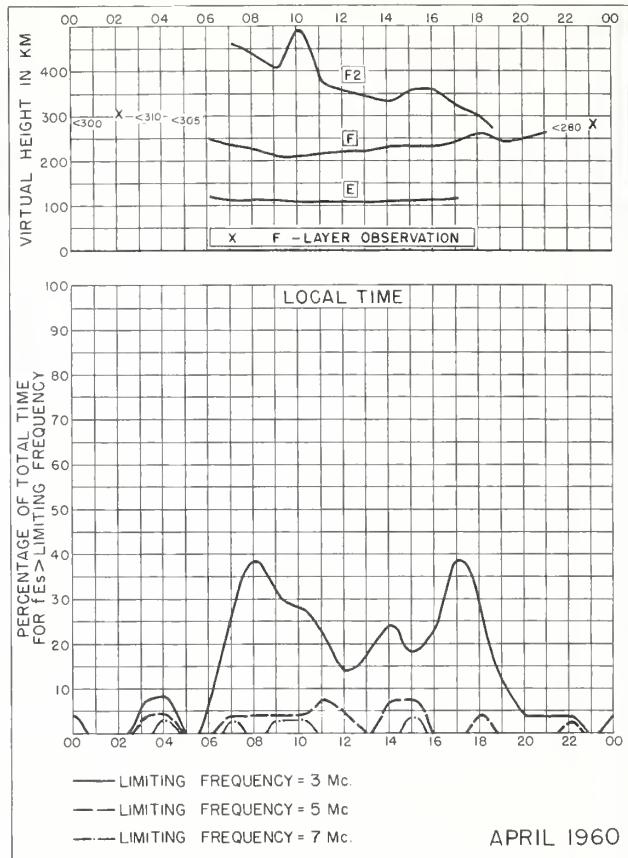
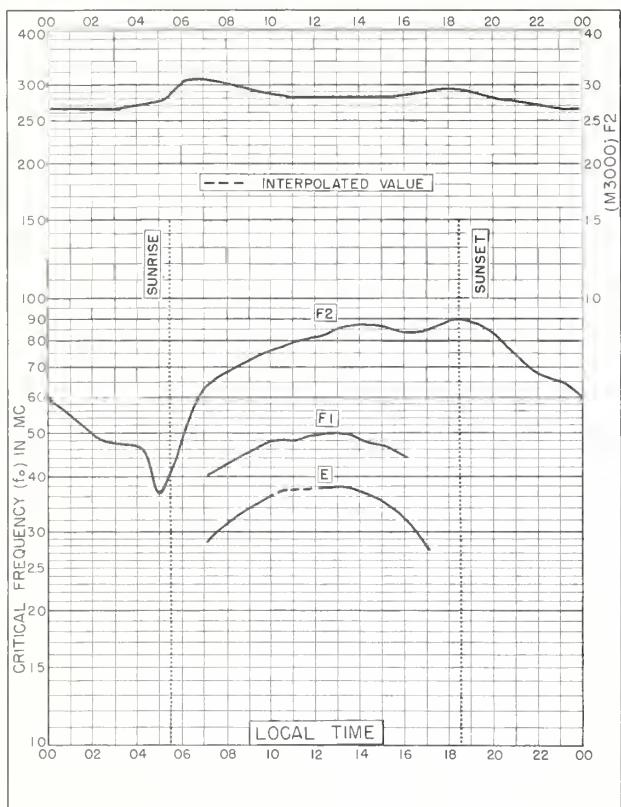


Fig. 44. GENOA (MONTE CAPELLINO), ITALY

APRIL 1960



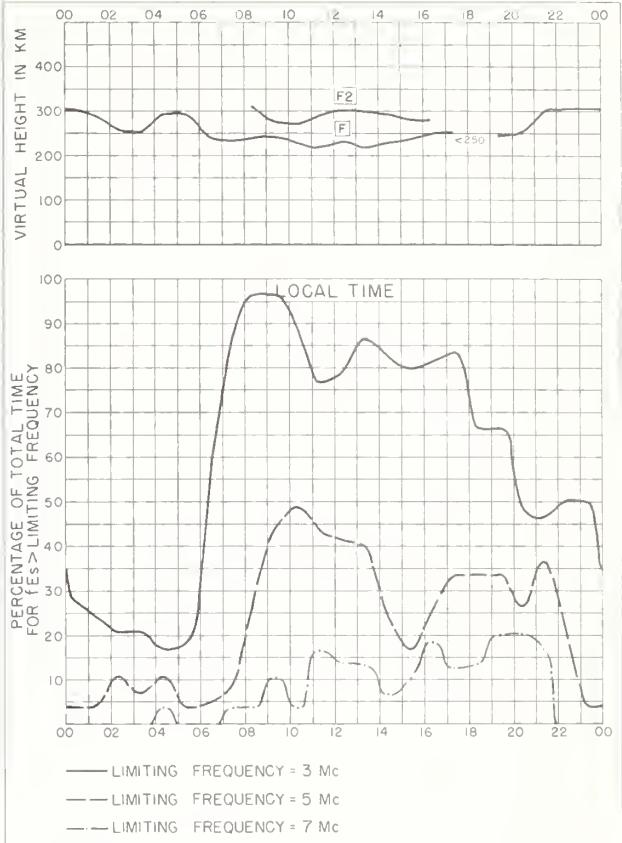
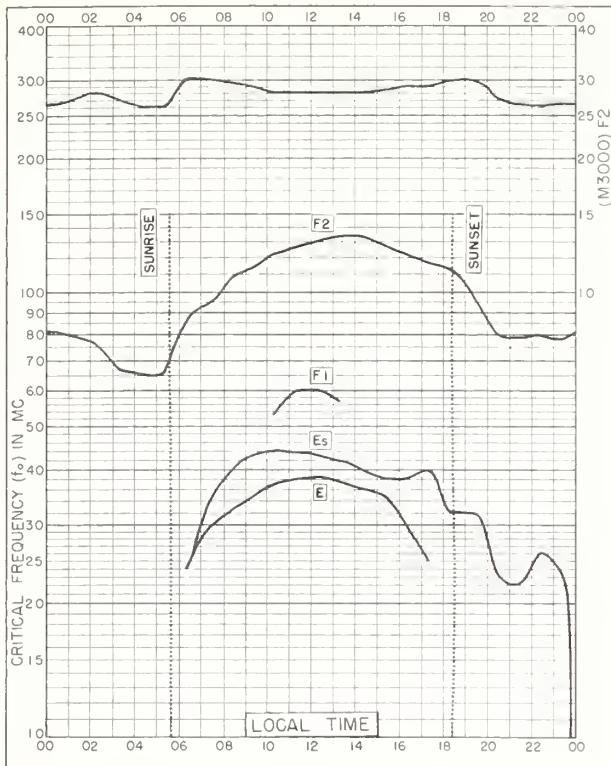


Fig. 50. TOKYO, JAPAN APRIL 1960

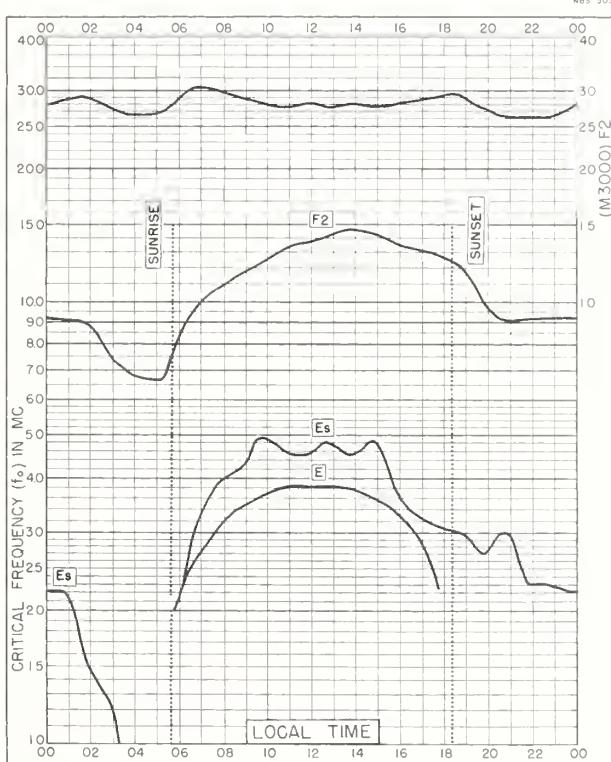


Fig. 51. YAMAGAWA, JAPAN
31.2°N, 130.6°E APRIL 1960

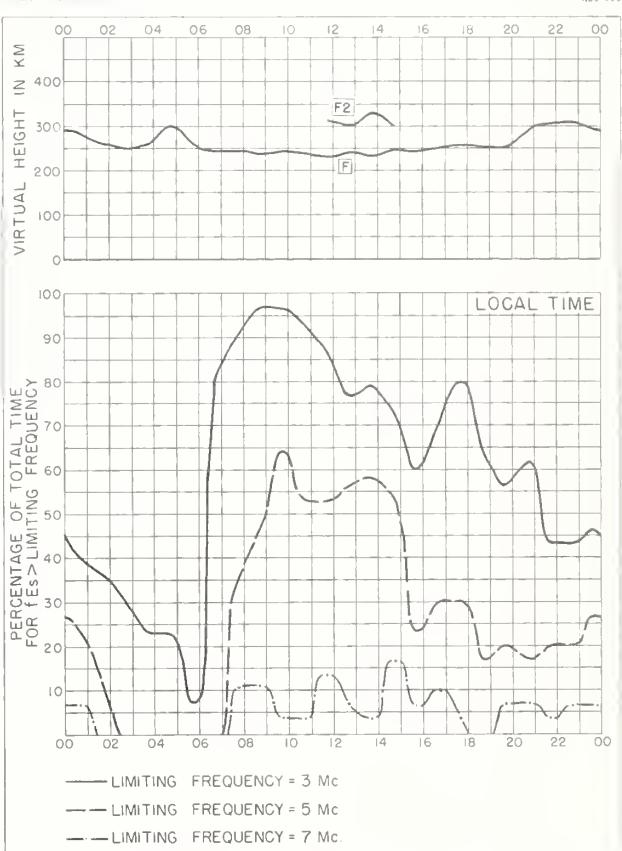


Fig. 52. YAMAGAWA, JAPAN APRIL 1960

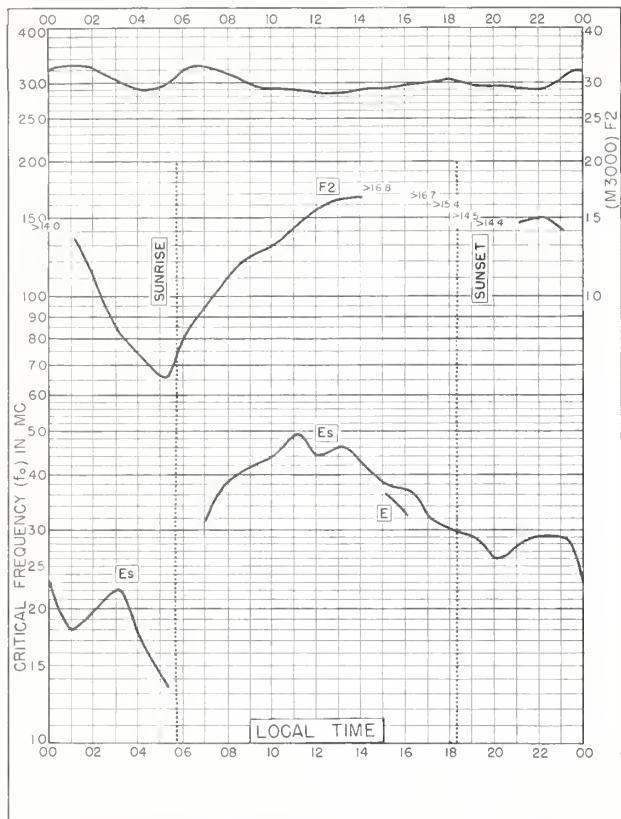


Fig. 53. FORMOSA, CHINA

25.0°N, 121.5°E

APRIL 1960

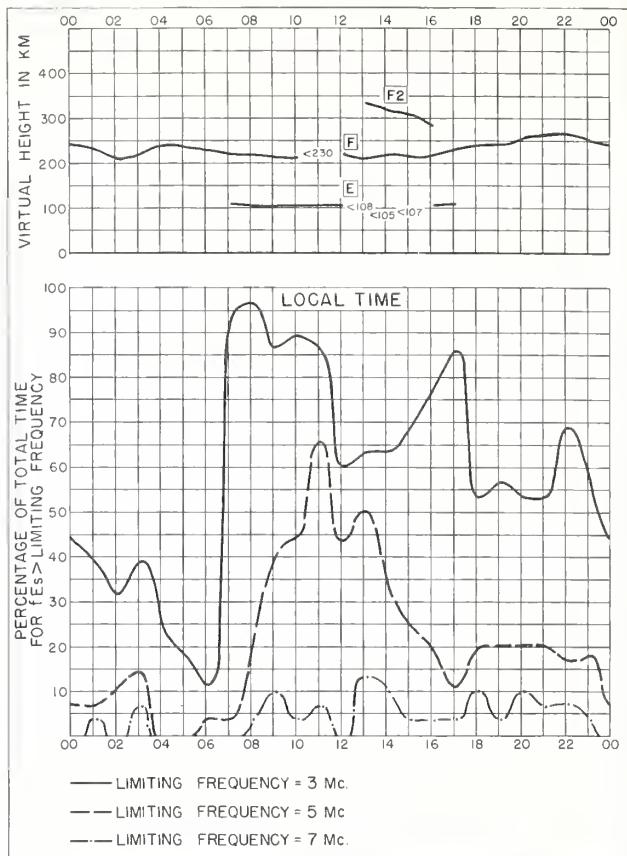


Fig. 54. FORMOSA, CHINA

APRIL 1960

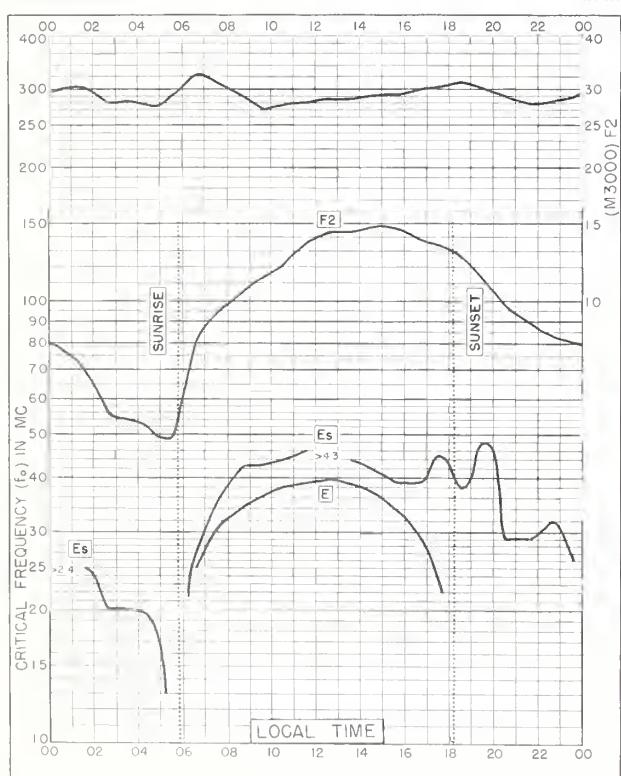


Fig. 55. MAUI, HAWAII

20.8°N, 156.5°W

APRIL 1960

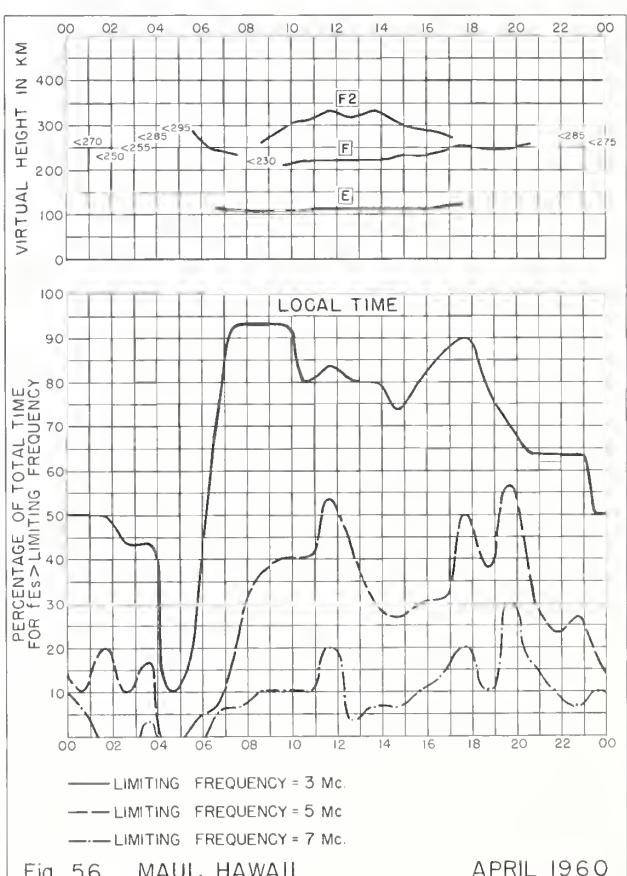
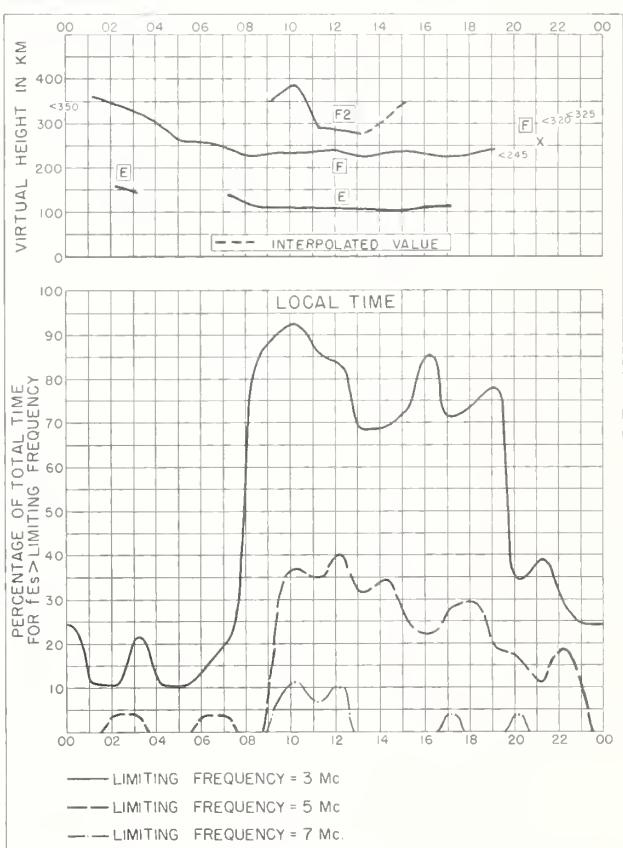
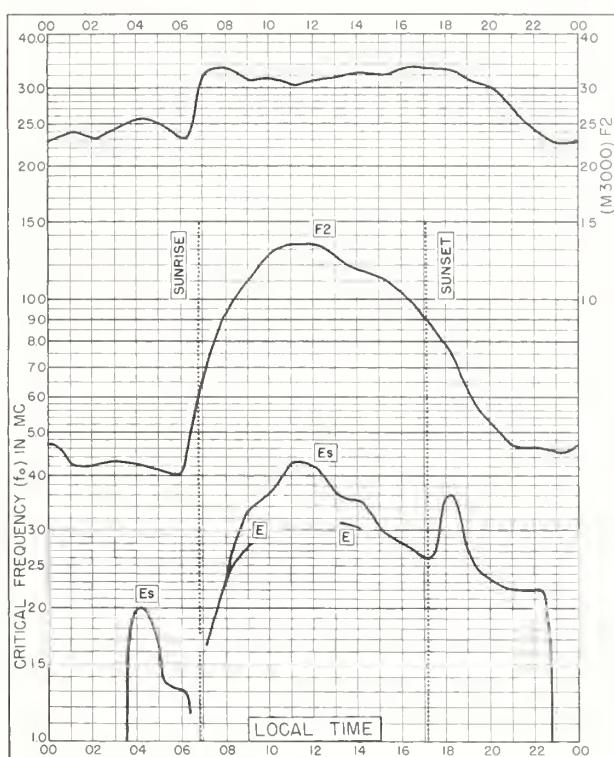
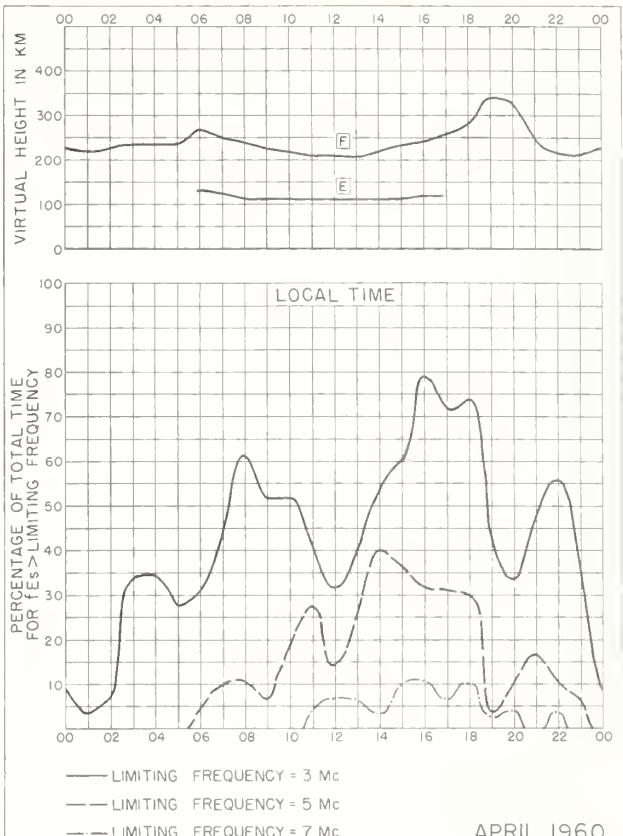
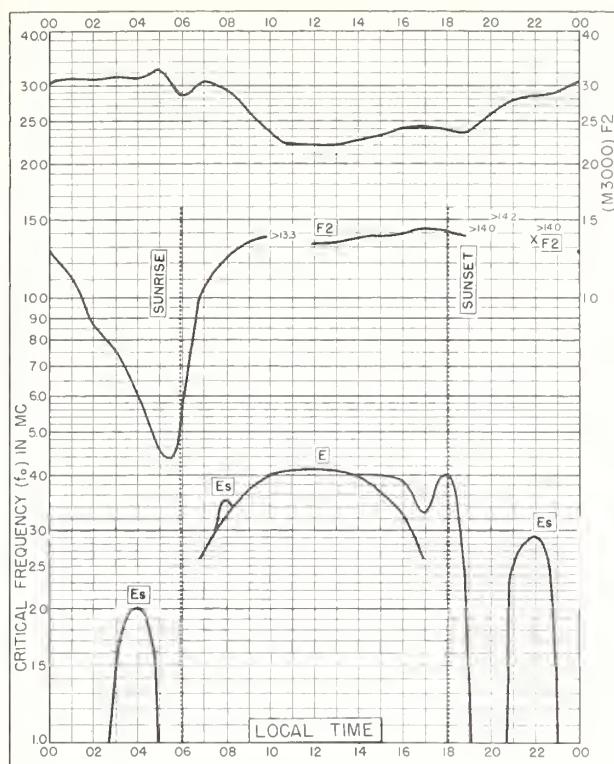


