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U. R. S. I.

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DAVID JOHANNES MALAN
1905 - 1970

It is with deep regret that the news has been received of the death of Dr. D. J. Malan, after a long illness, on 29 June 1970. He was a member of the URSI Committee in South Africa and Official Member for Commission VIII.

David Johannes Malan was of French Huguenot and Dutch extraction and was born at Malmesbury, South Africa on 12 April 1905. His childhood interest in physics was encouraged by his father who was a medical practitioner. After attending school in Wellington and Boshoff, he entered the University of Cape Town where he obtained a B.Sc. degree in 1925, majoring in mathematics, chemistry and physics. He gained his Master's degree in physics at that university two years later and lectured there in 1928. He then went to Paris, where he studied molecular spectroscopy under Professor Fabry, and obtained a D.Sc. at the Sorbonne in 1931.

He returned to Cape Town to take up a lecturing position. It was there that he met B. F. J. Schonland who had recently returned to South Africa from the Cavendish Laboratory in Cambridge where, among other things, he had attended lectures on thunderstorms given by C. T. R. Wilson. Schonland by this time was turning his interests to field work which could be done effectively in South Africa, namely, thunderstorms; the enthusiasm with which Schonland was studying atmospheric electricity greatly influenced Malan, who began to pay particular attention to the physics of the lightning discharge. Thus began a partnership which was to last for almost a quarter of a century.

Thunderstorms are rare in Cape Town. So, in order to be in Johannesburg where lightning occurs frequently, he took up a post as lecturer in physics at the University of the Witwatersrand in 1932. Here he and a few associates followed storms, riding rough roads across the veld at night and photographing lightning flashes with the Boys' camera. It was at this time that he discovered the stepped leader and a great deal about the behaviour of lightning. In later years, he would fondly recall this time as the "age of string and sealing-wax" because the amounts spent on his research were very small.

In 1935 he returned to lecture at Cape Town, and in this year he married Miss H. van Niekerk. In 1946 he accepted the post of Senior Research Officer at the Bernard Price Institute for Geophysical Research in Johannesburg. Here Malan, in association with Schonland, the Director of the Institute since its establishment in the late 1930's, could study lightning on a full-time basis for the first time. During this very productive period of his life, he developed a new field mill, known as the Spinning Ginny, modified the Boys' camera so that cloud flashes could be recorded more effectively, and also so that roll film could be used instead of plates. Together with Schonland he published a series of papers on field changes and lightning photography.

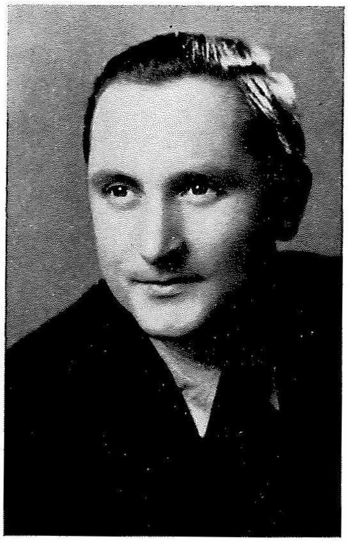
In 1956 he accepted an invitation from the Institute of Geophysics to work in Paris for five months. In 1948 he was elected a Fellow of the Royal Society of South Africa, and was awarded the Havenga Prize for Mathematics and Physics by Die Suid-Afrikaanse Akademie vir Wetenskap ens Kuns in 1956. In 1964 he became Deputy Director of the Bernard Price Institute and was elected to the Chair of Atmospheric Physics at the University of the Witwatersrand as a personal distinction in recognition of his outstanding achievements in that field. He was the author of 38 papers on lightning and his book *The Physics of Lightning* was published in 1963. In 1969 he was invited to write an article on lightning for the bicentennial issue of the *Encyclopaedia Britannica*, a distinction he greatly cherished although illness prevented him from completing the article.

His last researches were influenced by the construction of a 242 m tower which was within view of his laboratory. The peculiar behaviour of lightning discharges to this tower fascinated him, particularly because the sequence of events appeared to depend on the direction of travel of the storm. He spent the last 14 years of his life working on his own.

He is survived by his widow, two daughters and a son.

PENTTI MATTILA
1919 - 1971

With deep regret we announce the death of acting Professor, Dr. Pentti Emil Mattila, Official Member of URSI Commission III, who died on 23 February 1971 in Tampere, Finland.



Dr. Mattila was born in 1919 at Viljakkala. He graduated in 1947, received the degree of Licentiate in Engineering in 1954 and the degree of Doctor of Engineering in 1955 from the Helsinki University of Technology. In addition he studied at Princeton University in 1950-1951. He was appointed Docent in 1965, and was acting professor of Electrical Engineering at the Tampere University of Technology since 1970.

Dr. Mattila served as research engineer in the State Institute for Technical Research during the period 1947-1959 and worked on microwaves, radar, information theory, and wave propagation in the atmosphere. From 1962 to 1969 he was with the State Board of Technical Sciences as senior scientist, and worked on problems of wave propagation in anisotropic media. He lectured on Radio Engineering during the period 1952-1955 and on Information Theory during 1959-1970.

Dr. Mattila contributed greatly to the creation and the work of the Finnish National Committee of URSI as its secretary from its start 1952 until 1969, helping to arrange the work of IGY and Sodankylä geophysical observatory. He was Official Member from 1960 and attended many URSI conferences and symposia.

Dr. Mattila was a member of Electronics Engineers in Finland, the Society of Finnish Physicists, the Society of Geophysics, the Finnish Engineering Society and the American Association for the Advancement of Science.

Dr. Mattila will be remembered for his radiant personality and as a man who worked energetically for radio science. He will be greatly missed by the Finnish National Committee.

RÉUNIONS DU BUREAU ET DU COMITÉ DE COORDINATION DE L'URSI

Bureau

Le Bureau de l'URSI s'est réuni à Bruxelles les 20 et 23 avril 1971; tous les membres étaient présents.

