N° 78 March-April 1953

International Scientific Radio Union
U. R. S. I.

INFORMATION BULLETIN

published with the financial help of the United Nations Educational, Scientific and Cultural Organization (U.N.E.S.C.O.)

CONTENTS

Published by the Secretary General of U. R. S. I.
42 Rue des Minimes, BRUSSELS

X^th GENERAL ASSEMBLY

Publications

We have to inform our readers that fascicules 1, 2 and 3 have been sent for distribution to National Committees. Supplementary copies are available at the following prices :

Fascicule 1 (Administrative proceedings) Belgian francs 75.

Fascicule 2 (Commission I) Belgian francs 50.

Fascicule 3 (Commission II) Belgian francs 65.

Fascicule 4 (Commission III) Belgian francs 80.

Fascicule 1 contains the proceedings of the full sessions, the Secretary's report, the list of reports and papers submitted to the General Assembly, the resolutions and the National Committee progress reports.

The fascicules related to Commissions contain the full text of reports submitted to the Commissions, the minutes of sessions and the resolutions submitted to the General Assembly.

XIth GENERAL ASSEMBLY

The XIth General Assembly of U.R.S.I. will be held in the Netherlands (Amsterdam or The Hague) from August 23 to September 2, 1954. The Board of Officer and the Executive Committee will meet on August 20 and 21.

Organizing Committee

The Netherlands National Committee appointed an Organizing Committee whose Chairman is Prof. B. D. H. Tellegen, Vice-President of U.R.S.I. and Chairman of the National Committee, and Secretary Dr. Th. F. van der Wyck, General Direction, P.T.T., The Hague.

NATIONAL COMMITTEES

Belgium

MEMBERSHIP

Chairman : Prof. E. Divoire, Université de Bruxelles.

Secretary : Prof. A. Dorsimont, Ecole Royale Militaire.

Members :

Prof. Baudoux, Université de Bruxelles ;
Prof. Cnops, Université de Gand ;
Prof. Dacos, Université de Liège ;
Prof. DeDonder, Université de Bruxelles ;
Prof. Gillon, Université de Louvain ;
Prof. Harmegnies, Faculté Polytechnique de Mons ;
Mr. Lahaye, Directeur de l'Institut Royal Météorologique ;
Prof. Mannebach, Université de Louvain ;
Mr. J. Marique, Secrétaire Général du Centre de Contrôle des Radiocommunications des Services Mobiles ;
Mr. M. Nicolet, Chef du Service de Rayonnement à l'Institut Royal Météorologique.

Denmark

MEMBERSHIP

Mr. F. D. Heegaard, (*Secretary*), Chief Engineer of the Danish State Radio, Statsradiofonien, Radiohuset, Rosenørnsalle 22, Copenhagen V.

Mr. H. Holten Møller, Chief of the Radio Service of the Danish Greenland Administration, Strandgade, Copenhagen K.

Prof. J. Oskar Nielsen, Professor of Telecommunications, Royal Technical University of Denmark, øster Voldgade 10, opg. G, Copenhagen K.

Mr. Gunnar PEDERSEN, Chief of Technical Radio Section, Danish Post and Telegraph Administration, Centralpostbygningen, Copenhagen V.

Mr. Helge PETERSEN, Director of the Meteorological Institute, Meteorologisk Institut, Gamlehave Alle 8, Charlottenlund.

Prof. J. RYBNER, (*Chairman*), Professor of Telecommunications, Royal Technical University of Denmark, øster Voldgade 10, opg. G, Copenhagen K.

Prof. Dr. phil. Bengt STROMGREN, Director of the Danish Astronomical Observatory, Astronomisk Observatorium, øster Voldgade 3, Copenhagen K. Also : Director of Yerkes Observatory, Williams Bay, Wisconsin, U. S. A.

United States of America

Officers of the National Committee elected for a two-year term, 1953-1955, at the meeting of the National Committee on April 30, 1953.

Chairman : Dr. A. H. WAYNICK, Department of Electrical Engineering, The Pennsylvania State College, State College, Pennsylvania.

Vice-Chairman : Mr. H. W. WELLS, Carnegie Institution of Washington, 5241 Broad Branch Road N. W., Washington 15, D. C.

Secretary-Treasurer : Mr. W. E. GORDON, School of Electrical Engineering, Cornell University, Ithaca, N. Y.

U.S.A. Spring Meeting, 1953

(In collaboration with the I.R.E. Professional Group on Antennas and Propagation).

An attendance of approximately 350 was obtained at the Spring 1953 meeting of the U. S. A. National Committee of U.R.S.I., in collaboration with the I.R.E. Professional Group on Antennas and Propagation, held at the National Bureau of Standards, Washington, D. C. on April 17, 28, 29 and 30, 1953.

A total of 83 papers were presented which included subjects of interest to all but one of the seven commissions of U.R.S.I. ;

as enumerated below. Abstracts are available from the U.S. Secretary, Dr. W. E. Gordon, Cornell University, Ithaca, New York and from the Secretary General of U.R.S.I. No papers concerning the work of Commission VII, Electronics, were presented. Considerable interest was noted in the work of Commission V, Radio Astronomy, in which several noteworthy advances in this field were reported.

The next meeting will be held in the Fall of 1953 at Ottawa, Canada at the invitation of, and in collaboration with, the Canadian National Committee of U.R.S.I. It is anticipated that in addition to the Professional Groups on Antennas and Propagation, other I.R.E. Professional Groups will also participate in this meeting.

A listing of the commissions and papers which were presented under their sponsorship follows :

Combined Session of Participating U. S. A. National Commissions

1. Remarks Concerning The Xth General Assembly of U.R.S.I., Sydney, Australia, August, 1952, C. R. Burrows, Chairman, U.S.A. National Committees of U.R.S.I., Cornell University, Ithaca, New York.

2. Auroral Research At The Geophysical Institute, University of Alaska, C. T. Elvey, University of Alaska, College, Alaska.

3. The Probability Distribution of Atmospheric Noise, A. W. Sullivan, J. M. Barney and S. P. Hersperger, University of Florida, Gainesville, Florida.

4. Interstellar 21 CM Radiation, H. I. Ewen, Harvard University, Cambridge, Massachusetts.

5. Effects of the Moon on the Outer Atmosphere, A. G. McNish, National Bureau of Standards, Washington, D. C.

Commission I. Radio Measurement Methods and Standards

6. A New SWR Measurement Technique, Alan C. Macpheson and David M. Kerns, National Bureau of Standards, Washington, D. C.

7. The Measurement of High Frequency Resistors, C. Wellard, International Resistance Company, Philadelphia, Pennsylvania.

8. A Delay Line for Use as a Dummy Load of High Power Rating, Dr. H. Brueckmann, Signal Corps Electronics Laboratory, Fort Monmouth, New Jersey.

9. An Automatic Impedance Recorder for X-Band, William F. GABRIEL, Naval Research Laboratory, Washington, D. C.

10. Microwave Power Measurements, H. A. FINKE, Polytechnique Research and Development Company, Brooklyn, New York.

11. Precision Measurement of Near Field Distributions, R. JUSTICE and V. H. RUMSEY, Ohio State University, Columbus, Ohio.

12. A Radio-Frequency Permeameter, Peter H. HAAS, National Bureau of Standards, Washington, D. C.

13. Scale Model Studies at Radio Frequencies of Current Flow in a Stratified Medium, James R. WAIT, Canadian Defense Research Board, Ottawa, Canada.

14. Low Frequency Multi-Signal Correlator, D. G. C. HARE, The D. G. C. Hare Company, Connecticut.

15. Radio Ground Conductivity for the United States by Soil Types, R. S. KIRBY, F. M. CAPPS and R. N. JONES, National Bureau of Standards, Washington, D. C.

Commission II.

Tropospheric Radio Propagation

16. Aircraft Measurements of Variations in Atmospheric Refractive Index, H. E. BUSSEY, George BIRNBAUM, National Bureau of Standards, and R. E. KATZ, Naval Research Laboratory, Washington, D. C.

17. A Preliminary Survey of Tropospheric Refractive Index Measurements for U. S. Interior and Coastal Regions, C. M. CRAIN, J. R. GERHARDT and C. E. WILLIAMS, The University of Texas, Austin, Texas.

18. Atmospheric Refractive-Index Fluctuations as Recorded by an Airborne Microwave Refractometer, C. E. VON ROSENBERG, C. M. CRAIN and A. W. STRAITON, The University of Texas, Austin, Texas.

19. Interpretation of Diversity and Fading Measurements In Tropospheric Radio Scattering, W. E. GORDON, Cornell University, Ithaca, New York.

20. Tropospheric Propagation Well Beyond the Horizon and the Bilinear Index Model, Thomas J. CARROLL, Massachusetts Institute of Technology, Cambridge, Massachusetts.

21. Phase Incoherence Effects in a Time Varying Medium, Joseph FEINSTEIN, National Bureau of Standards, Washington, D. C.

22. About the Mode Theory of Tropospheric Refraction, J. B. SMYTH, U. S. Navy Electronics Laboratory, San Diego, California.

23. Computational Techniques for the Bilinear Model, Rose M. RING, Massachusetts Institute of Technology, Cambridge, Massachusetts.

24. VHF Field Intensities in the Diffraction Zone, R. N. GHOSE and W. G. ALBRIGHT, University of Illinois, Urbana, Illinois.

25. Microwave Propagation Over a Rough Surface, W. S. AMENT, Naval Research Laboratory, Washington, D. C.

26. Comparison of Calculated and Measured Fields Within the Radio Horizon for the 92 to 1046 MC Range, A. F. BARGHAUSEN, Jr., A. P. BARSIS, and R. E. McCAVIN, National Bureau of Standards, Washington, D. C.

27. An Analysis of Short Term Fading in 100-1000 Mc Propagation Measurements Beyond the Radio Horizon, A. P. BARSIS, H. B. JAMES and C. J. ROUBIQUE, National Bureau of Standards, Washington, D. C.

28. A Preliminary Study of Fading of 100 Megacycle FM Signals, Robert L. RIDDLE and Charles R. AMMERMAN, The Pennsylvania State College, College, State College, Pennsylvania.

29. Radio Transmission Loss Versus Distance and Antenna Height at 100 Mc, Philip L. RICE, National Bureau of Standards, Washington, D. C.

30. Electromagnetic Wave Propagation in the Troposphere, L. G. McCRACKEN, Naval Research Laboratory, Washington, D. C.

Commission III.

Ionospheric Radio Propagation

31. Ionospheric Roughness and Its Effects Upon Propagation, J. FEINSTEIN, National Bureau of Standards, Washington, D. C.

32. Radio Communication by Scattering from Meteoric Ionization, VON R. ESHLEMAN and Laurence A. MANNING, Stanford University, Stanford, California.

33. Equilibrium Distribution of NO in the Lower Ionospheric Regions, A. P. MITRA, The Pennsylvania State College, State College, Pennsylvania.

34. An E-Region Model with Variable Recombination Based on Phase Height Measurements at 150 kc/s, R. E. JONES and A. P. MITRA, The Pennsylvania State College, State College, Pennsylvania.

35. Rotational Temperatures of Auroral Nitrogen Bands, W. PETRIE, Canadian Defense Research Board, Ottawa, Canada.

36. Methods of Sharp Ionized Layer Formation, Stephen J. FRIDKER, Massachusetts Institute of Technology, Cambridge, Massachusetts.

37. The NBS Oblique Path Sweep Frequency Experiment : I. Some Results for the F2 Layer, II. Some Sporadic E Results, B. WIEDER, P. G. SULZER and J. W. WRIGHT, National Bureau of Standards, Washington, D. C.

38. Sweep-Frequency (3-25 Mc) Backscatter, Richard SILBERSTEIN, National Bureau of Standards, Washington, D. C.

39. Scatter-Sounding Studies of Sporadic-E Ionization, Allen M. PETERSON, O. G. VILLARD, Jr. and L. A. MANNING, Stanford University, Stanford, California.

40. The Coupling Problem at 150 kc/sec, J. J. GIBBONS and F. BELLAS, The Pennsylvania State College, State College, Pennsylvania.