Fig. 56. MAUI, HAWAII

APRIL 1960



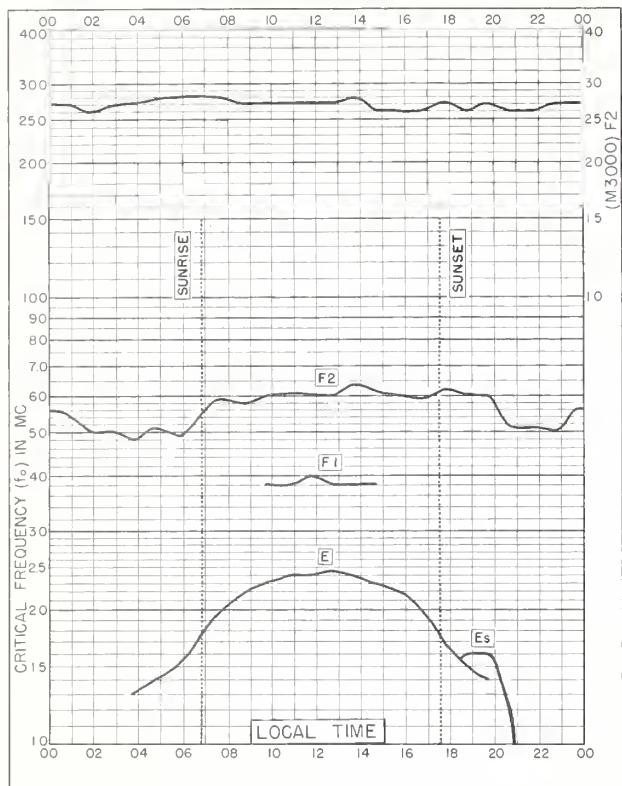


Fig. 61. RESOLUTE BAY, CANADA
74.7°N, 94.9°W MARCH 1960

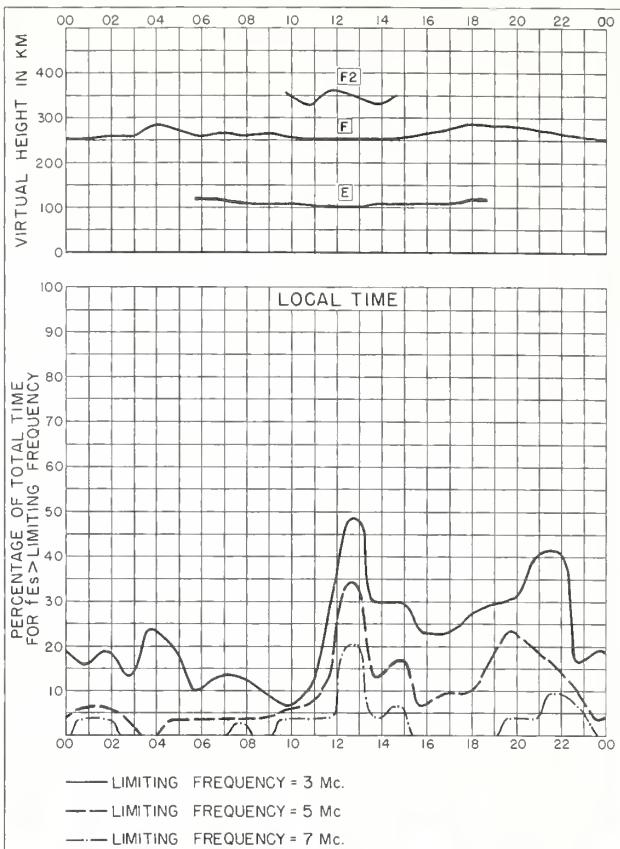


Fig. 62. RESOLUTE BAY, CANADA MARCH 1960

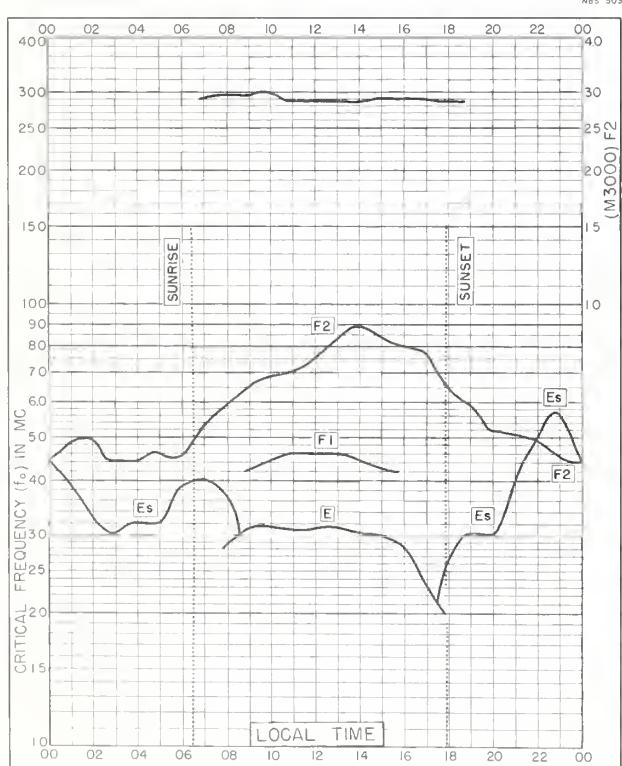


Fig. 63. CHURCHILL, CANADA
58.8°N, 94.2°W MARCH 1960

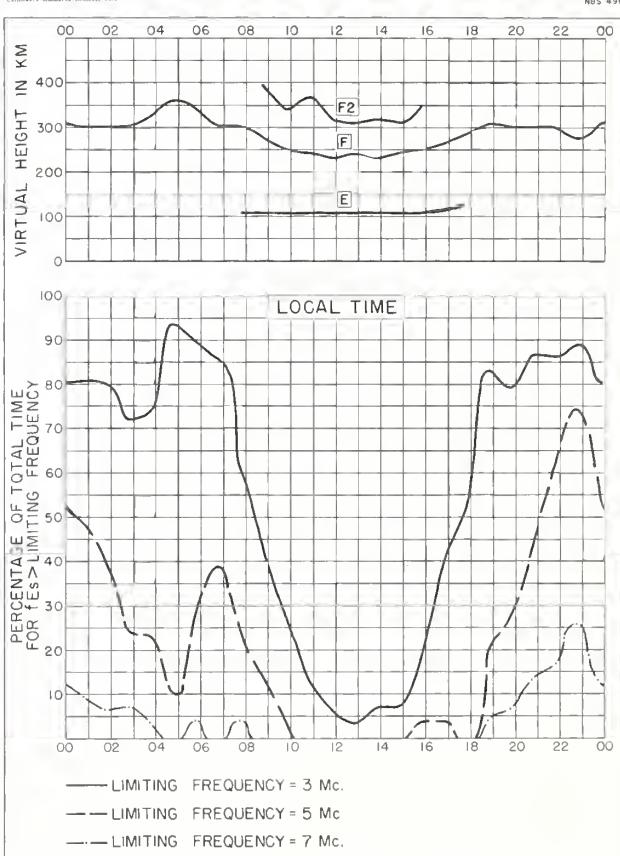


Fig. 64. CHURCHILL, CANADA MARCH 1960

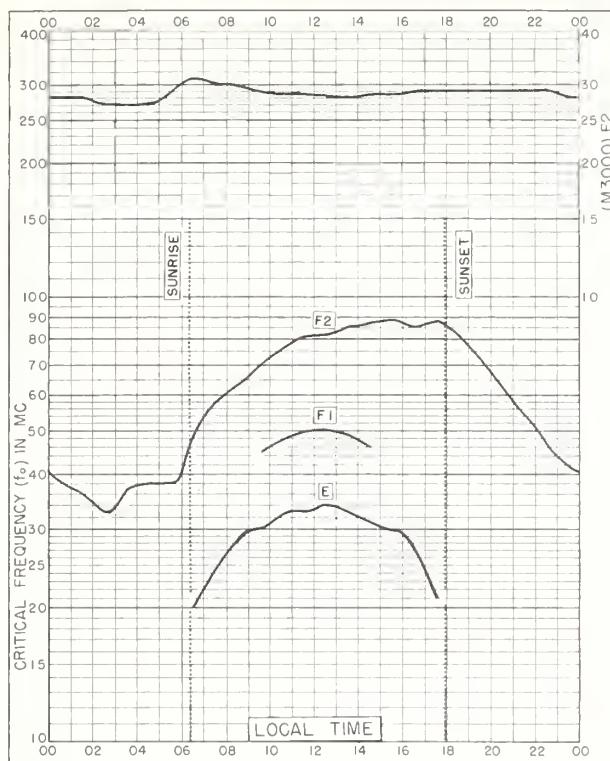


Fig. 65. WINNIPEG, CANADA
49.9°N, 97.4°W MARCH 1960

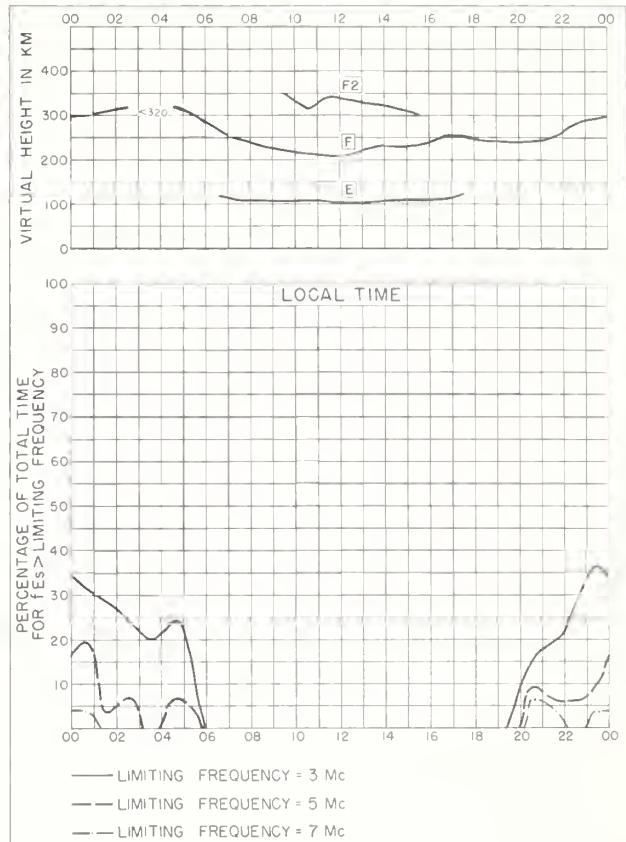


Fig. 66. WINNIPEG, CANADA MARCH 1960

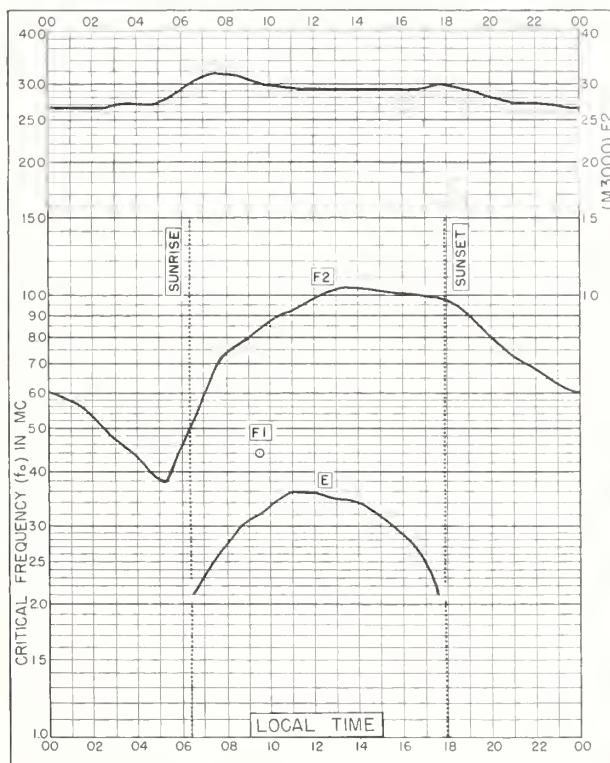


Fig. 67. ST. JOHN'S, NEWFOUNDLAND
47.6°N, 52.7°W MARCH 1960

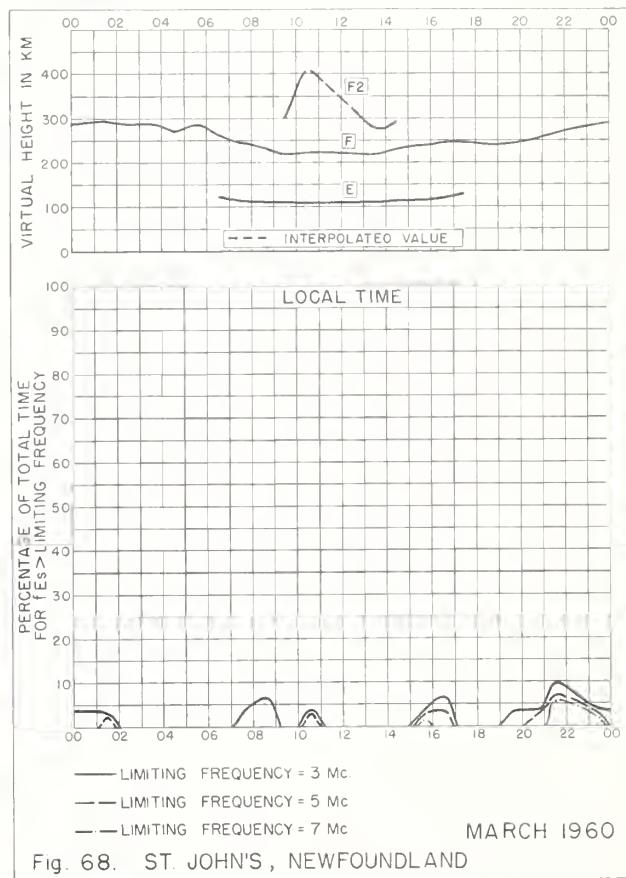
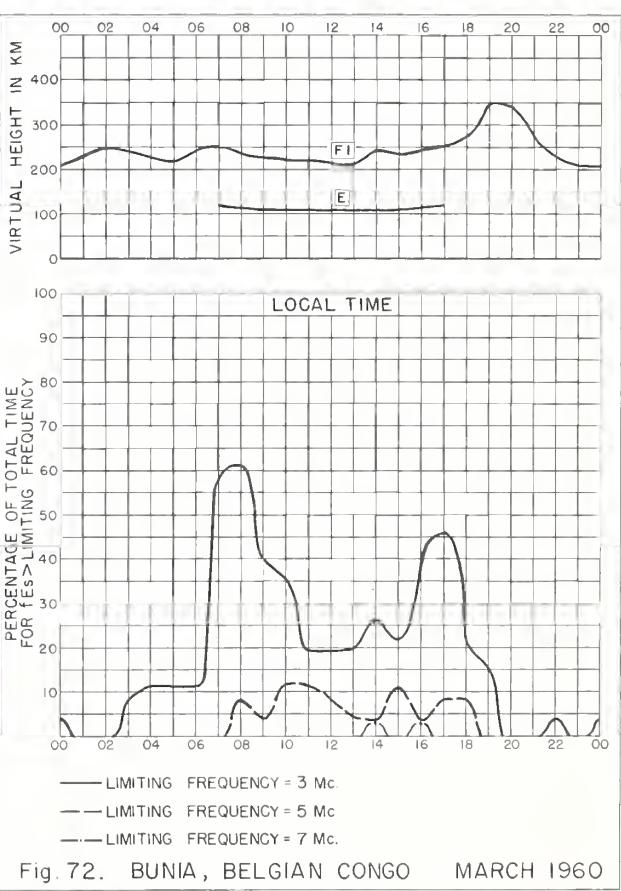
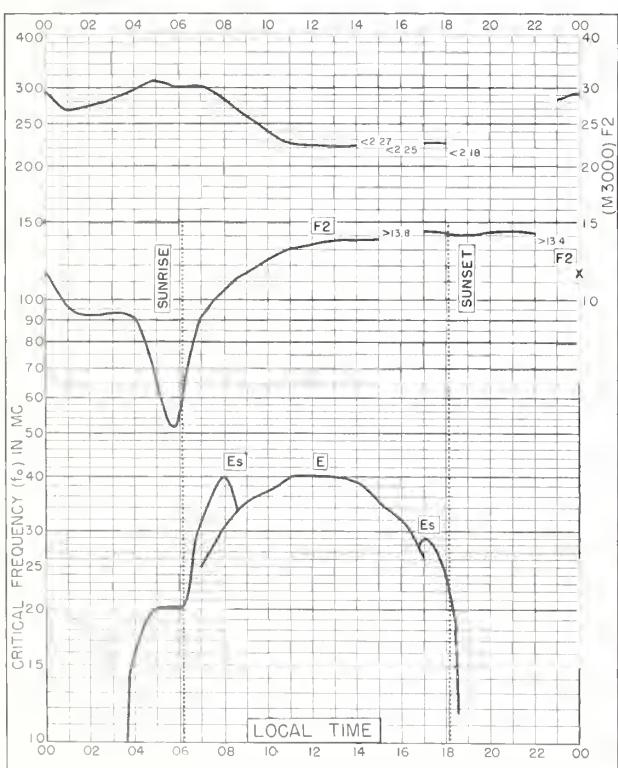
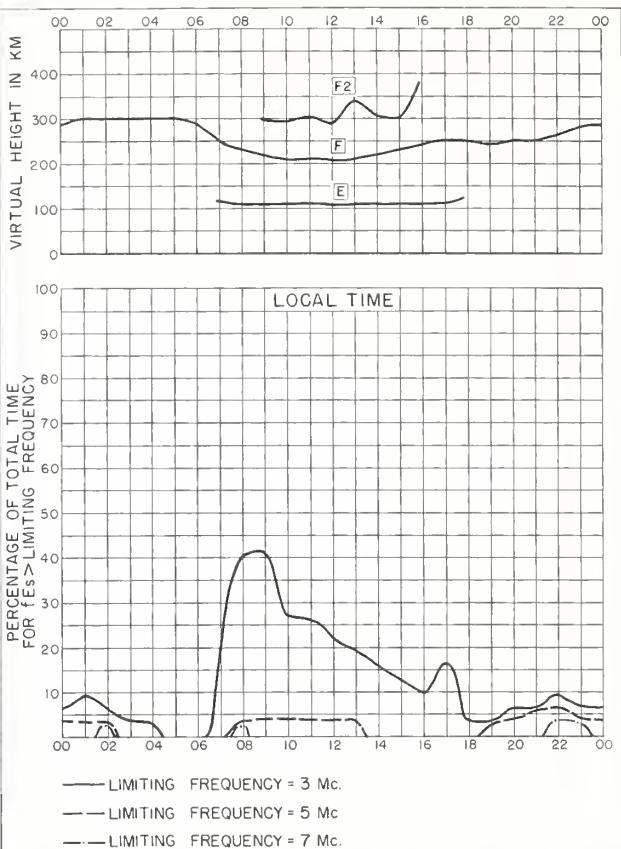
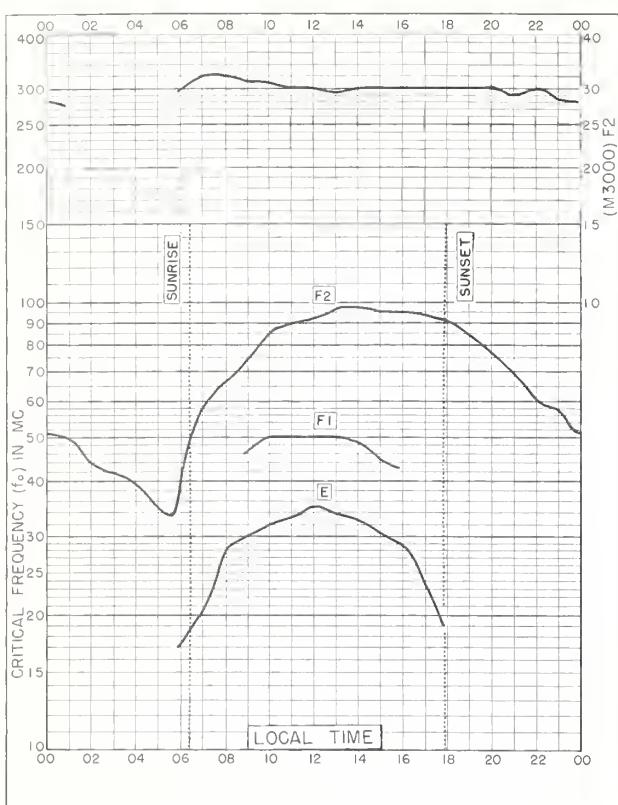


