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International Scientific Radio Union

U. R. S. I.

INFORMATION BULLETIN

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42, Rue des Minimes, BRUSSELS

INFORMATION

It is with deep regret that we have to inform our readers that Mr. Charles le Maistre, General Secretary of the International Electrotechnical Commission died on July 5th, 1953.

We tender our sincere condolences to the I.E.C. on the occasion of the great loss it has suffered.

X^{th} GENERAL ASSEMBLY

Publications

We have to inform our readers that fascicules 1 to 6 of the Proceedings of the Xth General Assemblies (Vol. IX) have been sent to the National Committes for distribution to their members. Supplementary copies are available at the following prices :

	B. F.	sh.	U.S.A. Dollars
Fasc. 1 (Administrative proceedings)	75	10/1	1.5
Fasc. 2 (Commission I)	50	7/2	1
Fasc. 3 (Commission II).................	65	9/4	1.3
Fasc. 4 (Commission III)	80	11/	1.6
Fasc. 5 (Commission IV)	40	5/6	0.8
Fasc. 6 (Commission V)	90	12/8	1.8

Fascicule 1 is concerned with 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.

LETTER TO THE ASSOCIATED EDITORS

Letter sent to the Associated Editors through the Presidents or Secretaries of the National Committees

5 August, 1953.

Dear Colleague,

In order to make U.R.S.I. publications, specially our Special Reports better known, our Vice-President, Doctor D. F. Martyn, suggested to send copies, for review, to internationally read journals as *Nature*, the *Journal of Geophysical Research*, the *Journal of Atmospheric and Terrestrial Physics*, *Science Abstracts*, *Comptes rendus Analytiques*, etc., etc.

In order to get in touch with as many journals as possible, we should very much appreciate to receive the names and addresses of such journals which, in your country, you think able to help us in reaching our purposes.

We thank you in advance for your courtesy and attention, and remain,

Yours truly,

The Secretary General,
(*sgd*) HERBAYS.

COMMISSIONS

Commission II

REPORT OF THE JAPANESE NATIONAL COMMISSION II

by H. HATAKEYAMA, *Chairman*

1. — SCIENTIFIC ACTIVITIES

In order to establish better understanding of the radio wave propagation in the lower atmosphere, we decided at the meeting of Sub-Committee II to carry out the cooperative observation of the propagation and meteorological condition over Kwanto plain during the period from 11th to 30th Nov., 1952. Organizations participated in the observation are as follows :

1. Electrical Communication Laboratory, Nippon Telegraph and Telephone Public Corporation (E.C.L.),
2. Radio Research Laboratories (formerly Central Radio Wave Observatory),
3. Technical Laboratory of Broadcast Corporation of Japan (N.H.K.),
4. Meteorological Research Institute,
5. Aerological Observatory at Tateno.

The experimental links of radio wave propagation consisted of sixteen links in which nine frequency bands were used (i. e. 4000, 2700, 510, 472, 200, 150, 103, 65 and 31 Mc/s).

The links were as follows :

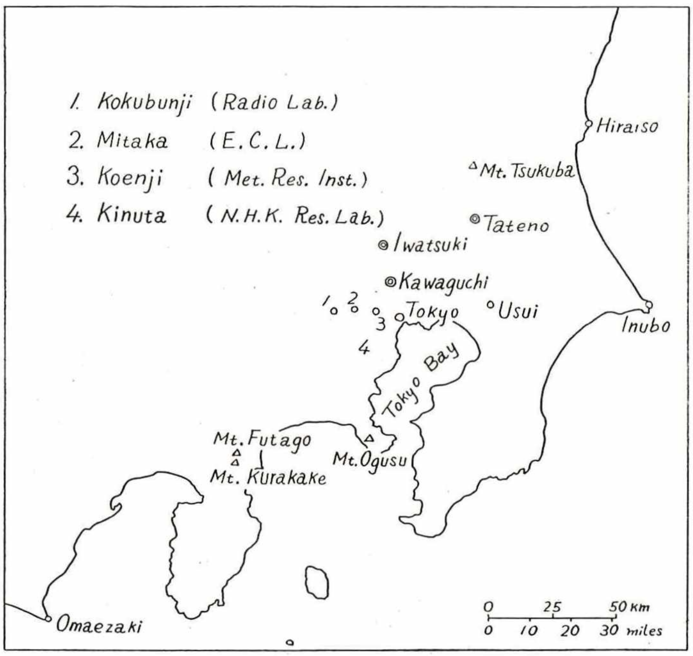
A. link, from E.C.L. (Electrical Communication Laboratory to Mt. Tsukuba (879 m above sea level, 4000 Mc/s),

B. link, from E.C.L. to the side of Mt. Tsukuba (249 m a. s. l., 4000 Mc/s),

C. link, from the side of Mt. Tsukuba to Ogusu Radio Relay Station (243 m a. s. l., 200 Mc/s),

D. link, from Futago Radio Relay Station (1090 m a. s. l.) to the side of Mt. Tsukuba (200 Mc/s),

E. link, from the Meteorological Research Institute to Mt. Tsukuba (2700 Mc/s),
F. link, from the Radio Wave Laboratories at Kokubunji to Hiraiso (153 Mc/s),
G. link, from Hiraiso to Kokubunji (31 Mc/s),
H. link, from Hiraiso to Kokubunji (65 Mc/s),
I. link, from Hiraiso to Inubo (65 Mc/s),
J. link, from Hiraiso to Inubo (472 Mc/s),
K. link, from Inubo to Hiraiso (150 Mc/s),
L. link, from Hiraiso to Omaezaki (31 Mc/s),
M. link, from Hiraiso to Omaezaki (65 Mc/s),
N. link, from N.H.K. Laboratory to the Radio N.H.K. Building Tokyo (510 Mc/s),
O. link, from the Radio N.H.K. Building to Usui (103 Mc/s),
P. link, from Usui to the Radio N.H.K. Building (4000 Mc/s).



Among them, the links from A to D were conducted by the Electrical Communication Laboratory, the link E by the Meteorological Research Institute, the links from F to M by the Radio Research Laboratories, and the links from N to P by the Technical

Laboratory N.H.K. respectively. The meteorological observations of the lower atmosphere with kytoons were made at Tateno by the Aerological Observatory and at Iwatsuki by E.C.L.. The observations were also made on the N.H.K. antenna tower at Kawaguchi (312 m in height) and on the tower at Kokubunji (50 m in height) by the Meteorological Research Institute and the Radio Research Laboratories respectively. The data obtained in the cooperative observations are now under analysis. The second cooperative observations will be carried out in the summer of this year.

Routine observations of 31, 65 and 153 Mc/s waves between Kokubunji and Hiraiso and those of 65, 150 and 472 Mc/s waves between Hiraiso and Inubo (over sea propagation) are continued by the Radio Research Laboratories. The last two waves are remarkably affected by meteorological conditions. A microwave link of 10,000 Mc/s band has been constructed between Inubo and Hiraiso and the routine observation of its field intensity is being carried out. Long range land propagation tests of VHF were carried out, using the 31 and 65 Mc/s waves transmitted from the Hiraiso observatory and received at Mt. Kurakake and Omaezaki, the ranges of these paths are 195 km and 291 km respectively. The observed field intensities were about 10 and 20 db higher than the calculated intensities for the 31 and 65 Mc/s respectively.

The Japanese National Railways installed a 4000 Mc/s 23-channel PPM-AM system in Oct. 1952 to connect Honshu and Hokkaido. This microwave link, including two terminals and two repeater stations, passes Tsugaru Strait where the span is longest and 49 miles over the sea surface. The maximum fading range exceeds 40 db in summer and 10 db in winter. Against these fadings, 52 db of the margin between the free space attenuation and receiving three-shold level were taken and the space diversity system was adopted in the link of the longest span. As the consequence, there was no trouble caused by fading even in summer. The peak power of transmitter was 60 W and the signal to noise ratio as always maintained above 50 db for each channel.

N.H.K. is now broadcasting television wave from three stations, i. e., Tokyo, Osaka and Nagoya. The television field intensity radiated from the top of the Radio N.H.K. Building has been measured in the vicinity of Tokyo and those radiated from the summit of Mt. Ikoma (Osaka) and from the Jock (Nagoya) tower have been measured in the vicinity of Osaka, Kyoto, Kobe, Nara and Nagoya respectively. The Tokyo-Nagoya-Osaka television relay link was established on the basis of 4000 Mc/s propagation tests. This link consists of three terminal stations and five repeating stations, all of them, except Nagoya's, are located on summits of mountains. The distance between successive stations is approximately 77 kilometers.

2. — List of Published Papers

Central Radio Wave Observatory : Statistical Results of the Data of the Routine Observation of VHF between Kokubunji and Hiraiso (in Japanese), Research Reports of Central Radio Wave Observatory, N° 2, p. 108 (1952).

M. Fukushima. — On the Effect of Cold Front on the Ultra Short Wave Propagation (in Japanese), Research Reports of Central Radio Wave Observatory, N° 2, p. 81 (1952).

M. Fukushima, K. Tao, Y. Uyesugi, K. Nishikori, K. Hirao. — Ultra Short Wave Propagation and Mirage. *Journal of Geomagnetism and Geoelectricity,* Vol. 4, p. 141 (1952).

K. Hirao. — A Note on the Anomalous Propagation of UHP (in Japanese), Research Reports of Central Radio Wave Observatory, N° 2, p. 104 (1952).

K. Hirao, Y. Uyesugi, K. Tao. — Propagation Characteristics of UHF over Distance of 125 km, *Journal of Geomagnetism and Geoelectricity,* Vol. 4, p. 131 (1952).

K. Isono, E. Hayashi. — Note on the Thermistor Psychrograph for the Sounding of the Lower Atmosphere, *Papers in Meteorology and Geophysics,* Vol. 3, p. 125 (1952).

I. Murakami. — Propagation Formulae and Calculating Nomogram for VHF and UHF over the Mountains (in Japanese), Research on VHF Communication (edited by H. Nukiyama), March 1953, Tokyo, pp. 227-238.

I. Murakami. — Propagation Formulae and Calculating Nomogram for VHF and UHF over Smooth Earth (in Japanese), Research on VHF Communication (edited by H. Nukiyama), March 1953, Tokyo, pp. 238-245.

K. Naito. — On the Scattering of the Plane Electromagnetic Wave by a Continuous Inhomogeneity with Spherical Symmetry in a Homogeneous Medium, Papers in Meteorology and Geophysics, Vol. 3, p. 313 (1953).

T. Nomura and others. — On the 4000 MC Repeating Equipment used in the Tokyo-Nagoya-Osaka Link (in Japanese), Research on the VHF Communication (edited by H. Nukiyama), March 1953, Tokyo, pp. 557-558.

K. Tao. — On the Propagation Modes of Radio Waves in the Troposphere Bounded by Discontinuous Interface (in Japanese), Research Reports of Central Radio Wave Observatory, N° 2, p. 36 (1952).

O. Tsukizi. — On the Frequency of the Scintillation Fading of Micro-waves, *Journal of Physical Society of Japan*, Vol. 8, p. 130 (1953).

Commission III

Attention of the Members of the Commission is drawn to the Proceedings of the September 1952 Meeting of the Joint Commission on Relationship between Solar and Terrestrial Phenomena (See p. 60).

Commission V

REPORT OF THE JAPANESE NATIONAL COMMITTEE COMMISSION V

by Yusuke Hagihara

Research Activities

A. *Routine Observations* :

(*a*) Tokyo Astronomical Observatory (Mitaka) on 3000, 200, 100 and 60 Mc/s.

(*b*) Research Institute of Atmospherics, Nagoya University (Toyokawa) on 3750 Mc/s.

(*c*) Osaka City University (Osaka) on 3260 Mc/s (including polarization measurements).

The result of these observations are reported to the U.R.S.I. and I.A.U. monthly, and a part of them are broadcast daily through Ursigrams.

B. *Other Activities.* — At Tokyo Astronomical Observatory, the ten-metre paraboloidal radio telescope will be completed in a few months. This radio telescope is to be used on 3000 and 200 megacycles simultaneously.

An apparatus for observating the dynamic spectrum of the solar radiation, and radio interferometers for the observations of the sun and discrete sources are under construction.

F. Moriyama (1) studied the correlation between active sunspots and geomagnetic storms, and concluded that the correlation is more conspicuous when the activity is defined by both spot-type and the magnetic character of the sunspot than by the spot-type alone.

T. Hatanaka and F. Moriyama (2) analyzed the observation of storms of the solar radio emission in metre wavelengths and discussed their characteristics. An intense flare accompanied by a non-polarized outburst seems to act as the exciting agency of a noise storm.

They (3) also calculated the long period variation in the apparent temperature of quiet sun in radio frequencies in accordance with the electron densities in the corona and chromosphere, for the purpose of studying how the temperature changes according to the sunspot cycle.

K. Aoki (5) observed the solar eclipse on February 14, 1953 on 3000 megacycles, and deduced the limb-brightning on that frequency.

At the Research Institute of Atmospherics, a multiple interferometer for the localization of the noise sources on the solar disk on 4000 megacycles has been constructed, and experimental observations have been carried out since March, 1953. It consists of five equatorially mounted paraboloidal aerials, each 1.5 metre in diameter. The main lobes are spaced 43 minutes of arc each other, and each has a half power width of 7.8 minutes of arc (6).

