WILKINSON

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* Under the auspices of Commission G, Working Group G1 of the International Union of Radio Science (URSI).

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1. INTRODUCTION

by W R Piggott, Chairman

My recent visits to China, Hong Kong, USA, New Zealand, Australia, including Tasmania, Indonesia and Belgium show that there is a widespread interest in INAG programmes and a desire for the organisation to continue. This Bulletin is mainly made up of your contributions, but more are needed if we are to be able to publish 3-4 editions per year. In practice, your problems are not only of local interest - in most cases they are also brought up by other groups. Thus, it is well worth while to collect and send INAG problems, ionogram sequences and notes on local phenomena.

For example, I have now looked at low Es of the type which normally blankets the normal E trace at several stations in both hemispheres and find many regularities in its phenology and morphology. It is not, in general, possible to study this properly from the published tables of ionospheric data, as it is frequently present when foEs, fbEs and h'Es are determined from higher, denser sporadic E layers. Some work can be done using stations where all Es-types are tabulated and thus the presence of this trace is shown even when another type has a larger value of foEs. However, for research purposes, one normally needs the values of all three parameters for each occurrence. This is therefore a natural problem for local study, or at least a regional study. Usually after my visit, people have said "We did not realise how much could be obtained from our data!". The VI community is very remiss in this; rocket, satellite and incoherent scatter people try to exploit their data to a much greater extent, even though, in some cases, their possibilities are less promising than for using our data. When blanketing low Es is present, it causes a decrease in fmin both because some of the absorbing layer is above it and because the losses during the process of reflection are much less than for a normal E trace. I have heard "Our fmin values vary greatly from hour to hour and so cannot be reliable or useful". When this phenomena is present, further investigation has shown that these changes were due to the low Es and therefore were significant for both scientific and practical purposes.

With the current financial situation, it is not enough for a service to be valuable for it to be continued. Clear evidence of a type understandable by the financial authorities must be provided. In the case of INAG, this means that there must be sufficient subscriptions from those able to pay $20 for three years to provide this evidence. At present, less than 15% of the copies sent out are supported in this way. I feel that I must point out that unless more subscriptions are received, the INAG Bulletin will not have much chance of surviving at the next URSI General Assembly.

The replacement of obsolete equipments and setting up of new stations still continues. On behalf of INAG, I wish to welcome the new workers and offer INAG's help in their endeavours.

I would like to draw your attention to the United Nations General Assembly proclamation of a World Communications Year, 1983. This is an opportunity to review the applications of your data to local, regional and world wide problems, to identify gaps which need attention and to obtain new sources of support. It is desirable to start these considerations soon so that you have a considered programme for this effort. The Fourth World Telecommunications Forum will also be held in this year. Further details of both these events are given later in the bulletin.

I am often asked about the availability of used ionospheric equipment. If you have any such equipment in usable condition, and would be willing to make it available, either free or at a low price, please let me know.

2. WORLD COMMUNICATIONS YEAR 1983

In November 1981, the General Assembly of the United Nations proclaimed the year 1983 World Communications Year: Development of Communications Infrastructures. The International Telecommunication Union (ITU) has been designated the lead UN Agency for the preparation and celebration, on a world-wide scale, of WCY 83, with responsibility for co-ordinating the inter-organizational aspects of the programmes and activities of other intergovernmental, governmental and non-governmental organizations.

The UN Resolution invites Member States, UN specialized Agencies, governmental and non-governmental organizations and users of communications services to participate actively in the fulfilment of the objectives of the Year and to cooperate closely with the ITU Secretary-General.

A "Guide to World Communications Year 1983" has been published by the ITU. The text reproduced below has been adapted from the Guide by the ITU Secretariat.

Summary - Principles and Objectives

World Communications Year 1983

- WCY is a specific set of activities to increase the scope and effectiveness of communications as a force for economic, cultural and social development.

- The principles and objectives for the Year have been defined by governments and adopted in resolutions of the UN General Assembly, the UN Economic and Social Council (ECOSOC) and the ITU Administrative Council.

- The Year stresses the expansion and refinement of communication infrastructures as a catalyst for and essential element of development.

- By identifying, coordinating and accelerating the implementation of communications infrastructures, the Year is an opportunity for a "quantum leap" in the development of a complete world communication network which will leave no one isolated from his local, national or international community.

- The Year's programme calls for the harnessing of all possible resources towards the accomplishment of its objectives - human, financial, governmental, industrial, intergovernmental and non-governmental, and the resources of the many other bodies and organizations with related interests.

- The Year focuses on the development of communication infrastructures at the national level. The growth of communication facilities varies greatly from country to country. In some it is minimal. In some it is extremely fast. In some it is haphazard. In some it is unbalanced. With no "master plan" to be imposed, the Year is an opportunity for realistic,

national analysis, review and planning to most speedily and effectively meet the communications needs of each country.

- Special attention is being given to the communications needs of developing countries.

- The WCY will promote and accelerate the achievement of the objectives of the Transport and Communications Decade in Africa.

For further information on World Communications Year 1983, contact:

International Telecommunications Union,
WCY83 Secretariat,
CH - 1211 Geneva 20,
Switzerland.

3. SYMPOSIA

4th World Telecommunications Forum Technical Symposium

Forum 83 Following the World Telecommunication Forums held in Geneva, Switzerland, in 1971, 1975 and 1979, the ITU and a great number of professional engineering societies from its 155 Member countries are organizing the 4th World Telecommunications Forum, Part 2, Technical Symposium. The forum theme will be "Telecommunications for everyone".

Forum 83, Part 2, will be held in the framework of TELECOM 83, in the new Exhibition and Conference Centre in Geneva from 29 October to 1 November 1983.

The Forum, organized by the International Telecommunication Union (ITU), is sponsored by national and international professional engineering associations from all five continents. Conference languages will be English, French and Spanish. Simultaneous translation will be provided.

More information on this symposium may be obtained from:

Forum 83 Secretariat,
International Telecommunication Union,
CH-1211 Geneva 20,
Switzerland.

Beacon Satellite Studies of the Earth's Environment

A conference entitled Beacon Satellite Studies of the Earth's Environment will be held in New Delhi, India from 7-11 February 1983. Those interested should contact:

Dr Tuhi Ram Tyagi,
Radio Science Division,
National Physical Laboratory,
Hillside Road,
New Delhi 110012,
INDIA

or

Dr R Leitinger,
Institut für Meteorologie und Geophysik,
Karl-Franzens-University Graz,
Halbärthgasse 1,
A-8010 Graz,
Austria.

Proceedings of the Spanish URSI Symposium

The Spanish URSI Committee organised a National Symposium in Madrid on 7-8 October 1980. The Proceedings of this meeting, which cover the activities of most URSI Commissions, have just been published (in Spanish). Information can be obtained from:

Prof. M Rodriguez Vidal,
President,
Spanish URSI Committee,
Facultad de Ciencias Fisicas,
Universidad Complutense,
Madrid 3,
Spain.