Fig. 68. ST. JOHN'S, NEWFOUNDLAND MARCH 1960



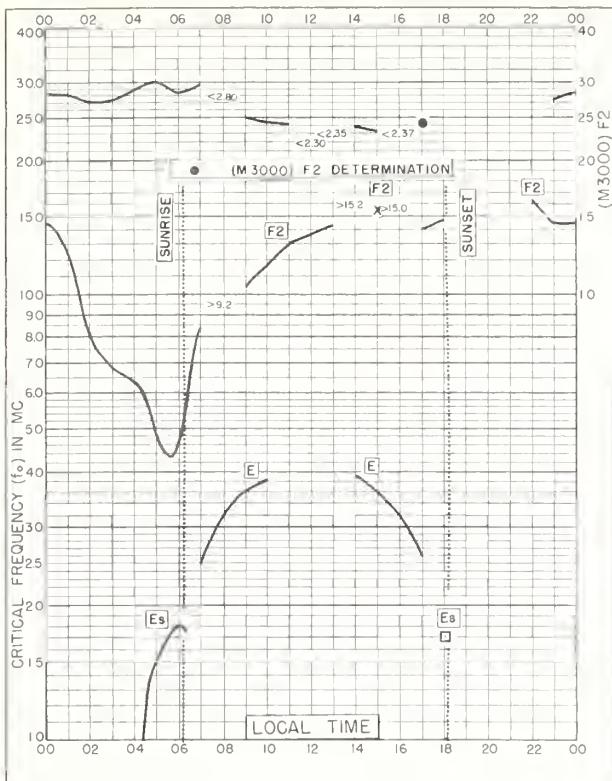
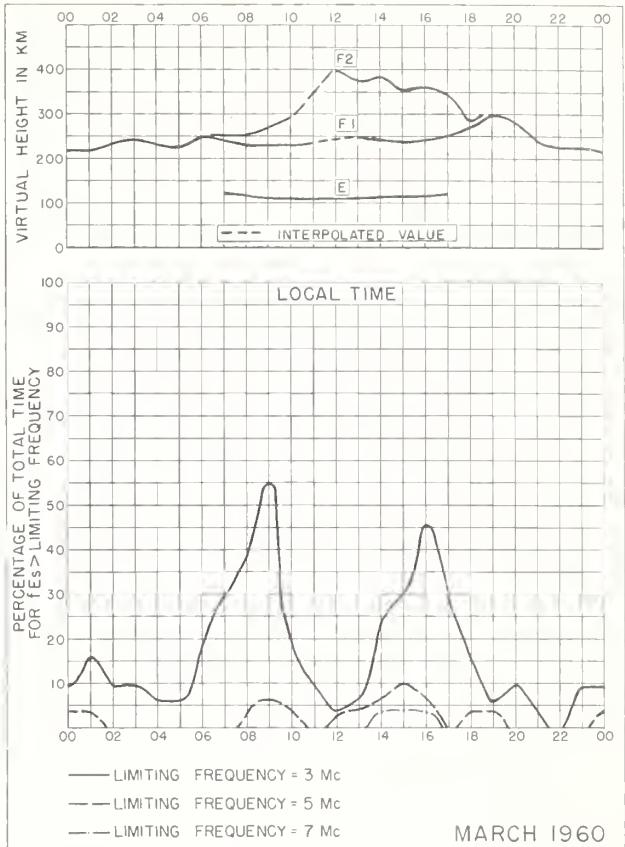


Fig. 73. LEOPOLDVILLE, BELGIAN CONGO
4.4°S, 15.2°E MARCH 1960



MARCH 1960
Fig. 74. LEOPOLDVILLE, BELGIAN CONGO

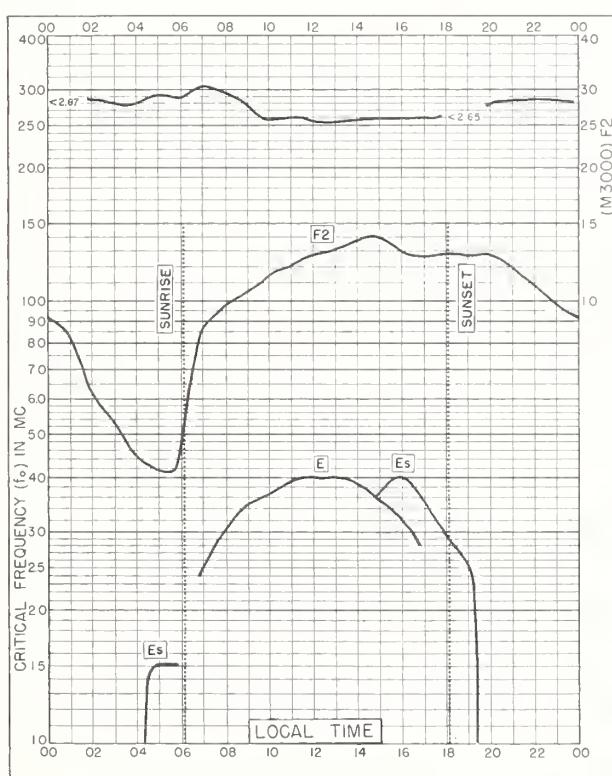
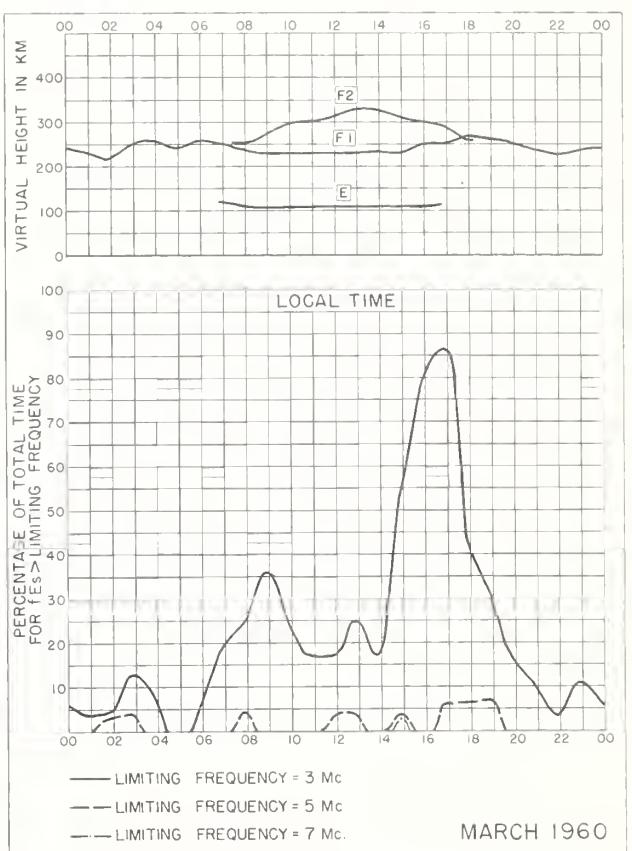


