National Bureau of Standards Library, N.W. Bldg MAY 1 4 1964

Central Radio Propagation Laboratory

## IONOSPHERIC PREDICTIONS

for August 1964

TB 11-499-17/TO 31-3-28



U. S. DEPARTMENT of COMMERCE National Bureau of Standards Number 17/Issued May 1964

## U.S. DEPARTMENT OF COMMERCE

Luther H. Hodges, Secretary

Central Radio Propagation Laboratory

## **Ionospheric Predictions**

## for August 1964

[Formerly "Basic Radio Propagation Predictions," CRPL Series D.]

The CRPL Ionospheric Predictions are issued monthly as an aid in determining the best sky-wave frequencies over any transmission path, at any time of day, for average conditions for the month. Issued three months in advance, each issue provides tables

describing the predicted worldwide distribution of foF2 and M(3000)F2 and maps for each even hour of universal time of MUF(Zero)F2 and MUF(4000)F2.

of numerical coefficients that define the functions

NOTE: Department of Defense personnel see back cover.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget (June 19, 1961).

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Price 15 cents.

Annual subscription (12 issues) \$1.50 (50 cents additional for foreign mailing).

## National Bureau of Standards

The functions of the National Bureau of Standards are set forth in an Act of Congress, March 3, 1901, as amended. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to government agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. The Bureau also serves as the Federal technical research center in a number of specialized fields.

## **Central Radio Propagation Laboratory**

The Central Radio Propagation Laboratory at Boulder, Colorado, is the central agency of the Federal Government for the collection, analysis, and dissemination of information on propagation of radio waves at all frequencies along the surface of the earth, in the atmosphere, and in space, and performs scientific studies looking toward new techniques for the efficient use and conservation of the radio spectrum. To carry out this responsibility, the CRPL—

1. Acts as the central agency for the conduct of basic research on the nature of radio waves, the pertinent properties of the media through which radio waves are transmitted, the interaction of radio waves with those media, and on the nature of radio noise and interference effects. This includes compilation of reports by other foreign and domestic agencies conducting research in this field and furnishing advice to government and nongovernment groups conducting propagation research.

2. Performs studies of specific radio propagation mechanisms and performs scientific studies looking

toward the development of techniques for efficient use and conservation of the radiofrequency spectrum as part of its regular program or as requested by other government agencies. In an advisory capacity, coordinates studies in this area undertaken by other government agencies.

3. Furnishes advisory and consultative service on radio wave propagation, on radiofrequency utilization, and on radio systems problems to other organizations within the United States, public and private.

4. Prepares and issues predictions of radio wave propagation and noise conditions and warnings of disturbances in these conditions.

5. Acts as a central repository for data, reports, and information in the field of radio wave propagation.

6. Performs scientific liaison and exchanges data and information with other countries to advance knowledge of radio wave propagation and interference phenomena and spectrum conservation techniques, including that liaison required by international responsibilities and agreements.

NATIONAL BUREAU OF STANDARDS A. V. Astin, Director

> Issued May 1964

Number 17

## Introduction

The "Central Radio Propagation Laboratory Ionospheric Predictions" is the successor to the former "Basic Radio Propagation Predictions," CRPL Series D. To make effective use of these predictions, National Bureau of Standards Handbook 90, "Handbook for CRPL Ionospheric Predictions Based on Numerical Methods of Mapping," should be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402, price 40 cents. This Handbook includes required additional data, nomographs and graphical aids, as well as methods for the use of the predictions. The Handbook supersedes the obsolete NBS Circular 465.

