Space

IONOSPHERIC NETWORK ADVISORY GROUP (INAG)*

Ionosphere Station Information Bulletin No. 6**

I. Introduction

The Postal strike in the U.K. has caused some difficulty in collecting material for this issue of the Information Bulletin, a number of letters are known to be awaiting delivery when the strike ends, and others not known may also be delayed. We apologize, therefore, if you have written to us for this issue and your letter has not been included.

It is with much regret that we have received the resignation from INAG of Dr. G.A.M. King. Dr. King took an active part in the Working Group which considered the future needs for Ionospheric Soundings and in forming the Report (London 1969) which resulted in the formation of INAG. He has been a valuable contributor to the discussions in INAG and to the INAG Bulletin, and his advice has been stimulating and apposite. Another contribution of his will be found below. We hope that he will be happy and successful in the new responsibilities which he has taken on.

In another part of this Bulletin we include some notes on the progress of Regional Cooperative Studies on the Polar Ionosphere and on Sporadic E. We also announce a SCAR (Scientific Committee for Antarctic Research) Symposium on Technical and Scientific Problems of Antarctic Telecommunications. This will involve both practical and scientific problems and it is hoped that information obtained on the Arctic will be included where it applies to Antarctic conditions.

Data from the Ionospheric Storm Project (ISP-1 October 28, 1970 - November 2, 1970, ISP-2 November 5, 1970 - November 12, 1970, see INAG-4, p. 11 and INAG-5, p. 16) is now flowing in considerable quantities and a statement of the position for the American sector is included below.

STP NOTES No. 8 was published in January 1971 and contains much material of direct interest to the Ionospheric Network. The IUCSTP has considered the value of the Geophysical Network, of which the Ionospheric Network forms an important part, and recommends that the existing network be formally and permanently recognized under the title: International Monitoring of the Sun Earth Environment (MONSEE). IUCSTP has begun informal exploratory talks with the World Meteorological Organization (WMO) about two possibilities:

(a) Reports on the current status of geophysical stations and future plans by National delegates to WMO
(b) Suitable cooperation in telecommunication of STP data.

Both steps should give greater stability to the collection and exchange of ionospheric data.

The STP NOTES issue also contains a Report on Working Group 1, Monitoring of the Solar-Terrestrial Environment (Chairman A. H. Shapley) and an article on MONSEE which are reproduced below.

INAG is giving in this Bulletin several reports of meetings or proposals for Regional Cooperation. If you are holding such meetings, please do not forget to let us know -- our main weakness is lack of knowledge locally about how our data are being used and what plans are being made to exploit them or to help the networks.

INAG is anxious to find out the need for International Guidance on two points:

(a) The interpretation of ionograms below the gyrofrequency, i.e. of ionograms which extend down to the LF band
(b) The scaling and use of data obtained by the technique of continuous recording of ionospheric characteristics.

The number of stations obtaining ionograms below 1 MHz has greatly increased in recent years, and some proposals were made in the IQSY Supplementary Instruction Manual for the IQSY. Are these satisfactory, or is more needed?

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* Under the auspices of the Solar-Terrestrial Physics Committee of the International Union of Radio Science (URSI/STP Committee).

** Issued on behalf of INAG by World Data Center A, Upper Atmosphere Geophysics, National Oceanic and Atmospheric Administration, Boulder, Colorado 80302, U.S.A. The bulletin is distributed to stations by the same channels (but in the reverse direction) as their data ultimately flow to WDC-A. Others wishing to be on the distribution list should notify WDC-A.

There is renewed interest in continuous recording of ionospheric soundings from the point of view of development of automatic ionosondes -- this could be a preferred system. However, relatively little has been published from the stations using this technique and an attempt should be made to compare results from different stations using uniform techniques and nomenclature. The preparation of standard instructions is a skilled job involving much time, and INAG is unwilling to undertake this unless there is a desire to collaborate amongst those producing the data and a general view that the product is needed.

If you want action on either or both of these points, (a) and (b) above, it is up to you to make your views known.

W. R. Piggott
Chairman, INAG and URSI/STP VI Consultant

II. European Cooperation on Ionospheric Research

The Polar Ionosphere

Professor W. Stoffregen has investigated (1970) the interest in cooperative research in Europe on the Polar Ionosphere and finds that some 20 individuals or groups are interested in such cooperation. For some of the projects, cooperation has already been established involving up to six countries. The widest interest seems to be concentrated on the following fields:

Polar F region by ground based, rocket and satellite techniques
Polar D region by rocket, VLF and riometer techniques
Study of ionosonde, riometer and beacon data at high latitudes
Photometric and synoptic studies of visible aurora
Relations with magnetic activity.

However, there are also a large number of other projects which would benefit from comparison with data obtained cooperatively.

The most successful cooperation appears to occur when one group or scientist takes the lead and arranges cooperation with other interested groups. It is clear that there is much good will and a willingness to extend cooperation but that meetings between the groups are needed for the cooperation to be fruitful.

Sporadic E

Over thirty scientists and groups have expressed interest in collaborative Es measurements in Europe, replies coming from 18 countries. Most groups are basing their effort on ionosonde data though the programs also involve numerous rockets, field-strength data, back-scatter radars, incoherent scatter sounding and oblique sounding. These programs include both scientific and practical objectives and the data obtained will be of interest to both URSI and C.C.I.R. (Coordinator Dr. J. Bossy)

III. { Second European Regional Meeting on Ionospheric Research / Symposium on European Space Research Studies of the Earth and its Environs / First European Earth and Planetary Physics Colloquium }

The three meetings referred to above will be held in parallel at the University of Reading (55 km from London, England) during the four day period 30 March - 2 April 1971. Application forms and further details can be obtained from:

Dr. J. W. King
Radio and Space Research Station
Ditton Park
Slough SL3 9JY
England

This Second European Regional Meeting on Ionospheric Research will be the second in a series which began with the highly successful first Meeting held at Lindau in June 1969. Subsequent to the Lindau Meeting, the URSI Commission III Official Members met in Ottawa in August 1969 and agreed that regular meetings of interest to European ionospheric physicists should be organized in different European countries. The purpose of the Meetings is to foster collaboration between ionospheric physicists and, in particular, to enable discussions of cooperative and interdisciplinary problems and projects to take place. Discussions with all participants actively participating are desired; each of the topics will be introduced and the relevant discussion subsequently led by an appropriate speaker. The discussions will be held at times when the sessions of the European Earth and Planetary Physics Colloquium are not of great relevance to those interested in ionospheric research.

Several topics have been suggested for discussion during the European Regional Meeting on Ionospheric Research, and the following appear to be the most appropriate:

(a) Coordinated programs of ground-based measurements associated with the GEOS satellite. (Leader: Professor B. Hultqvist)
(b) Current D-region problems. (Leader: Dr. L. Thomas)
(c) The role of ionospheric physicists in improving the future of radio communications. (Leader: Mr. W. R. Piggott)
(d) The auroral zone incoherent scatter facility and other European incoherent scatter programs. (Leader: Dr. F. du Castel)
(e) The International Magnetosphere Survey. (Leader: Dr. J. W. King)
(f) The International Ionospheric Storm Project. (Leader: Dr. C. Taieb)
(g) Other projects (including those cooperative projects established at the Lindau Meeting) requiring collaboration between scientists from different laboratories.

IV. Scientific Committee on Antarctic Research (SCAR) Symposium on Technical and Scientific Problems of Antarctic Telecommunications Norway - May 1972

Antarctic Telecommunications and Navigational Aids have been considered by Government Representatives meeting in Buenos Aires 1-12 September 1969. (Report of Second Antarctic Meeting on Telecommunications, Polar Record, 15, 200-215, 1970) Proposal 4 of this meeting proposes to the Governments associated with the Antarctic Treaty that they continue to examine ways of improving Antarctic telecommunications, that they encourage SCAR to foster and make known advances in science and technology applicable to the improvement of Antarctic telecommunication systems and invite SCAR to continue to make known further telecommunications needs, the satisfaction of which would enhance scientific activities in the Antarctic. SCAR set up a group of specialists on Technical and Scientific Problems affecting Antarctic Communications (Chairman - Mr. R. C. Kirby, U.S.A.) which presented its report to SCAR in Oslo 17-22 August 1970. This report identified a range of topics in Telecommunications and Navigational Aids, set up arrangements for studying these topics and proposed that a Symposium be held to allow more detailed discussion between Engineers, Network Operators and Scientists. This proposal was adopted by SCAR, and arrangements are now being made to organize the Symposium in May 1972.

In order to allow plenty of time for discussion it is proposed to invite review papers on the main topics and to strictly limit the number of supporting papers.

The attendance will also be limited to about 60 participants. Proposals to participate should be referred to the local National Committee of SCAR and titles and abstracts of papers for consideration by the Program Committee (Chairman - W. R. Piggott, Radio and Space Research Station, Slough, Bucks., England) are now invited.

The scope of the discussions will depend to some extent on the experts who can attend, but is expected to cover both problems in the use of telecommunications, studies of the propagation media, inter-relations between different techniques, e.g. LF, MF, HF, forward scatter, satellite methods of communication or navigational aid and technical problems, antennas, effect of snow and ice cover, modulation and coding, etc.

It is hoped that the Symposium will identify methods of improving Antarctic Communications, promote scientific research to this end and provide some consensus of technical opinion on possible future policy.

As these objectives will demand considerable discussion, the Program Committee will be very selective in choosing papers to be read at the symposium. There will probably be a soft-back publication containing papers, proposals and recommendations.

V. Excerpts from "Scientific Programs Involving The International Geophysical Calendar"

by

A. H. Shapley
Chairman, IUWDS

For full text see URSI Information Bulletin, No. 177, pp. 13-19, December 1970 or STP NOTES No. 8, pp. 58-59, January 1971.

INAG invites comments on the International Geophysical Calendar so that it can be modified to suit your needs.

The International Geophysical Calendar is issued annually as a guide to geophysicists and scientists in related fields in the conduct of their programs of observation and data analysis, in particular for programs which cannot be carried out continuously. It is a mechanism for general international coordination of work in geophysics. The calendar provides a basis for the systematic sampling of geophysical conditions on various time scales and for a useful concentration of effort by observers in various countries and various scientific disciplines. Regional or global geophysical modeling and the detailed study of particular short-lived phenomena is enhanced because the amount of raw data in existence as well as analyzed data in World Data Centers tends to be greater on days and intervals marked on the calendar.

The calendar is prepared by the International Ursigram and World Days Service in association with many other international scientific groups and spokesmen for the various specific programs. The disciplines which make use of the calendar are meteorology, atmospheric electricity, geomagnetism, aurora, airglow and ionospheric studies. Also involved are the fields of solar activity and balloon, rocket and satellite measurements in cosmic rays, aeronomy and interplanetary science. Summaries of the program recommendations in each field are printed on the reverse side of the calendar which is widely distributed to geophysical stations and scientists. Users interested in particular details are referred to these explanations and to the other sources indicated below.

In geomagnetism, it has always been a leading principle for standard observatories that operations should be as continuous as possible and the great majority of stations undertake the same program without regard to the calendar. However, stations equipped for making normal geomagnetic observations but which cannot carry out such observations and reduction on a continuous schedule are encouraged to do so on Regular World Days, Wednesdays, with data to be shared with the World Data Centers. This suggestion has come from the ionospheric community and has been concurred in by Dr. M. Sugiura of IAGA Commission IV.

The calendar marks four one-week intervals around new moon, a time when auroral and airglow observatories in any case operate with their full capacity. These intervals are thus not so much for the attention of optical observers, but to help concentrate the efforts of workers using other techniques (e.g. ionosondes, incoherent scatter sounding, balloons, rockets, satellites) to make progress in understanding the mechanism of aurora and particularly low latitude aurora.

Workers in ionospheric studies make rather extensive use of the calendar, both for observation schedules and for selected data exchange through the World Data Centers. Several groups and individual spokesmen have contributed to the recommendations, notably W. R. Piggott (Radio and Space Research Station, Slough, Bucks., England), the Vertical Soundings Consultant of the URSI Committee on Solar-Terrestrial Physics. The detailed recommendations for vertical soundings, for incoherent scatter observations, for drifts and absorption measurements and other more specialized ionospheric programs, are summarized in the calendar explanations. A fuller discussion of the recommendations (which should be checked with the 1971 specifications in the calendar explanations) has appeared in the ionosphere chapters of Annals of the IQSY, Vol. 1, M.I.T. Press, 1968. For ionospheric workers as well as other geophysicists, the calendar indicates the dates with unusual meteor shower activity, separately for the northern and southern hemispheres. These are provided by Dr. Peter Millman, National Research Council, Ottawa, Canada. These are provided both for the convenience of radio and radar workers studying the effects of meteors on the high atmosphere and also to alert other observers to the likelihood that apparently unusual or unexplained phenomena may be a consequence of the unusual meteor shower activity.

The days of solar eclipses are treated as "World Days" by most types of geophysical stations in the eclipse zones and their conjugate areas. During the eclipse interval, in general, the standard measurements are intensified and, of course, many stations make special experiments. The World Data Centers tend to receive an unusual number of inquiries regarding data for eclipse days taken at geophysical stations in the eclipse zone and also at solar activity observatories anywhere in the world. The calendar thus serves to remind stations who may not have specific eclipse programs of the scientific importance of achieving good observational coverage on those days. Maps of the eclipse tracks are normally published in STP NOTES; a map of the conjugate track for the March 1970 total eclipse (Barish and Roederer) appeared in STP NOTES No. 7, p. 119, and such maps can be supplied on request for other eclipses by the Deputy Secretary, IUWDS.