XVII^e Assemblée générale 1972.

L'un des principaux points à l'ordre du jour était la préparation de la XVII^e Assemblée générale, qui se tiendra à Varsovie en août 1972. Les Professeurs Smolinski et Hahn (Président et Vice-Président du Comité organisateur polonais) ont participé à l'examen de cette question.

Le programme général de l'Assemblée est reproduit à la suite du présent compte rendu (voir p. 14).

Le Comité polonais adressera en juin 1971 à tous les Comités Membres des exemplaires de la Première Annonce de l'Assemblée. La Deuxième Annonce sera envoyée en février 1972 aux Comités Membres, mais aussi aux personnes qui auront fait parvenir au Comité organisateur le Bulletin d'inscription préalable inclus à la Première Annonce.

Afin d'éviter que le nombre de participants à l'Assemblée soit par trop élevé, la participation sera limitée, comme d'habitude, aux membres des délégations des Comités Membres et à un certain nombre d'observateurs qui seront invités soit par le Président de l'Union, soit par le Comité polonais.

Le Bureau a décidé de renouveler son geste d'assistance aux jeunes scientifiques et, comme pour l'Assemblée d'Ottawa, une somme de 10 000 $ sera mise à la disposition de 15 à 20 jeunes chercheurs pour appuyer financièrement leur participation à l'Assemblée. Dans le courant de l'année, le Secrétaire général invitera les Comités Membres à présenter les noms de leurs candidats à cette aide.

Réorganisation de l'URSI.

Un tiers environ des Comités Membres ont fait parvenir au Bureau leurs commentaires sur les Recommandations du Groupe de travail pour les questions de réorganisation de l'URSI. Après examen de ces commentaires et des opinions exprimées par les Présidents et Vice-Présidents des Commissions, les membres du Bureau ont estimé qu'il serait prématuré de formuler dès maintenant les propositions définitives qui seront soumises à l'Assemblée générale en 1972.

Le Bureau recevra avec satisfaction les commentaires des Comités Membres qui n'ont pas encore fait connaître leurs opinions, ainsi que tous commentaires supplémentaires des autres Comités. Le Secrétaire général préparera vers la fin de 1971 un rapport sur la situation et le Bureau rédigera les propositions définitives lors de sa session d'avril 1972.

Divers.

Les membres du Bureau ont également examiné des questions relatives à l'organisation de colloques, à la représentation de l'Union aux conférences d'autres organismes, aux publications de l'URSI, à l'administration, aux finances, etc.

Le Bureau se réunira à nouveau à Bruxelles en avril 1972.

Comité de Coordination

Toutes les Commissions étaient représentées à la session du Comité de Coordination, qui s'est déroulée à Bruxelles les 21 et 22 avril 1971.

Réorganisation de l'URSI.

Une ample discussion a été consacrée aux Recommandations soumises par le Groupe de travail pour les questions de réorganisation de l'URSI. Les Présidents et Vice-Présidents des Commissions ont proposé un certain nombre d'amendements au texte de ces recommandations. Ces projets d'amendement seront pris en considération par le Bureau lors de la rédaction du texte définitif des Recommandations qui seront présentées à l'Assemblée générale en 1972.

XVII^{e} Assemblée générale 1972.

Les discussions entamées par le Bureau se sont poursuivies au sein du Comité de Coordination, qui a consacré une attention particulière au choix des thèmes pour les séances scientifiques des Commissions.

La liste des thèmes figure ci-dessous. Pour les séances qui seront organisées par deux Commissions, les numéros des Commissions intéressées sont repris à la suite du titre de la séance, le premier de ces numéros indiquant la Commission responsable de l'organisation.

COMMISSION I. — MESURES ET ÉTALONS RADIOÉLECTRIQUES.

1.1 Etalons de fréquence en électronique quantique, y compris étalons optiques (VII-I).
1.2 Emissions de signaux horaires et de fréquences étalon (VLF, LF et VHF).
1.3 Mesures par laser, y compris mesures des matériaux laser (I-VII).
1.4 Mesures aux fréquences radioélectriques et sur ondes millimétriques et submillimétriques.
1.5 Applications des méthodes radioélectriques (y compris longueurs d'onde laser) aux mesures scientifiques.
1.6 Mesures automatiques traitées par ordinateur.
1.7 Mesures relatives aux dangers de la radiation électromagnétique.
1.8 Comparaisons d'étalons à l'échelle internationale.

COMMISSION II. — RADIOÉLECTRICITÉ ET MILIEUX NON IONISÉS.

2.1 Comptes rendus de colloques récents.
2.2 Propagation radioélectrique au-dessus de 10 GHz : communications sol-espace.
2.3 Propagation radioélectrique au-dessus de 10 GHz : communications sol-sol.
2.4 Propagation radioélectrique au-dessus de 10 GHz : problèmes et modèles de précipitations.
2.5 Radiométrie, structure des raies du spectre atmosphérique, expériences.
2.6 Sondage à distance de la terre, cartographie et détection des ressources de la terre.
2.7 Sondage de l'atmosphère au moyen du radar et du lidar.
2.8 Sujets nouveaux, tendances futures des recherches.

COMMISSION III. — IONOSPHÈRE.

3.1 Base ionosphère : chimie des ions et interprétation des données obtenues au moyen de méthodes différentes.
3.2 Comptes rendus de colloques récents.

3.3 Flux dans la plasmasphère (IV-III).
3.4 Groupes de travail.
3.5 Coordination des observations ionosphériques à l'échelle régionale et à l'échelle mondiale.
3.6 Instabilités dans l'ionosphère polaire; besoins en programmes expérimentaux dans l'avenir.
3.7 *a*) Groupes de travail;
  b) Propagation ionosphérique ELF et VLF (III-VIII).
3.8 Combinaison des données ionosphériques obtenues par satellites et par stations au sol pour l'obtention de profils ionosphériques et l'étude des problèmes de propagation.

