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GÉNÉRAL G. FERRIÉ
1868-1932
Premier Président de l'URSI

Cette année marque le 100e anniversaire de la naissance du Général G. Ferrié, premier Président de l'URSI et l'un des membres fondateurs de la Commission Internationale qui se réunit pour la première fois en 1913 et fut à l'origine de l'organisation actuelle. Lors de la création de l'Union en 1919, il fut élu Président et il assuma ces fonctions jusqu'à sa mort en 1932.

Lors de l'Assemblée générale de Londres, en 1934, évoquant la mémoire du Général Ferrié, M. R. B. Goldschmidt, alors Secrétaire général, dit notamment :

« Le Général Ferrié était non seulement le premier Président de notre association mais, en réalité, il en était le fondateur. C'est lui qui fit acquérir à l'Union son caractère hautement utilitaire et universel indiscuté, et il sut grouper sous son égide les savants les plus éminents du monde entier spécialisés dans la science qui nous est chère.

» Redire ici son rôle primordial, montrer son influence animatrice, rendre tangible d'une façon complète la haute valeur de sa si compétente direction et des conseils éclairés qu'il ne cessait de prodiguer est une tâche qu'un rapport tel que celui que j'ai l'honneur de vous faire ne pourrait, hélas, pas entreprendre.

» Je compte sur vos sentiments de profonde reconnaissance, Messieurs, pour apprécier toute l'étendue de la précieuse et inoubliable collaboration du regretté Général Ferrié et comprendre que les débats qui s'ouvrent aujourd'hui, vont encore se poursuivre imprégnés de sa haute pensée, à laquelle ils doivent leur ampleur remarquable, leur intérêt profond et leur haute valeur scientifique. »

Le 100e anniversaire de la naissance du Général Ferrié sera célébré à Paris le 20 novembre 1968 et l'URSI sera représentée aux cérémonies commémoratives par le Dr R. L. Smith-Rose, Président d'Honneur et Président de l'Union de 1960 à 1963. M. B. Decaux, Président d'Honneur de l'URSI, est membre du Comité d'organisation des cérémonies.

CHANGE IN THE ENGLISH TITLE OF URSI

As from 1 January 1969, URSI will be known in English as the International Union of Radio Science. The French title, Union Radio-Scientifique Internationale, adopted in 1928, will be retained and the well-known initials URSI will be used in both French and English texts. As already announced in a circular widely distributed in October, these decisions have been made after consultation with the National Committees of URSI and have been approved by the Board of Officers.

At the General Assembly of URSI in 1927, there was some preliminary discussion about the name of the Union as it was then : Union Internationale de Radiotélégraphie Scientifique. This was based on the name of the original international Committee which first met in Brussels in 1913 and which later formed the nucleus of the Union itself when it was founded in 1919. Since radiotelegraphy had become an inaccurate description of the widening interests of URSI in 1927 it was decided to ask the 1928 Assembly to consider a change in the name.

In Brussels in 1928, General Ferrié announced to the Assembly :

« Le Comité Exécutif vous propose d'appeler notre groupement « Union Radio-Scientifique Internationale ». On a objecté que le mot « radio » n'était ni anglais, ni français. En ce moment, étant donnés les progrès constants de la technique et particulièrement de la technique de la radio, le besoin de mots nouveaux se fait sentir, et nous pensons que c'est pour nous une occasion d'adopter un mot nouveau. »

This proposal was adopted. It seems, however, that no formal decision was made regarding the English translation of the new title, but it appears on the covers of the Proceedings of the 1928 Assembly as International Scientific Radio Union and has been used ever since then.

After an interval of 40 years it is difficult to appreciate the exact significance, at the time, of the term "scientific radio". However, it is clear that in the present-day English language, the term "radio science" is a more appropriate description of the extensive range of subjects covered by the scientific activities with which URSI has been concerned for many years.

It is worth noting, in conclusion, that the term "radio science" is not by any means new; it was used several times by Dr. Eccles in the Vice-Presidential Address which he gave at the opening of the Assembly in London in 1934.

GENERAL MEETING ON SOLAR-TERRESTRIAL PHYSICS PROGRAMME

LONDON, 27-31 JANUARY 1969

1. The agenda for this meeting will include :
   1.1. Review of the 12 interdisciplinary programmes recommended in STP Notes No. 1 and No. 2.
   1.2. Review of the existing station networks and the need for additional stations. Treatment of observational data.
   1.3. Arrangements for cooperation between scientists in different countries in the execution of the STP Programme.
2. Scientists who have not received the Second Announcement (STP40(68) dated 7 September 1968) about the London Meeting and who are interested in the Programme should write to the Secretary of IUCSTP :

Dr. E. J. Dyer, Jr.,
National Academy of Sciences
2101 Constitution Avenue,
Washington, D. C., 20418,
USA.

COLLOQUIUM ON PLANETARY ATMOSPHERES AND SURFACES

A Colloquium on Planetary Atmospheres and Surfaces will be held from 11-15 August 1969 at Woods Hole, Massachusetts, USA under the joint sponsorship of IAU and URSI. The date and location have been selected so as to allow participants to attend both the Colloquium and the URSI General Assembly which follows immediately in Ottawa, Canada.

The objective of the Colloquium will be to make possible an exchange of the latest results of studies of planetary atmospheres and surfaces based on radioastronomical (including radar) observations and measurements made using space probes. One particular aim of the Colloquium will be to acquaint those working in the radio fields with recent new information from space probes, such as Surveyor (Moon) and Mariner (Venus), and the organizers will obtain invited review papers covering such work.

The provisional programme of the Colloquium is as follows :

Planet	Session	Topic	Organizer
Moon	1	Remote Sensing : Photographic Interpretation (Ranger, Orbiter, Surveyor)	H. Masursky
Moon	2	Remote Sensing : Radar, I. R. Radio	G. H. Pettengill
Moon	3	Direct Exploration : Properties of Surface Material	L. D. Jaffee
Moon	4	Interpretation : Surface Evolution	Z. Kopal
Venus	5	Direct Exploration : Atmosphere and Surface (Mariner 5, Venus 4)	V. R. Eshleman
Mercury/Venus	6	Remote Sensing : Optical, Radio, Radar	I. I. Shapiro
Venus	7	Interpretation : Models of the Atmosphere	A. D. Kuzmin
Mars	8	Remote Sensing : Mariner 4, Radar	C. Sagan
Jupiter and Giant Planets	9	Remote Sensing : Longwave Radio	M. A. Gordon
Jupiter and Giant Planets	10	Interpretation : Radio Emission Mechanisms	M. A. Gordon

This programme is subject to modification depending on the number and quality of the papers submitted.

The number of participants will be restricted to about 50 and these will be chosen on the basis of the papers received. The *full text* of proposed papers must be sent to the Chairman of the Organizing Committee (Dr. J. V. Evans) so as to arrive *not later than 31 May 1969*. The papers presented at the Colloquium will be published early in 1970 in a special issue of Radio Science.

The Organizing Committee at present includes the following members :

J. V. Evans *(Chairman)*, MIT Lincoln Laboratory, Lexington (Mass.) 02173, USA.

A. Boischot, France
V. R. Eshleman, USA
M. A. Gordon, USA
W. E. Gordon, USA
L. D. Jaffee, USA
Z. Kopal, UK
A. D. Kuzmin, USSR
H. Masursky, USA
G. H. Pettengill, USA
C. Sagan, USA
I. I. Shapiro, USA

XII GENERAL ASSEMBLY OF ICSU

PARIS, 28 SEPTEMBER — 2 OCTOBER 1968

REPORT BY ACTING SECRETARY GENERAL

1. — In the unavoidable absence of the President, URSI was represented at the XII Assembly and at meetings of the VIII Executive Committee by the Acting Secretary General.

2. — RESOLUTIONS.

The principal resolutions adopted at the end of the Assembly are as follows :

Resolved :

1. That the International Union of Nutritional Sciences be admitted to the Council as a Scientific Member.

2. That Turkey be admitted to the Council as a National Member through the National Scientific and Technical Research Council as its national adhering organisation.

3. That the IUGG, and IUBS in consultation with SCIBP be invited to appoint 3 members each to an ad hoc Committee of ICSU on Problems of Human Environment, for the purpose of preparing a report upon those characteristics of the environment which man himself is altering.

The Report will emphasize those problems which are of international concern, and will state if there are those toward the solution of which the scientific competence represented by ICSU could effectively be applied and it will be submitted, with all possible speed, to the Presidents of IUGG, and of IUBS, in the first instance, who will examine it and forward it with their comments to the Officers of ICSU. The Assembly authorizes the Officers and the Executive Committee to give the necessary financial help for the preparation of the report and further recommends that the Officers take prompt action on the report when it is presented to them.

6. To convey its appreciation and grateful thanks (*a*) to the U. N. specialised agencies for their most valuable cooperation in projects of the ICSU and its constituent bodies, (*b*) to WMO for its cooperation in the organization of GARP, and (*c*) especially to UNESCO for its continuing and increased support of the activities of the ICSU and its components which has proved mutually beneficial.

7. That, noting with satisfaction the formation of the World Federation of Engineering Organisations, a warm invitation be extended to WFEO to cooperate on matters of mutual concern.

8. That the appreciation of the ICSU be conveyed to the Inter-Union Commission on Science Teaching for its valuable work during the past years.

Noting, however, that the Executive Committee believed that a change from an inter-union commission to a committee of ICSU would increase its effectiveness in the consideration of integrated science teaching from the ICSU viewpoint, the General Assembly endorsed the following proposals from the Executive Committee :

(1) that the IUCST be dissolved in its present form;

(2) that a Committee be established with six members appointed by the Executive Committee on the recommendation of the Officers : each Union wishing to participate in the work of the Committee may nominate a representative on the Committee and shall contribute $200 annually towards the expenses of the Committee;

(3) that the first Chairman of the Committee be nominated by ICSU;

(4) that the Committee be renewable at the discretion of the next General Assembly of ICSU.

9. That the ICSU Abstracting Board be requested to examine its structure and functions with a view to increasing its effectiveness and to make proposals for a revision of its objectives, terms of reference to the Executive Committee of the ICSU.

The remaining Resolutions referred :

(*a*) to the adoption of the reports from the various ICSU bodies (including URSI, IUCAF, IUCRM, and FAGS of which IUWDS is one of the Permanent Services);

(*b*) to financial matters;

(*c*) to the thanks of the Assembly for services generously rendered by the Consiglio Nazionale delle Ricerche of Italy (to the ICSU Secretariat in Rome), by the Académie des Sciences de l'Institut de France (in acting as host to the XII ICSU General Assembly), and by the Secretariat and others associated with the organisation of the Assembly.

3. — ELECTIONS.

The results of the elections for the members of the Executive Committee were as follows :

Officers :

President : V. A. Ambartsumian (USSR);
Secretary General : K. Chandrasekharan (India);
Treasurer : N. B. Cacciapuoti (Italy);
Past President : J. M. Harrison (Canada).

National Representatives :

E. Andersen (Denmark);
D. A. Bekoe (Ghana);
H. Brown (USA) *(Vice-President)*;
E. Carafoli (Romania);
C. Chagas (Brazil) *(Vice-President)*;
C.-C. Hedén (Sweden);
I. Hela (Finland);
A. Katchalsky (Israel);
M. Kotani (Japan);
G. Laclavère (France);
H. Thompson (UK).

Union Representatives :

Prof. Silver remains as the URSI Representative;
Prof. W. O. Fenn replaces Prof. Duyff (IUPS);
A Representative of the newly admitted IUNS (See Res. 1) will be nominated later;
Prof. Perek (IAU) and Prof. Coulomb (IUGG) were elected Vice-Presidents.

The remaining Union Representatives are as shown in ICSU Year Book 1968, page 5.

4. — Scientific Affiliates.

An extraordinary session of the General Assembly approved a modification to the Statutes of ICSU. As a result Scientific Affiliates will be recognised within ICSU. They will pay no dues but will enjoy the privilege of participation in discussions at General Assemblies although without the right to vote.

5. — Reorganization of ICSU.

The Committee on Admissions and Organization is giving serious consideration to a new structure for ICSU. Preparatory work is in hand and is aimed at collecting the necessary statistical and other data relating to the volume of activity in the different fields of science as represented by the existing Unions, and related matters.

6. — PANEL ON WORLD DATA CENTRES.

An ICSU Panel on World Data Centres was established and will take over the responsibilities of CIG in this field; CIG was terminated at the end of 1967. It will be responsible for

(1) the coordination of the interests of the various ICSU Unions, Commissions and Committees in relation to geophysical data,

(2) the provision of a link with interested intergovernmental bodies,

(3) the provision of advice to the WDCs when required,

(4) the publication of consolidated guides to the interchange of geophysical data, and supplements dealing with individual disciplines,

(5) the stimulation of the flow of data as recommended in the guides.