As regards balloon, rocket and satellite measurements in the fields of cosmic rays, aeronomy and interplanetary science, the use of the calendar is more indirect. Experimenters should be aware that there tends to be more (or more detailed) data taken by collateral ground-based techniques on the days marked on the calendar, and thus they may want to schedule their own experiments accordingly if there is no other reason for choice. In particular, the IQSY Aeronomy Working Group recommended the desirability of concentrating rocket efforts to measure ionospheric parameters on the Quarterly World Days which appear on the calendar (IQSY NOTES No. 3, p. 62, June 1963). Further, the scheduling of satellite telemetry could take account of the calendar to provide ground experimenters with better coverage of collateral space measurements.

The International Geophysical Calendar is the servant of the scientific community. Each year, about January, the IUWDS officers make a preliminary draft of the calendar for the next year, based on the concepts of the current year. This draft is circulated to the spokesmen for the various programs and the leaders of the various URSI, IAGA, COSPAR and IUCSTP commissions or working groups. On the basis of the replies received, a Planning Edition is printed in limited quantity, about March, and circulated again, with special emphasis on making necessary or desirable changes in the "Recommended Scientific Programs". The planning edition is also taken to the COSPAR and any other appropriate international scientific meeting for further discussion and modification by these groups or by program spokesmen attending these meetings. Finally the Operational Edition is printed in large quantity about September and given broad circulation to a worldwide mailing list including all the leading scientific journals and information publications. Additional individual copies are available from IUWDS Regional Warning Centers, the World Data Centers or the IUWDS Secretaries. The IUWDS officers welcome comments on this coordination mechanism and undertake to satisfy the needs of all international activities in solar-terrestrial and geophysical sciences.

VI. International Ursigram and World Days Service (IUWDS)

Report on Activity during 1969

by

P. Simon

(Reprinted from URSI Information Bulletin, No. 176, pp. 52-55, September 1970)

The International Ursigram and World Days Service (IUWDS) is one of the Permanent Services of the Federation of Astronomical and Geophysical Services (FAGS), through which it receives subventions from UNESCO for part of its activities and publications. It is administered by the International Union of Radio Science (URSI) in association with the International Astronomical Union (IAU) and the International Union for Geodesy and Geophysics (IUGG).

According to its terms of reference, "the Service aims to provide information rapidly to the world scientific community to assist in the planning, coordination and conduct of scientific work in relevant disciplines". In fact the IUWDS is mostly concerned with solar-terrestrial physics and it has to react in order to be efficient according to the actual interests and requirements of the scientific community and according to the level of solar activity. The year 1969 has coincided with the beginning of the decreasing phase of the present solar cycle, a very disappointing one with around half the sunspot activity of the IGY maximum of the solar cycle. Thus, in many countries solar-terrestrial and space research has had to restrain its activity just at the time of its most popular success. However, IUWDS people have been working successfully in order to improve their capability of helping the work of their scientific colleagues.

A new 157-page Code Booklet giving the format for telegraphic data messages was issued in April 1969 greatly altering the 1965 edition for the better. A long introduction gives a review of the problems involved in preparing forecasts of solar activity and of propagation and is intended to stimulate the interest of observers who cooperate by providing data. Several kinds of alerts and combined messages are described. Thirty codes are included some of which permit the presentation of new data: detailed magnetic structure of sunspot groups, solar particle events, solar wind parameters and detailed solar activity of the active centers. The scheme for identifying observing stations is now formulated according to their geographic coordinates. Also more details are given on the Warning Centers' activities. We must point out that it has been been possible to prepare this edition only thanks to the longstanding cooperation between the IUWDS officers and the people in charge of all the IUWDS Warning Centers. The new Code Booklet may be obtained free of charge from the Secretary, at Meudon, or from the Deputy Secretary, Miss J. V. Lincoln, at Boulder.

At its meeting in Ottawa, at the time of the URSI General Assembly, the IUWDS Steering Committee reconfirmed the IUWDS officers: Mr. A. H. Shapley (Chairman), Dr. P. Simon (Secretary) and Miss J. V. Lincoln (Deputy Secretary).

Another interesting decision relates to the introduction of a new format for the daily worldwide alerting message, "Geoalerts", to be effective January 1, 1970. Beginning on that date, the Geoalerts describe the forecast of the activity of each spot group according to a four-step classification (quiet, eruptive, active or proton), and specify by means of alerts the exceptional phenomena expected in the near future. This new format supplies better information than in the past to the institutions receiving only the Geoalert messages. The WMO has continued to cooperate by assisting in the worldwide distribution of the Geoalerts in this new format.

We must point out that this improvement is the first outcome of work started three years ago at Meudon, and continued mostly in cooperation with Boulder, designed to classify Solar Events according to their Geophysical Effects and to classify Spot Groups according to their capacity for producing these Solar Events. According to this classification a solar event may be mainly a chromospheric event, or one which produces X-ray and centimetric emission, or a high-energy event with acceleration of particles to an energy of several tens of MeV. The spot group during a 24-hour day may be very quiet, or may produce several chromospheric events, or some strong X-ray and centimetric outbursts, or some high-energy event.

This classification will certainly be improved in the future, but now it provides material in order to evaluate the success of the solar activity forecast. We shall have to establish the most realistic way of making this evaluation, but a gross estimate indicates that nearly 80% forecasts are correct, 50% of the events are forecast in advance and 50% of the alerts are failures. However, these figures give a very incorrect view of the practical efficiency of the forecast which in fact is low for the frequently occurring events but becomes valuable with the unusual high-energy events. During a "Proton Alert" there is a 200 times greater chance of observing a proton event than at other times.

The IUWDS continues to give its support to particular international programs: the latest one was the Proton Flare Project of Working Group 2 of the Inter-Union Commission on Solar-Terrestrial Physics. Unfortunately in 1969 the sun was not very cooperative, and during the observing time of this program (May/July 1969) no large proton events were reported despite the fact that several complex groups transited the solar disk at that time.

For the IAU, 42 astronomical telegrams have been distributed to about 100 subscribers reporting promptly the close approach of the asteroid Geographos, the optical identification of the Crab pulsar NP 0532, the appearance of 9 comets, 8 supernovae and 3 other unusual objects.

The SPACEWARN activity operated on behalf of COSPAR has been transferred from the WWA at Boulder to the World Data Center A for Rockets and Satellites, which serves as the IUWDS World Warning Agency for Satellites. In 1969 this involved the designation of 110 satellites, the distribution of numerous launching announcements and the issue of the 26 bi-weekly SPX-Bulletins.

We need not expand on the two other regular publications of the IUWDS described fully in our previous annual reports: the International Geophysical Calendar and the Abbreviated Calendar Records. The latter are now published regularly in Part II (Comprehensive Reports) of the "Solar-Geophysical Data" prepared by the NOAA Research Laboratories at Boulder. A Condensed Calendar Record will be published in STP NOTES. Related to the 12 programs of international cooperation organized by the IUCSTP, these publications have received this year a wide distribution among the many groups involved in this cooperative work.

VII. Excerpts from Report on Workshop Sessions of IUCSTP Working Group 10, Held in Association with the International Symposium on Waves in the Upper Atmosphere IAMAP - COSPAR - URSI Toronto, January 1970 (Published in full in STP NOTES No. 8, pp. 38-44, 1971).

The following excerpts are of particular interest to those engaged in the Ionospheric Network. The full paper discusses the effects of waves on the ionosphere and advantages and disadvantages of different techniques. Those interested are strongly advised to read the original article.

4.3 Empirical evidence and theoretical support now abound, that some of the strongest gravity waves in the upper atmosphere are launched by ionospheric currents in the auroral zone. This suggests that special efforts for the study of wave properties, preferably by a variety of techniques, should be timed to follow upon the detection of strong auroral-zone currents by magnetometers.

6. Observational Practices

Certain general comments and recommendations on observation practices are collected here.

6.1 It goes without saying that one would ideally like to have global coverage, at all heights, with temporal continuity, for all relevant parameter fields; and equally, that this is an impossibility. The only practical approximation to the desired state is obtained by slicing: to provide latitudinal variations, say, or longitudinal variations; to provide long-term unsophisticated measurements of one or two parameters or short-term sophisticated measurements of several.

6.3 Measurements round one or more circles of latitude are needed. As a first step, it is suggested that the latitude belt 30°-45° N provides a realistic opportunity for establishing a chain of stations in which no two would be separated by more than about 90° of longitude, provided workers in a number of countries participate. Crucial to such a chain would be Japan and the United States of America, while a number of alternatives for completing the chain through the European/African/Asian sector appear possible. The Meteorological Rocket Network is already well represented in this belt; its extension round the belt and further exploitation, and the introduction of complementary techniques, is now urged most strongly. Emphasis on this particular belt is not intended to detract from possibilities, where they exist, of developing other belts where specific techniques may be particularly plentiful.

6.4 For many purposes, as in the collection of statistical and synoptic information (see, e.g., Paragraphs 3.6, 3.8, 4.1, and 4.4 above), regularity, continuity, and length of data series are more important than sophistication of observational techniques. Intermittency, or premature termination, may totally destroy the value of programs that are instituted to obtain such collections. In the case of university-based programs of this type, which are usually dependent on seriously fluctuating sources of labour (e.g., graduate students) and funds, collaboration with service organizations (e.g., weather bureaus) is urged as a means of effecting stability; and conversely, such organizations are urged to view sympathetically requests for this collaboration, as a contribution to their own ultimate objectives.

6.5 The repeated emphasis on global measurements (particularly in Parts 2 and 3 above) underscores the necessity of global networks for the acquisition of data by various techniques and the desirability of coordinators to facilitate the operation of these networks on a collaborative basis.

7. Individual Techniques

7.6 Ionosondes Spaced ionosondes, or their equivalent, have provided a large body of information on travelling ionospheric disturbances (TID's) and hence on gravity waves at F-region heights. The statistics they provide are severely contaminated by observational factors, as was demonstrated by W. H. Hooke in the course of the symposium, to such an extent that they cannot be considered a reliable source of neutral-gas gravity-wave statistics *per se*. On the other hand, individual ionosondes can provide useful data on the temporal variations of the spectra they do detect, while spaced ionosondes are ideal for measuring strong individual waves, since both the horizontal and the vertical structure, and its propagation, can be determined readily by them. For the purpose of propagation studies of TID's, regional networks are more appropriate than global. Again, standardization of equipment is not of serious concern, since most ionosondes meet all the requirements for these studies already (except, perhaps, in their capacity for repeated soundings at short intervals, e.g., 5 minutes). No global network was proposed, though it was noted that TID measurement comes within the purvue of Professor Wright in his URSI role. The existing ionosonde network itself, however, falls within the URSI purvue of Mr. W. R. Piggott. The development of regional networks for the study of aurorally launched TID's was advocated most strongly, and Europe was specified as an area where a suitable network could be established readily, almost from existing stations exclusively. Such a network indeed exists in embryo form; its further development, and the development of others like it, was urged.

VIII. Working Group 1
Monitoring of the
Solar-Terrestrial Environment

The following is abstracted from a report by Mr. A. H. Shapley, Chairman of Working Group 1, published in full in STP NOTES No. 8, pp. 22-24, January 1971. These excerpts have been selected to show the actions which are proceeding on those points which have been raised with INAG or the VI Consultant by many groups in the last few years.

Monitoring of the Solar-Terrestrial Environment continues at an effective level through the cooperation of hundreds of ground stations and several satellite stations. The results of monitoring provide the basic data for a great many scientific studies on the physics of phenomena in the solar-terrestrial environment and are in addition a necessary background ingredient for a great many special studies using special and advanced techniques.

1. Current Role and Resulting Action

The role of IUCSTP Working Group 1 falls in the following categories:

(1) Compile and issue a Guide for International Data Exchange. This task was completed in October 1969 with the publication STP NOTES No. 6, a special issue. The Working Group hopes that copies have reached all institutions participating in any of the STP programs. The Guide was based on extensive discussions at the London IUCSTP meeting in 1969. It covers both monitoring programs and many special investigations for which data exchange is valuable. The Guide provides that copies of actual data to go to the World Data Centers in those cases where there is a large interest by other workers in the data. For programs where the number of requests for the data is relatively small, the Guide provides only that information about observations and data (i.e., type, time intervals covered, etc.) be sent to the WDCs; in this case the WDC assists requesters to obtain the data they need. This information on data which exists, but not archived at the WDCs, is to be renewed annually, about March of each year; many STP participants will be receiving reminders on this point from the WDCs from time to time. The Guide covers ground-based programs and also monitoring from space vehicles; by decision of COSPAR in 1969, monitorings from space are supposed to follow the STP Guide rather than the more

general COSPAR Guide for rockets and satellites. This Guide for International Exchange of Data in Solar-Terrestrial Physics is the direct descendent of the IGY and IQSY Guides. Comments on the contents of the Guide are invited at all times. These comments will be reported through STP Notes. Probably a new edition of the Guide will be published about every two or three years.

(2) Compile and issue lists of active monitoring stations. A preliminary list of active stations was published in STP NOTES No. 6, October 1969. This list included stations which were already sending data to the WDCs and other stations mentioned in national reports to IUCSTP, both active and planned. Many corrections and additions to the published list have been received. Further corrections and additions are solicited. Up-to-date lists will be published in STP Notes at appropriate intervals.