41. Optic Axes and Critical Coupling in the Ionosphere, Norman DAVIDS, The Pennsylvania State College, State College, Pennsylvania.

42. A New Technique for Investigating the Ionosphere at Low and Very Low Radio Frequencies, C. William BERGMAN, Robert S. MACMILLAN, and William H. PICKERING, California Institute of Technology, Pasadena, California.

43. The Reliability of Sporadic-E Height Measurements, R. A. HELLIWELL, Stanford University, Stanford, California.

44. Polarization Observations at Dartmouth College, with Twin-Channel Transmitting and Receiving Equipment, of HF Ionospherically Reflected Pulse Signals at Vertical Incidence, M. G. MORGAN, Dartmough College, Hanover, New Hampshire.

45. The Effect of Ions on Magneto Ionic Characteristic Polarizations, W. SNYDER, Stanford University, Stanford, California.

46. Ionospheric Absorption of Obliquely Incident Radio Waves, Alan T. WATERMAN, Jr., Stanford University, Stanford, California.

47. Sunspot Cycle Changes in Ionospheric Absorption and in the Diurnal Variations of Terrestrial Magnetism, Mary B. HARRINGTON, National Bureau of Standards, Washington, D. C.

48. Geo-Magnetic Absorption, L. J. MCKESSON, Crosby Laboratories, Inc., Mineola, L. I. New York.

Commission IV.

Terrestrial Radio Noise

49. Program for Coordinated Lightning Measurements at Florida, New Mexico and Minnesota, J. WEIL, University of Florida, Gainesville, Florida, E. J. WORKMAN, New Mexico Institute of Mining and Technology, and M. M. NEWMAN, Lightning and Transients Research Institute.

50. A Brief Qualitative Discussion of the Mechanisms Leading to Charge Separation in Thunderstorms and Correlation with Sferics, E. J. WORKMAN and S. E. REYNOLDS, New Mexico Institute of Mining and Technology, State College, New Mexico, and M. M. NEWMAN, Lightning and Transients Research Institute.

51. Laboratory Study of the Lightning Discharge Propagation Process, M. M. NEWMAN, Lightning and Transients Research Institute, Minneapolis, Minnesota.

52. Atmospheric Direction and Wave Shape Recording Oscillograph, M. M. NEWMAN, Lightning and Transients Research Institute, Minneapolis, Minnesota.

53. The Effect of Atmospheric Noise on the Reception of Speech, A. W. SULLIVAN, University of Florida, Gainesville, Florida.

54. The Stochastimeter, A. W. SULLIVAN and J. D. WELLS, University of Florida, Gainesville, Florida.

55. A Wide-Range Panoramic Noise Meter, A. W. SULLIVAN, W. J. KESSLER and J. D. WELLS, University of Florida, Gainesville, Florida.

Commission V.
Radio Astronomy

56. Improved Calculations of Radiation Through and From a Quiet Solar Atmosphere (25-30,000 Mc), E. E. REINHART, Cornell University, Ithaca, New York.

57. Naval Research Laboratory Solar Eclipse Expedition of February 1952, John P. HAGEN, Naval Research Laboratory, Washington, D. C.

58. Radio Observation at 8 mm Wavelength of the Solar Eclipse of February 25, 1952, John P. HAGEN, John E. GIBSON, Robert J. MCEWAN, and Nannielou HEPBURN, Naval Research Laboratory, Washington, D. C.

59. The Radio Telescope Used at Khartoum at a Wavelength of 9.4 cm, C. H. MAYER and D. R. J. WHITE, Naval Research Laboratory, Washington, D. C.

60. Observational Evidence for Solar Limb Brightening at a Wavelength of 9.4 cm, F. T. HADDOCK and R. M. SLOANAKER, Naval Research Laboratory, Washington, D. C.

61. Brightness of the Solar Disc at a Wavelength of 10.3 centimeters, A. E. COVINGTON and N. W. BROTEN, Canadian Naval Research Council, Ottawa, Canada.

62. Radio Studies of Sun and Moon with High Resolution Antenna, John P. HAGEN and J. Edwin SEES, Naval Research Laboratory, Washington, D. C.

63. Space Charge Wave Amplification in a Shock Front and the Fine Structure of Solar Radio Noise, Hari K. SEN, National Bureau of Standards, Washington, D. C.

64. On Solar Radio Bursts on 200 Mc/s, Takeo HATANAKA, Cornell University, Ithaca, New York.

65. A Combined Radio Interferometer and Radiometer for Determination of the Position of Individual Solar Bursts, Leif OWREN and M. H. MC-KENZIE, Carnegie Institution of Washington, Washington, D. C.

66. Solar Flares and 2800 Mc/s Radiation, Helen W. DODSON and Ruth HEDEMAN, McMath-Hulbert Observatory, Ann Arbor, Michigan and A. E. COVINGTON, Canadian National Research Council, Ottawa, Canada.

67. The Association of Solar Outbursts at a Wavelength of 3.15 cm with Flare Light Curves, F. T. HADDOCK, Naval Research Laboratory, Washington, D. C.

68. The Status of the Radio Detection of Meteors-1953, L. A. MANNING, Stanford University, Stanford, California.

69. The Effect of Radar Wavelength on Meteor Echo Rate, VON R. ESHLEMAN, Stanford University, Stanford, California.

70. The Crab Nebula as a Radio Source, Jesse L. GREENSTEIN and Rudolph MINKOWSKI, Mount Wilson and Palomar Observatories, Carnegie Institution of Washington, California Institute of Technology, Pasadena, California.

71. The Power Radiated by Some Discrete Sources of Radio Noise, Rudolph MINKOWSKI and Jesse L. GREENSTEIN, Mount Wilson and Polomar Observatories, Carnegie Institution of Washington, California Institute of Technology, Pasadena, California.

72. GALACTIC Survey and Discrete Source Observations at 250 Megacycles, J. D. KRAUS and S. MATT, Ohio State University, Columbus, Ohio.

73. Harvard Radio Astronomy Research, H. I. EWEN, Harvard University, Cambridge, Massachusetts.

74. Lunar Eclipse of 29 January 1953, John P. HAGEN, John E. GIBSON and J. Edwin SEES, Naval Research Laboratory, Washington, D. C.

Commission VI*b*
Radio Waves and Circuits

75. Studies in Non-Linear Vibrations, Karl KLOTTER, Stanford University, Stanford, California.

76. Statistically Optimum Nonlinear Network Design, Otto J. M. SMITH, University of California, Berkeley, California.

77. On the Structure of Driving-Point Impedances, F. M. REZA, Massachusetts Institute of Technology, Cambridge, Massachusetts.

78. The Analysis and Synthesis of a Class of Linear Time Varying Networks, Harold DAVIS and DeForest L. TRAUTMAN, University of California, Berkeley, California.

79. Some Theorems Connecting Fields and Circuits, Edwin T. JAYNES, Stanford University, Stanford, California.

80. Optimum (Narrow Band) Transformer and Directional Coupler Performance, H. J. RIBLET, Microwave Development Laboratories, Inc., New York, New York.

81. Obstacles and Discontinuities in Multimode Waveguide, G. HELD and W. KUMMER, University of California, Berkeley, California.

82. A Sum and Difference Circuit for Circular Polarization, I. A. KURTZ and M. D. ADCOCK, Hughes Aircraft Co., Culver City, California.

83. Properties of Ferrities in Waveguide, N. G. SAKIOTIS and H. N. CHAIT, Naval Research Laboratory, Washington, D. C.

COMMISSIONS

List of official members

(See nº 77, pp. 9-16)

COMMISSION I

Belgium : Prof. J. MARIQUE, Secrétaire Général du Centre de Contrôle des Radiocommunications des Services Mobiles.

Norway : Mr. HELMER DAHL, Engineer, Christian Michelsens Institutt, Bergen.

United States of America : Dr. R. G. FELLERS, Naval Research Laboratory, Washington 15, D. C. (1).

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United States of America : Dr. L. V. BERKNER, Associated Universities, Inc., 350 Fifth Avenue, New York 1, New York (1).

COMMISSION IV

Belgium : Dr. LAHAYE, Directeur de l'Institut Royal Météorologique, Uccle.

(1) Instead of the name mentioned in nº 77.

Norway : Dr. Leiv Harang, Prof., Oslo University.

United States of America : Mr. F. H. Dickson, Office of the Chief Signal Officer, National Defense Building, Washington 15, D. C. (1).

COMMISSION V

Belgium : Mr. M. Nicolet, Chef du Service de Rayonnement, Institut Royal Météorologique, Uccle.

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Norway : Prof. Matz Jenssen, Norges Tekniske Höyskole, Trondheim.

United States of America : Dr. J. R. Whinnery, University of California, Bekerley, California (1).

Commission III

Results of British ionospheric observations p. 64.
See also p. 42 and 54.

Commission IV

Attention of Members of Committion IV is drawn on the contents of p. 38 and 54.

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(1) Instead of the name mentioned in nº 77.

Commission V

We draw the attention of Members of Commission V on the contents of p. 54.

Sub-Commission VIa on Information Theory

The Raytheon Manufacturing Company, Equipment Engineering Division, 148 California Street, Newton 58, Mass., U. S. A., has issued a « Bibliography on Information Theory, by Alma S. Baker, Research Librarian.

We are publishing hereunder the Introduction of this work.

« The purpose of this bibliography, initially, was to compile a list of references pertaining to radar information theory exclusively. However, it was found that relatively few such references existed and so the scope of the bibliography has been expanded to include general information theory, exclusive of speech and television information theory. Items on noise, modulation, bandwith theory, entropy, and the necessary mathematics have been included whenever they seemed to be basic to the development of the theory.

The period covered is mainly from 1928 to 1952. A few references which appeared previous to R. V. L. Hartley's classic paper. « Transmission of Information » of 1928, have been included.

The arrangement of the bibliography is alphabetical by author. Secondary authors have been cross-indexed in the body of the bibliography. References which have no signed authors have been listed under their issuing agencies wherever possible ; otherwise they have been listed alphabetically by the first word of the title. To supplement this arrangement, a subject index has been compiled from the titles of the references. No attempt has been made to index or abstract the contents of each item.

A list of journals and abbreviations used throughout the bibliography is also given. These abbreviations are those used conventionally by *Science Abstracts* and by the *Industrial Arts Index.* The place of publication of foreign journals have been listed also.

Items which were not available to be checked with the original publications have been indicated with asterisk. »

EUROPEAN URSIGRAMS

Erratum

Bulletin nº 77, p. 31 ; 6th line, read « Pontoise » instead of « Poitiers ».

Abbreviated codes of European Ursigrams (II)

See Bulletin nº 77, pp. 31-38.

3. — DATA ON MONOCHROMATIC INTENSITY OF THE SOLAR CORONA

« CORON » Code

CODING

GREEN LINE AND RED LINE

(For the yellow line, see p. 18)

First group. — Date and identification.

Place of the figure in the group

1-2 = Day of observation

	Green 5303 Å	Red 6374 Å	Red 6702 Å	Yellow 5694 Å
3 = Observed line : Weak brightness <30 millionths	1	2	3	0
Medium brightness 30-60 millionths	4	5	6	0
Strong brightness >60 millionths	7	8	9	0

4 = Observatory (code N)

Second group. — Observed quadrants — Mean time of observation

1-3 = Quadrants : 1 = N-E quadrant
2 = N-W quadrant
3 = S-W quadrant
4 = S-E quadrant

When the message contains values for all four quadrants, figures are 999 ; missing are replaced with X.

4-5 = Mean time of observation, U. T. (only the hours)

Third group. — Measured Intensities.

Values measured from 5° to 5° from the north pole (unclockwise), i. e., in the following order of solar quadrants : N-E, S-E, S-W and N-W.

First case : All measured values smaller than 100 :

1 = Reference figure giving in tens of degrees the latitude to which the group refers.

2 and 3 = Corona intensity for the position angle corresponding to this latitude.

4 and 5 = Intensity measured at the position angle 5° further (clockwise)

The reference figures of the following groups are at first decreasing from 9 to 1 (N-E quadrant) then increasing from 0 to 8 (S-E quadrant), decreasing again from 9 to 1 (S-W quadrant), then increasing from 0 to 8.

