IONOSPHERIC NETWORK ADVISORY GROUP (INAG)

Ionosphere Station Information Bulletin Nos. 18-19

I. Introduction

by

W. R. Piggott, Chairman

I must apologize for the delay in publishing the Bulletin due in June. This has been due to your Chairman having difficulties in finding time to study the material and to write the comments needed. He was trying to do too many jobs: We have decided to combine the June and September issues into one issue which will be rather longer than usual.

We would like to thank those who have volunteered to provide ionograms for the High Latitude Supplement of the Handbook.

We are now working intensively on these and would be grateful to receive your contributions as soon as possible.

The value of this Bulletin to those actually working on ionosonde stations is greatly increased when they can be translated into languages which can be read more easily than English. INAG is very pleased to be able to congratulate Prof. Harold Sagner, University of Concepcion, Chile, and Mlle. G. Pillet for translating issue 17 into Spanish and French, respectively, remarkably quickly so that the results of INAG's Geneva meeting could be widely circulated. INAG would like to stress the importance of translating Bulletin articles on INAG meetings and discussions on points of interpretation into more languages. If you make any such translations, please inform INAG so that others speaking your language can write for a copy.

The confusion which existed on the differences between particle E (night E) and retardation type Es now appears to be cleared up satisfactorily. It is now desirable to try to clarify the reduction of auroral type Es so that a uniform system is in operation for the IMS. INAG invites those of you who have local rules for this parameter to send a copy of them to INAG. Some notes on this subject -which are intended solely to start discussion — are included in this Bulletin. As usual, the object of INAG is to find a compromise solution which maximizes the usefulness of the data to the scientist and communications engineer, is simple enough to be taught easily and remembered by the operators in stations, and is in accord with the principles of ionogram analysis. The difficulties in reduction of auroral Es traces arise mainly because they are due to reflections at oblique incidence so that the general rules do not apply.

There will be a major meeting of INAG immediately before the URSI General Assembly at Lima, Peru, August 7th to 8th, 1975 (INAG 17, p. 11). Now is the time to consider whether you are happy with the clarifications of the new Handbook published in the INAG Bulletin. We need to know soon your views (INAG 17, p. 6—8) whether you have problems with any of them — or wish other points to be discussed. It is essential that the problems be identified and discussed widely before that meeting. Experience shows that amendments to rules are often overlooked and that it takes several years before the whole network is operating reasonably uniformally. Thus, Lima is the last chance for any changes needed for the IMS to be approved and adopted by stations in time for the IMS.

This is the first occasion on which INAG has had contributions in one issue from all the ionospheric WDCs. It is interesting to note that the use of your data is still increasing although the number of people specializing in purely ionospheric problems is probably decreasing. The fact that the data are being more and more used by people with no ionospheric training increases the need for uniformity in scaling.

As many of you will know, a very large amount of data on the Retrospective World Interval of August 1972 was collected and published in July 1973 as Report UAG—28 by WDC—A for Solar—Terrestrial Physics. Of necessity, data from Antarctica and data which needed much processing time could not be included in this publication. There has been fairly extensive publication of studies of these data in the standard literature. INAG wishes to inquire whether it would be useful to follow this up by publishing a further collection of delayed data and a bibliography? Our facilities are very limited so that such a publication would only be possible if sufficient people are willing to contribute. Please let us know whether you are interested or have material for this so that we can decide whether the potential value justifies the effort needed, In the event of little or no response, no further action will be taken by INAG.

There has been considerable effort this year in a number of countries to discuss the new Handbook and its amendments and to try to make reduction more uniform. Some of the problems which arose are discussed in this Bulletin. INAG exists to help you on these problems and welcomes notes on your national or international discussions. A number of these problems were considered at an ad hoc discussion among INAG members at Boulder August 27—30th. These involved your Chairman, the vice—chairwoman, Mlle. Pillet, A. H. Shapley, and some INAG consultants.

There has been much activity in planning ground—based programs for the IMS and the Antarctic and Southern Hemisphere Aeronomy Year (September 1975 - March 1977). Special efforts will be made to deploy new stations, adopt uniform techniques of analysis and organize special cooperative programs. Some summaries are included in this Bulletin. In many cases, the cooperation of the VI networks will be essential. Some of the recommendations and proposals for improving this are abstracted in this Bulletin. INAG wishes to draw the attention of administrations to these proposals.

The IMS and ASHAY programs call for the strengthening of the A1 absorption (pulse), A2 absorption (riometer), A3 absorption (oblique CW), satellite beacon, drift and travelling disturbance networks. These are closely associated with VI, and INAG wishes to encourage such developments by making the Bulletin available for circulating information on them.

WDC-A regrets to announce (see FA351) that, owing to financial difficulties, the publication of *Ionospheric Data* will be suspended after the issue of September 1974. The median data will continue to be processed at WDC—A and can be made available on special request. Fuller details will be found in the September issue of *Ionospheric Data.*

The Chairman wishes to apologize, particularly to those who have contributed to this Bulletin, for the delay in publishing their letters and the replies.

2, High Latitude Supplement

1. Time table:

In view of the need to have the High Latitude Supplement available in time for training scalers before the IMS, it must be published by June 1975 at the latest, preferably April 1975. To allow time for checking contributions so that they are consistent with INAG rules, it is necessary for them to reach the Chairman by September 15, 1974. For controversial ionograms an earlier date is needed so as to allow time for discussion.

2. Station position:

The intention is that the contents should mainly represent typical high latitude conditions. Unfortunately similar conditions are found in different longitudes at different values of geographic latitude, magnetic latitude, or L shell so that limits in any of these will be too high in some sectors, too low in others. As an approximate guide, stations with geomagnetic or magnetic latitude at or above 60° are acceptable.

3. Objectives of Handbook Supplement:

The main objective of the Supplement is to provide actual ionograms illustrating the difficulties in scaling discussed in the Handbook, both for training purposes and to show scientists the types of ionograms found in different zones at high latitudes.

The Supplement should also contain sequences showing the development of typical high latitude phenomena.

It is important that classical examples of the different phenomena be shown with some difficult cases picked so as to illustrate the steps taken to solve a difficult interpretation.

4. Layout:

The nigh Latitude Supplement will be produced to the same format as the Handbook. The master sheets are reduced in size by the ratio 5 to 4 before duplication. Thus, the preferred size for master sheets is 10x13 in. or 25x33 cm. The active space available is 8-5/8 x 11-5/8 in. or 22 x 30 cm. This allows the stapling to be removed, as for the Handbook, and the sheets to be punched and used as a loose leaf book. Unfortunately, production costs prohibit putting either into loose leaf form before circulation.

No attempt will be made to make all contributions uniform in style as INAG does not possess adequate editing facilities and this could prevent contributions from those with few facilities to reproduce ionograms. Glossy prints of ionograms produce the best reproductions. Some suggestions will be given below.

The main types of layout expected are as follows:

(a) Ionogram with line drawings, evaluated parameters and (if desired) text.
(b) Ionogram with evaluated parameters and (if desired) text.

(c) Group of ionograms on one page. Text on facing page. The former can be either upright or turned on side, depending on optimum matching of ionograms to space available.
(d) Sequence of ionograms reduced in size to fit on one page.

5. Scales:

It is essential that adequate frequency and height scales be provided for at least some of the ionograms so that the reader can easily deduce the standard parameters. Where a sequence is shown it is sufficient for one ionogram, which need not be part of the sequence, to be provided with clear scales.

6. Standard ionograms:

It would be helpful to trainee scalers if some normal ionograms could be included so that the usual operation of the ionosonde can be estimated. This is not essential if adequate ionograms are already available from the station in UAG-10 "The Atlas of Ionograms" edited by A. H. Shapley.

INAG proposes that, where practical, one day and one night ionogram be provided for each of the three seasons, Summer, Equinox, Winter.

7. f-plot representation:

INAG recommends that the f-plot representation of the ionograms be put under the ionogram, using the ionogram frequency scale, as shown in Chapter 6 of the Handbook (e.g., Figs. 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.11, 6.12, 6.13, 6.14, 6.16, 6.17, 6.18, 6.19, 6.20).

8. Choice of examples:

This is a general training book so examples should be chosen from phenomena which are common at the station. Very abnormal cases are more appropriate for publication in the INAG Bulletin and copies should be kept in a local reference collection. Do not forget that some phenomena are very rare or absent at particular high latitude stations. Leave these to the stations where they are common (e.g., Lacuna).

Phenomena which give most trouble and are therefore of higher priority include:

1. Scaling with small and large tilts (section 2.7).

2. Use of letter symbols at high latitudes (section 3).

3. Sporadic E (section 4), particularly fbEs and Es types.

4. Trough and replacement layer phenomena.

5. New parameters, particularly fxI and spread F types.

Unskilled operators have difficulty in matching the line drawings of the Handbook to actual ionograms, particularly when traces are complex or spread. The objective is to provide enough examples to minimize this difficulty.

There are a number of special cases which give difficulty in particular zones, e.g., presence of z-and o—traces with little or no x-trace, distinction normal E at night and night E, difference between Es type r and night E (type k) which should be illustrated.

9. Captions and text:

(a) It is useful to have a caption showing the main reason why the ionogram was included, e.g., "Tilt condition - interpretation of foF2".

(b) List all standard parameters available from ionogram with preferred value and correct letter symbols - help is needed in normal scaling as well as in abnormal.

(c) Add, where needed, comment or description of reason for interpretation.

(d) Where a sequence is shown make sure that each ionogram can be identified readily, e.g., by giving time and/or date or by sequence (a) (b) (c)... (1) (2) (3)...

(e) State date, time and station on every page of ionograms. It may be necessary to split your contribution amongst several chapters.

10. Plan of Supplement:

The final plan of the supplement will probably need to be modified by limitations in the material provided and by the fact that individual ionograms will probably illustrate several different points. Clearly a good cross index will be needed. The supplement will be used in conjunction with the Handbook and, as far as possible, will be arranged in similar order. There will be a special section for phenomena likely to be useful in the IMS or which fall outside the general plan of the Handbook.

The consensus at Geneva was that ionograms illustrating a particular point should be collected together and that the main chapters should be on E, Es, F layer, tilts, and special phenomena. The F layer might include spread F phenomena or this might form a separate chapter.

11. Advice:

INAG invites prospective users and those preparing material for the Supplement to send comments and proposals to the Chairman. The Chairman would also like to see any documents you have produced for your own use which show the type of material you would like to have included in the Supplement. Please note that the resources of INAG do not allow serious editing of your contributions which should, therefore, be in a form suitable for reproduction without editing.

3. Comments from INAG Members Dr. A. S. Besprozvannaya

treatment of oblique traces on f-plots. At present we are conducting at our Institute a number of seminars with the aim of instructing our people on the changes and additions connected with the new Handbook. In the course of training several questions arose we could not, however, find the answers in the book. I want to draw your attention only to the questions dealing with the fxI scaling. The parameter fxI is not difficult to tabulate, but it is the scattered and oblique traces on the f—plot that are difficult to present.

1. Figure 3.39(c, d) shows ionograms with two traces, one of these concerns oblique reflections. In accordance with 2d(1) rule (p.27) oblique reflections should be shown at f—plot. But we could not find in the Handbook the way it should be done: either by a solid line or a dashed one, whether we should mark the whole frequency range (as in the case with the range—spread) or only frequency interval near the critical (as in the case with the frequency spread). Examples of such ionograms are the ionogrammes of Figures 11A—27 and 11A—27 June and September, respectively (ATLAS);where two forms are present.

2. Figure 2.7 of the Handbook shows a series of ionograms with only oblique reflections, while the vertical trace of F—region is absent. It is not clear at should be in the column foF2 and how this trace should be shown at f—plot (there is no diffusion and we cannot use F letter).

3. Figures 11A—8 June and 11A—1O September (ATLAS) show ionograms with both range—spread reflections and traces with group delay, indicating the structure of the region. What is to be shown at f—plot? How should we show at the f—plot these two types of scattering?

4. What does the sentence on page 144 6.3 g. mean "... q is not used where a main trace is visible..." Could you give an example and explain how to show this ionogram on f—plot?

I would like to draw your attention to spread F reflections in FLIZ zone. (Pike C.P., J.Geoph. Res. 1971, vol. 76, 1031). It is very important to scale reflections identically in order to fix the station in "polar cusp" by the tabulated data and f—plots.