4. FELLOWSHIPS

ICSU-UNESCO Distinguished Fellowhsips in Science

The International Council of Scientific Unions (ICSU) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) announce the creation of the ICSU-UNESCO Distinguished Fellowships in Science. A small number of Fellowships have been established in the natural sciences, including their application to development, in order to strengthen the scientific capacity of developing nations. The fellowships will be awarded to individuals who have demonstrated exceptional scientific ability at the level of PhD, or its equivalent, and who desire to advance their scientific knowledge in order to conduct basic research relevant to national needs.

Candidates will come from developing countries and will be under 35 years of age when the Fellowship begins. Candidates will, ordinarily, have had one year of post-doctoral experience; special consideration will be given to candidates who have done research in their region. Fellowships will be awarded for one year, with extension for a second year in exceptional circumstances, and will be tenable in any centre of scientific excellence in the world. A letter will be required to show that the candidate will be accepted by the host department or laboratory where he proposes to study. In order to make sure that a position will be available when the Fellow returns to the country or region of origin, institutional commitment of a post will be required with the application as well as governmental approval of the application for Fellowship.

An important feature of the award is the follow-up programme which includes a UNESCO grant to the Fellow for research materials and services to support a research project to be carried out in the Fellow's region of origin. Another feature is the award of two travel grants in the two or three-year period after completion of the Fellowship. These travel funds will

allow one visit by the Fellow to the foreign, host institution as well as one lectureship for the foreign mentor, tenable in the country or region in which the former Fellow's research project is being conducted.

Application forms for the ICSU-UNESCO Distinguished Fellowships in Science are available from National Commissions for UNESCO or from the Division of Scientific Research and Higher Education at UNESCO, 7 place de Fontenoy, 75700 Paris, France. The forms will also be obtainable from the UNESCO Regional Offices.

Completed application forms should be sent to the Division of Scientific Research and Higher Education, UNESCO, 7 place de Fontenoy, 75700 Paris, France. They should be received at UNESCO not later than 1 AUGUST 1982.

Awards will be announced about 1 November 1982, and the first Fellowships will begin between 1 January and 30 June 1983.

COSTED Travel Fellowship Programme

The ICSU Committee on Science and Technology for Developing Countries (COSTED) continues to award travel fellowships to young scientists to attend international meetings. Recently, these meetings have included the International Conference on Environmental Education, New Delhi; The Sixth Indian National Heat and Mass Transfer Conference, Madras; The Workshop on Laser Technology and Applications, Madras; The Symposium on the Role of Physics in Development, Bangladesh; The Summer Institute of Physics, Santiago, Chile.

Those persons wishing to apply for a COSTED Travel Fellowship should write to the Scientific Secretary of COSTED, Department of Physics, Indian Institute of Technology, Madras 600 036, India.

5. SPECTRUM MANAGEMENT

Over the past few decades, radio scientists and communication engineers have been brought face to face with the fact that the radio frequency spectrum must be regarded as falling into the category of "scarce commodities". Practical considerations determine the upper and lower frequency limits of the part of the spectrum that can be used for radio communications and for the many other services recognised by the International Telecommunication Union (ITU) and yet the demand for new and extended allocations continues to increase.

Hence, it is not surprising that "spectrum management" plays an increasingly important role in the development and operation of systems of communication, and it is inevitable that international coordination of frequency allocations must be accepted if chaos is to be avoided.

The recent World Administrative Radio Conference (WARC) held in Geneva in 1979 was the occasion for a comprehensive review of the situation regarding frequency allocations and other matters, and important decisions were made which will affect the planning of communication systems during the remainder of the 20th century at least.

Guest Editors (D Bodson, R G Gould, G H Hagn and W F Utlaut), besides signing the Editorial on "Spectrum Management and the 1979 WARC", have collected 26 invited papers, grouped under the headings

a) Conference Perspectives,

b) General Summary : Conference Results,

c) Radio Services : Results and Issues,

d) Future Conferences.

The papers cover not only the traditional radio services, but deal also with such areas as radio-astronomy, radar, and the use of satellites in geostationary orbits.

This publication provides a very valuable survey of the important decisions made by WARC 1979 and their probable consequences. It will be especially useful to those who do not need to consult the original ITU publications but who, nevertheless, wish to acquire some understanding of the present situation and the problems of spectrum management in the 20th century.

Copies of Post-WARC-79 IEEE Transactions Joint Special Issue are available for $10 US ($5, first copy only, for IEEE members) from:

IEEE Service Center,
445 Hoes Lane
Piscataway,
NJ 08854,
U S A.

6. THE DEVELOPING COUNTRIES WITHIN URSI AND IAGA

URSI Committee on Developing Countries

At the 1981 General Assembly, several suggestions were made concerning the manner in which URSI could optimally support the scientific efforts of Developing Countries. One of the suggestions was that Member Committees might, through local contacts, identify unused scientific equipment which could be put at the disposal of these Countries. The sponsors of the idea had in mind good, serviceable equipment, perhaps not of the "state of the art" level, but of a quality appropriate to the needs of a beginning research team. A first request has now been received from Bangladesh, which is anxious to obtain communications research equipment. Member Committees desirous to help our Bangladesh colleagues are requested to contact Dr R I Sharif, Department of Applied Physics and Electronics, University of Dacca, Dacca 2, Bangladesh.

Strengthening IAGA Sciences in the Developing Countries

A workshop on 'Strengthening IAGA Sciences in the Developing Countires' was held at the IVth Scientific Assembly of IAGA at Edinburgh on two evenings in August 1981. This meeting was convened by Professor K D Cole. The aim of the workshop was to evolve a plan of action for strengthening IAGA sciences in developing countries following discussions of:-

1. The present status of education and research in geomagnetism and aeronomy in the developing countries.

2) The role of education and research in geomagnetism and aeronomy in the technical progress of developing countries.

3) Entrepreneurial steps which must be taken at the personal, institutional, governmental and international levels to strengthen IAGA sciences.

4) Identification of institutions interested in these problems.

5) Identification of individuals prepared to devote time and effort to do entrepreneurial work involved in implementing the plan.

The workshop was attended by about 80 people, representing about 25 countries who formed into four groups to discuss topics which the meeting considered significant. These were education; research and geomagnetic observatories; institutional networks and government agreements and also individual initiatives.