COMMISSION IV. — MAGNÉTOSPHÈRE.

4.1 Rapport du Groupe de travail sur la mesure de faibles densités électroniques.
4.2 Radiation en provenance du plasma environnant la terre (IV-V).
  Colloque sur l'interaction ionosphère-magnétosphère :
  4.3 Flux dans la plasmasphère (IV-III);
  4.4 Flux aux hautes valeurs L;
  4.5 Sous-orages magnétosphériques;
  4.6 Instabilités dans l'ionosphère polaire; besoins en programmes expérimentaux dans l'avenir (IV-III).
4.7 Sujets nouveaux.
4.8 Petits groupes de travail.

COMMISSION V. — RADIOASTRONOMIE.

5.1 Observations spectroscopiques de raies.
5.2 *a*) Radioastronomie LF, y compris résultats obtenus par satellites;
  b) Etudes galactiques, y compris pulsars.
5.3 Radiation en provenance du plasma environnant la terre (IV-V).
5.4 Instruments et traitement de l'information en radioastronomie.
5.5 Observations extragalactiques de haute résolution, y compris radioastronomie de position de haute précision.
5.6 Activités courantes et futures des Instituts de radioastronomie, y compris instruments nouveaux.
5.7 Techniques et observations sur ondes millimétriques.

COMMISSION VI. — ONDES ET CIRCUITS RADIOÉLECTRIQUES.

6.1 Configurations d'antennes actives (VII-VI).
6.2 Milieux et structures pour le guidage des microondes.
6.3 Simulation sur ordinateur de problèmes du champ électromagnétique, conception optimale.
6.4 Techniques de synthèse dans les circuits distribués.
6.5 Diffusion et diffraction des ondes électromagnétiques.
6.6 *a*) Systèmes d'adaptation;
b) Filtres, récepteurs, antennes et méthodes de reconnaissance des formes.
6.7 Théorie de l'information et codage.
6.8 Communications optiques au moyen des méthodes onde guidée et espace libre (VII-VI).

COMMISSION VII. — RADIOÉLECTRONIQUE.

7.1 Etalons de fréquence en électronique quantique, y compris étalons optiques (VII-I).
7.2 Configurations d'antennes actives (VII-VI).
7.3 Mesures par laser, y compris mesures des matériaux laser (I-VII).
7.4 Progrès dans le domaine des dispositifs semi-conducteurs à microondes.
7.5 Acoustique des microondes.
7.6 Dispositifs optiques pour communications et traitement de l'information.
7.7 Communications optiques au moyen des méthodes onde guidée et espace libre (VII-VI).

COMMISSION VIII. — BRUIT RADIOÉLECTRIQUE D'ORIGINE TERRESTRE.

8.1 Le bruit radioélectrique et les communications.
8.2 Bruit ELF.
8.3 Localisation des orages.
8.4 Bruits industriels.
8.5 Influences météorologiques dans la génération du bruit radioélectrique.
8.6 Propagation ionosphérique ELF et VLF (III-VIII).
8.7 Sifflements : source et propagation.

MEETINGS OF URSI BOARD AND COORDINATING COMMITTEE

Board of Officers

The Board of Officers of URSI met in Brussels on 20 and 23 April 1971; all the members were present.

XVII General Assembly, 1972.

One of the main items of business was to review the arrangements for the XVII General Assembly which will be held in Warsaw in August 1972. Profs Smolinski and Hahn (Chairman and Vice-Chairman of the Polish Organising Committee) were present during the discussion on the Assembly.

The general timetable for the Assembly is reproduced after this report.

The Polish Committee will send copies of the First Announcement about the Assembly to all Member Committees of URSI in June 1971. The Second Announcement will be sent out, in February 1972, to Member Committees, and also to individuals who have completed the provisional attendance form included in the First Announcement.

So as to keep the total number of participants within reasonable limits, attendance at the Assembly will, as usual, be restricted to members of the delegations of the Member Committees of URSI and a few observers invited by the President of the Union or by the Polish Committee.

The Board agreed to repeat the Young Scientists Scheme and, as for the Ottawa Assembly, to make available a sum of $10,000 which will be used to give partial financial support to 15-20 young research workers. Later this year, the Secretary General will write to Member Committees asking for suggested names of young scientists.

Reorganisation of URSI.

About one third of the Member Committees had submitted, in time for the Board Meeting, comments on the Recommendations of the Working Group on the Reorganisation of URSI. These and the views expressed by the Chairmen and Vice-Chairmen of Commissions were reviewed, but the

Board agreed that it would be premature to decide on the formal proposals that will be submitted to the General Assembly next year.

The Board will welcome the views of the Member Committees that have not yet replied and, if appropriate, supplementary expressions of opinion from those Committees that have submitted provisional comments. The Secretary General will prepare a progress report towards the end of 1971 and the Board will make proposals at its meeting in April 1972.

Miscellaneous Matters.

The Board reviewed also various questions relating to the organisation of URSI symposia, the representation of URSI at meetings of other bodies, URSI publications, the administration of the Union, finances, etc.

The Board will next meet in Brussels in April 1972.

Coordinating Committee

All the Commissions were represented at the meetings of the Coordinating Committee held in Brussels on 21 and 22 April 1971.

Reorganisation of URSI.

There was a very full discussion of the Recommendations made by the Working Group on the Reorganisation of URSI. The views of the Chairmen and Vice-Chairmen of the Commissions were summarised in a number of suggested modifications or amendments to the original recommendations.

These views will be taken into account by the Board of Officers when it considers the final form of the recommendations to be submitted to the URSI General Assembly in 1972.

XVII General Assembly, Warsaw 1972.

The discussions which had been initiated at the preceding meeting of the Board of Officers were continued, with special reference to the topics selected for the scientific sessions of the Commissions.

These topics are listed below. Sessions that will be jointly organised by two Commissions are indicated by adding the numbers of the Commissions after the title. The first Commission thus indicated will be responsible for organising the session.