While as to the radiometer used for the routine observation of the solar radio emission on 3750 megacycles, further efforts have been made to improve instrumental stability and the accuracy of measurement as well as to reduce the out put fluctuations (7, 9, 10).

H. Tanaka and T. Kakinuma (8) discussed the measurement of the sky temperature by substitution method. The calibration of the radiometer by hot load (heated from room temperature to about 300 degrees Centigrade) can be extended to 0 degree Kelvin by reversing the phase of the low frequency signal at the phase sensitive detecter in the Dicke type modulation method. Uniform temperature rise of the hot load, rejection of the substitution error and the loss of transmission circuits are the chief points of discussion. The result of measurements on 3750 megacycles shows that the sky temperature is between 0 and 5 degrees Kelvin.

T. Kakinuma (11) calculated the distribution of radio brightness on the quiet solar disk at about 4000 megacycles. Calculations are based on the record of the multiple interferometer on one of the most quiet days, associated with the eclipse observation on February 14, 1953. He concluded that the size of the radio-frequency disk is about six percent larger than that of the optical disk and that the excess region is about 2.5 times bright as that of the optical disk which has the uniform temperature of about 1.9×10^4 degrees.

At Osaka City University, T. Takakura (13, 14) discussed the directivity of the radiation from sunspots by examining the correlation between the intensity of the enhanced radiation and the position of the sunspots on the solar disk.

T. Takakura and others (12) investigated the mechanism of generation and radiation of the solar radio outbursts using the plasma of arc discharges and discharge tubes. It was found that the arc discharge in air radiates intense radio emission at the plasma frequency corresponding to their ion density at the cathode drop region by the interaction between ion sheath and the electron beam from the cathode.

They (15) introduced a theory to be applied to the solar radio outbursts and arc discharge noises. That is, the increasing « distorted space charge wave » with small « transverse » electric component can exist, when the direction of propagation of the wave is oblique to the drift velocity of two streams of charged particles, and radio wave can be radiated obliquely to the drift velocity.

The Radio Research Laboratories (former Central Radio Wave Observatory) constructed in their observatory at Hiraiso (140°38′ E, 36°21′ N) an apparatus for the observation of the solar radio emission on 200 megacycles. Daily observations have been carried out since October, 1952. The aerial used is an equatorially mounted broadside array.

K. Kawakami, M. Onoe and Y. Nakata (16) observed the solar radio emission on 200 megacycles and the conditions in the terrestrial ionosphere simultaneously during the solar eclipse on February 14, 1953, and found a good correlation between them.

List of Published Papers

1. F. Moriyama. — On Sunspots and Magnetic Storms. *Rep. Ion. Res. Japan*, Vol. 5, p. 151, 1951.
2. T. Hatanaka, F. Moriyama. — On Some Features of Noise Storms. *Rep. Ion. Res. Japan*, Vol. 6, p. 99, 1952.

3. T. Hatanaka, F. Moriyama. — A Note on the Long Period Variation in the Radio Frequency Radiation from the Quiet Sun. *Pub. Astr. Soc. Japan,* Vol. 4, p. 145, 1953.

4. S. Suzuki, N. Shibuya. — Observing Equipments for the Extra-terrestrial Radio Emission in the VHF Region. *Tokyo Astr. Obs. Rep.,* Vol. 10, p. 171, 1952 (in Japanese).

5. K. Aoki. — Observation of the Partial Solar Eclipse (February 14, 1953) at the Wavelength of 10 Centimetres. *Rep. Ion. Res. Japan* (in preparation).

6. H. Tanaka, T. Kakinuma. — On the Substitution Measurement of Sky Temperature at Centimetre Waves. *Proc. Res. Inst. of Atmospherics,* Vol. 1, p. 85, Jan., 1953 ; *Bull. Res. Inst. of Atmos.,* Vol. 2, N° 2, p. 121, Dec., 1951 (in Japanese).

7. H. Tanaka, T. Kakinuma, T. Takayanagi. — On the Low-Frequency Part of a Radiometer at Centimetre Waves. *Bull. Res. Inst. of Atmos.,* Vol. 2, p. 124, Dec., 1951 (in Japanese).

8. H. Tanaka, T. Kakinuma. — Equipment for Locating Sources of Solar Noise at 4000 Mc. *Bull. Res. Inst. of Atmos.,* Vol. 3, Nos 1-2, p. 55, Dec., 1952 (in Japanese), and Vol. 4, N° 1, June, 1953 (in Japanese, in press).

9. H. Tanaka, T. Kakinuma, H. Jindo, T. Takayanagi. — Improvement of the Radiometer Used for the Observation of Solar Noise at 8 cm. *Bull. Res. Inst. of Atmos.,* Vol. 3, Nos 1-2, p. 62, Dec., 1952 (in Japanese).

10. H. Tanaka, T. Kakinuma, H. Jindo, T. Takayanagi. — Equipment for the Observation of Solar Noise at 3750 Mc. *Proc. Res. Inst. of Atmos.* Vol. 1, p. 71, Jan., 1953.

11. T. Kakinuma. — On the Distribution of Radio Brightness on the Solar Disk at about 4000 Mc. *Bull. Res. Inst. of Atmospherics,* Vo. 4., N° 1, June, 1953 (in Japanese, in press).

12. T. Takakura, K. Baba, K. Nunogaki, H. Mitani. — The 3000 Mc/s Ion Plasma Noise Radiated from Arc Discharge and Solar Eruption. *Jour. Phy. Soc. Japan,* Vol. 8, N° 3, 1953.

13. T. Takakura. — A Method of Analysis of the Directively of Solar Radio Emission from Sunspots. *Nature,* Vol. 171, p. 445, 1953.

14. T. Takakura. — On the Directivity of Solar Radio Emission from Sunspots. *Jour. Phy. Soc. Japan,* Vol. 8, N° 3, 1953.

15. T. Takakura, K. Baba, K. Nunogaki, H. Mitani. — The Plasma Noise Radiated from Arc Discharges and Solar Eruptions, and Increasing Space Charge Wave with Transverse Component of Electric Field (Contributed lately to J.A.P.).

16. K. Kawakami, M. Onoe, Y. Nakata. — Simultaneous observations of 200 Megacycle Solar Radio Emission and Terrestrial Ionosphere. *Rep. Ion. Res. Japan,* (in preparation).

Documentation

Attention of the Members of the Commission is drawn to the Proceedings of the September 1952 Meeting of the Joint Commission on Relationship between Solar and Terrestrial Phenomena (See p. 60) and on the list of Radio-Solar Observatories (p. 16).

Commission VI

We draw the attention of the Members of Commission VI to the « Bibliography on Communication Theory » issued by the C.C.I.R. (See p. 61).

IONOSPHERIC STATIONS

The following modifications have to be brought to the informations given in the *Information Bulletin* n° 77 (Jan.-Feb. 1953), p. 23-29, for the stations mentioned hereunder.

Australia

Brisbane. — Geomagnetic latitude : 35°7 S.

Month and year of the beginning of the publication of results (2) : 1-49.

Macquarie Isl. — Time used : 157°5 E.

Townsville. — Month and year of the beginning of the publication of results : 1-52.

Brisbane, Canberra, Hobart, Macquarie Is., Townsville. — Results are published in *Australian Ionospheric Predictions, Series D.*

Watheroo. — Results are published in the *Geophysical Observatory Report* of the Australian Department of National Development.

France

Bizerte. — To delete.

Information on publication of results (4) :

Dakar : S.P.I.M. — O — Série D.

Djibouti : S.P.I.M. — O — Série Dj.

Fribourg : S.P.I.M. — O — Série F.

Kerguelen : On request. Limited distribution.

Nha-Trang : On request. Limited distribution.

Tananarive : S.P.I.M. — O — Série T.

Terre Adélie : *Bulletin d'Information du L.N.R.* ; *S.P.I.M.*, n° 42, 43, 44, Cdt. Charcot.

STATIONS PERFORMING RADIO SOLAR OBSERVATION

Station	Geographical		Frequency in Mc/s	Responsible for Observation
	Latitude	Longitude		
Cambridge	52°12′12″ N	0°5′40″ E	81 and 175	Dr. Martin Ryle.
Ithaca	42°29′18″ N	76°27′7″ W	200	Dr. Chas. R. Burrows.
Kodaikanal	10°14′ N	77°28′ E	100	Dr. A. K. Das.
Marcoussis	48°38′28″ N	2°12′35″ E	169	Dr. Jean Louis Steinberg.
Meudon	48°48′18″ N	2°13′52″ E	255 and 545	Dr. Ir. M. Laffineur.
Mitaka	52°14′ N	139°32′32″ E	60, 100, 200 and 3000	Prof. Dr. Y. Hagihara.
Nera	52°14′31″ N	5°4′38″ E	140 and 200	Ir. B. van Dijl.
Osaka	34°42′2″ N	135°30′36″ E	3260	Prof. Dr. Y. Hagihara.
Oslo	59°56′20″ N	10°43′23″ E	200	Ir. G. Eriksen.
Ottawa	45°17′45.7″ N	75°35′10″ W	2800	Mr. A. E. Covington.
Sydney	33°53′26.1″ S	151°2′16.2″ E	62, 98, 600, 1200, 3000 and 9400	Mr. S. F. Smerd.
Toyokawa	34°50′6″ N	137°22′5″ E	3750	Prof. Dr. Y. Hagihara.

Notes :

1. This list has been drafted by Ir. A. H. de Voogt, Chairman of Sub-Commission V*a* on World Wide Chaine of Solar Radio Observatories.

2. National Committees, Members of Sub-Commission V*a* and Organizations concerned, are kindly requested to inform us of the changes that should be brought to the above list.

INTERNATIONAL GEOPHYSICAL YEAR

First Plenary Meeting

MINUTES OF THE MEETING

The first plenary meeting of the Special Committee for the International Geophysical Year (C.S.A.G.I.) was held in Brussels from June 30 to July 3rd, 1953. The meeting was attended by 12 members of the Committee and 13 observers from 9 different countries. U.R.S.I. was represented by the President, Father Lejay, the Official delegates : Dr. Berkner, Dr. Beynon and Prof. Boella and by the Secretary General.

The National Committees of the C.S.A.G.I. had been asked to submit their proposals ; the list of documents (p. 18) gives the report, which were sent to the Committee and distributed for the meeting.

The parts of these documents which appeared to be of special interest to the various activities of U.R.S.I. are published on pp. 19-58.

At the opening session, the C.S.A.G.I. elected the following officiers :

Chairman : Prof. S. Chapman.

Vice-Chairman : Dr. L. V. Berkner.

General Secretary : Mr. M. Nicolet (from November 1st, 1953).

To consider the submitted documents and to draft a program which took into accounts the possibilities of the countries which have decided to collaborate to the enterprise, the C.S.A.G.I. appointed 11 Working Groups to deal with : 1. World Days, 2. Meteorology, 3. Magnetism, 4. Aurorae and Airglow, 5. Cosmic Rays, 6. Solar Activity, 7. Ionosphere, 8. Longitudes and Latitudes, 9. Glaciological and Climatic Change Studies, 10. Oceanography and 11. Publications.

The reports and recommendations of the Workings Groups were approved and handed to a Revising Committee which will coordinate these documents and draft a provisional programme to be distributed to National Committees, to the Unions interested into the C.S.A.G.I.'s activities and to the W.M.O. These organizations will draft a final programme of investigations and observations to be carried out during the International Geophysical Year.

Besides the scientific decisions, the following were the main decisions reached by the C.S.A.G.I...

1. The documents of the Committee may be written in either the French or the English language, except that the basic reports of the Committee should appear in both French and English, though the appendices to the reports could appear in either language.
2. National Committees and organizations taking part into the International Geophysical Year should be asked to give effective publicity for this international scientific enterprise.

A copy of the provisional programme shall be sent to each National Committee of U.R.S.I.; National Committees wishing to receive supplementary copies are requested to inform as soon as possible the Secretary General of U.R.S.I.

LIST OF DOCUMENTS

Nº 1 : Programme of the Swiss National Committee.
Nº 2 : Programme of the Norwegian National Committee.
Nº 3 : Proposals of the Japanese National Committee.
Nº 4 : Programme of the Netherlands National Committee.
Nº 5 : Programme of the Spanish National Committee.
Nº 6 : Programme of the French National Committee.
Nº 7 : German Proposals.
Nº 8 : W.M.O. Preliminary Report of the Working Group of the International Geophysical Year.
Nº 9 : Programme of the Danish National Committee.
Nº 10 : Recommendations of the Working Group of Radioelectric Meteorology of the W.M.O.
Nº 11 : Programme of the Yugoslavian National Committee.
Nº 12 : Swedish Proposals.

N° 13 : Austrian Proposals.
N° 14 : Comments and Suggestions from Sir Harold Spencer, International Astronomical Union.
N° 15 : Programme of the British National Committee.
N° 15*a* : British National Committee. Aurora Subcommittee. Report by Mr. J. Paton on Observation of Aurora.
N° 16 : Tentative Proposals of the U.S.A. National Committee.
N° 17 : Brazilian Programme.
N° 18 : Programme of the Czecoslovacian National Committee.
N° 19 : Report of the Belgian National Committee.
N° 20 : Suggestions from Pakistan.
N° 21 : Programme of the International Geodesic and Geophysical Union. Suggestions of the Executive Committee of the International Association on Meteorology.
N° 22 : Programme of the Australian National Committee.
N° 23 : French National Committee. Section on Longitudes.
N° 24 : Relations with countries adhering to I.C.S.U.
N° 25 : Programme of the Finnish National Committee.
N° 26 : Programme of the India National Committee.