Distinction between two consecutive quadrants is made by the order in which the reference figures succeed.

When in a group, an intensity has not been measured, the corresponding figures are replaced by XX ; when two intensities constituting a group are too weak or have not been measured the group is not drafted.

Second case. — Some intensities exceed 99.

(Only for messages from the Pic du Midi.)

The single group of the first case is replaced by two groups having the same reference figure. The first group refers to the value usually given by the 2nd and 3rd figures (intensity for the latitude), the second group refers to the value usually given by the 4th and 5th figures. Such values are given in full numbers (hundred, ten and unit).

The figure X into the groups eliminates any ambiguity owing to its changing place (2nd or 5th figure of the group) according as X is in the 1st or 2nd group.

For the decoding the message is as follows :

First group.

1 = Reference figure giving the tens of latitude degrees as in a single group.

2-4 = Corona intensity for the position angle corresponding to the latitude

5 = Always X (intensity read at the left of X shows that it refers to the left part of a single group).

Second group.

1 = Reference figure giving the tens of latitude degrees as in a single group (given at the reference figure of the preceeding group).

2 = Always X (intensity at the right of X shows that it is concerned with the single right part).

3-5 = Corona intensity for the position angle 5° further than the angle corresponding to the latitude of the reference figure (unclockwise).

Which has been said for the 1st case concerning position angles corresponding, latitudes, and resulting figures is valid for the 2nd case. The order of consecutive groups is the same but some of them may be splitted into two.

When one of such splitted groups contains a gaps, the hundred, ten and unit of the unknown intensity will be replaced by XXX.

When only one intensity exceeds 99, the other will be expressed by means of 3 figures (hundred, ten, unit) the first being 0.

Yellow Line 5694 Å

One group for each measurement reported for regions where the yellow line is observed.

First group. — Date and identification.

1 and 2 = Date of observation :

3 = Observed line,

0 = yellow line observed, one or more groups to follow,

X = no yellow line observed : a single group

4 = Observatory figure (N code).

Following groups (if any). — Position and value of each maximum.
1 and 2 = Position angle of a peak, in multiples of 5° (*g* code).
3 and 4 = Width of maximum (degrees).
5 = Maximum intensity in multiples of 5 millionths (I code).

Codes

(N) *Observatories*

16 = Kanzelhöhe	30 = Arosa	34 = Climax
		35 = Norikura
18 = Wendelstein	32 = Sacramento Peak	36 = Pic du Midi

(*g*) *Position angles of a maximum*

00 = 000°	18 = 090°	36 = 180°	54 = 270°
01 = 005°	19 = 095°	37 = 185°	55 = 275°
02 = 010°	20 = 100°	38 = 190°	56 = 280°
03 = 015°	21 = 105°	39 = 195°	57 = 285°
04 = 020°	22 = 110°	40 = 200°	58 = 290°
05 = 025°	23 = 115°	41 = 205°	59 = 295°
06 = 030°	24 = 120°	42 = 210°	60 = 300°
07 = 035°	25 = 125°	43 = 215°	61 = 305°
08 = 040°	26 = 130°	44 = 220°	62 = 310°
09 = 045°	27 = 135°	45 = 225°	63 = 315°
10 = 050°	28 = 140°	46 = 230°	64 = 320°
11 = 055°	29 = 145°	47 = 235°	65 = 325°
12 = 060°	30 = 150°	48 = 240°	66 = 330°
13 = 065°	31 = 155°	49 = 245°	67 = 335°
14 = 070°	32 = 160°	50 = 250°	68 = 340°
15 = 075°	33 = 165°	51 = 255°	69 = 345°
16 = 080°	34 = 170°	52 = 260°	70 = 350°
17 = 085°	35 = 175°	53 = 265°	71 = 355°

(I) *Intensity of a maximum of the Yellow Line* 5694 Å

0 = less than 5 millionths	5 = 26-30 millionths
1 = 6-10 millionths	6 = 31-35 millionths
2 = 11-15 millionths	7 = 36-40 millionths
3 = 16-20 millionths	8 = 41-45 millionths
4 = 21-25 millionths	9 = more than 45 millionths

4. — DATA ON E*s* CRITICAL FREQUENCY (*f*E*s*)
« ESFRE » Code

The ESFRE code has the same device as the FODEU code (see 5), i.e. : in a group :

Reference figure followed by two periods of values referring:
— the first to the even hour given by the reference figure ;
— the second to the following uneven hour.

Coding

First group. — Date and identification.

Place of the figure in the group

1 and 2 = Date of observation.

3 = Non-used figure, replaced by X.

4 and 5 = Ionospheric sounding station (N code).

When only values of *f*E*s* greater than 5.0 Mc/s are broadcasted and when systematically the figure of the ten Mc/s is omitted, the coding of values in tenths of Mc/s by means of two figures leaves out any ambiguity in the range of values from 5.1 to 15.0 Mc/s

Second and following groups. — *f*E*s* values from 00 to 24 h. U. T.
1 = reference figure = time of values given in the group (H code).

2 and 3 = *f*E*s* values (in tenths of Mc/s) for the even hour U. T.
4 and 5 = *f*E*s* values (in tenths of Mc/s) for the uneven hour U. T.
} referring to the reference figure of the group

Note. — Any value less than 5 Mc/s is replaced by XX.

Codes

(H) *Reference figure of the group*

0 = group for values measured at 00 and 01 U. T.
1 = group for values measured at 02 and 03 U. T.
2 = group for values measured at 04 and 05 U. T.
3 = group for values measured at 06 and 07 U. T.
4 = group for values measured at 08 and 09 U. T.
5 = group for values measured at 10 and 11 U. T.

6 = group for values measured at 12 and 13 U. T.
7 = group for values measured at 14 and 15 U. T.
8 = group for values measured at 16 and 17 U. T.
9 = group for values measured at 18 and 19 U. T.
0 = group for values measured at 20 and 21 U. T.
1 = group for values measured at 22 and 23 U. T.

(N) *Ionospheric sounding stations*

01 = Lindau — 02 = Neuerhausen
03 = — 04 = Casablanca

SYMBOLS

U.R.S.I. descriptive and qualitative symbols (Zurich, September 1950) which can be transmitted in the FODEU messages by means of SYMBO groups do not seem useful in the ESFRE messages. Nevertheless the use of SYMBO could be considered if needed.

Descriptive symbols

01 = A = Characteristic not measurable because of blanketing by E*s* or E2*s*

02 = B = Characteristic not measurable because of absorption either partial or complete, and non-deviative in type

03 = C = Characteristic non observed because of equipment or power failure

04 = D = Characteristic at a higher frequency than the normal upper frequency limit of the equipment

05 = E = Characteristic at a frequency lower than the normal lower frequency limit of the equipment

06 = F = Spread echoes present

07 = G = (*a*) F2 critical frequency equal or less than F1 critical frequency

(*b*) No E*s* or E2*s* echoes observed though regular E or E2 echoes are present

08 = H = Stratification observed within the layer

10 = J = Ordinary-wave characteristic deduced from measured extraordinary wave characteristic

11 = K = Ionospheric disturbance in progress (this is never applied to an isolated value)

12 = L = (*a*) *fo*F1, *fx*F1, MUF or MUF factor omitted or doubtful because no definite or abrupt change in slope of *h'f* is observed either for the first reflexion or any of the multiples

(*b*) *h'*F2 omitted or doubtful because the F2 trace is continuous and without a point of zero slope

13 = M = Missing value because of some failure or omission on the part of the operator

14 = N = The record is such that the characteristic cannot be interpreted

16 = P = Trace extrapolated to critical frequency (extrapolation higher than 2 %)

17 = Q = E or F1 non observed (used at the beginning and end of the daylight period to fill empty space in the monthly hourly columns where some numerical values exist)

19 = S = Characteristic obscured by interference or by atmospherics.

20 = T = Loss or destruction of successful observations

22 = V = Forked trace near critical frequency

23 = W = Characteristic at a virtual height greater than the normal upper height limit of the equipment

25 = Y = E*s* or E2*s* trace intermittent in frequency range

26 = Z = Third magneto-ionic component of *h'f* trace is observed

Qualitative symbols

27 = (.....) = Observed values thus enclosed are considered doubtful

28 = [.....] = Numerical values thus enclosed represent interpolations

29 = or D = Greater than the following number

30 = or E = Smaller than the following number

For ESFRE code

40 = Single value greater than 10 Mc/s

41 = First value of a series of values greater than 10 Mc/s

49 = Last value of a series of values greater than 10 Mc/s

5. — DATA ON F2 CRITICAL FREQUENCY (*fo*F2)

« FODEU » Code for *fo*F2 hourly values

« SYMBO » Code for descriptive symbols for the values given

Only two figures are used for the coding of *fo*F2 in tenths of Mc/s, consequently the exactly given values may cover the range 0.0-9.9 Mc/s.

For the coding of higher values the figure of ten Mc/s is systematically omitted. This may lead to some ambiguity for values between 0 and 6 Mc/s, and between 10 to 16 Mc/s. In order to remove any ambiguity, values higher than 10 Mc/s are always explained by a separate SYMBO message (see B).

In coding, the *fo*F2 values in tenths of Mc/s of two consecutive hours are grouped two by two and are preceded by a reference figure. In this way, hourly values measured for the 24 hours of the day need to be coded 12 groups for which the reference figures run from 0 to 9 followed by 0 or 1 (for 10 and 11) which indicate respectively 20 and 22 hours.

In order to remove the ambiguity which occurs in case when only values related to 20, 21, 22 and 23 hours are transmitted, the interested groups are preceded by a group indicating the lack of values at 18 and 19 hours.

A. — Coding of hourly values

First group. — Date and identification.

Place of the figure
in the group

1-2 = Date of observation

3 = Non used figure, replaced by X

5-5 = Ionospheric sounding station (N code)

Second and following groups. — *fo*F2 values from 00 to 24 h. U. T.

1 = Reference figure giving the hours to which the two values of the groups are related

2-3 = *fo*F2 values (in tenths of Mc/s) for the even U. T. hour 4-5 = *fo*F2 values (in tenths of Mc/s) for the uneven U. T. hour	related to reference of the group

« XX » will be used for a missing numerical value.

When two value, normally coupled in a group, are missing, this group is omitted, the identification of the following groups is given by means of the reference figure of each group.

Reasons for missing values may be stated in U.R.S.I. descriptive symbols (see B).

When values for a part of the following day are known, their transmission will be carried out in using again the first group (date and identification) followed by the groupe needed to describe this part of the day.

B. — Coding of U.R.S.I. descriptive and qualitative symbols

« SYMBO » Code

After trasmitting the signal = (in Morse code — . . . —), the word SYMBO is emitted and followed by a variable number of groups, each of them having the same reference figure as the group explained, this figure is followed by one or two numbers of two figures, each number corresponding to one U.R.S.I. symbol.

The place of such two figure number is the same as for the critical frequency values in the FODEU coding.

Codes

(H) *Reference figure of the group*

See « ESFRE » code, p. 20.

(N) *Ionospheric sounding stations*

See « ESFRE » code, p. 21.

Symbols

See « ESFRE » code, p. 21.

6. — TERRESTRIAL MAGNETISM

« MAGNE » Code

The MAGNE message contains generally three parts :

1° One group giving the date of observations and the observating station.

2° Two groups (2nd and 3rd) defining the *K characteristics* for the eight 3-hour periodes of the day, from 00 to 24 h. U. T.

3° If needed, a variable number of supplementary groups for describing *particular phenomena* observed.

Data given in a message are always related to the date of the first group. Recordings of some observatories cover 24-hour periods beginning at any time of the day (e.g. from 09 to 09) ; in such case magnetic observations are described by means of two messages. One having the date of the previous day reports on this day phenomena from 00 to 24 h. exclusively ; the other, the date of the current day, reports on the phenomena known for this day from 00 U. T. to the time of the drafting of the message, the day phenomena not yet known are coded by means of « X ». The end of each message is stated by means of « = » (— . . . —).

The message drafted in this way may be built up by means of components from various observatories specialized respectively in the observation of each of the components. The reference used for the message is the reference corresponding to all observatories.