The basic prediction appears in tables 1 and 2, presenting predicted coefficients for foF2 and M(3000)F2 defining the numerical map functions describing the predicted worldwide variation of these characteristics. With additional auxiliary information, these coefficients may be used as input data for electronic computer programs solving specific high frequency propagation problems. The basic equations, their interpretation, and methods of using the numerical maps are described in two papers by W. B. Jones and R. M. Gallet, "The Representation of Diurnal and Geographic Variations of Ionospheric Data by Numerical Methods," Volume 66D, Number 4, July–August 1962, pages 419–438, and "Methods for Applying Numerical Maps of Ionospheric Characteristics," Volume 66D, Number 6, November–December 1962, pages 649–662, both in the Journal of Research of the National Bureau of Standards, Section D. Radio Propagation. The predicted numerical map coefficients of tables 1 and 2 may be purchased in the form of a tested set of punched cards. Write to the Prediction Services Section, Central Radio Propagation Laboratory, National Bureau of Standards, Boulder, Colorado, to arrange for the purchase of the set of punched cards and for further information and assistance in the application of computer methods and numerical prediction maps to specific propagation problems.

The graphical prediction maps, derived from the basic prediction, are provided for those unable to make use of an electronic computer. Figures 1 to 12 present world maps of MUF (Zero) F2 and MUF (4000) F2 for each even hour of universal time. Figures 13 to 16 present the same predictions for hours 00 and 12 universal time for the North and South Polar areas. Predicted polar maps for each even hour of universal time may be obtained by special arrangements with the Central Radio Propagation Laboratory. Handbook 90 describes methods for including regular E-F1 propagation. Figure A is a graph of predicted and observed Zürich sunspot numbers which shows the recent trend of solar activity. Table A lists observed and predicted Zürich smoothed relative sunspot numbers and includes the sunpot number used for the current prediction.

Members of the U.S. Army, Navy, or Air Force desiring the Handbook and the Ionospheric Predictions should send requests to the proper service address; for the Navy: The Director, Naval Communications, Department of the Navy, Washington, D.C., 20350; for the Air Force: Directorate of Command Control and Communications, Headquarters, United States Air Force, Washington, D.C., 20330. Attention: AFOCCAA. Army personnel should refer to the Handbook as TM-11-499 and to the monthly predictions as TB 11-499-(), predictions for the month of August 1964 being distributed in May 1964 and designated TB 11-499-(17), and should requisition these through normal publication channels.

Information concerning the theory of radio wave propagation and such important problems as absorption, field intensity, lowest useful high frequencies, etc., is given in National Bureau of Standards Circular 462, "Ionospheric Radio Propagation." A revised work is in preparation which will be announced in the Ionospheric Prediction series when available. Additional information about radio noise may be found in C.C.I.R. Report Number 65, "Revision of Atmospheric Noise Data," International Telecommunication Union, Geneva, 1957.

Reports to this Laboratory of experience with these predictions would be appreciated. Correspondence should be addressed to the Prediction Services Section, Central Radio Propagation Laboratory, National Bureau of Standards, Boulder, Colorado.

## <u>Table A</u>

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1952	43	42	39	36	34	32	31	29	28	28	27	26
	(53)	(51)	(52)	(52)	(52)	(52)	(51)	(49)	(46)	(43)	(38)	(33)
1953	24	22	20	19	17	15	13	12	11	10	9	7
	(30)	(29)	(27)	(24)	(22)	(21)	(20)	(18)	(18)	(17)	(16)	(15)
1954	6	6	4	3	4	4	5	7	8	8	10	12
	(14)	(12)	(11)	(10)	(10)	(9)	(8)	(8)	(8)	(10)	(10)	(11)
1955	14	16	20	23	29	35	40	46	55	64	73	81
	(12)	(14)	(14)	(13)	(16)	(18)	(22)	(27)	(30)	(31)	(35)	(42)
1956	89	98	109	119	127	137	146	150	151	156	160	164
	(48)	(53)	(60)	(68)	(77)	(89)	(95)	(105)	(119)	(135)	(147)	(150)
1957	170	172	174	181	186	188	191	194	197	200	201	200
	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)
1958	199	201	201	197	191	187	185	185	184	182	181	180
	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)	(150)
1959	179	177	174	169	165	161	156	151	146	141	137	132
	(150)	(150)	(150)	(150)	(146)	(143)	(141)	(142)	(141)	(139)	(137)	(137)
1960	129	125	122	120	117	114	109	102	98	93	88	84
	(136)	(135)	(133)	(130)	(125)	(120)	(118)	(115)	(110)	(108)	(105)	(100)
1961	80	75	69	64	60	56	53	52	52	51	50	49
	(100)	(90)	(90)	(90)	(85)	(85)	(80)	(75)	(70)	(70)	(65)	(60)
1962	45	42	40	39	39	38	37	35	33	31	30	30
	(60)	(50)	(48)	(45)	(42)	(37)	(34)	(31)	(29)	(28)	(27)	(34)
1963	29 (31)	30 (28)	30 (26)	29 (25)	29 (25)	28 (25)	28 (23)	27 (21)	(20)	(18)	(18)	(17)
1964	(17)	(17)	(17)	(17)	(17)	(17)	(17)	(17)%	×			