N° 1. — Programme of the Swiss National Committee

Works to be carried out

Such works are within the field of the mentioned organizations.

Astronomy

Neufchâtel Observatory (Dir. Prof. Guyot). — Time determination by one observer and time signal reception for the world-wide longitude determination and for the study of the propagation time of radio waves.

Radio

Laboratoire de recherches et d'essais des P.T.T. (Prof. Furrer). — Fluctuation of the field of medium wave transmitters in correlation with solar activity.

Aerological Station of the Station Centrale Suisse de Météorologie (Prof. Lugeon). — Tropospheric propagation on 3 and 10 m wavelengths (Chasseron height 1700 m ; Payern height 500 m).

Storm Activity

Net of the Station Centrale Suisse de Météorologie (Prof. Lugeon). — Measurement in various stations by means of electromagnetic storm counters ; Collaboration to the W.M.O. world map of storms ; Radar photography of nearby storms at Zurich.

Radiometeorology (Atmospherics)

Radiogoniographic net of the Station Centrale Suisse de Météorologie (Prof. J. Lugeon). — Continuous atmospheric recording on 27 kc/s by means of radiogoniographs (direction), radiomaximographs (relative intensity), atmoradiograph (stroke number per minute), at Zurich and Payern ; cross-checking of distant centers ; collaboration to the WMO world net. Particular attention to twilight phenomena and to the D and E ionospheric regions.

Longitude Determination

A special report will be drafted by the Geodesy Commission of the Société Helvétique des Sciences Naturelles (Prof. Baeschlin) when the international programme will be known.

CONDITIONAL WORKS

The Swiss National Committee will patronize the following works if special grants are allocated.

Radio Meteorology

Station Centrale Suisse de Météorologie (Prof. J. Lugeon). — According to various recommendations of the World Colloquium on Atmospherics, included in the Working Group on Radio Meteorology of the W.M.O. Commission on Aerology, Zurich Meeting, 1953 (1), the direction of the Station Centrale Suisse de Météorologie would like to set up in collaboration with W.M.O. members or with any other specialists, a north polar radio meteorological station at the highest latitude possible in order to cross perpendiculary, namely according to the meridians, the azimuths of Americans and Europeans bases of the large centers in the northern hemisphere and particularly in North Atlantic.

(1) See Doc. N° 10.

N° 2. — The Norwegian National Committee on the International Geophysical Year 1957-58

The Committee had discussed research items on which Norway will have the possibility to cooperate. In drawing up the lines of research we have concentrated on the following topics : Meteorology, Physics of the Upper Atmosphere and Geodesy. Under each heading we have stated the contribution which can be made by Norway and further made comments on possible cooperation with other polar stations on similar work of observations.

2. — *Physics of the Upper Atmosphere*

(*b*) *Solar and galactic radio noise.* — Radio noise recording will be made at the Harestua Solar Observatory (near Oslo). Special attention will be paid to the study of fading and scintillation during aurorae and magnetic storms. Similar measurements are also intended to be made in Tromsö.

(*d*) *Terrestrial Magnetism.* — The recording stations *Tromsö* and *Bear Island* will be maintained. The three components D, H and Z will be recorded at normal speed and on selected days on recorders with great speed. We will stress the importance of similar recording stations being erected at other arctic stations : Spitzbergen, Jan Mayen and Greenland.

(*e*) *Aurorae* :

Height measurements. — The net of auroral stations around Oslo for parallactic measurements will be maintained. At Tromsö also height determinations will be made.

Spectroscopy. — Auroral spectra will be taken from Oslo and Tromsö.

(*f*) *Ionosphere* :

(i) Two ionospheric stations, *Kjeller* (near Oslo) and *Tromsö* will be maintained. Regular P'*f*-records will be taken each half an hour. It is also intended to have a third recording station erected at Spitzbergen.

(uu) *Absorption measurements.* — Quantitative measurements will be made at Kjeller (near Oslo). Similar measurements are also being planned to be made at Tromsö.

(iii) *Wind.* — Through fading records of E- and F-echoes wind measurements will be made at Kjeller. Similar measurements are also being planned afor Tromsö.

3. — *Geodesy*

An astronomical station for *determination of longitude* will be erected at Höykors (near Oslo). An Askania instrument supplied with photographic recorder and using time recording through radio will be used.

N° 3. — Proposal from Japanese National Committee

1. The Japanese National Committee for the Special Committee for the International Geophysical Year 1957-1958, I.C.S.U., supports all the resolutions concerning the programs of the International Geophysical Year observations passed by the Second and Third Assemblies of the Mixed Commission on the Ionosphere, the IXth General Assembly of U.R.S.I. and the IXth General Assembly of I.G.G.U.

II. The Japanese National Committee is especially interested in the observation programs of (i) radio, (ii) magnetic, (v) ozone, (vi) cosmic-ray, (vii) tropospheric and (viii) astronomical works, mentioned in the resolution of the Second Assembly of the above Commission, and will arrange to carry out in Japan all the observations designated under these subjects, including the world longitude survey.

III. Apart from the above, the Japanese National Committee suggests the addition of the following programs of observations, to be carried out with appropriate international coordination :

(i) For radio observations :

(*a*) continuous observation of the critical frequency and minimum virtual height of the ionosphere by several selected stations ;

(*b*) continuous observations of the field intensity of HF and VHF radio-waves through selected circuits so distributed as to cover the whole globe ;

(*c*) Systematic observation of atmospherics with appropriate international coordination ;

(ii) For magnetic work, magnetic surveys on land and sea :

(iii) For auroral observations : Recording of the intensity change of a few selected lines of the night sky ;

(iv) For tropospheric observation : Observation of solar and nocturnal radiation ;

(v) For solar observation : Continuous observation with appropriate networks of solar radio waves at various frequencies.

IV. The Japanese National Committee proposes to pay considerable attention to the accuracy of measurements and to the networks of observations, specially for ionospheric, magnetic, barometric and cosmic-ray observations. Under the international agreement, it would be desirable to prepare a carefully laid-out scheme to ensure accuracy in the measured quantities as well as in time-keeping, and also to provide for appropriate distribution of observing stations. The main purposes should be to obtain reliable simultaneous data sufficient to establish a world-wide perspective of the phenomena studied.

Based on the experience of the International Polar Year 1932-1933 the Japanese National Committee has its attention drawn to the following points :

(ii) For ionospheric work :

(*a*) Desirability of the use of the widest possible extent by ionospheric stations of automatic observing equipment mentioned in the resolution of the 1948 Plenary Assembly of C.C.I.R., and of holding under 1 minute the deviation of the starting point of each measurement from the observation time assigned in the proposed schedule ;

(*b*) Desirability of having the ionospheric stations distributed in so far as practicable throughout the continents and islands in the middle and lower latitudes ;

(*c*) Designating 30 minutes or some shorter interval as the standard time between succeeding observations of the ionosphere.

V. The Japanese National Committee is specially interested in systematic observations of magnetic and ionospheric variations along the magnetic equator, and hopes that some appropriate scheme for this particular purpose might be planned to be carried out under international agreement.

If requested by the Special Committee for the International Geophysical Year 1957-1958, Japan will cooperate in special observations by sending necessary observers and measuring apparatus for two or three stations for both magnetic and ionospheric work, though Japan might not be able to bear the expenses for the observer's travel and the transportation of the apparatus.

N° 4. — Netherlands National Committee

The scientific programme proposed for the Geophysical Year was discussed by the National Committee. The following remarks were made about the programme and the part the Netherlands probably can take in it.

(*c*) *Solar Radio Noise.* — Routine measurements of solar radio noise are desirable, with a special view on the localisation of active regions on the sun. Our country will be glad to cooperate in such a programme.

(*e*) *Ionosphere measurements.* — Observations of winds in the ionosphere will be made by vertical reflection methods, and by measurements of the scintillation means of synchronized transmitters and receivers are planned. It may be possible to establish an ionospheric station in the Netherlands West Indies or at Western New Guinea during the Geophysical Year, for the study of the upper atmosphere by ionospheric and geomagnetic methods.

(*f*) *Solar phenomena.* — We will be glad to cooperate in observations of disturbed regions on the sun by spectroscopic methods.

N° 6. — French National Committee

The French Committee considers that the study of the Upper Atmosphere has to be the main purpose of the I.G.Y.

It is suggested to extend the proposals of the Mixed Commission on Ionosphere, to the spectroscopic and photoelectric study of the nightsky and of the twilight and to the study of atmospherics considered as sources of information on long wave propagation.

The pulse observation suggested by the Mixed Commission on Ionosphere should be coordinated on an international basis, it should include simultaneous magnetic and geomagnetic recordings.

The I.G.G.U. recommendations (Brussels, 1951) concerned with World Days should be of strict application.

For the longitude determination, the propagation time should be measured with the most possible accuracy ; it is suggested to organize numerous duplex links.

N° 9. — Danish National Committee

It is suggested that Denmark should participate in the Geophysical Year programme along the following lines :

1. By securing that the three Danish magnetic observatories at Rude Skov, Godhavn and Thule are properly equipped with staff and instruments, so as to enable them not only to provide normal magnetic observations, but also to take up such special investigations as may be recommended in connection with the international programme.

2. By making at a number of Greenland stations such systematic visual auroral observations as may be recommended internationally.

It is further suggested :

3. To intensify the ionospheric observations at the Geophysical Observatory, Godhavn, by increasing the staff and by taking up special investigations.

4. To continue the observations of radio noise at a number of Greenland stations.

5. To study the connection between ionospheric conditions and the propagation of HF radio-waves.

6. To study the connection between tropospheric conditions and the propagation of VHF radio-waves.

N° 10. — World Meteorological Organization

COMMISSION ON AEROLOGY
WORKING GROUP ON RADIO-ELECTRIC METEOROLOGY
WORLD SYMPOSIUM ON SPHERICS
17-III — 24-III-1953

RECOMMENDATION VII

Programme for the International Geophysical Year

The Working Group on Radio-electric Meteorology.

Considering

(1) that researches on the origin of atmospherics should be correlated with those concerning the origin of atmospheric electricity,

(2) the value to be derived from a period of detailed study of atmospherics in relation to both climatology and synoptic meteorology,

Recommends

(1) that frequent measurements of the potential gradient at the surface of the earth and above (radiosonde) be made at points free from artificial disturbances,

(2) that, simultaneously, full utilization should be made of all stations studying atmospherics in operation during the International Geophysical Year, so as to contribute to our knoweldge of the global thunderstorm activity and its temporal variations, with consequent valuable climatological information for future synoptic uses,

(3) that measurements of the contribution of an individual thunderstorm towards the maintenance of the electric field should be made,

(4) that in so far as possible the recommended world network should be implemented by 1957,

(5) that particular consideration should be given to the installation of polar sferics stations in both the artic and antarctic at least for the duration of the International Geophysical Year.

N° 12. — Swedish Suggestions

Ionosphere and Radio wave Propagation

A. — *Proposals by Prof. O. E. H. Rydbeck, Göteborg*

I. *Systematic studies of « polar blackouts » using highpower, fast multi-frequency or panoramic methods.* — A chain of class A stations should co-operate by continuous measurements, preferably in the auroral zone. It is very important that the stations suggested operate with high-power, if possible 200 kW pulse, with highest possible receiver sensitivity and with separate recording CR tubes for the upper and for the lower ionosphere. The echo-sensitivity of the various stations should also be almost the same so that individual recording always can be compared. Low-power, unsensitive equipment will not be adequate. With such equipment one runs the risk of classifying moderate increase in ionospheric absorption as blackouts.

Preferably, co-operation should be arranged with stations operating in the southern auroral zone in order to find out whether polar blackouts occur simultaneously in the two zones or not.

Standard polar blackout studies should make use of vertical incidence recording. However, if long base recordings could be maintained at the same time, for example through the auroral zone from Kiruna to Iceland, no doubt very interesting and valuable material could be collected.

All co-operating ionospheric stations ought to remain at least in weekly contact during the polar year.

II. *Systematic studies of radio wave back scatter from the aurora.* — Such studies preferably are undertaken with recording systems using a sufficiently short wavelenght, about 9 m or less, with a rotating antenna having a sufficiently narrow beam. It would be extremely interesting to study long distance auroral back scatter. These measurements should be made with equipment using receiver input stages with minimum noise factor, so that the recorded noise background would be cosmic noise.

The measurements referred to should, like the regular ionospheric measurements, be organized in close contact with the auroral research.

III. *Regular recording, if it can be arranged, of radio noise from auroral displays.*

IV. *Systematic studies, if they can be organized, of the nature and frequency of ionospheric triple split phenomena as functions of the geomagnetic latitude.*

B. — *Proposals by Mr. W. Stoffregen, Uppsala*

Upsala Ionosphere Observatory (59°48.1′ N — 17°36′ E) is operated by the Research Institute of National Defence, Stockholm. The frequency range of the ionosonde is 1.4 — 17 Mc/s.