(3) Help to coordinate and guide the work of the World Data Centers. A council of WDCs for Solar-Terrestrial Physics is being formed under the Chairmanship of Professor N. V. Pushkov, Co-chairman of WG 1, to discuss by correspondence the problems and progress of the Centers A, B, and C.

(4) Provide information on the systematic data publications of the many institutions throughout the world which engage in such projects. Where there are gaps in the publication of important monitoring data, WG 1 tries to arrange for publication, and provides a forum for keeping data publication activities in tune with the needs of the scientific community.

(5) Help other IUCSTP projects in which monitoring observations play a part. This is brought about by any appropriate action suitable to the project. Much of this help is accomplished in association with the International Ursigram and World Days Service (IUWDS). Other projects, involving periods of time in which interesting interconnected phenomena occurred and identified retrospectively, called "retrospective intervals," are based on invitations to stations to provide more detailed data and discussions for the selected period of interest. There have been three main efforts of this kind, concerning phenomena of special interest: May 1967, October 1968, and November 1968; these resulted in comprehensive data publications by WDC-A. WG 1 would like further suggestions from other projects in IUCSTP for retrospective intervals which merit special study in this way.

(6) Provide a bridge between the IUWDS and IUCSTP on subjects of common interest. Thus, the International Geophysical Calendar is a mechanism used in several IUCSTP special projects, as well as in the monitoring program and elsewhere in the scientific community. The Alerts and Forecasts, both the regular ones and special and specific ones, play an essential role in many projects requiring international or interdisciplinary cooperation. The Telegraphic Data Exchange is similarly applicable. Finally the systematic Calendar Record is a comprehensive record of the indices and main phenomena which actually occurred in the solar-terrestrial environment.

The Longer-Range Future of Programs in Monitoring the Solar-Terrestrial Environment.

WG 1 will propose to the IUCSTP that, beginning at the end of the IASY at the end of 1971, there be recognized a continuing program for basic monitoring of the solar-terrestrial environment. This program would be more limited than IGY or IQSY and would be continuously adapted to changing needs and developments in the scientific and applied aspects of work on the sun-earth environment. It would have some similarities with GARP, the Global Atmospheric Research Program, including the World Weather Watch, but would have broader objectives. It is important for many reasons that this program be a recognized entity and have a recognizable name.

(Note: The name International MONSEE Program has been adopted -- MONitoring of the Sun-Earth Environment.)

A firmer organizational basis for STP monitoring. We have discussed now for several years the possible need for an "International Solar-Terrestrial Service," which refers to some mechanism intended to provide for even more active and effective cooperation in the systematic aspects of work in Solar-Terrestrial Physics than we can provide through the voluntary, spare-time activities of several ICSU organizations. Until relatively recently, many questions were properly raised about whether such a step was necessary or timely; our recent soundings of the feelings of STP workers, however, indicate a shift of opinion. The main needs we are trying to accommodate are:

(i) More formal national commitments to carry out monitoring and other systematic aspects of the work, such as communications, data publication, etc., with some analogies to national weather services.

(ii) A small full-time secretariat which can give continuous attention to the smooth running of the systematic aspects of the work--data flow, lists of network stations, communication problems, meetings of experts on standards of observations, etc.

We have struggled for several years to find an organizational formula which might apply to this case. It must be one where the leadership comes from the scientific community, but it must involve governments and some international funds in order to achieve the objectives listed. We have discussed mechanisms which might involve C.C.I.R., WMO, or UNESCO, or something entirely new.

We now have an example of effective cooperation in a somewhwat analogous undertaking between an ICSU group and an intergovernmental organization. This is the Joint ICSU-WMO Organizing Committee for GARP, the Global Atmospheric Research Program, mentioned in passing above. This committee has strong representation and scientific leadership from the ICSU side and active staff work provided by WMO. This may be a model on which we can build. We have indications of warm interest both from some leading officers of WMO and from its Secretary-General. WG 1 will therefore propose to the IUCSTP Bureau tomorrow that it make formal representations to the WMO for the formation of an ad hoc joint exploratory committee on this question.

* * *

There are many specific points which might be remarked, but only one of these will be noted, and it is this. It is evident that the monitoring program is proceeding almost as strongly as during the IQSY, and monitoring information from space vehicles is playing an ever-increasing role. But most important, it is clear that the data are being used. We can judge this both from the increasing numbers of requests to the World Data Centers and from the papers in the scientific literature and in reports on practical application that make use of such data. So the monitoring program seems to be fulfilling its purpose. The many improvements which are referred to above should make this work even more effective.

Note: INAG wishes to draw the attention of Regional Groups to the advantages of using Retrospective Intervals for Regional as well as Worldwide studies and invites applications for such to be declared.

IX. Ionosphere Storm Project

The international coordinator for URSI Commission III, Dr. Taieb, has designated two ISP intervals: 6-12 November 1970 for a disturbed period, and 28 October - 2 November 1970 for a quiet period. Both periods were covered by telegraphic alerts distributed through special IUWDS channels. (See INAG-4, p. 11, and INAG-5, p. 16.)

For the American region, the regional coordinator, A. H. Shapley, has received special information about observations as well as some special data reductions and analyses from a considerable number of stations. In addition it is assumed that standard monitoring data will be available from regularly reporting stations. In the summary given below, we indicate only the data mentioned in correspondence. In all cases the data availability or the data flow to WDCs is being expedited. More detailed information on the project and the available data is being distributed in a circular to participants.

(Note: Asterisks below denote special observations or analysis.)

Vertical Soundings

Thule	Narssarssuaq	St. Johns	*Pt. Arguello	Port Stanley	Argentine Is.
Resolute Bay	Churchill	Ottawa	Grand Bahama	Buenos Aires	Halley Bay
Godhavn	*Goose Bay	*Boulder	*Jamaica	Ushuaia	
*College	Kenora/Winnipeg	*Wallops	Concepcion	S. Georgia	

Riometry (A2 Absorption)

Thule/Geopole	26, 30, 40, 50 MHz	College	30 MHz	Sheep Mt.	30 MHz
Bar 1	30	Paxson	30	Wildwood	30
Godhavn	30	Narssarssuaq	18, 30, 56	Great Whale	30
Ft. Yukon	30	Anchorage	30	Wallops	30

Incoherent Scatter

*Millstone
*Arecibo
*Jicamarca

Other

Wallops (oblique cw field strength)
*Alouette II and ISIS-1 Topside Sounder satellites (ionograms)
Halley Bay (aurora, geomagnetism)
Port Stanley (aurora, geomagnetism)
S. Georgia (aurora, geomagnetism)
Argentine Is. (aurora, geomagnetism)
*Concepcion (geomagnetism)

X. IUCSTP PROGRAM FOR INTERNATIONAL MONITORING OF THE SUN-EARTH ENVIRONMENT (MONSEE) AND RELATED MATTERS*

(Reprinted from STP NOTES No. 8, p. 31-35, January 1971)

1. The System of Station Networks: "MONSEE"

IUCSTP Working Group 1 has responsibility for overseeing the status and performance of the "system" of networks of solar and geophysical observing stations that supply the synoptic monitoring data vital for most STP researches. The word "system" is in quotation marks, because in its present state, it is a rather loose collection of networks and even individual stations operated by national administrations, scientific institutions, and in some cases by individual investigators or research teams.

While the operation of some of the networks is quite continuous and stable, other networks and stations have been subject to fluctuating fortunes, often because they have been associated with programs of limited duration (e.g., the IGY, IQSY, or IASY). They have sometimes discontinued operations at the end of such programs, although the data they supplied were still necessary for on-going projects and researches. In any case, the continuance of some stations and networks has depended on factors other than scientific requirements.

These instabilities and discontinuities are obviously hurtful to the programs that depend on monitoring data, and the Commission, with the help of its Working Group 1, has sought ways to alleviate them. The Commission and all those whom it has consulted have concluded that the system of monitoring networks must be recognized in some way as an essential, continuing part of international cooperative programs in STP. It would, of course, be flexible enough to be adjusted from time to time in response to the changing needs for data. Generally, as successive problems are dealt with, there is decreased demand for some old forms of data, but increased demand for new forms, as these become available. But the monitoring activities should not be partially dismantled without careful consideration of the gaps in data coverage that such an action would leave. The IUCSTP Bureau hopes that this view will be shared by the operators of station nets and their sources of support, and has sent letters to its National Affiliates and Correspondents on the subject.

The following resolution, drafted with the help of WG 1 and enacted by the IUCSTP Bureau at its meeting in Leningrad on 27 May 1970, attempts to deal with the tendencies described above. Specifically, the resolution, to take full effect at the end of 1971 (the end of the IASY), (1) accords the system of station networks formal recognition as a definite entity and as an essential part of any future internationally coordinated STP program, by giving it a name, and (2) attempts to give the system of station networks greater continuity and stability and an opportunity for orderly evolutionary development by urging that the networks be maintained after the end of 1971, subject, of course, to modifications in response to changing needs.

* A detailed review of the background of these developments appears as an Annex to this article.

Resolution on International Monitoring of the Sun-Earth Environment (MONSEE)

Considering that a program for systematic monitoring of the solar-terrestrial environment and data exchange is an essential part of international cooperative research programs in solar-terrestrial physics,

Considering that the monitoring program and international exchange of data and information have continuously evolved according to the needs of the scientific community and of more practical applications, leading *inter alia* to the recent issuance of the Guide to International Exchange of STP Data (STP Notes No. 6), and,

Considering that there will be a continuing need for systematic monitoring and data exchange for these purposes,

The Bureau of IUCSTP

Recommends that, beginning in 1972, these activities be recognized as a formal permanent program to be known as International Monitoring of the Sun-Earth Environment (MONSEE),

Recommends further that national bodies participating in IUCSTP and STP programs continue to participate in the proposed program of systematic monitoring and data exchange, and

Requests IUCSTP Working Group 1 on Monitoring of the Solar-Terrestrial Environment (1) to act as a steering committee on behalf of IUCSTP to organize the International MONSEE, in consultation with all other Working Groups and other appropriate bodies, and (2) to make periodic reports and recommendations to IUCSTP concerning the current and future operation of MONSEE.

The basis for gathering, reporting, and exchanging STP data will continue to be that in the "Guide for the International Exchange of Data in Solar-Terrestrial Physics" (STP Notes 6), with revisions as necessary. All those familiar with the objectives and mechanisms of recent years realize that this represents no significant change. The present system dates back to the IGY, which in turn was an intensification and codification of practices going back to the middle of the 19th century.

2. Discussion with WMO.

The IUCSTP Bureau initiated another action at its Leningrad meeting, with objectives related to those described in Section 1 above.

As some readers are aware, in recent years there has been an increasing interest on the part of government and other technical services in obtaining certain types of solar-terrestrial monitoring data for practical purposes. In some cases, data for predictions of solar activity and its effects are needed; to be effective these must be obtained systematically and transmitted by the promptest possible means. These considerations, together with the increasing burden of managing the data gathering and distribution services on a purely volunteer basis, as is done at present, has led to the thought that such services might be reorganized on a more permanent basis, with the possible assistance of governmental and intergovernmental bodies.

Informal discussions over the last several years with representatives of various intergovernmental organizations (UNESCO, CCIR, WMO, etc.) indicated that more specific exploratory discussions with WMO, with its wide experience and competence in somewhat similar problems in the field of meteorology, would prove most useful. Accordingly, the IUCSTP Bureau adopted at its meeting on 27 May 1970 a resolution (text below) requesting the WMO to associate itself with IUCSTP in establishing a small temporary joint committee for that purpose:

Proposed IUCSTP-WMO Joint Exploratory Committee on Solar-Terrestrial Monitoring

Considering the evident need to achieve a firm organizational basis for solar-terrestrial monitoring and data exchange on all time scales,

Considering the strain on volunteer participation and volunteer coordination mechanisms resulting from the magnitude and importance of the work,

Considering the probable desirability of official participation by government representatives in the execution of the work, and

Considering the long history of cooperation between ICSU bodies and the World Meteorological Organization,

The IUCSTP Bureau

Requests the Secretary General of the World Meteorological Organization to arrange for the designation of some members to a joint exploratory committee on the question of arranging some kind of IUCSTP-WMO cooperation, which might include the formation of an IUCSTP-WMO joint organizing committee on solar-terrestrial monitoring, perhaps analogous to the existing Joint Organizing Committee for GARP, and

Designates the Chairman and Co-Chairman of IUCSTP Working Group 1 on Monitoring of the Solar-Terrestrial Environment, together with the IUCSTP Secretary, to represent IUCSTP on such a joint exploratory committee.

In reponse to the foregoing resolution, WMO appointed Dr. J. S. Sawyer, President of the WMO Commission on Atmospheric Sciences (CAS), and Mr. George W. Kronebach, WMO Secretariat, as its representatives. The membership thus comprises Mr. A. H. Shapley (Chairman of IUCSTP Working Group 1), Convenor, Dr. Sawyer, Mr. Kronebach, Professor N. V. Pushkov (Co-Chairman, WG 1) and Dr. E. R. Dyer (Secretary, IUCSTP).

The Joint Exploratory Committee met in Washington on 13-15 August 1970. Discussion began by an exchange of detailed information on IUCSTP (also IUWDS) and WMO experiences in the operation of data services, both managerial or advisory. (The IUCSTP experience is described in the annex to this article.) The Committee has made a first report to the Secretary-General of WMO and the President of IUCSTP, concluding that there are good reasons for IUCSTP-WMO cooperation in this field and that there are suitable mechanisms for achieving it. The objectives might include the use of WMO channels to its national members for regularly obtaining information on their intentions for MONSEE observations and data exchange (See Section 1 of this article) and for referring to countries recommendations for improvements--also, as may be suitable and practical, the application of the WMO experience in the coordination of networks and short-time data exchange. The Committee's report notes that the expertise for the scientific guidance of such work already exists in the ICSU structure, and that the proposed WMO cooperation with IUCSTP is intended to supplement the existing coordination of the monitoring program by suitable government involvement and by the WMO experience in coordinating analogous monitoring activities in meteorology. The Committee will meet at least once more, in order to define these objectives more sharply.