## Observed and Predicted Zurich Smoothed Relative Sunspot Numbers

Note: Final numbers are listed through June 1963, the succeeding values being based on provisional data. The predicted numbers are in parentheses.

\* Number used for predictions in this issue.



L	L		
-			
2			
2			

TIME VARIATION

0 7/	- 10/	0 0		_	2	10	4	ν v	φ	4	00
0-0-0-0-0-0-0	6 t t t t t t t t t t t t t t t t t t t	1842381 21089381 4687891 8766689 3137416 3137416 3137416 3137416 313766 313766 31376756 4835056 4835056 4542935 1751372	2011 2011 2011 2011 2011 2011 2011 2011	1.74260505 00 1.39627505 00 1.39627505 00 1.39626816 00 -5.20593916 01 -7.1166576 01 1.996275 02 -2.1222048776 02 -2.122204676 02 -2.122204676 02 -2.122204676 02 -2.122204676 02 -2.13625476 02 -2.136445576 01 -7.784445576 01	(1) 93887755 C0 -1, 93887755 C0 -2, 757911494 01 -2, 757911494 01 -1, 05, 5666 F0 -1, 05, 566 F0 -1, 05, 5666 F0 -1, 05, 566 F0 -1	-6.40694066-01 3.2390566 05 9.6%2286 05 -4.15902286 05 -4.15902286 05 -4.1590228 05 2.2472675 01 8.254126776 01 8.2541776 01 9.28011766 01 9.28011766 01 1.38720028 01 1.387240756 01 1.387240956 01 1.287240956 01 1.287240956 01 1.287240956 01 1.287240956 01 1.287240956 01 1.287240956 01 1.287240056 01 1.2872400000000000000000000000000000000000	1.6421427E-C1 -1.6421427E-C1 -1.642192509F 00 1.4325299F 00 1.4325299F 00 1.4325299F 01 1.350688F 01 1.350688F 01 1.350688F 01 0.103298F 01 0.103298F 01 -1.245949F 02 -1.245949F 01 -1.245949F 01 -1.245949F 01	-3.56276495-01 -4.53370355-01 -4.53370355-01 -4.53320355-01 -4.7323216 00 -4.94770315-01 -4.94770315-01 -33347515 01 -1.1852425 01 -1.1856925 02 -1.1656925 02 -1.16569250	-4.14787535-01 -2.9108165-01 -2.9205476 00 +5.295476 01 -2.0733156 01 -2.0733156 01 -2.0733156 01 -2.0733156 01 -2.0733156 01 -2.0735776 01 -4.0875566 01 -4.08755576 01 -4.08755576 01 -4.08755576 01 -4.08755576 01 -4.08755576 01 -4.08755576 01 -4.087555776 01 -4.08755776 01 -4.087555776 01 -4.08755776 01 -4.087557776 01 -4.087557776 01 -4.087557777777777777777777777777777777777	2.51655975-61 2.51655975-61 1.199564995 - 0 1.9994995 - 0 1.9994995 - 0 1.90259505 - 0 1.20255384 - 0 1.20255384 - 0 1.20255384 - 0 2.20255384 - 0 2.20255584 - 0 2.2025584 -	-1.007070707-51 4.00717067-51 4.278508726-01 -2.298062296-01 -2.29802876-01 -1.07623186-01 -1.07623186-01 -1.0721286-02 -3.4741867-01 -3.4741867-01 -3.4741867-01 -3.4741867-01 -3.4741867-01 -3.4741867-01 -3.4741867-01 -3.4741874187-01 -3.474187-01 -3.474187-01 -3.474187-01 -3.4