Fig. 75. ELISABETHVILLE, BELGIAN CONGO
11.6°S, 27.5°E MARCH 1960



MARCH 1960
Fig. 76. ELISABETHVILLE, BELGIAN CONGO



Fig. 77. POLE STATION

90.0°S

JUNE 1959

NBS 503

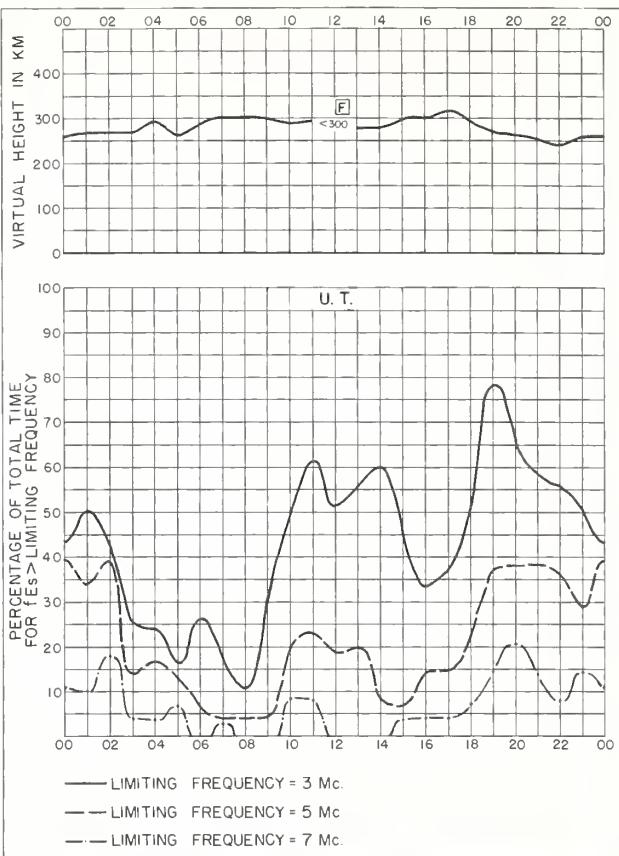


Fig. 78. POLE STATION

JUNE 1959

NBS 490



Fig. 79. POLE STATION

90.0°S

MAY 1959

NBS 503

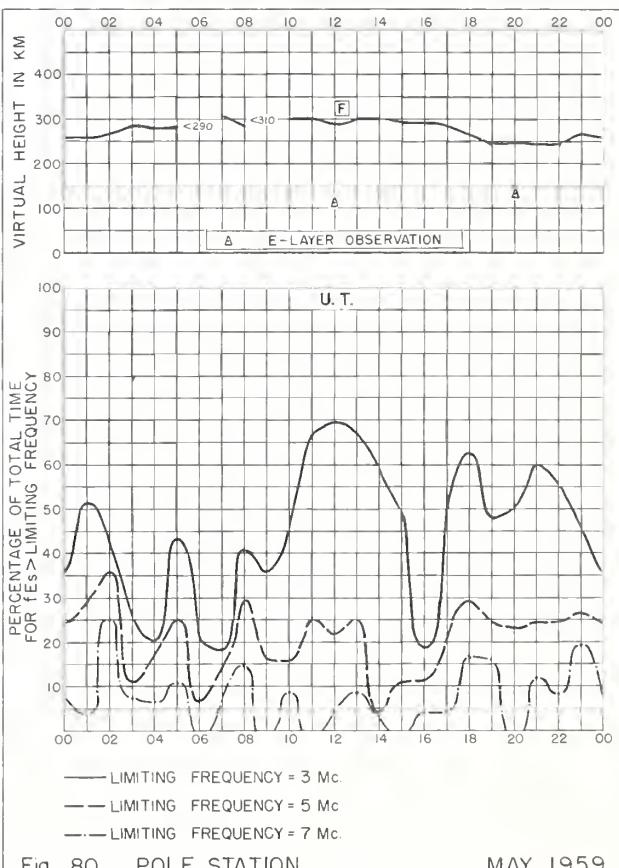


Fig. 80. POLE STATION

MAY 1959

NBS 490

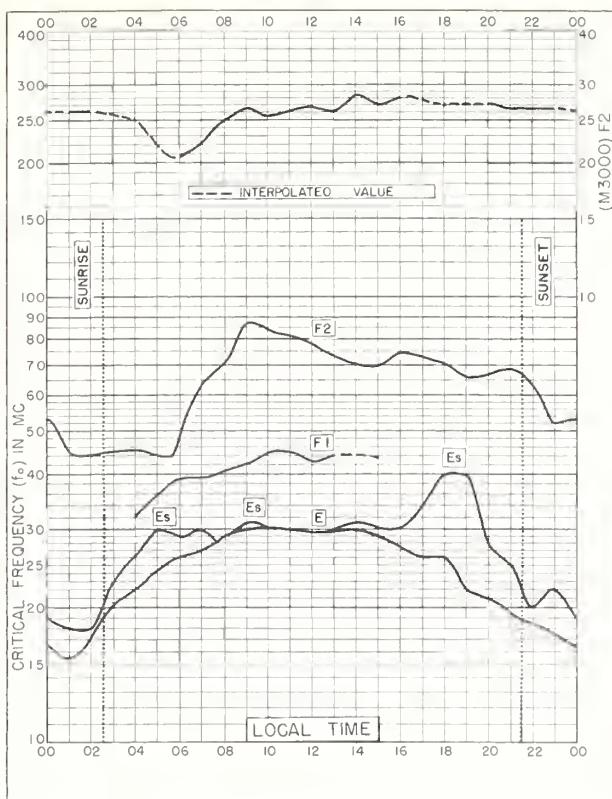


Fig. 81. SVALBARD, NORWAY
78.2°N, 15.7°E APRIL 1959

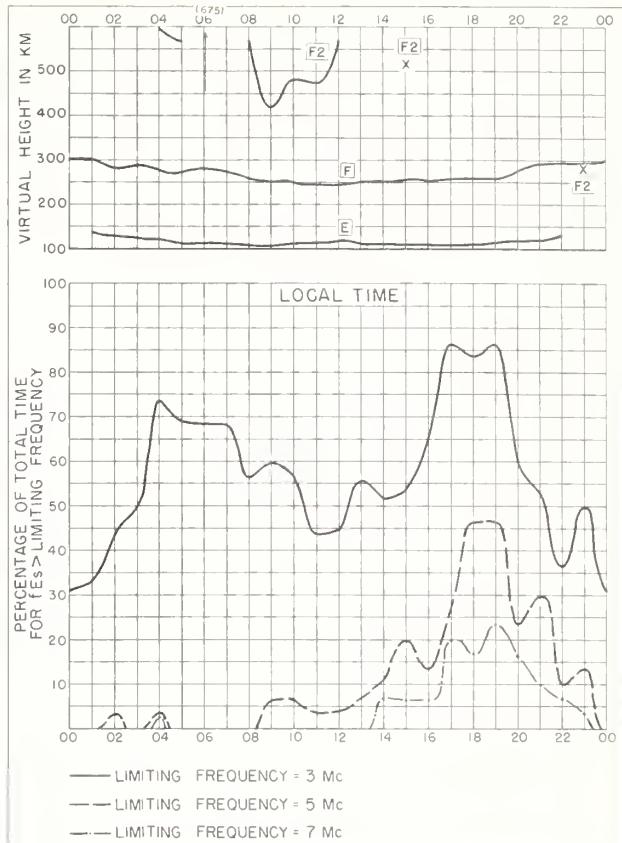


Fig. 82. SVALBARD, NORWAY APRIL 1959

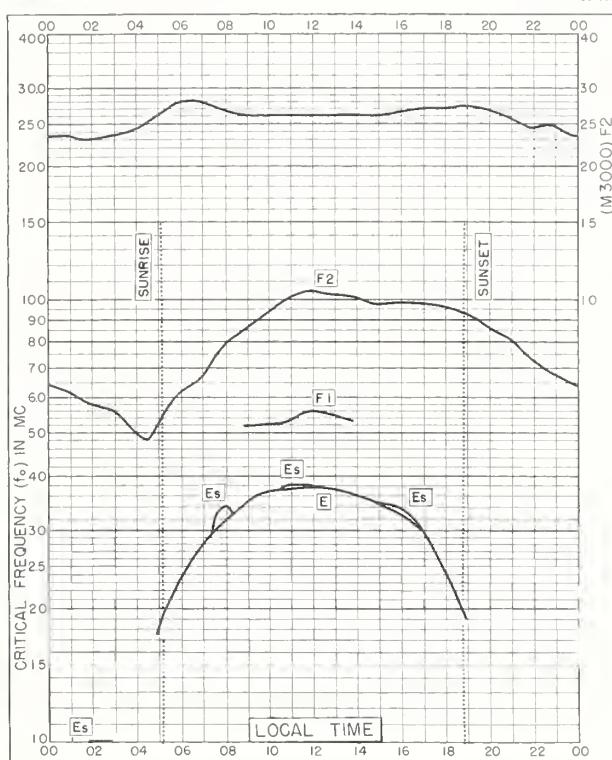


Fig. 83. JULIUSRUH/RÜGEN, GERMANY
54.6°N, 13.4°E APRIL 1959

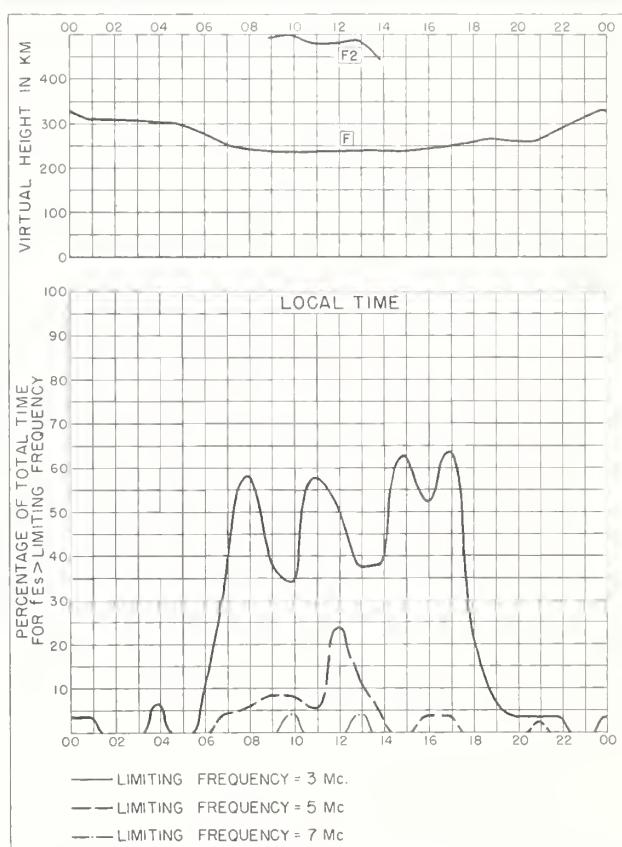


Fig. 84. JULIUSRUH/RÜGEN, GERMANY APRIL 1959

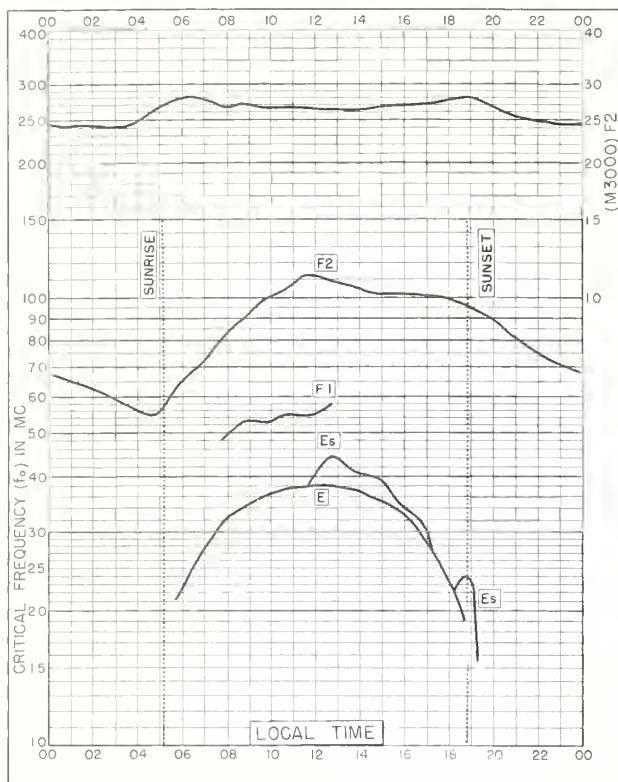


Fig. 85. LINDAU/HARZ, GERMANY

51.6°N, 10.1°E

APRIL 1959

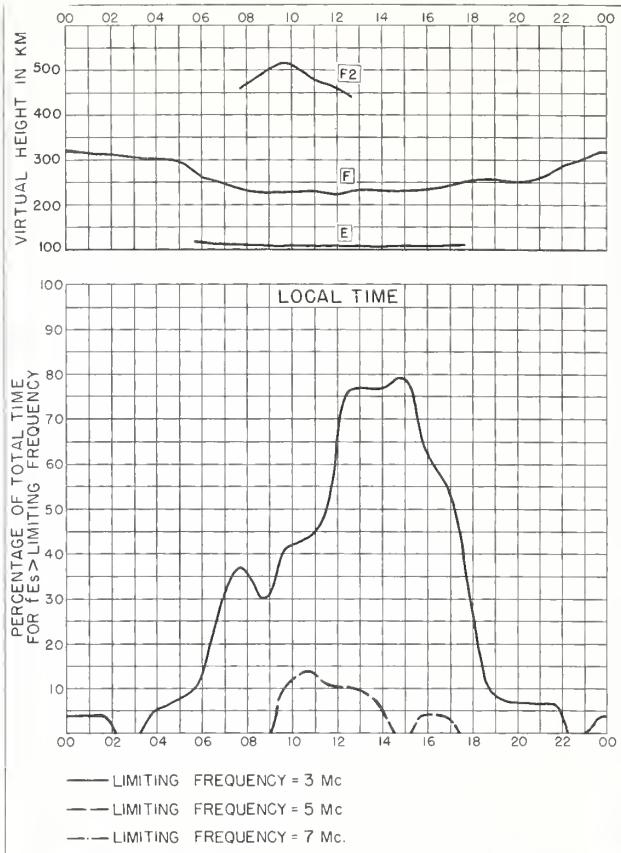


Fig. 86. LINDAU/HARZ, GERMANY

APRIL 1959

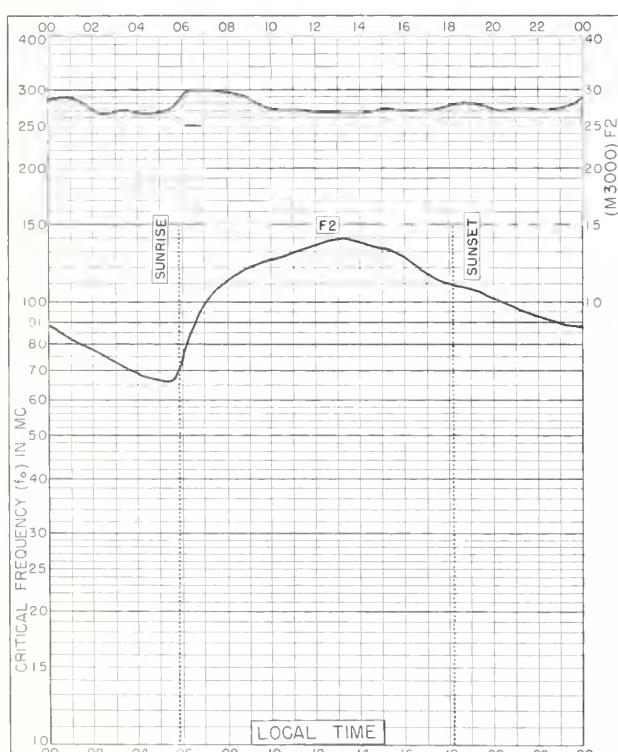


Fig. 87. EL CERILLO, MEXICO

19.3°N, 99.5°W

APRIL 1959

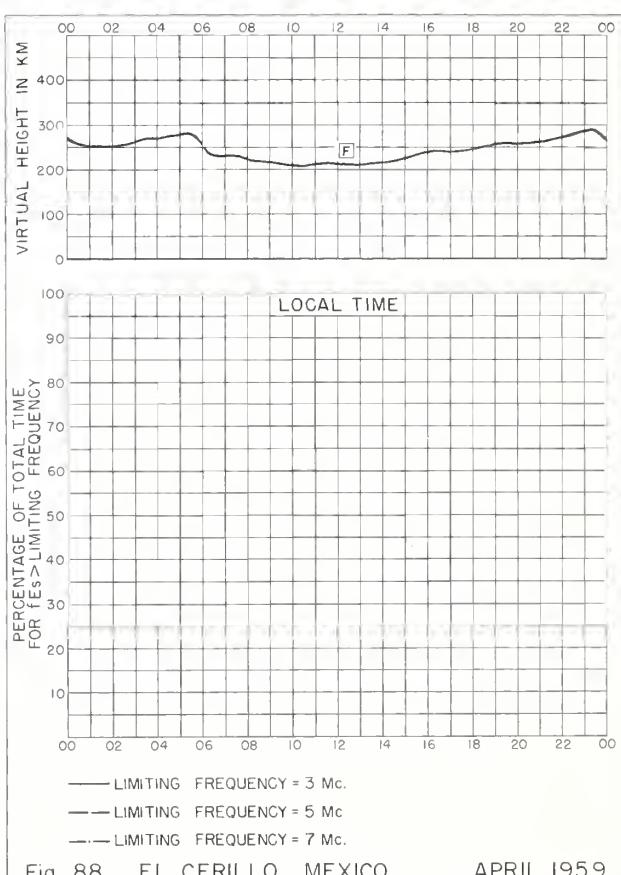


Fig. 88. EL CERILLO, MEXICO

APRIL 1959

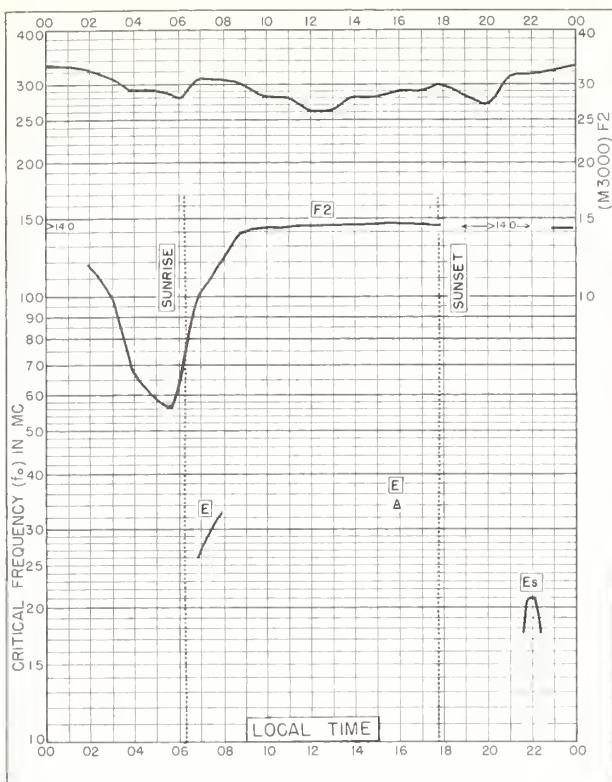


Fig. 89. SAO PAULO, BRAZIL
23.5°S, 46.5°W APRIL 1959

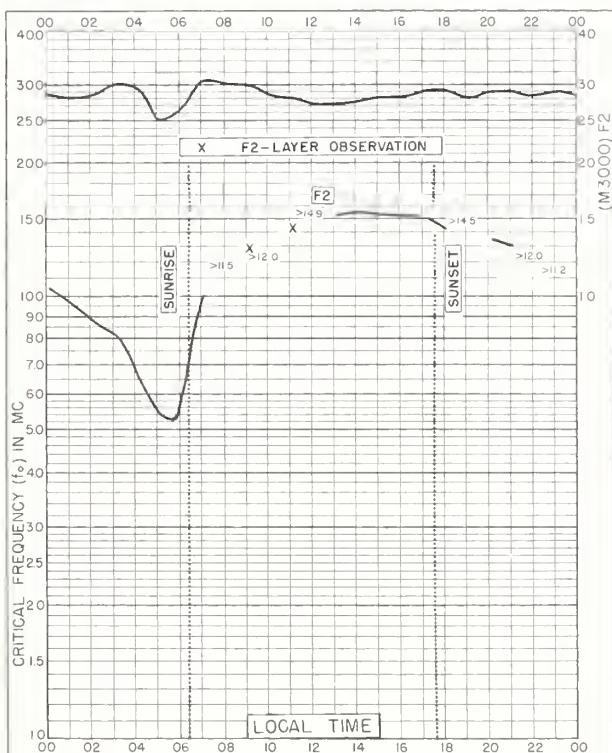
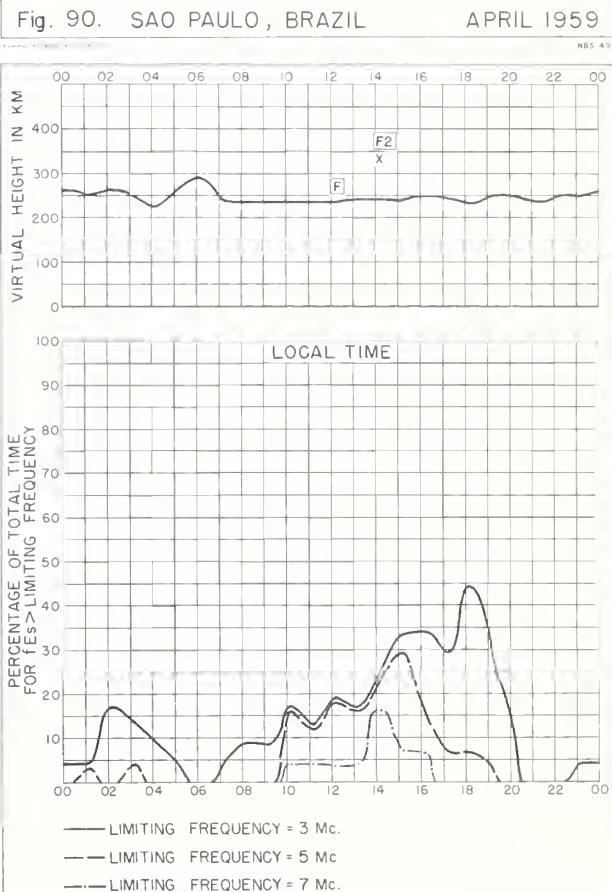
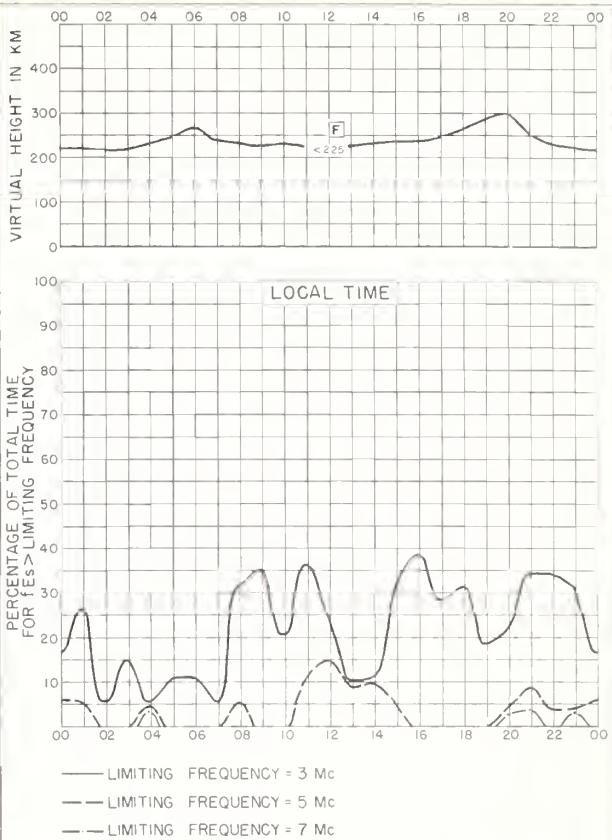