The initial membership of the Panel will include one representative from each of the following :

ICSU *(Chairman)*, IUGG, IUCSTP, WDC-A, WDC-B, WDC-C.

There will also be a Honorary Secretary and specialists representing oceanography, meteorology, solid-earth geophysics, space research, polar research, water research and FAGS.

7. — ORGANIZATION OF SCIENTIFIC MEETINGS.

The Unions were informally invited to consider the adoption of a general pattern, but with appropriate flexibility, for the organization of scientific meetings so as to increase their effectiveness.

Efforts should be made :

(1) to avoid unnecessary expenses,

(2) to discourage unnecessary publication of the proceedings,

(3) to ensure that the standards of the scientific activities of the meeting are worthy of an international body,

(4) to ensure adequate support from national resources.

The choice of location, the scientific programme and the selection of speakers for each meeting should be under the control of an international Committee of scientists which should ultimately include representatives of the host country and be approved by the corresponding Unions.

If they are published, the proceedings should, if possible, appear in existing periodicals or in book form.

Efforts should be made to stimulate interest in science in developing countries by holding meetings in them, but attention should be paid to overall cost and to problems of foreign exchange.

11 October 1968.

SYMPOSIUM ON LASER MEASUREMENTS

WARSAW SEPTEMBER 24-26, 1968

REPORT BY DR. L. ESSEN, CHAIRMAN, URSI COMMISSION I

The Symposium was suggested at the XV URSI General Assembly and was held in Warsaw at the invitation of the Polish National Committee for URSI and the Polish Academy of Sciences. The scientific sessions were held in the pleasant rooms of the Academy in Staszic Palace, and were opened by Professor Dr. J. Groszkowski, President of the Academy and also Vice-President of URSI. Professor P. Grivet, Chairman of URSI Commission VII, welcomed the participants on behalf of the President of URSI who was unable to attend because of the change in the dates of the Symposium.

Advances in the measurement of power were reported but, although a number of methods described could probably lead to standards of measurement, it was concluded that satisfactory standards were still to be developed. Real progress has been made in the difficult task of stabilising laser frequencies and it was possible to think reasonably of stabilities of 1 part in 10^{10}, or even 1 part in 10^{11}. A number of measurements of the wavelength of the He-Ne laser were reported, the highest accuracy so far achieved being 4 parts in 10^9. At the present time it would be difficult to set up a laser standard as accurate as the existing krypton line. The frequency of the H_2O line had been measured with error limits of several parts in 10^8.

An interesting application of the laser is the determination of the velocity of light from the wavelength and frequency of the same spectral line, and the progress of such an experiment at the National Bureau of Standards was described. Other interesting applications described were the study of plasmas, Kerr constant measurements, a meteorological laser radar and the measurement of the diameter of thin wires.

There was about 90 participants; 42 papers were received and 37 were presented by the authors. The summaries of the papers were available at the time of the Symposium and the full texts will be published in special numbers of the Polish journal *Electron Technology*.

The final session was devoted to a general discussion and it was concluded that the following topics merited the special attention of URSI.

1. Frequency measurements of laser oscillators.
2. Methods of frequency multiplication in the infra-red and visible regions.
3. Characteristics of laser materials.

4. Measurement of non-linear optical constants.
5. Noise phenomena in optical amplifiers.
6. Long-term laser stabilisation.
7. Measurement of energy and power in picosecond pulses.

Exposé pour l'ouverture du Colloque de Varsovie

PAR LE PROF. P. GRIVET, PRÉSIDENT DE LA COMMISSION VII

Par ma voix, l'URSI est heureuse de vous apporter ses remerciements chaleureux pour l'œuvre remarquable accomplie par le Comité National Polonais, en préparant la « Conférence sur les Mesures par Lasers ». Notre reconnaissance va d'abord au Professeur Groszkowski, Président du Comité National, et l'URSI le prie d'en transmettre l'expression à tous ceux qui ont participé à cet effort, en particulier au Dr. Hahn, Secrétaire du Congrès, à qui incombait la tâche de son organisation.

C'est un honneur pour l'URSI de voir que l'Académie des Sciences Polonaise a soutenu de sa haute autorité scientifique et morale cette entreprise — je prie le Professeur Groszkowski, Président de l'Académie des Sciences, pionnier universellement connu de l'électronique, d'être notre interprète auprès de cette haute Insitution pour lui exprimer la gratitude de l'URSI — le patronage de l'Académie est un gage certain de la haute tenue scientifique des communications que nous allons entendre. C'est une garantie pour cette Conférence qui traite des applications, de la qualité du choix des questions traitées et que la science appliquée reste au niveau de la science pure, tout en intéressant plus directement les citoyens de nos pays.

Ce dernier problème, qui est en somme le choix entre les désirs humains à court terme et l'intérêt scientifique à long terme, est toujours difficile et c'est l'une des raisons d'être de l'URSI, Société Savante Internationale, de faciliter ce choix en réunissant dans une organisation administrative efficace des moyens internationaux, pour résoudre ces importantes difficultés. Il me semble que le Président de l'URSI, le Professeur S. Silver sera très satisfait de la haute qualité du programme de ce Symposium établi par le Professeur Essen et son Comité Scientifique, et au nom de l'URSI, je les remercie pour leurs brillants efforts.

Si l'URSI apporte aux pays membres une aide scientifique, elle impose aussi aux activités poursuivies sous son égide un cadre, dont les restrictions apparaissent ici. En effet les applications des lasers sont apparues il y a plusieurs années déjà, et le laser a été appliqué en fait presque dès sa nais-

sance. Ainsi par exemple cette source de lumière est entrée presque sans qu'on le remarque dans la construction des spectrographes Raman, en multipliant leur efficacité, de manière à en faire des rivaux des spectrographes à infra-rouge ou à résonance nucléaire dans les applications à la chimie. De même l'interférométrie a assimilé sans révolution apparente ces nouvelles sources. Par ailleurs, une technique entièrement nouvelle, celle des hologrammes a été créée et employée immédiatement sur une grande échelle, au codage optique en particulier. J'ai cité ces questions, pour expliquer aux auditeurs qui en sont à leur premier contact avec l'URSI, que ces sujets ont été traités antérieurement lors de la 15e réunion plénière de l'URSI à Munich et pour cette raison ils ne sont pas envisagés ici. Mais le domaine des applications des lasers s'est étendu considérablement depuis 1966 et le programme de cette conférence couvre de nouveaux sujets pleins d'intérêt aussi.

J'en donnerai deux exemples. Le premier concerne l'un des domaines de base de l'URSI, celui des télécommunications. Une place de choix est aujourd'hui offerte à la lumière. Car d'une part l'atmosphère terrestre est justement transparente, pour le rayonnement infrarouge du laser à CO^2 ($\lambda \simeq 10$ [μm]), d'autre part les communications entre satellites artificiels et avec la Lune ou les planètes se font dans le vide qui est transparent pour les lumières de toutes les couleurs. C'est ce qui fait tout l'intérêt d'obtenir une onde porteuse aussi pure que possible pour transporter les informations : de là l'importance du laser « monomode » qui sera discuté en détail ici. C'est ce qui fait aussi que le laser semi-conducteur léger et le rendement élevé reste au premier plan de l'actualité, avec la création toute récente de l'opto-électronique.

A l'opposé, en théorie, on peut recourir pour communiquer à des impulsions. Cette méthode vient d'être essayée avec un très grand succès semble-t-il et les efforts entrepris dans cette voie ont même déjà dépassé le domaine des communications et de l'électronique. En effet ces dernières années on a pu mettre à profit la large bande de fréquence du rubis et surtout du verre au néodyme pour produire des impulsions extrêmement brèves dont la durée ne dépasse pas la picoseconde. On conçoit qu'on puisse écouler par leur moyen un nombre considérable d'unités d'informations, c'est-à-dire de « bit » par seconde. Leur nouveauté apparaît encore mieux en télémétrie, car la précision naturelle d'un radar optique ou « lidar » en employant ces impulsions est de l'ordre du 1/10 de millimètre. Enfin, on ne doit pas oublier que ces impulsions permettent d'accumuler un court instant une énergie phénoménale dans un volume très petit, au foyer d'une lentille, et que cependant leur durée reste longue vis-à-vis de celle des pro-

cessus nucléaires : il semble bien qu'elles aient permis d'initier d'une manière nouvelle une réaction de fusion nucléaire. Cette remarquable expérience a été réussie récemment au Laboratoire du Professeur Basov, Prix Nobel, dont de nombreux élèves contribuent à animer ce Congrès.

Ce bref examen de quelques-uns des sujets marquants inscrits à notre programme en fait, je l'espère, ressortir l'intérêt profond et l'actualité. C'est pourquoi l'URSI se félicite de ce que le Comité Polonais ait bien voulu dépenser ses efforts et ceux des scientifiques de son pays pour développer ce domaine passionnément.

Au nom du Président de l'URSI, le Professeur S. Silver, je prie le Président Groszkowski d'être notre interprète auprès du Comité Polonais et de tous ceux qui l'ont aidé, de la reconnaissance de l'URSI.

SYMPOSIUM ON ELECTROMAGNETIC WAVE THEORY

STRESA, 24-29 JUNE 1968

The triennial URSI Symposium on Electromagnetic Wave Theory was held in Stresa, from 24 to 29 June, 1968 at the invitation of the Italian National Committee for URSI. It was sponsored jointly by the Internationa Scientific Radio Union and the National Research Council of Italy with financial support from several Italian firms and organisations.

The opening meeting was presided over by Professor Boella, Vice-President of URSI, who welcomed the delegates. Other speakers at this session were Dr. Stumpers, Chairman of URSI Commission VI, and Professor Carassa for the Italian National Committee.

152 contributions from participants had been accepted, apart from the 14 invited lectures. In order to have single sessions, as far as possible, the invited speakers were asked also to take into account, in their reviews, all the individual contributions in their field. In this way it was hoped that 5 minutes would be sufficient for each of the participants to explain some more of the details of his subject. It is clear that such a scheme depends on the invited speaker and on the information available to him. Therefore the reactions of the audience were rather mixed, and it remains to be seen, whether the advantage of single sessions outweighs the disadvantage of such concise contributions. This is a subject for discussion at the next Commission VI business meeting.

The contributions were grouped according to subject and the details of the programme and speakers are listed in the Annex to this report.

On Wednesday a banquet was organized, and on Thursday a boat trip on the Lago Maggiore.

The attendance, 248 participants, was about the same as in Delft in 1965. Canada 9, Denmark 13, France 28, Germany 18, Israel 2, Japan 2, Netherlands 11, Norway 3, Poland 2, Sweden 11, UK 27, USA 46, USSR 21, Italy 14.

Professors Carassa and Clarricoats are organizing the publication of the invited papers and some of the individual contributions in two special issues of the periodical "Alta Frequenza".

On Tuesday an informal business session of Commission VI was held. It was moved and approved that the URSI be asked to cosponsor the Hungarian Colloquium on "Microwave Communication" in 1970. It was considered desirable for Commission VI to have a session on Plasmas at the URSI General Assembly. Topics for URSI symposia were suggested : radio study of ice caps, and the teaching of e.m. theory. Because of my unavoidable absence this meeting was presided over by Professor Barlow.

The Italian Committee deserves our thanks for the hospitality and the many arrangements made.

Dr. F. L. Stumpers
Chairman, URSI Commission VI

Session 1. — Wave Propagation in Inhomogeneous and Anisotropic Media

Topic : Formal Theory.

Tuesday, June 25, 8.30-10.30.

Chairman : Prof. J. B. Clarricoats.

Invited Speaker : Prof. N. Marcuvitz.

E. Gortin, G. Franceschetti : Radiation of the Electromagnetic Wave in Very General Time-Invariant Linear Medium.

V. Daniele : The Use of Dyadic Green's Functions for Wave Propagation in Anisotropic Media.

L. G. Bossy : Le tracé des rayons dans un milieu anisotrope dans le cadre d'une théorie Hamiltonienne à quatre dimensions.

E. A. Graham : On the Theory of Magnetoionic Propagation in the Earth's Ionosphere.

L. E. G. AhSam, M. C. Jones : Reflectivity and Transmittivity of a Metallic Thin Film in a Constant Magnetic Field.

R. Zich : The Use of Dyadic Green's Functions in Problems Involving Inhomogeneous Media.

R. Gabillard, F. Louage, J. Fontaine, J. P. Dubus : Théorie matricielle de la propagation dans un terrain stratifié d'une onde électromagnétique émise par une antenne verticale souterraine.

TOPIC : PROPAGATION IN DISPERSIVE AND INHOMOGENEOUS MEDIA.

Tuesday, June 25, 10.45-12.45.

Chairman : Prof. J. B. Clarricoats.