Reports of each of these four groups have been produced and collated into a single un-edited document, together with individual comments received during and after the workshops. Also, an ad hoc committee of IAGA was formed to take the next steps in promoting the aims of the workshop. Anyone wishing to make constructive suggestions on strengthening of IAGA science in the developing countries should contact the chairman of the committee, E Oni at the Department of Physics, University of Ibadan, Nigeria. Those people who would like a copy of the report should write to Professor K D Cole, School of Physical Sciences, La Trobe University, Bundoora, Victoria, Australia 3083.

7. COMMISSION G - OFFICE BEARERS AND WORKING GROUPS 1981-84

Office Bearers

Chairman : Dr P Bauer (France)
Vice-Chairman : Dr J Aarons (USA)

Working Groups

G.1 Ionospheric Network Advisory Group (INAG)

Chairman : Dr W R Piggott (UK)
Vice-Chairman : Dr D G Cole (Australia)

G.3 Southern Hemisphere Atmospheric Studies Group (SHAGS)

Co-Chairmen : Prof J A Gledhill (South Africa)
Prof S Radicella (Argentina)

G.4 International Reference Ionosphere (IRI) (with COSPAR)

Chairman : Prof K Rawer (FRG
Vice-Chairman : Dr A D Danilov (USSR)

G.6 Ionospheric Knowledge Needed to Improve Radiocommunication

Chairman : Dr C M Rush (USA)
Vice-Chairmen : Dr B M Reddy (USA)
Dr E Thrane (Norway)

G.8 Incoherent Scatter

Chairman : Dr M J Baron (USA)
Vice-Chairman : Dr M Blanc (France)

G.10 International Digital Ionosonde Group (IDIG)

Chairman : Dr J R Dudeney (UK)
Vice-Chairmen : Dr K Bibl (USA)
Dr J W Wright (USA)

G.11 Panel on Southern Hemisphere Incoherent Scatter Facility (SHISCAT)

Chairman : Prof J A Gledhill (South Africa)

G.12 Use of Beacon Satellite Transmissions

Chairman : Dr R Leitinger (Austria)
Vice-Chairmen : Dr L Kersley (UK)
Dr J A Klobuchar (USA)

8. INTERNATIONAL DIGITAL IONOSONDE GROUP - BULLETIN NO 3

IDIG bulletin no 3 contains much material already published in the INAG bulletins and is being distributed directly to IDIG members. To save space a shortened version is published here. The complete version can be obtained from Dr J R Dudeney. The comments on Commission G activities will probably be of interest to many INAG readers.

URSI Working Group G10 - International Ditial Ionosonde Group

Bulletin No 3 (Shortened Version) by J R Dudeney, British Antarctic Survey, Madingley Road, Cambridge, CB3 OET, UK.

1. Introductory Comments

This bulletin reports upon IDIG activities at the URSI General Assembly, 10th to the 19th of August 1981 in Washington DC. The activities included one half-day scientific session, two business sessions and participation in two Commission G business sessions.

2. Commission G Business Sessions

The Commission convened two business sessions during the course of the General Assembly. The chairman presented a report on the activities of IDIG in the period from the Helsinki Assembly at the first of these (see INAG 31 p 6-10; INAG 33, p 12-20 and this document).

The most important item of business discussed was the French proposal that Commissions G and H be merged into one unit covering the topic of radio waves in plasmas. The standard of the debate on this proposal was inadequate given its importance, but an official delegates' vote came down in favour by 10 for to 7 against, whilst an unofficial vote for all present was strongly in favour of the change. Since Commission H voted against, Council deferred action until the next Assembly. However, it is then

planned that the two Commissions should be merged, and as a first step a joint input to the next "Review of Radio Science" will be made.

Another important matter discussed was whether any special arrangements were necessary to incorporate the interests of the 'remote sensing' community within URSI. There was not vote taken within Commission G upon this matter, but the sense of the meeting was for minimum changes; preferably, an extension to the terms of reference of Commission F. It was felt that should a new Commission be formed, then it should limit its activities to the land, sea and ice surfaces of the Earth.

The Commission G Chairman will be Dr P Bauer (France) for the next three years, with vice-Chairman Dr J Aarons (USA). Dr D G Cole (Australia) will represent Commission G in Monsee in place of Mme Pillet (France).

The Commission spent a considerable amount of time reviewing the value and purpose of its various working groups. As a result of this several WGs were dissolved and several more merged. In particular, IDIG was asked to incorporate the activities of WGs G2 and G5 (see next section). For the next three years, there will be a total of eight working groups (INAG 34 p 7-8) including one on the 'Use of Beacon Satellite Transmission' transferred from COSPAR. There will also be one joint URSI/IAGA working group in which Commission G will be involved (Active Experiments; with Comm. H). The URSI/IAGA WGs on Structure and Dynamics of the Thermosphere, Ionosphere and Exosphere; and on the Neutral and Ion chemistry and Solar fluxes were to produce written terms of reference (INAG 34 p 7-8). Commission G generated 14 resolutions for consideration by Council. (INAG 34 p 9-10).

3. IDIG Business Meeting

a. First Business Meeting

This was held on the 12th of August, immediately following the IDIG sponsored scientific session and was attended by 22 people, including the chairman and both vice-chairmen. The headings below refer to agenda items.

i) Chairman's Report

The Chairman reported upon the previous three year's activities of IDIG and made some comments on how IDIG might develop in the future. Three specific recommendations were made:

1. IDIG should continue, but with a clear set of tasks.
2. IDIG should incorporate WGs G2 and G5.
3. IDIG's executive should be expanded to include three vice-chairmen, each having a specified area of responsibility within the expanded IDIG.

There was general agreement with the first two recommendations, but the third was not endorsed.

ii) Progress in Digital Sounding

Klaus Bibl reported that there were currently digisondes operational in Italy (three), Athens, Goose Bay and Dourbes; and that a practical method for automatic N(h) analysis was under development at Lowell. Mr Kelly of KEL Aerospace pointed out that his company had decided to cease development and marketing of DBD42 digital receiver, but that a new microprocessor controlled sounder (the IPS43) was under development. The chairman reported that the British Antarctic Survey's NOAA sounder was now in operation at Halley Bay (76^{o}S, 27^{o}W, L = 4.2) in Antarctica.

iii) Merger of WGs 2 and 5

Commission G approved the merging of the responsibilities of WGs 2 and 5 ("Data Processing in Ionospheric Research"; "Evaluation of Analysis Techniques in Ionospheric Research") into IDIG. There was some discussion as to how these new responsibilities might be adequately covered in practice. The topic area of WG2 fell naturally on J W Wright, since he was its past chairman. The major activity of WG5 had been to standardize methods for N(h) inversion. The next logical step for IDIG to take was the development and validation of automatic N(h) schemes. Klaus Bibl undertook to look after this topic (see 3a(vi) and 3b below).