Particular phenomena which may be coded are given below. The coding is carried out by means of a group whose *first figure* gives the *phenomenon* type and the four following figures, the time of beginning.

Phenomena coded by means of a first figure from 1 to 4 call for a second group started by « X » and giving either the duration or the intensity of the phenomenon or both. Two intensity scales are used according to the type of phenomena to be measured, one from 5 to 5 gammas, the other identical to the « K » index scale.

The following table gives the particular phenomena which may be described.

First figures of the group		Number of groups	Intensity scale
1	Gradual bay begin..........	2	0-9 («K» scale)
2	Pulsatory or sudden bay (P.S.C.)	2	0-9 («K» scale)
3	Long deep fluctuations	2	1-9 (5 to 5 γ scale)
4	Hook confirmed by connected phenomena (burst, outburst, S.I.D.)....................	2	1-9 (5 to 5 γ scale)
5	Non confirmed hook	1	
6	Gradual storm begin (S.S.C.)	1	
7	Sudden storm (S.S.C.).......	1	
8	Pronounced sudden storm ..	1	
9	Sudden fluctuations		
0	Microfluctuations (see coding below	1	

Coding

First group. — Identification.

1-2 = Date of observation

3 = General magnetic characteristic of 0000-2400 U. T. day (according to the scale of the observing station)

4-5 = Observation station (N code)

Second group. — « K » from 0000 to 0900 U. T.

1-2 = $\frac{A_k}{5}$ { « A_k » = mean amplitude of the day turbulence as defined by Dr. J. Bartel in the Bulletin de l'I.A.T.M.E. nº 12*e*, p. 132

3 = K 0000-0300 h. U. T.

4 = K 0300-0600 h. U. T.

5 = K 0600-0900 h. U. T.

Third group. — « K » from 0900 to 2400 U. T.

1 = K 0900-1200 h. U. T.	Unknown values of K for the current day are replaced by « X »
2 = K 1200-1500 h. U. T.	
3 = K 1500-1800 h. U. T.	
4 = K 1800-2100 h. U. T.	
5 = K 2100-2400 h. U. T.	

(If needed) *Fourth group* and following. — Particular phenomena.

Group beginning by « 1 » or « 2 » : Bays
(calls for a second group)

First group.

1 = Reference figure { 1 = gradual bay begin; 2 = pulsatory or sudden bay (P.S.C.)

2-5 = Beginning of the phenomenon (hours and minutes U. T.)

Second group.

1 = Always « X » this group is related to preceding and is concerned with duration and amplitude

2-4 = duration of the phenomenon (minutes)

5 = Amplitude

0 = < 5 gammas	5 = between 70 and 120
1 = between 5 and 10	6 = between 120 and 200
2 = between 10 and 20	7 = between 200 and 333
3 = between 20 and 30	8 = between 333 and 500
4 = between 30 and 40	9 = > 500 gammas

Group beginning with « 3 » or « 4 ». — Fluctuations
(calls for a second group)

First group.

1 = Reference figure { 3 = Long deep fluctuations; 4 = hook

2-5 = Time of beginning (hour and minute U. T.)

Second group.

1 = Always « X » = this group is related to the preceding and is concerned with duration and amplitude

2-4 = Duration of the phenomenon (minutes)

5 = Amplitude
- 1 = < 5 gammas
- 2 = between 5 and 10
- 3 = between 10 and 15
- 4 = between 15 and 20
- 5 = between 20 and 25
- 6 = between 25 and 30
- 7 = between 30 and 35
- 8 = between 35 and 40
- 9 = > 40 gammas

Group beginning with « 5 », « 6 », « 7 », « 8 » or « 9 »

(No second group)

1 = Reference figure
- 5 = non confirmed hook
- 6 = gradual storm begin
- 7 = sudden storm
- 8 = pronounced sudden storm
- 9 = sudden fluctuations during a storm

2 = Time of beginning (hour and minute U. T.)

Group beginning with « 0 ». — Micro-fluctuations

(beginning-end)

(No second group)

1 = Always 0

2-3 = Beginning — For weak micro-fluctuations hour without minutes. For deep fluctuations 50 is added to the hour.

4-5 = End (same as for 2-3)

CODE

(N) *Magnetic Observatories*

11 = Wingst — 53°45′ N-09°04′ E
General characteristic for the day : 0-9

17 = Furstenfeldbruck — 48°10′ N-11°17′ E
General characteristic for the day : 0-9

18 = Chambon-la-Forêt — 48°01′ N-02°16′ E
General characteristic for the day : 0-7

31 = Tamanrasset — 22°42′ N-05°31′ E
General characteristic for the day : 0-7

50 = Mering — 48°16′ N-10°59′ E
General characteristic for the day : 0-9

60 = All the German Observatories

70 = All the French Observatories

80 = All the French and German Observatories

90 = All the European Observatories

7. — IONOSPHERIC DISTURBANCE WARNING

« PERTU » Code

In the « PERTU » code the following data may be coded :

For Enhancements (coded in two groups)
- time of beginning
- time of maximum
- duration in minutes (when it can be defined)
- relative intensity (1 to 3 scale)

For Fadings (coded in two groups
- time of beginning
- relative quantity of disturbed links
- duration in tens of minutes
- time of maximum

Occurrence of Ionospheric Storms and Anomalies can also be reported by means of the « PERTU » code.

Coding

First group. — Identification.

Place of the figure in the group

1-2 = Date of observation

3 = Not used « X »

4-5 = Observating station (N code)

Group beginning with « 1 », « 2 », « 3 » : : Enhancements
(Always two groups)

First group.

1 = Reference figure
- 1 = weak
- 2 = moderate
- 3 = strong

2-3 = Time of beginning (hour and minute U. T.)

Second group.

1 = Duration of the enhancement : tens of minutes (*t* code)

2-5 = Time of maximum (hour and minute U. T.)

Group beginning with « 4 », « 5 », « 6 », « 7 » : Fadings
(Always two groups)

First groupe.

1 = Reference figure
- 4 = Small fading on a few paths
- 5 = Small fading on every path
- 6 = Strong fading on some paths
- 7 = Strong fading on every path

2-5 = Time of beginning (hour and minute U. T.)

Second group.

1 = Duration of fading, tens of minutes (*t* code)

2-5 = Time of maximum (hour and minute U. T.)

Group beginning with « 8 » *or* « 9 » : Storm-Anomalous absorption
(One single group)

1 = Reference figure
- 8 = Ionospheric storm
- 9 = Anomalous absorption

2-3 = Time of beginning (hour without minute)

4 = Mean intensity, 1-5 scale

5 = Duration in 3 hour multiples according to the following scale :

1 = < 3 hours	6 = 15-18 hours
2 = 3-6 hours	7 = 18-21 hours
3 = 6-9 hours	8 = 21-24 hours
4 = 9-12 hours	9 = 24-27 hours
5 = 12-15 hours	0 = > 27 hours

Note. — To facilitate de decoding, the message will be given as follows : Fadings (2 groups), Enhancements (2 groups), other phenomena (one single group for each).

CODES

(N) *Observating stations*

01 = Bagneux	07 = Lindau	12 = Poitiers
02 = Casablanca	08 = Météo Paris	13 = Rabat
03 = Dakar	09 = Nederhorst/Berg	14 = Schauinsland
04 = Darmstadt	10 = Neuershausen	15 = Villecresnes
05 = Hamburg	11 = Noiseau	17 = Wendelstein

60 = All the German Observatories
70 = All the French Observatories
80 = All the French and German Observatories
90 = All the European Observatories

(*t*) *Duration of Enhancement or Fading*

0 = less than 10 minutes	5 = 51-60 minutes
1 = 11-20 minutes	6 = 61-70 minutes
2 = 21-30 minutes	7 = 71-80 minutes
3 = 31-40 minutes	8 = 81-90 minutes
4 = 41-50 minutes	9 = more than 91 minutes

8. — RADIO SOLAR EMISSION OBSERVATORIES

« SOLER » Code

A separate message is transmitted for each receiving station which is mentioned by means of two figures.

The message is constituted by five figure groups and contains a first group giving date and identification, a second group gives data on the day general characteristics : mean flux (average of medians values as defined below), mean polarisation rate and variability.

Supplementary groups (third and following) may be added, if needed, to provide data on the activity observed over 3-hour periods. Such groups give the median flux (i.e. the flux exceded during half the period), the polarisation rate and the variability during the period.

At last, particular groups permit to mention notable disturbances : two groups for a burst, one group for a sudden change of polarisation.

Coding

First group. — Date and identification.

Place of the figure
in the group

1-2 = Date of observation

3 = Number of days since the preceding observation

4-5 = Receiving station (N code)

Second group. — General characteristics of the radiation during the day.

1 = 3 hour period during which the observations of the day started

2-3 = Mean level of the flux for the day, according to I_1 code

4 = Mean level of circular polarisation for the day, see P code

5 = Variability index for the day, according to V_1 code

Third and following groups (if needed).

Each group gives data on radiation characteristics over a 3-hour period. Data given in the third group are always related for the 3-hour period mentioned in the first figure of the second group. The following groups are concerned with the 3-hour periods following in chronological order.

1 = Hour of actual observation during the 3-hour period, according to H_2 code

2-3 = Median flux level according to I_2 code

4 = Mean rate of polarisation according to P code

5 = Variability index according to V_2 code

Pair of groups, the first beginning with 9
(Data on particularly notable bursts)

First group.

1 = Always 9

2-5 = Time of beginning in hours and minutes U. T.

Second group.

1 = Maximum intensity (smoothed) of the burst, according to I_2 code

2-3 = Burst duration, from 0 to 10 800 seconds (*t* code)
4 = Mean rate of polarisation during the burst (P code)
5 = Burst pattern (F code)

Groups beginning with 0
(Data on sudden polarisation changes)

1 = Always 0
2-5 = Time of sudden change, hours and minutes U. T.

CODES

(F) *Burst pattern*

	U.R.S.I. Terminology
1 = Single increase in intensity followed by decrease	S
2 = Single increase in intensity followed by decrease during a period of activity	SA
3 = Single increase in activity followed by decrease during a quiet period	SD
4 = Complex oscillations of intensity	C
5 = Complex oscillations of intensity during a period of activity	CA
6 = Complex oscillations of intensity during a quiet period	CD
7 = Burst at the beginning of a level	E
8 = Group of simple short bursts	M
9 = Burst with original shape not included in the preceding categories	—
0 = Burst with polarisation change	P

(H_1) 3-*hour periods*

Used only to code the 3-hour period during which the observation of the day started :

1 = 00-03 h. U. T.	5 = 12-15 h. U. T.
2 = 03-06 h. U. T.	6 = 15-18 h. U. T.
3 = 06-09 h. U. T.	7 = 18-21 h. U. T.
4 = 09-12 h. U. T.	8 = 21-24 h. U. T.

(H_2) *Time of actual observation during each 3-hour period*

1 = Observations made during the 1st hour 2 = Observations made during the 2nd hour 3 = Observations made during the 3rd hour 4 = Observations made during the 1st and 2nd hour 5 = Observations made during the 1st and 3rd hour 6 = Observations made during the 2nd and 3rd hour 7 = Observations made during the three hours	of the 3-hour period considered

8 = Observations do not cover all a full hour

When no measurement has been made during a 3-hour period, the group is coded 8XXXX.

(I_1) *Radiation Intensity (quiet sun)*

Missing values are replaced by X.

The radiation intensity is given by means of two figures :

a) When the flux received on two polarisations is less than 90 units (see below), the two figures given in clear the intensity in corresponding units.

b) When the flux is higher than 90 units, the first figure is always 9, the second gives the intensity according to I_2 code.

(I_2) *Radiation Intensity (disturbed sun)*

Missing value replaced by X.

1 = Intensity less than 20 units 2 = Intensity between 21- 40 units 3 = Intensity between 41- 80 units	used only to code burst intensity

4 = Intensity between 81- 160 units
5 = Intensity between 161- 320 units
6 = Intensity between 321- 640 units
7 = Intensity between 641-1250 units
8 = Intensity between 1251-2500 units
9 = Intensity higher than 2500 units

Definition of units follows.