The research program of the observatory is at present concentrated on the lower part of the ionosphere on frequencies between 0.2 and 1.5 Mc. Word-wide ionosphere investigations show inadequacies in the determination of the height of E-layer, as the equipment used in many cases is not suited to measure the h'E on frequencies low enough to give exacte values.

In the polar regions investigations of these parts on the ionosphere will be of special interest, and observations in the North of Sweden during the Geophysical Year are being considered. The preliminary program is :

(1) Ionosphere records on *low frequencies* for investigations of the lowest part of the E-region.

(2) Studies of the ionosphere with high speed panoramic recordings, especially during storm periods. Collaboration with other polar stations is desirable in order to make simultaneous records at different places.

(3) Visual aurora observations in collaboration with the Meteorological and Hydrological Institute of Sweden in order to study the correlation between ionospheric disturbances and aurora.

Aurora Observations (*Proposed by Dr. N. Herlofson, Stockholm*). — At the present stage in auroral theory there is little hope of interpreting in detail the spectacular curtains and rays observed during great aurora displays, but it seems likely that useful information can be gained from a study of the position and direction of quiet aurora arcs during minor disturbances. Observations made during the First Polar Year (Carlheim-Gyllenskiöld : Expl. int. Polaires 1882-83. Exp. Suédoise. Aurore boréale. Stockholm 1886) indicate that the polar distance of quiet arcs varies in a systematic way during the night. Considered on a planetary scale this variation is consistent with the view that the aurora zone is eccentric and remains in a fixed orientation relative to the direction towards the sun. Similar effects also appear in geomagnetic data (H. Alfvén : Cosmical Electrodynamics, Ch. 6. Oxford 1950).

The range of the displacement is of the order of 500 kilometres measured along the meridian, and the position of arcs should therefore be studied along several sections spaced at intervals along the auroral zones. One section might go from Isfjord on Svalbard, via Hopen and Björnöya to Tromsö or Kiruna. A second section might include Scoresbysund and Angmagsalik on Greenland and Isafjördur and Reykjavik on Iceland. A third section might follow the west coast of Greenland preferably right up to the geomagnetic pole near Thule. Further sections might be placed north of the American continent, and at Franz Joseph's Land. A section across the auroral zone at about 160° E. Grw. would be of great interest in order to complete the survey of the auroral zone.

Several of the stations mentioned in this preliminary survey are already permanently manned by meteorological or geomagnetic observers, so simple and well defined aurora observations might be carried out during the Geophysical Year without undue difficulties. Swedish geophysicists are establishing contact with colleagues in other Scandinavian countries in order to make preliminary trials on a small scale as soon as possible to gain experience before 1957. It is desirable, the Swedish National Commission will consider to undertake the reduction and working up of observations of the position and direction of auroral arcs on a planetary scale.

The Swedish National Commission for the Geophysical Year is also in contact with airlines operating along the northern auroral zone, and it seems likely that visual observations of aurora arcs may be carried out by members of the crew on passenger planes between Europe and America. These observations are independent of overcast sky, and with several planes in traffic it is likely that a substantial portion of the auroral zone might be observed simultaneously.

For a comparaison with auroral theory a possible correlation between auroras in the northern and southern auroral zones should be investigated by simultaneous observations from stations located on, or near, the end points of the same geomagnetic field line. When more is known about the location of observing stations during the Geophysical Year, it would be necessary to compute the periods during which both ends of the same field line are in darkness at the same time.

Lightning Discharges in Arctic Regions, (Proposed by Professor H. Norinder, Uppsala.) — The electromagnetic field of individual atmospherics, originating in arctic regions, should be investigated by cathode ray oscillographs. The technique is described in a paper by H. Norinder (Tellus, Vol. 1, N° 2, 1949).

N° 14. — International Astronomical Union

Royal Greenwich Observatory
2nd. January, 1953.

Dear Prof. Nørlund,

I have been asked by the General Secretary of the I.A.U. to send you comments and suggestions concerning the programme of observations to be made during the International Geophysical Year 1957-1958, before the meeting of the Special Committee next July, on which you are a representative of the I.A.U.

My remarks are concerned with the programme of longitude determinations. The two previous world longitude programmes have been limited to two months. Much more reliable determinations are to be expected from a programme extending over a complete year. It will be possible for systematic effects of a seasonal nature to be more completely eliminated.

From the geophysical aspect, the time determinations should provide much valuable information about the speed of travel of radio-waves, both of long and of short wave-lengths, their diurnal and annual variations, etc. The correlation with the heights of the ionised layers may prove of interest. The advantage of arranging for the world longitude programme to coincide with the geophysical year observations is that the most complete information will be available about all factors that can effect the speed of travel of radio waves.

The following are some of the matters that need to be considered by the participating observatories, and which may entail preliminary investigation :

3. *Pole mouvement.* — Corrections for pivot errors are generally ignored in effects of polar motion. It is important that all stations use the same co-ordinates of the pole. These co-ordinates should be provided by the Central Bureau of the International Latitude Service and should be based on the visual observations at the international stations, combined with the data provided by P.Z.T.'s. It is important that the polar co-ordinates should be supplied with the minimum of delays.

4. *Clocks.* — The use of quartz crystal clocks should be encouraged. Such clocks are practically free from short period erraties and their errors and rates can therefore be much more

accurately controlled than the errors and rates of pendulum clocks. Interpolation between observed clock-errors (e. g. for the times of reception of radio signals) becomes possible with much higher accuracy than can be achieved with pendulum clocks. Stations not provided with good quartz crystal clocks should be regarded as secondary stations. It is to be hoped that by 1957 many membre observatories will have installed quartz-crystal clocks. Intercomparisons between individual quartz-crystal clocks provide a good check on their individual performance.

5. *Radio time-Signals.* — As many radio time signals as possible should be observed during the geophysical year at each station participating in the longitude programme. A special effort should be made at each station to increase the number of time signals observed beyond the number that is normally observed. Special attention should be given to signals of long wave-length: The number of such signals is small and their speed of propagation is rather uncertain. The possibility of increasing the number of long-wave time-signals during the geophysical year needs to be considered.

Methods of reception of time-signals and of comparison with the clocks need to be improved at many observatories. With suitable methods of observation and recording, the errors of reception should not exceed a few tenths of a millisecond. Special care is necessary when receiving long wave signals, because such signals have a slow build up during several milliseconds. A definite point in the build up should be used, and the receiving equipment should be designed so that this can be achieved. When comparing times of reception at different stations it is essential to have precise details of the methods of reception, so that possible systematic differences arising from the slow build up can be assessed.

These are preliminary considerations. The time is none too long for different observatories to consider improvements or changes in instruments, clocks, radio equipment, methods of making time determinations, methods of receiving radio-signals, etc. A preliminary circular should be sent as soon as possible to all observatories that are likely to co-operate.

Yours sincerely,

(*Sgd.*) H. Spencer Jones

Astronomer Royal.

Nº 15. — British National Committee

PROGRAMME TO BE SUBMITTED TO THE INTERNATIONAL COMMITTEE

The following recommendations are made by the British National Committee for the International Geophysical Year :

2. — *Observations of aurorae*

(*d*) *Radio observations of aurorae.* — That a worls-wide coverage of radio observations of aurorae be attempted by creating a ring of observing stations, placed within the optimum belt of geomagnetic co-latitude 29° to 32°. Ideally a similar ring of observation stations should be established in the Southern hemisphere. Three methods of investigation are recommended, i. e. (i) the radio echo technique in which the reflection or scattering of radio waves from auroral formations is observed, (ii) techniques involving the reception of radio waves from the radio stars, with particular reference to the effect of aurorae on the scintillation of the radio stars, (iii) observation of radio noise emitted by the aurorae.

British contribution. — Observations will be carried out at the Jodrell Bank Experimental Station and experiments will be made with an automatically operated camera so that simultaneous photographic and radio echo observations can be made.

3. — *Radio observations*

(*a*) *Observations on the ionosphere and its characteristics by radio methods* :

(i) That ordinary observations and records at ionospheric observatories should be speeded up on World Days to quarter-hour intervals if possible, or at least half-hourly during the International Geophysical Year.

(ii) That during the International Geophysical Year special attention be given, in daily routine recording, to characteristics of the E region and that, if possible, there should be continuous *h't* recording on a frequency in the neighbourhood of 2.5 Mc/s.

British contribution. — Britain expects to participate in these two general proposal.

(iii) That all ionospheric observatories should do everything in their power between now and the International Geophysical

Year to improve their records of observations with a view to facilitating analysis.

British contribution. — British stations will make every possible effort to improve their records : in particular the cooperation of the Falkland Islands and Singapore stations of the D.S.I.R. will be invited in making ionospheric observations.

(iv) That the study of ionospheric characteristics at oblique incidence by back scatter technique, whose development was expected to continue, should be used to supplement other information gained during the International Geophysical Year.

British contribution. — Britain hopes to participate.

(v) It is hoped to submit before the end of 1953 a recommendation on the subject of measurement of atmospheric temperature and pressure by radio echo observations of meteors.

(vi) That observations of scintillation of radio stars be encouraged and if possible continuous observations recorded at polar, equatorial and southern hemisphere observatories.

British contribution. — These observations will be continued at Cambridge and Manchester.

(vii) That the sun be continuously observed both on radio frequencies and visually, and if possible photographically during the International Geophysical Year, and with this in view advantage be taken of polar expeditions, attention drawn to the resolution of Commission V of U.R.S.I. IXth General Assembly, and visual observation of the sun undertaken with special reference to the maximum number of flares and to the real sources responsible for ionospheric regions.

(viii) That observations of winds in the ionosphere by Mitra fading methods be continued and that this be undertaken in Britain and by at least one other station in the auroral region, e. g. in Alaska or Norway, and that observations of scintillation of the radio stars should at some sites be carried on with three separated receivers so that winds in the higher F2 region can be measured ; also that observations of winds in region F2 at present being carried out in this country using three spaced vertical incidence *h'f* recorders, be continued : and that special attention to this recording be paid during World Days when observations should be made every half-hour.

British contribution. — Britain expects to participate.

(ix) That these stations equipped for measuring ionospheric winds using the Doppler Effect on ionised meteor trails should be encouraged to carry out observations during the International Geophysical Year, particularly in the E region.

British contribution. — Britain hopes to participate.

(x) That direct study of meteors by radio technique be carried out as far as possible by a world chain of stations in the Northern and Southern hemispheres.

British contribution. — Britain hopes to participate

(xi) That the study of absorption in the ionosphere by direct sounding methods be carried out.

British contribution. — This will be undertaken at Singapore and in the Falkland Island sas well as in the United Kingdom.

(xii) That preparation be made for observations of absorption in the ionosphere by using galactic noise sources during the International Geophysical Year and that the method be used if possible in the auroral region during polar blackout.

British contribution. — This will be carried out at Slough and/or a station in Scotland.

(xiii) That there should be one forecasting authority, e. g. Washington, to give warning of ionospheric storms and to chose World Days at short notice ; and that on an average there should be not more thar 5 World Days chosen per month including these fixed at long notice. Each country should give wide publicity to this forecasting in their own regions.

(*b*) *Atmospheric disturbances in relation to radio phenomena* :

(i) That Britain should continue its own subjective method with regard to measurement of strength of noise field, extended to low frequencies at certain stations and that the coverage should be as wide as possible, with extension into the auroral zone, and that at some stations there should be overlap with the objective method of measuring.

British contribution. — Britain expects to participate.

(ii) That support be given to the proposal made by the WMO to equip observatories with specially designed counters for measurement of strenght of noise field created by atmospheric disturbance.

(iii) That other countries equip their station as far as possible with direction-finding apparatus for the location of sources of atmospheric disturbances, and set up stations to make observations.

British contribution. — Britain to continue observations already being made.

(iv) That other countries, particularly Europe and North America, should be invited to collaborate in investigating the dependance of the wave form atmospherics on type of storm and on the distance and direction of transmission.

British contribution. — Britain to continue existing observations.

7. — *General*

(i) That the International Committee consider what advantage could be taken of the situation of Huancayo on the magnetic equator in connexion with many of the projects proposed in connexion with the International Geophysical Year.

(ii) That the attention of the International Committee be drawn to the importance of the prompt publication of the results obtained from the investigations pursued during the International Geophysical Year.

N° 15a. — British National Committee. Aurora Subcommittee. Report by Mr. J. Paton on Observation of Aurora

Existing Organisation in Britain

(*a*) *Parallactic Photography.* — Three stations, equipped with Krogness cameras, are situated at Abernethy and Blairgowrie in Perthshire and Rosneath in Dunbartonshire. They are run by voluntary observers; the parish minister at Rosneath, the district road engineer at Blairgowrie and J. Paton at Abernethy. The shortest and longest base lines are 27 and 192 km.

(*b*) *Aurora Survey.* — The survey of auroral occurrences over the British Isles commenced a year ago in April 1952. Forms designed for the recording of simple visual observations on each night of a month were distributed among members of the Auroral and Zodiacal Light Section of the British Astronomical Association and to other interested people recruited in various ways, mainly through notices in the *B. A. A. Journal*, **62**, 226 (July 1952); *Weather*, **7**, 256 (August 1952); *Irish Astronomical Journal*, **2**, (June 1952); *Nature*, **170**, 829 (November 1952); and *The Observatory*, **73**, 37-39 (February 1953). The last mentioned note contains preliminary results of the survey.