Fig. 91. BUENOS AIRES, ARGENTINA
34.5°S, 58.5°W APRIL 1959

NBS 503



NBS 490

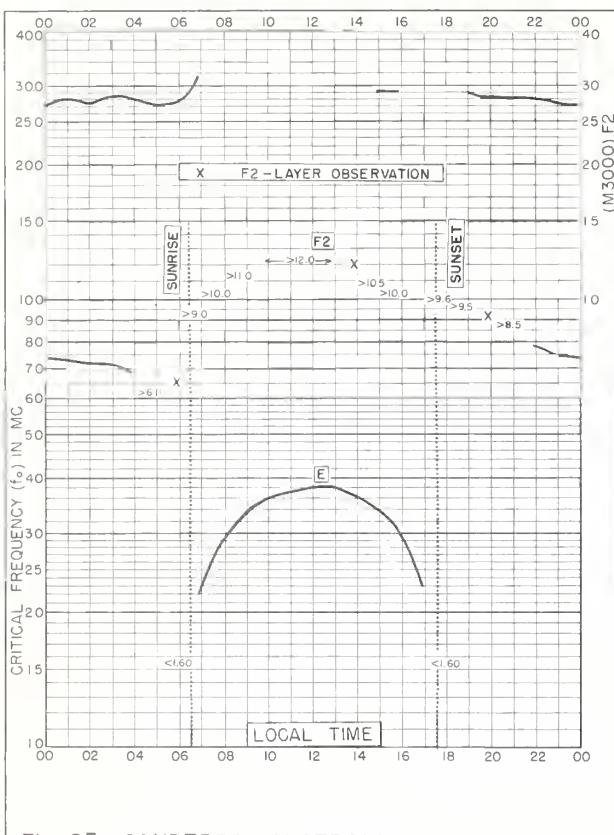


Fig. 93. CANBERRA, AUSTRALIA

35.3°S, 149.0°E APRIL 1959

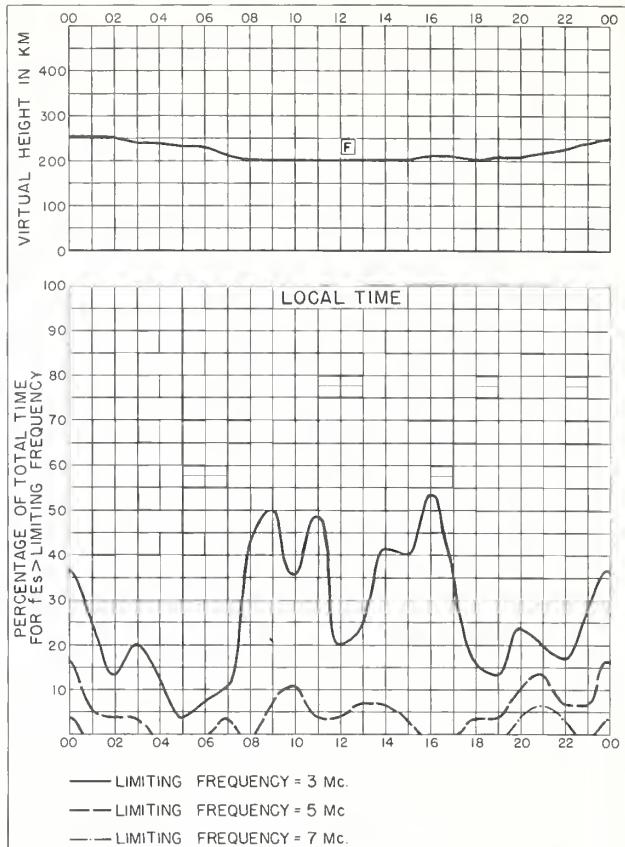


Fig. 94. CANBERRA, AUSTRALIA

APRIL 1959

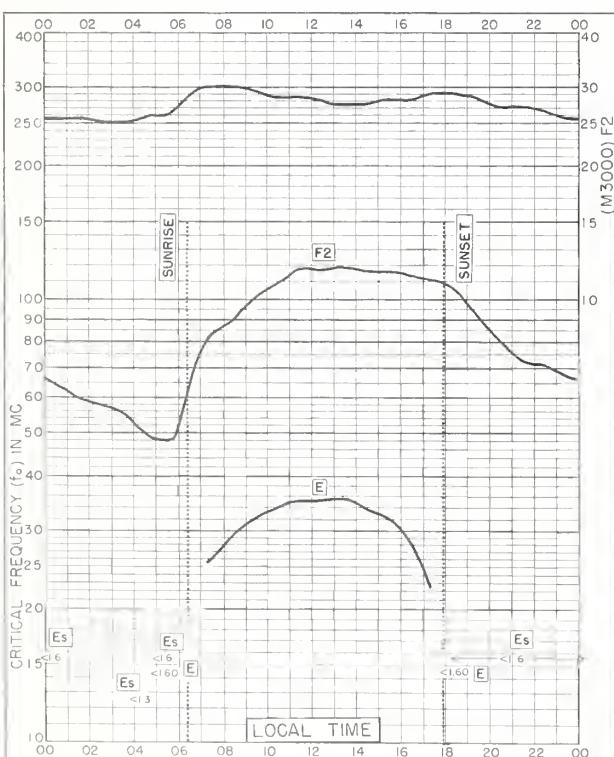


Fig. 95. DOURBES, BELGIUM

50.1°N, 4.6°E

MARCH 1959

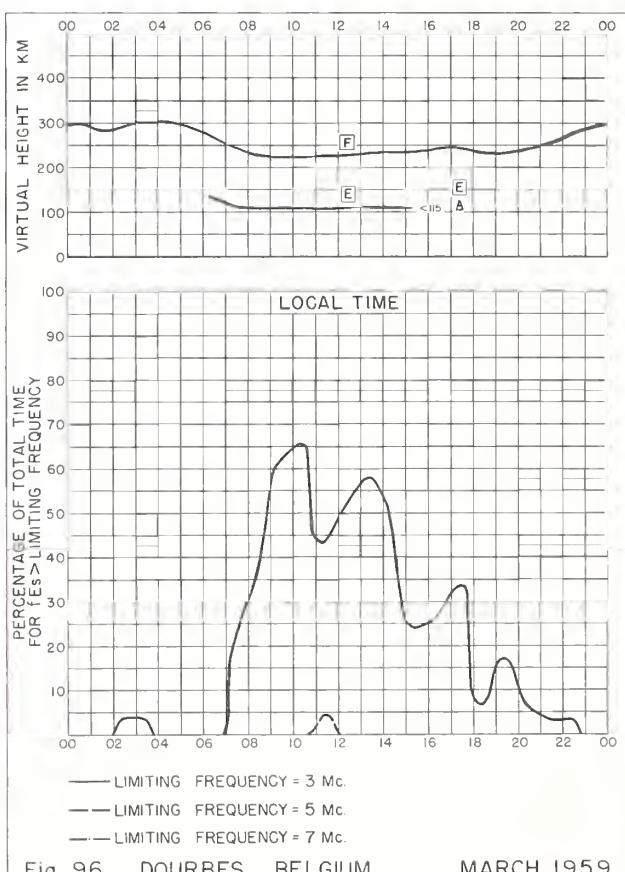
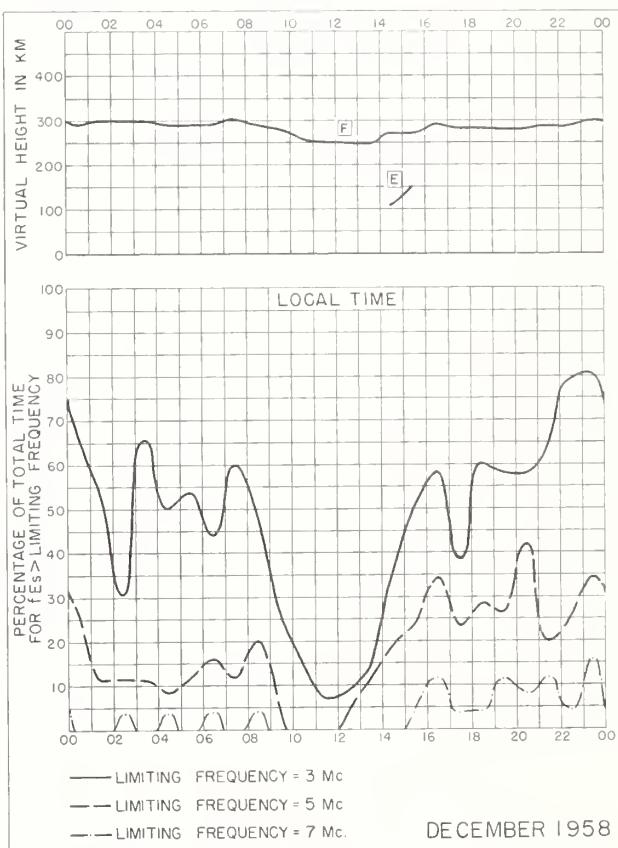
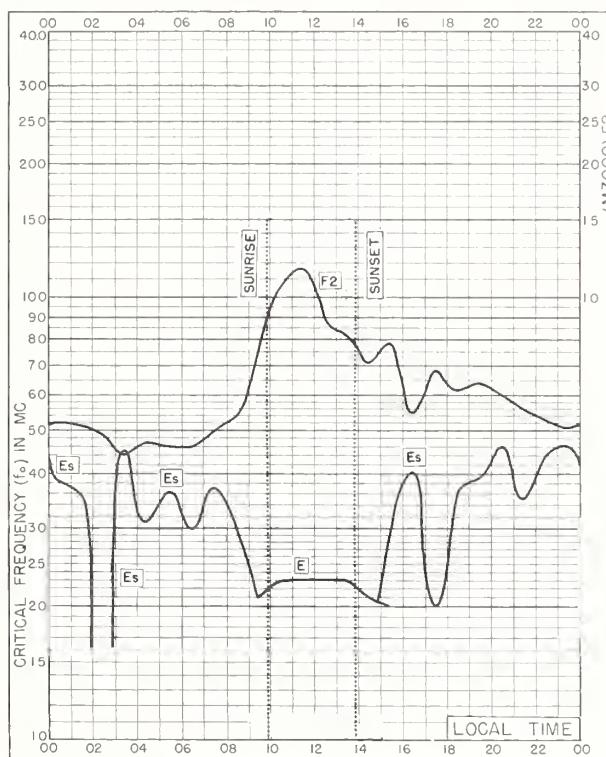
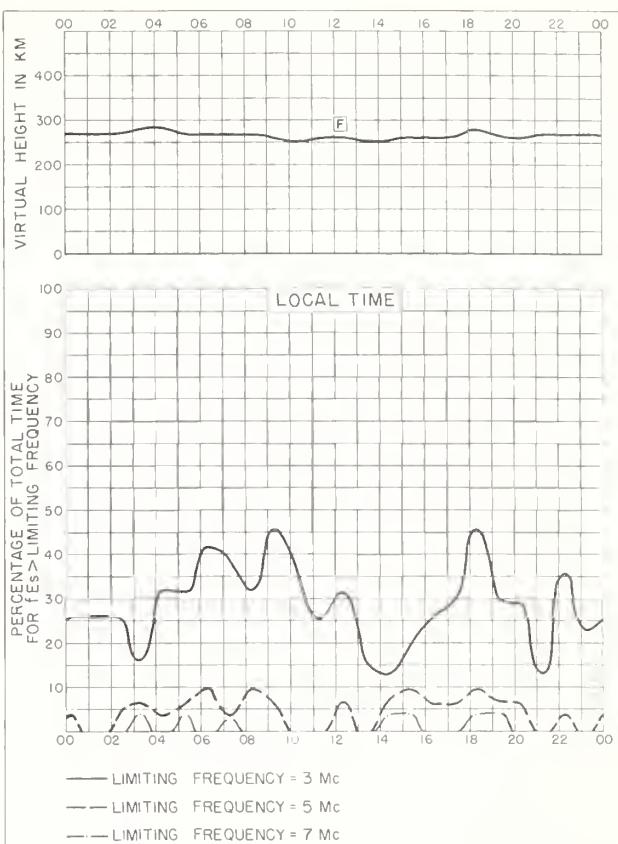
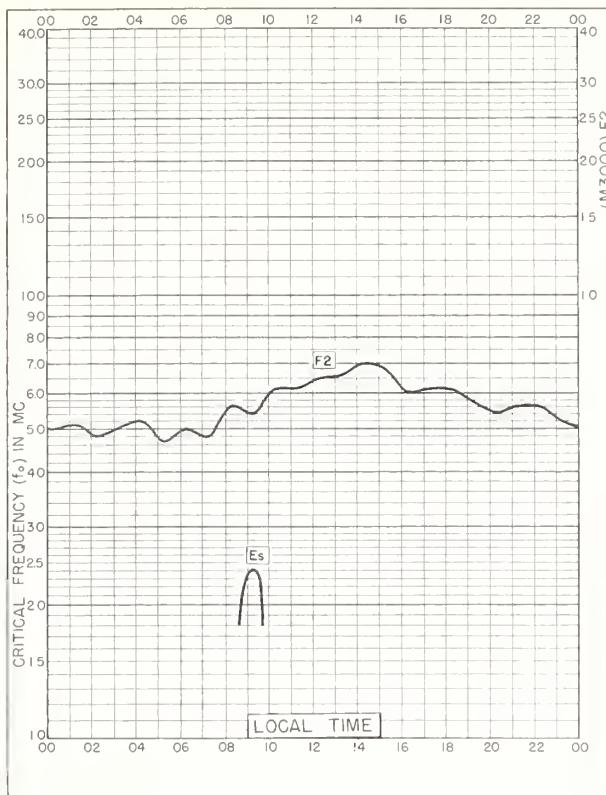


Fig. 96. DOURBES, BELGIUM

MARCH 1959



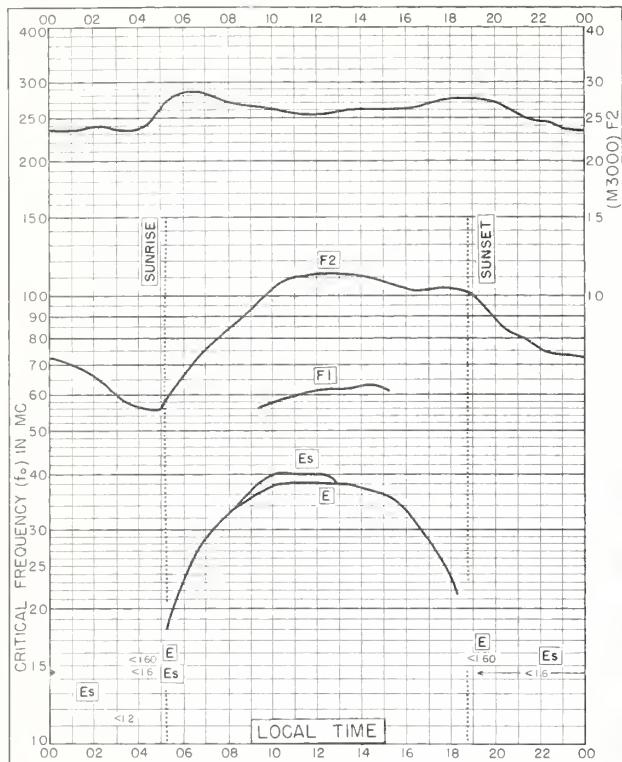


Fig. 101. DOURBES, BELGIUM

50.1°N, 4.6°E

APRIL 1958

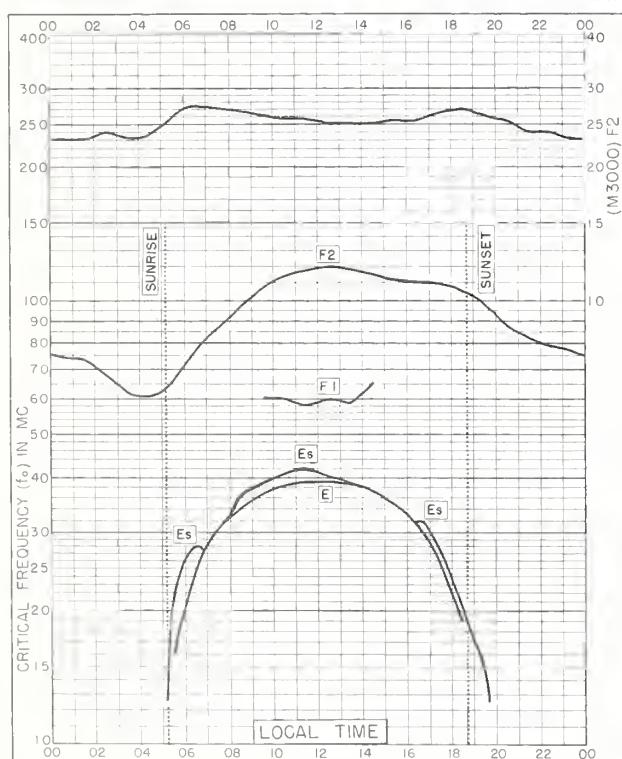


Fig. 103. FREIBURG, GERMANY

48.1°N, 7.6°E

APRIL 1958

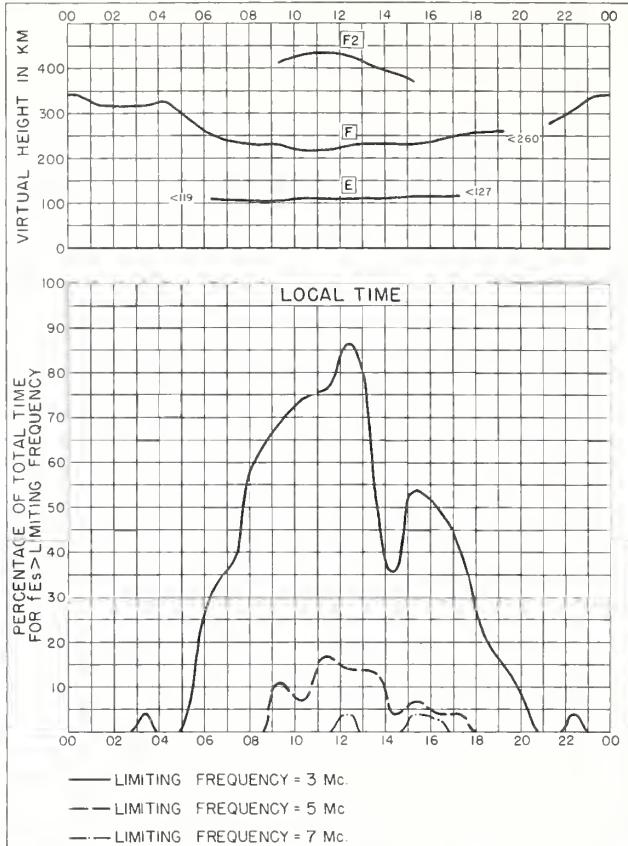


Fig. 102. DOURBES, BELGIUM

APRIL 1958

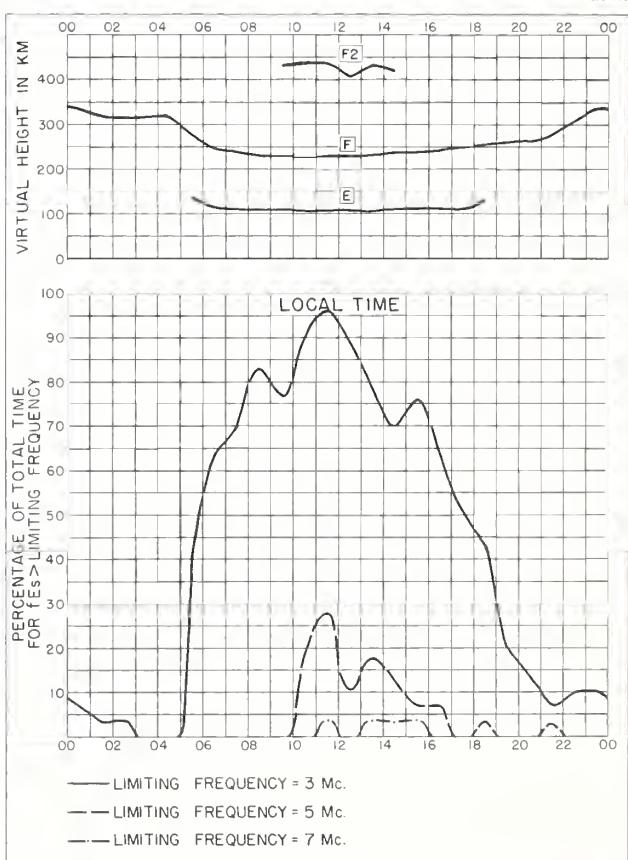
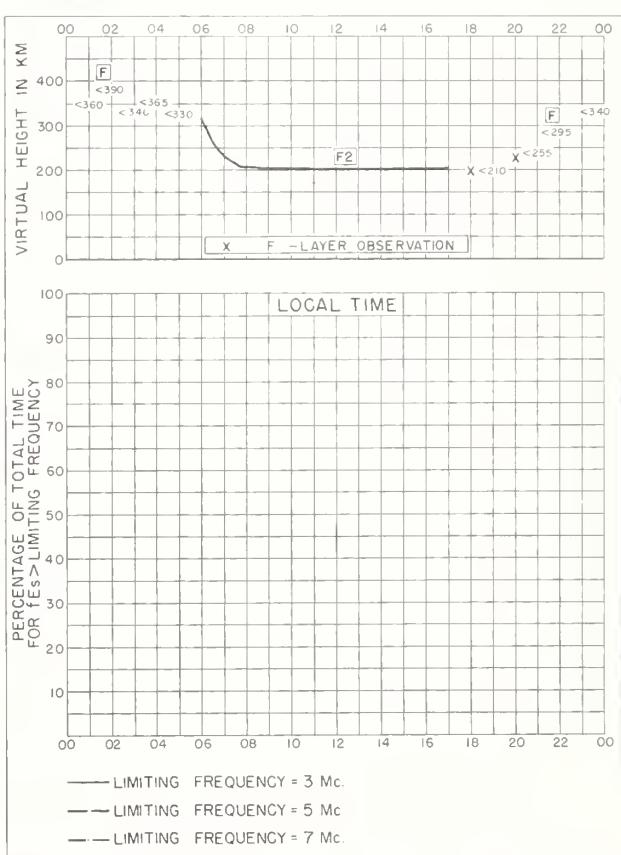
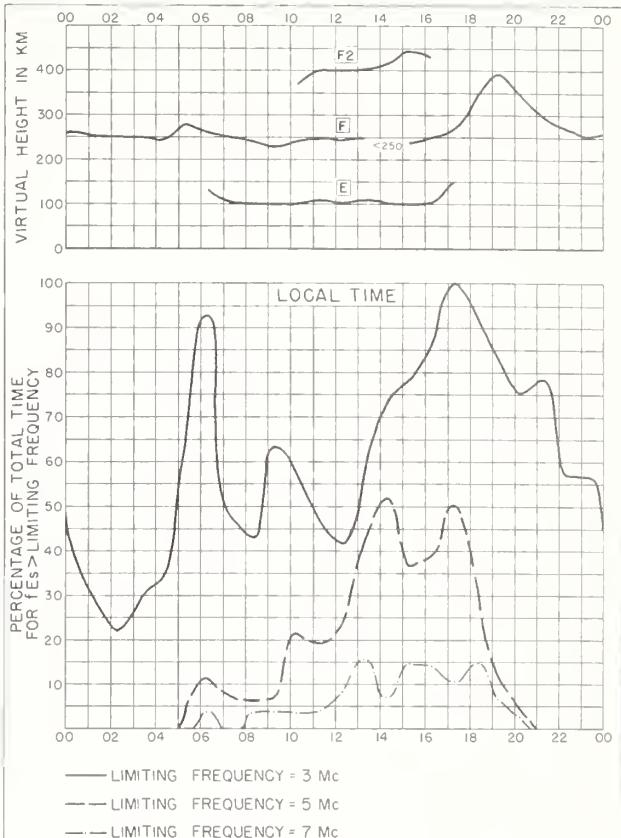
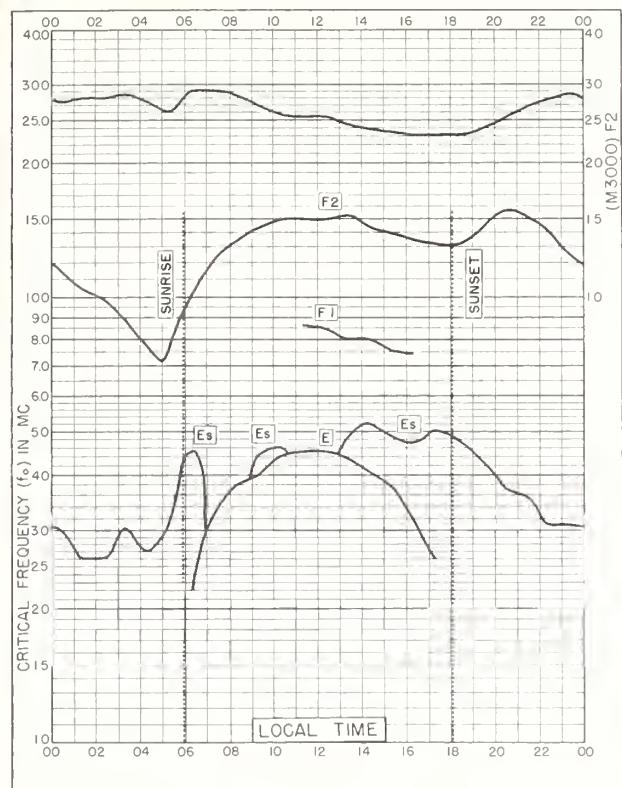