URSI Assembly, Warsaw
General Programme

1972 August	Board	Council	Coord. Committee	Plenary	Commissions	Evening
18 morn	I					
18 aft		I				
19 morn		II				
19 aft		III				
Sun 20 morn						
Sun 20 aft			I			
21 morn				I		Reception
21 aft					BS	
22 morn					I	
22 aft					II	
23 morn					III	Theatre
23 aft					RU	
24 morn					IV	
24 aft					V	
25 morn					VI	
25 aft					VII	
26 morn		IV				
26 aft						
Sun 27 morn						
Sun 27 aft						
28 morn					VIII	
28 aft					IX	
29 morn					X	Reception
29 aft				II		
30 morn		V				
30 aft	II or	VI				
31 morn	II if not 30					
31 aft						

BS First Business Session
RU Open Meeting (all Commissions) on Reorganisation of URSI

COMMISSION I. — RADIO MEASUREMENTS AND STANDARDS.

1.1 Quantum frequency standards, including optical standards (VII-I).
1.2 Standard time and frequency transmissions (VLF, LF and VHF).
1.3 Laser measurements, including laser material measurements (I-VII).
1.4 Measurements at radio frequencies and at millimetre and submillimetre wavelengths.
1.5 Applications of radio methods (including those made at laser wavelengths) to scientific measurements.
1.6 Automated and computerized measurements.
1.7 Measurements relating to electromagnetic radiation hazards.
1.8 International comparisons of standards.

COMMISSION II. — RADIO AND NON-IONIZED MEDIA.

2.1 Reports on recent symposia.
2.2 Radio propagation above 10 GHz : Ground-to-space communications.
2.3 Radio propagation above 10 GHz : Ground-to-ground communications.
2.4 Radio propagation above 10 GHz : Precipitation problems and models.
2.5 Radiometry, the structure of atmospheric spectrum lines, and related experiments.
2.6 Remote sensing of the earth; mapping and detection of earth resources.
2.7 Atmospheric probing by radar and lidar.
2.8 New topics, future directions of research.

COMMISSION III. — IONOSPHERE.

3.1 The lower ionosphere : ion chemistry and the interpretation of data obtained using different methods.
3.2 Reports on recent symposia.
3.3 Flow in the plasmasphere (IV-III).
3.4 Workshop meetings.
3.5 Regional and world-wide coordination of ionospheric observations.
3.6 Instabilities in the polar ionosphere; the need for future experimental programmes (IV-III).
3.7 (*a*) Workshop meetings;
(*b*) Ionospheric propagation at ELF and VLF (III-VIII).
3.8 Combination of ionospheric data from satellites and ground stations for ionospheric profiles and for propagation problems.

Commission IV. — Magnetosphere.

4.1 Report of Working Group on measurement of low electron densities.
4.2 Radiation from the earth's plasma environment (IV-V).
Symposium on Ionosphere-Magnetosphere Coupling (IV-III) :
4.3 Flow in the plasmasphere;
4.4 Flow at high L-values;
4.5 Magnetospheric substorms;
4.6 Instabilities in the polar ionosphere; the need for future experimental programmes.
4.7 New topics.
4.8 Meetings of small groups.

Commission V. — Radio Astronomy.

5.1 Spectral line observations.
5.2 (*a*) LF radio astronomy, including satellite results;
(*b*) Galactic studies, including those relating to pulsars.
5.3 Radiation from the earth's plasma environment (IV-V).
5.4 Instrumentation and information processing in radio astronomy.
5.5 High-resolution extra-galactic observations, including high-accuracy positional radio astronomy.
5.6 Current and future activities of radioastronomical institutes, including new instrumentation.
5.7 Millimetre-wave observations and techniques.

Commission VI. — Radio Waves and Circuits.

6.1 Active antenna arrays (VII-VI).
6.2 Media and structures for the guidance of microwaves.
6.3 Computer simulation of electromagnetic field problems; optimization in design.
6.4 Synthesis techniques in distributed circuits.
6.5 Scattering and diffraction of electromagnetic waves.
6.6 (*a*) Adaptive systems;
(*b*) Filters, receivers, antennas and methods of pattern recognition.
6.7 Information theory and coding.
6.8 Optical communications using guided wave and free-space methods (VII-VI).

COMMISSION VII. — RADIO ELECTRONICS.

7.1 Quantum frequency standards, including optical standards (VII-I).
7.2 Active antenna arrays (VII-VI).
7.3 Laser measurements, including laser material measurements (I-VII).
7.4 Advances in microwave semi-conductor devices.
7.5 Microwave acoustics.
7.6 Optical devices for communications and information processing.
7.7 Optical communications using guided waves and free-space methods (VII-VI).

COMMISSION VIII. — RADIO NOISE OF TERRESTRIAL ORIGIN.

8.1 Communications aspects of radio noise.
8.2 ELF noise.
8.3 Location of thunderstorms.
8.4 The man-made noise environment.
8.5 Meteorological influences in the generation of radio noise.
8.6 Ionospheric propagation at ELF and VLF (III-VIII).
8.7 Whistlers : source and propagation.

STANDARD FREQUENCY AND TIME SIGNAL EMISSIONS

The information given below is a résumé of the detailed instructions for the implementation of Recommendation 460 (XII Plenary Assembly, New Delhi 1970) as given in CCIR Report 517 by Study Group 7. Persons directly concerned with standard frequency and time signal emissions should refer to the Report mentioned for further details.

A special adjustment to these emissions should be made at the end of 1971 so that the reading of the UTC (Coordinated Universal Time) scale will be 1 January 1972, 0 h 0 m 0 s at the instant when the reading of Atomic Time (AT), indicated by BIH, will be 1 January 1972, 0 h 0 m 10 s.