Immediately after the meeting of the Joint Exploratory Committee described above, the WMO Commission on Atmospheric Sciences (CAS) met, also in Washington, for about two weeks beginning 17 August. Mr. Shapley was invited to attend as Convenor of the Joint WMO-IUCSTP Exploratory Committee and as an expert to provide more detailed information about solar-terrestrial monitoring, to assist CAS in exploring the relationship of those data to problems of interest to meteorologists, and to discuss tentative proposals. (The material provided to CAS included that given in the annex.) As a result of the discussion, CAS adopted the following resolution establishing a working group of experts to advise it and WMO.

CAS-V, Resolution 16/1, Establishing a Working Group on Meteorological Aspects of Solar-Terrestrial Relations

The Commission for Atmospheric Sciences

Noting:

(1) The progress made recently in the field of solar-terrestrial physics and its important relationship to ionospheric phenomena and to the meteorology of the upper atmosphere;

(2) Work done which appears to indicate the existence of solar relationships with the dynamics of the troposphere, which might be of practical significance;

(3) The importance of the study of such relationships for the further development of short range and long range forecasting;

Considering

(1) That the Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP) has formally approached the Secretary-General with a view to obtaining close WMO-IUCSTP cooperation in the

field of solar-terrestrial monitoring;

(2) That a Joint Exploratory Committee of WMO-IUCSTP has made a report to its sponsoring bodies;

Decides

To appoint a Working Group on Meteorological Aspects of Solar-Terrestrial Relationships with the following tasks:

(1) To consider meteorological problems related to solar-terrestrial physics and to suggest programmes of scientific study and their priorities.

(2) To advise the Executive Committee, through the President of CAS, on the meteorological implications of programmes on solar-terrestrial physics, particularly with regard to WMO participation in IUCSTP's programme for monitoring the sun-earth environment (MONSEE).

(3) Through the representative of IUCSTP, to coordinate their respective programmes directly with IUCSTP Working Group 1 as appropriate.

(4) To inform other CAS Working Groups in related areas of developments in this field in order to stimulate their interest and ensure coordination as necessary in their related programme.

(5) To provide a review of present relationships between meteorology and solar-terrestrial physics and make proposals for CAS-VI with regard to the Commission's involvement in future activities.

(6) To submit a report to the President of the Commission not later than six months before the next session of CAS.

Since WMO is an intergovernmental organization, each of its bodies has broad representation from countries with interest in the questions with which the particular body is concerned. CAS thus nominated Mr. Shapley to be the USA representative and invited IUCSTP to nominate a representative. IUCSTP has nominated Professor Pushkov.

3. Relations with STP-WDCs and Station Networks (MONSEE)

The IUCSTP Bureau authorized WG 1 to establish a committee or panel representing the STP World Data Centers under the chairmanship of Professor N. V. Pushkov, Co-Chairman of WG 1. The Commission hopes thereby to provide a better channel for those at the working level at WDCs to discuss their problems and to seek solutions. IUCSTP WG 1 is planning a meeting in Moscow at the time of the XVth IUGG General Assembly (August 1971), in which it also hopes to involve those associated with station networks (the future MONSEE; see Section 1). The agenda will provide an opportunity to review any aspects of, and problems connected with, the gathering of monitoring data, its reporting to WDCs, storage, distribution, etc., and, as appropriate and feasible, to organize and plan for the succeeding years. By that time, the IUCSTP expects to have a revised and reorganized program of cooperative interdisciplinary projects for the years from 1972 on, at least in draft form (see pp.29-30), which will provide guidance for future trends in the gathering of synoptic data. By involving the STP WDCs and MONSEE at the planning stage, the Commission hopes not only to anticipate future developments, but also to consolidate the MONSEE program into a real entity.

Annex to
preceding article

Background Information on Cooperation in Solar-Terrestrial Monitoring

(Excerpted from material prepared by Mr. A. H. Shapley, Chairman, IUCSTP WG 1, for the use of the Joint WMO-IUCSTP Exploratory Committee and the WMO Commission for Atmospheric Sciences.)

(1) There is a long history of cooperation between WMO and various organizations of the International Council of Scientific Unions. As examples: The WMO participated in the program of the International Geophysical Year 1957-58, the International Years of the Quiet Sun 1964-65. The cooperation is especially close in GARP through the Joint (ICSU-WMO) Organizing Committee. The WMO has liaison representation on many ICSU bodies, including the Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP) and the International Ursigram and World Days Service (IUWDS). There are other examples of WMO-ICSU cooperation, but the above are the major ones relevant to the present topic.

(2) IUCSTP has been responsible since its inception in 1966 for coordination of international cooperative projects in solar-terrestrial physics. This includes various special projects, limited in scope, time or scientific disciplines, but also the basic monitoring of the solar-terrestrial environment and the exchange of data through the World Data Centers. The kinds of observations involved are fully described in the "Guide for International Exchange of Data in Solar-Terrestrial Physics" in the IUCSTP publication STP Notes No. 6, September 1969. The rapid data interchange in these fields, on the other hand, is under the auspices of the International Ursigram and World Days Service (IUWDS), an older organization composed of representatives of essentially the same ICSU groups which make up IUCSTP. There is much overlapping of scientists involved in IUCSTP and IUWDS and full cooperation between the two organizations. WMO has liaison representation with both.

(3) Elements of the sun-earth monitoring program, including international cooperation and coordination, can be traced back almost a full century. The IGY provided a great impetus, both for improving global coverage and for improved coordination mechanisms, in particular systematic data exchange through the World Data Centers. For the IGY, the IQSY and for the beginning of the IUCSTP program, the national scientific institutions (academies) reported their planned observational and experimental programs in response to the scientific plans recommended by the ICSU organization. Participation, both as regards observation and data exchange, was always fully voluntary; the adhering national scientific institutions did their best to obtain support from internal national sources (usually government sources)

for the parts of the scientific program (including monitoring) which they wanted to become involved in, because of either geographical location or the special interests of their scientists. This overall scheme of "pious resolution" by the ICSU body and local initiative by national scientific groups has been remarkably successful, as the results of IGY, IQSY, and similar ICSU-sponsored programs so clearly attest.

(4) The remarks above also apply in general to the short-time data exchange and related activities in the timely coordination of solar-terrestrial work under the auspices of the IUWDS. An added feature, though, is the actual practical applications of some aspects of solar-terrestrial monitoring in the forecasting and warning of disturbances in the ionosphere which affect long-distance high-frequency radio propagation. In recent years there have also developed practical needs for solar activity forecasts related to radiation hazards to man's activities in space and the very high atmosphere. Thus the ionosphere and space "weather" information, forecasts and warnings are of concern in these practical areas, as well as to large- and small-scale scientific activities.

(5) Ever since the IGY and probably earlier, there have been informal discussions on the possible or eventual need for coordination at the intergovernmental level of solar-terrestrial monitoring and information and data exchange. The CCIR of the International Telecommunications Union has been, and continues to be, active in some aspects having to do with global description and monitoring of the ionosphere, and the forecasting of ionospheric disturbances important to telecommunications. The CCIR has played an important role, in close cooperation with the ICSU International Union of Radio Science. The CCIR is also concerned with basic solar indices important to prediction of technical characteristics of telecommunications. However the CCIR has looked to the ICSU groups for much of the detailed or active coordination of the work. It has also become increasingly clear that the monitoring of the sun-earth environment must be treated as a whole in order to satisfy the needs of telecommunications, the needs of space disturbance forecasting, and the needs of research leading to a better understanding of the environment. For example, the monitoring data from an isolated magnetic observatory may contribute to a specialized magnetic index which importantly affects the interpretation of a satellite observation of the ionosphere half a hemisphere away, or the statistical basis for the prediction of telecommunication outages five years hence. The IUCSTP is thus attempting to pull together and coordinate all of the individual disciplines and programs which contribute to the full description, prediction, and understanding of the sun-earth environment. It raised the question in 1967 of the possible need for an intergovernmental "solar-terrestrial service" to assist in this work. This would supplement the "pious resolution" approach with more formal commitments in the monitoring and data exchange activities. It could provide alternative mechanisms for improving data quality, observing standards, rapid data exchange arrangements, and the like. The strength and balance of the monitoring effort could be enhanced by providing information into individual governmental channels relevant to the desirable level of support.

(6) The Bureau of IUCSTP adopted a resolution at its 10th meeting in Leningrad, May 27, 1970, designating the permanent solar-terrestrial monitoring program beginning 1972 as the International MONSEE Program (MONitoring of the Sun-Earth Environment). It delegated the organization and coordination of MONSEE to its Working Group 1 on Monitoring of the Solar-Terrestrial Environment. At the same time the Bureau of IUCSTP adopted a resolution requesting the WMO to participate with IUCSTP in a joint exploratory committee on WMO-IUCSTP cooperation in solar-terrestrial monitoring and data exchange on all time scales.

(7) This matter is also being raised at the August 1970 meeting (Washington) of the WMO Commission on Atmospheric Sciences (CAS-V) under an agenda item "WMO Participation in Other Programs". In effect, CAS was asked for an advisory opinion as to the WMO posture on this proposed cooperation from the standpoint of the advancement of science in the WMO areas of interest. In this connection the following points are relevant:

(a) There is an increasing experimental and theoretical basis for the existence of important interactions between the lower (~30 km) and middle (~60-120 km) regions of the upper atmosphere. The fields of aeronomy and ionospheric physics and chemistry are contributing to understanding of the "meteorology" of the thermosphere, mesosphere, and stratosphere. The basic monitoring data of the lower part of the sun-earth environment is of growing interest to research meteorologists. Conversely, the aeronomers are using tools and data (e.g., meteorological rocketsondes and noctilucent clouds) traditionally thought of as meteorological. Studies of gravity waves, composition, chemistry, and dynamics in the lowest 120 km inevitably ignore discipline boundaries.

(b) Solar flare effects are traceable down to 50 km, or even lower, and may be important as a potential radiation hazard under certain circumstances at SST altitudes. There is even evidence (Schuurmann) of a significant statistical (though not necessarily direct) effect at the 300-mb level.

(c) Trace components of the atmosphere such as ozone and water vapor (and hydrated protons) are of mutual interest to the disciplines of meteorology and solar-terrestrial physics. Closer cooperation in global monitoring will tend to improve cooperation in research efforts, both those using monitoring results and those based on special experiments and theoretical work.

(8) WMO and its members are already involved in solar-terrestrial monitoring and related activities in several ways, including the following:

(a) In more than 22 countries the national organization undertaking elements of sun-earth monitoring is the same as that doing the meteorological services. Notable examples are Australia, Belgium, USSR, and USA. The current trend is to unify these kinds of environmental monitoring.

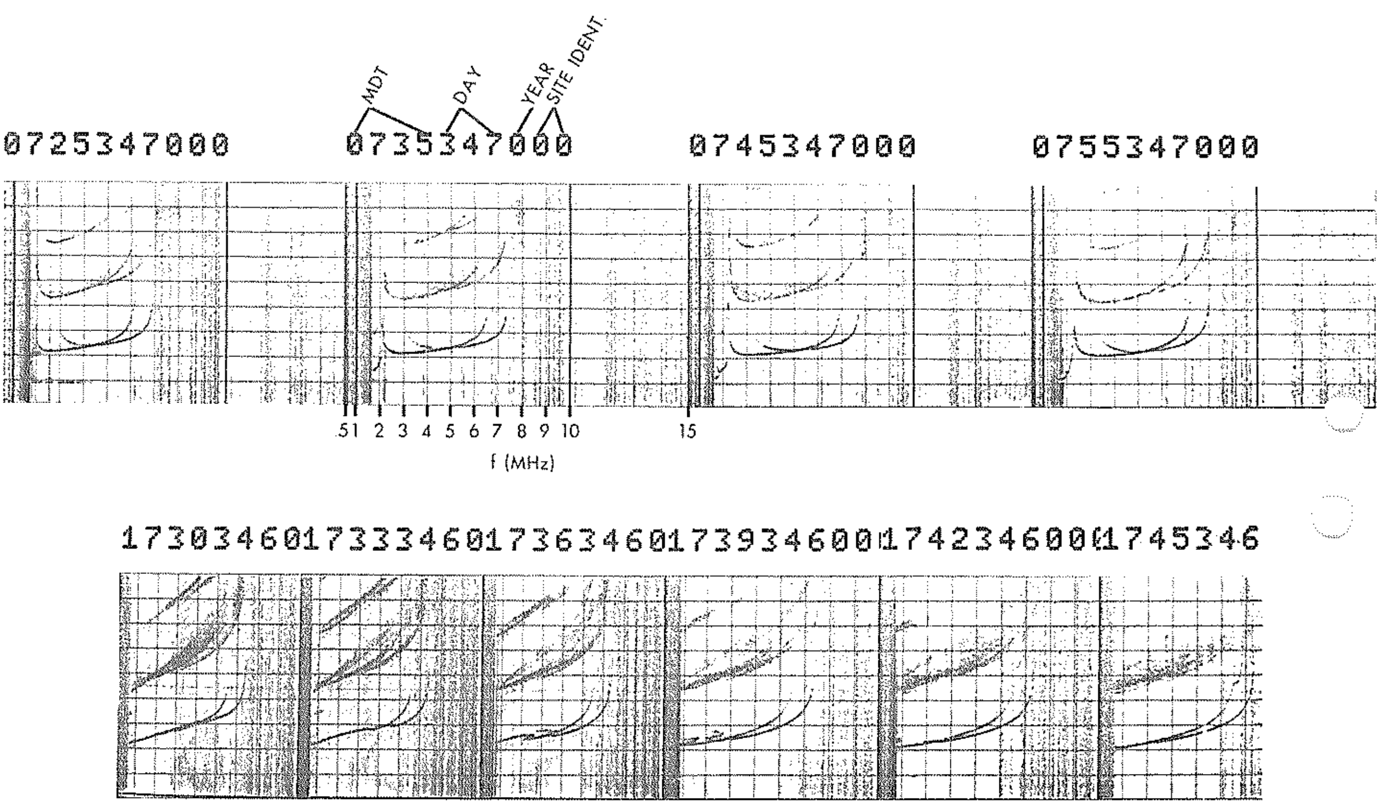
(b) The communication needs of telecommunication and space disturbance forecasting (both data collection and interchange, and forecast dissemination) have many similarities, although also important differences, compared to meteorological needs. The arrangements under IUWDS already involve the cooperation of meteorological telecommunications where this is practical and effective. In fact a daily "GEOALERT" message has circulated on the global meteorological communications network since the IGY (1957), and the STRATWARM alerts since about 1964.