A few of those who replied were captains and officers of civil air lines; this prompted an approach to BOAC and BEA. The response, especially from BOAC, has been very encouraging. Since these aircraft often fly above the cloud that hampers land observers, their crews are playing a very valuable part indeed in the survey. Negotiations for similar co-operation from suitable RAF Flights are in progress.

In addition, weather ships have now commenced regular observation and selected ships, which at present supply meteorological reports to the M. O., are to commence observations in the autumn. A general article on aurora, designed to interest and also to instruct observers, is to appear in the *Marine Observer* of July 1953.

Forms are supplied to land, air and sea observers. To facilitate the return of completed forms at the end of each month, postage paid reply labels are supplied with the forms.

To maintain the interest of observers, news letters are sent periodically with fresh forms (the forms are being continually amended in the light of experience) and reprints of publications. Observers too are invited to visit the laboratory when in Edinburgh to see for themselves the use to which their observations are put.

The Superintendent of the M. O. Edinburgh kindly supplies aurora reports made by observers of the M. O. Negotiations are at present in progress to obtain regular simple observations of sky conditions (definite absence or presence of aurora *or* no observation possible because of cloud etc.) at each night observing hour at selected M. O. stations. These would be invaluable, especially in covering the early morning hours when voluntary observers are seldom on duty.

When the survey commenced, it was intended to cover only the British Isles. Then an observer in Reykjavik, Iceland commenced sending in very full reports and enlisted a friend in the north of the island to do likewise. This led to an extension of the survey across the maximum aurora zone. Arrangements were also made for observation by the British North Greenland Expedition 1952-54.

While most of the observers give only the brief summarised reports asked for, others send in very detailed reports of the displays they observe. For their guidance (they are mostly members of the B.A.A. Aurora Section) a set of instruments has been issued.

At present about ninety land observers situated between magnetic longitudes 70° and 90° are sending in reports month by month. Their observations, combined with those of the airmen and of the M. O. observers, are providing much needed data for the correlation of auroral characteristics with other terrestrial and solar phenomena, e. g. geomagnetic field variations, ionospheric effects, sunspots, flares, and solar M — regions.

The data are also being used to investigate the geographical distribution of aurora, i. e. to revise the chart of isochasms prepared by Fritz in 1881 from the limited information then available. In addition, the distribution of occurrence of overhead aurora, coronas, in different latitudes, the significance of which was pointed out by Prof. Chapman, is being examined. (The Fritz Chart was based on simple visibility of aurora irrespective of its position with respect to the observer).

It is intended to continue the survey over a period of at least one solar cycle.

Proposed arrangements for the International Geophysical Year. — The arrangements outlined above will continue over and beyond the I.G.Y. It is proposed to establish a second and independent photographic network in the south west of England which would examine the southerly extension of aurora at sunspot maximum, i. e. during the I.G.Y. Facilities for the reduction of the plates exist in the Natural Philosophy Department of Edinburgh University.

The present grant of £ 70 per annum from the Gassiot Committee is adequate for the maintenance of present arrangements at this time of sunspot minimum. Telephone costs will increase as the sunspot maximum is approached. (It costs roughly £ 4 per hour to operate a group of three stations). If a southern network is established, the cost during 1957-1958 may be about £ 200. This assumes that cameras on loan from U.G.G.I. may be retained. We have five Krogness cameras in Britain ; three of these are on loan from U.G.G.I. One more will be required.

It is hoped that a spectrograph may be installed in a suitable place. Edinburgh is quite unsuitable, though the apparatus for measurement of spectrographic plates is available at the Royal Observatory there. It is thought that King's College, Aberdeen may be a suitable station for a spectrograph. The information of height and position obtained by the parallactic stations will be of special value when used in association with the spectrographic work.

Suggestions for International Co-operation. — The clamant need for extension of the area of the survey — ideally so that it becomes completely circumpolar — has become increasingly evident to us during this preliminary phase of the work. If the co-operation of civil air lines, especially those new or projected lines, flying over the arctic can be enlisted, then information of the unmost value would become available. Our experience of aircraft captains and officers shows them to be, almost without exception, interested and excellent observers. The help of ocean-going vessels and all weather ships must also be obtained.

Finally, it is earnestly hoped that suitably situated countries may joint us in organising a network of voluntary observers, as well as requiring that their professional meteorological observers should keep a look out for aurora at each night observing hour. Although some account of aurora appears in official observers ' handbooks, it is usually reported only when its appeareance is spectacular.

N° 14. — Tentative proposals for the I. G. Y. prepared by the United States National Committee

SECTION III. — PROGRAM IN ATMOSPHERIC ELECTRICITY

Of the various problems in atmospheric electricity which can best be pursued through international cooperation, the problem of global diurnal variation in air-earth current density is probably the most important. Substantial progress has been made during the last few months in demonstrating that the atmospheric electrical air-earth current density, measured during fair weather conditions on mountain tops at altitudes above 2000 m, resembles in phase and relative amplitude the *mean* diurnal variation of the air-earth current density found at sea. In essence, it seems that a means is being found for measuring a quantity which is proportional to the potential difference between the earth and the high atmosphere. If a global network were established during the I.G.Y., it would be possible for the first time to obtain a reliable measure of the diurnal and seasonal trends of the potential difference between the earth and the high atmosphere. A minimum of six stations is recommended. The measurements are of great importance in determining the true cause of the earth's electric field, which is now generally believed to be currents produced by thunderstorms.

If the thunderstorm hypothesis were fully established, the atmospheric electrical measurements would serve to give a continuous record of integrated thunderstorm distribution by continents. Furthermore, if it proves possible to measure the global variation of the atmospheric electrical field on an hour to hour basis (as distinguished from weekly averages) an improved study could be made of the local effects produced by meteorological fronts as they approache the recording station.

Associated with the above program of atmospheric electricity determinations, a more accurate measurement of the global thunderstorm activity is necessary. These observations may be made in cooperation with the various National Weather Services, through the establishement of networks of sferics stations, or by both means. A sufficient number of observers are already available in the United States and in Europe to permit the establishement of such networks. However, a minimum total number of 6-10 additional stations in South America, India, Japan and the East Indies is also recommended.

Prior to the beginning of the I.G.Y., the proposed sferics network must be effectively calibrated in order to insure that thunderstorm activity is measured in a quantitative manner.

The stations which are selected for the measurement of atmospheric electricity should be as free as possible from local electrical effects ; in this way global effects would be relatively enhanced. In general, the sites should be well removed from regions of industrial activity. At each station, measurements would be made of the (*a*) positive conductivity, (*b*) negative conductivity, (*c*) electric field, (*d*) air-earth current, (*e*) rate of ion production, (*f*) concentration of large ions, (*g*) large ion mobility spectrum, (*h*) concentration of Aitken nuclei, and (*i*) temperature, pressure and relative humidity.

In addition to ground observations, it is also recommended that a selected number of balloon flights be made simultaneously from the various sites. If possible, measurements should be made at altitudes of 25-30 km. During balloon flights, data on the positive and negative conductivity, electric field, pressure and relative humidity should be coordinated with those listed in Section IV (Program in Meteorology) and Section VIII (Program in Ionospheric, Auroral and High Altitude Physics).

SECTION VIII. — PROGRAM IN IONOSPHERIC, AURORAL AND HIGH ALTITUDE PHYSICS

A rather extensive program is possible during the I.G.Y. in the field of Ionospheric, Auroral and High Altitude Physics.

1. *The Geographical Location of the Auroral Zone and its Variations.* — The recent observations on the presence of hydrogen ions in the spectrum of aurorae and their Doppler displacement when viewed along the auroral ray verifies that aurorae are produced primarly through bombardment of the atmosphere by protons. It has long been recognized that the bombarding particles are electrically charged.

The distribution of aurorae around the magnetic poles has been the subject of many investigations. H. Fritz in 1881 published his well-hnown map of isochasms of equal auroral frequency. E. H. Vestine (Terr. Mag. 49, 77, 1944) has discussed observations subsequent to Fritz' work and in particular has tried to eliminate the variable factor of weather at the various observing points.

The principle objection of these data is the integration over such large areas. The lower edge of an auroral arc or ray may be easily distinguished when only 3° above the horizon. Hence, with the average height of the lower edge being, say 100 km, this means that auroras are counted within a radius of 800 km or over almost the entire territory of Alaska as seen from College, Alaska.

The lack of resolving power in the data makes it difficult either to locate the auroral zone accurately, or to know its width. Hence questions such as the following cannot be answered : Does the auroral zone shift in position with the size of the disturbance or as a function of the sunspot cycle ? Does the zone expand symmetrically or asymmetrically as a function of the size of the disturbance ?

It is proposed that during the I.G.Y. auroral observations be systematically made every fifteen minutes beginning on the hour, the strip across the sky representing the magnetic meridian. Recording should be made of :

(*a*) Zenith distance of lower edge of aurora,
(*b*) Auroral form according to the international classification,
(*c*) Estimate of intensity on a scale of 1-5,
(*d*) Motion and its direction,
(*e*) Pulsation and frequency,
(*f*) Color,
(*g*) Additional data for those off meridian (loops, isolated rays, spirals, diffuse surfaces),
(*h*) Degree of cloudiness.

Data should be taken in as simple form as possible so that they may be readily tabulated, or preferably transferred to punched card. (*Suggested instructions for auroral observers were appended to the report*).

The main bulk of the data should be provided by (*a*) amateurs who are already organized in astronomical societies and (*b*) meteorological observers. Where a group can work together, a fixed installation should be made. For individuals, a portable sighting protractor can be made available at moderate total cost. Certain selected sites, manned by meteorologists, ionosphericists, etc, could employ wide-angle cameras or possibly sequence cameras. A danger however, with automatic equipment is that large amounts of data may be collected which cannot be measured, reduced and published.

3. *Regular Ionospheric Sounding Stations.* — Analysis of records from regular ionospheric sounding stations can make an important contribution to understanding sudden ionospheric disturbances, magnetic storms, auroral disturbances, andipodal relationship, etc.

It is proposed that the regular sounding stations, using equipment such as the C3, be operated during the I.G.Y. substantially as usual, but with much more increased emphasis on the reduction and analysis of the records obtained. The usual practice of reducing one record every hour might be replaced by reduction of one record every fifteen minutes. Greater effort could be devoted, however, to accuracy of scaling records, particularly with regard to height (see appendix C), More especially there should be greatly increased emphasis on the analysis of the results obtained, and to collation of records from stations distributed over the world.

Special attention should be paid to analysis of records from polar stations, and in this connection, careful thought should be given before the Geophysical Year to the interpretation of polar ionospheric records. It is doubtful whether the quantities scaled at polar stations always have the same interpretation as at lower latitudes. The questions of what quantities to scale from polar records and what are their physical interpretations should be settled if possible before the Geophyiscal Year and standards for scaling established.

Off-vertical echoes are thought to be common at polar ionospheric stations and a simple antenna system (perhaps a vertical rod) should be installed so as to check when echoes are seriously off-vertical. In view of the fact that the appearance of sporadic echoes on ionospheric records often depends on the power of the transmitter and the gain of the receiver, groups of records should be taken in quick succession with different calibrated gain settings. During the Geophysical Year, ionospheric stations that are in the hands of « operators » should be frequently inspected by scientific personnel.

In establishing new ionospheric stations, attention should be paid to arranging them roughly in lines convenient for studying the behavior of the ionosphere. Longitudes lines of stations possibly along the meridians 20° E, 75° W, and 140° E should be considered. There are obvious gaps at the present time in South America. A ring of stations beneath the northern auroral zone is also very desirable and here results could be achieved by arranging for complete interchange of information between all of the countries concerned.

4. *Scatter Sounding.* — Where possible, ionospheric sounders should be equipped with beam antennas for looking roughly horizontally in various directions, in addition to the usual antennas for looking upwards. These might take the form of rhombic antennas. With this arrangement, it is possible to obtain back-scattering from the earth mirrored in the ionosphere. Frequency-sweeping records taken in various directions in this way permit an ionospheric sounder to monitor ionospheric behavior over a considerable region around it. In particular it is possible to make deductions about the geographical distribution of sporadic ionization (See appendix D).

An alternative arrangement is to use one or two fixed frequencies together with rotating directional antennas. Experience between now and the Geophysical Year will probably determine the best technique to be utilized at that time. Frequencies to perhaps 50 Mc/s should be considered.

5. *VHF Ionospheric Investigation by Radar Techniques.* —It is likely that, between now and the I.G.Y., V.H.F. ionospheric sounding will have developed to the point where at least one installation of this type should be made in polar regions. The frequency that would be appropriated would be in the region 30-100 Mc/s, and 50 Mc/s might be a good choice. Preliminary investigation before the Geophysical Year would, however, be required in order to determine details. Such sounder could be used in conjunction with a vertically-looking antenna to obtain echoes at vertical incidence. It is quite likely that echoes at V.H.F. could be obtained at all times, even during H.F. polar « black-outs ». The sounder could also be used in conjunction with a moderate-gain steerable antenna to obtain echoes from meteoric ionization. Likewise, the sounder could be used in conjunction with a high-gain horizontally-looking rotating antenna for the detection of ionospheric scattering regions presumed to be associated with the aurora. Alternately, an omnidirectional antenna might be used in conjunction with a number of distance receiving sites equipped with rotatable directional antennas. The most appropriate arrangements would have to be the subject of investigation between now and the I.G.Y.