I am very sorry but I could not participate in Geneva Meeting, since all our trips abroad should be planned a year in advance.

Chairman's comment

1. The representation of range spread structures on the f—plot have been discussed several times in the Bulletin (e.g., INAG—4, p. 5, INAG—8, p. 3). There has not, however, been a detailed discussion in an INAG meeting with the practical difficulties illustrated by ionograms.

   The philosophy of f—plot representation of spread on oblique traces has not been discussed since the dissolution of the W.W.S.C. after the IGY and is certainly overdue. The W.W.S.C. philosophy can be summarized as follows:

The first priority is to indicate frequency spread by lines showing the frequency range over which frequency spread can be observed.

Where there is no danger of confusing the presentation of the frequency spread, range spread traces should be shown by a line with letter *Q* at both ends of the frequency band showing range spread. The Handbook rules 6.3 (f)(g) are consistent with this philosophy.

At that time the cases raised by Dr. Besprozvannaya were treated by a local rule that the *Q* convention was used on frequencies above the top frequency of frequency spread traces (usually x—trace) with *Q* and a less than sign to show where the oblique or range spread trace reached the top end of the frequency spread trace. However, there was little interest in range spread for many years and the convention fell into disuse and was therefore omitted from the Handbook.

The first question is whether this, or some alternative convention, should be agreed? In view of the wide spread interest in spread and oblique traces, my feeling is that it should. Please let us have your views.

The second question is whether it is important to identify the lowest frequency showing range spread when frequency spread is also present? My feeling is that this is very controversial with the probability that the consensus answer would be No. Please let us have your views as soon as possible and in any case not later than our Lima meeting. I would ask INAG members in particular to send use their opinions on this.

Pending further discussion and clarification, I tentatively suggest readopting the old W.W.S.C. rule in the form (p. 144, section 6-3 after (Note on C')):

(j) When a range spread or oblique trace is present on frequencies above the top frequency which shows frequency spread on a critical frequency, it is denoted by a solid line which is identified by letter 'q' placed at the upper and lower frequency end of the trace. If the range spread trace extends below this top frequency, the letter 'q' is placed immediately above the top frequency and a less than (<) sign placed at the lower end of the range spread line. Under no circumstances may a range spread and frequency spread line be allowed to touch each other. They must always be separated by q.

The f—plot representations of Fig. 3.39, p. 84, would be:

Fig. 3.39c   •   o- x- q π——— q

Fig. 3.39d —•   o- q π————— q

2. By convention we tabulate foF2 and h'F2 from the first order trace which represents the conditions most nearly overhead. We have no convention to identify such cases though in practice Q is often appropriate as satellite traces are also found when the possible error is significant. Do you wish INAG to consider creating a convention for these cases? In general the inaccuracy involved is small and this is the reason why none has been used in the past.

3. See discussion under 1. We have to select the most important frequency parameters for an f—plot, omitting those of less importance and this means that some traces have to be ignored; e.g., we ignore the x traces of E and F1. It will be very difficult to find a technique which enables appreciably more information to be put on the f—plot without confusion and we should also be reasonably certain that there will be a real use for the information before asking scalers to do more work. A fuller comment on questions 3,4 will be given in the next INAG Bulletin when we hope to reproduce some ionograms.

4. The main application of p. 144 6.3 (g) is to equatorial spread F and the rules have been written with the object of giving the greatest information about this phenomenon. Both from the practical and the scientific point of view, there is a marked distinction between ionograms showing a main trace and those which do not. For the former there is a totally reflecting layer present giving a relatively strong signal but with much weaker scattered signals superposed. For the latter the majority of the signal passes right through the F layer and only weak partial reflections (reflection coefficient of order 0.001) are present. Fig. 6.1Ob on p. 147 illustrates this case and shows this appropriate f—plot representation. In extreme cases the ionogram shows a broad band of weak scatter traces with no structure.

Dr. A. S. Besprozvannaya

Lacuna. The last seminar in our Institute was on the Lacuna phenomena. I want to attract your attention to the fact that in the Handbook there are no conditions of a full lacuna with the sporadic E-layer and slant Es- layer present. Nevertheless this situation is most typical for the high latitude ionosphere where the slant Es starts to grow not from the normal E-layer, but from Es (Handbook, p.109). An example of one of such ionograms is given In the Atlas of Ionograms III-7 Narssarssuaq where the slant Es starts to grow from the trace of the night E. How should the parameters of the F-2 and F—1 layers (A,G,Y) be reduced in this case? The same question arises if there are no re— flections from the slant Es in the ionogram but the trace at low altitudes (from the sequence of hours) can be with certainty assigned to the sporadic layer and the critical frequencies of the F-2 and F-1 layers wittingly should be above the limiting frequency of the Es trace (lacuna condition). What should be used in the limiting frequency of the Es— layer (whether the Y symbol can be used in this case?) and in the parameters of the F—1 and F—2 layers and the normal E—layer?

Chairman's comment

The Lacuna text in the Handbook, p. 48 section 2.75, was replaced by a new text INAG—16, p. 14. A fuller discussion will be found in the Warsaw meeting report INAG—12, p. 10—14. The point made in this letter is also stressed in the article by J. K. Olesen on 'Slant E condition' INAG-12, p. 14—19 which shows a typical slant Es — Lacuna series of ionograms.

I concur that full Lacuna with a slant Es trace from Es is a typical type of pattern and that it might be worth— while to have illustrated this case in the Handbook. I hope that adequate sequences of ionograms will be sent to use to show this case in the High Latitude Supplement. From the point of view of the operator, there are two distinct phenomena associated with the intense activity -(a) a gap in the traces which should be reflected over a certain range of height and (b) slant Es. The association of these in time makes the diagnosis of the phenomena certain. However, slant Es can occur without Lacuna, e.g., at low latitudes. I would like to point out that the definition of slant Es, section 4.83, p. 109, of the Handbook states, "At high latitudes the slant Es trace usually starts to rise from a horizontal Es trace, such as Es λ or Es f at frequencies which greatly exceed the E-layer critical frequency or from Es types r or night E traces." In using slant Es in the text, I had intended this meaning to apply and was stressing that Lacuna associated slant Es could also rise from a normal E trace or the use of A, G, Y, and foEs:

(a) foEs is deduced from the top frequency of the Es pattern from which the slant Es rises (see also comments on auroral Es p. 9 of this issue).

(b) Slant Es cannot blanket.

(c) If the Es trace is of a blanketing type and there are mood reasons to believe that blanketing is effective in screening the upper level, characteristics below the estimated value of fbEs should be replaced by A or (particle (night) E)) G.

(d) If the F1 trace is seen but the F2 trace is missing, the F2 parameters are treated as G cases (foF2 less than foF1). It is quite possible for a G condition to occur during or after a Lacuna event.

(e) If the F1 trace is missing, the F1 parameters are replaced by Y.

(f) If both F1 and F2 traces are missing, both F1 and F2 parameters are replaced by Y. We do not know whether a G condition exists because the Lacuna is present, Y, so the use of G would be completely wrong in this case.

('j) If the E region trace is Es, the problem of whether Y should be used depends on whether foEs is likely to be influenced by the Lacuna phenomenon. For low flat or auroral types of Es this is improbable. For particle E (night E) or retardation Es the appearance of the ionogram sequence will suggest when Y is needed, i.e., when the nose of the trace is missing. If there is no evidence suggesting that foEs is affected by the Lacuna, it would appear best not to use Y - we know Lacuna is present from the F—layer tables. However, this point should be discussed more fully in the Bulletin and at INAG meetings.

(h) Although slant Es frequently accompanies Lacuna and is usually present at some stage in a Lacuna sequence, its presence is not essential on particular ionograms. If the F traces are missing, Y should be used for the missing parameters except where (G) above applies. INAG invites further correspondence on this point.

<u>G. Pillet</u>

<u>Comments on INAG—17 (especially on the topics of the INAG meeting, Geneva</u>)

1. <u>f—plot representation of fbEs</u> (Sect. 8, p. 6). For the French stations, f—plots are drawn up at the station (without any later checking) and the adjacent fbEs numerical values are linked, without taking the different types into consideration.

2. <u>Letter P</u> (Sect. 9, p. 6), we agree for the draft definition of P as descriptive letter and for the use of P to denote Spur-type spread F.

3. <u>Tabulation of Spread-F types with standard parameters</u> (Sect. 10, p. 6). We support the Australian proposal of using descriptive letters F, *Q* and P in the foF2, h'F and fxI tables, respectively.

   We would agree to extend the meaning of L, to use it in the fxI table to indicate the presence of a continuous band characteristic of mixed type.

4. Frequency spread and range spread (Sect. 11, p. 7). We support the Australian proposal of always using F when the frequency spread exceeds a given limit. The point is to choose this limit as it could depend on the gain, ± 0.2 MHz is perhaps too low a value.

5. Night E - Particle E (Sect. 12, p. 7). We agree to replace "night E" by "particle E" and also on the definition given on top of page 8. We suggest to add "(see tables 10.3 and 10.4)" at the end of the sentence, after "having a critical frequency greater than that of the normal E layer

6. History of the stations (Sect. 16). We will send in October the information concerning this item and will indicate dates of changes in equipment and dates when the new Handbook rules were used in the French stations.

Chairman's comment

1. The W.W.S.C. felt that it would be useful to scientists if the f-plot distinguished between fbEs values due to different Es traces and the original rules were written to allow this (Handbook p. 152, section 6.6). However the facility does not appear to have been used in practice and many stations use the convention adopted by the French (see comments INAG-17, p. 6 on Fig. 6.15 of Handbook).

   INAG would like to know which convention you prefer and this will be discussed at Lima. The practical point is whether to keep the present wording of paragraph 1, section 6.6, p.152, of the Handbook or whether to omit "which are attributable to the same Es trace."

2. and 3. These appear to be generally agreed. *If you wish to object or raise an alternative, please inform INAG before or at Lima.* In the absence of objection, INAG will propose and formally adopt them.

4. This raises two points:

   (a) Should the limit for using F be dependent on the normal appearance of the ionograms or be fixed?

   (b) If fixed, should it be ± 0.2 MHz?

   The general convention in the past has been that a descriptive letter should not be inserted if it would apply to nearly all numerical values, i.e., it should be limited to cases where the phenomenon was abnormally intense for that station. For studies of the incidence of spread F over the world it is more interesting to know whether spread F was present or not, particularly at high latitudes where it is very common. This implies using a fixed interval, though it might be worth-while to incorporate local rules where the technical design or mode of operation of the ionosonde made the data misleading relative to that expected from a more normal ionosonde. This type of problem was raised by Turunen at the Geneva INAG meeting. *I wish to ask all INAG members to state their views on this as soon as possible and invite comments from all our readers.*

   We must note that there cannot be an ideal solution. If we get worldwide uniformity, it is at the expense of losing significance of F at the stations where spread F is most common. Would the scientists studying spread F phenomena be interested in a crude gradation with magnetic latitude, as is used in the magnetic K indices? We could adopt one limit below and another above a stated latitude (e.g., 55° magnetic?).

5. This amendment is a clarification and will probably be acceptable without discussion (see Section 4 below).

6. *Other administrations please do likewise!*

4. Particle E (night E).

Users of the Handbook have asked for guidance on the definition of night E, section 1.15, p. 17, when the normal foE cannot be seen.

INAG proposes to add in line 3 of 1.15 after normal E "see tables 10.3, 10.4, p. 209." INAG intends to present the amended definitions (see also INAG-17, p. 7) for ratification at the INAG meeting at Lima. *If you have any further amendments or views on the Physical Definition of particle F (INAG-17, p. 8), please let INAG know by letter or at the Lima meeting.* Thus far the consensus of views has been strongly in favor of changing the name 'night E' to particle E' (as in INAG-17, p. 7). The operators appear to prefer the operational definition as in section 1.15, p. 17, scientists prefer the physical definition. A reasonable compromise might be to give both. *What are your views?*

5. Auroral Es

The purpose of this note is to start discussions on the analysis of auroral Es traces so that similar procedures are used at all stations during the IMS. At present there appears to be considerable differences between different stations in the treatment of Es type a when the traces are variants of the bottom diagram of Fig. 4.29, p. 115, of Handbook (ladder types). The problem can be summarized by the statement that auroral type Es is usually oblique. It is possible that the bottom edge of the classical Es type (Fig. 4.29, top diagram) is overhead or nearly overhead but the other cases represent reflections at considerable angles to the vertical. To obtain uniformity of treatment we probably need a more or less arbitrary convention which should be as consistent as possible with our standard conventions and easy for operators to learn and use.