XI. Ionosonde Developments

The VIS-1 Vertichirp Sounder

A specification has been received of a new commercial ionosonde. This uses solid state frequency modulation (Chirp) techniques applied to vertical incidence, with the enormous gains in signal-to-noise ratio and reliability that these make available. The equipment is known as the VIS-1 Vertichirp Sounder, covers 0.5 to 30 MHz with 3 watts average power and 8 watts peak output power. Total power consumption is low, 270 watts for unattended operation, 500 watts for attended operation with display units and recorder. The data can be transmitted over a data link with 333 Hz bandwidth. Further particulars are available from the Barry Research Corporation, 1330 Page Mill Road, Palo Alto, California 94304 U.S.A. The following figure shows sample ionograms from such an ionosonde.

VIS-1 VERTICHIRP RECORDS



DEC 1970 SWEEP RATE : 50 kHz/sec

The Ionofax

A new rapid method of obtaining ionograms for immediate use has been developed by Dr. I. Kasuya and T. Koseki of the Radio Research Laboratories of Japan (Japan Electronic Engineering, August 1969, pp. 90-93). The standard cathode ray tube and camera is replaced by an Optical Fibre tube which prints directly onto a low sensitivity size A4 electro photography paper with ZnO coating known as FAX paper. No darkroom is required. The system has been successfully operated since March 1968.

Other Developments

INAG members occasionally hear of ionosonde developments which would be interesting to other groups. If you are developing or have developed such a system, we would be glad to publish a note on it for you. Methods of saving costs or improving convenience are especially valuable, e.g. we would like to hear more from groups developing magnetic tape storage of ionograms with replay through commercial television receivers. Topside soundings have been recorded on magnetic tape for many years with great success and with more flexibility in adjusting effective output gain, signal-to-noise ratio, height and frequency scales, etc., than is possible with a photographic record.

Another active field at present is the development of Digital Ionosondes though these tend to be too expensive to be interesting to most of the network.

(The following report is reprinted from URSI Information Bulletin No. 177, pp. 11-12, December 1970)

The New Digital Ionospheric System of The Royal Meteorological Institute of Belgium (IRM) at Dourbes

by

L. Bossy
Institut Royal Meterologique, Geophysique externe, 1180 Bruxelles

Since September 1970, IRM has been operating a new digital ionospheric sounding system the heart of which is a DIGISONDE 128 developed, built and put into operation at Dourbes by the Lowell Technological Institute Research Foundation (Bibl, 1968). A detailed description of this linear ionosonde is being prepared by Bibl, Reinisch and Büchau for publication in the "Air Force Cambridge Research Laboratories, Scientific Papers Series".

The scanning of the frequency band from 250 kHz to 16 MHz in discrete steps of 25, 50 or 100 kHz guarantees accurate knowledge of the operational frequency. On each frequency a selectable number of pulses is transmitted and the receiver output is sampled in 128 consecutive equidistant height gates. A new digitizing and integration scheme generates median values of amplitude and phase for each of the 128 height ranges. For each frequency, these 128 complex amplitudes are recorded on magnetic tape together with time, day, year and all the operational parameters of the sounder -- in accordance with Recommendation III.6 adopted at the XVI General Assembly of URSI in 1969. The recording format and quality make the tapes directly readable by all modern computers.

For on-line evaluation, as well as for operational control, the hourly ionograms are printed out in parallel with their recording on magnetic tape. The DIGICODER, in conjunction with the MAGNAFAX 850 facsimile printer, generates an analog ionogram presentation while retaining the numerical information on the echo amplitudes.

The flexibility required for special studies by the researcher is given by two different programmes with independent selection of the following operational parameters: height range, height resolution, receiver gain, pulse width and repetition rate, start and end of the frequency sweep, frequency increments, number of pulses per frequency, or fixed frequency operation. At present, using this versatility, we alternate, at intervals of 10 minutes, between "normal" ionograms covering the height range from 55 km to 630 km, and "E" ionograms which provide for special E-region studies with 1.5 km height samples and 25 kHz frequency resolution.

The DIGISONDE at IRM is designed to permit also the remote control of all its operational parameters. This mode of operation will be applied in the near future by means of a SAIT system, the main element of which is an ordinator CII 10010 with a memory of 8K. While operational control of the DIGISONDE will be one task of the SAIT system, its main function will be to further process and analyze on-line the flow of preprocessed digital data as it comes from the DIGISONDE. Methods and programme for the SAIT system are presently being prepared to record on-line: fmin, ftE, ftF and h' as functions of time.

The DIGISONDE and the SAIT system form an ensemble which has great operational flexibility and which, at the same time, eliminates much of the effort and time normally required for data reduction and compression. This enables the researcher to concentrate on the real problems of the physics of the ionosphere. The amplitude and phase information provided by the DIGISONDE gives the possibility of developing new types of research, for example: absorption as a function of frequency, echo pulse shape correlated with ionospheric conditions, phase-height studies, and measurements of the angle of incidence. The application of this digital ionospheric sounding system to world-wide warning and forecasting services is evident.

XII. Future Applications of Satellite Beacon Experiments
Lindau, 2-4 June 1970

Report prepared by the Coordinator of the Symposium
Dr. G. Hartmann

(Reprinted from URSI Information Bulletin, No. 176, pp. 10-14, 42, September 1970).

Summary

The Symposium was sponsored by: Max-Planck-Institut für Aeronomie, Deutsche Gesellschaft für Ortung und Navigation and received financial support from URSI.

The programme included:

(a) Reviews of theoretical and practical aspects of trans-ionospheric radio propagation, as a background to detailed discussions.
(b) Short reports and discussion notes on very recent results.
(c) Actual working sessions:

I. One specific item was the coordination of the beacon measurements with the geostationary NASA satellite ATS-F which is due to be launched in early 1973.

II. Measurements which can now be carried out with low orbiting satellites were discussed. Throughout this decade four US NNSS-naviation satellites will continue to be available on 150 MHz and 400 MHz, which will enable Faraday and differential Doppler measurements to be carried out.

III. Proposals on new types of satellite beacon experiments as well as on various types of receiving equipments were presented.

IV. Discussions on information exchange and on closer cooperation in general took place.

The Symposium felt that some important aspects of the programme should be emphasized in a more detailed manner.

Reviews

Reduction of data now available from beacon measurements clearly reveals that, to obtain more detailed synoptic investigations, a well-coordinated and distributed network of observing stations is still required for several years. It was suggested that some form of prompt data handling and exchange should be investigated to provoke intercomparison and stimulate practical applications.

The following investigations, amongst others, can be supported by the beacon data:

(1) the daily changes of the total electron content of the ionosphere;
(2) dynamics of the upper atmosphere;
(3) the depletion of the ionosphere during magnetic storms;
(4) the relative importance of hydrogen (H+) in the topside ionosphere;
(5) studies of neutral winds in the upper atmosphere;
(6) satellite scintillations;
(7) magnetospheric electron content, ionosphere-magnetosphere coupling;
(8) possible calibration of so-called "occultation experiments", e.g. Mariner IV or HELIOS.

An exchange of more detailed information on the design and progress of recent electronic devices usable for beacon measurements should be envisaged.

An important application is the determination of navigation errors of radio navigation systems due to magnetosphere, ionosphere and troposphere. Amplitude, phase, frequency, group delay, angle of arrival, and polarization of the beacon signals are measurable. For application purposes these quantities have to be known fairly accurately as a function of elevation, azimuth and time; furthermore the predictability and the probability of the errors have to be determined by actual measurements rather than by mere theoretical investigations. There is a great lack of data in the GHz frequency ranges but, even in the VHF-range (~ 137 MHz), the data are as yet still insufficient. It was strongly emphasized that future beacon measurements could give a good support to many open questions of the application people.

Working Sessions

Session I: ATS-F

One session was devoted to a discussion of the radio beacon specified for the NASA geostationary satellite ATS-F, covering scientific opportunities, engineering aspects, and data reduction. The principal investigator for the beacon is Dr. K. Davies (NOAA Research Laboratories, Boulder, Colorado 80302, USA) who, with Mr. R. B. Fritz and Mr. R. N. Grubb of the same Laboratories, will send out to potential observers information about the progress of the beacon. At a subsequent working group meeting, Dr. G. Hartmann (Max-Planck-Institut für Aeronomie, Lindau) and Dr. J. K. Hargreaves (University of Lancaster, England) were asked to serve as a coordinating group for observations in the European sector. It was agreed to apply to IUCAF for frequency protection for the beacon transmissions. It is hoped that information on receiver design and recommendations on data procedures can be made available to intending observers in due course. Various participants offered to consider these matters in detail for discussion at a further meeting, probably to be held at Graz, Austria, in autumn 1971, under the coordination of Dr. R. Leitinger (Institut für Meteorologie und Geophysik der Universität Graz, A-8010 Graz, Halbärthgasse 1).

Dr. A. V. da Rosa, Stanford University, Calif., USA, is going to prepare more detailed suggestions on data handling which will refer to the very basic data and the very final processed data. Dr. J. Aarons, Cambridge Research Laboratory, Bedford, Mass., USA, very likely is going to submit some suggestions on this topic.

It is suggested that, in view of the wide range of recording and data handling facilities available to individual observers, the possibilities of data exchange at various levels be explored. In this way it is hoped that full participation of the maximum possible number of observers, regardless of individual resources, will be encouraged. All interested groups are kindly asked to send their suggestions or comments to Dr. K. Davies, Dr. G. Hartmann and Dr. R. Leitinger. Dr. K. Davies intends to send a questionnaire in early 1971 to all potential observers so as to obtain some more detailed information on their plans.

Session II: NNSS-Satellites

Measurements with the NNSS satellites are highly recommended, not only in polar regions where any geostationary satellite is not observable, but also in all other regions. These beacon data might then be compared with those from geostationary satellites and data on the magnetospheric electron content can be expected if the accuracy of the measurements is reasonably good.

Session IV: General

It is strongly emphasized that the beacon activities should not be restricted to the above-mentioned two types of satellites. All other useful beacons installed aboard any type of satellite which will be available in the near future should also be taken into consideration since data from all over the world are highly desirable and ATS-F, for example, is not visible all over the world. This symposium, which should be regarded mainly as a start of new cooperative beacon activities, kindly invites colleagues from all over the world to participate in this programme and to make comments or suggestions. The next meeting on this topic is envisaged to be held in Graz, Austria, in the autumn of 1971.

The Symposium wishes to thank URSI for financial support.

This report will be sent to URSI and to COSPAR-RTT in anticipation that the Interim Working Group on Satellite Beacon Experiments will be formally sponsored by URSI.

Note added by Secretary General of URSI:

A detailed list of topics suggested for discussion at the next Symposium has been circulated. Those who are interested in this or in other aspects of satellite beacon experiments should write to Dr. G. Hartmann, Max-Planck Institut für Aeronomie, 3411 Lindau/Harz, Germany.

ATS-F Satellite Beacon Experiment

The probable date of launch of the above geostationary satellite is early 1973. Its position will be Lat. 0° Long. 15°E. The carrier frequencies will be 40.016, 140.056 and 360.144 MHz. A Working Group including members from Asia, Europe and North and South America has been formed to coordinate the collection and analysis of observational data.

Observers who wish to participate in the programme are invited to write to Dr. K. Davies, Space Disturbances Laboratory, NOAA, Boulder, Colorado 80302.

Decisions adopted by the XIIIth Plenary Meeting of COSPAR
Leningrad, 29 May 1970

Decision No. 1 proposed by the Executive Council on the proposal of Working Group 1

COSPAR

considering that a large international group of observers of ionospheric beacon satellites EXPLORER 22 and 27 have made important contributions to ionospheric studies that should be continued; and believing that, in addition to planned geostationary beacons, only low altitude satellites are adequate for the continuation of many types of observations; again

invites those administrations who are planning satellite programmes to consider the possibility of putting ionospheric beacons on low-altitude satellites, using harmonic frequencies near 30, 40 and 41 MHz, and possibly 360 MHz. (See Decision No. 6, COSPAR XII Meeting, Prague 1969.)