6. *Ionospheric Winds.* — It would be very desirable to take advantage of the I.G.Y. to obtain, if possible, a clear idea of the

world-wide distribution of the ionospheric movements commonly interpreted as ionospheric winds. This could be done by installing at ionospheric stations, triplets of spaced receivers for comparing the fading obtained from ionospheric echoes on one or two fixed H.F. frequencies. Equipment would be necessary for evaluating the correlation between the fading at the three receivers and interpreting these as a « wind » in magnitude and direction. Observations should be such as to provide the diurnal, seasonal and geographical distribution of the winds (see appendix F.).

For ionospheric winds high in the F2 region, see Section 7.

7. *Study of the Ionic Layers by Extraterrestrial Radio Waves.* — The various ways in which the extraterrestrial radiations may be utilized to provide information on the ionosphere involve such measurements as those of ionosphere absorption of cosmic noise during normal times as well as during sudden ionospheric disturbances, of ionospheric refraction of radiations coming from discrete sources preferably at two frequencies, and of radio scintillations made simultaneously by at least two, and preferably, three, suitable separated stations (separated by a few km) employing nearly identical receiving equipment to investigated wind motions in the upper part of the F2 region. Of these various methods the ones which might be profitably used during the Geophysical Year are :

(*a*) Measurements of ionospheric absorption, using preferably the cosmic noise at frequencies near the critical frequency of the F2 layer, for normal times as well as during sudden ionospheric disturbances (see Appendix G.).

(*b*) Measurement of ionospheric winds high in the F region using the radiation from a discrete source (see Appendix H).

8. *Solar Observations.* — To facilitate studies in solar terrestrial relationships and radio-optical solar conditions, it is suggested :

(*a*) That special emphasis be placed on the careful timing of outstanding phenomena of solar activity, both in terms of seconds and hours of time ;

(*b*) That, in addition, to the usual descriptive tables of solar activity phenomena, small scale reproductions of the solar radio patrol records (tapes) from the world-chain of solar radio observatories be interchanged among solar, magnetic, ionospheric and other types of laboratories which need solar activity data for the interpretation of their own observations.

(*c*) That, for the period of the Geophysical Year, the U.R.S.I. program be expanded to provide solar and geomagnetic activity data on a short time schedule, both by electrical means and by air mail, to the principal laboratoris involved in the program of the I.G.Y.

9. *Additional Studies Suggested but not Examined in Detail* :

(*a*) Annual variation of intensity of Na-D lines in the airglow spectrum for the southern hemisphere to compare with that observed in the northern hemisphere. There is a maximum in December-January which is five to six times the minimum intensity observed in July-August.

(*b*) Visual observations of luminous clouds and bands not apparently associated with the magnetic activity. This may be part of the program for the visual observation of auroras by groups of amateurs but with extension of the observations to equatorial regions. Attempts should be made to distinguish auroral and noctilicent clouds from luminous clouds and bands.

(*c*) Use of rockets for direct measurement of the properties of the upper atmosphere. A number of firings might take place in New Mexico and Australia, and arrangements might be made for firings from ships which could go in polar regions. Information obtained in this way at specific places and times would have to be collated with other less direct observations that are more widely available in space and time.

(*d*) World-wide measurements concerned with radio meteorology.

(*e*) World-wide measurements of terrestrial radio noise.

(*f*) Measurements of low frequency « swishes » or « whistlers » to verify the theory of Ratcliffe and Storey reported at the Xth General Assembly of U.R.S.I. This theory is potentially important in revealing the state of ionization above the F region out to several earth's radii. According to the theory, there should be an important variation in the properties of the « whistlers » with latitude. From this the correctness of the theory could be further verified and additional deductions could be made about the ionization above F region (see Appendix I).

(*g*) Measurements of the direction of arrival of ionospheric echoes using the four-loop method of Eckersley.

(*h*) Measurement of collisional frequency by wave interaction techniques (see Appendix J).

(i) Oblique incidence field-strength measurements on paths at different distances from the auroral zone. For example, measurements of WWV at College, Alaska, Anchorage, Alaska, Kodiac, Alaska, etc.

(*j*) World distribution of ionospheric absorption using CW reflections at early vertical incidence.

(k) Oblique incidence pulse studies in the Arctic involving reception by one ionospheric station of pulses from another. It would be desirable so to arrange the experiment that there is a third ionospheric station near the midpoint of the path.

(l) Observation of meteors at a frequency of about 12 Mc/s during polar blackouts. Low meteor trails might be observable and high ones unobservable thereby giving information on the height of the absorbing layer.

(*m*) Meteor counts by radio methods are needed from one or two places in the northern *and* southern hemispheres, both for their astronomical interest and for correlation studies with E*s* observations by vertical and oblique soundings. The methods employed by Lovell's group would seem appropriate.

(*n*) It is noted that a solar eclipse will occur in June 1958 in the western Pacific and there should therefore be an opportunity with little added effort to obtain ionospheric and radio propagation observations of great potential value.

10. *Facilities.* — It is by no means clear that all or even a substantial part of the program outlined above could be carried out by the United States on a large scale. The opinion has been expressed, for example, that the U. S. National Bureau of Standards might be able to support the program outlined on either Scatter Souding or Wind Measurement, but not both. In considering how large a program it might be feasible for the U. S. to support, it is strongly urged that high priority be given to a program that can be based at the Geophysical Institute of Alaska. It is suggested that, in addition to observations at College, Alaska, Anchorage,

Alaska and Barrow, Alaska, a line of stations making various kinds of observations might be established across Alaska in a north-south direction. Suggested locations are Barter Island and Fort Yukon to the north of College, together with Sheep Mountain and Kodiak Island to the south of College. Observations of certain types might also be made on routine weather flights from Alaska.

After the requirements of a program based on the Geophysical Institute of Alaska are met, it is suggested that American resources and effort might suitably be devoted to observations of various sorts at Thule, Greenland on account of the proximity of this location to the geomagnetic pole.

Apart from special installations in Alaska and Greenland, as outlined above, it is felt that when the overall international program for the I.G.Y. is available, specific stations should be selected to play a key role in the program. About three to five such base stations in appropriate locations might be operated by the U. S. In addition, observations during the I.G.Y. could be integrated into the regular work of weather stations, ionospheric stations, universities, etc. To cut down the amount of time that might be involved in this work at such locations, observations at a number of sites might be confined to World Days.

Appendices to Section VIII

Appendix C. — *Note on uniform interpretation of results of ionospheric soundings*

Comparing the results of ionospheric soundings at many different observing sites is possible in the practical sense only if there are uniform standards of interpretation. The quantity of data is very large in ordinary times; if during the I.G.Y. there are new stations in operation or special observations or extra reductions, the quantity becomes tremendous. Investigations involving data during the Geophysical Year from many stations should be planned in advance so that the needed characteristics are scaled at the field stations, and special measures taken that the scaling practices at the various stations are uniform.

At the present time the routine analysis of ionospheric sounding records involves scaling 12 different characteristics. The common practice is to reduce one record each hour, so that there are 288 values per day, or about 10^5 per year per station.

More important than the size of the mass of material is the appropriateness of the characteristics scaled to the problems under investigation. The international scheme (1) for reducing ionospheric sounding records calls for scaling critical frequencies and minimum vertical heights of the regularly occurring layers E, F1 and F2, and also transmission factors for standard distances. Other characteristics commonly scaled are the « top » frequency and minimum virtual height of E*s* reflections, and the lowest frequency at which any ionospheric echo is observed with the sounding equipment. A number of other characteristics are recognized internationally and are scaled at some stations. There is a complicated system of descriptive symbols to be used to describe the appearance of the sounding record or to explain the absence of measurement. For consistency of interpretation the field depends upon a few remarks in the international documents, on informal of interchanges among laboratories and on a few instruction manuals (2).

The reduction scheme has been found fairly satisfactory for studies of some slowly varying characteristics of the ionosphere in the middle and low latitudes. The routine hourly reductions have made possible extensive work on the gross ionospheric characteristics important to radio communications, and their predictions. For other characteristics and studies, for example *fo*F1 or *f*E*s*, there have been important differencies of interpretation at the various stations and the world-wide data are far from homogeneous. There should be available by the time of the I.G.Y. a more comprehensive manual of interpretation, well illustrated, for observations at middle and low latitudes.

Ionospheric sounding observations from near and inside the auroral zone present more serious reduction problems. At present the record are interpreted according to the same scheme employed at lower latitudes. The results are not completely satisfactory because short time changes are common and because the prevalence of scattered reflections, E*s* clouds, auroral echoes and other anomalies. The success of any Geophysical Year investigations involving ionospheric soundings from high latitudes will depend on the prior development of improved schemes for interpreting these soundings. U.R.S.I. Sub-Commission III*b* has this matter under study.

REFERENCES

1. *U.R.S.I. Proceedings*, VIII, Part I, p. 345, 1950; *U.R.S.I. Information Bulletin* N° 73, p. 41, 1952.

2. See for example, « Ionospheric Observer's Instruction Manual », J. H. Meek and C. A. McKerrow, Radio Physics Laboratory, Ottawa, 1951.

Appendix D. — *Technique of scatter sounding using variable frequency*

Observations of bakscatter with the sweep-frequency technique (1) offer the following advantages over observations by the fixed frequency technique :

(*a*) As frequency increases and the regular *h'-f* curves are traced, the scatter echoes are seen to develop, often out of the second order echoes. Thus information is revealed as to the origin of the scatter.

(*b*) The diurnal behavior of a continuous spectrum of frequencies can be observed.

(*c*) In studying the relation of the scatter range to the maximum usable frequency for a fixed distance, a large number of samples are obtainable in any given day, since, for a given distance there is usually one frequency in each sweep which is the maximum frequency for that distance.

Output powers of the order of 30 kW from a modified conventional ionosphere recorder such as the U.S. National Bureau of Standards Model C3 will afford fair daytime scatter records on a large rhombic antenna with a pulse length of 100 microseconds, sweeping the 2 to 25 megacycle range in 12 minutes. It may not be possible to receive scatter during a large part of the night without higher power, however, because the skip distance for the lower frequencies is long, requiring low wave angles, which may not be favored by the rhombic. Pulse lengths greater than 100 microseconds can be used with potential increase in signal-to-noise ratio but with sacrifice of final detail.

Receiving should also be done on a large rhombic antenna. Because received signals will be weak, narrower bandwidths should be used than with the usual vertical-incidence recorder, with some sacrifice of fast rise and fall times. A rough, non-critical value is :

$$B = \frac{1200}{t}$$

where B = bandwidth in kilocycles,

t = pulse length in microseconds.

Reception of powerful interfering stations as the frequency is swept will cause shifts of the video reference voltage in the oscilloscope circuits which may obliterate the weak scatter signals unless very good clamping is used. Also, differentiation suitable for ordinary vertical-incidence work may be too much with the high receiver gains necessary in scatter reception.

A test of origin of short-distance F2 or F1-layer-propagated backscatter is the tangent test (2, 3, 4). With the h'-f sweeps plotted on a linear scale a straight line is drawn from the origin so that it falls tangent to be second-order F2 or F1 trace and continues onward. If the scatter is from the ground it will fall along this line but if it is from the top of a lower ionosphere layer, such as the E layer, it will fall along a similar line starting at about the layer height below the first one at the ordinary wave critical frequency.

To test the origin of backscatter at intermediate and long distances a two-day synchronized sweep frequency pulse reception test (5) is best, so that MUF and travel time can be compared with backscatter delay time. Much can be learned however, by orienting the backscatter antennas along the great circle path to a vertical-incidence ionosphere station at a distance of 1500 km or less and comparing data. The origin of scatter propagated by the F2 and F1 layers can be deduced by comparing the MUF for an oblique path for a given layer with the frequency at which the delay time for the scattered echo to return is correct for the path length, assuming scatter from ground or form the top of a lower layer. A comparison of travel times and MUF for oblique sporadic-E propagation should yeld information on various types of sporadic-E-propagated scatter.

It should be possible to track ionosphere disturbances by noting changes in long-distance scatter patterns (6).

BIBLIOGRAPHY

1. R. Silberstein. — Sweep-Frequency Backscatter-Some Observations and Deductions, to be published.

2. W. Dieminger. — Origin of Ionospheric Scattering, Proceedings of the Conference on Ionospheric Physics, Vol. II, 1950, *U.S.A.F. Geophysical Research Papers*, N^{os} 7 and 11, Cambridge, Mass. 1952.

3. W. Dieminger. — The Scattering of Radio Waves. *Proc. Phys. Soc.*, London, **64**, 2, 374B,. 142-158, February 1951.

4. A. M. Peterson. — The Mechanism of F-layer propagated Backscatter Echoes. *Jour. Geophys. Res.*, **56**, 221-237, June 1951.

5. E. E. Ferguson, P. G. Sulzer. — Sweep-Frequency Oblique-Incidence Ionosphere Measurements over a 1150 km path, letter to the editor. *Proc. I. R. E.*, **40**, 9, Sept. 1952.

6. W. L. Hartsfield, R. Silberstein. — A Comparison of CW Field Intensity and Backscatter Delay, National Bureau of Standards Report N° 1297, Nov. 16, 1951 ; also *Proc. I. R. E.*, **40**, 1700-1706, Dec. 1952.