Fig. 104. FREIBURG, GERMANY

APRIL 1958



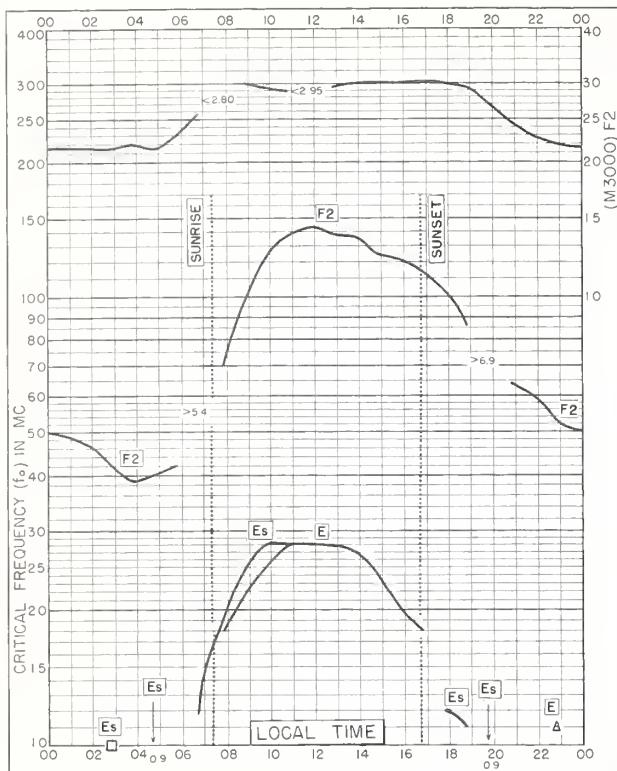


Fig. I09. PORT LOCKROY

64.8°S, 63.5°W

APRIL 1958

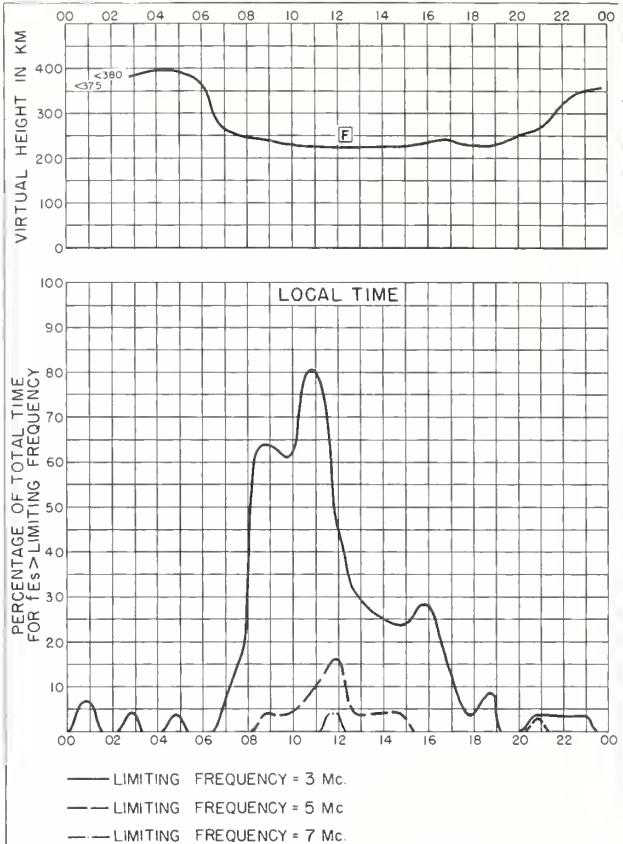


Fig. I10. PORT LOCKROY

APRIL 1958

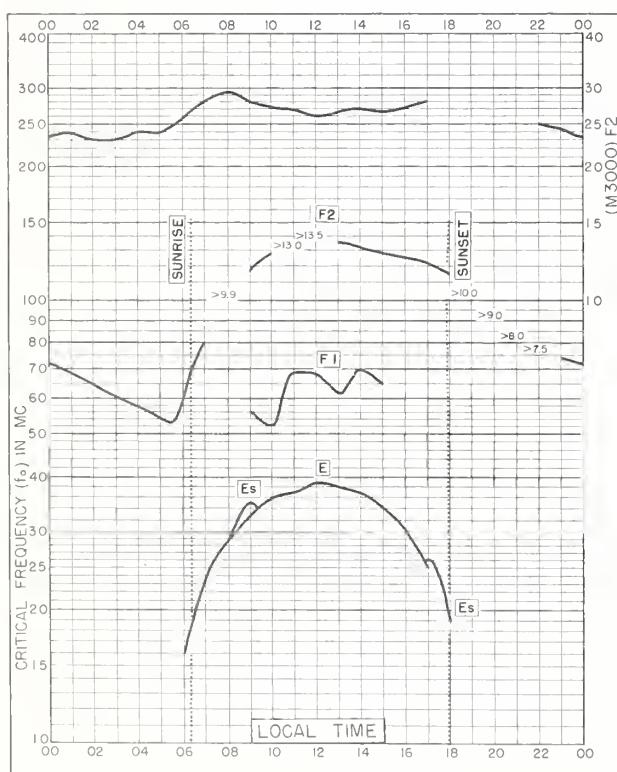


Fig. III. POITIERS, FRANCE

46.6°N, 0.3°E

MARCH 1958

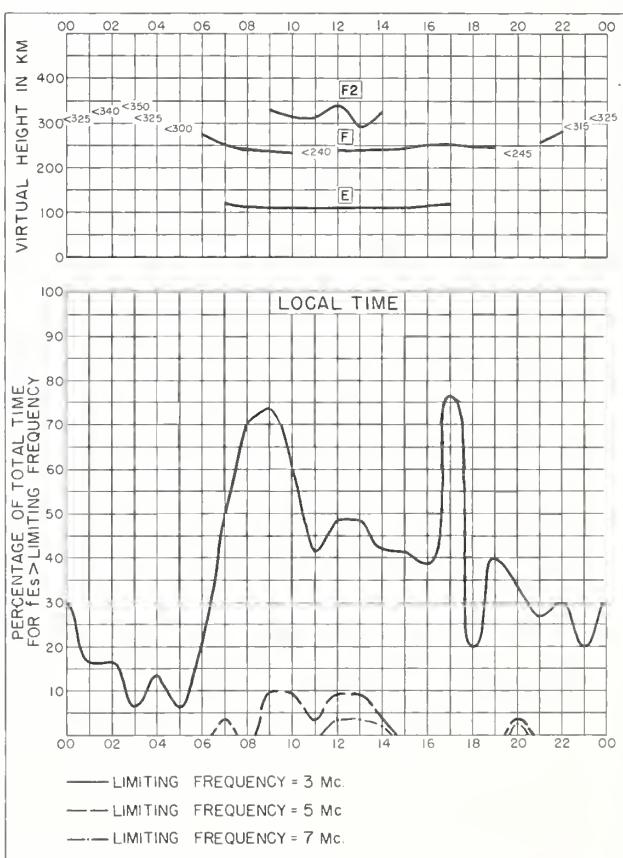


Fig. II2. POITIERS, FRANCE

MARCH 1958

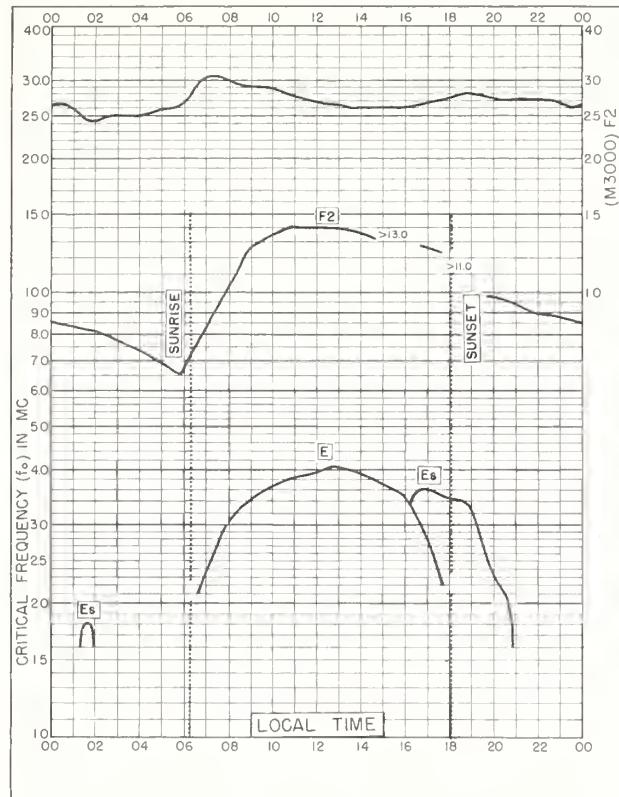


Fig. II3. RABAT, MOROCCO
30.9°N, 6.8°W MARCH 1958

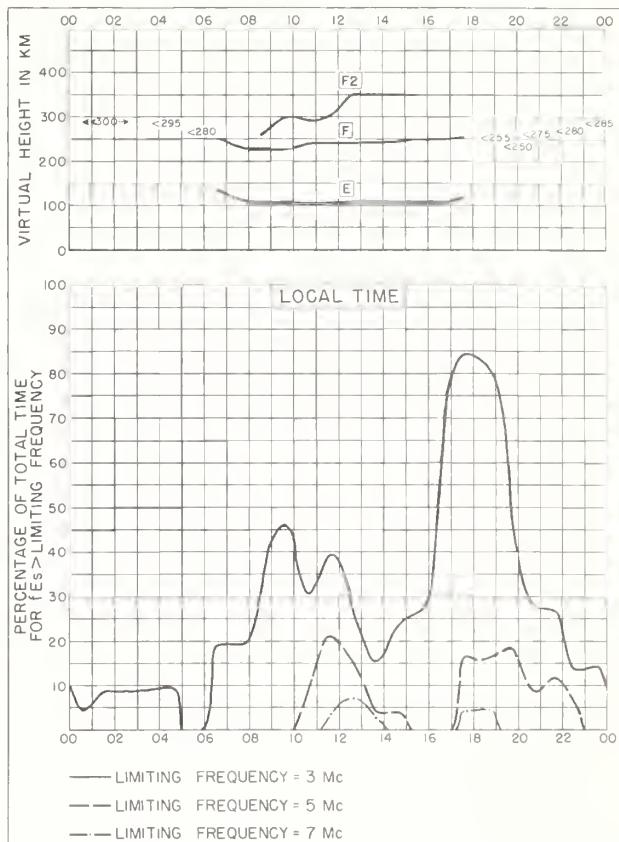


Fig. II4. RABAT, MOROCCO MARCH 1958

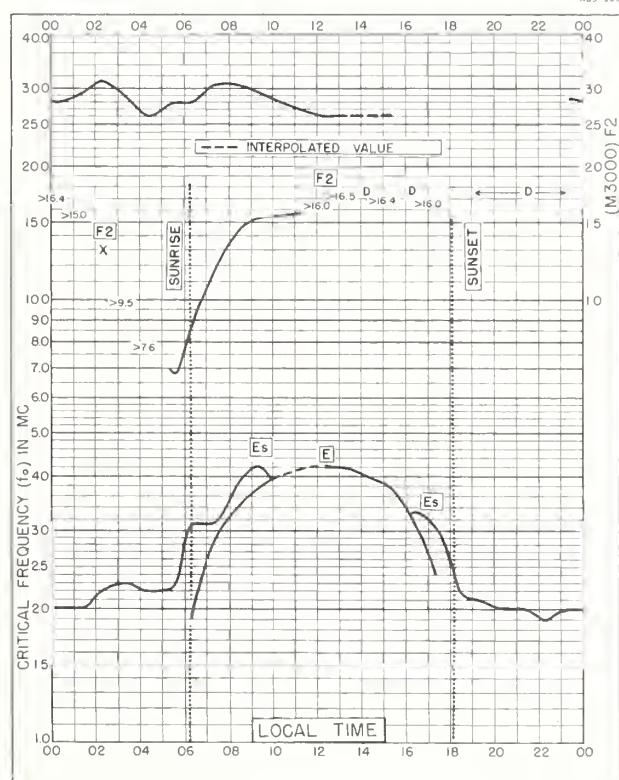


Fig. II5. TAMANRASSET, FRENCH W. AFRICA
22.8°N, 5.5°E MARCH 1958

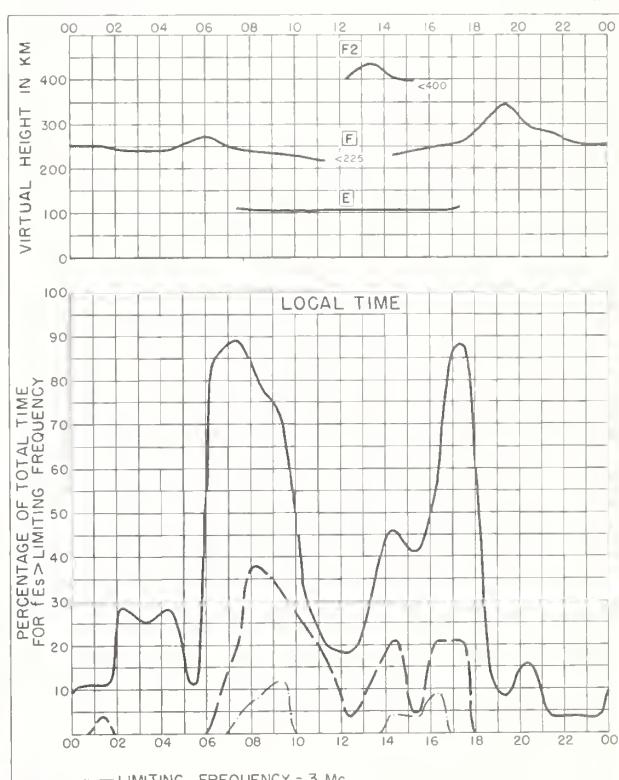