Units used for I_1 and I_2 codes

10^{-23} W. m^{-2} $(c/s)^{-1}$ for frequencies under 100 Mc/s
10^{-22} W. m^{-2} $(c/s)^{-1}$ for frequencies from 100-1000 Mc/s
10^{-21} W. m^{-2} $(c/s)^{-1}$ for frequencies from 1000-10 000 Mc/s
10^{-20} W. m^{-r} $(c/s)^{-1}$ for frequencies over 10 000 Mc/s

(N) *Receiving stations and observed frequencies*

01 =	Meudon	555 Mc/s	05 =	Marcoussis	158 Mc/s
02 =	Meudon	255 Mc/s	06 =	Nederhorst den Berg	140 Mc/s
03 =	Meudon	200 Mc/s	07 =	Nederhorst den Berg	200 Mc/s
04 =	Meudon	3000 Mc/s			

(P) *Polarisation rate*

1 = Right polarisation with $\tau < 10$
2 = Right polarization with $10 < \tau < 50$
3 = Right polarisation with $50 < \tau < 90$
4 = Right polarisation with $90 < \tau < 100$
5 = Left polarisation with $|\tau| < 10$
6 = Left polarisation with $10 < |\tau| < 50$
7 = Left polarisation with $50 < |\tau| < 90$
8 = Left polarisation with $90 < |\tau| < 100$
9 = No observable polarisation

(*l*) *Burst duration*

By means of two figure numbers, the following table permits duration coding from 0 to 10 800 seconds (3 hours) Each number of the table is used for the duration corresponding et for longer durations up to the duration corresponding to the higher number, excluded.

Numb.	Duration s	Number	Duration m	s	Number	Duration m	s	Number	Duration h	m	s
00 =	< 2	25 =	0	35	50 =	04	02	75 =	0	27	59
01 =	2	26 =	0	38	51 =	04	21	76 =	0	30	15
02 =	3	27 =	0	41	52 =	04	42	77 =	0	32	41
03 =	4	28 =	0	44	53 =	05	05	78 =	0	35	19
04 =	5	29 =	0	47	54 =	05	29	79 =	0	38	10
05 =	6	30 =	0	51	55 =	05	56	80 =	0	41	14
06 =	7	31 =	0	55	56 =	06	25	81 =	0	44	34
07 =	8	32 =	1	00	57 =	06	56	82 =	0	48	10
08 =	9	33 =	1	05	58 =	07	29	83 =	0	52	03
09 =	10	34 =	1	10	59 =	08	06	84 =	0	56	15
10 =	11	35 =	1	15	60 =	08	45	85 =	1	00	47
11 =	12	36 =	1	21	61 =	09	27	86 =	1	05	41
12 =	13	37 =	1	28	62 =	10	13	87 =	1	10	58
13 =	14	38 =	1	35	63 =	11	02	88 =	1	16	42
14 =	15	39 =	1	43	64 =	11	55	89 =	1	22	53
15 =	16	40 =	1	51	65 =	12	53	90 =	1	29	34
16 =	17	41 =	2	00	66 =	13	56	91 =	1	36	47
17 =	18	42 =	2	10	67 =	15	03	92 =	1	44	36
18 =	20	43 =	2	20	68 =	16	16	93 =	1	53	02
19 =	22	44 =	2	32	69 =	17	34	94 =	2	02	09
20 =	24	45 =	2	44	70 =	18	59	95 =	2	12	00
21 =	26	46 =	2	57	71 =	20	31	96 =	2	22	38
22 =	28	47 =	3	11	72 =	22	11	97 =	2	34	08
23 =	30	48 =	3	27	73 =	23	58	98 =	2	46	34
24 =	32	49 =	3	44	74 =	25	54	99 =	3	00	00

(V_1) *Variability over a day*

Used only for the fifth figure of the first group.

Missing values are replaced by X.

0 = No observable variability
1 = Slight variability
2 = Moderate variability
3 = Great variability

(V_2) *Variability over a 3-hour period*

This code permits to specify the most disturbed hour in the 3-hour period considered.

Missing values are replaced by X.

Code	Meaning	Perturbation index
1	The 1st hour of the period was the most disturbed	perturbation index = 1, slight variability
2	The 2nd hour of the period was the most disturbed	
3	The 3rd hour of the period was the most disturbed	
4	The 1st hour of the period was the most disturbed	perturbation index = 2, moderate variability
5	The 2nd hour of the period was the most disturbed	
6	The 3rd hour of the period was the most disturbed	
7	The 1st hour of the period was the most disturbed	Perturbation index = 3, great variability
8	The 2nd hour of the period was the most disturbed	
9	The 3rd hour of the period was the most disturbed	

0 = No observable variability.

EXISTING AND PLANNED SFERICS STATIONS

Reprinted from W.M.O's work mentioned on p. 64.

Abbreviations :

E = existing   NS = narrow sector recorder
P = planned   K = cathode-ray direction finder

Stations	Coordinates		Frequency kc/s	Type	Remarks
	Lat.	Long.			
Argentina					
1. Corrientes	27°28′ S	58°49′ W	27	NS-E	Temporarily out of operation
2. Cordoba	31°24′ S	64°11′ W	27	NS-E	In operation
3. Buenos-Aires	34°35′ S	58°11′ W	27	NS-E	In operation
4. Bariloche	41°09′ S	71°18′ W	27	NS-E	Temporarily out of operation
5. Comodoro-Rivadavia	45°47′ S	67°30′ W	27	NS-E	Temporarily out of operation
6. Rio Gallegos	51°40′ S	69°16′ W	27	NS-E	Temporarily out of operation
Belgian Congo					
7. Léopoldville	04°19′ S	15°18′ E	27	NS-E	In operation
Belgium					
8. Dourbes			27	NS-E	In operation 1953

Egypt					
9.					
France and French Union					
10. Brest	48°27′ N	04°25′ W	27	NS-E	In operation
11. Bagneux			27	NS-E	In operation
			27	NS-E	Experimental only
			11	NS-E	Experimental only
			27	K-E	Experimental only
12. Rabat	34°00′ N	06°50′ W	27	NS-E	In operation
13. Casablanca	33°35′ N	07°39′ W	27	K-E	In operation
14. Poitiers	46°35′ N	00°19′ E	27	K-E	In operation
15. Tunis	36°50′ N	10°14′ E	27	NS-E	In operation 1953-1954
16. Kerguelen	49°20′ S	70°10′ E	27	K-E	In operation
17. Terre Adélie	66°50′ S	141°25′ E		NS-P	Will replace the K station
				1954-	
				P 1957	(French antarctic expedition)
18. AFN 1				K-P	
19. AFN 2				K-P	
20. AFN 3				K-P	
21. AFE 1				K-P	
22. AFE 2				K-P	
23. AFE 3				K-P	
Italy					
24.			27	NS-E	
India					
25. Calcutta (?)					

Stations	Coordinates		Frequency kc/s	Type	Remarks
	Lat.	Long.			
Japan					
26. Tokyo	35°41′ N	139°46′ E	12	K	Not in regular operation (Research and typhon tracking)
27. Fukuoka	33°35′ N	130°23′ E	12	K	
28. Asahigawa	43°46′ N	142°22′ E	12	K	
Northern European Countries					
29. Denmark				K(?)-P	These four projected stations are planned to constitute a Northern European network
30. Finland				K(?)-P	
31. Norway				K(?)-P	
32. Sweden				K(?)-P	
Poland					
33. Legionovo	52°24′ N	20°58′ E	27	NS	Near Warsaw
Spain					
34.			27	NS-E	
35.			27	NS-E	
36.			27	NS-E	
Southern Rhodesia					
37. Boulouwayo	20°09′ S	28°37′ E		K-E	In operation

Sudan					
38. Khartoum	15°36′ N	32°33′ E		K-P 1954	
39.				K-P 1954	
40.				K-P 1954	
Switzerland					
41. Zurich	47°23′ N	08°34′ E		NS-E	In operation
42. Payern	46°49′ N	06°57′ E		NS-E	In operation
U. K.					
43. Leuchars	56°25′ N	02°53′ W	10	K-E	In operation. Connected to the European teleprinter network
44. Hemsbey	52°41′ N	01°41′ W	10	K-E	
45. Camborne	50°13′ N	05°19′ W	10	K-E	
46. Irvinestone	54°29′ N	07°38′ W	10	K-E	
U. S. A.					
47. Belmar (N. J.)	40°20′ N	74°05′ W	10	K-E	In operation
48. Robins (Georgia)	32°42′ N	83°39′ W	10	K-E	In operation
49. Kindley Field (Bermudes)	32°22′ N	64°40′ W	10	K-E	In operation
50. Pepperrell (New Foundland)	47°35′ N	52°42′ W	10	K-E 1953	
51. Lajes (Azores)	38°45′ N	27°05′ W	10	K-E 1953	
52. Keflavik (Iceland)	65°57′ N	22°37′ W	10	K-E 1953	

National Committees, Members of Commission IV and interested organizations are kindly requested to forward to the Secretary General of U.R.S.I. any supplementary information to the above list.

C.C.I.R. - U.R.S.I. COOPERATION

Exchange of information for forecasts and warnings

Recommendation N° 59 (Geneva, 1951) deals with the exchange of information for the preparation of short term forecasts and the transmission of ionospheric disturbance warnings. We publish hereunder the steps taken by the United States with respect to the several sections of this recommendation.

(1) The Central Radio Propagation Laboratory of the National Bureau of Standards has been designated as the official agency for the United States for the reception, coordination, and exchange of data pertaining to short term radio propagation forecasts and to ionospheric disturbance warnings and for liaison with corresponding agencies in other countries.

(2) The C.R.P.L. has continuing arrangements with the major observatories and laboratories of the U.S. for speedy transmission of solar, magnetic, ionospheric and other information required for short term forecasting.

(3) Such data are available to forecasting agencies in other countries and to other forecasting agencies in the United States. For instance, data are furnished regularly by telegraph to R.C.A. Communications, New York, and to C.R.P.L. North Pacific Radio Warning Service, Anchorage, Alaska. No requests from forecasting agencies in other countries have been received as of July, 1952. Data of this sort are received by C.R.P.L. by electrical means from agencies in France, Germany, Japan and Canada.

(4) Data of use for the improvement of forecasting techniques in general and other purposes are distributed to a dozen agencies in the United States and to agencies in Great Britain and Japan, prior to publication according to arrangements made with the

agencies concerned. There is no dissemination of detailed information by radio in the United States.

(5) Short term forecasts of radio propagation conditions are broadcast by WWV twice each hour in a two-character code. These forecasts refer to conditions on North Atlantic transmission paths and are issued every six hours. Forecast by RCA are issued daily on working days for each of the ensuing four 6-hour periods and for several areas of the world. The forecasts are on the 1 to 9 scale, with one or two quality grades specified for each forecast period. As of July, 1952, short term forecasts for North Pacific transmission paths are not broadcasts they are, however, available by other means.

(6) In the absence of standardization of codes by U.R.S.I. for use in dissemination of information in (3), (4), and (5), above, the United States has wherever possible avoided the introduction of new codes where existing codes of the U. S. or of agencies in other countries are suitable.

(7) The current codes employed by C.R.P.L. for forecasts and data are attached as appendix.

(8) The C.R.P.L. systematically collects records of operating agencies and summarizes them in radio propagation quality figures for comparison with advance and short term forecasts. These comparisons appear in the monthly C.R.P.L.- F reports « Ionospheric Data ». The results of these comparisons and of similar work by individual agencies are regularly reviewed by the forecasting agencies in assessing the value of various forecasting techniques.

(9) and (10) There has been no opportunity as yet to coordinate with other countries with view to adopting common methods of comparing forecasts and actual behavior of radio circuits or the description of ionospheric perturbations. A large part of the work in the United States describing radio propagation conditions is carried on in terms of a character figure scale ranging from 1 (useless) to 9 (excellent) where more than 80 percent of the characterizations fall in five categories, usually 3, 4, 5, 6, and 7.

APPENDIX

C.R.P.L. Radio Warning Service
Central Radio Propagation Laboratory
National Bureau of Standards
Washington 25, D. C.