The departure of UTC from UT1 should not normally exceed 0.7 s and whole seconds will be inserted or omitted (positive and negative leap seconds respectively) when required preferably at the last UTC second of

31 December and/or 30 June. BIH will make announcements about these adjustments at least eight weeks in advance.

The approximate difference UT1 — UTC is referred to as DUT1 and will be disseminated using the following code :

— a positive value of DUT1 (= $n \times 0.1$ s) is indicated by emphasising seconds numbers 1 to n inclusive following the minute markers;
— a negative value of DUT1 (= $m \times 0.1$ s) is indicated by emphasising seconds numbers 9 to $8 + m$ inclusive following the minute markers.

DUT1 will be determined by BIH and circulated one month in advance.

It is important to note that m and n are integers in the range 1 to 7 inclusive. Thus the coded sequence will always occur in the range covered by seconds 1 to 15 inclusive after the minute marker. If DUT1 = 0, there will be no emphasised second marker.

The emphasis may be achieved by lengthening, doubling, splitting or tone modulation of the normal second markers.

Special rules are given for the dating of events which occur in the vicinity of a leap second.

In connection with the precise definitions of Universal Time (UT), it should be recalled that UT1 is a form of UT in which corrections have been applied for the effects of small movements of the Earth relative to the axis of rotation. UT2 is the same as UT1 but with an additional correction for small seasonal changes in the rate of rotation of the Earth.

INTERNATIONAL REFERENCE IONOSPHERE IRI

PRESENT STATUS

K. Rawer
Arbeitsgruppe für physikalische Weltraumforschung
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Editor's Note. — In September 1968, the URSI-STP Committee established a Working Group to prepare an International Reference Ionosphere under the Chairmanship of Prof. K. Rawer. It was agreed that the new Working Group should work in close contact with COSPAR Working Group 4, Panel 4B (Co-Chairmen : Profs S. A. Bowhill and E. Lauter).

The status report reproduced below was presented by Prof. Rawer at an open meeting of this Panel during the XIII Plenary Meeting of COSPAR in Leningrad in May 1970. It has been modified in the light of the discussions in Leningrad and has been updated and slightly edited since the original version was published in *COSPAR Information Bulletin* No. 56. Prof. Rawer's Group will meet again in Seattle during the COSPAR Meeting in June 1971. A progress report will be prepared on this occasion for subsequent publication.

Introduction

Following the general discussion of IRI at the COSPAR Meeting in Prague (May 1969), two more such sessions were held at the URSI General Assembly in Ottawa (August 1969). After this, the Chairman of the Working Group paid several visits to possible contributors : one to CRC in Canada, and several in the USA, to Bedford, Pennstate and Greenbelt. Reports on the Ottawa discussions and the subsequent visits were widely circulated, by the URSI Secretariat, to a large number of interested scientists. We may assume that these Reports are known and in this report we shall summarize the present situation, taking into account the results of all the earlier discussions. The best ways of promoting the work under present circumstances were discussed in detail at the COSPAR Meeting in Leningrad in 1970.

1. — Organisation of IRI.

1.0 IRI shall be subdivided into two main parts :

A rather detailed introductory part from which the statistical significance, the ranges of applicability, and the causes of possible deviations and disturbances should appear and a second and main part with tables giving profiles for the mainly interesting parameters (see 1.1) under certain selected conditions covering a wide range of geographical and geophysical situations (see 1.2).

It is felt that at the present time the main tables only should be discussed and the introductory chapter be written after agreement has been obtained on the tables.

1.1. — *Parameters.*

According to the definition of the task and subsequent discussions the following parameters should be represented in the final tables :

electron density :	N_e
relative number density of positive ions of different kinds (h) :	N_{ih}/N_e
electron temperature :	T_e
ion temperature :	T_i
neutral particle temperature :	T_n
electron-neutral particle collision frequency :	ν_{em}
electron-ion collision frequency :	ν_{ei}

Finally, there seems to be a desire for an estimated numerical density of negative ions (all kinds together) wherever it is considered to be significantly greater than the electron density (e.g. in the lowest ionosphere).

1.2. — *Number of tables (different conditions)* :

4 latitudes :	very small magnetic dip — lower temperate latitude — higher temperate latitude — high latitude
3 seasons :	summer — equinox — winter
4 hours :	noon and midnight and, probably, the hours of maximum and minimum peak electron density
3 solar activities :	high — medium — low.

This would give a total of 144 tables. It might, however, not necessarily be feasible to get all these completed with the input data available at present.

As incoherent scatter data will probably be extremely helpful for obtaining T_e, T_i and N_{ih}/N_e profiles, the locations of the few existing stations using this technique should have some priority. It was agreed at Leningrad to adapt the provisional IRI tables to the following locations :

L1 = 12° S 77° W = *Jicamarca* (magn. dip −1°)
L2 = 18° N 67° W = *Arecibo* (magn. dip +51°)
L3 = 45° N 02° W = *St. Santin* (magn. dip +61°)

For L4 (high latitute) none of the incoherent scatter stations is feasible. This position will be chosen according to the availability of ground based data. [At present the following are being considered provisionally : *Thule*/Greenland and *Murmansk*/USSR.]

2. — Electron number density N_e.

2.0 As this is the parameter for which the greatest number of observational data are available, it is intended to produce, as a next step, tables of N_e along the following ideas :

2.1. — *D region.*

2.1.1. Ferraro and Lee have promised tables for mid-latitudes using the observational data of the *Pennstate* Group with low-frequency sounding together with cross modulation work obtained at the same latitude. These data are probably the most complete in existence.

2.1.2. Partial reflection technique is applied by Belrose in Canada and by Weiss in South Africa. Data typical for L3 and L4 are to be exptected from these observations.

2.1.3. Data obtained with *in situ* probes during rocket ascents will be collected and compiled by K. Maeda (Kyoto University, *Kyoto*, Japan).

2.1.4. Data obtained with rockets using propagation techniques will be collected and compiled by S. Bowhill (Illinois State University, *Urbana*, USA).

2.1.5. Profiles obtained by Bain and by Krasnuškin when applying propagation theory to VLF and LF field-strength observations have been shown at Leningrad. Krasnuškin will apply his method to other field-strength data as these become available. These computation techniques could also be reversed to check a proposed profile for consistency with the VLF and LF data.