Fig. II6. TAMANRASSET, FRENCH W. AFRICA MARCH 1958

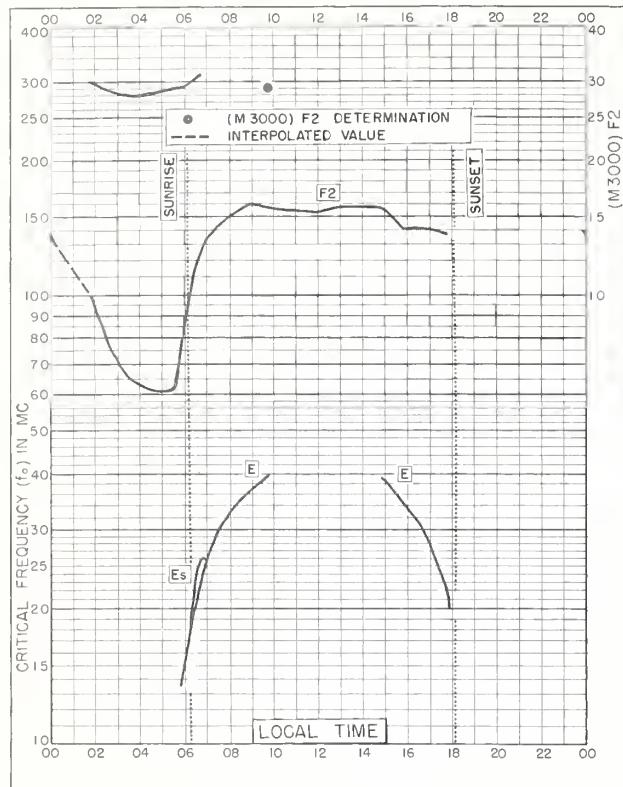


Fig. II7. DAKAR, FRENCH W. AFRICA
14.7°N, 17.4°W MARCH 1958

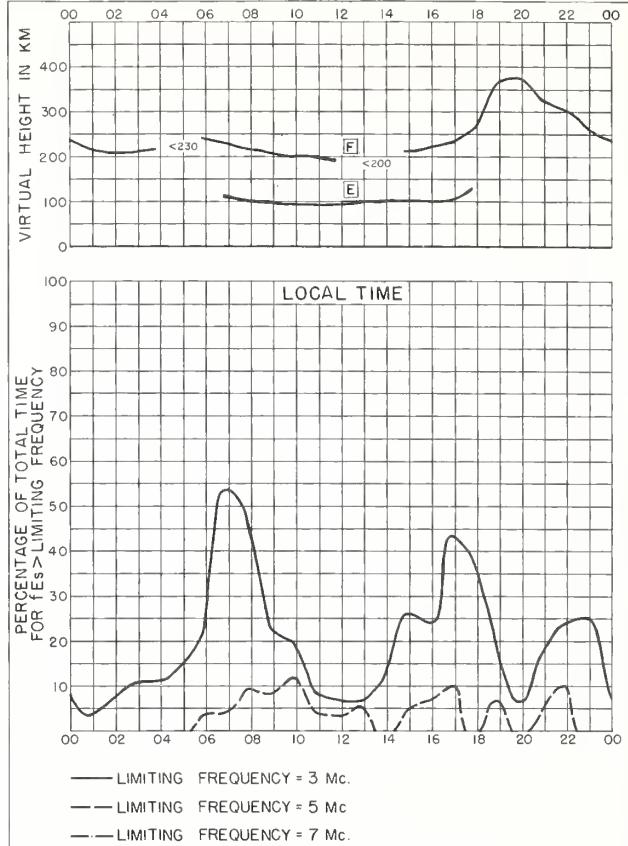


Fig. II8. DAKAR, FRENCH W. AFRICA MARCH 1958

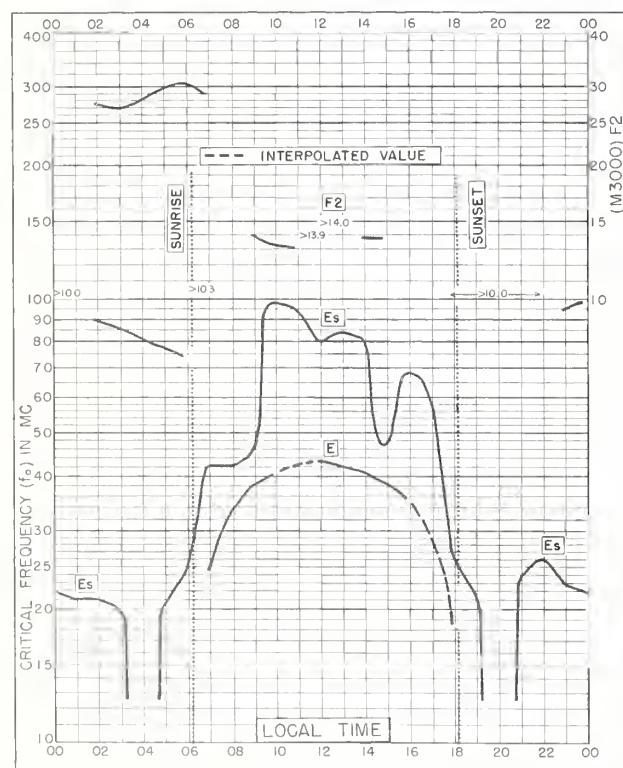


Fig. II9. DJIBOUTI, FRENCH SOMALILAND
11.6°N, 43.2°E MARCH 1958

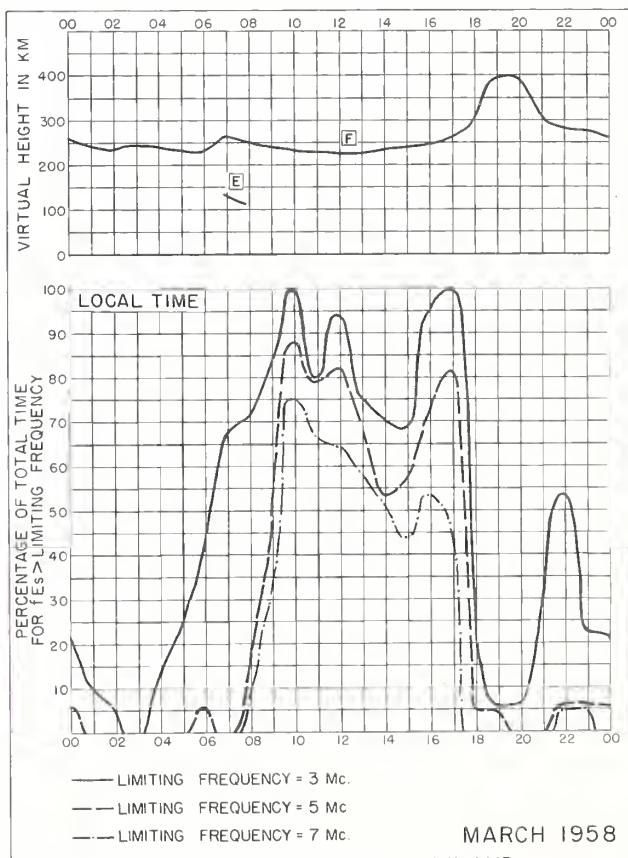
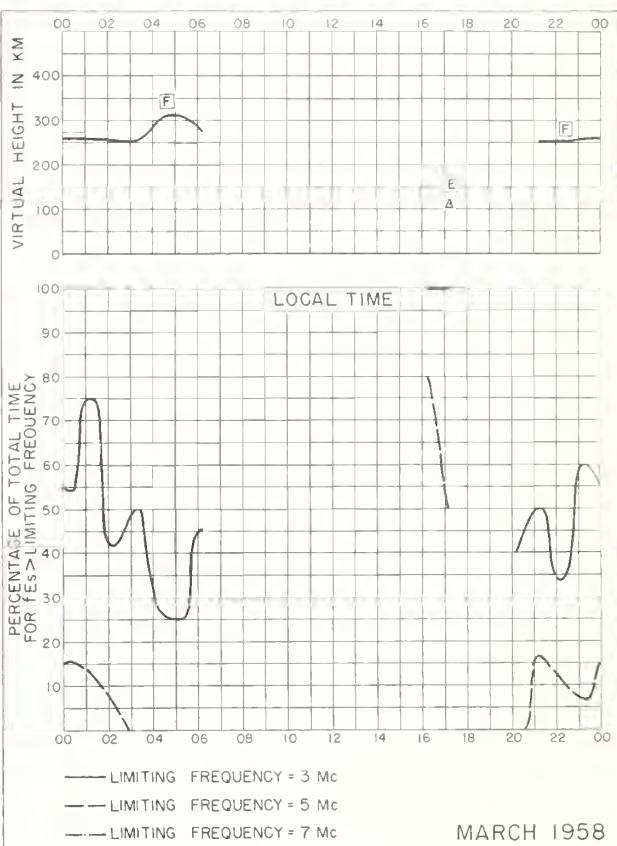
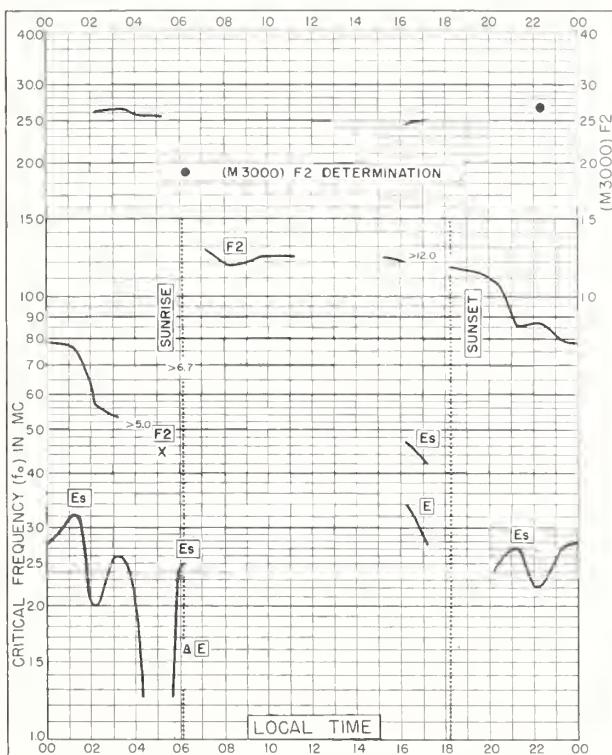
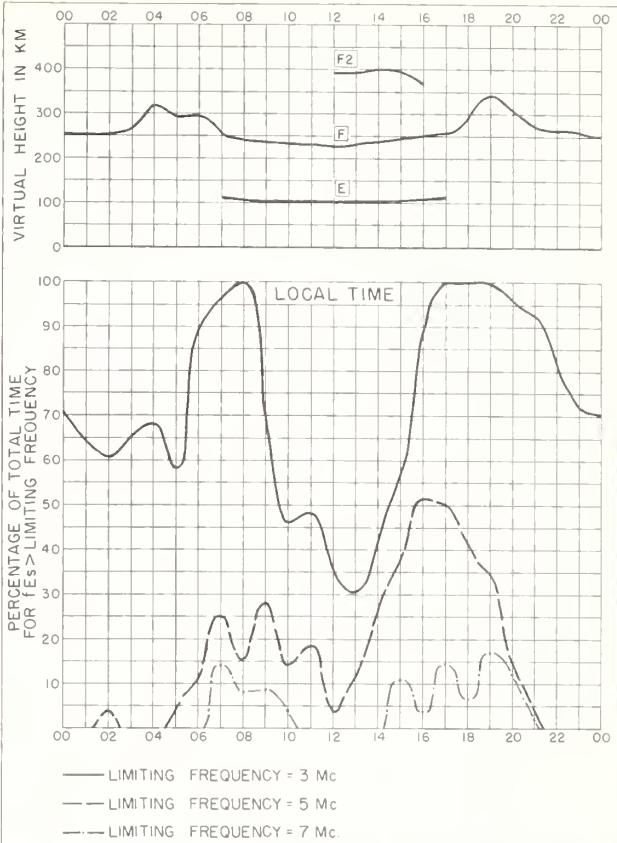
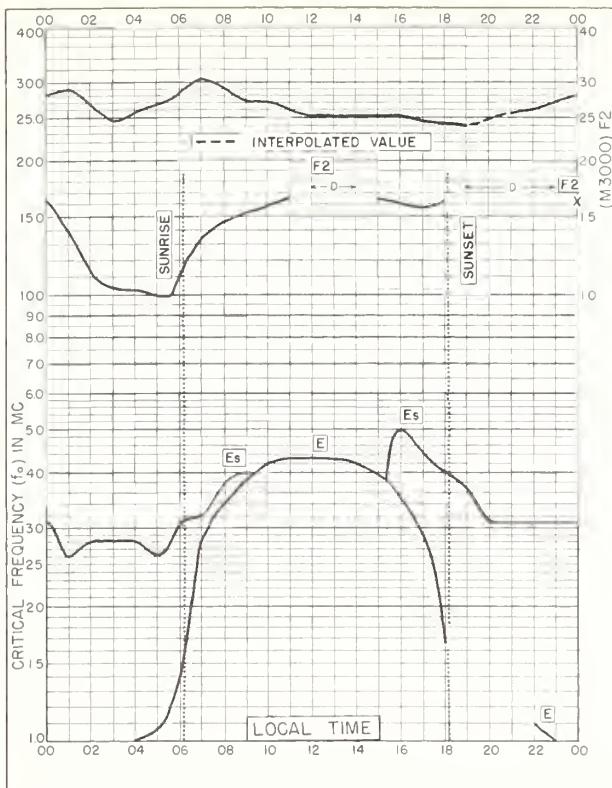
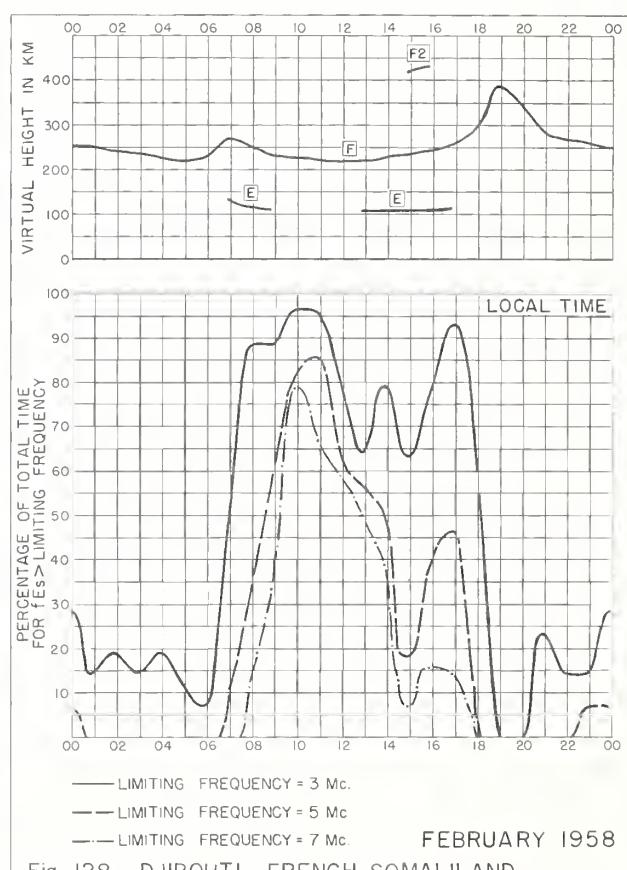
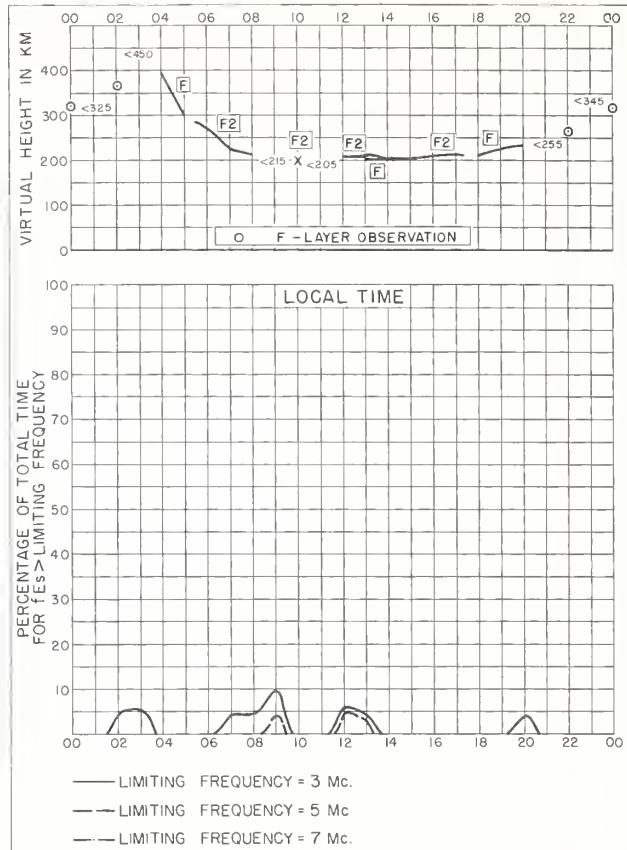
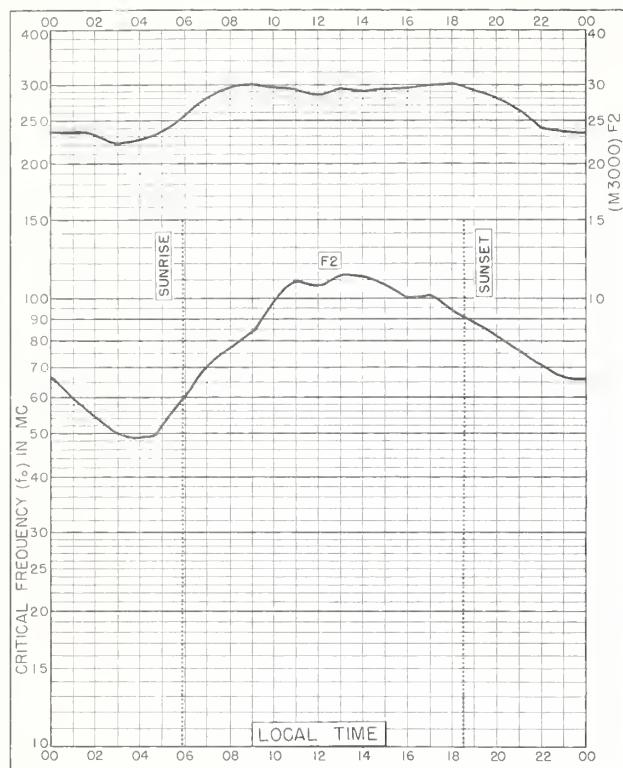