Synoptic Codes for Cosmic Data

(N° C.R.P.L. 06-52)

General Notes :

(*a*) This compilation supersedes Codes N° C.R.P.L. 10-51 (C.R.P.L.-R.W.S.-7).

(*b*) All dates and times are Greenwich (Universal Time) unless otherwise specified.

(*c*) Codes II, III*a*, V, VI are consistant in most respects with U.R.S.I. codes.

I. — Sunspots
(position, area, activity, etc.)

SS*abb* RN*ccc deefg ghijk* (2 code groups for each sunspot group reported)

a = observatory : N = U.S. Naval ; W = Wendelstein
bb = date
ccc = relative sunspot number (Zurich scale)
d = heliographic latitude of group : 0 = north, 1 = south
ee = latitude in degrees
f = longitude difference of group : 2 = east ; 3 = west
gg = longitude difference in degrees
hi = area in millionths divided by 10 (U.S. Naval Obs.)
j = spot count, 0 if 10 or more (U.S. Naval Obs.)
h = activity : 1 = small ; 2 = moderate ; 3 = great (Wendelstein)
i = area on scale of 0 to 5 :
0 = 0 to 11 millionths (Wendelstein)
1 = 12 to 99 millionths
2 = 100 to 299 millionths
3 = 300 to 699 millionths
4 = 700 to 1199 millionths
5 = 1200 millionths or more

j = growth classification : 1 = *a* ; 2 = *b* ; etc. (Wendelstein)
k = check, units digit of sum of preceding 9 digits

II. — Chromospheric Phenomena
(Flares, eruptions, etc.)

CHROM *aabcd*[1] *aaeff ghijk lmmmm* (2 code groups for each phenomenon reported by a given observatory)

aa = date of observation of phenomenon

b = number of days since last report (0 = ten or more days)

c = activity of disk regions as a whole [1] :
1 = small ; 3 = moderate ; 5 = great

d = activity of prominences as a whole [1] :
1 = small ; 3 = moderate ; 5 = great

e = key to phenomenon, e.g. :
7 = flare ; 8 = high speed dark flocculus ; 9 = eruptive prominence

ff = reporting observatory, e.g. :

04 = Greenwich	18 = Wendelstein
08 = McMath	31 = U. S. Naval
09 = Mt. Wilson	32 = Sacramento Peak
16 = Kanzelhohe	33 = Boulder
17 = Schauinsland	34 = Climax

g = longitude difference of phenomenon :
5 = west ; 6 = east

h = longitude difference code :

1 = 00-09°	4 = 30-39°	7 = 60-69°
2 = 10-19°	5 = 40-49°	8 = 70-79°
3 = 20-29°	6 = 50-59°	9 = 80-90°

i = latitude code :

1 = North 00-09°	6 = South 00-09°
2 = North 10-19°	7 = South 10-19°
3 = North 20-29°	8 = South 20-29°
4 = North 30-39°	9 = South 30-39°
5 = North 40-49°	0 = South 40-49°

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(1) *Special note.* — The first group of numbers in the code (*aabcd*) will generally be omitted.

j = duration (of phenomenon in tens of minutes :
0 = less than ten minutes ; 9 = 90 minutes or more

k = importance : flares and prominences :
1 = small ; 2 = moderate ; 3 = great ; 4 = very great (3 plus)

Sac. Peak : Area	< 100	100-300	300-750	> 750
Intensity				
< 15	0	1	2	3
$\geqslant 15$	1	2	3	4

high speed dark flocculus : maximum radial velocity/10

l = key :
9 = time following is time of first observation
0 = time following is beginning of phenomenon

mmmm = Universal Time in hours and minutes

IIIa. — Coronal Intensities
(U.R.S.I. code)

COSO*a* *bbcdd* *effgg* *effgg* *effgg* *effgg* *hiiii*
(NE) (SE) (SW) (NW)

a = observatory : C = Climax ; S = Sacramento Peak ;
W = Wendelstein ; K = Kanzelhohe ; P = Pic du Midi

bb = date

c = key : 1 = green line ; 2 = red line

dd = time of observation, hour only in U. T. (without minutes)

e = latitude of center of gravity of intensity peak

1 = 10° or less	7 = 40°
2 = 15°	8 = 45°
3 = 20°	9 = 50°
4 = 25°	X = no observation
5 = 30°	N = no maximum
6 = 35°	

ff = mean intensity in units (or code) used by the reporting observatory

gg = maximum intensity in units (or code) used by the reporting observatory

(*e*, *ff*, *gg*:) In each quadrant in order

h = always a zero

i = maximum intensity of the yellow line in code of reporting observatory, in NE, SE, SW, NW quadrants in order

IIIb. — Coronal Intensities
(« Climax » code)

CORON *aabcd efghi jjjjj jjjjk lllll llllm nnnnn nnnno ppppp ppppq*

aa = date
b = time of observation in tenths of a day
c = reporting observatory :

1 = Pic du Midi	4 = Wendelstein
2 = Arosa	5 = Kanzelhohe
3 = Climax	6 = Sacramento Peak

d = check, units digit of sum of preceding 4 digits
e = latitude of principal maximum of intensity in NE quadrant, in degrees divided by 5
f = principal maximum of intensity in SE quadrant
g = principal maximum of intensity in SW quadrant
h = principal maximum of intensity in NW quadrant
(for *e*–*h*: N = no maximum; X = no observation)
i = check, units digit of sum of preceding 4 digits
jjjjjjjjj = green-line intensity of 10° intervals of position angle on character figure scale of reporting observatory (1), from 0° to 80°, inclusive, solar rotation coordinates (NE quadrant)
k = check sum of *j's*, units digit
llllllll = same as *j's* for 90° to 170°, inclusive (SE quadrant)
m = check sum of *l's*, units digit
nnnnnnnnn = same as *j's* for 180° to 260°, inclusive (SW quadrant)
o = check sum of *n's*, units digit
ppppppppp = same as *j's*, for 270° to 350°, inclusive (NW quadrant)
q = check sum of *p's*, units digit

(1)

Char. Fig.	Climax and Sacramento Peak	Wendelstein	Kanzelhohe
0	0-6	0-13	1-11
1	7-12	14-22	12-19
2	13-16	23-28	20-25
3	17-20	29-34	26-31
4	21-23	35-39	32-35
5	24-26	40-43	36-39
6	27-29	44-48	40-43
7	30-32	49-52	44-47
8	33-35	53-56	48-51
9	> 35	> 56	> 51

IV. — Calcium Plages
(« McMath » code)

P*abbb cccde eefff ggghi* (3 groups for each plage)

aa = quality of observation :
1 = excellent ; 2 = good ; 3 = fair ; 4 = poor ; 5 = very poor (McMath-Hulbert) ;
6 = excellent ; 7 = good ; 8 = fair ; 9 = poor ; 0 = very poor (Mt. Wilson)

bbb = date in tenths of Greenwich day

ccc = serial number of plage region

d = activity : 1 = small ; 2 = moderate ; 3 = great ; 0 = no observation

e = } latitude { 0 = north ; 1 = south

ee = } latitude { latitude in degrees

f = } longitude difference { 2 = east ; 3 = west

ff = } longitude difference { longitude difference in degrees

ggg = area in millionths divided by 100

h = intensity, scale : 0 = faint to 5 = very bright

i = check, units digit of sum of preceding 14 digits

V. — Magnetic Activity

MAG*aa bbccc ccccc ddefx ghhhh*

aa = observatory : CH = Cheltenham ; SI = Sitka, etc.

bb = Greenwich date of beginning of period (hour of beginning by arrangement with observatory) [1]

cccccccc = K figures for the 24-hour period reported

dd = sum of K-figures for the Greenwich day given in « *bb* »

e = character figure for the day : 3 = 0 ; 5 = 1 ; 7 = 2

f = character of the trace : 3 = magnetic bay ; 5 = rapid small fluctuations ; 7 = long deep fluctuations ; 9 = irregular

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[1] Cheltenham = 1200, Sitka = 1800, College = 1800, Barrow = 2100, Anchorage = 1800 UT.

g = key to time following : 1 = storm end ; 6 = gradual storm begin ; 7 = sudden storm commencement ; 3 = begin brief isolated bay

hhhh = U. T. of phenomenon occurring in 24-hour period described by « *cccccccc* »

VI. — Sudden Ionospheric Disturbances (SID)

SPIDE *aabbb cdddd*

aa = date

bbb = station code, e.g. : 211 = Washington ; 001 = Bagneux ; 213 = Lindau

c = always a zero

dddd = U. T. of phenomenon

VII. — Evaluation of North Atlantic Radio Propagation Conditions

VAL*aa bcdef ghijk lmnop qrstu vwxyz* ABCDE FGHIJ KLMNO

aa = date of report

b, *c*, *d*, etc. = degree of disturbance according to the various indicators :
7 = quiet ; 6 = moderate/quiet ; 5 = moderate ; 4 = moderate disturbed ; 3 = disturbed

k, *u*, E, O = check, units digit of sum of preceding 9 digits

b = Solar
c = Navy AM
d = Navy PM
e = Coast Guard AM
f = Cosat Guard PM
g = FCC 0200 U. T.
h = FCC 1100 U. T.
i = FCC 1900 U. T.
j = Army Sig. Corps PM
k = check, units digit of sum of preceding 9 digits
l = BBC AM
m = BBC AM
n = MDR AM
o = CBC PM
p = Washington
q = Resolute Bay
r = Baker Lake
s = Churchill
t = Ft. Chimo
u = Check, units digits of sum of preceding 9 digits
v = Winnipeg
w = St. Johns
x = Ottawa
y = Mag. Int. 21-06 U. T.
z = Mag. Int. 06-15 U. T.

A = Mag. Int. 15-21 U. T.
B = Mag. Var. 21-06 U. T.
C = Mag. Var. 06-15 U. T.
D = Mag. Var. 15-21 U. T.
E = checks, units digit of sum of preceding 9 digits
F = DF 21-24 U. T. (previous date)
G = DF 00-03 U. T.
H = DF 03-06 U. T.
I = DF 06-09 U. T.
J = DF 09-12 U. T.
K = DF 12-15 U. T.
L = DF 15-18 U. T.
M = DF 18-21 U. T.
N = Overall Summary at 2100 U. T.
O = check, units digit of sum of preceding 9 digits

VIII*a*. — Short Term Forecast
(Individual forecast)

CRPL ATLANTIC / PACIFIC RADIO SFORECAST *aabb*S *ccccc ddddd*

aa = Greenwich date of beginning of 12-hour forecast interval

bb = Greenwich time of beginning of 12-hour forecast interval

c = letter part of forecast statement (description of current conditions) — repeated 5 times : N = normal ; U = unsettled ; W = disturbed

d = number part of forecast statement (expected average quality of propagation conditions in 12-hour forecast interval beginning at *bb*) — repeated 5 times :

1 = useless	4 = poor to fair	7 = good
2 = very poor	5 = fair	8 = very good
3 = poor	6 = fair to good	9 = excellent

(Sample : CRPL ATLANTIC RADIO SFORECAST 2106S NNNNN 44444)

VIII*b*. — Short Term Forecasts
(Daily record)

ST*abb cdefg hijkl* (*mmnno*)

a = A = Atlantic ; P = Pacific

bb = date of beginning of period

cd = forecast of 00 to 12, e.g. « N4 » (the letters are coded as follow : N = 7 ; U = 5 ; W = 3)

ef = forecast for 06 to 18

gh = forecast for 12 to 24

ij = forecast for 18 to 06

k = key to following group : 0 = no specials ; 9 = special forecast in following group

l = check, units digit of sum of preceding 11 digits

mm = time to nearest hour special was issued

nn = special forecast, e.g. : « W2 » coded as 32

o = check, units digit of sum of preceding 4 digits

IX. — Medium Term (Daily) Forecast

CRPL ATLANTIC / PACIFIC RADIO MFORECAST *aabbm ccccc aabb*M *ccccc*

aa = Greenwich date of beginning of 12-hour forecast interval

bb = Greenwich time of beginning of 12-hour forecast interval

c = expected average quality of propagation conditions in 12-hour forecast interval beginning at *bb* — repeated 5 times :