2.2. — *E region.*

Maximum electron density for the daytime E region might be obtained from an existing ESSA programme giving *foE* over the whole world. This programme, at high latitudes, contains also the thick layers at the same height as produced during auroral events, mainly at night. It was agreed that this so-called 'night E' should not be taken as typical.

Thus it might be better to use an equation depending upon the solar zenith angle instead of ESSA's purely empirical computer programme.

Maeda's compilation of the shape of the E-region profile, presented at Prague in 1969, will be completed with additional rocket data. It appears that it gives a reasonable basis for determining the shape below and slightly above the E-region maximum.

2.3. — *F1 layer.*

There are no really usable inputs at hand at this time, except for a few general formulae which attempt to relate *foF1* with solar activity (Eyfrig-Ducharme-Petrie).

The difficulty is, however, that the relative height and the shape of the transition in the profile are not well enough described. The transition may be very shallow in many cases. We try to obtain a provisional solution first, using W. Becker's normalized summer day profile.

2.4. — *F2 layer.*

2.4.1. For the *maximum electron density* (monthly medians) there exists a well established computer programme of CCIR which uses an improved Gallet-Jones method. As it is based upon an enormous mass of empirical data gathered at ionospheric stations, it will probably be the appropriate tool even for later editions of IRI.

2.4.2. As to the *corresponding height*, it has been shown that there is great difficulty in obtaining it at this time from reduced topside soundings.

2.4.2.1. It is therefore proposed to proceed provisionally with the CCIR programme for *M(3,000)* and an empirical formula due to Shimazaki by which this parameter may be roughly translated into a value of h_{max} as used by ESSA for certain practical purposes. Eyfrig (FTZ, *Darmstadt*, FRG) is looking into possibilities of improving this formula so that it can be used at different magnetic latitudes.

2.4.2.2. Nisbet (Pennstate University, *College Park*, USA) has established a computer programme (along the lines of the CCIR programme mentioned under 2.4.1) summarizing h_{max} from profile reductions of ionograms. The data input to this programme is, unfortunately, geographically rather limited.

2.4.2.3. Meanwhile A. Paul (ESSA, *Boulder*, USA) indicated the availability of so-called 'composite profiles' from quite a few stations in the western hemisphere. Part of these have been obtained with Paul's formulae assuming a minimum, but the earlier ones may be inaccurate as Budden's simple matrix method was used.

2.4.2.4. W. Becker has profile data for a middle latitude in Europe.

2.4.2.5. Incoherent scatter data are not available in large quantities but could be used as independent check.

2.4.3. — *Shape of the layer below the peak.*

It is important to have a simple empirical formula for describing this shape in an easy way.

2.4.3.1. For mid-latitudes we have Becker's equation which allows us to determine the shape, once $(N_e)_{max}$ and h_{max} are known (see 2.4.2.4 above).

2.4.3.2. It is hoped that similar shapes will be obtained for the other interesting latitudes from existing $N(h)$ data (see 2.4.2.3 above).

2.4.3.3. In some cases, incoherent scatter data could also be used though their total number is as yet rather small.

2.4.3.4. There was some discussion at Leningrad about the possibility of computing profiles from an aeronomic model starting with solar radiation and computing its effects in a given neutral atmosphere. Different opinions have been expressed by Nisbet (pro) and Hanson (contra). It could be shown that all computations which give realistic profiles use somewhere an adaptation term by which observed data are fed in.

2.4.4. — *Shape of the layer above the peak.*

2.4.4.1. Some typical equations for possible shapes have been obtained empirically from Alouette data by Ramakrishnan and could possibly also be deduced from Colin's work at *Ames* (USA). However, these empirical equations are not really helpful so far, as the relevant Alouette data do not give the maximum electron density.

2.4.4.2. From five incoherent scatter stations (three of which are located at higher temperate latitude) quite useful empirical equations have been obtained by Ramakrishnan (APW, *Freiburg*, FRG). The advantage of the technique is that the maximum electron density value is known; a disadvantage is the rather small number of observations (very few days per month). It is important to correct the individual data for their position by reference to the monthly averages (which could be determined from ground station observations made regularly as a routine).

2.4.4.3. There is also a considerable number of data from probe measurements on satellites; K. Maeda agreed to compile these also. It is hoped that persons concerned with these techniques and their reduction might help by sending him their results even before publication. (For example Piggott, RSRS *Slough*, UK, could supply reasonable contributions from the Ariel 3 data after smoothing out local disturbance effects.)

None of these techniques gives much useful information above an altitude of 1,000 km.

2.4.4.4. Some rocket and satellite *in situ* observations have been made at altitudes above 1,000 km. Gringauz has reported on such data existing in USSR. Other observational data should be available from NASA.

2.4.4.5. For greater heights, up to the plasmapause, Maeda mentioned the importance of a systematic reduction of whistler observations. One difficulty is the field-aligned plasma distribution which means that some geomagnetic latitude dependence must probably be assumed. Carpenter should be asked to deliver a written report on this subject.

3. — Electron temperature.

Data are available from one "ground-based" method, namely incoherent scatter observations, and from "space" observations with probes, both on rockets and satellites. Full temperature equilibrium can practically be assumed below 100 km, so that T_e and T_i as special parameters would not be needed in the D and lower E region, provided T_n is known there.

3.0. *Probe methods* were discredited at the 1969 URSI Assembly by Booker and Smith and by Sayers.

3.0.1. A few comparison measurements with incoherent scatter stations now exist. The probes on board Alouette 2 and Explorer 31 gave values higher by 80-100° K. There is, however a large dispersion of the error when other types of *in situ* probes are considered, ranging from rather small differences up to an error of 2,000° K. The error seems to be always positive so that *in situ* probes tend to give too high an electron temperature. Hinteregger explained that probes are always sensitive to rather small populations at high temperature, while backscatter determinations are more sensitive to larger populations. W. Pfister (AFCRL, *Bedford*, USA) promised to produce a critical compilation of *in situ* probe data about T_e and T_i.