It was noted that there was a danger that the needs for continued development of N(h) methods for use with analogue soundings might be overlooked with the new grouping of WGs. The concensus was that WG4 (International Reference Ionosphere) would be a more appropriate forum. The chairman of that group (Dr Rawer) agreed and Dr McNamara (past chairman WG5) agreed to be responsible within it.

iv) IDIG Terms of Reference

The following terms of reference were tabled by the chairman, approved and endorsed by Commission G.

1. To act as a forum and channel of communication for individuals and administrations interested in the design, construction and application of digital ionospheric sounders.

2. To stimulate international support of the digital sounding community's interests within the Scientific Unions.

3. To promote standards for data acquisition, interchange and archiving where a user need is identified.

4. Assist in the interchange of appropriate system specifications and software for data acquisition and analysis.

5. To facilitate the planning of cooperative research campaigns.

6. To encourage theoretical studies relevant to the design, development and application of digital sounding techniques.

v) Selection of Officers for IDIG

The officers will be J R Dudeney (Chairman), K Bibl and J W Wright (vice-chairmen) for the next three years.

vi) Selection of Action Tasks for the Next 3 Years

The chairman suggested that the WG should set itself a number of identifiable tasks to be carried out by the next general assembly (1984). He presented seven possible topic headings for the group to consider:

1. Identification of efficient forms of data interchange.

2. Assessment of needs for standardization of parameter names.

3. Assessment of the real information content of reflected echoes;

   a) extracted directly from the complex echo description.

   b) derived from those concerning the aeronomy of the reflection region.

4. Preparation of a directory of digital soundings.

5. Development of the bulletin.

6. Development and validation of real-time N(h) and of moving pattern analysis.

7. Development of procedures for software interchange.

There was some discussion of the relative importance of these suggestions and the practicality of carrying them out. Subsequently, Klaus Bibl synthesised the discussion and suggested that a technical session be convened to further discuss the three of these topics (1, 2, 6) which appeared to most interest the assembled group, together with a new topic; the interchange of sounder specifications (see below).

vii) Resolutions

There were no formal resolutions generated by IDIG, but most produced by Commission G are of relevance.

viii) Symposia

There were no suggestions forthcoming for further scientific session to be organised under the auspices of IDIG, but the Alaska meeting "Radio probing of the high latitude ionosphere and atmosphere: new techniques and new results" (9-13 August 1982) would be the next appropriate forum for our science.

ix) Future of IDIG Bulletin

The IDIG Bulletin was generally taken to be a valuable information document and there was some pressure for it to be expanded to include contributed material from members. The chairman welcomed this suggestion, but pointed out that at present the Bulletin was produced and circulated by the good offices of the British Antarctic Survey, with help from INAG. Any major expansion to the extent that either the resources of INAG were overloaded, or the costs became significant to BAS might jeopardize its future. He undertook to look into the matter further and report back.

x) Any Other Business

There was no other business.

b. Second Business Meeting

A short technical session was organised on Thursday 13th of August to discuss further the four action identified topics.

i) Nomenclature for Ionospheric Parameters

The definition of a standard set parameters to characterize digital sounding was accepted as a highly worthwhile goal. However, there was some disagreement as to whether these parameters should be labelled using only ASCII standard characters, allowing commonality from program listings to published papers. It was agreed that such a set should be prepared for discussion and J W Wright, who had already circulated his own suggested list, agreed to act as coordinator. Please respond directly to him with comments upon the material already circulated.

ii) Introduction of N(h) Parameters

It was agreed that the potential possessed by digital sounders to perform automatic N(h) analyses should be more fully realised. Important work on this topic was currently in progress at Space Environment Laboratory (Wright and Paul) and Lowell (Bibl and Reinisch). Klaus Bibl agreed to coordinate a report on progress to date.

iii) Digital Data Formats

It was agreed that the development of a common format for data recording and exchange was a long-term ideal to aim for. However, it was much more important initially that details of data formats currently in use were circulated so that data could readily be exchanged. Three categories of data were identified:

1. Raw data as recorded.

2. Compressed or analysed data sets.

3. Special data sets.

The chairman offered to coordinate the interchange of data specifications.

iv) Sounder Specifications

It was stressed that data interchange would only produce effective results if users were thoroughly familiar with capabilities and operating characteristics of the equipment in question. Thus such information should be widely circulated. The chairman offered to coordinate interchange.

4. "Aeronomic Studies Using Digital Ionospheric Sounders"

Although the intention of this symposium was to concentrate upon aeronomy as investigated using digital sounders; in the event, the programme was split between this and the radio science aspects of the systems. This resulted in an interesting, but very varied programme which ranged from studies of the auroral ionosphere to plans for a global real-time ionospheric monitoring system. The session was very well attended. I hold a complete set of abstracts which can be circulated upon request.

5. Possibility of Formal Association with IAGA

The formulation of IDIG's terms of reference showed that IDIG has interests both in the radio science aspects of digital sounding and in the aeronomic applications thereof. It will clearly be very important to maintain a careful balance between these two general areas. In view of this, J W Wright has suggested that IDIG should seek to be established as a joint working group of URSI Commission G and IAGA Division 2. I welcome your comments for or against this proposal before raising it with the higher authorities.

6. Future Activities

The next scientific meeting of direct interest to IDIG is the symposium "Radio probing of the high latitude ionosphere and atmosphere; new techniques and new results", to be held at Fairbanks, Alaska in August. I plan to attend this meeting and will convene an IDIG business session at some time during it.

I would like to generate some effective progress on the action topics identified, so please respond quickly to the relevant coordinator with any information or comments you may have.

9. THE AUSTRALIAN OPERATORS' CONFERENCE

The Australian Operators' Conference was held during 3rd-5th March 1982 and was attended by the INAG Chairman, four of the Australian operators (George Goldstone - Hobart, Ivan Bozic - Canberra, Arthur Drury - Townsville and Fred Jowett - Norfolk Island), as well as members of the Australian Ionospheric Prediction Service.

The Conference agenda was designed to provoke as much interaction as possible between Dr Piggott and the Australian network. Inevitably the discussions mainly concerned equipment and interpretation of ionograms.

In addition to these topics, Dr Piggott emphasised the great importance to be attached to Southern Hemisphere data, especially in the Australasian sector where there are large difference in magnetic and geographic coordinates. He also emphasised and demonstrated the considerable power available to the scaler once 'finger prints' of common events at a particular station have been recognised. The information available on an ionogram, if used carefully, can greatly aid interpretation of otherwise quite difficult ionograms.

Improving Ionosondes

Dr Piggott commented on a number of ways in which recording ionograms can be improved. The optimum choice of aerials is different for transmit and receive. For transmission maximum power radiated upwards is needed. For reception, a smaller aerial is often desirable, provided it returns sufficient signal to exceed noise picked up in earth leads. Smaller aerials can be quite advantageous in improving the overall signal to noise ratio of the system. When large aerials are in use it is often desirable to add resistive pads to the receiver aerial at night to lower the amplitude of local broadcast transmissions which might otherwise drive the wide band front stages of the ionosonde receivers non-linear.