うみちんておりじょううふうひゃねのしょ こうみちひゃる		1112112 121255 121255 121255 121255 1225555 1225555 122555 122555 1225555 1225555 1225555 1225555 1225555 1225555 1225555 1225555 1225555 1225555 12255555 12255555 12255555 1225555555 12255555 1225555555555	2011-01-01-01-01-01-01-01-01-01-01-01-01-	1.8993006612 1.7323941E-02 1.7323941E-02 1.7323941E-02 1.412443E C0 1.412443E C0 1.412443E C0 1.42505E 01 4.77135265E 01 4.77135265E 01 4.77135265E 02 1.6509527E 02 1.6509528 02 1.650958 02 1.65095	1.2659306F01 4.4A7055590 4.4A70555901 4.4A70555901 4.4A7055590 4.599047500 -4.599047500 -4.599047500 -4.599047500 -4.59419500 -4.59419500 -4.59419500 -4.59419500 -5.59439670 -5.59439670 -5.59439670 -5.59439670 -5.554395600 -5.554397600 -5.554397600 -2.555397600 -2.555397600 -2.555397600 -2.555397600 -2.555397600 -2.555397600 -2.555397600 -2.5553976000 -2.5553976000 -2.5553976000 -2.5553976000 -2.5553976000 -2.5553976000 -2.5553976000 -2.5553976000 -2.5553976000 -2.5553976000 -2.55539760000 -2.55539760000 -2.55539760000 -2.55539760000 -2.55539760000 -2.555397600000 -2.5553376000000000000000000000000000000000	-4.2 (91596-02 -2.7 / 37795 C01 -2.7 / 37795 C01 -4.9 / 558016 C0 -4.9 / 558016 C0 -4.9 / 173045 C0 -5.5 / 9173045 C0 -6.5 / 9190545 C0 -4.0 / 17945 C0 -5.2 / 19464 C0 -5.2 / 19464 C0 -6.2 / 19464 C0 -7.2 /	-4.32819976-02 -1.1(556.266-02 -1.2(596.326-02 -1.2(397996 C2 -1.2(397996 C2 -1.2(397996 C2 -1.2(397696 C1 -1.4(3914676 01 -1.4(3914676 01 -1.4(3914676 02 -1.4(3914676 02 -1.4(39166 02 -1.4(391576 02 -1.4(3911397 02 -1.4(3911397 02 -1.2(306.411397 02	2.00003/9/-92 -5.13%506566-02 -1.3%506566-02 -1.3%50666-01 1.77-294066-01 1.77-294086-01 -5.3043375 -5.3043375 -5.3043375 -5.3120186-02 -4.3048376 -5.31201826 -5.3120186 -5.4464186 1.74600252 01 3.82011466 01 7.4664187 1.4460252 01 3.82011466 01 7.4664187 1.38003546 01 2.2934406 01 2.293405 00 2.293405 00 2.2934000000000000000000000000000000000000	4,4539531F-02 -1.54395040E-02 -3.7439426F-01 -2.054916F-02 -2.0569102E 00 4,455102E 00 4,455102E 00 4,455102E 00 3.0454735E 01 -2.0510806 -2.743026E 01 -2.743056E 01 -2.483550806 -2.483550806 -2.48355080 -2.49355080 -2.4935080 -2.49350800 -2.49355080 -2.49350800 -2.49350000 -2.49350000000 -2.4	844121406-53 72000046-52 72000466-52 7200046086-52 720046086-52 720046086-51 720146086-51 720146086-51 720146086-51 72014604505 72014604505 7201470495 71007407045 7100740740745 7100740740745 7100740740745 7100740745 7100740745 7100740740745 7100745 710075 710075	-1.77619416-03 -1.57619416-03 -1.59470656-02 -5.36470656-02 -5.13331206-02 1.15213518 0.52713508 0.38094956-01 0.38094956-01 0.3809496 -1.25791466 01 -1.25791466 01 -1.25791466 01 -1.25791466 01 -1.25791466 01 -1.1712926 01 -1.1910466 -1.1712926 01 -1.4907562 01 -1.4907562 01 -1.4907562 01 -1.4907562 01 -1.4907562 01 -2.5773562 01 -2.5773562 01 -2.5773646 01 -2.5773646 01 -2.5773646 01 -3.4719446 01 -3.4719446 01 -3.4719446 01 -3.5773766 02 -2.5773766 01 -3.4719446 01 -3.4719446 01 -3.4719446 01 -3.4719466 01 -3.4719446 01 -3.4719446 01 -3.4719756 -3.5715566 01 -3.5715546 01 -3.5715566 01 -3.5715566 01 -3.5715566 01 -3.5715566 01 -3.5715566 01 -3.5715566 01 -3.5715566 01 -3.57155