XIII. Notes by INAG Members

Letter of G.A.M. King to Madame Cartron, C.N.E.T.

Mlle. Pillet has sent me your letter and the example of the 'gap', or 'lacune F' as you appropriately call it. We use the word 'lacuna' to indicate a gap in one's knowledge, and certainly this phenomenon does not seem to fit in with our present knowledge of the processes of reflection.

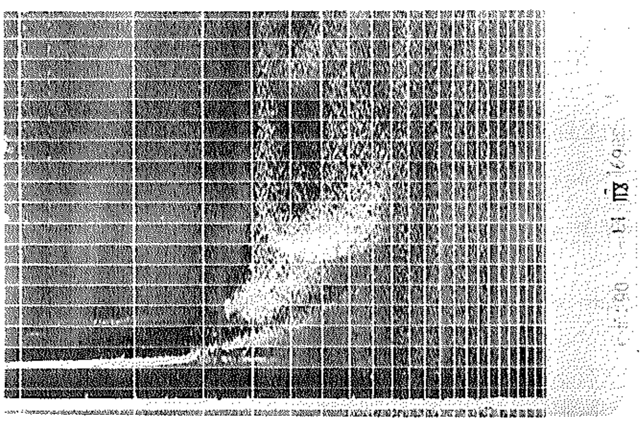
You point out that observers have difficulty in knowing what symbols to use when describing these ionograms. I have used R, although aware that it is an unsatisfactory usage. We do need a convention. However, I feel that the convention should be determined, if possible, from some knowledge of the physical processes that produce the 'gap'. Perhaps INAG members or others could make suggestions as to the cause.

To help the discussion I enclose an example from Scott Base: 0700 L.T., 13 December, 1969. The lowest frequency marker is 1MHz and the height marks are at 50 km intervals. Notice the strong interference from a local station at 3.3 MHz. For comparison, the 0645 record shows conditions just before the gap developed.

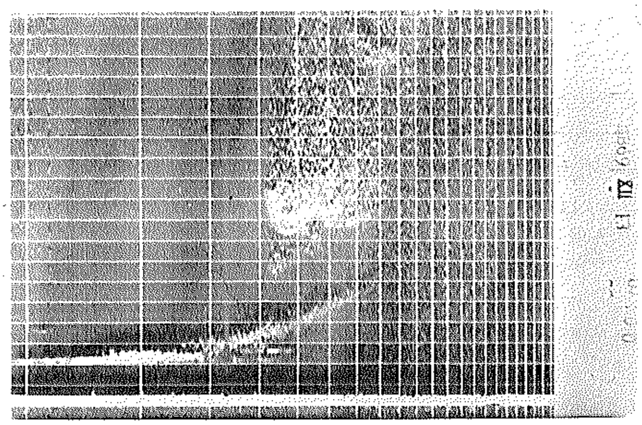
At 0700 foE is near 3.0 and slant Es rises from it. The x trace of the slant Es can be seen and it is even clearer on the high gain record one minute earlier; its presence indicates that the slant echoes are not coming from overhead, and indeed it is generally believed that they are weak, partial reflections showing time-delay focussing. There are stray oblique echoes above 3MHz but no overhead echoes between 3.0 and 4.1 MHz. Between 4.1 and 4.2 the F region comes in abruptly. Many of the F region echoes are oblique yet these have the same, or almost the same, low frequency cutoff as the overhead echoes. Notice that the F1 'fan' also cuts off at the same frequency as F2.

Now for some general impressions on occurrence: The appearance varies considerably with the quality of the ionograms. For example, we used to get slant -Es very seldom at Scott Base and it, together with the 'gap', was considered a rare phenomenon. Now we have a new display on the ionosonde and slant -Es and the 'gap' are common. I have just run through the film for 17 days of the 69/70 summer. Slant -Es occurred on 11 mornings and was accompanied by the 'gap' on 8 of these. The 'gap' did not occur if slant -Es were absent, but the sporadic was often on the records without the gap. I must emphasize the point about the quality of the ionograms. I first observed the phenomenon at Hallett, using a C4, and then would at times get the 'gap' without any slant Es. But I now believe this was because the equipment was not sensitive enough to pick up the weak partial reflections.

This phenomenon was the most frustrating of the interpretation problems I had at Hallett and it encourages me to hear from you that it is a point of general difficulty.



0645 LT



0700 LT

Scott Base, December 13, 1969

XIV. Notes from Stations

A comparison of ionogram analyses at Argentine Island by D. Binney, British Antarctic Survey

Few facts are known about the reliability of data from ionospheric stations. Ionosphericists about to serve on the Antarctic stations for the British Antarctic Survey are trained at the Radio and Space Research Station, Slough, England, and as part of this training a complete month of data from Argentine Islands was reduced. As this month, October 1968, had previously been scaled on base, this provided a comparison of results and thus some factual knowledge of the reliability of the analyses of this station's data. The errors found and to be discussed briefly below are attributable to scaling differences and to accidental errors in the detemination of the medians by hand.

Generally, the agreement between the 'E' and 'F' layer frequency measurements was very encouraging. Figures 1, 2 and 3 show the number of times a given difference between corresponding medians occurred for the parameters foF2, M(3000)F2 and foE. No systematic errors emerged in any of these data.

Sporadic 'E' parameters, however, could show systematic errors. These errors had little effect on the published medians other than to increase slightly the deviations of the medians relative to those found in Figures 1, 2 and 3. Figure 4 shows the difference between medians for foEs. Systematic errors are evident in Figure 5 which shows the occurrence for the complete month of the four main types of sporadic-E layers noted by each scaler.

An explanation of these errors will help to illustrate the sort of cases where scaler differences became important:

(a) Sporadic-E type 'f'

At night an intermittent Es trace was often observed extending out of severe interference for a few hundred kilo-Hertz. This was scaled by one scaler (B) and ignored by the other (D).

(b) Sporadic-E types 'c' and 'h'

Here there were two phenomena which contributed to the observed differences:

(1) In the limit case where Es could be scaled as either type 'c' or 'h', one scaler consistently scaled type 'c' while the other scaled type 'h'.

(2) A condition which is not infrequent at Argentine Islands is one where the trace could be ascribed either as Es-type 'h' or as 'E'-layer stratification with equal probability of being correct. Again one scaler consistently scaled as the former while the other scaled as the latter alternative.

That it was the Es parameters which were found to be subjected to systematic errors was not surprising, as it is in the scaling of these parameters that the scaler must rely more upon his experience and judgment. Little can be done to eliminate these errors, but the new URSI handbook, edited by W. R. Piggott and K. Rawer will, it is hoped, remove some of the ambiguities which exist at present.

There was some evidence for systematic errors also on all the height measurements. This is most likely to have been caused by a tendency to scale to the nearest 10 km rather than 5 km. Both scalers were guilty of this although this was more marked in the case of the trainee. However, where this was most marked, in the case of h'E, the median plots would suggest that neither scaler's median was correct and that the true median lay mid-way between them.

The general impression gained from this work was that the medians and quartile values agreed very well. This was particularly pleasing as October is a changeover month in the case of Argentine Islands, showing great contrast between diurnal variations at the end of the month. It would thus seem reasonable to expect the reliability of the other months to be at least as good as for October, or even better.

Help in the carrying out of this work was given by Mr. W. R. Piggott and also the scalers who carried out the original reduction on base, i.e. Messrs. J. Dudeney and R. Kressman.

DISTRIBUTIONS OF DIFFERENCES BETWEEN MEDIANS Δ

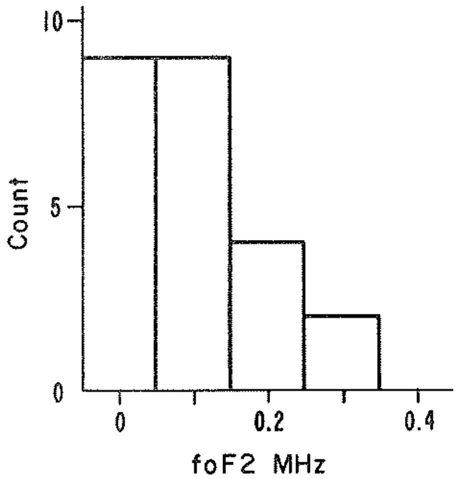


Fig. 1

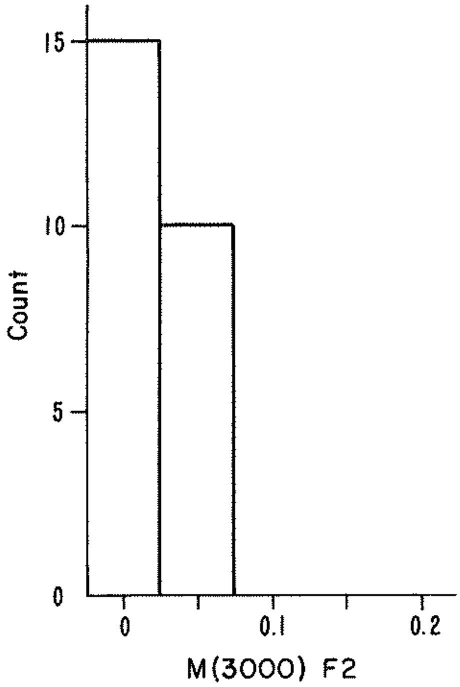


Fig. 2

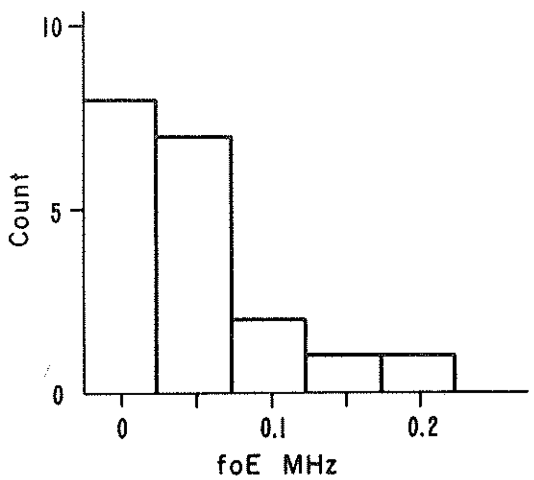


Fig. 3

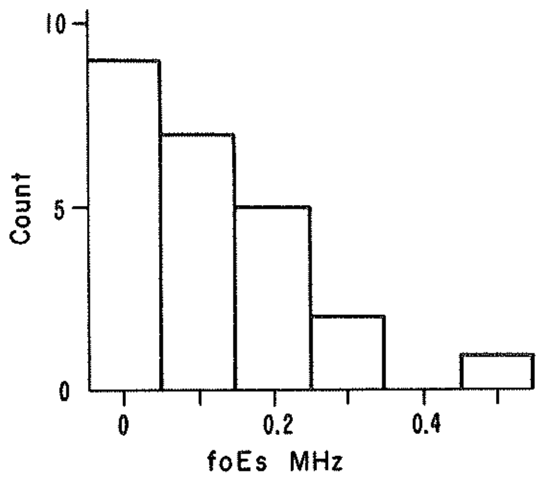


Fig. 4

Argentine Island

Es TYPES

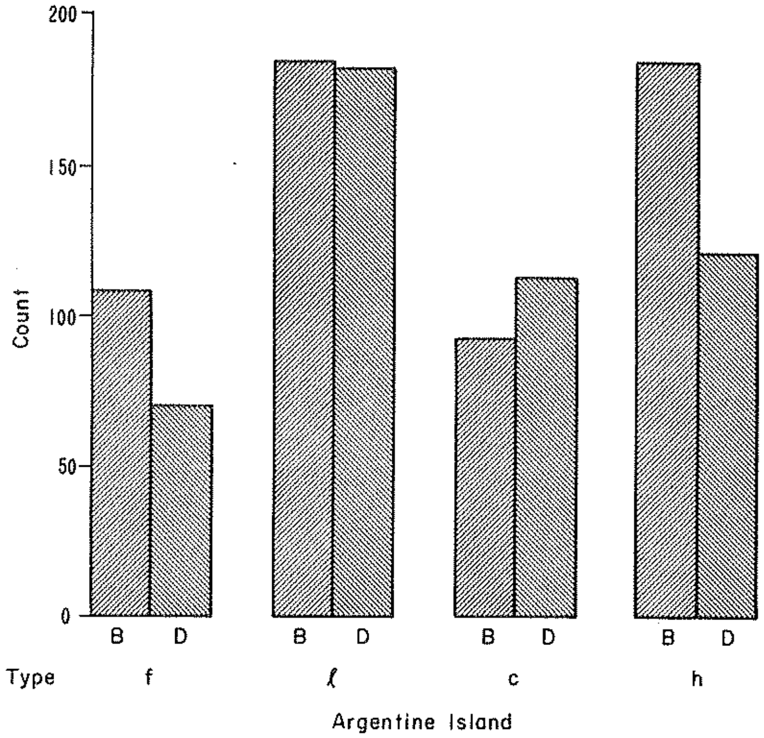


Fig. 5 Comparison of counts of Es types.

College

The College ionosonde schedule has been revised as of 20 January 1971. The new sounding schedule has soundings of normal gain with a maximum range of about 600 km at 00, 15, 30 and 45 min. each hour. At 58 a long range (1200 km) high gain sounding will be made, and a low gain normal range sound will be made at 59.