Fig. I20. DJIBOUTI, FRENCH SOMALILAND MARCH 1958





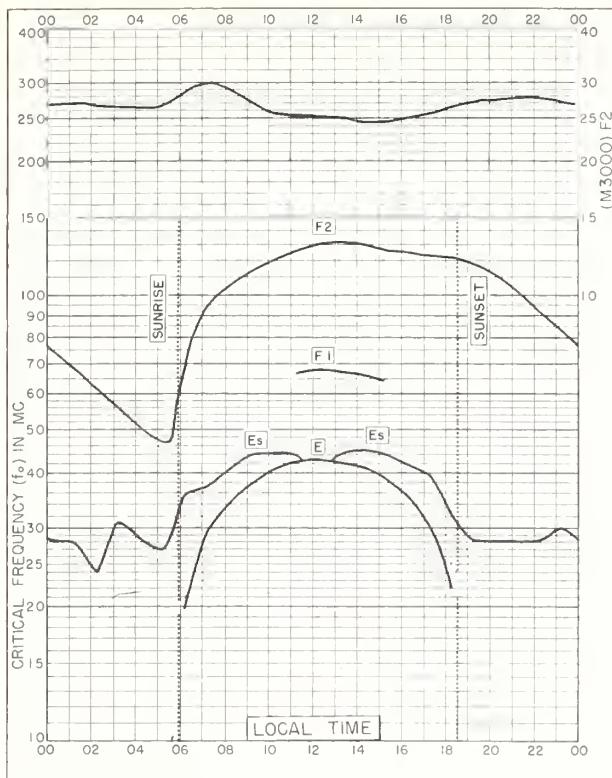


Fig. 129. TSUMEB, SOUTH W. AFRICA
19.2°S, 17.7°E FEBRUARY 1958

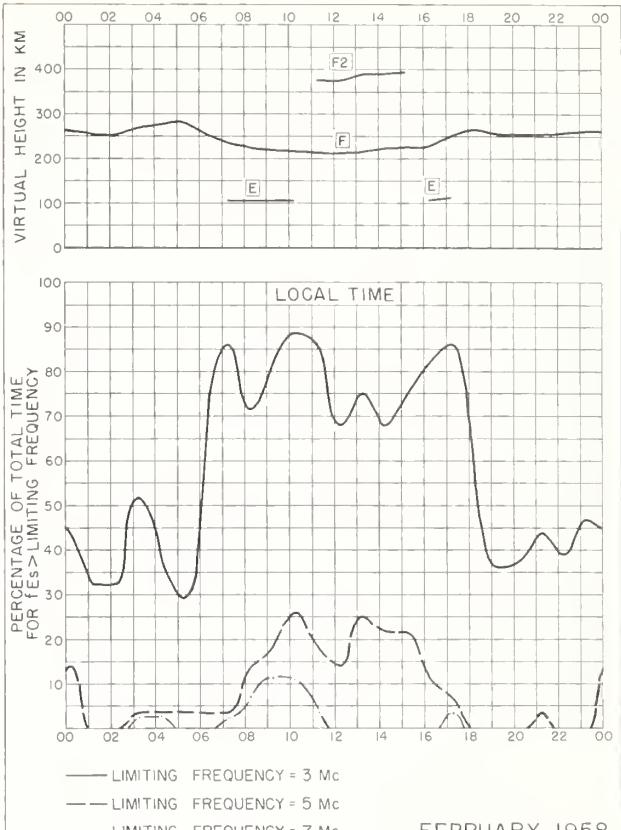


Fig. 130. TSUMEB, SOUTH W. AFRICA FEBRUARY 1958

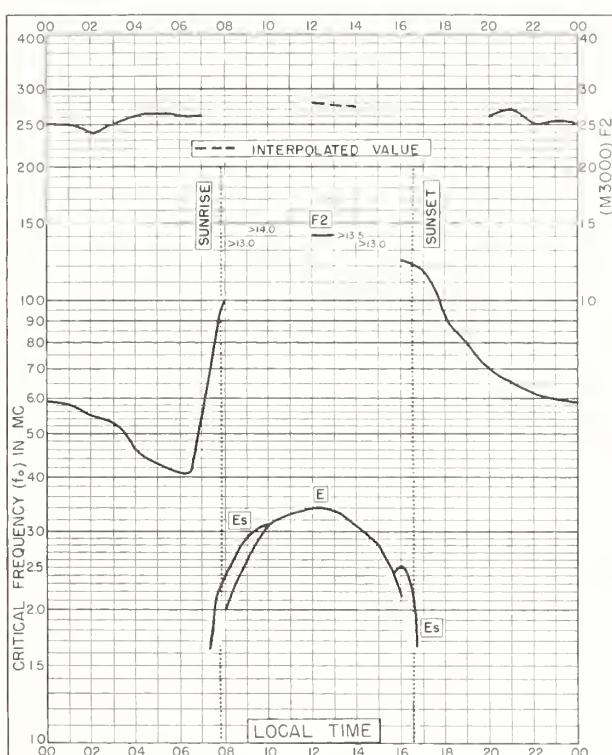


Fig. 131. POITIERS, FRANCE
46.6°N, 0.3°E JANUARY 1958

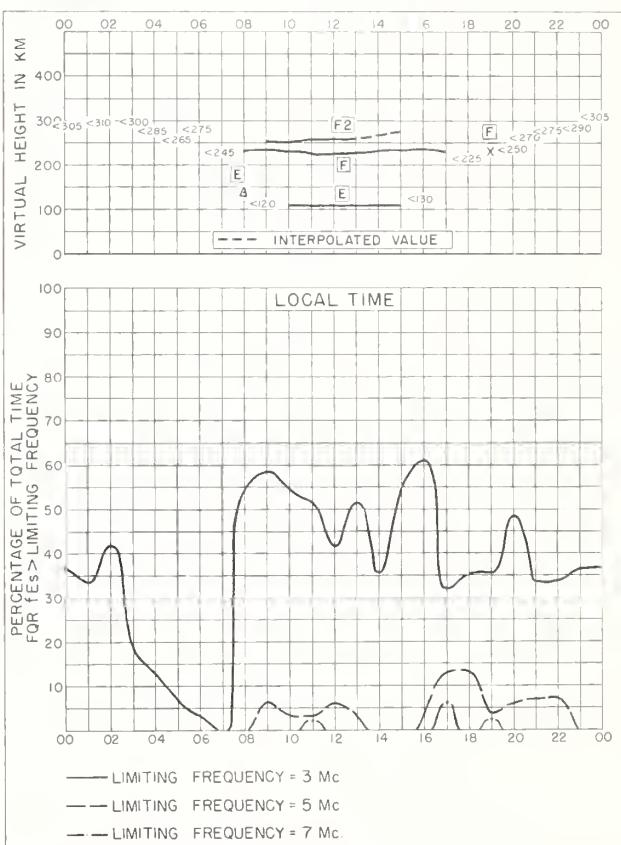


Fig. 132. POITIERS, FRANCE JANUARY 1958

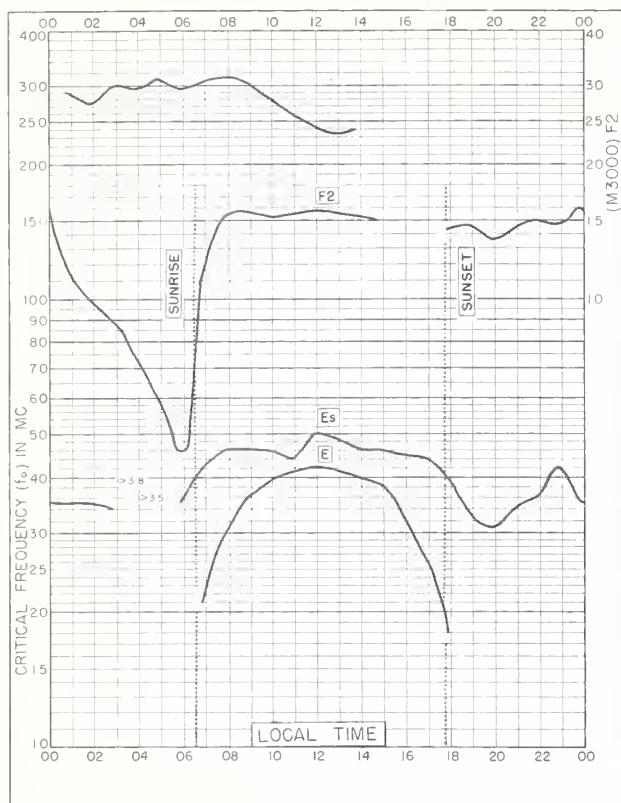


Fig. 133. DAKAR, FRENCH W. AFRICA
14.7°N, 17.4°W JANUARY 1958

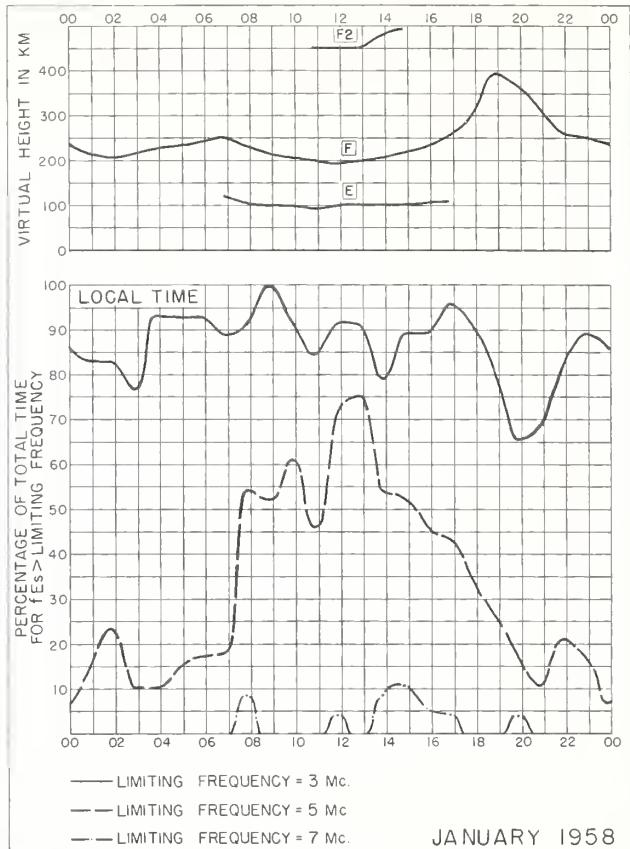


Fig. 134. DAKAR, FRENCH W. AFRICA JANUARY 1958

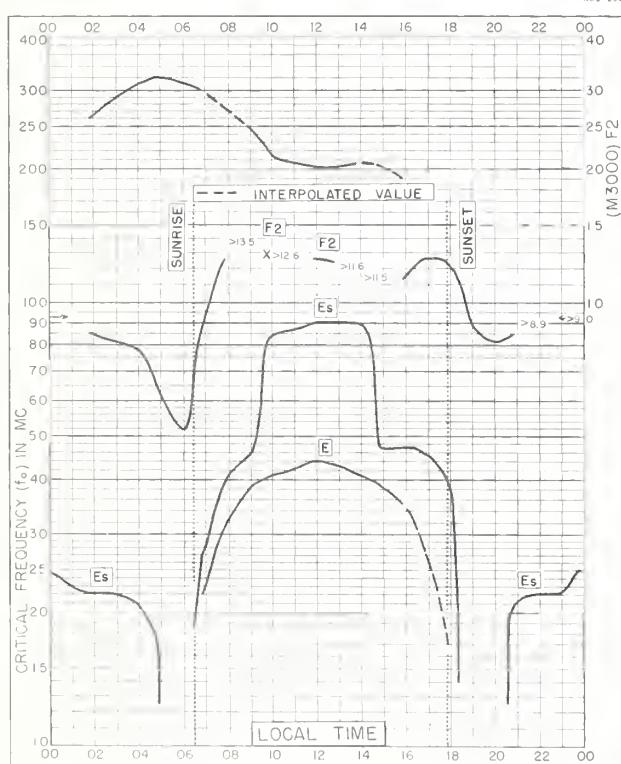


Fig. 135. DJIBOUTI, FRENCH SOMALILAND
11.6°N, 43.2°E JANUARY 1958

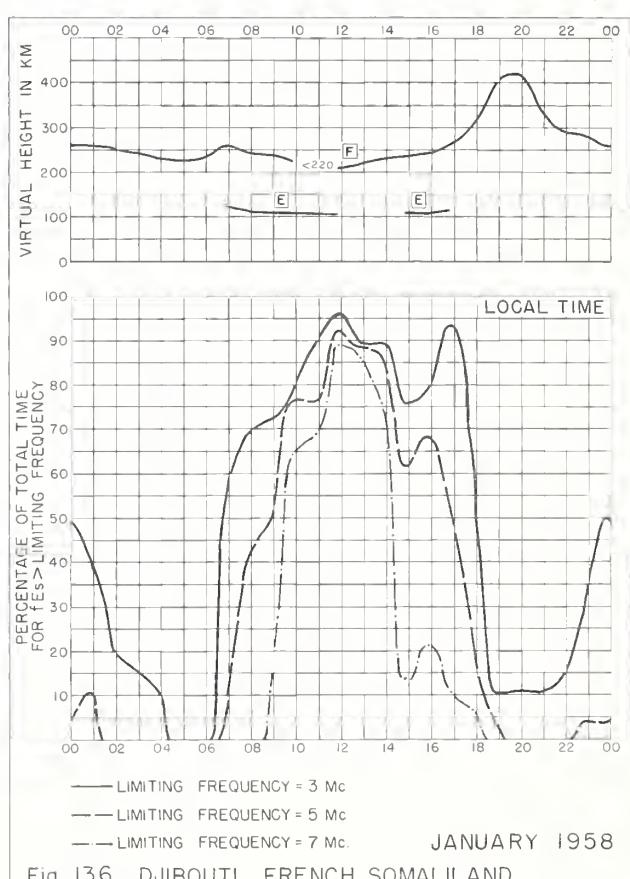


Fig. 136. DJIBOUTI, FRENCH SOMALILAND JANUARY 1958

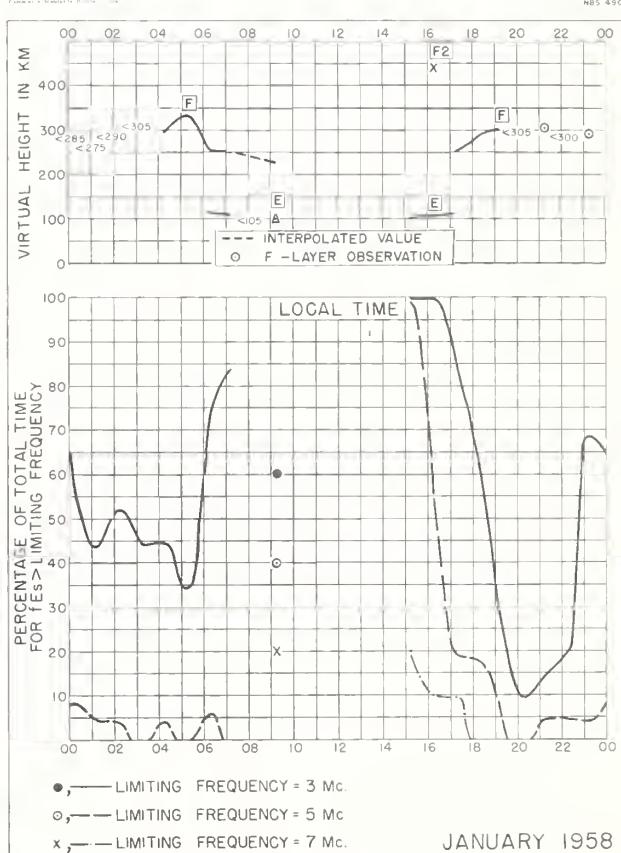
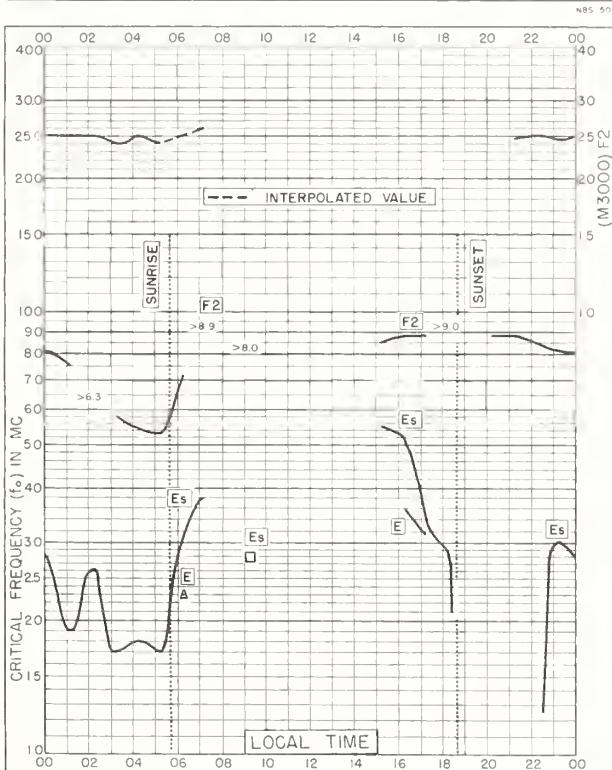
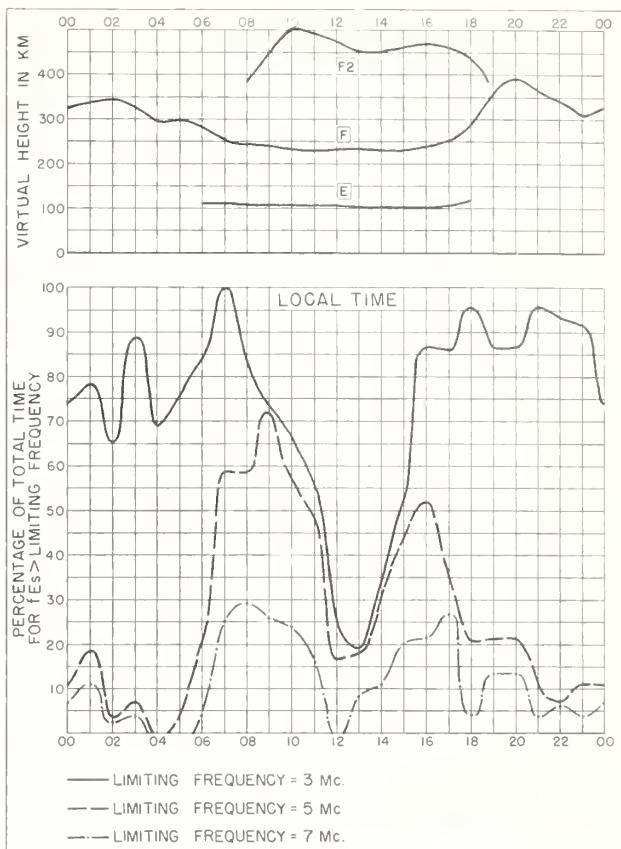
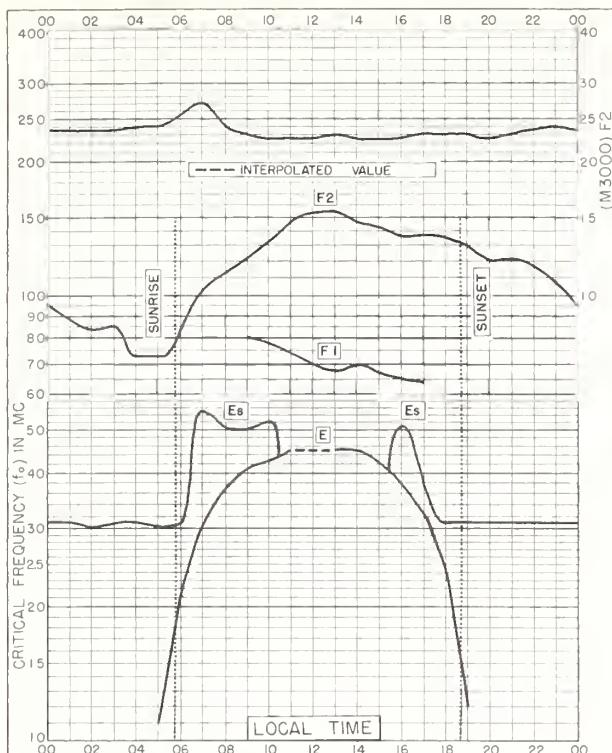




Fig. 141. PORT LOCKROY
64.8°S, 63.5°W JUNE 1957

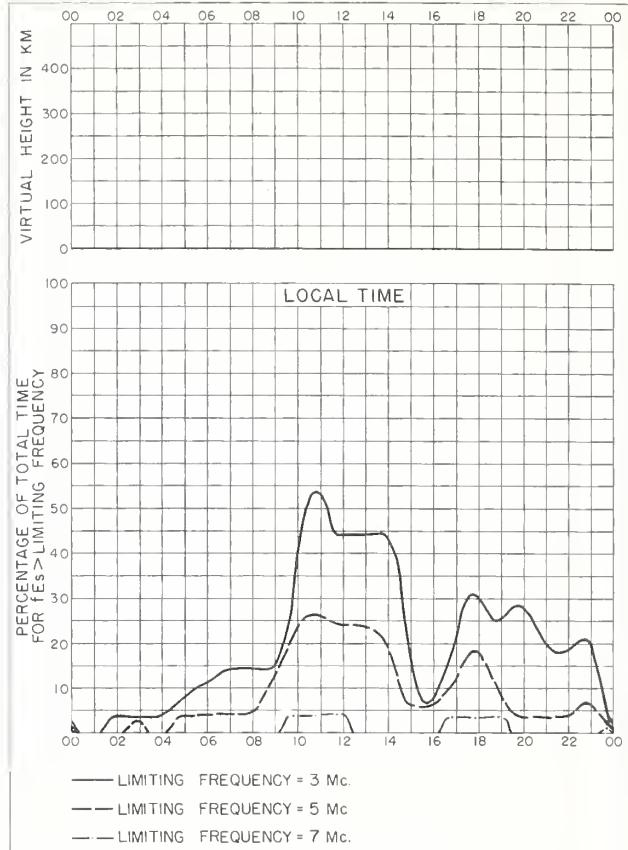


Fig. 142. PORT LOCKROY JUNE 1957

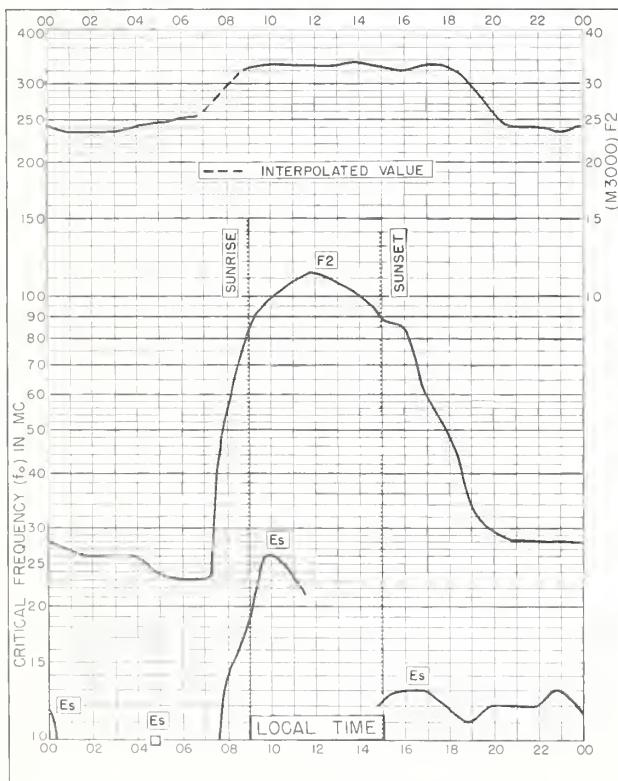


Fig. 143. PORT LOCKROY
64.8°S, 63.5°W MAY 1957

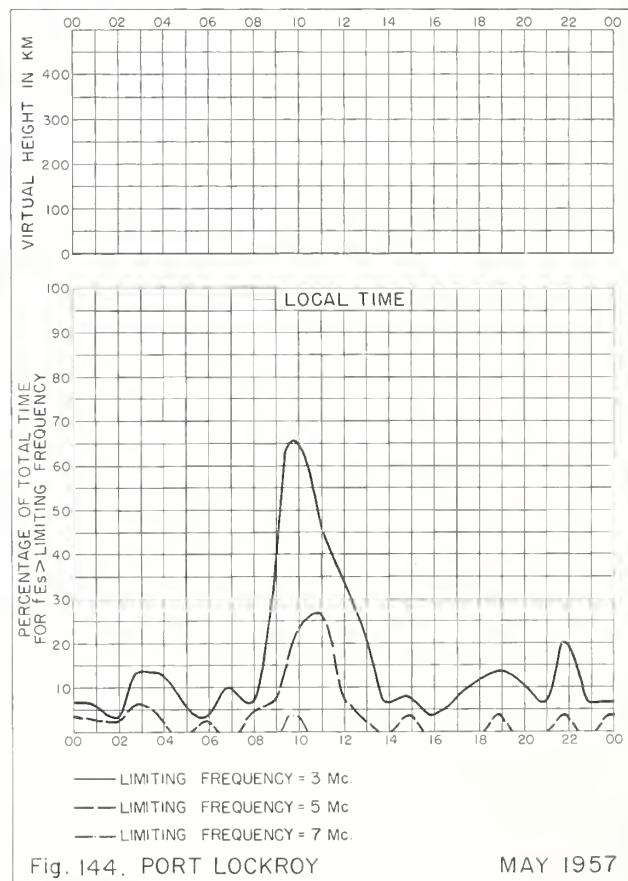


Fig. 144. PORT LOCKROY MAY 1957

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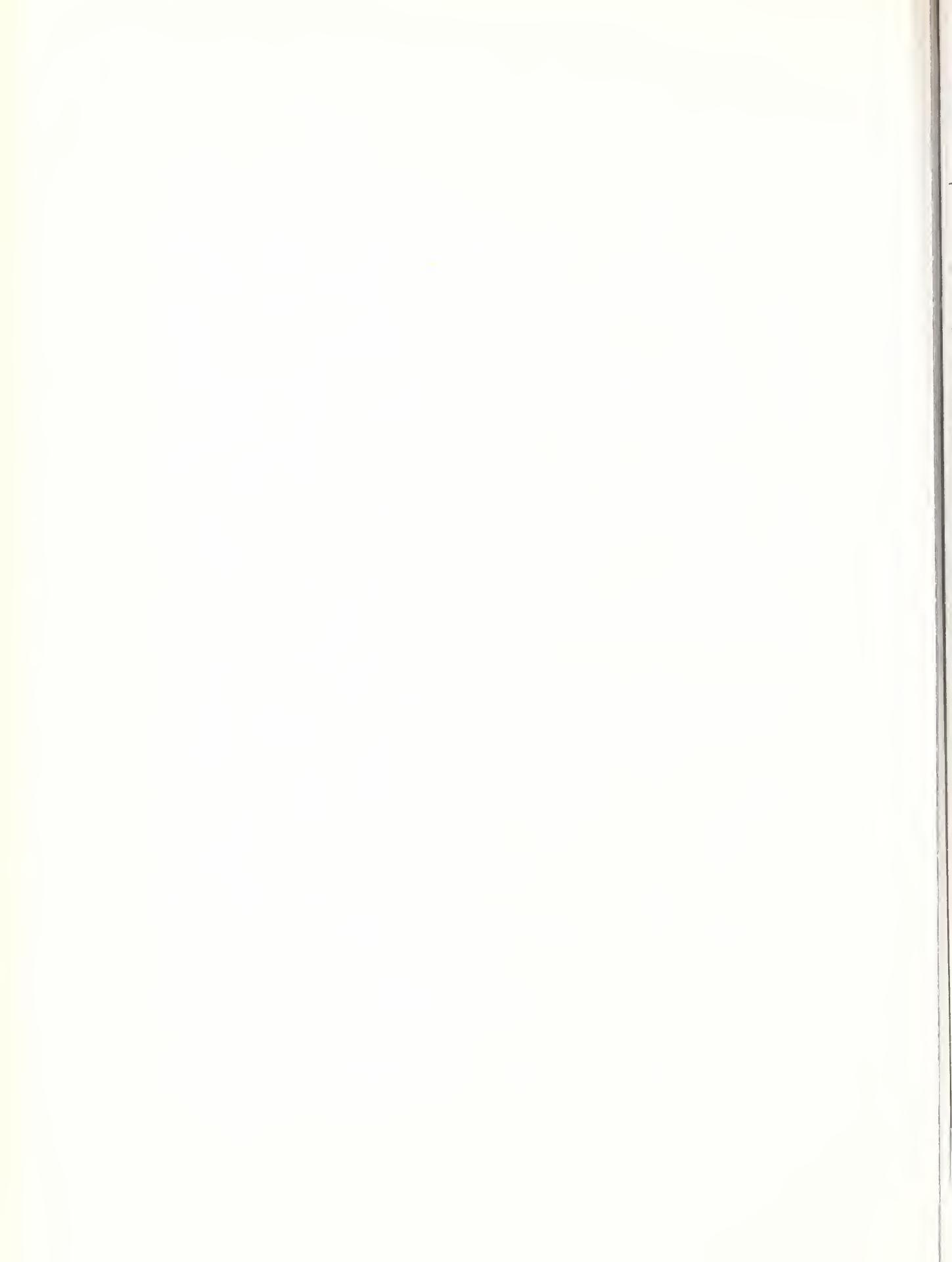
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