It is necessary to remember that the auroral Es traces which cause the difficulty are usually very variable in time. At most stations the top frequency of Es seen is relatively stable but h Es can vary over several hundred km in a short time. Physically it appears that particle activity is creating an Es or particle E (night E) Layer which is seen at oblique incidence, that the position of this activity is varying rapidly in time and that reflections are often possible over a range of distances or azimuths. It is probable that the real height of the reflecting structures is usually close to 100 km, the large range of virtual height being mainly due to the obliquity of the trace. Typically an Es a type trace represents conditions over a radius extending to beyond 100 km from the station, sometimes up to 400 or 500 km.

There are two main alternatives:

(a) To adopt a convention based on the principle that analyzed data should represent conditions near the station. This leads logically to meaning foEs from the lowest part of the auroral Es structure and ignoring all traces above an arbitrary preset height. The value of foEs is then very variable in time and nonrepresentative.

(b) To regard the Es type a patterns as one entity in which the maximum top frequency of any trace represents the densest Es near the station and h'Es represents the slant range to the nearest part of the Es structure. An alternative to (b) might be to take the slant range to the trace with the highest value of foEs, this gives the approximate range of the trace but will not be the minimum height of the Es pattern and will be very unstable in time and therefore nonrepresentative.

Very frequently there are two or more distinct Es patterns, at widely different slant ranges. Should only the lower be considered? Should the one with the highest value of foEs be considered? As rapid time sequences show that the patterns often run together or separate should the separation seen on a single ionogram be ignored and minimum height and maximum critical frequency for the pattern as a whole be adopted as in (b) above?

Scientifically and for practical communications the maximum critical frequency in the zone seen from the station is probably the most significant parameter obtainable from synoptic measurements and the slant range to the nearest part of the structure is probably the most useful height parameter but these come from different structures. INAG would like to have the views of both scientists and station operators on this problem and would like to start a discussion on the merits of different possible conventions.

6. On Spread-F Typing

The following additional notes on the paper by G. Cairns, INAG-17, p. 15—16, have been contributed by D. G. Cole. I would like to give the background of the scaling rules described by G. Cairns.

"The rules were devised for local use at a time when INAG had not adopted any particular usage of descriptive letters for range spreading. Our purpose was to scale the spread F as simply as possible and yet retaining as much information as possible. We felt two columns of a scaling sheet should be set aside for this since this allowed range and frequency spread characteristics to be separately monitored. Our system of distinguishing between resolved and unresolved spread was based on the assumption that this indicates the fading characteristics of the spread for propagation purposes. Mixed types of spreading can be identified by entries in both the range spread and frequency spread columns. An example of our scaling is shown in Figure 1.

While I would agree that most range spread is resolved when clearly not a mixed type and most unresolved range spread is associated with a mixed type, there are a number of occasions where this is not so. I have included here some copies of ionograms showing what I believe is resolved range spread with resolved frequency spread (Figure 2), unresolved range spread accompanied by resolved frequency spread (Figure 3), and resolved range spread extending to the critical frequencies (Figure 4). All of these cases can be defined by our two columns (Figure 1).

Our feelings are that one column with different descriptive letters is not enough to adequately define spread F for useful purposes. Extra space is required either for describing the different types separately or for quantifying the spread. Of course, the spaces may be those already used for describing foF2, h'F, etc.

We agree that in our present system K (resolved spread) could reasonably become *Q* and our P (unresolved spread) could be described by K, although this would mean resolved frequency spread will be described by Q.

We can change our scaling rules immediately if required but we would rather wait until an overall scheme is endorsed by INAG when we could then convert our descriptive letters within the computer. Since our scheme is for our own local use we feel justified in this.

We would be interested to hear what opinions other people have of our scheme. Is it useful in its present form? Should we publish the scaled data?
With best wishes to you in our new post."

Q = Resolved Spread
K = Unresolved Spread
R.S. numbers in km of spread
F.S. indices refer to extent of spread

IONOSPHERIC DATA

STATION .... DATE ....

LMT	fmin	foE	h'E	Es type	fEs	fbEs	h'Es	R.S.	F.S.	foF1	h'F	foF2	(M3000)F2	fx(I)	(M3000)I		LMT
00				1973	SEPT	8	0005	75 Q	2 Q								00
01				1973	AUG	15	2315	50 K	2 Q								01
02				1973	SEPT	22	0000	25 Q	2 Q								02
03																	03
04																	04
05																	05
06																	06
07																	07
08																	08

Fig. 1. Examples of Spread F Scaling

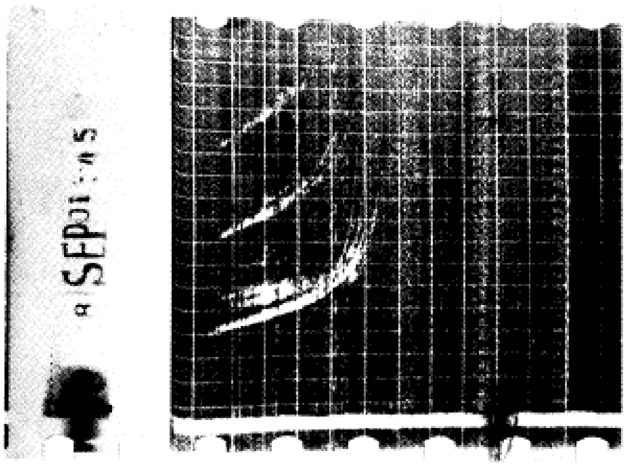


Fig. 2. September 8, 1973
0145 Vanimo
Resolved range spread
Resolved frequency spread

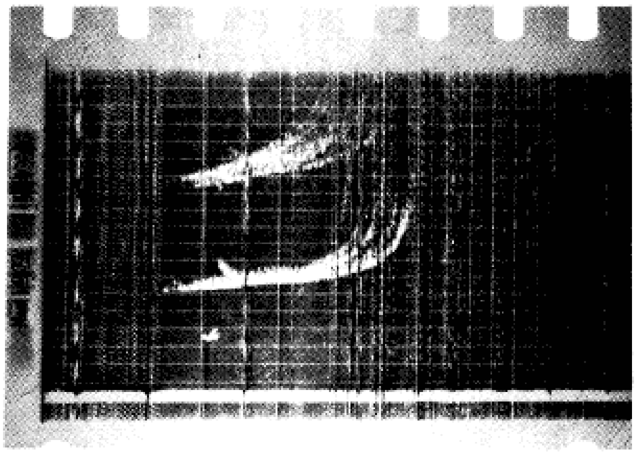


Fig. 3. March 19, 1973
2315 Canberra
Unresolved range spread
Resolved frequency spread

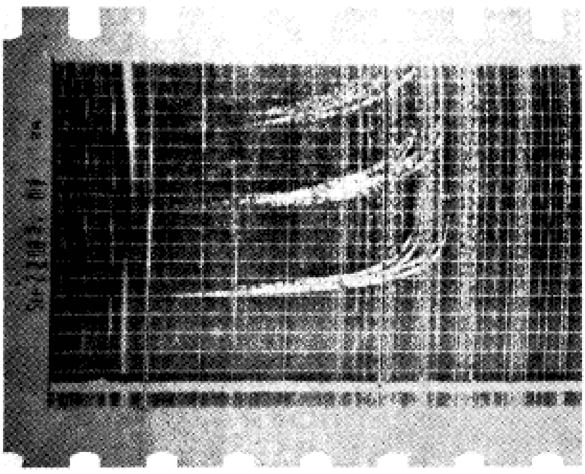


Fig. 4. September 22, 1973
0000 Brisbane
Resolved range spread
extending to critical frequencies

Chairman's comment

These points will be discussed in detail at Lima, where we hope to get agreement on spread F scaling.

The main difficulties in dealing with spread F are to make a proper compromise between a complete description of the phenomena, which would be ideal for the scientist, and the need for economy in number of tables to be published and the work needed by the scalers. In practice very few administrations are prepared to add significantly to the present effort. In practice most scientists prefer to analyze complex patterns themselves so that they know what the data mean. The synoptic measurements are, therefore, planned to show where and when phenomena occur but not necessarily to fully describe them. We would like to have as many views on this as possible.

7. Notes on INAG-16 by T. Turunen

These notes were sent to the Chairman as input to the INAG meeting at Geneva.

1. The sequence of ionograms on INAG-16, page 7, showing night E-layer with Es-h is quite common in Sodankyla when the ionosonde is adjusted to give some amplitude information. I feel that usually there is some Es-like disturbance in Night E and also scatter. If one does not have amplitude information the pattern appears to be, in such cases, auroral type Es.

2. fxI and ridges of ionization. At Sodankyla, there are certainly systematically behaving night time F-layers of steep gradient. The gradient is so steep, that it is possible to measure the angle of the oblique echo by using horizontal antennas at a fixed frequency. The oblique echo at Sodankyla can be seen practically every night at least in equinoxes and sometimes also during daytime. It is clear also in cases when overhead foF2 is very small. It disappears only during exceptionally quiet conditions. I have made measurements at 4.2 MHz.

3. I suggest that it is time to make at least the basic rules for interpreting ionograms on which amplitude information is accurate. This is very important and may be that in high latitude sounding it is more important than elsewhere.

Chairman’s comment

1. There is little doubt that the use of short differentiator time constants greatly increases the difficulties of ionogram interpretation when spread traces are present. Although increasing the time constant decreases the effective signal to noise ratio of the ionosonde, in most cases at high latitude stations it is preferable to accept this loss. It is very important to keep some amplitude information so that the main trace can be seen through the scattered traces. It is also very important that the second order trace can be seen at high latitude stations so that tilt phenomena can be readily recognized. This means that the normal height range recorded at such stations should be 1000 km. INAG recommends attention to these points to administrations responsible for high latitude stations.

   The main distinction between particle E (night E) and retardation type Es depends on the relative amplitudes of the two types of traces. I concur that weak scatter can make particle E or retardation Es traces appear like auroral Es traces when no amplitude information is present on the ionogram.

3. It is usually undesirable to try to set up international rules until there is a reasonably wide spread use of a given technique, e.g., the special difficulties of digital ionosondes have not as yet been raised internationally. I feel that this proposal is premature.

8. Gain Sensitive Parameters

The following notes have been contributed by T. Turunen (Geophysical Observatory Sodankyla, Finland) (INAG-17, p. 4) in response to a request made by INAG at its Geneva meeting. Turunen s results are of wide interest for the interpretation of gain sensitive parameters and other groups may be interested in trying similar methods. This work forms part of a European Regional Cooperative Effort (INAG-15, p. 13-14).

A new automatic gain control system by T. Turunen

A new automatic gain control unit for ionosonde was installed in the beginning of April 1974.

The amplitude of the strongest echo is kept constant if:

1. The mean value of the amplitude increases with increasing frequency

2. The mean value of the amplitude decreases <u>slowly</u> with increasing frequency

3. Rapid variations in the echo amplitude are within the range of normal fading.

If the strongest echo decreases by a large amount and the decrease is not slow, the gain is not altered but the median value of the gain control voltage generated during the last few hundred kilohertz of frequency sweep is used instead. If, however, the amplitude of the echo increases later above the level which was obtained before the gain control voltage was locked, the automatic gain control again starts to compensate the amplitude variations the way described above.

The gain remains thus constant from that frequency on, at which the deviative absorption begins to cause decrease in the amplitude of the F-layer echo or, in case of total blanketing, the reflection coefficient of the Es-layer begins to decrease.

The automatic gain control described above has some important consequences:

1. The change in absorption causes change in the signal—to—noise ratio but not in the amount of weak echoes. Thus the numerical values of the gain sensitive parameters are no more dependent on absorption. This is, of course, true only within certain practical limits.

2. The system is easy to keep stable with time.

3. The dynamic range of echo is known. In Sodankyla the weakest echo seen on the film is about 26 dB below the strongest echo. This is again true only within practical limits.