Dr Piggott felt the total coincidence systems, as used at present, could result in an effective reduction in signal to noise ratio, for example, when the signals were not sufficiently strong for all samples to be above the selection level. This was particularly important when the general noise level or absorption was relatively large. Also when deep and rapid fading was present, as in Spread-F, this could destroy the pattern of the traces. Two out of three, or three out of four coincidences might minimise this effect without too large a loss in interference suppression.

When the signal to noise ratio was inadequate to provide good ionograms, increasing the pulse length and decreasing the receiver band-width could give a considerable improvement. This also minimises dispersi effects which can be important near the critical frequencies.

These last two points are being tested at Hobart and Sydney and the results will be submitted to INAG in the future.

Accuracy

Historically, U has been used in two contexts; to show a measurement with definate uncertainty limits and to show when the pattern of the ionograms was so different from normal that normal interpretation did not appear to be appropriate.

The Australian practice has been to use it only when the numerical accuracy was doubtful as indicated by the accuracy rules. This is in accord with modern practice in most parts of the world. The descriptive letter indicates the most important cause of the inaccuracy in reading the parameter. Good reading accuracy is sometimes possible, even with very abnormal patterns, but the presence of the abnormality is then shown by the appropriate descriptive letter.

Dr Piggott stressed that in determining the probable error to select the effective accuracy, reasonable estimates should be made using the information available on the ionograms, from the ionogram sequence and from knowledge of the normal behaviour of the parameter. Controlled extrapolation was often overlooked, degrading the reliability of the reading and a knowledge of the usual behaviour of the ionosonde (e.g. presence of interference bands) could be very useful. It is important to learn when a parameter is likely to behave regularly and when not. Complex patterns often show similar sequences in time which can be recognised surprisingly easily. Building in knowledge of the behaviour of such patterns is equivalent to building previous knowledge of the ionosphere into scalings.

A pattern may be complex and force the operator into the position of feeling there is insufficient information to nominate a reasonable accuracy. In such circumstances, operators can do no better than say, "with the present equipment and to the best of my knowledge, on the basis of the evidence available the value is . . .". Accuracy limits, by definition, cannot be exact - they are estimates of reasonable doubt.

The Australian network, therefore, use the qualifying letter U to indicate numerical accuracy and advocate this usage be adopted internationally. The chairman of INAG concurs with this view, but invites any contrary comment.

U ... H When fo(0.5)F is Present

In UAG 23A, p20, Fig 1.12(b), it is recommended that h'F be scaled ... UH - the old convention when a F0.5 layer is present. Often, at Australian stations, this type of event can persist for 2 hours or more in which case there is no doubt in the accuracy interpretation. In future, this scaling recommendation will not be used. Instead, only the descriptive letter H will be appended to indicate the presence of an abnormal h'F measurement. The qualifying letter U will only be used if the actual accuracy is affected.

Scaling foF1

The identification of foF1 when F1.5 or F0.5 stratifications are present in the sequence raises some difficulties. A good guide is to note that foF1/foE is usually nearly constant at any one station. This should be evaluated when both are available and used as a guide to show whether F0.5, F1 or F1.5 is present.

The scaling conventions related to foF1, and accepted at the Washington URSI meeting of INAG were discussed. Australian stations have long been dissatisfied with the ...DL scaling of foF1 when the foF1 cusp is ill-defined. The agreed scaling of replacement letter L will now be used. It is interesting that this scaling convention is evidently a product of scaling what is expected on an ionogram rather than what actually appears. Removal of this scaling is consistent with the general terms of accuracy adopted by the Australian network.

In addition, h'F2 will only be scaled when the F2 trace is clearly horizontal. When it does not satisfy this criterion it also will be scaled as replacement letter L.

Bad Ionograms

Poor quality ionograms are often obtained due to persistent equipment faults or changes in personnel maintaining equipment. Instrumental errors greatly increase operator difficulties, preventing reliable interpretaion of ionograms and often result in unsatisfactory data reduction. This subject was discussed and Dr Piggott offered a number of useful pointers to assist in scaling such data.

When ionograms are poor, the first objective will often be to estimate where various parameters should be. Patterns can then be built up using such relationships as the ratio of foE to foF1, and by using overlays of the F layer obtained from the occasional good traces. Although single ionograms will often be adequate, sequences of ionograms allow a picture to be built-up.

Although variation of the accuracy rules is permissable under normal URSI scaling conventions, it is hard in computer handling of data to keep this information with the data, so it should be avoided unless really essential.

Data can also be given the descriptive letter C to warn of poor quality. Excessive use of C will mean it is hard to know reasonable values from poor.
Dr Piggott recommended that when a scaling letter (in this case C) is used for over 50% of the data, information is being lost and an attempt to use alternative scalings or less severe criteria should be sought.

Spread F and fxI

The importance of obtaining the best value of foF2 in the presence of spread was strongly emphasised. Often it is possible to determine a main component in the spread using multiples or other information on the ionogram or from an ionogram sequence, which can be easily scaled within the accuracy limits. ...UF, ...DF or replacement letter, F, is often not really consistent with the normal accuracy rules.
Dr Piggott emphasised that if you have three independant confirmations of a particular value for an ionogram, then this is good grounds for accepting that the value is correct. This approach is also invaluable when interpretation is doubtful. Statistics of the data can be used to show that the values are liekly to be correct. Three points arose from discussions on the British Antarctic Survey scaling aid published in INAG-33. Following the UAG 23A definition of fxI the top frequency of the x-component of the disturbances shown in examples 2 and 3 of the aid should be scaled as fxI rather than the lower frequency values scaled in the aid. While the scaling isn't necessarily a physically realistic description of the conditions, only small errors will arise from the convention and it is easier to apply in general than the approach implicitly implied in the scaling aid.

Currently the Australian network adopts Spread-F typing using the standard tables. In this approach range spread is indicated on h'F by Q, frequency spread by F on foF2 and no spread by X on fxI . This results in disagreement with the BAS aid in example 16 where 038DF instead of 038DS would be scaled, and arguably example 15 where 044JF instead of 044DS should be scaled (spread on x means a strong probability there is spread on o. A sequence would clarify this).
In both cases F has priority as a typing index over the normal descriptive letter giving the reason for the use of qualification letters J, U, D, E.

In example 7 we would scale fxI as 0160X indicating scatter is improbable as none is seen on the o-component.