CO-10020025220	-4422000	950755 9507555 950755555 975155555 97515555 975555555555 95555555555	6460 6400 6400	-1.1389377E-01 -1.389376E-02 3.285795E-01 2.685795E-01 2.8144111F 00 2.9456095 00 5.9947846-01 3.9947846-01 3.9947846-01 3.9947846-01 2.415391F 00 -1.533391F 00 -1.533391F 00 -1.533391F 00 -1.53717244E-01 7.15522705 00	6.8733545E-05 -27735565E-02 -27735565E-02 -27735565E-05 -1.677357956-05 -1.6773595E-01 -2.5648596E-01 -2.5648596E-01 -2.5648596E-01 -2.70743955E-03 -3.0743955E-03 -3.0743955E-03 -3.0743955E-03 -3.07439552E-03 -3.0743952E-03 -3.0743952E-03 -3.0743952E-03 -3.0743952E-03 -3.0743952E-03 -3.0743952E-03 -3.0743952E-03 -3.0743952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-01 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.0443952E-03 -3.045352E-03 -3.045352E-03 -3.045352E-03 -3.045352E-03 -3.045352E-03 -3.04552E	-5.7493112E-02 7.84464656202 3.181277E-01 4.3488886E-01 1.73649886E-01 1.73649886E-01 1.7364998E-01 1.0739366240 1.1073936E-01 1.643934E-01 1.5106537E-01 1.5106527E-01 1.51005557E-0005557E-0005557E-0005557E-00055	6.0526336E-92 -3.05167688E-92 -3.05167688E-02 -3.051676984E-01 -2.2185084E-01 -2.22957099 -2.25950919 -2.49494590-00 -3.494945E-01 -2.494945E-01 -2.494945E-01 -2.4023338E-02	-3.7803371E-02 -1.9052531E-03 -1.9059058E-02 -7.979466E-03 -2.734620E-03 2.734627E-03 1.9916827E-02 1.916405E-03 -2.820378037E-02 -1.9329837E-01	B.04225CF-03 B.04225CF-03 1.7547946-01 -1.21547956-01 -1.20121656-01 -1.00121656-01 -1.00121656-01 -1.01512056-01 -5.9817756 0.2451957766 -2.451937766-00 -2.451957676-00 -2.71126356-00 -2.71126356-00 -2.71126356	9.3388100E-63 2.0458119-02 -3.5673146-02 -3.5673146-02 -1.2751294E-01	-1.91140576-02 -1.2549916-02 -1.25487986-02 -1.26447760-02 -1.2644776-01 -1.254486-01 -1.254486-01 -1.2538486-01 -1.25384872466-01 -1.2538487206-01 -1.2538487206-01 -1.2495158626-01 2.78715776-00
19	75	Har	monic	ى ا			Q			W	
JIH			s/x	σ	0 )	-	1 2	13	4	15	16
10 4 0 0 0 0 0 0	TAI9AV TAI9AV	н	0-0-0-5	1.137500H-01 -1.4781576-01 -3.34731566-01 1.3327909f-01 2.3275106-01	1.5571364E-01 -2.7152357E-02 -3.507556:3E-01 2.2455237E-07 2.0305714E-01	-1.2540890E-01 -7.2339322E-02 3.1899385E-01 8.4271655E-02 -1.89211996E-01	2.0866415F-02 -1.0800622E-01 8.6374820E-02 1.0799235E-01 -1.0973928E-01	-4.2233224F-02 1.0174831E-01 1.12900295-01 -1.0611553E-01 -7.6340580E-02	-7.663A0555-C2 -8.7145381E-03 1.9238334E-01 1.1266427E-01 -1.1772412E-01	7.07990H3E-02 1.2895047E-02 -2.109562E-01 -1.6279484F-02 1.43C5038 <sup>c</sup> -01	-2.1560295E-02 5.8643646E-02 -3.3102559F-02 -6.1413435E-02 5.7653572E-02