Invited Speaker : Prof. L. B. Felsen.

B. O. Ronnang : Propagation and Reflection of an Electromagnetic Transient in a Layered Ionized Medium.

B. Granoff, R. M. Lewis : Asymptotic Theory of Electromagnetic Wave Propagation in an Inhomogeneous Anisotropic Plasma.

J. Bazer, D. H. Y. Yen : Wave Propagation in Two-Dimensional Anisotropic Media : A Study of the Fundamental Solution and its Lacunas.

G. I. Makarov, V. V. Novikov : Application of the Method of Standard Equations for the Study of Electromagnetic Wave Propagation in a Non-Homogeneous Anisotropic Medium.

P. L. E. Uslenghi, N. G. Alexopoulos : A Special Class of Spherically Inhomogeneous Dielectrics.

B. V. Stanic, E. R. Wooding : Computer-Aided Microwave Scattering on an Inhomogeneous Non-Stationary Cylindrical Plasma Column.

Kunihiro Suetake : Recent Activities on the Research and Development of Electromagnetic Absorbing Wall and Anechoic Chamber in Japan.

TOPIC : PERIODIC STRUCTURES.

Tuesday, 25 June, 14.15-15.15.

Chairman : Prof. A. A. Oliner.

Invited Speaker : Prof. R. Mittra.

B. Singer, T. Tamir : The Field of a Line Source Embedded in a Periodically-Stratified Medium.

C. Yeh : Wave Propagation in Sinusoidally Stratified Plasma Media.

W. Braeckelmann : Wave Propagation in a Cylinder-Loaded Waveguide.

P. Bernardi, A. Salsano : Wave Propagation in Rectangular Guides Having a Time-Space Periodically Modulated Side-Wall.

D. Tsang, A. Hessel, A. A. Oliner : Scattering by a Multimode Corrugated Structure with Application to P Type Wood Anomalies.

TOPIC : RADIATION AND DIFFRACTION IN PLASMAS.

Tuesday, 25 June, 15.15-16.15.
Chairman : Prof. B. Felsen.
Invited Speaker : Prof. R. Mittra.
Yu. Ya. Broskii, I. G. Kondratiev, M. A. Miller : Electromagnetic Beams in Anisotropic Media.
H. S. Lu, K. K. Mei : Current Distribution and Input Admittance of a Cylindrical Antenna in a Uniaxial Medium.
B. Knudsen : Diffraction by a Slit in an Anisotropic Medium.
R. J. L. Grard : Coupling between two Electric Antennas in a Warm Plasma.

TOPIC : GUIDED MODES AND RESONATORS.

Tuesday, 25 June, 16.30-18.30.
Chairman : Dr. K. M. Siegel.
Invited Speaker : Prof. H. Bremmer.
A. E. Karbowiak : Solution of the Excitation Problem in Resonant Dissipative and Inhomogeneous Structures.
H. Bremmer : Propagation in a Plasma Filled Cylindrical Wave Guide with an Axial Magnetic Field.
A. J. Weil, E. H. Klevans : Trapped Modes in Plasma Slabs and Cylinders.
P. de Santis : Geometrical Acoustics for Quasistatic Modes in Ferrite Resonators.
P. Edenhofer : Eigenvalue Representation of Electromagnetic Modes in a Double-Anisotropic, Compressible Plasma.
P. J. B. Clarricoats, P. R. Huckle : On the Radiation from a Ferrite Slab Excited by a Line Source.

SESSION 2. — PROPAGATION IN RANDOM MEDIA

Wednesday, 26 June, 8.30-12.45.
Chairman : Prof. A. E. Karbowiak.
Invited Speaker : Prof. G. D'Auria.
C. H. Liu, K. C. Yeh : Diffusion of Rays in Random Media.
V. D. Gussev : Scattering of Radiowaves in Homogeneous Gyrotropic Medium.
U. Frisch : L'optique géométrique en milieu aléatoire.

K. Furutsu : Application of the Methods of Quantum Mechanics in the Statistical Theory of Waves in a Fluctuating Medium.

A. Ishimaru : Fluctuations of a Beam Wave Propagating through a Random Medium.

Y. A. Ryzhov : On Radiation of a Thin Metal Antenna in a Randomly Inhomogeneous Medium.

H. J. Albrecht : Theoretical Analysis of a Variable Scatter Mechanism in a Tropospheric Propagation Medium.

F. Schmitt : On the Conversion from Frequency Modulation into Amplitude Modulation with Multipath Propagation.

M. Bertolotti, N. Carnevale, B. Crosignani, P. di Porto : Phase Variations of Electromagnetic Waves in a Medium with Thermal Turbulence.

S. F. Mirkotan : Method of the Phase Height's Measurements in the Ionosphere.

S. F. Mirkotan, V. D. Gussev : Investigation of the Ionospheric Echoes by the Coherent Method.

M. Bertolotti, N. Carnevale, L. Muzi, D. Sette : Phase Fluctuations of Laser Beam Propagating in Turbulent Atmosphere.

P. Burlamacchi, A. Consortini, L. Ronchi, G. Toraldo di Francia : Theoretical and Experimental Investigation on the Propagation of a Coherent Light Beam in a Turbulent Medium.

B. Daino : Optical Processing of Measurements on Laser Beam Propagated through a Turbulent Atmosphere.

G. Di Blasio : Characterization of a Random Linear Time Variant Transmission Medium, as Regards Information Bearing Signals and Measuring Equipment.

C. M. Ottavi, D. Solimini : Statistical Properties of Fields in Waveguides with Partially Coherent Excitation.

Session 3. — VLF Propagation

Thursday, 27 June, 8.30-10.30.

Chairman : W. C. Bain.

Invited Speaker : Prof. K. G. Budden.

J. Galejs : Propagation of ELF and VLF Waves below a Generally Anisotropic Ionosphere.

E. Bahar : Analysis of Mode Conversion in Waveguide Transition Sections with Surface Impedance Boundaries Applied to VLF Radio Propagation.

B. Wieder : Rapid Calculation of Low Frequency Reflection Coefficients.

C. Altmann, H. Cory : The Generalized Thin-Film Optical Technique in Radio Propagation.

C. Altmann, E. Fijalkov : The Transmission of Electromagnetic Waves through the Ionosphere at Micropulsation Frequencies.

Thursday, 27 June, 10.45-12.45.

Chairman : G. Barzilai.

P. V. Blioch, A. P. Nikolaenko, Yu. P. Filipov : Excitation of the Earth-Ionosphere Waveguide by Lightning. Discharges and Geomagnetic Field Effects on the ELF Noise Spectrum.

R. M. Jones : A Quasi-Optical Method for Calculating Propagation of LF Radio Waves in the Presence of an Ionosphere with Horizontal Gradients :

Part I. — Ray Theory for Lossy Media

Part II. — Diffraction by the Earth.

J. Rieker : Représentation synoptique de l'amplitude et de la phase relative d'une émission de signaux de basse fréquence reçus en Suisse.

A. C. Das : The Stimulation of VLF Emissions.

R. H. Doherty : LF Pulse Propagation Related to the Chemical Constituents of the Ionospheric Media.

Session 4. — Non-Linear Phenomena in Wave Propagation

Wednesday, 26 June, 16.30-18.30.

Chairman : Prof. K. G. Budden.

Invited Speakers : Prof. J. Keller, Prof. P. L. Christiansen.

P. L. Christiansen : On the Non-Linear Coupling between an Electro-acoustic Wave and an Electromagnetic Wave in a Compressible Isotropic Plasma.

A. J. Ferraro, H. S. Lee : Effect of Radio Wave Interaction and its Application to Ionospheric Study.

H. C. S. Hsuan, K. E. Lonngren : Non-Linear Effects in the Scattering from Inhomogeneous Plasma Columns.

J. Askne : Wave Reflection from and Propagation in a Pumped Semi-Infinite Medium.

Session 5. — Antennas

Topic : Arrays.

Friday, 28 June, 8.30-10.30.

Chairman : Prof. Sinclair.

J. Appel-Hansen : Optimization of the Reradiation Pattern of a Van Atta Array.

E. Borchi, V. Cappelini : Gain and Impedance of Multi-ring Arrays of Antennas.

D. G. Dudley : Random Phase Errors in End-Fire Linear Antenna Arrays.

W. E. Goddard, R. M. MacPhie : A Non-Uniformly Spaced Broadband Antenna Array.

A. Meijer : Simulation of Far-Field Patterns of Unequally Spaced Linear Antenna Arrays.

J. Munier, J. Ph. Reboul : Emploi de lignes dispersives dans les réseaux Van Atta et les lentilles à propagation contrainte.

R. R. N. Utukuri, R. H. MacPhie : Spatial Frequency Analysis of Random Arrays.

Yu. P. Syhtov, Yu. P. Iliasov : Resolution Characteristics and Sensitivity of the Correlation Arrays.

TOPIC : MUTUAL COUPLING IN ARRAYS.

Friday, 28 June, 10.45-12.45.

Chairman : Dr. R. C. Hansen.

Invited Speaker : Prof. A. A. Oliner.

G. V. Borgiotti : Modal Analysis of Infinite Periodic Phased Arrays.

S. M. Kutuzov : Mutual Couplings in One-Dimensional Scan Wide-Band Array.

J. Roger : Spectre d'ondes vectorielles planes d'une répartition de champ électromagnétique.

L. Stark : Multi-Mode Phased Array Element for Wide Scan Angle Impedance Matching.

W. Wasylkiwskyj, W. Kahn : A Formulation of the Interrelations Among Coupling, Element Efficiency, Active Impedance and Patterns in Linear Arrays.

TOPIC : ANTENNAS.

Friday, 28 June, 14.15-16.15.

Chairman : Prof. H. L. Knudsen.

Invited Speaker : Prof. W. V. Tilston.

E. Corti, G. Franceschetti, G. Latmiral : Oblate Spheroidal Antennas for Conducting Media.

L. Marin : Radiation from a Slotted Circular Wave-guide.

F. Galejs : Surface Fields, and Near Fields of Linear Antennas.

S. Drabowitch, C. Aubry, M. Mathias : Augmentation du pouvoir séparateur d'une antenne par décomposition du champ reçu en distribution orthogonale et emploi de la théorie statistique de la décision.

P. Bruscaglioni, A. Consortini : Radiation Characteristics of Style Antennas over Metallic Spherical Surfaces.

F. Jacobsen : The Radiation from Periodic and Log-Periodic Structures.

L. C. Shen, R. W. King : The Long Antenna with Broadside Radiation Pattern.

F. Bacon, R. G. Medhurst : A Super-Directive Aerial Array Containing only one Fed Element.

TOPIC : APERTURES AND SYNTHESIS.

Friday, 28 June, 16.30-18.30.

Chairman : Prof. H. L. Knudsen.

Invited Speaker : Mr. K. S. Kelleher.

M. E. J. Jeuken, J. S. Kikkert : A Broadband Aperture Antenna with a Narrow Beam.

G. F. Koch : Possibilities for Reducting the Sidelobes of Paraboloid Antennas.

G. D'Auria, D. Solimini : The Double Aperture Problem with Partially Coherent Illumination.

Y. L. Chow, S. C. Wu : A Synthesis of Array Space Factor.

L. Wegrowicz : Aperture Radiation and Superdirectivity.

E. Borchi, V. Cappelini : Gain and Impedance of Multi-ring Arrays of Antennas.

S. Dobrzynska : Calculating the Voltages and Current for Dipoles in an Array Taking into Account the Mutual Coupling Effect.

SESSION 6. — APPLICATION OF COMPUTERS AND NUMERICAL METHODS

Monday, 24 June, 10.30-18.30.

Chairman : Prof. Bouwkamp.

Invited Speaker : Prof. J. B. Davies.

M. L. V. Pitteway, S. Horowitz : Numerical Techniques for Solving Differential Wave Equations at Higher Frequencies.

J. Bitoun, P. Graff : Programme de calcul sur ordinateur de la vitesse de groupe des ondes dans un milieu anisotrope.

A. R. Neureuther, K. Zaki : Numerical Methods for the Analysis of Scattering from Nonplanar Periodic Structures.

J. R. James, L. Longdon : Prediction of Arbitrary Electromagnetic Fields from Measured Data.

K. K. Mei : A New Algorithm for Solving Differential and Integral Equations of Electromagnetic Problems.

R. Mittra, S. W. Lee : Some Aspects of Numerical Solution of Boundary Value Problems.

U. R. Embry : Some Problems in Using Digital Computers to Study High Frequency Antenna.

P. F. Checcacci, A. Consortini, A. M. Scheggi : Numerical Technique for the Investigation of High Loss Regions in Flat-Roof Resonator.