Currently fxI and foF2 complement each other in scaling spread F. It is, however, possible for all spread-F information to be scaled on fxI. This would mean F would cease to have the high priority it now has and foF2 would be scaled with normal descriptions of accuracy even in the presence of spread F. While the Australian network currently gives F the high priority URSI scaling conventions recommend, there are sufficent advantages in having all spread F scaling on fxI that we feel it is worth further consideration by INAG. If such a change were adopted we would strongly recommend that at least for two or three years spread F be scaled on both foF2 and fxI before discontinuing the scalings on foF2. (Chairman's note. While this is possible it prevents showing frequency spread on the F trace when a spur is present - the current practice shows both. Is the simplification worth the loss - frequency spread is often, but not always, present with spurs).

Sporadic E

From January 1982, W type sporadic E has been used at the Australian stations in place of types h, c, l and f. This does not now seem to have been a useful change and we will return to the original typing before June 1982. While this produces a discontinuity in our data, it is preferable because of the ease of typing and the loss of information we experience by using W-type.

As of June 1982, if a low type sporadic E is present, it will always be scaled as the second type of sporadic E observed on the ionogram, although foEs and fbEs will only be scaled from this layer if (a) foEs $\geq$ foE and (b) foEs for the low layer is higher than foEs for any other sporadic E layer on the ionogram.

Dr Piggott emphasised the general applicability of auroral type Es to similar sporadic E layers seen at mid-latitude, Australian stations see this occasionally. The term 'auroral' is a misnomer in this case, as such layers occur at all latitudes whenever dense tilted Es layers are formed. An ionogram pattern defines a common geometry, not a common cause.

Particle E was mentioned although it is only commonly seen at Mawson, the most southern of the Australian station. Australia will not adopt the changes allowed at the Washington INAG meeting as they have not given training problems to us in the past and appear to reduce the amount of information immediately available in the scaled form.

Use of Descriptive Letters V and H for Travelling Distrubances

The descriptive letter H would normally be used at the Australian stations if travelling disturbance effects perturb foF2 producing a forked trace with a turn-up on the low frequency side of the event. If there is no turn-up the trace is treated as a true forked trace and is described by V. As a consequence of this convention V is rarely used at the Australian stations in comparison with H. Dr Piggott felt that V would appear rather more frequently in northern hemisphere data than H and that this may be because the southern hemisphere disturbances are rather larger than those in the northern hemisphere. It could be valuable to establish if there is a real difference here or only one of different scaling conventions.

Tilted Layers

There was much discussion on the recognition of tilted layers. Dr Piggott felt that many cases of slight tilt, sufficient to change the values of M(3000)F2 and hmF2 significantly, were often missed. Tracings of successive ionograms gave an excellent indication of this and could be used to improve the standards of analysis rather quickly and easily. As with the finger prints of particular phenomena giving abnormal ionograms, once the regularities had been recognised it was surprisingly easy to see them in new examples.

10. OVERLAYS USED FOR TRAINING SCALERS

by P J Wilkinson

A set of five overlays are now used at IPS during the initial training of scalers. These are not innovative but are found useful in setting clearly quantified limits on parameters scaled thereby ensuring good and consistent scaling habits are learned early. All the overlays are drawn to the same scale as the projected ionogram so that they can be overlaid on the projected image. They are for use with a logarithmic frequency scale.

The first two overlays are used for scaling Spread-F. The simplest (a) is for scaling range spread. If range spread exceeds the width of the two parallel lines, the descriptive letter Q is scaled with h'F. Range spread of less than 20km can appear important to a scaler anxious to do the best job possible. Insistence on clear limits is important and the overlay provides strict guidance.

The second overlay, (b), is used for scaling frequency spread. Because the ionograms being scaled have a logarithmic frequency scale, 0.3 MHz projects to a different amount for changing frequency. This is especially noticeable below about 4 MHz. Overlay (b) is placed over the spread region and if spread equals or exceeds the 0.3 MHz limit, the descriptive letter F is scaled with foF2. The range of the magneto-ionic splitting is also plotted on this overlay, (b). This separation is station dependent. In the example shown the split for Camden (0.8 to 1.0 MHz) is plotted. This is found to be a convenient reference for the scaler.

Three further overlays have been constructed to quantify the normal accuracy rules as described in UAG 23A, section 2.23. For both height and frequency, the range of accuracy is discussed as this seems easier to interpret subjectively.

Four levels of accuracy are considered. If the total range of uncertainty is:

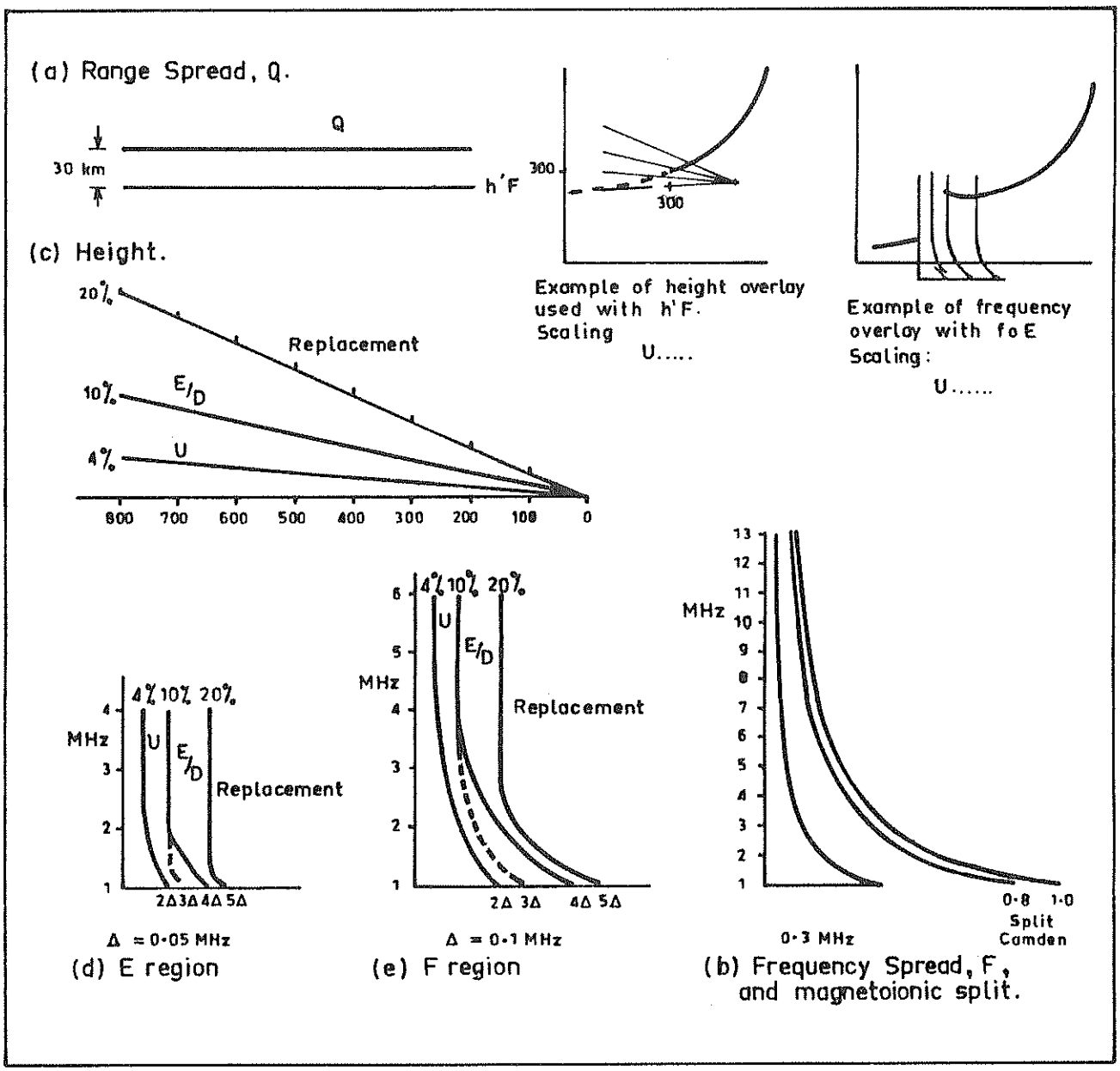
- less than 4% (or 2Δ), then the numerical value is scaled unqualified.
- between 4% (or 2Δ), and 10% (or 4Δ), the numerical value is scale qualified by E or D.
- between 10% (or 4Δ) and 20% (or 5Δ), a limit value is scaled qualified by E or D, whichever is appropriate.
- greater than 20% (or 5Δ) and only a descriptive letter is scaled.