4. There is no need to use differentiation.

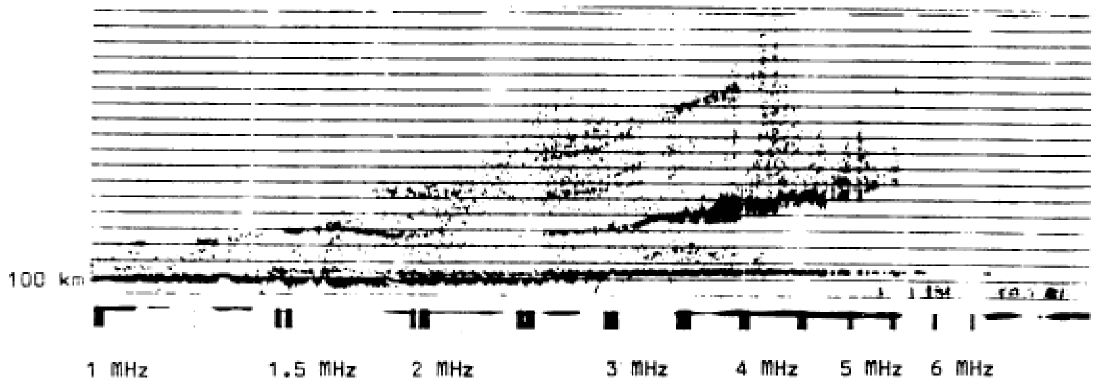
5. fmin data are not comparable with data from stations using conventional gain control methods. However, fmin is now a very nice and accurate measure of absorption.

6. There is frequently a nice trace when spread F is present giving reasonable numerical values without difficult interpretation.

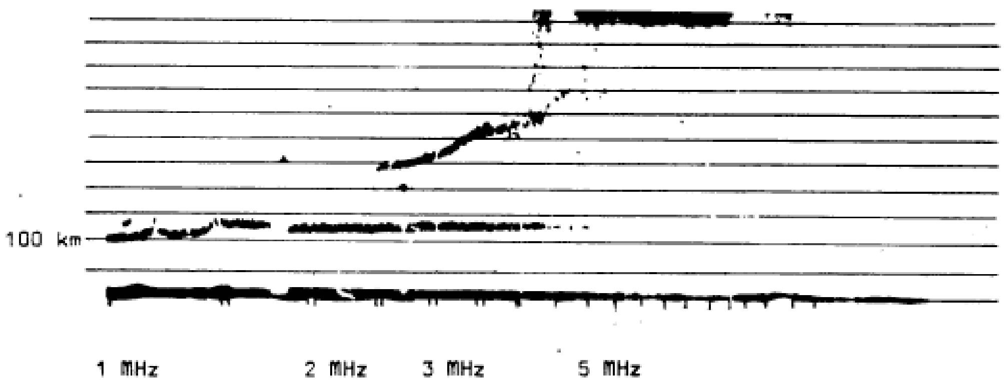
<u>Effect of gain and differentiation on ionograms by T. Turunen*</u>

Figure 1 shows simultaneous ionograms taken by using same transmitter and same antennas but different receivers, The first one has automatic gain control and the gain is highest possible which can be used before interference is going to be serious problem. The differentiator time constant is comparable with the pulse length (100 μs). Another ionogram is taken by using very low gain and differentiator time constant is much longer than pulse length. In the high gain ionogram auroral type Es is seen, in the low gain one there seems to be E-layer echo with high type Es. The explanation for this difference is that in the auroral zone we usually have weak scattered echoes at least in the neighborhood of E-layer critical frequency. Although these echoes are considerably weaker than total reflection echoes, they can, when gain is high, saturate the last stages in the receiver and differentiation makes “cloud of echoes” and there is no information about the echo amplitudes. In fact often weak echoes are favored because there are more occasional minimums between weak echoes but the neighborhood of strong echo is continuously saturated.

In Figure 2 ionograms taken at short intervals with different differentiation and high gain are seen under quiet ionospheric conditions. It is clear that when we differentiate we change ionogram very much and we certainly make systematic errors in parameters. Finally Figure 3 shows what happens in the receiver. The phenomenon is serious at E-layer heights and of course also when spread F is present. It appears, at least in Scandinavia, that differences between data from different stations are caused more often by equipment than by the scaler, at least nowadays.



a)



…………………………………………………………………..

* Figs. 1, 2 and 3 above have been reproduced from electrostatic copies rather than from glossy prints. In order to expedite the printing of this Bulletin and its dissemination, the INAG Secretary asks you to forgive the quality of the reproductions. Prof. Turunen, in a telephone conversation, reported his originals had been sent to Mr. W. R. Piggott while the manuscript was being prepared. It was not considered worthwhile to await the possible receipt of the glossy prints from Mr. Piggott.

Fig. 1. Simultaneous ionograms 20.6.1973. 20.40 LT, Sodankyla

Same transmitter and same antennas are used.

a) Automatic gain control (highest possible gain) and differentiation. Time constant approximately same as pulse length (100 μs). Auroral type sporadic E layer is seen.

b) Fixed low gain and long time constant in differentiation. Sporadic-E layer resembles more that of type high than auroral and sequence shows that it should be of type high.

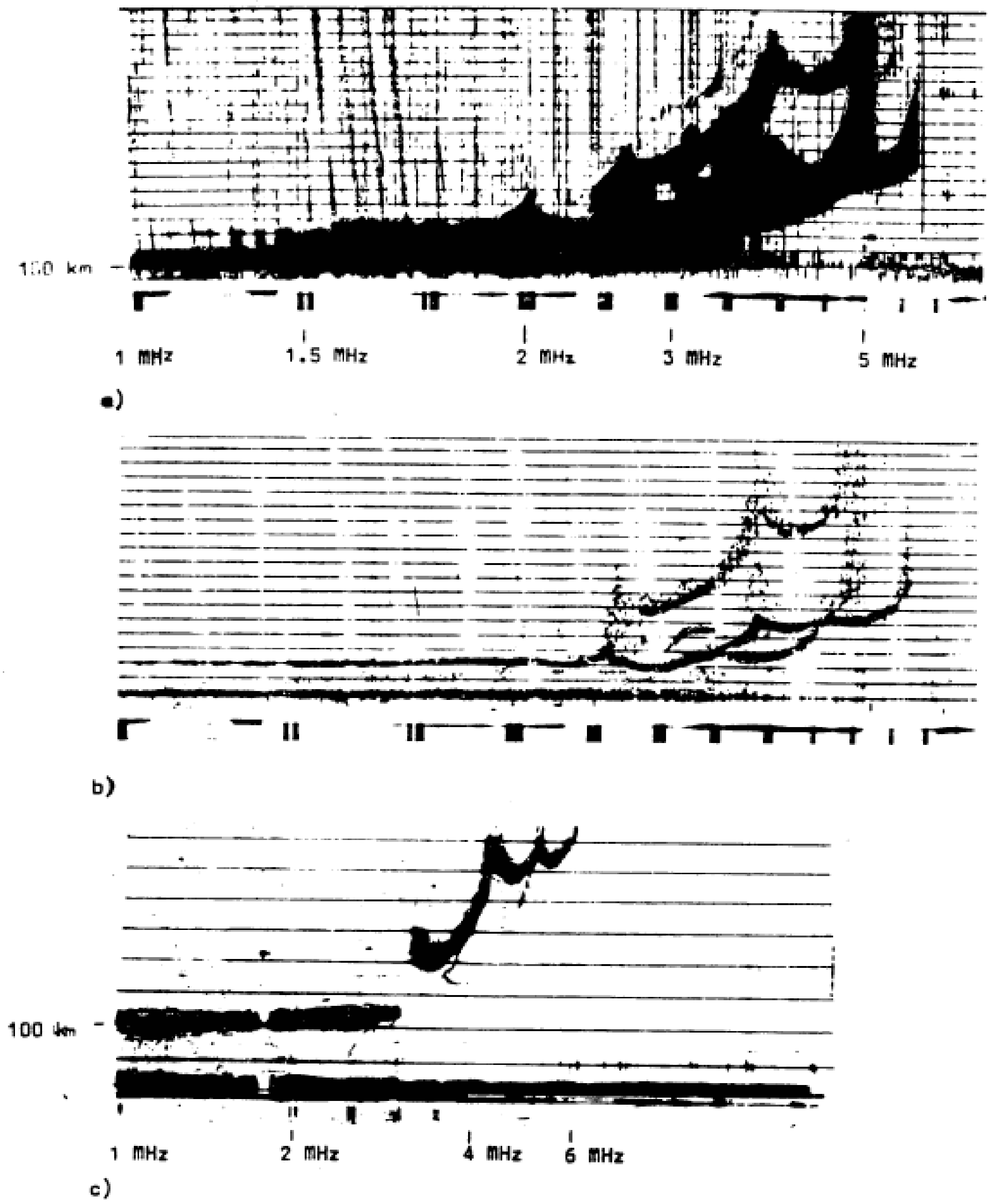


Fig. 2. a) High gain without differentiation

b) High gain with differentiation, time constant approximately same as pulse length

c) Low gain ionogram with differentiation, long time constant. Ionograms almost simultaneous 25.6.1973

13.40 LT, Sodankyla.

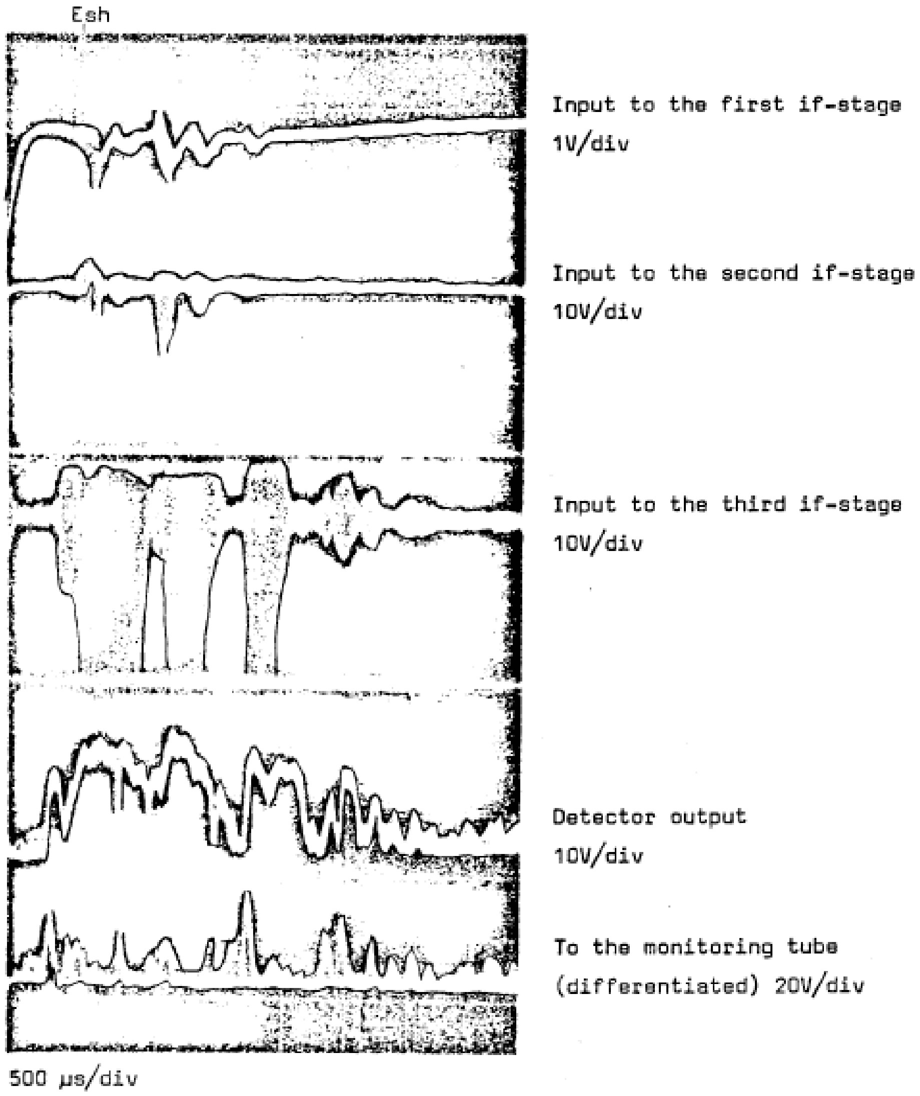


Fig. 3. Effects of too high gain and differentiation in ionospheric sounding. Ionosonde has 10 kW output power, pulse length 100µs, antenna is rhombic, height of mast 64 meters. Frequency 2.7 MHz (0.25 MHz over foE). Ionosonde is located at Sodankyla.