Appendix F. — *The technique of measuring ionospheric winds by means of the fading of radio echoes from the ionosphere.*

The basic requirements of a system for determining ionospheric winds by the fading method have been described by Mitra (1) and by Krautkrämer (2). Pulses of radio energy reflected from the ionosphere are received at three receiving antennas spaced on the order of a wavelength apart at the corners of a right triangle. Comparisons of the fading of the echo amplitudes at pairs of the antennas then lead to a value of the speed and the direction at which the diffraction pattern produced by ionospheric roughness is drifting over the ground. The speed of the ionospheric wind is taken to be half of the speed of drift of the ground pattern (3).

Equipment. — A pulse transmitter operating at a fixed frequency is required. The transmitter of a conventional ionospheric sounding unit may be employed. Since fading observations over a 5 or 10 minute period are sufficient for a determination of the wind vector, these observations might be made between scheduled ionospheric sounding observations.

A separated receiver may be employed for each antenna, or a single receiver may be switched electronically between the three receiving antennas in synchronism with the transmitter pulses in such a way that the echo of every third pulse is received on the same antenna. An electronic gate of variable delay time is provided to keep the receiver insensitive except during a brief interval when the echo is received.

The output of the receiver may be applied directly to a cathode ray oscilloscope and photographied on moving film in the manner described by Mitra (1), Phillips (4) or Chapman, or the envelopes of the pulse amplitudes may be detected and recorded on paper tapes (5). If a single receiver is used, the output must of course be switched in synchronism with the input.

Antennas. — The receiving antennas may be dipoles or loops and spacings of the order of one and a half wave lengths afford sufficent time resolution for satisfactory determination of the time delays. Care should be taken to avoid excessive pickup by long transmission lines especially if relatively inefficient antennas such as loops are employed. Chapman (6) used preamplifiers at the base of each antenna.

Best results are obtained if the fading is not complicated by interference between successive reflections of the wave or between the two magneto-ionic components of the wave. A single reflection is isolated by gating the receivers. But as a rule the magneto-ionic components cannot be separated by gating. In daytime the extraordinary mode is considerably more attenuated than the ordinary, but at night this is not always the case. The interference can be eliminated by suitably polarizing either the transmitting antennas or the receiving antenna or both. In moderately high latitudes, circular polarization gives adequate discrimination.

Operating Frequency. — Relatively long series of observations have been made at 2.3 Mc/s by the U.S. National Bureau of Standards (5), at 2.4 Mc/s by the Cavendish Laboratory (4) and at various frequencies by Chapman (6). Such frequencies are reflected by the E layer in the daytime and, except when reflected by sporadic E, by the F2 layer at night. A frequency well above the E layer critical frequency, say 4 M c/s or higher, would be necessary to study reflections from above the E layer during the day.

Wind measurements at low frequency (150 kc/s) have been made at Pennsylvania State College (7).

Observation Schedules. — For several years, observations at the Cavendish Laboratory, at the National Bureau of Standards, to some extend those by Chapman in Canada, and possibly also by other workers, have been made at half-hour intervals during three days near the middle of each calendar month.

Determination of the Wind Vector from the Fading Records. — Methods of determining the wind vector from the fading records are discussed in references. In each case a time interval is determined for each pair of antennas which is related to drift speed of the diffraction pattern. The values of the time interval depend upon the operating frequency and upon the antenna spacing as well as the wind speed. At 2.3 Mc/s and a spacing of 130 m (1 ½ wavelengths) (5) the time intervals range from 0 to 3 or 4 seconds. The fading rate varies from perhaps 6 to 60 fades per minute.

REFERENCES

1. Mitra, S. N. — *Proc. Inst. Elect. Eng.*, III, **96**, 441 (1949).
2. Krautkrämer, J. — *Arch. der Elektrischen Ueber/tragung*, **4**, 133 (1950).
3. Briggs, B. H., Phillips, G. J., Shinn, D. H. — *Proc. Phys. Soc. B.*, **63**, 106 (1950).
4. Phillips, G. J. — *J. Atm. and Terr. Phys.*, **2**, 141 (1952).
5. Salzberg, C. D., Greenstone, R. — *J. Geophys. Res.*, **56**, 521 (1951).
6. Chapman, J. H. — *Cand. J. Phys.*, **31**, 120 (1953).
7. Millman, G. H. — *Annales de Géophys.*, **7**, 272 (1951).

Appendix G. — *Measurement of ionospheric attenuation using cosmic noise*

Normal Absorption. — Mitra and Shain (unpublished) have already investigated the possibility of measuring ionospheric absorption by using cosmic noise at 18.3 Mc/s with a narrow-beam aerial of 30 dipoles and conventional receiving and recording equipments. The records obtained had much less fluctuations than in the terrestrial method of ionospheric absorption. The accuracy of estimation of absorption was limited primarily by the accuracy of reading a mean value of the fluctuating intensity and, in general, under good conditions the equivalent aerial temperature could be estimated to about 1 per cent.

The variations in the observed radiation involve those of the incoming radiation as the sky moves over the aerial as well as those caused by variations in ionospheric absorption. The first depends on sideral time, the second on solar time. By comparing observations over a whole year, it was possible to separate the two types of variations.

Mitra and Shain have carried out some detailed analysis on the data obtained by the above technique over a year. The essential conclusions are that the total absorption during summer noon is some 1.4 db, that absorption during the daytime in winter is larger than in the equinoxial period, that about 25 % of total absorption is contributed by the F2 region, that F2 absorption increases much more rapidly with *fo*F2 than a Chapman layer would allow and that the absorption due to the D and E layers shows a pıonounced assymmetry round noon. Further there was evidence of a nocturnal source of absorption caused presumably by irregularities occurring in the F2 region.

The most interesting point in the method is the consistency of the results obtained and the fact that reliable conclusions could be made from only a year's data, whereas in the ordinary terrestrial method a number of year's data are necessary to get even rough conclusions.

Absorption during Sudden Ionospheric Disturbances. — Useful studies of solar flares and their effects on the ionosphere may be made by measuring the intensity of cosmic noise at the time of the solar flare. The effect appears as an excess absorption and is easily distinguishable from the effects of atmospheric or man-made noises which appear as an *increase* in the intensity of the received radiation. Shain and Mitra (unpublished) have investigated, by the same technique as outlined above, all such effects observed during a year. It was found that the method is highly sensitive and indicated a larger number of flares than were visually observed. In fact, the method was found to be as sensitive as that of « sudden phase anomalies » discussed by Bracewell and Straker, while at the same time, the equipment is simple and does not suffer from the sporadic gaps of transmission from which measurements of long waves transmitting stations suffer. Statistical analysis regarding occurrence, duration and growth of the effects, made along the same lines as those of Bracewell and Straker, gave identical results. Further, strong evidence was found for appreciable corpuscular absorption beginning eighteen hours after the occurrence of the solar flare and reaching a maximum at about twenty-six hours.

Study of ionospheric absorption by the method outlined above does not involve equipment that is too elaborate, and a number of ionospheric stations might conceivably be equipped before the I.G.Y.

Appendix H. — *Measurement of ionospheric winds high in the F region*

Estimates regarding the velocity of ionospheric winds in the F2 region may be made by comparing the scintillation patterns of a single discrete source simultaneously at two or more stations. Such measurements are now being made in England at Cambridge and Manchester. (See, for example, Little and Maxwell, *Nature*, **169**, 746, 1952, and Hewish, *Proc. Roy. Soc.*, **214**, 494-514, 1952). The separation between the stations should be of the order of a few km. A frequency far removed from the critical frequency of the F2 layer should be used, so that there is no appreciable absorption by irregularities in the F2 layer.

As this method involves elaborate antennas there would be a severe restriction on the number of laboratories which could carry on such measurements during the Geophysical Year. For those stations which already have some radio astronomical equipment for measuring radiations from discrete sources, the necessary arrangements might be made in time.

Appendix I. — *Measurements of « whistlers »*

« Whistlers » are a most remarkable audio-frequency phenomenon first observed many years ago during studies of earth currents. They can be heard at irregular intervals on a sensitive audio amplifier (gain of order 80 db) connected to a long wire or loop antenna. They resemble a rough, whistling tone, with varying degrees of « musical » quality, which descends in frequency from several kilocycles to a few hundred cycles in an interval of about one second. Whistlers are frequently preceded by clicks caused by lightning discharges.

A theory of whistlers was described by Ratcliffe at the Xth General Assembly of U.R.S.I. It is based on the idea that the VLF energy radiated from a lightning discharge may travel through the ionosphere as an extraordinary ray in the magneto-ionic longitudinal mode of propagation. This requires that the path of propagation be in the direction of the earth's magnetic field and that there be sufficient ionisation along the path to sustain the longitudinal mode. The energy follows the fields lines into the opposite hemisphere, is reflected from the earth's surface and returns to the starting point. The dispersion is such that $1/\sqrt{f}$ varies linearly with the time, where f is the instantaneous frequency of the whistler. Since lines of the earth's field originating in areas where whistlers have been observed pass far beyond the maximum of the F2 layer, the theory is potentially useful in studying that part of the ionosphere above the F region.

Although several features of the theory are in agreement with experiment, certain other predictions of the theory must be checked before final acceptance is possible. According to the theory, there should be a pronounced variation in occurrence of whistlers with latitude. From this the correctness of the theory could be further verified and additional deductions could be made about the ionization above the F region. Furthermore, the variation of whistler frequency with time (i.e., dispersion) can be expected to show latitude dependence.

Information on whistler occurrence is easily obtained using a sensitive audio amplifier connected to a long terminal wire or loop antenna. The characteristics of whistlers can be recorded permanently on magnetic tape. Accurate timing is highly desirable.

One simple method for doing this is to use a dual-channel tape recorder, recording whistlers on one channel and WWV timing signals on the other. Stations should be located not more than about 1000 km away from the reasonably active thunderstorm areas. It would be desirable to set up at least one pair of

« conjugate » listening stations; that is, stations located on the same geomagnetic meridian and equidistant from the geomagnetic equator. Only one member of such a pair would have to be near a storm aera. Other stations should be established near the geomagnetic equator and the geomagnetic poles. It is suggested that at least five stations be set up; one near the geomagnetic equator, one near the geomagnetic north pole, two at intermediate latitudes, and one in the southern hemisphere at a point conjugate to one of the intermediate-latitude stations in the northern hemisphere.

Appendix J. — *Measurements of collisional frequencies by wave interaction experiments*

One method by which the collisional frequency of electrons in the ionosphere can be determined is based upon the production of heat at the level where this value is desired. On penetrating the ionosphere, an electromagnetic wave undergoes absorption which becomes a maximum usually just before the wave reaches its reflection level. This absorption manifests itself as an increase in energy or heating of the electrons in the ionic region concerned. As the temperature of the electrons increases their velocity increases and consequently the collisional frequency of the electrons increases, resulting in an increase in their hability to absorb radio wave energy. The time constant of this heating effect is used to determine the collision frequency of electrons in the ionosphere.

It is feasible to obtain the necessary measurements experimentally. A pulse of sufficient duration is transmitted vertically and on being absorbed in the ionosphere produces the desired local heating. This wave is then reflected from a level dependent upon the frequency of the transmitted signal. By measuring the time delay and the amplitude change of the reflected wave it is possible to determine the collisional frequency.

In practise, in carrying out this experiment two transmitters should be employed : one for transmitting the heating pulse and the second for transmitting the probing pulses which are used for measuring the height and the time constant. The heating transmitter produces a pulse of about 50 *millisecond* duration with a peak power of about 100 kW. The probing transmitter produces pulses of 20 microsecond duration with a repetition rate of 1000 per second. As there is a decrease in the amplitude of the received signal while the heating take place, there is likewise an increase in amplitude of the signals received from the probing pulses as the region of reflection « cools off » to its normal state. By measuring the amplitudes of the received pulses of the probing rays and knowing their separation in time, a value for the collisional frequency can be determined.

The time duration of 59 milliseconds and the 100 kW power for the heating pulse is necessary to insure sufficient heating in the ionic layers. With a repetition rate of 1 second for the entire process, sufficient time is allowed for the ionic region to return to its undisturbed condition before a second heating pulse is transmitted. On the other hand, the probing pulses are sufficiently short so that their heating effect on the ionosphere is practically negligible. Probing pulses of longer duration in themselves would produce some noticeable heating so that the results of the experiment would be inaccurate.

It is preferable that the same frequency be used for the heating and for the probing pulse in order to insure that the collisions are measured at the same height where heating occurs. A slight difference in frequencies may nevertheless be desirable.

The equipment used for the probing pulse may be of the conventional ionosphere recorder type. While an automatic sweep frequency transmitter could be employed, it may be better to utilize equipment in which the frequency can be adjusted manually. With this possibility the variation of collision frequency with the height can also be determined.

The desirable frequency range in which to conduct the experiments is from 0.5 to 1.5 Mc/s. The lower frequency represents a value at which reflections would be obtained from the lower portions of the ionosphere (about 90 km). The frequency of 1.5 Mc/s is the highest at which this experiment is practical. It is to be noted that the gyro frequency falls within this range of 0.5-1.5 Mc/s. Operation at the gyro frequency should probably be avoided even though it has the distinct advantage of being a frequency at which energy is strongly observed in the ionosphere. However, the heating effect is less concentrated at a specific height.