(Note: Δ is the maximum reading unit as tabulated in section 2.13 of UAG 23A).

These four ranges were used to construct three accuracy overlays for heights and frequencies.

The height slider, (c) has an horizontal axis of virtual height (not to projected scale) and the vertical axis gives the projected virtual height errors for 4%, 10% and 20%. Only percentage errors are shown because these are nearly always greater than the associated scaling accuracies. This slider is quite useful in setting accuracy limits on extrapolation on h'F at night.

Two overlays are used for frequency measurements - one (d) for normal E-region parameters, where the scaling accuracy if 0.05 MHz and the other (e) for the F-region and Es parameters when the scaling accuracy is 0.1 MHz. The vertical axis of both overlays is frequency. The horizontal axis is the range of uncertainty in frequency plotted as the logarithm of frequency. The range is thus as it appears on the projected ionogram. Percentage ranges are constant while frequency increments (e.g. 2) vary logarithmically with changing frequency.



11. STATION NOTES

The following note has been received from Dr P Bencze about the ionospheric observatory at Békéscsaba, Hungary. INAG is pleased to publish short historical description of stations. Please send your contributions to Alan Rodger.

Békéscsaba, Hungary

The ionospheric observatory at Bekescaba, Hungary (46° 40' N, 21° 10' E) opened in 1957 and ceased operation in September 1978 when the old Hungarian-made automatic ionosonde type IRX became unserviceable. The Hungarian State Meteorological Service purchased an IPS-42 from KEL Aerospace Ltd, Australia. This equipment began sounding in February 1982 from the same building as before, but will be transferred to a new building nearby shortly.

Slough

A new 'Bibl' ionosonde has been delivered and commissioned, but is not yet being used for the routine programme.

Port Stanley

The ionospheric observatory was damaged during the recent hostilities in the Falkland Islands, and ceased operation at the beginning of April. The programme will restart at the earliest opportunity.

12. INTERFERENCE BETWEEN TWO IPS 4B IONOSONDES

by P J Wilkinson

The Australian ionosondes (IPS 4A, 4B and 42) use a three pulse coincidence detection system to eliminate interference from the recorded ionograms. For a received signal to be displayed it must satisfy two conditions:

(a) be of sufficiently large amplitude, and

(b) recur on three successive transmit cycles.

Provided the amplitude limitation is set sufficiently high only returns associated with ionosonde transmissions will satisfy both these conditions and appear on the final ionograms.

As all the Australian ionosondes are controlled by very stable clocks, have the same pulse period (5.33 msecs) and operate on normal 15-minute sounding schedules, it is possible for two ionosondes to interfere with each other in such a way as one ionosonde records echoes from the others transmissions.

The accompanying ionograms show clear interference between the ionosondes at Canberra (35.3°S 149°E) and Sydney (34°S, 150.6°E) over a forty-five minute period, on 11 July (Day 193) 1980. The Sydney ionosonde, station number 02, shows universal time rather than the local time. This unconventional display was used during 1980.

The 1730 LT ionogram from Canberra shows a first order echo caused by a transmission from Sydney just above 600 km. Thus the Sydney transmissions lag those of Canberra by about 2.7 ms. For this time, the echoes from the Canberra transmissions fall outside the Sydney ionogram display. By 1745 LT ionograms from both stations are clearly showing mutual interference. For example the echo near 150 km on the Sydney ionogram is the single hop transmission from the Canberra ionosonde. The echo near 360 km on the Canberra ionogram is a single hop reflection from the Sydney ionosonde. From the relative positions of these echoes it can be determined that Sydney lags Canberra by about 0.3 ms. At 1800 and 1815 LT, interference is still apparent. For the latter the transmissions from Sydney now lead those from Canberra by 3.2 ms.

Comment

Mutual interference between two ionosondes will in general be very rare. It can be expected at sites where two identical ionosondes with very stable clocks are operating within a few hundred kilometres of each other. Otherwise the strength of the obliquely propagating signal will be insufficient to be recorded. In Japan, the exact times of operation have been staggered so that the oblique traces can be recorded separately (see INAG 33, pp 25-27).

13. WORLD DATA CENTRES

World Data Centre C2 for Ionosphere, Radio Research Laboratories, Japan

Activities for the period April 1979 to March 1980.