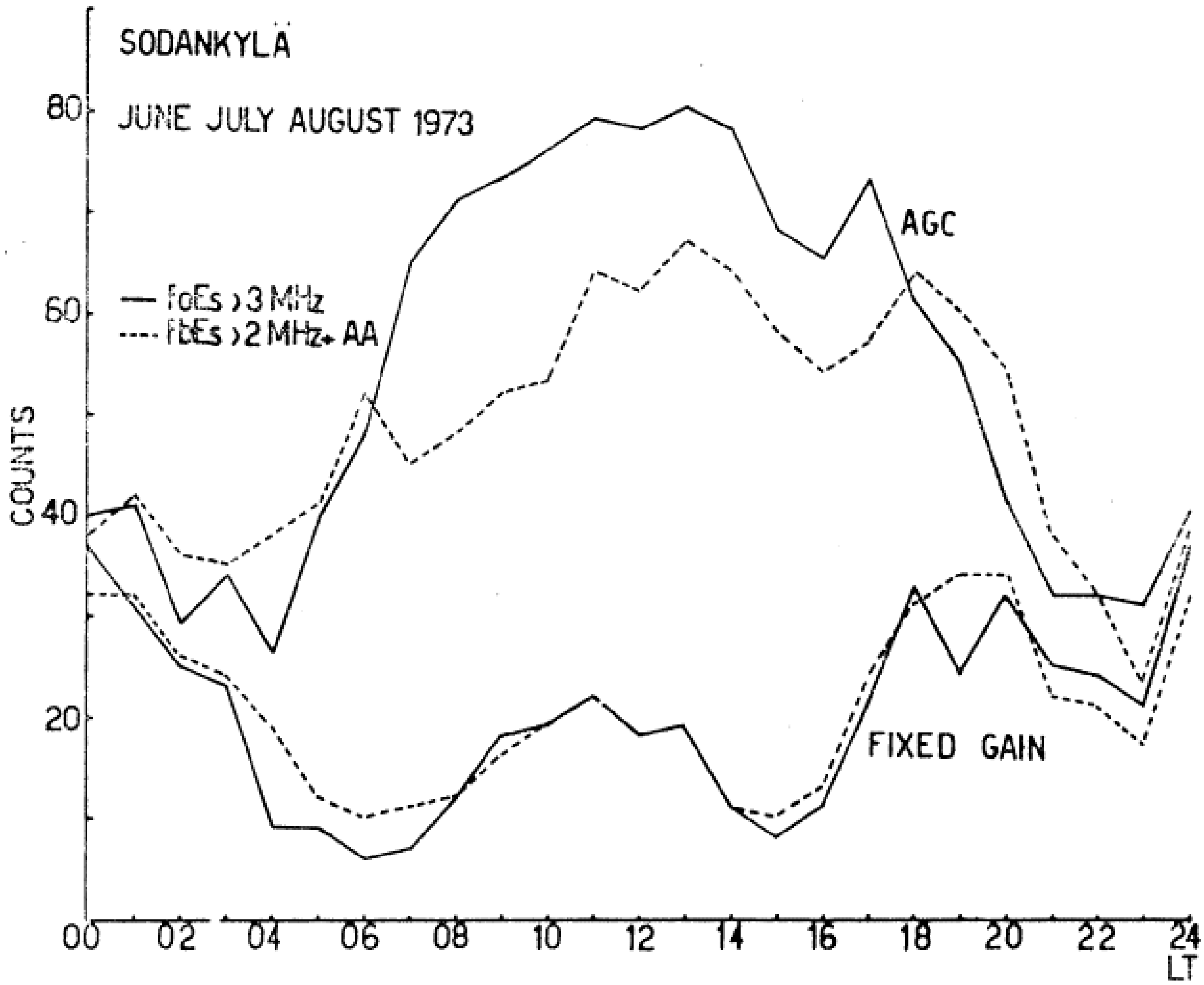
9. Some Effects of Receiver Design on the Measurement of fbEs and foEs

T. Turunen

It is important to examine the differences in ionospheric parameters due to the design of the ionosonde and, in particular, to effects of gain used. Some results are given in the Figure from a comparison between the number of times foEs exceeded 3 MHz and fbEs exceeded 2 MHz (including all AA cases) for June, July and August 1973 at Sodankyla for two different systems of operation.

a) A fixed low gain system. This is fixed at a low gain value so that there are no difficulties due to interfering stations.

b) A disturbance controlled AGC system in which the gain varies so that noise and interference are at a fixed level. This is the extreme high gain case. Since the AGC system (b) is much more sensitive than the fixed gain system (a) foEs is higher for (b) than for (a) and the count is larger. For the same reason, fbEs would be expected to be lower for (b) than for (a).



In the fixed gain system all gain-dependent parameters are modulated by D-layer absorption, the — AGC-system overcompensates the effects of D layer. The foEs curves probably show some kind of envelope within which the real foEs behaviour exists.

In the AGC sounder, the main Es type is low. This type is very rarely seen at fixed gain. So the λ type belongs to "weak scattered types". However its amplitude is often larger than that of the x-component from E layer and it sometimes shows even multiple. So what is "weak echo" in ionospheric sounding?

Because the AGC system is always much more sensitive than fixed gain it is understandable that foEs is higher with the AGC system. However, the corresponding fbEs-curve for the AGC system should always be below that for the fixed gain system. It is not. The explanation is systematically occurring saturation of receiving system by weak E-layer scatter which is always seen. This means that E layer and sometimes also parts of F layer seem to be blanketed although they are not. I believe that this error is common in heavily differentiated sounders, which are at the same time very sensitive. Note that in Sodankyla in both cases the gain is however so low that we had never difficulties caused by interfering stations even below 1.6 MHz during the time when the test was made.

10. Future of the Ionosonde Network

The following circular has been sent out by U.R.S.I. WG 3.2, who invite comments from WG 1. and from readers of the INAG Bulletin. Please send any contributions direct to Dr. H. Rishbeth.

It is unlikely that WG 3.2 have direct contact with all the Regional Groups who are planning to extend the VI network during the IMS and Convenors of such groups are asked to send their proposals to Dr. Rishbeth. Administrations who are planning to set up new stations or close existing ones are also invited to indicate their probable plans. INAG is aware of a number of proposals for new stations which are subject to financing being available. It would help the general planning if these could be identified even though the money has not been allocated and the future of the station is therefore doubtful.

Circular follows

TO MEMBERS AND CORRESPONDENTS OF U.R.S.I. WG 3.2

THE IONOSONDE NETWORK

The Chairman and Vice-Chairman of WG 3.2 would like to have your views on scientific requirements for ionosondes. If you have any comments on this topic, and specifically on the matters mentioned below, please send them to one or both of the undersigned.

1. It seems unlikely that the world-wide ionosonde network will remain at its present size for long. Certain individual stations have been under critical review. Besides difficulties of finance and staff, some old ionosondes are getting increasingly hard to maintain and the question of how or whether to replace them is becoming urgent.

2. The Working Group could render a valuable service to radio science by considering what kinds of measurements are needed scientifically and where they should be made. It should base its opinions on scientific needs only: other people, such as radio communications users, can speak for themselves.

3. What technical specification should an ionosonde have? What should it measure? How accurately? How often? How should the data be displayed and reduced?

4. In particular would the Working Group recommend extensive use of

   (a) The Kinesonde technique? (JATP 31, 925 (1969)).

   (b) The directional ionosonde? (Plan. Sp. Sci. 19, 1387 (1971)).

   (c) A device to measure HF absorption continuously?

   (d) Fixed-frequency HF phase height or doppler recordings?

   (e) Any other refinements?

5. The siting of ionosondes is determined by many factors besides scientific ones. It is not feasible to plan a completely new network. But if the Group can agree on what stations are particularly important, this may be useful in the future, should proposals ever be made for closing any of these key stations. Perhaps there should be a distinction regarding time scales, namely (a) present requirements, (b) requirements during the IMS (circa 1976-1978), (c) requirements after the IMS.

Dr. H. Kohl, Chairman
Max-Planck-Institut fUr Aeronomie
3411 Lindau/Harz GERMANY

Dr. H. Rishbeth (Vice Chairman)
Appleton Laboratory
Ditton Park
SLOUGH 5L3 9JX ENGLAND

26 March 1974

11. Translations of U.R.S.I. Handbook of Ionograms Interpretation and Reduction, Second Edition

(See also INAG-17, p. 4, for Spanish, Finnish and French translations see INAG-12, p. 9, for U.R.S.I. Recommendations III.4.)

Dr. I. Kasuya reports that the Japanese translation of the Handbook was published in June 1974 and that copies will shortly be circulated to those interested. Inquiries should be directed to:

Dr. Isao Kasuya
Director of Radio Wave Division
Radio Research Laboratories
Ministry of Post and Telecommunications
2-1. Nukui-Kitamachi 4—chome
Koganei -s hi
Tokyo 184, Japan

WDC B2 has prepared a Russian version of the Handbook which can be obtained by application to:

Mrs. A. N. Sukhodolskaya
World Data Center B2
Molodezhnaya 3
Moscow 117296, U.S.S.R.

12. Reports from World Data Centers

World Data Center A for Solar-Terrestrial-Physics, Boulder, Colorado U.S.A. 80302

During the twelve month period July 1973 through June 1974 WDC-A received about 2800 station months of vertical incidence data; 700 of these were ionograms from 51 stations and 2100 were hourly values from 129 stations. In the same twelve months 97 requests were made for ionograms and over 1100 station months of ionograms were disseminated. There were 149 requests for hourly values for which 16,500 station months of data were disseminated. Thus 1.5 times as many ionograms and about 8 times as many hourly values of ionospheric data were distributed as received during the year. The volume of hourly values distributed amounts to about 40% of the total holdings in the ionospheric discipline. This indicates significant demand for and use of the archives.

In addition, the monthly publication *Ionospheric Data* was given worldwide distribution; and special compilations of ionospheric data were included in the Report UAG-28, “Collected Data Reports on August 1972 Solar-Terrestrial Events,” Report UAG-34, “Absorption Data for the IGY/IGC and IQSY” was a compilation of ionospheric absorption measurements by the pulse reflection technique Al.

World Data Center B2 for Ionosphere, Moscow

1. From January through December 1973 WDC-B2 received 1758 station months of ionospheric data from WDCs A, C1, C2 and ionospheric stations including 1432 station months for vertical ionospheric sounding.

   In 1973, 6017 station months were disseminated in reply to the requests. The users of WDC-B2 were provided with 6080 station months.

2. WDC-B2 has prepared a Russian version of the U.R.S.I. Handbook of Ionogram Interpretation and Reduction. Second Edition. November 1972 (Report UAG-23)

Mrs. A. N. Sukhodolskaya

Chief of the Ionospheric Group

World Data Centre C1 for the Ionosphere, Slough

Established in 1957 as the European sector World Data Centre for the Ionosphere. Receives data from a world-wide network of ionospheric stations and from several solar and magnetic observatories. Sends out data and information on request and provides facilities for scientists to study in the centre. Publishes annual catalogues. Brief summary of data held as follows:

IONOSPHERIC:

Vertical incidence ionogram parameters in monthly bulletins of hourly values and medians, from about 200 stations. Some data available on punched cards and magnetic tape. Much pre-1957 data, e.g., Slough from 1931.

Frequency plots (f plots) of quarter hourly values, mainly for Regular World Days.

Ionograms, mainly on 35 mm film. Maximum number of stations of about 100 in IGY, IQSY.

Absorption as measured by Pulse echo, Riometer and C.W. field strength (A1, A2, A3).

Ionospheric drift, whistlers and V.L.F. emissions, back scatter, forward scatter, total electron content and atmospheric radio noise.

Sudden ionospheric disturbances, enhancement of atmospherics and short wave fadeouts. H.F. predictions from Argentina, Australia, France, India, South Africa, U.K., U.S.A.,

U.S.S.R., B.B.C. summaries of H.F. Propagations.

Topside ionograms from Alouette and Isis satellites for several telemetry satations. Alosyn (Alouette synoptic) data and world maps of orbital data.