3.0.2. Pfister pointed out that temperature determinations with incoherent scatter techniques depend upon the velocity distribution of electrons or ions along the line of sight. Gringauz expressed doubts about the value of low-latitude incoherent scatter temperatures because the gyro-motion is observed there and it seems doubtful that, at large heights, temperature equilibrium should exist parallel and perpendicular to the magnetic field. Some information could possibly be obtained from the ESRO-1a satellite. It was finally agreed that, wherever it is anisotropic, the temperature should be defined for a direction *parallel* to the magnetic field. Cohen should be asked for a statement about the observations made in particular at *Jicamarca*.

3.1. — *E region.*

3.1.1. Incoherent scatter data are only very rarely obtained from this region. Therefore rocket data have a greater chance. W. Pfister (AFCRL, *Bedford,* USA) promised to compile T_e and T_i data.

3.1.2. T_i in the E region could possibly be derived from T_n, with a small correction to be obtained from heat transfer considerations.

3.2. — *F region.*

3.2.1. *Incoherent scatter* data are available throughout this region up to about 1,000 km from six stations.

3.2.1.1. A greater data input could only be obtained at present from four stations, two at lower latitude :

Jicamarca (12° S 77° W, dip −1°),
Arecibo (18° N 67° W, dip +51°)

and two a higher temperate latitude :

Millstone Hill (43° N 72° W, dip +73°),
St. Santin (45° N 2° E, dip +61°).

A station at similar latitude has more recently been established in southern England, and another one at *Kharkov* (USSR).

(*Note* : COSPAR Decision No. 10 recommends continuation of all existing incoherent scatter stations and refers the subject to URSI's attention.)

3.2.1.2. Temperature data of plasma components are not necessarily obtained with the same accuracy from all existing stations. It may also be found that suitable methods of smoothing will be needed as, for practically all stations, the number of observational days is limited.

3.2.1.3. Bauer (GRI, *St. Maur,* France) has established a semi-empirical relation between T_e-T_i and N_e. While the slopes differ largely for individual days, the average is quite well defined. The equation would be

$$T_e - T_i = A + BN_e$$

with coefficients A and B depending upon height and location. The relation could only be applied if these dependences were well established.

3.2.2. *Probe measurements* of plasma component temperatures made aboard satellites were regarded with great doubt at the last URSI Assembly (see 3.0 above). Such data have not been published for all suitable satellites.

3.2.2.1. W. Pfister will undertake to judge the reliability of data obtained with different instruments. He will also consider whether it might be possible to consider comparative measurements with incoherent scatter stations made in the past. (Arrangements for future occasions for such comparisons seem to be urgently needed.)

3.2.2.2. Satellite probe measurements are the only ones obtainable from heights considerably above 1,000 km; unfortunately errors seem to increase considerably with greater height (due to decrease of plasma density). Data from Langmuir and similar probes should be available up to 3,000 km from Explorer 31, from OGO 5, and from Electron 2 and 4.

3.2.3. *Electron and ion temperatures* should, as a consequence of heat conduction, not be independent at greater heights. At lower heights, on the contrary, T_i should be quite near to neutral temperature T_n.

3.2.3.1. T_i as deduced from incoherent scatter observations shows a diurnal maximum clearly after 16 h LMT. This is apparently in disagreement with CIRA 1965 (and, probably, also with the forthcoming CIRA) where the maximum of T_n is assumed to occur at 14 h.

3.2.3.2. Champion remarked that present CIRA's assume local equilibrium (plus a particular lower boundary condition). The experimental data on which the 14 h maximum is based are neutral *density* determinations from satellite drag. These data seem to be well established.

3.2.3.3. Bauer (France) stated that the observed experimental facts could be understood satisfactorily if diffusive equilibrium is accepted and a stationary heat flux (from electrons through ions to neutral particles) is assumed. Composition changes could be important. Champion intends to study this problem in more detail.

3.2.4. No other practical methods exist at present from which *independent temperature determinations* could be expected. (Plasma resonances should possibly be considered in this context.)

4. — Positive ion composition.

4.0. Data are available from mass-spectrometer measurements on rockets and a few satellites, and to some extent from incoherent scatter observations.

4.1. *Mass spectrometer* data for ions can not be reduced directly to absolute ion densities.

4.1.1. So-called 'absolute calibration' is usually obtained from independently made electron density measurements. Carefully interpreted, ion mass spectrometers give, however, reliable *relative* values down to quite low densities.

4.1.2. Some contamination effects, e.g. due to outgassing of the space vehicle, are quite well known, so that they can be disregarded.

4.1.3. A compilation of existing ion composition data will be undertaken by H. A. Taylor (NASA, *Greenbelt*, USA).

4.2. Incoherent *scatter* is in a less good position in this context. It is, however, possible to deduce from detailed spectral analysis the relative importance of the main ions. Some *a priori* knowledge of their nature is normally needed for this purpose. R. Cohen (ESSA, *Boulder*, USA) will be asked to discuss merits and limitations of the method.

5. — Electron collision frequencies.

5.0. In order to get solid basic information, we have asked K. Suchy (University of *Marburg*, FRG) to write a short paper explaining the different theoretical approaches, their merits and limitations. (The paper was widely distributed after the Leningrad meeting.)

5.1. It appears clearly from this paper that distinctions must be made between different kinds of collision frequencies to be used for different purposes. For future IRI users, one main question will certainly be that about 'effective collision frequencies' for all kinds of radio-wave propagation problems. Aeronomic problems, however, need another approach which may also be rather important in IRI.

5.2. Electron-neutral particle collisions must be considered mainly below 150 km. A 'most probable' collision frequency, ν_{en}, is what is needed there.