1. Data received from WDCs A, B2, C1 and other ionospheric stations:

Booklets	:	1800 copies
Microfilms	:	16 cans (1000 ft per can) 23 cans (100 ft per can)
Microfiche	:	191 sheets

2. Data sent to WDCs A, B2 and C1:

Booklets	:	339 copies
Microfilms	:	60 cans (100 ft per can)

3. Data Services:

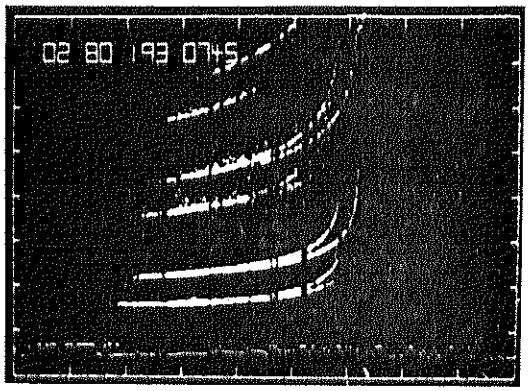
Tables and Plots of Vertical Incidence Soundings	:	4467 months
Tables of Ionospheric Absorption	:	690 months
Tables of Whistlers and VLF Emissions	:	298 months
Ionograms	:	8277 frames
Miscellaneous	:	182 months

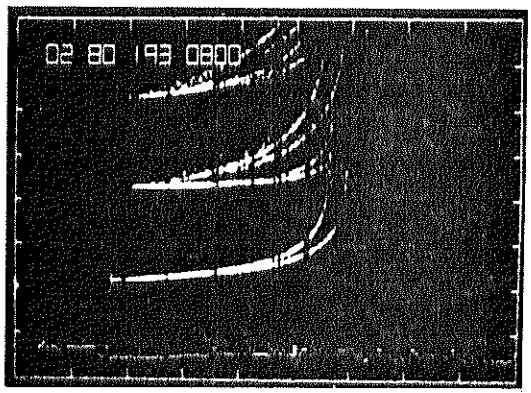
4. Adjustment and compilation of microfilms data received from each WDC and ionospheric stations in C2 region:

WDC-A	:	Ionograms	6 cans (1000 ft per can)
		Others	4 cans (100 ft per can)
WDC-B2	:	Ionograms	18 cans (1000 ft per can)
		Others	24 cans (100 ft per can)
WDC-C1	:	Ionograms	2 cans (1000 ft per can)
		Others	1 can (100 ft per can)

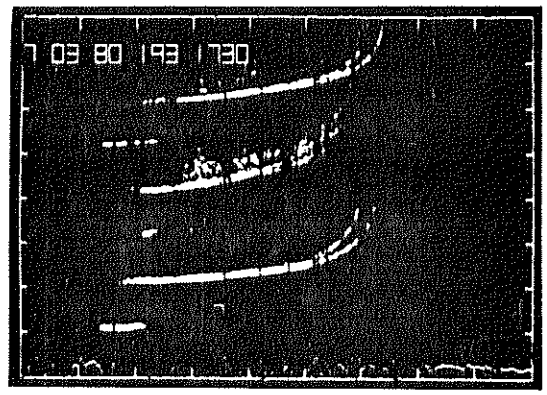
cont. on page 14

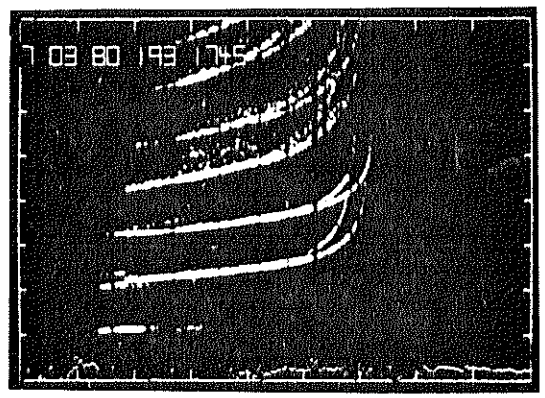
SYDNEY

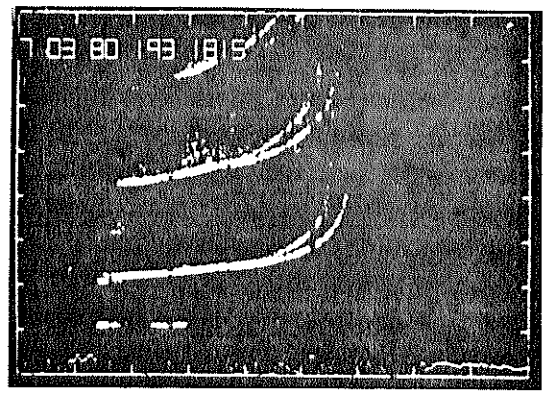




CANBERRA







C2 region : Others 70 cans (100 ft per can)

5. Catalogue of data in WDC-C2 for Ionosphere

New catalogue of ionospheric data for the period July 1 1957 to March 31 1980 will be available in August 1980.

6. Daily hourly values of ionospheric data obtained by ionospheric stations in Japan are stored on magnetic tapes since June 1968.

Activities for period April 1980 to March 1982

1. Data received from WDCs A, B2, C1 and other ionospheric stations:

Booklets	:	2900 copies
Microfilms	:	29 cans (1000 ft per can) 42 cans (100 ft per can)
Microfiche	:	503 sheets

2. Data sent to WDCs A, B2 and C1:

Booklets and Sheets	:	714 copies
Microfilms	:	81 cans (100 ft per can)

3. Data Services:

Tables and Plots of Vertical Incidence Soundings	:	2129 months
Tables of Ionospheric Absorption	:	1288 months
Ionograms	:	300 days
Miscellaneous	:	623 months

4. Adjustment and compilation of microfilms data received from each WDC and ionospheric stations in C2 region:

WDC-A	:	Ionograms	5 cans (1000 ft per can)
		Others	6 cans (100 ft per can)
WDC-B2	:	Ionograms	31 cans (1000 ft per can)
		Others	44 cans (100 ft per can)
WDC-C1	:	Ionograms	1754 cans (100 ft per can)

5. Catalogue of data in WDC-C2 for Ionosphere.

New catalogue of ionospheric data for the period July 1 1957 to March 31 1982 will be available in December 1982.

6. At the end of December 1981, C2 centre has moved to the new building in RRL Headquarters, Koganei, Tokyo.

World Data Centre - C1, UK

As a consequence of the merger of the Appleton and Rutherford Laboratories, the World Data Centre C1 for ionosphere has recently been moved from Slough to Chilton nexr Oxford. In the new premises, the operational part of the data centre is located in a large room on the ground floor and includes adequate accommodation and facilities for visitors, who are always welcome. Two other rooms in the basement, directly below the data centre, are used for archival records and for data which are required infrequently. Included in these records are Slough and Tromsø ionograms obtained by Appleton and colleagues during the early days of ionospheric sounding.

Those having regular contact with WDC-C1 have been informed of the change of address, but for the benefit of others wishing to either send or request data the address is as follows:

Rutherford Appleton Laboratory
World Data Centre C1
Building R3 G1/3
Chilton
Didcot
Oxfordshire
OX11 0QX

Telephone: 0235 21900 extension 6579

Telex : 83159

Each year the WDC-C1 publishes a catalogue of ionospheric data collected since the start of IGY. Earlier data, which was acquired by the Slough ionospheric research group during the period 1931 to 1957, has been catalogued and is now being printed. Copies will be sent to the other data centres and will also be available from the above address on request.