World maps, contoured and colored, of plasma frequency at about 550 km from Ariel III satellite; also on color slides. Computer print-outs of comparisons between ground station foF2 and satellite plasma frequency for about 100 stations. Orbital plots of radio noise at 5, 10, 15 MHz from Ariel III.

SOLAR

Radio Noise from Ondrejov (Czechoslovakia), Tremsdorf (Germany), Slough.

10 cm Flux (Ottawa) since 1947.

Sunspot numbers, past and current, and sunspot positions on disc.

Photographic Journal of the Sun (Rome).

MAGNETIC

IUGG Geomagnetic Planetary Indices, K indices from several observatories including Hartland and Lerwick. Books of Magnetograms and Hourly values.

Auroral Electrojet indices AE and hourly Equatorial Dst.

PUBLICATIONS:

Publications held include IGY annals and IQSY notes. Current publications received include reports (UAG, COSPAR, IAU, URSI, Solar-Geophysical Data, Penn. State) and bulletins (AFCRL Geophysics and Space Data, IAGA, NOAA Enviromental Data Service).

World Data Centre C1
Appleton Laboratory
Ditton Park
Slough, Bucks. 5L3 9JX, England

Use of Ionospheric Data by R. W. Smith, Slough

In the early fifties, I was in charge of a small ionospheric observatory in Singapore where we operated an ionosonde, A1 absorption equipment and a magnetometer. At the end of each month we had to prepare the data for inclusion in the monthly bulletin published by the Radio Research Station -now the Appleton Laboratory - at Slough. There was frequently a rush to meet the deadline of the end of the first week of the following month and I often wondered - as no doubt many of you still do -who used our data and why it was required so quickly.

Some twenty years later, I find myself working in the ionospheric World Data Centre for the European zone at Slough, with duties which include answering queries from would-be users and supplying them with data. I now have a much better idea of who uses our data, what they use it for and why current data are so important. By way of illustration, I have selected the following four requests taken from about forty which we have received during the past six months:

1. All IGY, IQSY A1 absorption and foE data for a scientist at a European University. Required for prediction purposes.

2. Ionograms, preferably quarter-hourly, for several short periods during the past five years from European stations. Required by a post-graduate student who is studying travelling disturbances.

3. foEs and fbEs data for the summer months of 1973, for the study of Es clouds as seen on back scatter radar.

4. Normal E-region profiles, derived from high quality ionograms, for studying a possible link between the troposphere and ionosphere.

All these are university requests, but we have received many of a similar nature from other establishments.

As for the time factor, current data are required both by the predictions people and by scientists who have noticed special phenomena. Early circulation is most important at the present period of uncertainty near the time of sunspot minimum.

R. W. Smith
WDC-C1
Appleton Laboratory

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

Activities for the period April 1973 - March 1974:

1. Data received from WDCs A, B2, C1 and Ionospheric Stations:

Booklets and Sheets:	2000
Microfilms:	45 rolls of 1000 feet each
	129 " "100 " "
Microfiches:	15 leaves

2. Data sent and lent to users:

To	Other centers	Domestic researchers	Foreign researchers	Total
Booklets and Sheets	119	1068	10	1197
Microfilms (roll)	120	876	35	1031

3. Adjustment and compilation of microfilm data in office:

Microfilm from WDC - A	Ionograms	(19) reels	(1000 feet each)
	Others	(9) "	(100 " ")
Microfilm from WDC - B2	Ionograms	(26) "	(1000 " ")
	Others	(93) "	(100 " ")
Microfilm from WDC - C1	Ionograms	(25) "	(100 " ")
	Others	(2) "	(100 " ")

4. WDC - C2 Catalogue of Data for Ionosphere:

   Cumulative catalogue of ionosphere data for the period 1 July 1957 - 31 March 1974 will be available in August 1974.

5. Daily hourly values of Japanese ionospheric data are stored on magnetic tape from June 1968 onwards.

13. International Geophysical Calendar for 1975

The Calendar for 1975, reproduced here, was published in August 1974. Full details of programmes of observation and data interchange are given on the back of the published version. Copies can be obtained from the INAG Secretary.

International Geophysical Calendar for 1975

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

JANUARY

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

FEBRUARY

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

MARCH

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

APRIL

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

MAY

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

JUNE

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

JULY

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

AUGUST

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

SEPTEMBER

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

OCTOBER

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

NOVEMBER

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

DECEMBER

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

JANUARY 1976

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

(14) Regular World Day (RWD)

(15) Priority Regular World Day (PRWD)

◇12 Quarterly World Day (QWD) also a PRWD and RGD

8 Regular Geophysical Day (RGD)

[11] Day of Solar Eclipse

14* Dark Moon Geophysical Day (DMGD)

[5 6] World Geophysical Interval (WGI)

[3 Day with unusual meteor shower activity, Northern Hemisphere

5] Day with unusual meteor shower activity, Southern Hemisphere

10 11 Airglow and Aurora Period

NOTE: For the Antarctic and Southern Hemisphere Aeronomy Year (ASHAY) there are plans to coordinate experiments within the 18 months September 1975 through March 1977. Contact is S. Radicella (Argentina).

OPERATIONAL EDITION, August 1974

SEE OTHER SIDE

14. Station Notes

Fort Archambault

The French ionospheric station at Fort Archambault (now called Sahr, Chad) was originally set up in January 1969 and finally closed in February 1974. The ionosonde was operated every 15 minutes during this period. Ionospheric drift measurements (D1 method) were carried out on a non-routine basis in order to study the equatorial electrojet in connection with a fast run magnetometer network, operated by an ORSTOM group (Office de la Recherche Scientifique et Technique Outre Mer).

Sodankyla Geophysical Observatory

Mailing address: Geophysical Observatory
SF-99600 Sodankyla, Finland

Coordinates: Geographic $\Phi = 67°22'N$, $\lambda = 26°38'E$, h = 180 m

Geomagnetic $\Phi = 63.8°$, $\Lambda = 120.0°$, $\Psi = 26.7°$, dip = 76.7°

Corrected Geomagnetic $\Phi = 63.4°$, $\Lambda = 108.9°$, L = 5.2

Magnetic Station: In operation since January 1914. For technical details, see the sheet of "special events". Time used: UT. Observer-in-charge: Eero Kataja.

Ionospheric Station: In operation since August 1957. Time used: EET (UT + 2^h)
Observer-in-charge: Tauno Turunen.

Routine vertical sounding half hourly, centered at 2.8 MHz passage. Recording on 35 mm film.

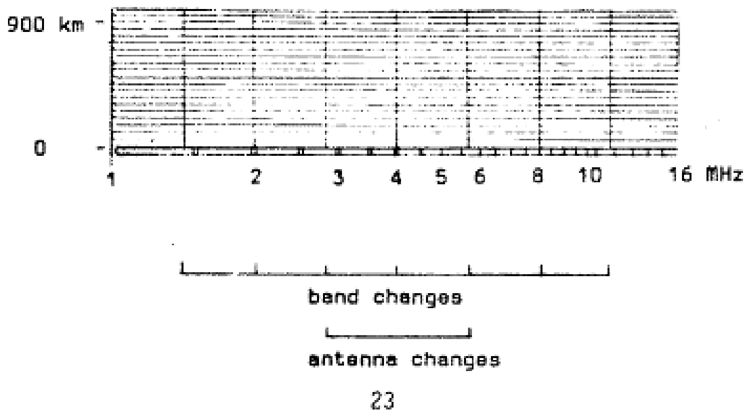
Frequency range : 1.0 - 16.0 MHz, in 8 bands, bandchange at 1.4, 2.0, 2.8, 4.0, 5.6, 8.0, and 11.3 MHz

Sweep time	: 8 mm, 1 mm per band
Peak power	: 10 kW
Gain control	: automatic, rapid
Pulse repetition rate	: 50 /sec
Pulse length	: 100 μs
Frequency scale	: logarithmic, frequency markers every 0.5 MHz
Height range	: 900 km
Height scale	: linear, height markers every 50 km
Aerials	: 3 rhombics, Antennas change at 2.8 and 5.6 MHz TR- switch, height of mast 64 meters
Differentiation	: Time constant approximately the pulse length

Using another independent receiving system ionograms are recorded using almost fixed gain, longer time constant in differentiation and better height resolution. Parameters of this recording system are changed according to special demands.

Scaling according to URSI Handbook of Ionogram Interpretation and Reduction edited by W. R. Piggott and K. Rawer (1972).

Ionogram parameters



INAG-18-19 September 1974

Special features:

Because of rapid automatic gain control f-min data not comparable with f-min data from other stations. In practice gain is very high compared with the gain values which are practical when fixed gain is used. Es-d reflections are usual, weak Es-λ almost always seen. Usually there are no problems caused by interference.

Only those ionograms where AGC is used are scaled. Fixed gain ionograms which are recorded simultaneously are used only in special studies and in the cases when main system fails.

15. The Use of fmin to Detect Ionospheric Effects Associated with Solar Proton Precipitation

by

W. R. Piggott and E. Hurst
Appleton Laboratory,* Ditton Park,
Slough 5L3 9JX, England

Solar proton events have been studied for a number of years using high energy proton detectors on spacecraft. Data have been collected systematically by the International Union for Pure and Applied Physics, Reporter for Cosmic Rays, M. A. Shea, who has made them available to us for comparison with ionospheric data.

A preliminary examination showed that the satellite detectors could detect all events capable of giving measurable ionospheric effects and, in fact, showed many with no detectable ionospheric response. This could occur either because the flux of particles was too small or their penetrating power too weak.

Piggott and Shapley [Antarctic Research, Geophysical Monograph No. 7, 1962, pp. 111—126] showed that ionosonde methods of detecting polar cap absorption (PCA) are usually appreciably more sensitive than the use of riometers or forward scatter techniques. They also showed that the relative magnitudes of different events differed greatly with the radio frequency used to detect them, the ionosonde and A1 absorption being mainly sensitive to abnormal ionization formed above about 70 km and the riometer and forward scatter more sensitive to abnormal ionization formed at lower heights.

The solar protons are restricted to the polar cap area by the magnetic field, and only stations in this zone would be expected to show PCA effects. The main practical difficulty is to separate, from hourly tabulations, abnormal absorption due to PCA events from abnormal absorption due to auroral and relativistic electron precipitation events. The main criteria are that the former are widespread, slowly varying in time and larger in the sunlit than in the dark sectors, the latter limited in area, irregular in time and usually more evident at night than in the day.

The following stations in the Northern and Southern hemispheres were chosen mainly on grounds of position and availability of data:

> Godhavn, GO; Resolute Bay, RB; Thule, TH; Tromso, TR (when Thule not available); Mawson, MW; Scott Base, SB; Terre Adelie, DU; Wilkes, WL.

Every occasion of proton detection reported by satellites was investigated for increases in fmin exceeding 1 MHz above the monthly median value, the size of the increase, in units of the nearest MHz being noted for each hour. The data from all stations were then compared and PCA events identified. The criterion for the start and end of an event was that at least two stations should show excess absorption. All data were examined for possible auroral event contamination and this was eliminated as far as possible. It can, however, cause errors in the start or end times of some events. In some very weak short lived events it is quite possible that the event was really auroral in type rather than PCA. Such events are marked as doubtful by enclosing them in brackets. The events have been classified using the system described in detail by Piggott and Shapley [loc. cit.], namely:

(VW)	Very weak, doubtful	W	weak	L	large
VW	Very weak	M	medium	VL	very large

In general a medium event gives widespread blackout during sunlit hours, a large event blackout at all hours of at least the majority of the test stations. Most (VW) and VW events would not be expected to cause serious field strength losses to communication circuits crossing the polar cap.

* formerly Radio and Space Research Station.
W. R. Piggott is now with the British Antarctic Survey.

A list of detected events for the years 1964 to 1969 is given in Table 1. The stations showing abnormal absorption during the event are identified using the code given above.

It is interesting to estimate the fraction of proton events seen by satellites which caused significant abnormal absorption. M. A. Shea, for the period studied, lists 545 events, which we have condensed into 327 periods of activity. The table shows 76 reliable and 24 doubtful cases of absorption. Thus, the fraction of proton events seen by satellites in 1964-69 which give detectable changes in fmin lie between 1 in 7 and 1 in 3; the most probable fraction appears to be near 1 in 6. Only one half of the detected fmin events would be expected to cause serious dislocation of polar HF communications, i.e., about 1 in 12 of the satellite events.