J. Janse : Theoretical and Numerical Investigations of Modes in Ring-Shaped Resonators.

H. Block : A Numerical Study of Open Resonators for Lasers.

E. Corti, M. R. Occorsio : A Contribution for Solving Electromagnetic Problems by Using the Difference Method.

P. Silvester : Finite Element Solution of Homogeneous Waveguide Problems.

D. Corr, J. B. Davies, C. A. Muilwyk : Finite Difference Solution of Arbitrarily Shaped Dielectric Loaded Waveguides Including Microstrip and Coaxial Structures.

P. Halley, Baloud, Vicard : Emploi de la machine électronique pour le calcul des trajectoires électromagnétiques en propagation ionosphérique.

Session 7*a*). — Diffraction

Part I.

Saturday, 29 June, 8.30-10.30.

Chairman : Prof. H. M. Barlow.

Invited Speaker : Prof. G. A. Deschamps.

E. Borchi : The Electromagnetic Scattering by a Helical Sheath.

J. B. Smyth, L. A. Morgan : On the Diffraction of Electromagnetic Waves by an Acoustic Beam.

P. C. Waterman : Scattering by Dielectric Obstacles.

E. Lüneburg, K. Westpfahl : Diffraction by a Strip : High Frequency Asimptotic and Kleinman's Solution.

N. W. Howell, G. S. Tsiang : Electromagnetic Scattering Prediction by Computerized Ray Optics.

M. A. K. Hamid : Diffraction by Dielectric-Loaded Horn Antenna.

R. Mittra, C. P. Bates : Quasi-Optical Theory of Diffraction with Application to Open Resonators, VLF Waveguides, and Other Problems.

A. T. de Hoop, H. Block : Scalar Diffraction Theory of Open Resonators.

PART II

Saturday, 29 June, 10.45-12.45.

Chairman : Prof. H. M. Barlow.

Invited Speaker : Prof. R. E. Kleinman.

S. Przezdziecki : Diffraction by a Right-Angled Wedge with a Side Perpendicular to the Distinguished Axis of a Uniaxially Anisotropic Medium.

D. Ludwig : Boundary Layers in the Field Scattered by a Convex Object at High Frequencies.

O. M. Bucci, G. Franceschetti : Propagation and Scattering for a Lossy Wedge-Tapered Structure.

H. J. Frankena : Scattering of Electromagnetic Waves by Angled Bends in Rectangular Waveguides.

A. Wirgin : On the Theory of Scattering from Rough Lamellar Surfaces.

A. Wirgin : Diffraction by a Grating of Cylinders of Rectangular Cross Section.

R. Petit, M. Cadilhac : Diffraction d'une onde plane sinusoïdale par un réseau infiniment conducteur.

L. Robin : Comparaison entre les diffractions par la terre et par le dièdre bitangent aux points d'émission et de réception.

SESSION 7*b*). — MISCELLANEOUS

Friday, 28 June, 2.15-18.30.

Chairman : Prof. N. Marcuvitz.

G. A. Deschamps : Beam Optics and Complex Rays.

R. H. De Groot, H. Block : The Scalar Theory of a Beam Waveguide of the Iris Type.

P. F. Checcacci, A. M. Scheggi : Open Resonator with Rimmed Mirrors.

C. Ancona : Focalisation de miroirs non-paraboliques à l'aide de sources multilobes corrigés en phase.

C. A. Bridges, S. Cornbleet : Analysis of the Confocal Cavity with Interior Phase Plate.

K. C. Kao, G. A. Hockham : Solution of an Optical Communication Dielectric Waveguide Problem.

E. L. Rope, G. P. Tricoles : Microwave Holography.

P. F. Checcacci, V. Russo, A. M. Scheggi : Microwave Holograms.

R. Wohlleben, S. Stief, K. Kammann : Characteristic Impedance of Complicated Cross Sections by the Method of Approximated Conformal Mapping of Twice Connected Regions.

M. Gaudaire : Couplages du second ordre entre deux modes dégénérés d'une cavité électromagnétique.

G. I. Makarov, V. V. Novikov : Some General Properties of Electromagnetic Waves in Impedance Plane and Spherical Waveguides.

Y. Garault : Les ondes hybrides dans le guide circulaire chargé par des iris métalliques.

R. H. Dubs, B. Prasad, R. Finn : Generalization of Cowling's Conductivity for Wave Propagation in a Partially Ionized Gas.

SUMMER SCHOOL ON CIRCUIT THEORY

PRAQUE 1968

This Summer School was organized by the Institute of Radio Engineering and Electronics of the Czechoslovak Academy of Sciences and cosponsored by the International Scientific Radio Union. It was held in the new campus of the Prague Technical University (Prague 6-Dejvice) from 28 June to to 12 July 1968.

At the opening session on 28 June, Professor Stransky welcomed the participants on behalf of the Czechoslovak Academy of Sciences, Dr. Stumpers on behalf of URSI and Dr. Novak on behalf of the Organizing Committee.

The two official languages were Czech and English, and simultaneous translation was available. There were 31 invited main lectures and 88 short contributions. From this, one can see that the main aim of the Summer School did not lie in teaching, but in discussing and encouraging the most recent trends. It had therefore more the character of a Symposium. The large number of contributions made it necessary to use a second lecture room apart from the main auditorium in which all the main lectures were given.

The lectures started at 08.30 ,and closed at 17.30 with a luncheon interval of $1\frac{1}{2}$ to 2 hours. There was ample time available for the lectures and for the discussion period.

252 participants were present from 19 countries : Austria (2), Belgium (3), Denmark (2), Hungary (26), East Germany (24), West Germany (25), Italy (9), Japan (3), Netherlands (3), Poland (5), Rumania (8), Sweden (5), Switzerland (1), Turkey (3), United Kingdom (13), USA (10), USSR (9), Yugoslavia (4), and Czechoslavakia (97).

In the invited lectures all aspects of modern circuit theory were treated. All these lectures were very well prepared with much illustrative material. The texts of all invited lectures were given to the participants at the beginning of the Symposium. It is not easy to choose, from such a series of good lectures, those which were most oustanding; my choice may be different from others, but it would be :

Belevitch (Interpolation);
Bellert (Topological Analysis and Synthesis);
Gregor (Mathematical Theory);
Kishi (Sensitivity in L. C. R. networks);
Kuh (Multi Loop Feedback);
Mitra (Active Network Synthesis);
Saraga (Multipath Selective Systems);
Schüssler (Pulse forming Networks);
Su (Constant Delay Networks);
Vich (Digital Filters).

In the short contributions, active RC networks played an important part, research in several countries having led to somewhat overlapping results, but still leaving many open problems.

A banquet was arranged for the participants in an atmsophere of real cordiality, even leading to an improvised international folksong festival. A trip by steam boat, excursions to the environs of Prague (Kokorin and Kutna Hora), to Cesky roy and sightseeing in Prague itself were organized and took place during the excellent summer weather. Technical excursions to the Research Institute of Radiocommunications, to the Nuclear Research Institute and to the Institute of Radio Engineering and Electronics were also available.

The Summer School Committee Drs Novak, Vich and Cizek, and their secretary Miss Tarasevicova looked after not only the technical arrangements but also the personal well being of the delegates, hotel accomodation etc. On behalf of all participants I offer them our warmest thanks and our best wishes for their future research.

Dr. F. L. Stumpers.
Chairman, URSI Commission VI

URSI-CCIR COOPERATION

URSI Information Bulletin, No. 167, pp. 54-104 contained the text of the documents submitted to CCIR, on behalf of URSI, following recommendations made at the General Assembly of URSI in 1966. These documents were considered at the appropriate meetings of CCIR Study Groups V, VI, VII and VIII held in Boulder, Colorado in July 1968.

On 23 July an informal meeting to discuss cooperation between URSI and CCIR was convened by Prof. John P. Hagen on behalf of URSI. About 30 people, most of whom have associations with both URSI and CCIR, attended the meeting and participated in a very worth-while discussion.

The Chairman of Study Group VI (Dr. Bailey) and the Acting Chairman of Study Group V (Dr. Saxton) both spoke appreciative about the value of the documents submitted by URSI, and their remarks were strongly endorsed by the Director of CCIR (Dr. Herbstreit). It was generally agreed that there had recently been a marked improvement in the extent and usefulness of the cooperation between URSI and CCIR and there was an obvious desire to see this improvement maintained. Continued cooperation is important because, on the one hand, the CCIR can assist URSI by providing the technical information on which the frequency allocations for radio and space science are based; while on the other hand, URSI can contribute to the basic scientific information which is necessary to the formulation of sound CCIR reports and recommendations. On this latter point it was stressed at the Boulder meeting that it was particularly valuable to obtain URSI responses to CCIR questions from people who are not already active in the work of CCIR. The fresh approach which such people could bring to CCIR problems and the possibility that new ideas may be generated by them are believed to be important considerations.

Those who have contributed to the URSI documents submitted to CCIR may expect to receive, in due course, acknowledgements and comments from the CCIR and suggestions on the continuation of these collaborative efforts.

FADING OF SIGNALS PROPAGATED BY THE IONOSPHERE

The document on the above subject submitted by URSI to Study Group VI of CCIR was published in *URSI Information Bulletin*, No. 167 pp. 99-101. Several additional comments have since been received and are reproduced below :

1. Sect. 2, line 5; after (3,4) add :

« Very severe scintillations have been observed in the vicinity of the northern and southern auroral zones, and also during spread-F conditions in the equatorial belt ».

2. Sect. 2 (*c*); after (14) add :

« The full spectrum of ionospheric irregularities has to be studied in this context, including the effect of gradients (14*a*) ».

3. Sect. 4; at the end of para 4.1, add :

« Numerical studies with sophisticated ray tracing computer programmes are under way ».

4. Sect. 6, Para 6.3; delete « The method ... fading analysis ». Substitute :

« Frequency broadening is generally associated with random motions of ionospheric irregularities, whereas spectral-line splitting is usually due to the relative vertical motions of ionospheric layers. The former type of spectrum is associated with random fading and the latter with periodic fading. Particularly broad spectra have been obtained under conditions of equatorial flutter fading which are closely associated with equatorial spread-F. The depth and frequency of fading is of considerable practical importance in radio telecommunications. For example, the greater the frequency fluctuations, the wider must be the available bandwidth for reliable communications. Furthermore, the depth of fading, together with the ambient level of noise and interference, set a lower limit to the transmitter power required for reliable communications ».

5. After Reference 14 add :

14*a*. Georges, T. M. Report on "Ionospheric Effects of Atmospheric Waves" IER 57-ITSA 54 (1968).

6. Reference 22 refers to a paper presented at the AGARD/EPC meeting in Leicester in 1966 which has not yet been published.

PROPOSAL FOR A LOGARITHMIC SCINTILLATION INDEX

Errata

The following corrections should be made to the Equations which appeared in *URSI Information Bulletin*, No. 168 :

page 23, the second equation should read :

$$(\sigma/m)_A^2 = \overline{(A - \bar{A}^2)}\ /\bar{A}^2$$

page 24, the second equation should read :

$$(P/\bar{p}^2) - 1$$

where $p = P^{\frac{1}{2}}$

SOME CONSIDERATIONS ON THE LOGARITHMIC SCINTILLATION INDEX

In the study of satellite radio signals the need arose to define a scintillation index (S. I.). This definition must be rigorous and unique so that no ambiguity exists in the computation of the index by different experimenters using amplitude or power measurements of the incoming signal.

In a note in the last issue of this bulletin [1] Prof K. Rawer reported on the proposal of the Real Time Telemetry Panel of COSPAR WG II for a logarithmic scintillation index. In the present note more details are given about this proposed index and its meaning.

Over a certain time interval Δt, a scintillating received signal, from the passage through a time-varying medium of a wave of constant amplitude, has a mean power $\langle P \rangle$ and a mean amplitude $\langle a \rangle$, where P and a are respectively the instantaneous power and amplitude, and $\langle\ \rangle$ indicates an average over the interval Δt. We wish to point out that the average power $\langle P \rangle$ is not identical, in general, with the received power in the absence of scintillation. An average power proportional to $\langle a \rangle^2$ corresponds to the received average amplitude $\langle a \rangle$ and can be regarded as the power associated

with an undisturbed signal. Hence $\langle P \rangle - \langle a \rangle^2$ will represent the power associated with a random noise-like signal due to the scintillation superimposed on the constant amplitude signal $\langle a \rangle$.

In view of this statement the S. I. can be derived from the noise/signal power ratio, where the noise power is represented by the power of the random signal $\langle a^2 \rangle - \langle a \rangle^2$ and the signal power by $\langle a \rangle^2$. Hence

$$\text{S. I.} = \frac{\langle a^2 \rangle - \langle a \rangle^2}{\langle a \rangle^2} = \frac{\langle (a - \langle a \rangle)^2 \rangle}{\langle a \rangle^2} = \frac{\langle P \rangle - \langle P^{\frac{1}{2}} \rangle^2}{\langle P^{\frac{1}{2}} \rangle^2}$$

This scintillation index corresponds to the square of S_2 as defined by Briggs and Parkin [2] and gives a unique value of S. I. whether power or amplitude are used for the computations.