As reported in INAG-4, a system has been devised at College to send the video from the ionosonde at our Sheep Creek site to the new Geophysical Institute building (a distance of about 6 miles) by a dedicated microwave circuit. The data are then retransmitted by another microwave circuit to the Eielsen Air Force Base about 26 miles distant. The data are scaled in near real time by Air Force personnel and are transmitted by teletype to Boulder and other stations. The system has been in operation for some weeks and is performing well. If any of the readers would like to have further information on the system and its operation, please feel free to write to Glenn Stanley. We'll do the best we are able to reply promptly.

A second generation improvement is now proposed. We plan to move the film recording of the data (still done at our remote site) back to the Geophysical Institute building where a more careful monitoring of the operation may be done. It seems clear that when this is done that the savings in time and improved operation should pay for the costs of the modification within a year or so.

Excerpt from letter to W. R. Piggott from H. Sagner, Concepcion

We wish to thank you again for your kindness in visiting our Station in Concepcion and for your help and many suggestions. I am sure that our group has been inspired to continue our work with more force and enthusiasm than before. I can only emphasize the importance of such visits to so isolated groups so as to widen their horizons beyond their own "little vacuum."

I shall take the liberty of sending you some sample ionograms that we will obtain with our new antenna system as soon as it is definitively installed and properly adjusted.

Soon after you left Concepcion, we found the bug in the proton precession magnetometer, and we were able to register good data before and during the first program of the International Storm Project (ISP). We will send this data to Mr. Shapley as soon as they are interpreted.

Note by W. R. Piggott: Prof. Sagner and his colleagues were using a method of installing tall masts for the LF antenna which was new to me and might be helpful to other isolated groups. This involved borrowing a Fire Engine with a large escape ladder. This was driven to the site of each mast and used as a mobile crane and mobile working platform for fixing successive mast sections. In this way very light guided sections could be used, lighter than for a mast which must sustain its own weight while being tilted from horizontal to vertical. Antennas were adjusted using the same system.

Report on Spread F at Hobart by George Goldstone

Recently a large broad band antenna measuring 2000' x 2000' and utilizing 2048 dipoles, was built by the Physics Department, University of Tasmania, Hobart, and located at Llanherne near Hobart (dip 72.8°).

Ionograms obtained by Professor G.R.A. Ellis using this narrow beam antenna have been made available to the Ionospheric Prediction Service Division, which has a 'vertical' incidence sounder, also located near Hobart, using a standard delta antenna.

Of particular interest are Ionograms recorded simultaneously by the two stations when spread echo traces appear on the I.P.S.D. Ionograms.

A typical night-time Spread-F ionogram (Figure 1), recorded by the I.P.S.D. ionosonde, shows little evidence of a resolved trace and the foF2 value would be scaled using the inner edge of the spread.

The "narrow beam" ionogram (Figure 2) recorded at the same time, shows that the true foF2 value at vertical incidence is approximately 0.7 MHz higher than the value obtained using the normal delta.

The I.P.S.D. ionogram (Figure 3) shows a Z trace present which greatly assists in determining the foF2 value.

The simultaneous narrow beam ionogram (Figure 4) confirms this value.

Conclusion: When diffuse spread echo traces are present, the measurement of foF2 by the inner edge scaling rule will usually produce a value outside the uncertain accuracy rule limits and considerably lower than the actual vertical incidence value.

Port Stanley

Arrangments have recently been completed for the daily transmission of foF2 and fmin data from Port Stanley to Slough. These provisional data are thus available in WDC-Cl within a few of days of the event.

Slough

Certain characteristics are at present being scaled from Slough ionograms within 24 hours of the event, except at weekends. Copies of these provisional data are being lodged with WDC-Cl.

First Results from South Georgia by J. R. Dudeney and R. I. Kressman

As noted in INAG-4, observations started at South Georgia (54.27°S 36.5°W) on July 1, 1970, and some provisional data have become available. A sample of this is presented in Figures 1 and 2, together with the corresponding provisional values for Port Stanley (51°S 57°W), and the NOAA predicted values for South Georgia.

The station should prove of considerable value to the Prediction Services, since it fills a considerable gap in the chain of mid-latitude southern stations. Being also at the center of the southern geomagnetic anomaly, it is hoped to observe the effects of low energy particle precipitation on the ionosphere. Prediction services are in general biased towards the northern hemisphere, where the height and critical frequency of the F2 layer varies less with longitude than in the south. Also the geomagnetic circumstances in the south differ widely from those pertaining in the north, and it would not be fair to expect that conversion at corrected magnetic latitude to be effective.

Referring to Figures 1 and 2 on pages 24-25 it will be noted that the diurnal variations predicted are smaller than those measured, the predicted values of foF2 at noon being of the order of 20% less than measured, although night-time values correspond reasonably well. It is of note, that in winter, the dawn increase in foF2 is predicted at least 2 hours early and the rate of increase of foF2 in the morning is considerably reduced.

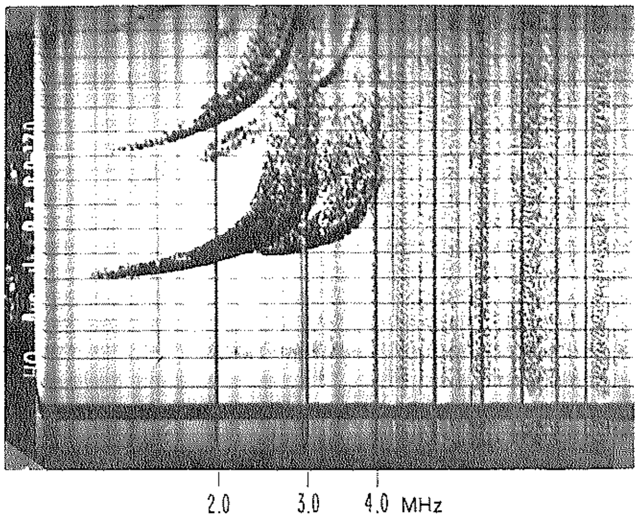


Fig. 1 Hobart I.P.S.D. Ionogram

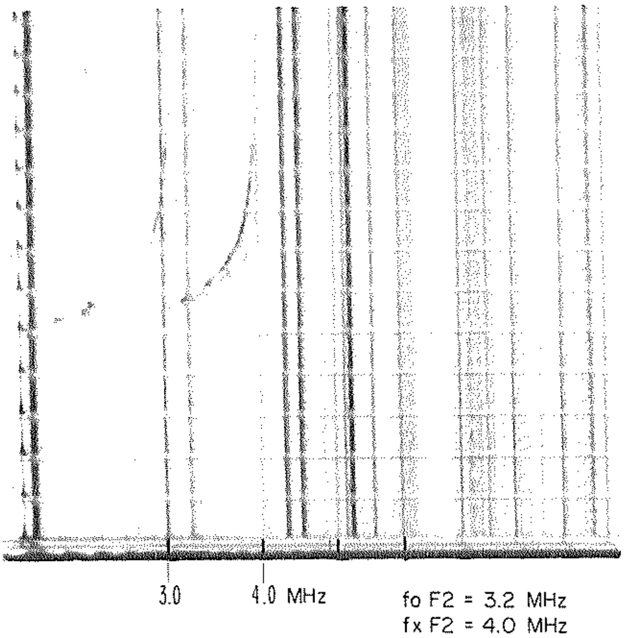


Fig. 2 Hobart "Narrow Beam" Ionogram, Time of Fig. 1

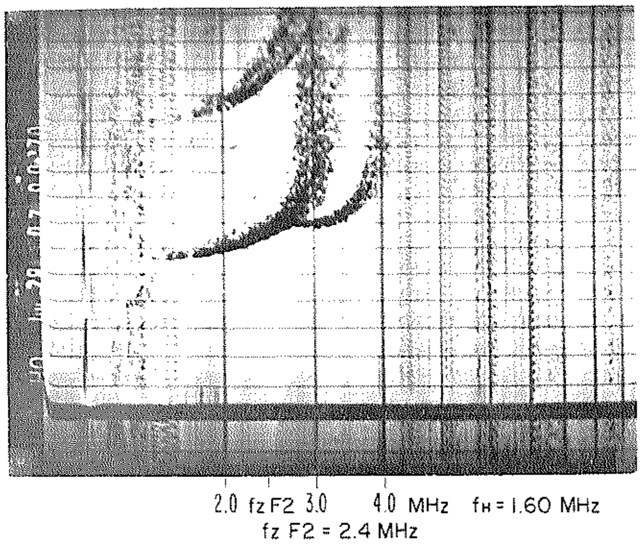


Fig. 3 Hobart I.P.S.D. Ionogram

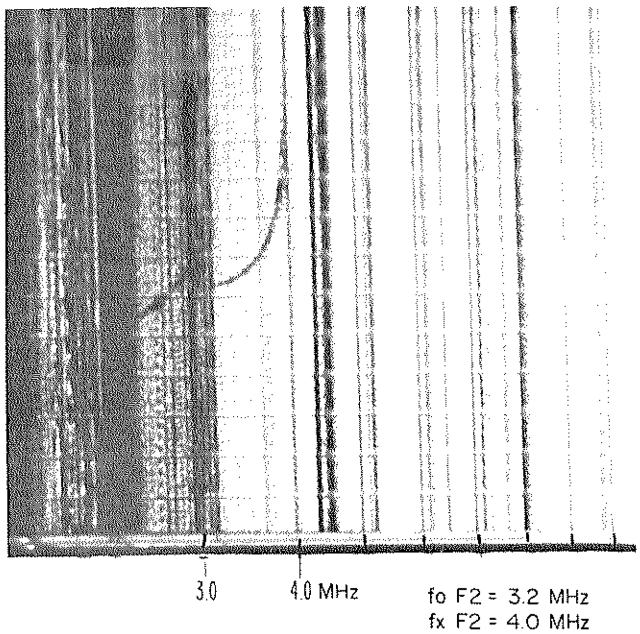


Fig. 4 Hobart "Narrow Beam" Ionogram, Time of Fig. 3

IONOSPHERIC DATA

MONTHLY MEDIANS

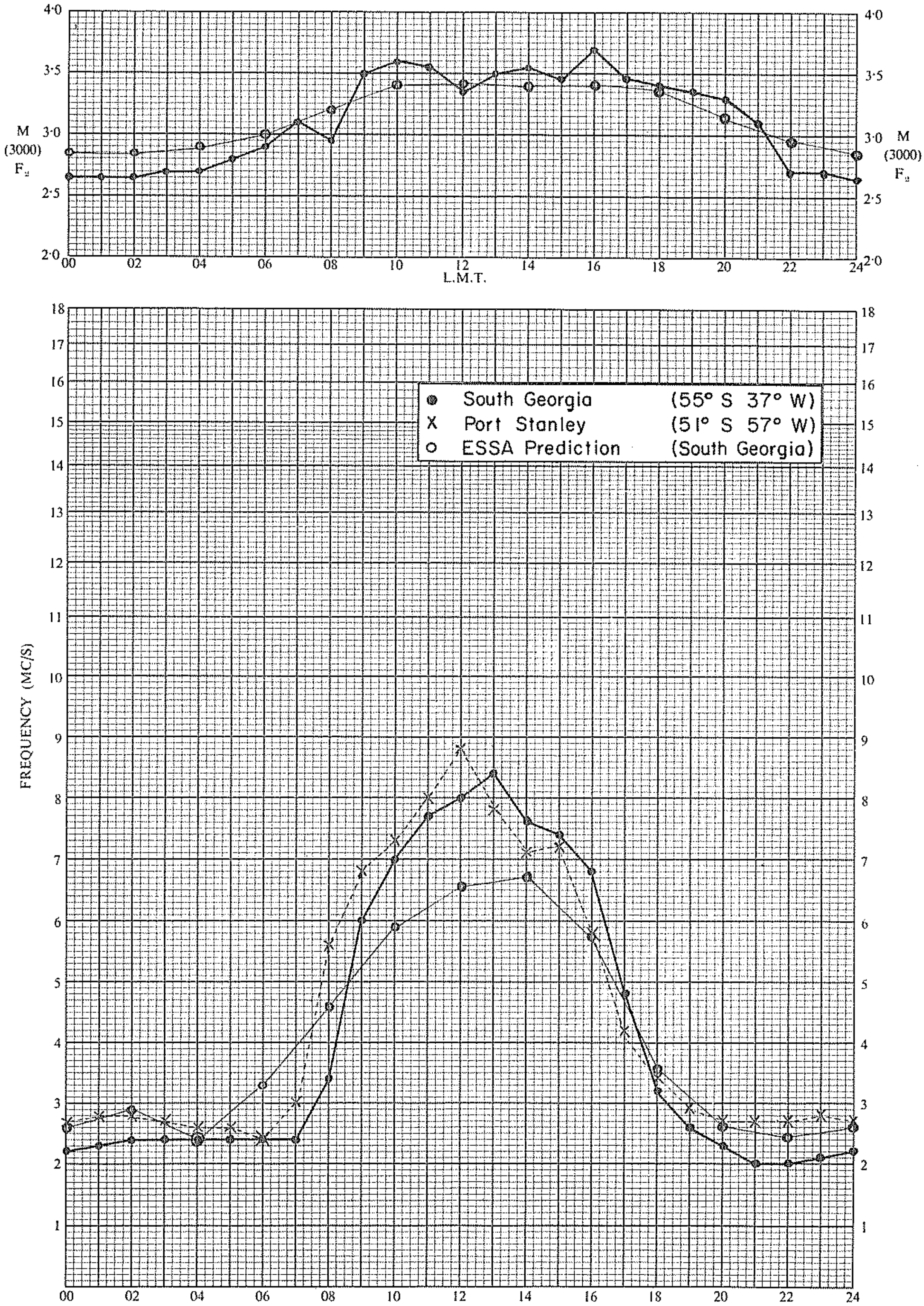


Fig. 1 Data for July 1970.