GEOGRAPHICAL VARIATION

TABLE 2

## PREDICTED COEFFICIENTS D<sub>sk</sub> defining the function $\Gamma(\lambda, \theta, t)$ for monthly median $f_o$ F2 (mc/s) AUGUST 1964

I-Main latitudinal variation. Mixed latitudinal and longitudinal variation: Π - First order in longitude, Π - Second order in longitude Notation: For each entry the number given by the first eight digits and sign is multiplied by the power of ten defined by the last two digits and sign.

TABLE 2

TIME VARIATION

0 1 2 3	s/x	I 	П 112 112 112 112 112 112 112 112 112 11	23 28 28 29 30 1- 1- 20 28 23 33 35 35 35 35 35 35 35 35 35 35 35 35	-	NC IC⊄ſ	НЧАЯ НТАІ Я
- 3	0	0151307E 49383099E 493843099E 8396695E 41865465 418694622E 80790028 80790028	49807355 6988915 6988915 59994405 29103795 29103795 130374875 1355155 13555255 58997755 5599275 55992755 55992755 5599276 55993785 5599277 55932555 55932476 55932555 55932476 55932555 55932476 55932555 55932476 55932555 55932476 55932555 55932476 55932555 55932476 55932555 55932476 55932555 55932476 55932555 55932476 55932555 559324775 55932555 559324775 5593255 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 55932555 5593255 55932555 55932555 55932555 55932555 55932555 55932555 55932555 5593555 5593555 55935555 55935555 55935555 55935555 55935555 55935555 55935555 55935555 55935555 55935555 55955555555	.89398786 .95987306 .42044156 .42044156 .10287996 .09129756 .91295586 .91295286	Harm		ŀ
- 3		000000000000000000000000000000000000000	000 000 000 000 000 000 000 000 000 00	-03 -03 -01 -02 -02 -01 -01	onic	s/x	0 -
3	_	-1.234418E-01 -1.39037646-01 9.35964076-01 9.35964076-01 -2.3112462E -2.3112462E 00 -4.1568241E-01 2.5535478E 00 9.8083251E-02 -1.0413850E 00	7.0362478E-03 4.7517506E-02 -6.1213404E-02 -3.2517987E-01 -3.2516982E-01 4.5027885E-01 1.9220768E 00 1.7653714E 00 1.7653714E 00 -3.465587E 00 -3.465587E 00 -3.465587E 00 -3.47371431E 00 -3.465687E 00 -3.465687E 00 -3.465687E 00 -3.5599796E 00 2.4820209E 00 2.4820209E 00 2.4820209E 00 2.4820209E 00	-1.8112767E-02 -9.8274166E-03 -1.0820169E-01 -5.2873899E-02 4.61825915-02 1.2751131E-01 2.1922465E-01 2.1922465E-01 2.1571910E-01	4	7	3.5074923E-02 3.7273195E-03
. С	N	-2.5861804E-01 -3.3447554E-01 2.6282034E 00 1.1599680E 00 -1.8715032E 00 -1.8715032E 00 -1.8765941E 00 7.4568811E 00 9.3134985E-01 9.3134985E-01 -2.9601714E 00	<pre>4.3335888E=02 7.248659E=02 1.5960182E=01 -9.348886E=01 -6.9571357E=01 -6.9571357E=01 -6.0028578E=01 -6.0028578E=01 -6.0123259E=01 7.28749461E 00 -1.7294401E 00 -1.17294401E 00 -1.17264566 0 -1.17264566 0 -1.17756456 0 -1.17756456 0 -1.17756456 0 -1.17756456 0 -1.17756456 0 -1.17756456 0 -1.17756456 0 -1.17756456 0 -1.17756456 0 -1.17756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.1756456 0 -1.12756456 0 -1.12756456 0 -1.12756456 0 -1.12756456 0 -1.12756456 0 -1.12756456 0 -1.12756456 0 -1.12756456 0 -1.12756456 0 -1.12756456 0 -1.1275645 0 -1.1275645 0 -1.1275645 0 -1.1275 -1.1275 -1.127 -1.12 -</pre>	1.5219374E-02 1.7957328E-02 -1.2755371E-02 -2.8002308E-02 3.381642E-02 -1.6596618E-01 4.9469977E-03 1.0500611E-02 2.5833717E-02		ω	2.0060577E-03 3.4718229E-02
ю	50	-2.7398260E-02 1.3124341E-01 1.283544E-01 -9.4217874E-01 -0.68370F 00 1.663370F 00 1.663370F 00 -8.5690526E-01 -7.876449E-01	-3.4948801E-02 -5.1623387E-02 1.0898106E-02 1.11930857266-02 4.7179306E-01 6.8481017E-01 6.8481017E-01 -8.2608835E-02 -2.496296E-01 -2.8799410E 2.1810447E-02 2.9991067E-02 8.91267265-01 4.594067E 00 4.594067E 00 4	-2.1698030E-02 -1.295573E-02 1.0709111E-02 4.2805088-02 1.324651E-01 5.0802625E-02 -6.0923414E-02 -3.3979561E-01 -2.4289807E-01	2	σ	4.3223167E-03 -3.5069415E-02
3	4	-1.1125978E-01 -6.1930190E-01 -4.1410399E-01 3.0330604E 00 2.48094155E 00 -4.678904155E 00 -4.6789082E 00 -3.7006882E 00 2.2515048E 00 1.7333184E 00	<pre>4.1802807E-03 8.7328564E-02 2.0197557E-02 2.0197557E-02 -3.429731E-01 -1.6240093E 00 -3.429731E-01 3.6083215E-01 1.6102918E 00 -1.0139256E 01 -4.659853E-01 -2.7380267E 00 -1.0739256E 01 2.2084482E-01 1.5048401E 00 5.2814576E 00 5.2814576E 00 </pre>	5.1434256E-03 1.2460016E-02		01	2.8975351E-02 -1.5862664E-02
	ŝ	2.1289236F-02 1.015827E-01 -5.203497E-01 -5.203497E-01 -3.8916093E-01 1.9557813E 00 5.636820E-01 -2.675357F 00 -2.7324295F 00 -2.7324295F 00	1.6201783E-02 -9.5286532E-02 -4.5319620E-02 1.533055195E-01 1.53305532E-01 8.5710984F-02 8.5710984F-02 8.5710984F-02 1.2365959F-01 -2.3972695E-01 2.4978641E 00 -3.9118610E-01 2.4978641E 00 -3.9118610E-01 2.4978641E 00 -3.9128098E-01 -1.4799971E 00 -2.9873543E-02 -2.9873545E-02 -2.987565565565565565565565565565565565565565	-4.4176655E-04 3.8315205E-04	Ģ	-	-1.1590486E-02
	9	-3.76.25548E-03 -3.276.213E-02 -2.7849781E-01 -3.1163015F-01 6.2163628E-01 6.2790960E-01 -3.6447056E-01 -4.0371004E-01 1.7478493E-02	-6.2256968E-03 5.2352496E-03 -3.8681519E-02 1.97686486E-01 1.97686486E-01 7.5102203E-02 2.523375560 -1.1141610E 00 9.4893302E-01 -1.1141610E 00 9.4893302E-01 -1.1618701E 00 -1.3571662E 00 -1.3571662E 00 -1.3571662E 00 2.1618701E 00 2.1618701E 00 2.1618701E 00 2.1618701E 00 -1.2583549E-01 -1.2583549E-01 -1.2583549E 01	-8.88293105-03 2.44990435-03 -3.10424175-02 1.4001155-02 1.68467485-02 -1.33492585-02 1.03996805-01		12	3.8048451E-03 -2 58828345502