A convenient dB unit, which is the one proposed, can be obtained by putting

$$\text{S. I.} = 20 \lg \frac{(\langle a^2 \rangle - \langle a \rangle^2)^{\frac{1}{2}}}{\langle a \rangle} = 20 \lg S_2$$

or

$$\text{S. I.} = 10 \lg \frac{\langle P \rangle - \langle P^{\frac{1}{2}} \rangle^2}{\langle P^{\frac{1}{2}} \rangle^2} = 10 \lg S_2^2$$

In these units — dB corresponds to the absence of any scintillation and 0 dB corresponds to complete scintillation. Because of the physical significance (N/S power ratio) of the above definitions they are most important both for the study of the properties of the medium and also for communication engineering. However, the definitions must specify also the interval Δt; this is especially true for a short time interval Δt.

If the signal level is recorded in sampled digital form the evaluation of the proposed index is straightforward provided a computer is used. However the scintillation index based on other definitions and evaluated in different ways (manual or automatic) can be converted into the one defined above. In fact if the statistical characteristics, i.e. the relative frequency curve, of the signal level is known, a suitable conversion coefficient can be

obtained either theoretically or through a calibration with a pseudo-random signal having the same characteristics (3].

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REFERENCES

1. RAWER, K. — Proposal for a Logarithmic Scintillation Index to be Applied to Satellite Radio Signals, *URSI Information Bulletin*, No. 168, p. 23, Sept. 1968.
2. BRIGGS, B. H., PARKIN, I. A. — *Journal of Atmospheric and Terrestrial Physics*, 29, 1175, 1963.
3. MÜNTHER, G. — Comparison of Five Different Methods for Determining a Scintillation Index. Presented at the Eleventh COSPAR Plenary Meeting of Tokyo, May 1968.

ABSOLUTE CALIBRATION OF SOLAR RADIO FLUX DENSITY

PRELIMINARY REPORT OF THE URSI COMMISSION V WORKING GROUP
BY H. TANAKA (CONVENER)

Since the formation of the Working Group at the XVth General Assembly in Munich (*URSI Inf. Bull.*, No. 159. p. 48, 1966), extensive efforts have been made to solve the problem of the discrepancies of the absolute calibrations of solar radio flux density which have been found among a few important series of observations. We are glad to inform you that the problems are being solved with considerable success.

Soon after the Munich Assembly, the Working Group invited the collaboration of two colleagues, who have actively contributed to the calibration work. They are : J. P. Castelli, Air Force Cambridge Research Laboratories (AFCRL), USA and T. L. Landecker, University of Sydney, Australia.

The difficulty of making intercomparisons between the calibrated absolute values arises from the fact that neither the flux value at a single frequency nor the spectrum is stable even for several hours. However, the statistical analyses show that the "ratios of monthly means" of daily flux values for careful routine observations made at different longitudes and at near-by frequencies should be constant within a few percent, except for a quite smooth change over a solar cycle. The "absolute calibration" which we are

discussing is to find a correction factor to be applied to a consistent series of daily flux values.

The most important progress made since 1966 is as follows :

(1) The Heinrich-Hertz Institut Group has constructed a new standard horn which has been used for the calibration of flux at 1470 MHz. The first measurements were made in July-August 1967, and a correction factor of 0.87 was reported at the IAU Assembly at Prague in 1967. The measurements were repeated in February 1968, and these gave a final correction factor of 0.82 to be applied to the published data before 31 May 1968. Since June 1968, the new scale has been used. The important progress is that some unexpected errors in the old calibration method were found.

(2) The AFCRL Group has established a final correction factor of 0.91 to be applied to their 606 MHz values. This result is based on a series of comparisons with Cassiopeia A. It was found therefore that the calibration scale of Prague 536 MHz is alos good since May 1966.

(3) The Sydney Group has made two series of experiments using the standard horn at 1420 MHz. The first series was made on five days in September 1966. The values, within a few percent, were on the average on a smooth spectrum derived from corrected Toyokawa values. The second series was made on three days in December 1966. The plots were, on the average, 10 percent higher than the smooth spectrum. A suspected reason for the difference was the change of spectrum, but this seems doubtful when comparisons are made with all the other observations. The daily calibration of Sydney seems to be unsatisfactory for the period 1966/1967, although the present one is good. The important contribution is that the Sydney Group first pointed out the much too high values of HHI by an experiment at a near-by frequency.

(4) The National Research Council (NRC) Group is prudently making calibrations at 2800 MHz but, according to a private communication in 1966, Mr. Covington has concluded provisionally that the published values on those days were 8 per cent higher than those obtained from standard-horn experiments.

When ratios are calculated of monthly means, all relative to NRC values, and median values are taken for several months in 1967/1968, we obtain

				Corrected	
Toyokawa	9400	Ottawa	2800 = 2.10	1.08	
Tokokawa	3750	Ottawa	2800 = 1.00	0.96	
Ottawa (corrected)	2800	Ottawa	2800 = 0.92	0.92	(provisionnal
Toyokawa	2000	Ottawa	2800 = 0.81	1.05	
HHI	1500	Ottawa	2800 = 0.73	0.82	
Toyokawa	1000	Ottawa	2800 = 0.62	1.11	
AFCRL	606	Ottawa	2800 = 0.42	0.91	

When these values are plotted on a logarithmic scale, one finds a quite smooth spectral curve, which shows that the correction factors are quite reasonable.

The correction factor for Ottawa 2800 MHz has not yet been definitely fixed but it is hoped that NRC will soon obtain a final value. The Toyokawa Group is now making preparations for the absolute measurement of flux at 2750 MHz and the results will become available within a few months.

The calibration standards at six frequencies seem to have become consistent, but this does not mean that all the daily values at these frequencies are as accurate as the above discussion indicates. Efforts should be continued, therefore, to keep the daily calibration more consistent over a long period by checking daily calibration standards as frequently as possible.

We hope that more definite conclusions will be reached before the XVIth General Assembly of URSI 1969 in Ottawa.

Nagoya University, Japan
August 1968

APPLICATION OF DATA PROCESSING TECHNIQUES TO IONOSPHERIC OBSERVATIONS

Even though Dr. Bibl's report, which follows, mainly describes the development made in one specialized research laboratory, we hope it may initiate some discussion about the possible applications of modern data-processing methods in a new generation of ionospheric measuring tools. These combine directly radio measurements with data processing electronics and the aim is to try to replace manual reduction of records by automatic and possibly real-time systems.

Copies of this report were circulated at the beginning of 1968. It is intended to have a discussion among all interested in this subject at the URSI General Assembly at Ottawa in August 1969. Dr. Bibl will be convenor of an informal working party and those intending to participate or to offer a written statement are asked to contact the convenor as soon as possible before the Assembly. His address is : Dr. K. Bibl, Lowell Technological Institute Research Foundation, 450, Aiken Street, Lowell (Mass.) 01853, USA.

We are certainly aware that at this time it is not yet possible to leave all decisions needed in ionospheric routine reductions to machines. We feel, however, that an important progress in this direction could be made in rather short time.

K. Rawer
Vice-Chairman,
URSI Commission III

Data Processing in Ionospheric Measurement Systems (1)

K. Bibl
Lowell Technological Institute Research Foundation
Lowell, Massachusetts

1. — Introduction

1.1. — Data Compression.

The growing field of environmental science has increased the amount of available information bits to an unimaginable number. It is impossible to monitor or even to record and store all available data. Since the amount of existing data has sometimes prevented the evaluation of even a reasonable fraction of them, it has become obligatory to consider this situation even in the planning of an experiment. As soon as the range and the variation of data expected in a certain task can be estimated, the data production must be matched in direction of minimizing the output dependent on the expectance range in information. It can happen that the amount of available

(1) This is an advance version of a paper which Lowell Technological Institute Research Foundation intends to have published soon. Use of any information contained in it should be made only in agreement with the author. Comments, even critical, are invited; any hints of parallel and superior developments will be very welcome and will be integrated into a later survey if possible.

funds after installation and operation of an experimental system is barely sufficient to record and store the produced data which will never be touched; whereas, in case of a voluntary compression and limitation of the available data, all finally recorded information can be evaluated with the same funds.

In the necessary process of data compression, very important concepts must be considered. Only experience and imagination together can optimize the necessary process of parameter limitation for every task. Since a wrong decision leads to total loss of data, the choice of parameters and variables is fundamental for the result if data limitation and compression is required.

1.2. — Digital Data Presentation.

Although most existing systems have started with analog recording of data, it has become more and more obvious that complex and even simple systems will be conceived in the near future with digital output, ready-cut for feeding into computers. Translation of analog information, whether manual or automatic, is time consuming and thus expensive, and very inaccurate. Since the feeding of data into almost any computer still takes much longer than the most complicated computations, the creation of an adequate format is important.

Incremental magnetic tape recorders are relatively inexpensive and very accurate; they fulfill the functions of precision continuous tape recorders if the data flow is not too fast, and are far superior to punched card or paper tape input if the data flow is not very slow. Integrated in most of the incremental tape recorders are several format control features. Although digital storage by photographic means will become the solution in the distant future, analog storage on film cannot be supported any longer. Evaluation time of such records is inordinately long and the environmental conditions are unreasonable. Necessary checks should be printed as numerical patterns or as tables.

1.3. — Preprocessing.

Another reason for the inadequacy of analog storage on film is the limited integration capacity of film exposed by oscillograph tubes. Not more than five grey levels are distinguishable by the human eye. Methods of pulse shaping, applied in many ionosondes, prohibit photographic integration almost completely. In this respect, numerical integration is far superior and can lead to significant data compression.

2. — Survey of Past Solutions

2.1. — Compressed Ionogram Data.

The majority of ionospheric stations use sweep-frequency ionosondes for their basic studies. Ionograms taken in at least hourly sequence give an instantaneous, although involved, picture of the vertical electron-density distribution. The obvious advantages of this method diverted attention from the important fact that the time dependence of most characteristics were not visible in the ionograms. Creation of moving picture films by Wells from a fast sequence of ionograms overcame that handicap, but not many stations used this capability of the ionosondes. In Japan, (Nakata *et al.*, 1953) the method of continuously recorded ionospheric characteristics was developed so as to record directly, as functions of time, the minimum virtual heights, $h'E(t)$ and $h'F(t)$, and the top frequencies in the E and F regions : $ftEs(t)$ and $ftF(t)$. Since the quality of $ftF(t)$ records was insufficient, Bibl (1956) replaced them by the recording of $MUF(3000)F$, generated from the vertical incidence ionogram data by an analog transformation process. Instruments with this feature are used by at least six European stations.

Evaluation of these data is still limited since the records are presented in a complex analog form in which intensity must be considered (Nakata *et al.*, 1953; Bibl, 1956; Eyfrig, 1957).

2.2. — Fixed-frequency Experiments.

Generating time-dependent records is certainly simpler if the frequency parameter can be avoided. Fixed-frequency vertical soundings have been used in monitoring the phase of the signal for accurate measurements of reflection height changes (Findlay, 1951), and the signal amplitude for absorption and drift measurements. In oblique incidence soundings the frequency parameter has been replaced by color recordings of the azimuth dependence of backscatter and meteor echoes.

Comparison between signals with ordinary and extraordinary polarization is the specific process for medium-frequency partial-reflection D-layer measurements. In most of these experiments film or paper chart recordings were used for a long time. However, Harnischmacher (1957) succeeded in processing his drift data in digital form in real time, at least in a provisional manner.

The new incoherent scatter technique used by Evans at Millstone Hill and by the Cornell group at Arecibo applies sophisticated integration processes for establishing data relating to the different height ranges.

2.3. — Airborne Measurements.

With the appearance of scientific satellites, the need for fast data collection was intensified. For several stations which monitored Russian and American beacon satellites, analog magnetic tape answered that demand. If each available track monitors only one characteristic, the bandwidth of the tape recording is sufficient for all satellite measurements in or through the ionosphere and for most rocket experiments. Lowell Technological Institute Research Foundation (LTIRF) built a beacon satellite receiving system for US Air Force Cambridge Research Laboratories. For three years the system recorded, on 13 tracks, eight independent phase and five amplitude measurements so as to monitor phase path, polarization and angle of incidence of radiations at 20, 40 and 41 MHz. A similar system was built for a "mother-daughter" satellite experiment. Possibility of compression and expansion in data presentation is an important feature of prerecording on magnetic tape. Many systems, however, still use direct paper-chart readout where a certain data format presentation is given once and for all.

With the polarimeter of ITSA/ESSA (Institute for Telecommunication Sciences and Aeronomy/Environmental Science Services Administration) the azimuth characteristic of the antenna is recorded as a second parameter useful for multipath propagation studies.