IONOSPHERIC DATA

MONTHLY MEDIANS

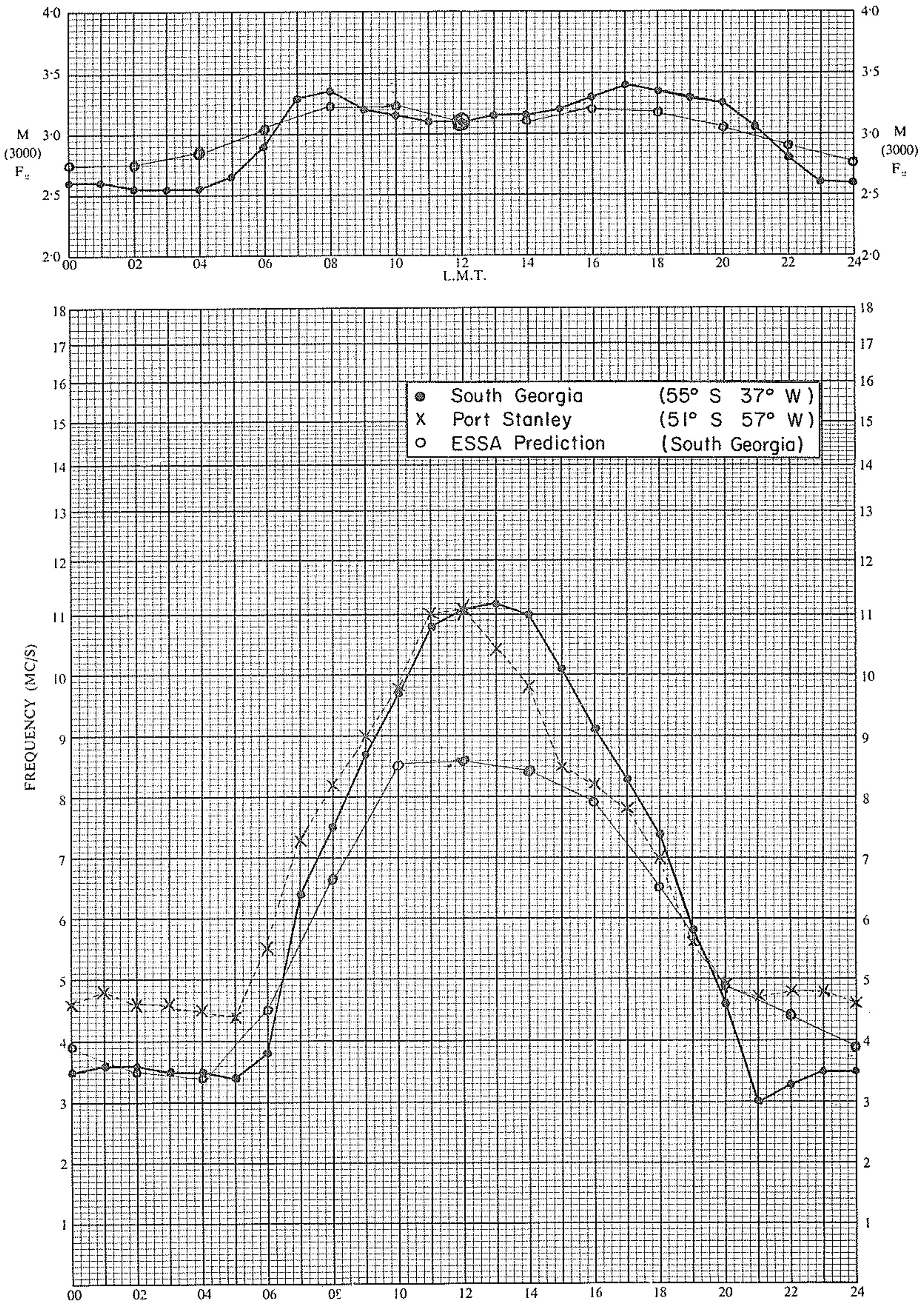


Fig. 2 Data for September 1970.

In the comparison with Port Stanley, the slight difference in solar zenith angle should not be significant. Therefore any differences between the two stations should be due to other mechanisms, such as particle precipitation and neutral air wind effects. However, the present lack of M(3000)F2 data for Port Stanley does not allow detailed analysis. The marked differences between the night-time foF2 values is an interesteg feature.

South Uist

The Union Radio ionosonde which has been used intermittently at this range in the Hebrides (N57°21', W7°25') since 1968 in support of rocket launches, is shortly to be replaced by a Magnetic 1005W instrument. It is hoped to extend the periods during which routine observations are made. The data will be stored in WDC-C1, but no bulletin will be published.

XV. Notes from WDCs

World Data Center-A, Upper Atmosphere Geophysics, Boulder, Colorado, U.S.A.

The first published Station Notes from Hong Kong have been received. These were for the months of January and February 1970.

The monthly bulletin "Ionospheric Data" is now being published as a generally available publication. Free distribution to contributors of ionospheric or related data continues, but others may subscribe by application to the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. (The catalog order number is C55.218, Annual subscription is $10.00. Additional for foreign service mailing $2.50. Additional for U.S. airmail $9.60. Additional charges for foreign airmail will be quoted on request.) At present the bulletins include the median values for 292 station months in each issue. In FA-317, January 1971, data were published from 73 stations: Ahmedabad, Akita, Argentine Is., Auckland, Bangkok, Boulder, Brisbane, Budapest, Buenos Aires, Campbell I., Canberra, Cape Town, Churchill, Cocos Is., College, Dourbes, Freiburg, Ft. Archambault, Garchy, Godhavn, Godley Head, Halley Bay, Hobart, Huancayo, Hyderabad, Ibadan, Johannesburg, Juliusruh/Rugen, Kerguelen, Kinshasa Binza, Kiruna, Kodaikanal, Lycksele, Manila, Maui, Mawson, Mexico City, Miedzeszyn, Moscow, Mundaring, Narssarssuaq, Norfolk I., Nurmijarvi, Okinawa, Ottawa, Ougadougou, Poitiers, Port Moresby, Port Stanley, Pruhonice, Rarotonga, Resolute Bay, Roma, Salisbury, Sanae, Schwarzenburg, Scott Base, Singapore, Sodankyla, St. Johns, Syowa, Taipei, Thumba, Tokyo, Townsville, Tromso, Tsumeb, Uppsala, Wakkanai, Wilkes, Winnipeg, Woomera and Yamagawa.

World Data Center-C1, Radio and Space Research Station, Ditton Park, Slough, Bucks, England

The WDC for Sudden Ionospheric Disturbances has been transferred from Mill Hill Observatory, London, to WDC-C1 at Slough. Hourly values of foF2 and certain other ionospheric data recorded at the Slough and Port Stanley observatories are now being deposited in WDC-C1 within a day or two of the event.

XVI. Special Notes

Topside Soundings

Correction to INAG-5, p. 10: The Special Report on Topside Sounding was written by E. R. Schiffmacher and J. M. Warnock. We apologize to Mr. Schiffmacher for omitting his name from the report.

The launch of the next satellite in the ISIS series, ISIS-B, is now scheduled for early in the second quarter of calendar 1971. The sounder experiment is essentially identical to that of ISIS-1. The orbit will be 1400 km, circular, and approximately polar in inclination. ISIS-1 and ISIS-B orbit planes will be orthogonal.

The map we published in INAG-5, p. 13, showing telemetry stations, needs correcting and updating. We inadvertently omitted the station at Ahmedabad, and note that a new French station in the Antarctic (Terre Adelie) has recently become operational. Other changes are forthcoming. The Ionospheric Prediction Service, Australia, has announced their plans to construct a station near Darwin, and New Zealand is also proceeding with construction of a facility on their southern island. On the negative side, it now seems definite that the Singapore station will close in June of this year.

Letter from R. G. Rastogi, Chairman, Aeronomy Area, Ahmedabad, to W. R. Piggott

I am thankful to you for including the reference of my paper in Nature on upward travelling disturbance in the INAG report. I have had few queries about the frequency of such events and therefore have been going through the ionograms of Kodaikanal for the period 1952 onwards. I am glad to inform that these events are not rare and I have noted about 15 events per year. There is strong seasonal as well as solar cycle effect in its occurrence. I am duplicating these films and shall compute N-h profiles and the velocity of upward movement after my return to Ahmedabad. Mr. Shapley has sent to me about 30,000 ft. of Huancayo ionograms for similar survey. I wish if you could induce people to examine ionograms of other equatorial stations like Ibadan, Djibouti, Nhatrang and Dopango.

I have been asked by Dr. Sarabhar to organize a detailed study of the electrojet effects in the ionosphere around our longitudes. I shall be pleased to have your suggestions in this collective program if any.

XVII. National Members of URSI

(Reprinted from URSI Information Bulletin No. 176, pp. 78-80, Sept. 1970)

Commission III on the Ionosphere
(As of 18 August 1970)

Chairman: Prof. K. Rawer, Arbeitsgruppe für physikalische Weltraumforschung, Kronenstrasse 13, 78 Freiburg im Breisgau.

Vice-Charman: Prof. S. A. Bowhill, Department of Electrical Engineering, Univeristy of Illinois, Urbana, Illinois.

Official Members:

Argentina:	Ing. V. H. Padula-Pintos, Executive Secretary, CORCA, Av. Libertador 327, Vicente Lopez, B. A.
Australia:	Prof. C. R. Ellis, Physics Department, University of Hobart, Hobart, Tasmania.
Austria:	Univ. Prof. Dr. O. Burkard, Institut für Meteorologie und Geophysik, Universität Graz, Halbärthgasse 1, A-8010 Graz.
Belgium:	Dr. L. Bossy, Institut Royal Meteorologique, 3 avenue Circulaire, B-1180 Bruxelles
Brazil:	Dr. F. de Mendonça, Scientific Director, CNAE, C.P. 515, Sao Jose dos Campos, Sao Paulo.
Canada:	Mr. J. H. Meek, Defence Research Board, A Building, DND, Ottawa, Ontario.
Ceylon:	Dr. S. Gnanalingam, Head, Applied Physics Section, Ceylon Institute of Scientific and Industrial Research, P. O. Box 787, Colombo 7.
China (Taipei):	Prof. K. H. Pai, Department of Electrical Engineering, National Taiwan University, Taipei, Taiwan.
Czechoslovakia:	Dr. Ludmila Triskova, Geophysical Institute CSAV, Bocni II-la. Praha 4 -Sporilov.
Denmark:	Dr. J. K. Olesen, Ionosphere Laboratory, Technical University of Denmark, DK-2800 Lyngby.
East Germany:	Dr. K. Sprenger, Zentralinstitut für Solar-Terrestrische Physik, Observatorium fur Ionosphärenforschung, Mitshurinstrasse, DDR-2565 Ostseebad Kühlungsborn.
Finland:	Dr. P. Mattila, Electrical Engineering Department, Technical University of Helsinki, Otaniemi.
France:	M. F. du Castel, CNET, 3 avenue de la Republique, F-92 Issy-les-Moulineaux.
Ghana:	c/o Mr. M. N. B. Ayiku, Secretary, URSI Committee, Institute for Standards and Industrial Research, Ghana Academy of Sciences, P. O. Box M. 32, Accra.
Hungary:	c/o Dr. K. Geher, Associate Professor, Polytechnical University of Budapest, XI. Stoezek u. 2, Budapest.
India:	Dr. A. P. Mitra, Radio Propagation Unit, National Physical Laboratory, Hillside Road, New Delhi 12.
Israel:	Dr. J. Mass, Scientific Department, Israel Ministry of Defense, POB 7063, Hakyrya, Tel Aviv.
Italy:	Prof. P. F. Checcacci, Centro Microonde, Via Panciatichi 56, Firenze.
Japan:	Prof. K. Maeda, Faculty of Engineering, Kyoto University, Yoshidahon-machi, Sakyo-ku, Kyoto 606.
Mexico:	Ing. Carlos Nunez A., Comision Nacional del Espacio Exterior, SCT, Dr. Vertiz 800-4to Piso, Mexico 12, D.F.
Morocco:	c/o M. Aoud, Division des Telecommunications, Ministère des PTT, Rabat.
Netherlands:	Prof. J. Veldkamp, Koninklijk Nederlands Meteorologisch Instituut, de Bilt, Utrechseweg 297.
New Zealand:	Mr. G.A.M. King, Geophysical Observatory, DSIR, Box No. 2111, Christchurch.
Nigeria:	Prof. O. Awe, School of Mathematical and Physical Sciences, University of Lagos, Lagos.
Norway:	Dr. E. Thrane, Scientific Officer, NDRE, P. O. Box 25, N-2007, Kjeller.
Peru:	c/o Dr. A. A. Giesecke, Instituto Geofisico del Peru, Ministerio de Fomento, Apartado 3747, Lima.
Poland:	Prof. S. Jasinski, Telecommunication Institute, ul. Szachowa 1, Miedzeszyn-Warsaw.
Portugal:	c/o Mr. A. Silva de Sousa, Servico Meteorologico Nacional, R. Saraiva de Carvalho 2, Lisboa 3.

Official Members (Cont'd)

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If you need to get in touch with groups in other countries and do not know the address, the above could forward your letters. Addresses of stations can also be obtained through the World Data Centers.

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