(*To be continued.*)

Special Committee for the International Geophysical Year C. S. A. G. I.

MEMBERSHIP

The Membership given in *Bulletin* 77, p. 41, should be replaced with the following :

Chairman : Prof. S. CHAPMAN (I.G.G.U.),

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Special Committee of the World Meteorological Organization

The membership of the W.M.O. (*Bull.* 77, p. 45) is as follows :

Prof. C. E. PALMER (U.S.),

Prof. Dr. J. VAN MIEGHEM (Belgium).

BOOK REVIEWS

Joint Commission on Relationship between Solar and Terrestrial Phenomena. International Council of Scientific Unions. Proceedings of the meeting held in Rome, September 1952.

Contents : Internal organisation and activity of the commission.

1° Approbation du procès-verbal de la séance de Zurich (August 1948).

2° Application du nouveau règlement des commissions mixtes.

3° Activité de la commission.

4° Développement ou perfectionnement à apporter, aux prochains rapports de la commission.

5° Développement des informations solaires et géophysiques par messages radiodiffusés « Ursigrammes ».

6° Données du « Quarterly Bulletin on solar activity ».

7° Questions diverses.

Papers submitted to the colloquium :

1° Réseau d'enregistreurs de P.I.D.B. (renforcements brusques) sur 11 000 m, R. Bureau.

2° Relations between flares and 1.5 meter solar radiation, Helen W. Dodson.

3° Researches on the solar and terrestrial relationship, Y. Hagihara.

4° Solar radio emissions at 4 metres wavelength during 1947-50 inclusive and their relation to solar activity, J. S. Hey.

5° The relation between the solar corona and the geomagnetic disturbances, K. O. Kienheuer.

6° Corrélation entre certains phénomènes géophysiques et le rayonnement solaire sur 55 cm, M. Laffineur.

7° A simple numerical illustration of the statistical relationship between geomagntic storms and the larger sunspots, H. W. Newton.

8° Actions de l'atmosphère terrestre sur les équilibres de photo-dissociaciation et de photo-ionisation par le rayonnement ultra-violet et X du soleil, M. Nicolet.

9° The solar component of the cosmic radiations derived from intensity variations, J. A. Simpson.

10° Mécanisme possible de l'action de l'activité solaire sur la basse atmosphère, A. and E. Vassy.

11° Auroral spectroscopy and its bearing on the physics of the ionospher and on solar terrestrial relationships, L. Vegard.

International Electrotechnical Commission. *I. C. E. Specification for Fuses for Voltages not exceeding* 1000 *V for A. C. and D. C.* (First edition), published by the Central Office of the I. C. E., 39, route de Malagnou, Geneva (Switzerland). Pric : S. Fr. 5, plus postage.

C.C.I.R. *Bibliography on Communication Theory.*

Introduction :

1. *General.* — As required by paragraph 1 of C.C.I.R. Study Programme N° 10, the Director of the C.C.I.R. takes the pleasure in presenting an Indixed Bibliography on publications regarding the *Theory and General Practice of Communications.*

2. *Sources* :

(*a*) Extensive research for relevant articles has been conducted by the Secretariat of the C.C.I.R., and we must expresse our appreciation for the help from various national sources, in particular, from the United States and the Netherlands.

(*b*) The Secretariat of the C.C.I.R. is greatly indebted to the following publications, from which the major part of the abstracts has been taken :

Annales des Télécommunications,

Engineering Index,

Mathematical Reviews,

Proceedings of the Institution of Radio Engineers,

Proceedings of the London Symposium on Information Theory,

Science Abstracts, Sections A and B,

Wireless Engineer.

A small part of the abstracts have either originated with National Committees, or are those first published with the articles in question.

All the abstracts in the Bibliography are reproduced in their original language.

3. *Presentation.* — The abstracts are grouped in alphabetical order of author's name *by year* thus, for exemple : N° 50/033 means Abstract N° 33 of an article originally published in 1950. They are presented in such a manner as to fit on a standard card of 150 × 210 mm (6″ × 8″).

Where abstracts were too long to be accommodated on one card, an interval has been made in the text so that it can be arranged on two or more cards.

4. *Index.* — For convenance of reference, two indices have been added, one by *author,* the other by *subject.*

5. *Price.* — Copies of the Bibliography may be obtained upon application to :

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at the price of 10 Swiss francs.

6. *Supplements.* — It is intended to publish periodically supplement to the Bibliography as new articles appear, and additional abstracts of those already issued become available.

United Nations. Economic and Social Council. *List of Non-Governmental Organizations in Consultative Relationship with the Economic and Social Council.*

INTERNATIONAL SCIENTIFIC AND TECHNICAL CONFERENCES

Date	Subject	Organizer	Location
1953 August 3-7	7th Intern. Congress on History of Science. 3rd General Assembly I.U.H.S.	Prof. F. S. Bodenheimer, Hebrew Univ. Jerusalem.	Jerusalem
August 17-21	I.U.B.S. 11th General Assembly	Prof. P. Vayssière, General Secretary I.U.B.S., 57, rue Cuvier, Paris 5e. Prof. Stuart Mudd, Department of Microbiology, School of Medecine, Univ. of Pennsylvania, Philadelphia 4.	Nice
August 22-25	Joint Commission on High Altitude Research Stations (I.C.S.U.).	Dr. R. Stampfli, 5 Bülhlplatz, Berne, Switzerland.	Denver, Colorado
August 24-26	Rocket Explorations of the Upper Atmosphere Conference	Mr. H. S. W. Massey, University College, Gower Street, London, W. C. 1	Oxford, England
August 10-September 5	W.M.O. Commission for Instruments and Methods of Observation. 1st Session.	Mr. Jean R. Rivet, W.M.O., 1 Avenue de la Paix, Geneva.	Toronto

Date	Subject	Organizer	Location
September 1-2	Joint Commission on Oceanography (I.C.S.U.).	Mr. Laclavère, I.G.G.U., 30 Avenue Rapp, Paris 7e.	Liverpool
September 2-9	British Association for the Advancement of Science. Annual Meeting.	D. N. Lowe, Esq., British Association for the Advancement of Science, Burlington House, Piccadilly, London W. 1.	Liverpool
September 6-12	6th International Congress of Biology (I.U.B.S.).	Dr. V. Puntoni, Città Universitaria, Rome.	Rome
September 7-9	Conference on Motions in the Upper Atmosphere, University of New Mexico and National Science Foundation.	Prof. Victor H. Regener, Department of Physics, Univ. of New Mexico, Albuquerque.	Albuquerque, New Mexico
September 9-15	Meeting of the Royal Meteorological Society and 124th National Meeting of the American Meteorological Society.	Mr. Kenneth C. Spengler, Executive Secretary of American Meteorological Society, 3 Joy Street, Boston 8, Mass. U.S.A.	Toronto, Canada
September 14-24	I.U.P.A.P. Colloquium on Fundamental Physical Theory.	Dr. Y. Fujioka, Science Council, Ueno Park, Tokyo.	Kyoto, Japan

September 15	International Bureau of Weights and Measures. Consultative Committee for the Definition of the Metre.	Bureau International des Poids et Mesures, Pavillon de Breteuil, Sèvres (S. et O.), France.	Sèvres
September	U.I.T.-C.C.I.R. 7th Plenary Assembly.	General Secretariat U.I.T., Palais Wilson, Geneva.	London
September	International Organization for Standardization. Meeting on Terminology.	General Secretariat, 39 route de Malagnou, Geneva.	Vienna
September	Symposium on Gravimetry (U.G.G.I.).	Col. Laclavère, U.G.G.I., 30 Avenue Rapp, Paris 7e.	Paris
October 6-27	W.M.O. Executive Committee. 4th Session.	Mr. J. R. Rivet, W.M.O., 1 Avenue de la Paix, Geneva.	Geneva
October 8-11	Congress of the International Federation of National Engineering Associations	Associations Nationales d'Ingénieurs, 90 via delle Terme, Rome.	Rome
October 11-12	French Canadian Association for the Advancement of Science.	Dr. J. J. Lussier, M. D., Association Canadienne-Française pour l'Avancement de la Science, 2900, Boulevard du Mont Royal, Montreal 26, Canada.	Montreal

Date	Subject	Organizer	Location
October 12-15	International Organization for Standardization. International Committee on Radio Interference.	General Secretariat, 39, route de Malagnou, Geneva.	London
November 3	W.M.O. Commission for Agricultural Meteorology, 1st Session.	Mr. J. R. Rivet, W.M.O., 1 Avenue de la Paix, Genève.	Geneva
November 9-12	Conference on Radiometeorology, American Meteorological Society, Radar, Weather Conference, I.R.E. National Conference, I.R.E. National Commission II of U.R.S.I., and Joint Commission on Radio Meteorology.	Mr. Kenneth C. Spengler, American Meteorological Society, 3 Joy Street, Boston 8, Mass. U.S.A.	Austin, Texas, U.S.A.
November 16-28	8th Pacific Science Congress.	Dr. P. Valenzuela, National Research Council of the Philippines, Univ. of the Philippines, Quezon City, Philippines.	Phillippines
November 24	W.M.O. Commission for Bibliography and Publication. 1st Session.	Mr. J. R. Rivet, W.M.O., 1 Avenue de la Paix, Geneva.	Paris

November 26-29	Ceylan Association for the Advancement of Science 9th Annual Session.	Mr. V. Appapillai, The Ceylan Association for the Advancement of Science, University of Colombo, Colombo 3, Ceylan	Colombo
November or December	International Standardization Organization. Meeting on Quantities, Symbols, Units and Conversion Tables.	International Standardization Organization, 39, route de Malagnou, Geneva.	Copenhagen
December 26-31	American Association for the Advancement of Science.	Mr. R. L. Taylor, American Association for the Advancement of Science, 1515 Massachusetts Avenue, N.W., Washington 5, D. C.	Boston
1954 Januari 2-8	Indian Science Congress.	Dr. U. P. Basu, F.N.I., General Secretary, Indian Science Congress Association, 1 Park Street, Calcutta 16.	Hyderabad
January 15-26	Australian and New-Zealand Association for the Advancement of Science.	Prof. J. R. A. McMillan, Honorary Secretary, Science House, 157 Gloucester Street, Sydney, Australia.	Canberra, Australia

Date	Subject	Organizer	Location
March	Symposijm on Compensation of the European Geodetic Network, U.G.G.I.	Mr. Laclavère, U.G.G.I., 30 Avenue Rapp, Paris 7e. Mr. Waldo E. Smith, 1530 P Street N.W. Washington 5, D.C.	Paris
July 6-10	I.U.P.A.P. 8th General Assembly	Prof. P. Fleury, I.U.P.A.P., 3 Boulevard Pasteur, Paris 15e	London
July 6-10	Joint Commission on Electron Microscopy (I.C.S.U.).	Mr. F. M. Cuckow, Chester Beatty Institute, Royal Canier Hospital, Fulham Road, London, S. W. 3.	London
June or July	Joint Commission on Spectroscopy (I.C.S.U.).	Dr. Henry A. Barton, American Institute of Physics, 57 E 55th Street, New York, 22.	Lund, Sweden
July 21-28	I.U.Cr. 3rd General Assembly.	R. C. Evans, Esq., Crystallographic Laboratory, Cambridge	Paris
August 16-18	Joint Commission on the Ionosphere (I.C.S.U.) (4th Meeting)	Dr. W. J. G. Beynon, Secretary of the Commission, Department of Physics, University College, Singleton Park, Swansea, England. Col. E. Herbays, Secretary General of U.R.S.I., 42, rue des Minimes, Brussels.	Brussels

August 20-21	U.R.S.I. Executive Committee	Idem.	Ten Hagen (Netherlands)
August 23-September 2	U.R.S.I. 11th General Assembly	Idem.	Idem
August 30-September 9	International Mathematics Union 2th General Assembly-Congress.	Prof. Dr. J. F. Koksma, 2e Boerhaaverstraat 49, Amsterdam O Prof. Bompiani, Via Verona 22, Rome. Prof. Marshall H. Stone, Department of Mathematics, University of Chicago, Chicago 35.	Ten Hagen and Amsterdam
August 15-28	Pan Indian Ocean Science Congress.	Prof. A. D. Ross, C.B.E., Pan Indian Science Association, 31, Ventnor Avenue, West Perth, Western, Australia.	Perth, Western, Australia
September 1-8	British Association for the Advancement of Science. Annual Meeting.	D. N. Lowe, Esq., British Association for the Advancement of Science, Burlington House, Piccadilly, London W. 1.	Oxford
September 15-29	International Association of Physical Oceanography (I.G.G.U.) 11th General Assembly.	Mr. Laclavère, U.G.G.I., 30 Avenue Rapp, Paris 7e	Rome

Date	Subject	Organizer	Location
September first two weeks	International Electrotechnical Commission. Jubile Meeting.	Mr. L. Ruppert, C.E.I., 39, route de Malagnou, Geneva.	Philadelphia, Pa., U.S.A.
September 2nd half	U.G.G.I. General Assembly.	Mr. Laclavère, U.G.G.I., 30 Avenue Rapp, Paris 7e.	Rome
October 5	10th General Conference on Weights and Measures.	Bureau International des Poids et Mesures, Pavillon de Breteuil, Sèvres (S.-et-O.) France.	Sèvres