Analog magnetic recording of complete ionograms in a short time has not been very successful; this method was finally used as a backup for an ionosonde carried in an aircraft (Gassmann, 1966) as a safeguard in case of a film recording failure and as storage capability for top-side sounder reception. For storage of local electron-density probe measurements in satellites, Pfister (1967) is using digital tape.

2.4. — Drift Measurement.

Since the amplitudes of ionospheric reflections show significant random variations, more than amplitude data from three antennas and a large quantity of collected data are necessary before drift interpretation is possible. Two methods of data handling have been pursued. The first, called the similar fading method, is concerned with comparing larger amplitude variations of specific time behaviour at different antennas. The time delays between the antennas are measured either manually or, as mentionned in Sect. 2.2, automatically (Harnischmacher, 1957). In the second method, numerous digitized data are processed by a computer for cross-correlation analysis.

In Pfister's drift system, maintained by LTIRF in Billerica (Mass.), amplitude and phase information from the three antennas is recorded by commutation on a single track of a quarter-inch tape. Two more tracks provide time information and synchronization pulses. In a second process, the data are digitized and recorded on a digital tape in a serial form. After slight smoothing of five consecutive samples, a third process cuts each data block into a series of records usable for fast computer input. Pfister (1967) will analyze amplitude and phase data independently and jointly for better understanding of the reflecting layer structure. Because of the difficult data processing, only preliminary results are available (Bibl and Reinisch, 1966).

3. — Digital Data Recording

3.1. — Digital Sampling.

Because of bandwidth limitation in analog tape storage and difficulty in analog tape processing, LTIRF has built two digitizing systems for step-frequency sounders. Six arbitrarily selected frequencies can be monitored simultaneously. Both systems are ideally suited for multi-frequency absorption and drift measurement if an operator is present for setting the delay range gates on the desired pulses. The first system maintains the original solid-state Granger sounder function and alternates between ionogram, absorption and ionospheric-drift measurement. The second system, using a Granger sounder with modified frequency range and coherent frequency generation, measures simultaneously amplitude and radio-frequency phase of pulses received at four antennas. Amplitude and phase distribution within the pulse, as well as frequency changes due to dispersion in the ionosphere, can be studied with this precision instrument.

With a special converter, the pulse amplitude is translated into a gate of variable width. This gate feeds, proportional to its width, up to 200 pulses to a counter. Through a special 4-flip-flop shift register, three decimals digits of amplitude information and two decimal digits of phase information are combined to form a 5-digit decimal word. Twenty-four such words, namely, information on six frequencies at four antennas, form a frame. All of these functions, as well as the record format control with vertical and longitudinal parity check, are created by dual-in-line packaged micro-logic circuitry. Because of the proximity of the high-frequency pulse transmitter the high noise immunity of the diode-transistor-logic is an important feature.

The phase of any intermediate-frequency (i.f.) zero crossing for each single pulse can be measured to 4.5°, and an average of several pulses is

even more precise. Monitoring several i.f. zero crossings within the pulse determines the average frequency of the pulse return. The phase variation, as well as the amplitude distribution within the pulse, provides a new dimension to the amplitude and the phase information. A 4 MHz counter, gated during the interval between a certain receiver output zero crossing and the gate edge, is responsible for the accurate digital phase measurement.

The same method of digital measurement is being used by LTIRF for a new beacon satellite polarimeter system. Since it uses digital integration over many cycles of the continuous wave signal, the phase comparison between the right-hand and the left-hand polarized signals of the two parallel channels has an accuracy of 1°, resulting in a 0.5° determination of the direction of the plane of polarization. Phase-coherent frequencies permit the same accuracy for dispersive Doppler measurements. The specific system has a paper tape output to match existing facilities. Two 3-digit decimal numbers represent the Faraday phase at two frequencies and one 3-digit decimal number represents the dispersive Doppler phase. In each second, seven samples are perforated in alternation with one 12-digit time and date identifier; all information can be printed in real time.

3.2. — Digital Integration.

The high precision of the satellite polarimeter already shows the advantage of digital integration. Certainly, the most extreme data integration process will be applied in a low-frequency sounding system in which 40,000 pulse amplitude samples will be integrated to assure more than 40dB signal-to-noise improvement. The system uses a fast integrating digital memory developed by Bibl and Olson (1966) to compare instantaneous data with the corresponding accumulated median value in each range interval. Dependent on the results of the comparison, the median is to be changed by one bit. The principle of the memory will be described, in a later paper, as part of a new digital ionosonde. In this sounder, 80 phase-coded pulses with high repetition rate will be integrated for 20dB signal-to-noise ratio, in order to overcome the large coherent interference in the used band. Coherent interference is the main difficulty in radio-frequency sounding since all interesting frequency ranges from vlf and hf are used for communication links. Digital integration is independent of the signal repetition rate and creates either extremely accurate delay-line loops if synchronized with the signal, or extremely variable delays if synchronized with the interference.

Digital integration of phase-decoded signals suppresses incoherent and coherent interference as well. This process is necessary in areas where there

is a high level of man-made interference. Since true amplitude representation is recommended for interpretation and absorption study purposes, integration prior to detection is everywhere useful in cleaning the reproduced echo signals.

Accurate amplitude and phase recordings in digital form open new dimensions in multi-frequency sounding. In addition, integrated digital data can easily be used for the communication of real-time information to any desired location.

3.3. — Real-Time Information.

Starting with the monitoring of short-distance radio links for breakdown because of high absorption and low critical frequencies, the Ionsophären-Institut at Breisach, Germany built up a short-term warning system. This system alerted an operator who, excluding technical failures, increased the rate of records taken by more sophisticated instrumentation. These recordings allowed a physicist to make short-term predictions. When digital sounder data becomes available in real-time, it will be possible to combine the information from several stations at a warning center with much greater insight and reliability. At least the information from the remote sounding stations should be transferred by telephone to the central laboratory or institute where the ionospheric data can be compared with magnetic and optical information.

In radio astronomy research, and other fields using radar-like systems, digital integration and digital data output have already been used successfully by V.R. Eshleman at Stanford. Arendt *et al.* (1966) generate on punched paper tapes digitized outputs of differential Faraday recordings.

By integrating a small computer into a sounding system, Granger Associates claim they have successfully created digital data from ionosondes with real-time information, thus permitting short-term prediction for specific communication links. Gauthier (1967) has applied such a system to vertical incidence sounding and directly prints ionograms of certain resolution in real time. These encouraging attempts lead to the necessity of programming computers for automatic evaluation of future digital ionogram data, a task which J.W. Wright at ESSA approaches in parallel with an attempt to incorporate more computer functions into the sounder.

4. — Conclusion

Two completely independent methods of data compression through preprocessing are envisaged : selection of parameters and integration of con-

secutive samples. Application of either method requires experience and good judgement.

If operators are available, especially in short-term experiments, selection of parameters can be modified during the experiment for optimizing the output information. Otherwise, decisive tests must precede the selection of parameters.

Direct digitizing of amplitude and phase information is preferable for both accuracy and simplicity. Even if high resolution is not required, the advantage of recording clear levels with a minimum number of bits is obvious.

For most ionospheric characteristics the recording of median values is preferable to any other averaging process. This fact justifies the application of a special integrating memory which will be described in a later paper. Digital integration increases the signal-to-noise ratio substantially and permits generation of real-time information, as well as construction of remote readout and warning systems.

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IUWDS INTERNATIONAL GEOPHYSICAL CALENDAR FOR 1969

The calendar for 1969 designates days and intervals for selected special attention in connection with geophysical observations, experiments, data interchange and special analyses. Thus it provides a framework for world-wide interdisciplinary coordination of observational programmes where it

IUWDS International Geophysical Calendar for 1969

(See other side for instructions on the use of this Calendar)

1969 JANUARY

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

1969 FEBRUARY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

1969 MARCH

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

1969 APRIL

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

1969 MAY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

1969 JUNE

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

1969 JULY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

1969 AUGUST

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

1969 SEPTEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

1969 OCTOBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

1969 NOVEMBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

1969 DECEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

1970 JANUARY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

(14) Regular World Day (RWD)

[18] Day of Solar Eclipse

3 Day with unusual meteor shower activity, Northern Hemisphere

7] Day with unusual meteor shower activity, Southern Hemisphere

[4] World Geophysical Interval (WGI)

(19) Quarterly World Day (QWD) also a PRWD and RGD

(15) Priority Regular World Day (PRWD)

(1) Regular Geophysical Day (RGD)

[5] Special Equatorial Interval (see text)

TABLE OF WORLD DAYS MARKED ON THE CALENDAR

1969	RWD	PRWD	QWD	RGD	WGI	ECL.	METEORS
Jan.	14, 15, 16	15		1, 8, 15, 22, 29	6-19		3, 15
Feb.	11, 12, 13	12		5, 12, 19, 26			
Mar.	18, 19, 20	19	19	5, 12, 19, 26	10-23	18	
Apr.	15, 16, 17	16		2, 9, 16, 23, 30			21, 22
May	13, 14, 15	14		7, 14, 21, 28			4-6
June	17, 18, 19	18	18	4, 11, 18, 25	9-22		8-10, 13-14
July	15, 16, 17	16		2, 9, 16, 23, 30			27-31
Aug.	12, 13, 14	13		6, 13, 20, 27			10-14
Sep.	9, 10, 11	10	10	3, 10, 17, 24	8-21	11	
Oct.	14, 15, 16	15		1, 8, 15, 22, 29			20-22
Nov.	18, 19, 20	19		5, 12, 19, 26			17
Dec.	16, 17, 18	17	17	3, 10, 17, 24, 31	8-21		4-6, 12-15

Special Equatorial Interval March 7 to April 4.

OPERATIONAL EDITION, SEPTEMBER 1968

would not be practical to carry out very comprehensive measurements every day. It is intended mainly for use in the branches of geophysics which are concerned with the earth's atmosphere.

The Calendar is prepared by the International Ursigram and World Days Service (IUWDS) with the advice of appropriate scientific workers. The 1969 Calendar has been drawn up by A. H. Shapley, Chairman, and J.V. Lincoln, Deputy Secretary, of the IUWDS Steering Committee, in close association with the IUCSTP Commission and the Reporters and spokesmen for the various scientific disciplines and COSPAR. It is common practice for individual geophysical stations or groups of stations to arrange some of their observational programmes in accordance with the Calendar.

Full details of the recommended programmes are printed on the back of the Calendar as well as definitions of the different types of World Days. Copies are available upon request to IUWDS Secretary, Dr. P. Simon, Observatoire, 92 Meudon, France, or IUWDS Deputy Secretary, Miss J.V. Lincoln, WDC-A Upper Atmosphere Geophysics, ESSA, Boulder, Colorado, 80302, USA.

ESTABLISHMENT OF REGIONAL WARNING CENTRE AT SYDNEY, AUSTRALIA

To Members of WPRCUWDS
Partial Amendment of Regional Committee Rules Following the Establishment of Sydney RWC

1. — Establishment of Sydney Regional Warning Center.

The IUWDS Steering Committee planned to establish a regional warning center in charge of the Australasian and Antartic regions, and at the Fifth Steering Committee held in Belgrade in August, 1966 it was resolved to recommend the responsible national authorities to appoint the Sydney Associate Regional Warning Center, which plays an active part within our region, to be a Regional Warning Center.

Such being the case, the Australian URSI National Committee took charge of this affair. Then the Seventh Steering Committee, held in Tokyo on May 14 this year, decided upon the main lines of the following three items for establishement of Sydney RWC :

(1) Name : Australasian and Antarctica Region;
(2) Service area : Australia, New Zealand, and Antarctica;
(3) Date of Establishment : July 1, 1968.

The details were discussed with Mr. McCue, Assistant Director, Ionospheric Prediction Service Division, Australia, on May 31 when he came to Japan. As a result, Mr. McCue agreed entirely on these main lines.

According to the letter to me from Prof. W. N. Christiansen, Chairman of the Australian National Committee for URSI, of 2 July 1968, it is reported that the Australian National Committee approved formally the establishment of the Australasia and Antarctica Region of IUWDS and the establishment of the Regional Committee is now in preparation. Moreover, it is expected that Mr. McCue will be appointed as Chairman of the Regional Committee, and Mr. Cook as Secretary. We offer our congratulations on the birth of Sydney RWC and offer our best wishes for its future development.

2. — Partial amendment of the Regional Committee Rules.

As stated in item 1 above, as a result of the establishment of the new Sydney RWC, Australia and New Zealand have been separated from the

countries included in the Western Pacific Regional Committee. Therefore, I wish to point out that paragraph 1 of the Rules for Western Pacific Regional Committee of the Ursigram and World Days Service is to be amended as follows :

(1) List of countries included in the Committee :

Burma	Indonesia
Formosa	Japan
Hongkong	The Phillippines
India	Viet-Nam Republic

3. — ACKNOWLEDGMENTS.