GEOGRAPHICAL VARIATION

AUGUST 1964

# PREDICTED COEFFICIENTS D<sub>sk</sub> DEFINING THE FUNCTION $\Gamma(\lambda, \theta, t)$ FOR MONTHLY MEDIAN M(3000)F2

Notation: For each entry the number given by the first eight digits and sign is multiplied by the power of ten defined by the last two digits and sign.

I - Main latitudinal variation. Mixed latitudinal and longitudinal variation: II - First order in longitude, II - Second order in longitude.





AUGUST 1964 UT=04









FIG. 6B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)

LATITUDE

LATITUDE





## AUGUST 1964 UT=16







AUGUST 1964 UT=20





135° 150° 165° 5451 160° WEST 165° 150° 155° 120° 105° 90° 75° 60° 45° 30° 15° FIG. 12B. PREDICTED MEDIAN MUF(4000)F2 (Mc/s)



FIG I3 B. PREDICTED MEDIAN MUF (4000)F2 (Mc/s)



FIG. 14 B. PREDICTED MEDIAN MUF (4000) F2 (Mc/s)



FIG. 15 B. PREDICTED MEDIAN MUF (4000) F2 (Mc/s)



FIG. 16 B. PREDICTED MEDIAN MUF (4000) F2 (Mc/s)

UNITED STATES GOVERNMENT PRINTING OFFICE DIVISION OF PUBLIC DOCUMENTS WASHINGTON, D. C., 20402

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID PAYMENT OF POSTAGE. \$300 (GPO)

## DEPARTMENTS OF THE ARMY AND THE AIR FORCE

WASHINGTON, D. C., 20301, 1 May 1964

TB 11-499-17/TO 31-3-28, Central Radio Propagation Laboratory Ionospheric Predictions for August 1964, is published for the use of all concerned.

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

EARLE G. WHEELER, General, United States Army, Chief of Staff.

## OFFICIAL:

J. C. LAMBERT, Major General, United States Army, The Adjutant General.

CURTIS E. LEMAY, Chief of Staff, United States Air Force.

## OFFICIAL:

R. J. PUGH, Colonel, United States Air Force, Director of Administrative Services.

Distribution :

Active Army:

USASA (4); USA Elct Comd (1); USA MI Comd (2); USA Test & Eval Comd (1); USACECD Agcy (1); USCONARC (3); ARADCOM (2); OS Maj Comd (5); OS Base Comd (2); Log Comd (2); MDW (1); Armies (5); Corps (2); Div (2); USA Elct RD Actv (4) Fort Huachuca; White Sands (4); Svc Colleges (4); Br Svc Sch (4) except USASCS (20); USAADCEN (2); ARADCOM Rgn (2); WSMR (2); USA Elct RD Agcy (4); JBUSMC (12); USA Corps (1); USA Mbl Spt Cen (2); USAEPG (2); USAMC (1); Tech Svc Bd (1); Atlanta Army Dep (1); USSTRICOM (1); USASA Bd (1); USASA, Europe (1); USASA, Pacific (1); USASA, Alaska (1); USASAUSASOUTHCOM (1); MAAG (Pakistan) (6); Units org under fol TOE: 11–18 (1); 11–95 (1); 11–500 (AC) (1).

 $NG\colon$  None.  $USAR\colon$  None. For explanation of abbreviations used, see AR 320–50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1964-0-