1 = useless	4 = poor to fair	7 = good
2 = very poor	5 = fair	8 = very good
3 = poor	6 = fair to good	9 = excellent

(Sample : CRPL ATLANTIC RADIO MFORECAST 2500M 44444 2512M 66666)

X. — Advance Forecast

CRPL ATLANTIC / PACIFIC RADIO JFORECAST *aabbb bbbbc ddeef*

(one group for each expected disturbed period)

aa = date

bbbbbbb = forecast (J-scale) for first seven days *after* date

c = check, units digit of sum of preceding 9 digits

dd = date of beginning of disturbed period

ee = date of end of disturbed period

f = check, units digit of sum of preceding 4 digits

(Sample : CRPL ATLANTIC RADIO JFORECAST 16445 66654 18199)

XI. — Ionospheric Disturbance Data
(Short form)

(long form has 7 groups; groups 2, 3, 4 are the same in each, except for the last digit in group 4)

ION*aa* *bbccc* *ddeef* *ffggh* *ijklm*

aa = station : WA= Washington ; OT = Ottawa, etc.

dd = date of end of period

ccc= *fo*F2 at 18 h. previous day (Local Standard Time) (tenths of Mc/s)

dd = *fo*F2 at 00 current day (Local Standard Time) (tenths of Mc/s)

ee = *fo*F2 at 06 current day (Local Standard Time) (tenths of Mc/s)

ff = *fo*F2 at 12 current day (Local Standard Time) (tenths of Mc/s)

gg = number of hours in 24 before 12 h. the F2 layer was scaled

h = maximum *f*E*s* in period 00-06 LST in megacycles (9 = 9 Mc/s or more)

ijklm = special indicators, varying with the station

XII. — Ionospheric Disturbance Data
(Long form)

ION*aa* *bbccc* *ddeef* *ffggh* *ijklm* *mnnop* *qrstu*

aa = station : WA = Washington ; OT = Ottawa, etc.

bb = date of end of period

ccc = *fo*F2 at 18 h. previous day (Local Standard Time) (tenths of Mc/s)

dd = *fo*F2 at 00 current day (Local Standard Time) (tenths of Mc/s)

ee = *fo*F2 at 06 current day (Local Standard Time) (tenths of Mc/s)

fff = *fo*F2 at 12 current day (Local Standard Time) (tenths of Mc/s)

gg = number of hours in 24 preceding 12 h. the F2 layer was scaled

h = average signal strength of WWV-5 Mc/s, 1800-0600 LST

i = number of hours WWV-5 Mc/s heard, 04-12 LST

j = number of hours WWV-10 Mc/s heard, 04-12 LST

k = number of hours WWV-15 Mc/s heard, 04-12 LST

l = number of hours WWV-20 Mc/s heard, 04-12 LST

mm = fmin. at 0001 LST

nn = fmin. at 1200 LST

o = maximum intensity of aurora (0, 1, 2, 3 ; 3 = very bright)

p = percentage of hours of aurora to total observable hours :

0 = no observation possible	3 = 26-50 per cent
1 = 0 per cent	4 = 51-75 per cent
2 = 1-25 per cent	5 = 76-100 per cent

q = F region spreadiness at 00
r = F region spreadiness at 03
s = F region spreadiness at 06
t = F region spreadiness at 09
u = F region spreadiness at 12

1 = clear thin trace
2 = *o or x* trace spread
3 = *o and x* trace spread
4 = *o and x* trace spread, with spur
5 = *o and x* trace spread, overlapping but distinguishable
6 = spread, inside and outside edges clear
7 = spread, outside edge indefinite
8 = spread, inside edge indefinite
9 = blob with no definite edges
0 = no F region observed

Note 1. — Symbols to explain missing *fo*F2 values : 01 or 001 = A 02 = B ; 03 = C... 07 = G ; 08 = N ; 09 = S.

Note 2. — Where type of message is clear, the first group is sometimes replaced by *aaa'a'a'*, where *aa* is the station designation (its geographic latitude in degrees) and *a'a'a'* is the serial number of the message.

XIII. — Solar Radio Waves

SRW*aa bccde*

aa = Greenwich date

b = observatory and frequency : 1 = Cornell, 200 Mc/s

cc = relative intensity of background, in tenths (observations to local noon)

d = burst classification : 0 = quiet ; 1 = few ; 2 = many ; 3 = storm

e = check, units digit of sum of preceding 6 digits

Ionospheric Propagation

To the attention of Members of Commissions III, IV and V

We publish hereunder abstracts and annexes of a letter sent by Dr. J. H. Dellinger, Chairman of C.C.I. Study Group VI (Ionospheric Propagation) to all participants of this group.

« Resolution 5 of Geneva indicated that each Study Group should establish a list of definitions of the principal terms and symbols used in its field. It is my thought that such definitions, as far as ionospheric propagation is concerned, are adequately covered in generally accepted standards issued by other organizations, e.g., U.R.S.I., I.R.E., I.E.C., and various national organizations. The standards are widely available and in use. If, however, you feel that there are terms and symbols in our field for which we should establish definitions, please tell me of them, and if possible suggest a definition in each case. »

« The Geneva Recommendations, Questions, etc., referred certain matters to the U.R.S.I. (International Scientific Radio Union) for comment or study. These were examined at the 1952 General Assembly of U.R.S.I. at Sydney, Australia. I send herewith the resulting comments or statements of U.R.S.I. I would be glad to have your thoughts on any of these. »

Comments by International Scientific Radio Union at Australia 1952 General Assembly

Recommendation 56
The reservation of frequency for the study of extraterrestrial radio noise

It is considered impracticable to make general use of the frequencies specified for solar observations ; however, it is suggested that C.C.I.R. ask the Frequency Allocation authorities to give all possible protection to those engaged in radio astronomical measurements in the radio spectrum from 10 Mc/s to 30 000 Mc/s.

Recommendation 57
Production and reduction of ionospheric data : standards, symbols and conventions (1)

Whereas the coordination of conventions and symbols used in the systematic reduction of records of ionospheric soundings, hitherto carried out both by C.C.I.R. and U.R.S.I., has by Recommendation 57 of C.C.I.R. devolved solely upon U.R.S.I., it is resolved that :

(1) A permanent sub-committee of U.R.S.I. Commission III be appointed to coordinate this work, with National Committees having a major interest naming one member each and Commission III designating one of these as Chairman.

(2) This Committee will, between General Assemblies, collect proposals for modifying the conventions and symbols in the light of current experiment and experience, the proposals to be acted on by the Committee at the following General Assembly.

(3) The conventions and symbols shall be such that the operational use of the data in ionospheric predictions shall be facilitated and also, as much as possible, the use of the systematic reduction for ionospheric research purposes.

(4) In the next biennium the Committee shall pay special attention to the problem of systematic reduction of observations made at high geomagnetic latitudes.

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(1) *U.R.S.I. Inf. Bul.*, **73**, p. 41.

Recommendation 59

Exchange of information for the preparation of short-term forecasts and the transmission of ionospheric disturbance warnings (1)

U.R.S.I. has considered Recommendation 59 of the C.C.I.R. and as regards paragraph 3, calls attention to the work of its permanent Subcommittee on Ursigrams, concerned with the rapid exchange of data useful for short-term forecasting. Further steps to carry out the recommendation of this document are embodied in the following resolution of the Subcommittee taken at the Xth General Assembly of the U.R.S.I. in Sydney.

1. Considering that agreement has been reached in Europe for the centralisation of Ursigram data in Paris, and that data within the American Zone is already centralized in Washington, both centres now agree to cooperate by interchanging by electrical means, at least such information as may be used within 48 hours for the preparation of short-term forecasts. It is expected that Japan, and possibly also Australia, may subsequently cooperate on a similar basis.

2. Owing to the length of Ursigrams, consideration should be given by the Ursigram centres to the provision of essential information in a shortened form at the commencement of each message.

Experience has shown that chromospheric data (CHROM) is of first priority, followed by sudden ionospheric disturbances and other ionospheric anomalies (PERTU), solar noise (SOLER) and solar coronal data (CORON).

3. Further unification of coding is desirable and will again be considered by the permanent Subcommittee on Ursigrams.

4. As regards paragraphs 4 and 5 of the C.C.I.R. Recommendation, the Subcommittee on Ursigrams wishes to defer the standardization of codes until the necessity for the provision of interchange facilities on an international basis, both for short-term warnings and for data leading to the improvement of such warnings, has become more evident.

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(1) *U.R.S.I. Inf. Bul.*, **73**, p. 44.

5. It is recommended that an Australian representative be added to the Permanent Subcommittee on Ursigrams.

In addition to these recommendations consideration has been given to the proposal for the establishment of a new U.R.S.I. Subcommittee for the Publication of Ionospheric Data. This proposal was forwarded through Sir Edward Appleton from the Chief of the Central Radio Wave Observatory, Tokyo, Japan. Following study of the document, it is recommended that :

i. The Official Members of Commission III representing each country be asked to prepare, as soon as possible, a comprehensive list of all available basic hourly values of ionospheric data for their respective countries. Such lists should cover the full period from the commencement of routine recording to the end of 1951, and should indicate which material could be made available as reprints, which material could be supplied on special request, and which material could not be made readily available. The lists should be forwarded to the permanent secretary of U.R.S.I. for publication as a single report.

ii. The Official Members of Commission III should be asked to forward to the permanent secretary of U.R.S.I., at the conclusion of each year, a comprehensive register of all current basic ionospheric data tabulated or published during the year by their respective countries.

iii. Consideration should be given by the National Committees before the XIth General Assembly of U.R.S.I., to the Japanese suggestion that ionospheric hourly values from all countries be published together, possibly as monthly units, by a proposed new Publishing Subcommittee of U.R.S.I. Such a publication would replace existing National publications.

Recommendation 69. — Prediction of solar index (1)

Commission III of U.R.S.I., having taken note of Recommendation N° 69 of C.C.I.R., regarding the selection and prediction of indices of solar activity applicable in the prediction of ionospheric characteristics makes the following comments :

(1) It is highly desirable that the technique of modern statistics

(1) *U.R.S.I. Inf. Bul.*, **73**, p. 47.

be brought to bear on the prediction of the commonly used relative sunspot numbers. Autocorrelation methods seem especially promising but the problem of dealing with a finite time series has not yet been adequately handled.

(2) U.R.S.I. concurs that for radio purposes the relative sunspot number should eventually be supplemented by a less arbitrary and more objective index of solar activity which affects the ionosphere. Although measurement of other promising indices should be undertaken, it is obvious that they will not become immediately useful. Satisfactory predictions can be made only from data taken for many years. At the present time, an index which seems to hold promise for eventual use is the mean-flux-density of approximately 3 000 Mc/s solar radiation for which satisfactory observations now exist for four years.

(3) In seeking a solar index to supplement the relative sunspot number, one should not overlook the possibility of indices derived directly from ionospheric or geomagnetic observations. In this connection, the square of E-layer critical frequencies normalized to the subsolar point is suggested. Data of this kind are available for about twenty years.

Study Programme N° 23
Measurements of atmospheric radio noise (1)

See Resolutions of Commission IV, U.R.S.I., Vol. IX, Fasc. 1, p. 67 and U.R.S.I., Inf. Bul., **76**, p. 11.

Question N° 53
Choice of a basic index for ionospheric propagation

See Resolutions of Sub-Commission Vc, U.R.S.I., Vol. IX, Fasc. 1, p. 71 and U.R.S.I., Inf. Bul., **76**, p. 14.

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(1) *U.R.S.I. Inf. Bul.*, **73**, p. 61.