Deep gratitude is expressed to the members and consultants in Australia and New Zealand for their cooperation in developing the Western Pacific Regional Committee of the International Ursigram and World Days Service, such as the cooperation of this service, the reception and transmission of IUWDS messages, and so forth. Especially, we tender our sincere thanks to Mr. F. E. Cook who, since the establishment of the Committee, has assumed the heavy responsibility for the operation of the Committee as its member, and has played an active part for many years in immediate charge of the Associate RWC in supplying and exchanging important observational data, and has thus contributed largely to the develoment of international cooperation.

Yours sincerely,

Hiroyuki Uyeda
Chairman, Western Pacific Regional Committee of Ursigram and World Days Service,
Member, IUWDS,
Director, Radio Research Labs,
Ministry of Posts and Telecommunication
2-1, Nukui-Kitamachi,
4-Chome, Koganei-shi, Tokyo 184.

22 July 1968.

MEMBERS OF WESTERN PACIFIC REGIONAL COMMITTEE OF URSIGRAM AND WORLD DAYS SERVICE ON 10 SEPTEMBER 1968

Members :

H. Uyeda (Japan) *Chairman*;
Ba Kyi (Burma);
T. V. Miao (China, Taiwan);
G. J. Bell (Hongkong);

M. K. Vainu Bappu (India);
M. Sukantu (Indonesia);
A. Alcaraz (Philippines).

Consultants :

Y. N. Huang (China, Taiwan);
K. R. Ramanathan (India);
P. R. Krishna Rao (India);
R. Susanto (Indonesia);
R. Konta (Indonesia);
Y. Aono (Japan);
K. Miya (Japan);
L. Tolentino (Philippines).

Secretary :

Mr. Toshio Takiguchi, Radio Research Laboratories, Ministry of Posts and Telecommunications, 2-1, Nukui-Kitamachi 4-chome, Koganei-shi, Tokyo, 184 Japan.

THE NETHERLANDS
MEMBERS OF THE NATIONAL COMMITTEE
as at 29 August 1968

President :

Dr. F. L. Stumpers, Philips Research Laboratories, Eindhoven.

Secretary :

Dr. A. D. Fokker, Astronomical Institute, Utrecht.

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Prof. J. W. Alexander, University of Technology, Delft;
Mr. J. J. Bloemsma, Mient 551, The Hague;
Prof. M. P. Breedveld, University of Technology, Enschede;
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Prof. R. Timman, University of Technology, Delft;
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Prof. A. A. T. M. van Trier, University of Technology, Eindhoven;
Prof. J. Veldkamp, Royal Netherlands Meteorological Institute, de Bilt;
Mr. H. J. A. Vesseur, Royal Netherlands Meteorological Institute, de Bilt;
Mr. L. R. M. Vos de Wael, Dr. Neher Laboratory of the Netherlands PTT, Leidschendam.

Official Members :

Commission I : Mr. L. R. M. Vos de Wael;
Commission II : Mr. L. Krul;
Commission III : Prof. J. Veldkamp;
Commission IV : Prof. J. Veldkamp;
Commission V : Prof. J. H. Oort;
Commission VI : Prof. J. W. Alexander;
Commission VII : Prof. A. A. T. M. van Trier;
Commission VIII : Mr. J. J. Bloemsma.

PROCEEDINGS OF THE ASTRONOMICAL SOCIETY OF AUSTRALIA

Vol. 1 Nos. 1 and 2 of this new journal were published in February and November 1967; No. 2 is devoted to solar research. No. 3 was published in February 1968; in addition to invited papers on Maser action in interstellar OH and on the Anglo-Australian 150-inch telescope, it contains 31 contributions on solar, stellar, interstellar, extragalactic, X-ray and cosmic ray astronomy and 3 contributions which deal with radiation theory and instrumental design.

The Editor and Assistant Editor are J. P. Wild and S. F. Smerd respectively, both of the Division of Radiophysics at CSIRO, in Australia. The annual subscription is US$ 4.10 (for two issues) or US$ 2.05 each for single issues. Orders may be placed with booksellers or with the publisher :

Sydney University Press,
University of Sydney, N. S. W. 2006,
Australia.

DEPOLARIZATION

Volume 1 of the Golem Series in Electromagnetics ([1]) is concerned with the change of the polarization of an electromagnetic wave, from one state to another, as the result of the interaction of the wave with some material agent. The larger part of the book considers depolarization by reflection and scattering in one form or another. However, two chapters treat the basic principles of depolarization in anisotropic media and by scattering from random rough surfaces respectively. The volume includes a brief guide to the literature on the subject and a list of nearly 200 references.

([1]) Petr Beckmann, The Depolarization of Electromagnetic Waves, 214 pages. The Golem Press, Boulder, Colorado, 1968. Price $11.

URSI-STP COMMITTEE

Minutes of First Meeting : September 1968

The first meeting of the URSI-STP Committee was held at the URSI Secretariat in Brussels over the period 18-20 September 1968. The following members of the Committee and its Working Groups were present :

Prof. W. J. G. Beynon, *(Chairman)*;
Prof. S. A. Bowhill;
Mr. G. M. Brown *(Secretary)*;
Prof. W. Dieminger;
Dr. J. W. King;
Prof. E. A. Lauter;
Mr. W. R. Piggott;
Prof. K. Rawer;
Dr. R. Rivault;
Mr. A. H. Shapley;
Prof. R. W. Wright.

Dr. C. M. Minnis (Acting Secretary-General of URSI) also attended.

1. — IUCSTP Projects

The role of radio in the twelve projects selected by IUCSTP for the main solar-terrestrial physics programme during and through the forthcoming Active Sun Years (IASY) were separately reviewed by the Committee. Some modifications and additions to the wording of the accounts published in STP Notes No. 1 were suggested for Project 1 (Monitoring of solar terrestrial phenomena) and Project 6 (Electric fields in the magnetosphere) and these will be referred to Mr. Shapley and Prof. Booker respectively. Project 5 (Conjugate point experiments) is to be referred to Dr. Reid, and Project 10 (Dynamics of the upper atmosphere) to Prof. Hines. Prof. Bowhill and Dr. King presented up to date reports on the activities of Project 11 (Ion chemistry of the D and E regions) and Project 12 (Sudden ionospheric disturbances). Revised descriptions of both these projects will shortly be published as review papers in the *Journal of Atmospheric and Terrestrial Physics*.

A report from Dr. Dungey from the Magnetosphere Symposium held at Washington immediately prior to the present meeting was received, in

relation to Project 4 (Determination of the characteristics of the magnetosphere). It was noted that the analysis of magnetospheric satellite data was now proceeding satisfactorily, and that IUCSTP was being approached with a view to making space data available to individual scientists.

It was agreed that a letter received from Dr. Pushkov recommending the appointment of consultants to IUCSTP Working Group 1, in order to improve the organization of various ionospheric and other geophysical patrol observations during IASY, be referred to Mr. Shapley.

It was agreed that details of the U. S. National Science Foundation plans to coordinate the efforts of observers coming to the USA for the total eclipse in March 1970 should be published in the *URSI Bulletin*.

2. — Data Processing and Exchange

Prof. Rawer reported on the activities of the Sub-Committee on Data Processing. It appears that few groups are closely concerned with this problem at present. It was agreed that the report drafted by Dr. Bibl and circulated to the sub-committee members should be published in the *URSI Bulletin* and discussion of it should be invited at the next URSI General Assembly.

Recommendation (1) was approved, inviting WDCs to look into the feasibility of supplying users with digitalised data rather than microfilm copies.

It was agreed that in some cases the filing of concise descriptions of data and procedures for obtaining directly from the holder could be a simpler, cheaper, and effective alternative to the storage of masses of data in the WDCs.

Mr. Shapley reported on the activities of WDC-A, and emphasised their introduction of a new International Series of publications under the title "Upper Atmosphere Geophysics". The revised Atlas of Ionograms will be published in this series. It was reported that both WDC-A and WDC-B have recently been reorganized.

An extended discussion took place on data exchange for sudden ionospheric disturbances, and the role played by the SID Data Centres. Many workers were apparently unaware that such Data Centres existed at all. It was noted that for the success of IUCSTP Project 12 it was necessary for rocket and satellite X-ray data to be available for comparison with the SID data, and both should ideally be routed to a common place. *Recommendation (2)* was approved, indicating that where possible SID and Ionosphere Data Centres should be combined. It was agreed that the matter be referred

to the URSI-STP Working Group on Radio Science Data Centres and Project 1 Working Group of IUCSTP.

It was noted that the Guide to WDCs needed revising to allow for new programmes, etc., and that IUCSTP Project 1 was assuming responsibility for this. It was agreed that Mr. Shapley should discuss the details individually with the URSI-STP sub-discipline consultants.

It was noted that a recommendation had been made to ICSU for the establishement of an ICSU Panel on WDCs and agreed that the URSI-STP Committee would cooperate fully with the new Panel in respect of radio science data.

3. — International Reference Ionosphere

Prof. Bowhill summarized his final report on the URSI/COSPAR Working Group on the feasibility of an International Reference Ionosphere, presented at the COSPAR Assembly in May 1968. In this, it was concluded that the preparation of an IRI should prove feasible, and that the models should be prepared by a working group with representation from both URSI and COSPAR in view of the inter-disciplinary nature of the field. The report has been approved by COSPAR.

The Chairman expressed his thanks to Prof. Bowhill for the work of his group, which was now accomplished. Prof. Rawer undertook to be the convener of a new Working Group to put the proposals into action, with Prof. Bowhill, Dr. K. W. Champion, and Prof. E. A. Lauter as initial members. It was anticipated that the members of the URSI-STP Working Group on Ionosphere would act as a nucleus for the project, and additional representatives from COSPAR would be invited. Mr. Piggott undertook to encourage specific stations to provide the data required for this project.

It was felt that the introductory chapter to the IRI would have to be fairly detailed to stress the purposes, uses, and limitations of the representative profiles for various latitudes. After discussion it was agreed that detailed data on such additional parameters as recombination coefficients, minor constituents, drifts, etc. should not be included in the IRI, but relevant literature references could be given. Provisional tables should be available by the time of the STP Symposium in March 1970, and a first draft of the document by the autumn of 1970.

4. — Ionospheric Measurements

4.1. — Vertical Soundings.

Mr. Piggott presented a series of reports covering various aspects of the vertical sounding technique. The following summarises the main points discussed.

(*a*) *Station Network.*

In general, data flow from stations is now very slow, and morale at routine stations is low. Although the centre of gravity of ionospheric research has tended to move away from vertical soundings, the greatest demand for data from the WDCs continues to be for vertical incidence data. There is a continuing need, particularly for theoretical studies, to improve the quality of ionograms. Many stations, however, still operate with old and obsolete equipment which should be replaced. *Recommendation (3)* was agreed on this point.

It is important that when published data are used, the fact should be communicated to the stations producing such data. See *Recommendation (4)*.

A long discussion took place on the size of the synoptic network. Many problems are of a global nature, and require a global picture, while others are more amenable to intensive measurements at one or two selected sites. In general, stations can be classified into three types : routine stations (run mainly by technicians), university stations (where instruction is the primary concern), and research stations (operated by scientists who want the data directly). Approximately 75 % of the total number of current stations are in the first group. The question of continuing operation of individual stations has to be examined for each case, but it does not necessarily follow that specific use of the data at the present time is the appropriate criterion.

It was agreed that a number of stations should be invited to consider the possibility of producing high quality data : see *Recommendation (5)*.

It was also agreed, on a proposal of the Chairman, that URSI should organize a meeting of those responsible for the operation of vertical soundings stations to discuss the whole problem of an optimum network, morale and general maintenance of standards at the stations. The distribution of stations would have to be examined in particular in relation to the IUCSTP programmes. A small sub-group consisting of Prof. Beynon (Convener), Mr. Piggott, Mr. Shapley, Prof. Bowhill, and Prof. Wright was nominated to organize the meeting, which, it was suggested, might take place in London

at the time of the STP meeting in January 1969. Mr. Piggott undertook to draft some documents for Prof. Beynon to send out with his invitations to attend this meeting.

Prof. Rawer felt that there was a strong need for URSI to appoint someone as a full-time organizer of the vertical soundings stations, who could visit stations and generally bolster the scientific reliability and morale. It was agreed that this matter should be referred to the meeting mentioned above.