5.2.1. Pfister proposes the simple relation

$$\nu_{en} = 7 \times 10^7 \,(p/mb)\,(T_e/T_i)\ \mathrm{sec}^{-1}$$

Other relations have been given by Piggott and Thrane, and by Suchy.

5.2.2. An important data input from higher temperate latitudes, obtained from both pulse reflection and cross modulation techniques, has been announced by Ferraro and Lee. These should be compared with computed values (see 5.2.1) using parameters from IRI itself, and CIRA.

5.3. Electron-ion collisions are probably needed mainly above 150 km, as well as a 'most probable' collision frequency, ν_{ei}.

5.3.1. The 'effective collision frequency' for radio-wave phenomena is obtained by combination of ν_{en} and ν_{ei} (A. A. Ruhadze, *Moscow*, USSR), in the easiest case by simple addition.

5.3.2. Computation with the usual equations (as given, for example, by Majumdar, Nicolet, Suchy and others) introduces a critical effect of the electron temperature. [The reliability of such equations and their conditions of applicability should be discussed by theoreticians in the future.]

RADIO PHENOMENA ASSOCIATED WITH SOLAR FLARES

The following terminology for the various flare-associated phenomena observed at radio frequencies is in general use :

SNB	Solar noise burst	UHF, VHF
SCNA	Sudden cosmic noise absorption	VHF, HF
SWF	Short-wave fade-out	HF, MF
SFD	Sudden frequency deviation	HF
SPA	Sudden phase anomaly	VLF
SEA	Sudden enhancement of atmospherics	27 kHz
SES	Sudden enhancement of signal	any frequencies

Dr. S. N. Mitra (1970) proposes the introduction of a new term :

SCL	Sudden change in long-wave field	VLF.

This term would be used to denote both increases and decreases, in the fieldstrength of a long-wave radio signal, caused by a solar flare. Mitra suggests also the deletion of the term SES on the grounds that, apart from SEA, there is no other phenomenon characterised always by an increase in signal strength during a solar flare.

Mitra has found that there are three different types of SCL (sudden change in long-wave field). The classification is based on a long series of observations on the Tashkent-Delhi path at a frequency of 164 kHz.

Type A. — Sudden increase of signal followed by gradual recovery (X rays : $>$ 8-10 A; 65-70 km).

Type B. — Sudden decrease followed by a sudden increase in signal, and then a gradual recovery (X rays : 2-10 A; below 65 km).

Type C. — Sudden decrease of signal followed by gradual recovery (X rays : 0-4 A; 55-65 km).

Radio scientists and others who are interested in solar flares and their effects on radio signals are invited to express their opinions on Dr. Mitra's proposals namely :
(1) the introduction of the term SCL;
(2) the deletion of the term SES.

Comments should be sent to Secretary General URSI, 7 Place E. Danco, 1180 Brussels, Belgium.

REFERENCE

MITRA, S. N. (1970). — *Solar Physics*, **15**, 249-252.

GLOBAL ATMOSPHERIC RESEARCH PROGRAMME (GARP)

The Global Atmospheric Research Programme (GARP) is the first major international programme devoted specifically to atmospheric research. The programme will, in fact, be a series of experiments to determine the behaviour of either the whole atmosphere or some part of it; the first, the GARP Atlantic Tropical Experiment, will be held for a period of approximately three months during the course of June, July and August 1974. This will be followed, after a period of two or three years, by the first GARP Global Experiment, which will probably take place in 1976.

The prime object of the Programme, which is a joint undertaking of ICSU and the WMO, is to observe the general circulation of the lower atmosphere (below about 30 km), in order to be able to understand it better and to make short-term predictions about its future behaviour. With a better understanding of the physical processes of the lower atmosphere it should be possible to provide increased accuracy in weather forecasting, from the present order of one to two days to more than a week. Preliminary studies have already indicated that, if accurate weather forecasts could be provided three or four days in advance, considerable economic benefits would derive, especially for the agricultural and marine communities, and by minimizing the damages caused by certain types of natural disasters.

Although GARP is not being designed with the intention of solving problems of atmospheric pollution, it is certain that the Programme will provide important information for future studies of how man's activities are liable to cause accidental modifications to the atmosphere of our planet.

The following publication has been received in addition to those listed in *URSI Information Nulletin*, Nos. 175, p. 25 and No. 177, p. 4 : *GARP Publication Series No. 6.* Numerical Experimentation related to GARP (September 1970).

INTEGRATED SCIENCE TEACHING

Volume I of *New Trends on Integrated Science Teaching* (ed. P. Richmond) was published by UNESCO in May 1971. This volume includes selected papers presented during the Congress on the Integration of Science Teaching which was organised by the ICSU Committee on the Teaching of Science in Droujba (Bulgaria) in September 1968.

The ICSU Committee, on which URSI is represented by M. Voge, has been invited by UNESCO to give advice on the preparation of Volume II of the *New Trends* series to be published in 1972.

The Secretary General would be glad to receive comments (favourable or otherwise) on Volume I from anyone who is interested in integrated science teaching. Opinions or suggestions on the contents of Volume II would also be welcome.

FOURTH INTERNATIONAL BIOPHYSICS CONGRESS

Moscow, 7-14 August 1972

The above Congress is being organised by IUPAB and the Academy of Sciences of the USSR. URSI has not, so far, been concerned with electromagnetic radiation outside fields such as physics, astronomy, communications, etc. However, from time to time suggestions are made that radio scientists should assist in the solution of problems such as the transmission of nerve impulses (apparently using a pulse code modulation system) or the biological effects of rf fields (see *URSI Information Bulletin*, No. 172, pp. 18 (French) and 59 (English).

Among the topics proposed for the Congress the following may be of interest to radio scientists :

— Propagation of the nerve impulse and synaptic transfer
— Biomagnetism and action of magnetic fields
— Radiochemistry and radiation biophysics.

Further information about the Congress is available from the Secretary General of the Organising Committee :

Prof. L. P. Kayushin,
Fourth International Biological Conference,
Profsoyuzaya 7,
Moscow V-133, USSR.