C.C.I.R. (green sheet) Recommendation on ionospheric absorption (1)

The Report of the Working Party on Ionospheric Absorption of the IXth General Assembly at Zurich and the (Green Sheet) Recommendation of the C.C.I.R., Study Group VI were considered. In the former report the opinion was expressed that the intensity of cosmic noise might be too low to permit of accurate absorption measurements, but from results obtained in the last two years it is now clear that useful results can be obtained by this method. Dr. Laffineur described equipment developed in France for such measurements and Mrs. Mitra and Shain described some results already obtained in Australia. The recommendations set out in the C.C.I.R. document were considered to be satisfactory but further consideration was given to other methods of measuring absorption and in particular the observation of extra-terrestrial noise radiation mentioned above. After discussion in which the desirability of continuing the Slough absorption measurements for comparison with measurements by any new methods, the Working Party formulated the following resolution :

« The Working Party on Ionospheric Absorption is in general agreement with the draft recommendations of C.C.I.R., but in connection with methods of investigating ionospheric absorption, we feel that the method employing cosmic noise signals merits closer attention and further development. However we are fully agreed with the principal conclusions embodied in the report of the Working Party on Ionospheric Absorption of Commission III of the IXth General Assembly and in particular paragraph 3(*a*), in which the need for maintaining continuity between existing and new methods of measuring ionospheric absorption was emphasized. »

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(1) *Inf. Bul.*, **73**, p. 50.

WORLD METEOROLOGICAL ORGANIZATION

The World Meteorological Organization invited the Members of U.R.S.I. to attend, as observers, the First Session of the Commission for Instruments and Methods of Observation to be held from August 10 to September 5, in the Economics Building of the University of Toronto, Toronto, Canada.

Prof. J. Lugeon will represent U.R.S.I. at the session.

Members of U.R.S.I. who are intended to attend this meeting are kindly requested to inform the Secretary General of U.R.S.I. who will provide them with supplementary information.

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See also the work mentioned on p. 64.

INTERNATIONAL GEOPHYSICAL YEAR

National Committees

SECOND LIST

This list should be added to the list published in Information Bulletin N° 77. National Committees to which amendment or addition is made are reproduced in full and indicated by an asterisk.

Canada

Correspondance to be sent to : T. D. NORTHWOOD, Secretary, Associated Committee on Geodesy and Geophysics, National Research Council, Ottawa, 2.

Germany (Federal Republic)

Director : Prof. Dr. J. BARTELS, Geophysikalisches Institut der Universität Herzberger Landstrasse, 180 (20*b*) Göttingen.

Great Britain (*)

(1) *British National Committee for the International Geophysical Year* :

Professor S. CHAPMAN, (*Chairman*), The Geophysical Institute, College, Alaska, U.S.A.

Members : Dr. W. J. G. BEYNON, Vice-Admiral A. DAY, Dr. G. E. R. DEACON, Mr. T. GOLD, Sir Nelsol JOHNSON, Sir Harold SPENCER JONES, Prof. A. C. B. LOVELL, Mr. J. PATON, Mr. J. M. WORDIE.

(2) *Aurora Sub-Committee of the British National Committee for the International Geophysical Year* :

Prof. S. CHAPMAN, (*Chairman*).

Members : Dr. A. H. R. GOLDIE, Prof. R. V. JONES, Prof. A. C. B. LOVELL, Mr. J. PATON, Prof. D. R. BATES.

(3) *Sub-Committee of the British National Committee for Scientific Radio* :

Dr. R. L. SMITH-ROSE, (*Chairman*), Director, Radio Research Station, Slough, Bucks.

Members : Dr. W. J. G. BEYNON, Prof. A. C. B. LOVELL, Mr. J. A. RATCLIFFE, Mr. H. W. L. ABSALOM.

Greece

Secretary : Prof. Jean TRIKKALINOS, Masalias, 4, Ahtena.

Members :

Astronomy : Prof. J. XANTHAKIS.
Meteorology : Prof. I. MARIOLOPOULOS ; Prof. C. ALEXAPOULOS.
Geodesy : Mr. SPHIKAS.
Seismology : Prof. A. GALANOPOULOS.
Radioelectrology : Prof. A. ANASTASSIADIS.
Geography : Prof. J. TRIKKALINOS.

Morocco

Chairman : Mr. PASQUALINI.

Secretary : Commandant ROUX, Chef du Service de Physique du Globe et de Météorologie, 2, rue de Foucauld, Casablanca.

New Zealand

Correspondance to be sent provisionally to : Miss M. WOOD, The Royal Society of New Zealand, Victoria University College Buildings, Wellington W. 1.

Switzerland (*)

Chairman : Prof. Dr. J. LUGEON, Station Centrale Suisse de Météorologie, Krähbühlstrasse, 58, Zurich.

Secretary : Dr. E. WANNER, Station Centrale Suisse de Météorologie, Zurich.

Members : Prof. Dr. C. F. BAESCHLIN, Prof. E. GUYOT, Prof. Dr. R. HAEFELI, Prof. Dr. G. F. HOUTERMANS, Prof. Dr. W. JOST, Dr. W. MÖRIKOFER, Prof. Dr. Fr. TANK, Prof. Dr. M. WALDMEIER.

Spain

Secretary : Mr. Antonio ROMANA, Director, Observatorio del Ebro, Tortosa.

Yugoslavia

Secretary : S. P. BOŠKOVIĆ, General Secretary, Geodesy and Geophysics National Committee, Conseil des Académies de la République Fédérative de Yougoslavie, Bozidara Adzije II, Boîte Postale 794, Beograd.

NEW BOOKS AND WORKS

Department of Scientific and Industrial Research (U. K.). Radio Research : *Special report n° 23 : « Characteristics of the ionosphere observed in Great Britain,* 1930-1946 ». Her Majesty's Stationery Office, P. O. Box 569, London SE 1. Price : 1/6 sh.

This report describes the work conducted during the past twenty-five years in connection with observations on the characteristics of the ionosphere.

Tables giving the results of all the measurements during the period 1930-1946 are available in a micro-film or enlarged form, on application to H. M. Stationery Office. A minimum of ten consecutive tables on micro-films can be supplied at 3 d. per table, and a microfilm copy of all the tables is priced at £ 3 3 s. 0 d. Enlargements on sheets 9 in. × 7 in. are available at 1 s. 0 d. per table. Sets of no less than 100 consecutive tables can be supplied at £ 2 10 s. 0 d. per 100 net. All prices quoted are exclusive of postage.

The tables may be consulted at the Technical Information and Documents Units (T.I.D.U.) of the Department at Cunard Building, 15 Regent Street, S. W. 1 (Tel. n° Whitehall 9788), or by arrangement at the Radio Research Station, Ditton Park, Slough (Tel. n° Slough 20.391).

Request should quote table numbers, place of observation, and the form in which they are required.

Worl Meteorological Organization (W.M.O.). Commission for Aerology. Working Group on Radioelectric Meteorology. *World Symposium on Spherics, Final Act of the Meeting in Zurich* (17-24 March 1953).

This work, in English and in French, contains the following items : President's report, list of Members of the Working Group on Radioelectric Meteorology, list of attendance to the Symposium, Agenda, Resolutions and recommendations, minutes, titles of contributions made at the scientific discussions, list of documents and working documents.

International Electrotechnical Commission. *International letter symbols used in connection with electricity. Quantity symbols. Alphabets and letter type* (Third Edition), published by the Central Office of the I.E.C., 39, route Malagnou, Geneva (Switzerland). Price : Swiss francs 3.

Radio Spectrum Conservation. A program of conservation based on present uses and future needs, by the Joint Technical Advisory Committee of the I.R.E. and R.T.M.A. A 221-page volume, cloth boards, 14 × 21 cm, McGraw-Hill Book Company, Inc., New York 1952, Price : $ 5.

This book is one of the reports made by the Joint Technical Advisory Committee formed in 1948 by the Board of Directors of the Institute of Radio Engineers, U.S.A., and the Radio-Television Manufacturers Association of the U.S.A. The authors give a general survey of the history of frequency allocation by international agreement; a study on the propagation characteristics of radio waves; an approach to the problem of frequency allocation; a criticism of the present allocation and finally the dynamic conservation of spectrum resources.

Die Ionosphäre, by K. Rawer. A 189-page volume, cloth boards, measuring 15 × 23.5 cm, with 67 figures. P. Noordhoff N. V., Groningen (Netherlands).

This book gives practical and theoretical information about the ionosphere, from the geophysical as well from the radiocommunication aspect.

The author describes observation methods used and the results obtained as regards the physical constants of the ionosphere and he treats the theoretical aspects of the different conducting layers.

Fortschritte der Radio-Technik. Records of radio technic discoveries in 1951-1952, 382 pages, 569 figures, diagrams and tables, cloth boards. Frankh'sche Verlagshandlung W. Keller and Co., Stuttgard-O Pfizerstrasse 5-7. Price DM 46.

Fortschritte der Funtechnik. 1940-1949, 387 pages, more than 500 figures, diagrams and tables, cloth boards. Frankh'sche Verlagshandlung W. Keller and Co., Stuttgard-O, Pfizerstrasse 5-7. Price DM 60.

CALENDAR
OF FORTHCOMMING INTERNATIONAL SCIENTIFIC CONFERENCES

This list should be added to the calendar published in Bulletin N° 77. It amplifies information already given, and where amendment is made to a Conference mentionned in Bulletin N° 77 the entry is reproduced in full and indicated by an asterisk.

Date	Subject	Organizer	Location
1953 June 23-27	*Symposium on the Coordination of Galactic Research I.A.U.	Prof. J. H. Oort, Leiden Observatory, Leiden, Netherlands.	Groningen Netherlands
June 24-26	Colloquium on the study of the water molecules in solids by electromagnetic waves.	Secretary, Centre National de la Recherche Scientifique, 13, quai Anatole France, Paris 7e.	Paris
July	I.C.S.U. Joint Commission on Physico-Chemical Data and Symbols.	Prof. A. Hill General Secretary I.C.S.U. c/o the Royal Society, Burlington House, Piccadily, London W. 1.	Stockholm
July 6-11	*Symposium on Gas Dynamics of Interstellar Clouds I.A. and I.U.T.A.M.	Dr. H. C. van de Hulst, Leiden Observatory, Leiden, Netherlands.	Cambridge (U. K.)

July 18-23	Conference on Ionization Phenomena in Discharges.	Dr. G. Francis, Secretary of Conference, Clarendon Laboratory, Oxford.	Oxford
July 29-August 7	13th International Congress of Pure and Applied Chemistry. 17th Conference of I.U.P.A.C.	Division of Chemistry and Chemical Technology, National Research Council, Washington 25, D. C. or 13th International Congress of Pure and Applied Chemistry, Stockholm 70.	Stockholm and Uppsala
September 15	Regional Association for South-America of W.M.O. 1st Session.	Dr. G. Swoboda, Secretary General of W.M.O. Campagne Rigot, Avenue de la Paix, Geneva, Switzerland.	Rio de Janeiro
August 3-7	Regional Association for North and Central America of W.M.O. 1st Session.	Idem.	Toronto, Canada
August 4-12	7th International Congress for the History of Science and 3rd General Assembly of I.U.B.S.	Prof. F. S. Bodenheimer, President of Congress, Hebrew University, Jerusalem.	Jerusalem
August 10-September 5	Commission for Aerology and Commission for Instruments and Methods of Observations of W.M.O. 1st Sessions.	Dr. G. Swoboda.	Toronto, Canada

Date	Subject	Organizer	Location
August 17-21	I.U.B.S. 11th General Assembly.	Prof. P. Vayssière, Musée National d'Histoire Naturelle, 57, rue Cuvier, Paris 5e.	Nice, France
August 21-25	I.C.S.U. Joint Commission on High Altitude Research Stations.	Dr. R. Stämpfli, 5, Bühlplatz, Berne, Switzerland.	Denver, Colorado
October 8-11	Fédération Internationale des Associations Nationales d'Ingénieurs. (F.I.A.N.I.). 1st Congress.	Prof. Ing. A. Ferrari-Toniolo, 90, Via delle Terme, Roma.	Roma
November 9-12	Conference on Radiometeorology (American Meteorological Society Radar Weather Conference, Institute of Radio Engineers, U.R.S.I. National Commission II, Joint Commission on Radio Meteorology).	Mr. Kenneth C. Spengler, Executive Secretary of American Meteorological Society, 3, Joy Street, Boston, 8.	Austin, Texas
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July 21-28	I.U.Cr. 3rd General Assembly.	R. C. Evans, Cavendish Laboratory, Cambridge.	Paris
Autumn.	International Mathematical Union. 2nd General Assembly.	Prof. E. Bompiani, Instituto Matematico, Citta Universitaria, Roma.	Paris
	3rd Symposium on Information Theory.		London