As usual, the duration of the PCA increased, on average, with their intensity; e.g., the ten largest events were detected for about 1400 hours, the next ten for about 650 hours.

Proton events are sometimes accompanied by the emission of high energy electrons. These usually reach the Earth earlier than the protons. Since they are almost entirely absorbed above 75 km, these electrons can cause very large absorption at MF and HF but comparatively little at VHF. Thus the relative size of events seen using fmin, using proton fluxes or using riometers can be significantly different. This is actually found, (cf. Piggott and Shapley loc. cit.), in particular, cases with large electron fluxes appearing more important than would be expected from the proton flux or riometer absorption. Oblique incidence communications are also more influenced by a given electron flux than by a similar proton flux. In terms of proton flux, there appear to be significant differences in the average proton flux for the three classes:

> very weak and weak medium
> large and very large

but there is some overlap and some events with typical medium proton fluxes were not detected by the fmin data.

This work formed part of the program of the S.R.C., Appleton Laboratory, and is published by permission of the Director.

<u>Summary of PCA's as shown by fmin</u>

1964	No cases				
1965	Feb. 5	2000 UT to Feb. 8	0700	VW	SB, MW, GO, TH, WL
	April 20	0000 UT to April 20	0800	VW	WL, MW
	Oct. 4	1000 UT to Oct. 4	1900	VW	WL, TH, SB, RB, GO
1966	Jan. 18	2000 UT to Jan. 19	1700	VW	WL, GO
	Jan. 20	0700 UT to Jan. 20	1900	W	SB, DU, MW, TH, GO
	Mar. 17	1900 UT to Mar. 18	0800	VW	MW, SB, TH, WL
	Mar. 19	0200 UT to Mar. 20	1100	W	WL, GO, MW, TH
	Mar. 21	2300 UT to Mar. 22	2300	W	WL, SB, MW
	Mar. 23	1100 UT to Mar. 25	0700	M	RB, GO, SB, WL, MW
	April 1	1600 UT to April 2	0200	VW	TH, GO, RB, WL, MW
	May 3	0000 UT to May. .3	0900	VW	DU, GO, TH, MW, WL
	May 7	0300 UT to May 7	1200	VW	GO, TH
	June25	1700 UT to June25	2300	(VW)	WL, TH, RB
	July 4	2000-UT to July 5	0300	(VW)	WL, RB, MW
	July 7	0000 UT to July 8	2300	M	MW, RB, SB, WL, DU, GO
	July 17	0400 UT to July 18	0200	W	MW, GO, WL
-	July 30	0600 UT to Aug. 1	0100	VW	MW, RB, WL, GO
	Aug.28	1600 UT to Aug.31	2100	M	RB, WL, GO, SB, MW, DU
	Sept. 2	0600 UT to Sept. 7	1100	L	DU, MW, SB, GO, WL, RB
	Sept.14	2300 UT to Sept.17	0000	W	DU, MW, SB, GO, WL, RB

Summary of PCA’s *as* shown by fmin (contd.)

1967	Jan. 7	1900 UT to Jan. 8	0500	(VW)	RB, MW, GO
	Jan. 11	1300 UT to Jan. 13	0500	W	RB, MW, SB, GO, DU, WL, TR
	Jan 28	0600 UT to Feb. 8	1300	L	RB, MW, SB, GO, DU, WL, TR
	Feb. 16	0000 UT to Feb. 16	0900	VW	RB, SB, GO, DU, WL, TR
	Mar. 11	2100 UT to Mar. 12	1600	VW	RB, MW, SB, GO, DU, WL, TR
	May 7	0600 UT to May 8	1800	W	RB, MW, SB, GO, DU, WL, TR
	May 23	2000 UT to May 31	1600	L	RB, MW, SB, GO, DU, WL, TR
	May 28	0300 UT to May 31	1600	L	RB, MW, SB, GO, DU, WL, TR
	June 3	0600 UT to June 3	1500	VW	GO, MW, RB, TR
	June 6	0800 UT to June 7	1900	M	GO, MW, WL, SB, TR
	June 14	1300 UT to June 16	0600	VW	GO, MW, WL, TR
	June 26	0600 UT to June 27	1600	VW	RB, SB, WL, DU, MW, GO, TR
	Aug. 1	1800 UT to Aug. 1	2100	(VW)	SB, GO
	Aug 10	2100 UT to Aug. 11	- 1300	W	WL, MW, RB, SB, DU, GO, TR
	Aug. 18	0700 UT to Aug. 18	1400	(VW)	TR, GO
	Sept. 18	1000 UT to Sept. 21	1800	W	SB, DU, MW, GO
	Sept. 19	0100 UT to Sept. 21	1800	W	SB, DU, MW, GO
	Sept. 30	0300 UT to Sept. 30	1400	(VW)	MW, GO
	Oct. 13	0000 UT to Oct. 13	0900	(VW)	SB, MW, WL, TR
	Oct. 30	0000 UT to Oct. 30	1100	W	GO, SB, MW, WL, DU, TR
	Nov. 2	0900 UT to Nov. 4	0100	VW	WL, RB, MW, SB, GO, TR, DU
	Nov. 13	0000 UT to Nov. 17	1500	W	SB, GO, MW, RB, WL, TR
	Nov. 15	1900 UT to Nov. 16	1900	W	SB, GO, MW, RB, WL
	Nov. 28	0100 UT to Nov. 28	1200	(VW)	GO, MW, TR
	Dec. 3	1000 UT to Dec. 5	0800	M	SB, MW, RB, GO, WL, TR
	Dec. 16	0700 UT to Dec. 19	2300	M	GO, WL, RB, DU, SB, TR
1968	Jan. 6	0700 UT to Jan. 6	0800	(VW)	MW, WL
	Jan. 12	0400 UT to Jan. 12	1200	(VW)	GO, DU, TR, WL,
	Feb. 2	0300 UT to Feb. 2	0700	(VW)	DU, MW
	Feb.13	1400 UT to Feb.13	2000	VW	DU, GO, MW, SB
	Feb.17	0700 UT to Feb.17	1700	VW	DU, GO, MW, SB, TR

Feb.21	2100 UT to Feb.22	0700	VW	GO, MW, TR
Mar.10	1700 UT to Mar.10	2300	(VW)	SB, WL
Mar.15	2000 UT to Mar.16	0900	(VW)	GO, MW, TR
Mar.28	0500 UT to Mar.28	1000	VW	MW, RB, TR, WL
Mar.30	0500 UT to Mar.30	1200	(VW)	TR, GO
Mar.31	1900 UT to April 1	1100	VW	MW, RB, TR
April 4	2200 UT to April 5	0200	(VW)	DU, MW
April23	0100 UT to April23	0900	VW	GO, MW, TR
April23	1900 UT to April24	0200	VW	GO, MW, TR
April26	1800 UT to April27	1100	W	GO, MW, TR, WL
April28	0100 UT to April28	1400	W	GO, MW, RB, TR, WL
April30	1500 UT to May 1	0000	VW	GO, RB, TR

Summary of PCA's as shown by fmin (contd.)

	May 13	1800 UT to May 13	2000	VW	GO, MW, TR, WL
	June 9	0900 UT to June 12	1300	L	DU, GO,MW, RB, SB, TR, WL
	July 7	0900 UT to July 7	1700	W	MW, RB, TR, WL
	July 9	2000 UT to July 15	0000	VL	DU, GO, MW, RB, SB, TR, WL
	July 26	2000 UT to July 27	0500	(VW)	MW, TR, WL
	Aug. 14	1700 UT to Aug. 14	1900	(VW)	DU, GO, MW, TR, WL
	Sept.26	1100 UT to Sept.27	1100	W	DU, GO, RB, SB, TR, WL
	Sept.28	1800 UT to Sept.29	1800	M	DU, MW, RB, SB, WL
	Sept.29	1800 UT to Sept.30	1100	M	DU, MW, RB, SB, TR, WL
	Oct. 1	1000 UT to Oct. 2	0300	W	DU, GO, MW, RB, SB, TR, WL
	Oct. 4	0100 UT to Oct. 7	0200	M	DU, GO, MW, RB, SB, TR, WL
	Oct. 26	2200 UT to Oct. 27	0300	(VW)	DU, GO, MW
	Oct. 29	(1400)UT to Oct. 30	0500	W	DU, GO, MW, RB, SB, WL
	Oct. 30	(1100)UT to Oct. 30	2100	(VW)	DU, MW, RB, TR
	Oct. 31	0000 UT to Nov. 3	1400	VL	DU, GO, MW, RB, SB, TR, WL
	Nov. 4	(0200)UT to Nov. 4	2300	W	DU, GO, MW, RB, SB, TR, WL
	Nov. 18	1100 UT to Nov.22	1200	L	DU, GO, MW, RB, SB, TR, WL
	Dec. 4	0100 UT to Dec.10	0700	VL	DU, GO, MW, RB, SB, TR, WL
1969	Jan. 14	0900 UT to Jan. 14	1300	(VW)	TR, MW, SB
	Jan. 17	2100 UT to Jan. 18	0300	(VW)	TR, MW
	Jan. 24	1200 UT to Jan. 25	2100	W	TR, RB, NW, SB, WL
	Feb. 25	1000 UT to Mar. 1	0200	M -	TR, GO, RB, DU, WL, SB
	Mar. 16	1100 UT to Mar. 17	0900	VW	TR, GO, RB, MW, WL
	Mar. 21	- 0200 UT to Mar. 22	2100	W	TR, GO, RB, MW, WL
	Mar. 30	0000 UT to Apr. 1	0500	W	TR, GO, RB, DU, SB, WL
	Apr. 4	0400 UT to Apr. 4	1100	VW	TR, MW
	Apr. 11	1100 UT to Apr. 20	0300	VL -	TR, GO, RB, DU, MW, SB, WL
	June 7	2200 UT to June 11	1800	M	TR, GO, RB, DU, MW, SB, WL
	June 27	0600 UT to June 27	1000	(VW)	TR, MW
	Aug. 10	0800 UT to Aug. 10	1300	(VW)	TR, MW
	Sept. 25	0500 UT to Sept. 26	1700	W	TR, DU, MW, WL
	Sept. 27	1700 UT to Sept. 30	0200	M	TR, DU, MW, SB, WL
	Nov. 2	1100 UT to Nov. 6	0800	VL	TR, GO, DU, MW, SB, WL
	Nov. 7	0900 UT to Nov. 10	1200	L	TR, GO, DU, MW, SB, WL
	Nov. 24	1000 UT to Nov. 25	0000	VW	MW, WL
	Dec. 18	2000 UT to Dec. 18	0200	(VW)	- MW, WL
	Dec. 20	0100 UT to Dec. 20	2300	W	TR, DU, MW, SB, WL

16. URSI Recommendation 17

In response to URSI Recommendation 17 and with the active assistance of the URSI Secretary General, Mr. N. Nkanga, Geophysical Division of the Meteorological Service of Zaire in Kinshasa has received a grant from the French Foreign Office to spend three months training on ionospheric data reduction and interpretation.

He spent three months at the Centre National d' Etudes de Telecommunications (CNET) with the Ionospheric Research Group (GRI) at Issy-les-Moulineaux and at the Ionospheric and Radio Measurements Department (MIR) at Lannion. Thanks to a grant from the Belgium Government, Mr. Nkanga was also able to spend a month in Belgium with the Service de Meteorologie at Brussels and Dourbes.

No international funds exist for this type of training and INAG wishes to thank the Administrations involved for making these visits possible.

17. URSI General Assembly Lima, Peru. August 1975

The URSI General Assembly will be held in Lima, Peru, August 8 - 20, 1975 (see INAG-17 pp. 12-13). There will be an INAG meeting immediately before this Assembly, August 7-8 to which all who are interested in VI soundings are invited to attend (INAG-17, p. 11).