(*b*) *CCIR Matters.*

Mr. Piggott reported on a study he had made in response to a request from CCIR Study Group VI that URSI consider possible parameters for use when "Spread F", "polar spurs" etc. are present. From a questionnaire circulated to about 100 groups, it was clear that there is strong support for the introduction of a new parameter, to be denoted fxS, as a measure of the top frequency of Spread F. Full details are given in *Recommendation (6)*. It was also noted that there is interest in providing a more quantitative index of Spread F, such as one based on the width of the spread, and the Committee encourages more ad hoc studies in this respect. The question of MUF factors when Spread F is present is also of importance to CCIR, and the Committee wishes to encourage investigation of this problem.

At its recent meeting CCIR Study Group VI recommended that additional stations be added to those used to generate the IF2 index, particularly stations in the Southern Hemisphere. The Committee requested the V. I. Consultant, Mr. Piggott, to examine the technical merits of adding data in this way for any of the long established stations, taking into account the willingness of the administrations concerned to maintain the efficiency of the stations to provide the index data quickly. Mr. Piggott was asked to make recommendations on the results of his investigations to CCIR through the Secretary-General. He was also asked to request further information from CCIR on the usefulness of the IF2 index.

Mr. Piggott pointed out that the needs of CCIR call for special investigation of particular ionospheric phenomena in certain areas, not catered for by the synoptic network; *Recommendation (7)* was agreed.

(*c*) *Station Codes.*

Mr. Piggott emphasised the need to use an agreed identification number for every station which employs computer handling of data, and it was agreed that the codes used by ITSA at WDC-A should be adopted : see

Recommendation (8). Arrangements have been made for details of all existing codes to be published in the WDC-A Catalogue and in STP Notes.

(*d*) *Ionogram Atlas.*

Mr. Shapley reported that the revised atlas of ionograms should be published by the end of 1968. It will, in general, be for the epoch 1961. It will be published by WDC-A in their new International Series (UAG) of Monographs.

It was agreed that the preparation of a third atlas of ionograms should not be pursued now. Stations should be encouraged to make their own compilations of ionograms.

4.2. — ABSORPTION.

Prof. Rawer reported on ionospheric absorption studies during and since the IQSY. The coverage during IQSY had been disappointing, but the quality of the data, in general, seemed better. Stations should be encouraged to continue the improvement in quality by being more exact with their calibrations, etc. so that really useful data for comparison with theory become available.

Prof. Bowhill and Prof. Lauter both reported good agreement between rocket measurements and simultaneous A1 or A3 observations.

In response to a proposal received from Dr. M. D. Fligel, it was agreed that daily noon absorption measurements are always the first priority and daily constant χ observations should rank equally with diurnal observations on RWDs as alternatives for the second priority. Stations should also be encouraged to supplement A1 observations by A3 measurements, which are much simpler to make. These points were drafted into *Recommendation (9)*.

It was agreed that the Committee should recommend that aeronomic D-region measurements should be supplemented by A1/A3 measurements if at all possible : *Recommendation (10)*.

It was further agreed that the relationship between sudden stratospheric warmings and anomalous winter absorption should be studied on a world-wide basis. For this purpose, integration of A1/A3 stations with the GARP STRATWARM programme was recommended : *Recommendation (11)*.

Prof. Rawer reported that Dr. Bibl was carrying out studies of the effects of ionospheric roughness on deviative absorption, particularly near a critical frequency, as measured by method A1, and of the problems associated with the analysis and reduction of automatic amplitude measurements.

These investigations had been requested by URSI Commission III at the Munich Assembly, and the groups would be asked for a report to be presented at the Ottawa Assembly.

Prof. Rawer reported that two of the contributions to the new Absorption Manual were to hand, and a third was expected quite soon. The Secretary was asked to write to Dr. Belrose and Dr. Mitra to enquire what the position was with regard to their contributions.

4.3. — Drifts.

Prof. Wright gave statistics of the numbers of stations sending in ionospheric drift data, which showed a steady decline from 26 during the IGY to a mere 5 at the present time. There is, however, considerable interest in drifts, but the interest has tended to shift to special experiments designed to investigate questions of interpretation, rather than routine measurements.

It was agreed that Prof. Wright should send to the Data Centres copies of the list he has prepared of all workers in the field.

The Working Group on Ionospheric Drifts met in Appenzell, Switzerland in October 1967, and the Report and Recommendations of this meeting have been published in *URSI Bulletin*, No. 167, p. 30-33. An Appendix to this report will follow. *Recommendation (12)* was agreed, setting out details of systematic drift studies which it was felt should be encouraged.

It was agreed that no new Instruction Manual in Drifts should be prepared at the present time.

Several suggestions for the D1 programme, submitted by Dr. Kushnerevsky, were referred to the Working Group on Drifts.

5. — CCIR Questions

Following the considerable documentation prepared by members of the Committee and submitted to CCIR Study Groups V and VI in Boulder in June 1968 as URSI responses to several CCIR questions, a request has been made to review these documents in the light of any new information available before they are presented at the next meeting of the Study Group VI in Geneva in late 1969.

It was agreed that Dr. Minnis should refer the revised questions to those members who prepared the original replies. The text of any new URSI documents must be sent to Dr. Minnis not later than 15 April 1969.

6. — Others Matters

Dr. Rivault gave a brief report on the activities of the Working Group on Synoptic Whistlers, all the members of which belong to Commission VIII. It was thought that the membership would be revised at the Ottawa Assembly.

It was agreed that Dr. Whitehead and Dr. Gusev be invited to become members of the Working Group on Ionosphere, and that Dr. G. C. Reid should replace Dr. Little as A2 Consultant on this Working Group. It was also agreed that Dr. B. H. Briggs should be invited to become a member of the Working Group on Ionospheric Drifts.

RECOMMENDATIONS

Rec. (1) Data handling.

The URSI-STP Committee, noting that automatic devices are now available which are capable of reading printed or typewritten digits and characters and transcribing these into standard punched format, or magnetic tape, *recommends* that WDCs should investigate the possibility of using such devices for reading existing microfilms to enable users to obtain digitalised records instead of microfilm copies.

Rec. (2) SID Data Centres.

The URSI-STP Committee, noting that for many studies of sudden ionospheric disturbances it is necessary to compare the data with ionospheric and rocket and satellite X-ray data, *recommends* that where possible the SID Data Centres and Ionosphere Data Centres should be combined.

Rec. (3) New ionosondes.

The URSI-STP Committee draws attention to the fact that the ionosondes in use at many synoptic stations are obsolete, or wearing out, or both, and that there is an urgent need to provide for their replacement by modern equipment.

Depending on local conditions, the main requirements are for :

(*a*) A number of highly accurate equipments, using either conventional or modern techniques.

(*b*) A large number of cheap observatory type instruments capable of high reliability.

(*c*) A still larger number of very simplified cheap sounders capable of recording a few parameters only and producing the results in a form suitable for computer handling.

REC. (4) USE OF V. I. DATA.

The URSI-STP Committee requests those using synoptic data for scientific purposes to send copies of any published papers or preprints to the administrations responsible for producing the original data.

REC. (5) SYNOPTIC NETWORK FOR V. I. SOUNDINGS.

The URSI-STP Committee, having considered the views of those who produce and use vertical incidence soundings data, *recommends* that all V. I. stations be encouraged to participate in intensive studies of regional and other problems and that a strong effort be made to increase the degree of flexibility in the V. I. network to meet the changing needs of international cooperation and of coordination with space experiments. The URSI-STP Committee further recommends that a number of stations be identified by consultation with countries interested in the possibility of developing these stations to meet high standards of quality at a limited number of locations.

REC. (6) SPREAD F INDEX.

The URSI-STP Committee, noting that a measure of the top frequency of Spread F is urgently required for CCIR purposes and also has scientific interest, and that a proposal to introduce such an index has been widely supported by those responsible for stations, *recommends* that a new ionospheric parameter denoted fxS (with computer symbol 41) be adopted for international analysis, tabulation and normal circulation through WDCs and other publication methods, defined and applied according to the intructions following. It is recommended that all stations at high latitudes or subject to equatorial spread F tabulate and circulate this parameter, and that stations at other latitudes be invited to volunteer to analyse the parameter as a trial. Tests are particularly important at stations where the spread of frequencies of spread F often exceeds $fH/2$ at certain hours.

The URSI-STP Committee further recommends that stations report the properties of the new parameter in the scientific literature, through STP Notes, or through the URSI V. I. Consultant (Mr. W. R. Piggott, Radio and Space Research Station, Slough, Bucks, UK), and that its operation be reviewed at the next General Assembly of URSI where any suggested

modifications can be considered and approved. It is recommended that this resolution be brought to the attention of CCIR, who should request administrations to adopt this index.

The parameter fxS.

Definition.

The parameter *fx*S is defined as the highest frequency on which reflections from the F region are recorded, independent of whether they are reflected overhead or at oblique incidence. Thus, *fx*S is the top frequency of spread F traces including polar or equatorial spurs, but not including ground backscatter traces.

Scaling Rules.

1. The normal descriptive letter symbols should be used to show the reasons for absent entries, but the accuracy rules do not apply for this parameter.

2. Monthly tabulation sheets should be left blank for columns at hours at which spread F traces are seldom or never seen as is the practice for E and F1 parameters.

3. The use of replacement letter B, or descriptive letter B, should be determined by the same procedure as that given for *fo*E*s* in the "URSI Handbook of Ionogram Interpretation".

(*a*) If the scatter traces disappear as a result of high absorption, use replacement letter B.

(*b*) If *f*min*x* is above the top frequency seen (see *fo*E*s* rules) add *f*H/2 to the top frequency, and add qualifying letter O, descriptive letter B.

(*c*) If *f*min is high, showing large absorption, but the value of *f*min*x* cannot easily be determined, use qualifying letter M (interpretation doubtful : reading may be *fo*S instead of *fx*S) and descriptive letter B.

Note :

(i) When the signal/noise ratio is low, *fx*S is power sensitive; when high, it is independent of power as far as is known at present. For ionosondes with low signal/noise ratio for normal absorption the extra work in computing *fx*S from *fo*S may not be justified.

(ii) Special care is needed when *fo*S is near or below *f*H, since absorption can then hide *fx*S.

REC. (7) MAPPING PARTICULAR IONOSPHERIC PHENOMENA.

The URSI-STP Committee draws the attention of scientists to the need of the CCIR to map the zones, in space and time, where particular ionospheric phenomena occur and to establish the laws connecting related phenomena at different locations.

REC. (8) STATION CODES.

The URSI-STP Committee *recommends* that the station codes at present in use at ITSA, WDC-A, be adopted as the standard station indicators for computer identification. All stations changing to computer methods of data handling are requested to obtain code numbers from ITSA, WDC-A, Boulder, USA.

REC. (9) ABSORPTION PROGRAMME.

The URSI-STP Committee *recommends* that during IASY (1969-1970) the absorption A1 stations should undertake as a first-priority noon observations every day according to the IGY and IQSY schedules. Second priority in the measurements should be either diurnal observations on RWDs, or constant χ observations on all days (modified if necessary to appropriate morning and afternoon measurements according to local conditions). In this context, stations are recommended to consider the possibility of using the method A3 as a supplement to noon A1 observations.

REC. (10) ABSORPTION MEASUREMENTS IN ASSOCIATION WITH AERONOMIC D REGION PROBES.

The URSI-STP Committee *recommends* that A1 or A3 ionospheric absorption measurements be made at rocket stations where aeronomic D region probes are launched; such measurements should extend over a period of at least ten days centred on the day of launch.

REC. (11) ABSORPTION MEASUREMENTS IN ASSOCIATION WITH METEOROLOGICAL OBSERVATIONS.

The URSI-STP Committee notes that the relationship between sudden stratospheric warmings and anomalous ionospheric absorption events has so far not been studied on a world-wide basis, and therefore *recommends* that further A1 or A3 stations be established for this purpose, particularly in association with the GARP STRATWARM sub-programme.

REC. (12) DRIFT MEASUREMENTS.

The URSI-STP Committee, noting the recommendations of its Working Group on Ionospheric Drift Analysis

1. Strongly *endorses* the need for intensive studies of the various methods of analysis of the D1 data in order to provide a comparison of these methods and an assessment of both their accuracy of representation of the actual conditions prevailing and the physical significance of the parameters which are derived.

2. Strongly *endorses* the need for further experiments to intercompare the various methods of measurement of motion in the upper atmosphere, such as spaced antennas using ground-based transmitter (D1), meteor measurements (D2), spaced antennas extra-terrestrial radio sources (D3), widely spaced receivers (D4), partial reflection studies (D5), chemical trail studies and Thomson scatter measurements.

3. *Recommends* special attention to the following methods which whilst providing valuable data are not widely in use : (*a*) D1 using L. F. waves, (*b*) D5 using partial reflections of H. F. waves, (*c*) Thomson scatter, and (*d*) meteor scatter.

4. *Recommends* that methods of measuring the vertical component of motion, such as Doppler shift Thomson scatter, should be strongly encouraged.

Geoffrey M. Brown,
Secretary

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