The program of Commission 3 of URSI will be in the nature of a Symposium on Radio Waves and the Ionosphere with topics organized by the URSI Commission 3 Working Groups. The suggested topics and Working Groups mostly concerned are as follows:

1. Ionospheric heating and its effects, 1 day (3.2, 3.3, 3.8, 3.9)
2. Radio measurements of E-region drifts and waves; techniques and results, a half day (3.2, 3.2.1, 3.2.2)
3. Global models of the Ionosphere, including the International Reference Ionosphere, 1 day (3.1, 3.6, 3.8)
4. Ionospheric scintillation effects at VHF and UHF, a half day (3.9)
5. VLF and ELF propagation; theories and results, 1 day (3.3, 3.9 and Commission 8)
6. New Advances in incoherent scatter, 1 day (3.2, 3.6, 3.8, 3.10)
7. D-region absorption; latitudinal effects, a half day (3.3, 3.9)
8. Ionospheric radio measurements for the IMS, a half day (All, but particularly 3.7)
9. Equatorial ionosphere dynamics, a half day (3.2, 3.8)
10. Data processing in ionosphere research, a half day (All, but particularly 3.4)
11. Uses of the ionosonde in modern ionosphere research and communication, a half day (3.1, 3.2, 3.4)
12. Radio sensing of the mesosphere using radio techniques, a half day (3.3, 3.8 and Commission 2)

The Lima sessions will be open to all interested scientists instead of being restricted to National Delegates as in previous URSI Assemblies.

URSI Commission 3 Working Groups

The following abstracts from W.G. reports may be of interest to our members:

W.G. 3.1. INAG

INAG has held meetings in Boulder, Colorado, Nov. 9, 1972; London April 6, 1973; Geneva Jan. 3-4, 1974 and an informal meeting at Boulder Aug. 28-29, 1974.

W.G. 3.2. E-and F-region dynamics

Dr. H. Rishbeth is surveying the scientific requirements for future ionosondes, including the extensions to direction finding, absorption and phase height measurements.

W.G. 3.2.1 Drift measurements

The coordinated drift or wind measurement periods by various radio techniques (INAG-13, p. 19-20) have been amended as follows:

January 14-26	(as cited in URSI Information Bulletin No. 186, p. 16).
April 16-May 7	(to study the behavior of the upper atmosphere after the final warming of the stratosphere)
August 7-22	(including the simultaneous recording run proposed by Dr. Roper, coordinator of the Global Radio Meteor Wind Studies Project of IAGA Commission VIII)
October 23 - November 14	(to study the beginning of winter conditions on tidal and planetary waves).

Additional measurements of those who wish to operate monthly are recommended to be concentrated on the weeks including the Regular World Days of the International Geophysical Calendar.

Exchange of observational results obtained during the periods mentioned above should be arranged individually between the groups concerned, but information on the material available at the individual groups should be given to Dr. Sprenger's address in order to enable him to compile the information and to circulate it to all participants.

W.G. 3.2.2 Travelling ionospheric disturbances

The following periods in 1974 have been selected for coordinated measurements of gravity waves induced by magnetospheric activity:

February	23 (RWD),	13 (PRWD)
April	16 (RWD),	17 (PRWD)
May	1 (RWD),	15 (PRWD)
July	16 (RWD),	17 (PRWD)
November	12 (RWD),	13 (PRWD)

Coordinated activity is also planned for the periods selected by W.G. 3.8 (below).

W.G. 3.3.1 Absorption measurements

Dr. Schwentek (Ionospheric stations, Lindau Harz) will be issuing a data booklet on the winter anomaly in absorption as observed by the European network of stations.

W.G. 3.5 Production and loss of ionization

This W.G. will meet at the IAGA General Assembly in Grenoble and become the first joint W.G. of URSI Commission 3 and IAGA Division 2.

W.G. 3.6.2 Complete electron density profiles

W.G. 3.6.2 has reviewed the techniques in use for N(h) analyses and will shortly be issuing a report (cf. Chapter 10 Handbook). Further particulars are available from:

Dr. L. F. McNamara
I PS
162-166 Goulburn Street
P.O. Box 702
Darlinghurst 2010
Sydney, Australia

W.G. 3.8 Incoherent scatter

All incoherent scatter workers now correspond regularly within the auspices of this W.G. The URSI Commission 3 group on Incoherent Scatter has set up a program of common observations for 1974 which meets the following requirements:

1. To provide coordinated observations of atmospheric tides.

2. To include a program of coordination with Atmospheric Explorer for the purpose of Ionosphere F region and Thermosphere studies.

3. To offer a coordination for the study of thermospheric parameters, of F-region electric fields, and of gravity waves induced by magnetospheric substorms.

4. To follow closely the international geophysical calendar.

Points 2 and 3 would benefit most from having V.I. soundings simultaneously at a typical rate of 5 minutes.

Coordinated measurements are being arranged by Dr. P. Bauer on the dates selected by W.G. 3.2.2 and are as follows:

Tidal observations:

January	16	(PRWD)
March	20	(QWD)
June	19	(QWD)
August	10-15	(Intense meteor shower period, includes one PRWD and two RWD)
October	15	(RWD)
December	11	(QWD)

Coordination with Atmospheric Explorer:

September	11	(RGD)
September	18	(QWD, WGI)
September	25	(RGD)
October	2	(RGD)
October	9	(RGD)
October	16	(PRWD)

The program in August coincides with a period of intense activity for meteor radar workers.

18. Scientific Activities of URSI Commission II after 1975 with Special Reference to Telecommunications

F. Eklund, Vice-Chairman URSI Commission II

1. Driving Forces for Research in the Field of Telecommunications.

1.1. - First it should be noted that there is a trend in many countries to allocate relatively more research funds to applied research, directed towards the solution of current problems in society, and less to free academic research. Perhaps URSI should consider this trend and discuss how it affects the future scientific activities of the Union. Telecommunications is one of these areas of applied research which has been given high priority in many societies (cf. The formation of OT/OTP in the USA, the “Cost” - programme in Europe, etc.).

1.2. - There are some trends in the development of needs and techniques for telecommunication systems which seem to be particularly important in relation to the future of the activities of URSI Commission II. They are listed below, but not in order of importance:

(a) Increasing need for air-to-ground and ground-to-ground mobile telecommunication systems.

(b) Increasing need for national and international satellite telecommunication systems for both fixed (including broadcasting) and mobile services.

(c) Increasing demand for broad-band radio links.

(d) Increasing need for high-precision air traffic control and guidance around airports and along main air routes.

(e) Increased use of PCM-systems.

(f) Increased use of adaptive systems or system parts.

This list is not complete but it may serve as a background for some statements concerning what might be expected from telecommunications research in the near future.

2. Some Consequences for Future Research in the Field of URSI Commission II.

2.1. - The trends in the needs mentioned above and the development of technical resources will create questions for which we should try to have answers ready when these questions arise; a well-balanced, forward-looking and problem-oriented research programme will be required if we are to provide answers. In the following, I shall try to describe what I feel are some of the main problem areas in telecommunications research, with special reference to tropospheric radio-wave propagation.

2.2. - It is inevitable that all parts of the frequency spectrum will become more and more crowded. As our frequency space is limited, we must try to use each part of it in an optimum way. So, when a new telecommunication need arises, it will be necessary to try to find a frequency which is particularly suited for it; we shall also have to ask whether the need is important enough, from the social and economic points of view, to justify the occupation of a part of the costly frequency spectrum.

Research aimed at describing the possibilities and the limitations, for telecommunications, of frequencies above 10 GHz (including optical frequencies) will continue to have a high priority as it will increase the available spectrum range.

2.3. - It is also inevitable that interference problems will become more and more serious. In order to handle them we must learn more about the propagation conditions that give rise to high fields beyond the normal radio horizons of transmitters, and develop models describing where and when these high fields will occur.

2.4. - It seems to me that high priority must be given also to studies of propagation problems likely to be encountered in the development of new mobile telecommunications systems of all kinds. Here we need to know more about field variations in time and space, multipath effects, depolarization phenomena, and many other problems.

2.5. - Satellite telecommunication problems are well recognized both nationally and internationally. Of special importance is a study of the problems involved in frequency sharing between satellite and ground-based systems, especially in the microwave region, and a study of the possibilities for using millimetre and shorter wavelengths.

2.6. - The demands for extremely broad-band systems or for high precision in navigation and traffic control can, as a rule, be met by sophisticated design of equipment. More and more often the ultimate limits for system precision and capacity are set not by the equipment itself, but by electromagnetic wave propagation phenomena.

So we must learn about these phenomena and describe them in such a way that the total system design can be optimized. This means also that it is important that radio-wave propagation studies should form an integrated part of telecommunication system studies. It is of special importance in this context to learn more about fading, time-delay spread and Doppler spread with special reference to PCM-systems for all types of ground-to-ground fixed paths.

2.7. - For many applications it is also of importance to know about the spatial field characteristics.

2.8. - For all the types of telecommunication system considered here, propagation conditions change from time to time and even from moment to moment. The classical way of solving the problems that follow from this situation is to design telecommunication systems with such margins that they can operate during nearly all conditions. The increasing density of such systems, however, tends to make this approach impracticable. The possible use of adaptive systems suggests that the system instead should be made flexible so that it can work in an optimum way with regard to the existing propagation conditions.

An important problem is to find out and to describe what the relevant propagation conditions are, especially the short-term characteristics to which the system must adapt. This implies an increasing need for the development of combined detailed deterministic and statistical propagation models. As the type of model needed may vary between systems, it is important that the work on models be performed in close contact with system studies.

19. Working Meeting of Ionospheric Sounder Experts, Buenos Aires, March 14-18, 1974

A meeting was held at the Argentine Antarctic Institute March 14-18, 1974 to discuss the requirements and design of an ionospheric sounder suitable to meet the scientific requirements of the ASHAY project. A design presented by the Ionospheric Station of the National University of Tucuman was adopted in principle. Cooperation between the Argentine Institutes and the National Institute for Telecommunications Research South Africa was also discussed.

It was decided to adopt a basic ionosonde, capable of synchronization with similar equipments for oblique incidence soundings. This would be designed so that additional units for absorption, drift, and oblique incidence soundings could be added later when necessary or convenient.

The working party drew attention to the need to re-examine transmitting and receiving antenna systems.

The main technical characteristics of the proposed equipment are summarized below. Copies of the full report can be obtained from SHISH (Dr. S. Radicella, Argentina).

Main Technical Characteristics:

Frequency range - 0.2 (tentative) to 20 MHz, in discrete frequencies, with discrimination selection among 10, 50 and 100 kHz, with adaptable upper and lower frequency scan.

Pulse length of 10 (tentative), 50 or 100 μsec.

Pulse repetition frequency - 50 and 100 pps.

Height range — 250, 500 and 1000 km.

Optic integration - 1, 2, 4, 8, 16, 32, 64 pulses.

Presentation of the information - On oscilloscope tube, with Z axis modulation and frequency scan for discrete positions.

Registration type - Projection on a fixed film, advanced by steps, corresponding each step to a unique emitted frequency.

Height marks - Every 25, 50 or 100 km.

Frequency scan time - function of: frequency range, frequency discrimination, integration factor and pulse repetition frequency. Nominally, for a 0.2/20 MHz range, 100 kHz discrimination, 8 pulses integration, pulse repetition frequency 50 pps, 30 sec. approximately.

Frequency scan configuration - Lineal.

Synchronism - Height marks, emitted frequency and position in time of the emitted pulse synchronized by a unique crystal, which also controls the program and identification watch of the recording.

Receiver sensitiveness - Maximum, about 1 μV for 6 dB S+N/N, with automatic selection of three predetermined values.

Frequency marks - Commanded by the frequency generator.

Program - Continuous registration every 1, 5, 15, 30 and 60 min.

Output power - Because of economic considerations, the power of the normal transmitter will be determined through direct testing. For that reason, transmitters with output power between 1.5 and 60 kW will be available.

Working Conference on ASHAY Planning, Buenos Aires, 10-13 June 1974

A working conference on the planning for ASHAY (Antarctic and Southern Hemisphere Aeronomy Year 1975-1976) was organized by the Southern Hemisphere Ionospheric Studies Group (SHISG) and held at the Sociedad Cientifica Argentina in Buenos Aires, June 10-13, 1974. It was attended by 41 delegates from 12 countries. Working Groups were formed as follows:

		Convener
1.	Aeronomic Effects of the South Atlantic Anomaly	Prof. J. Gledhill
2.	Low Latitude F region in the South American Sector	Dr. R. Woodman
3.	Southern Hemisphere Subauroral and Antarctic Aeronomy	Prof. K. Cole

A full report of the conference is available on request from the ASHAY Chairman -

Prof. S. M. Radicella
Comision Nacional de Estudios
Geo-Hel iofisicos

Bussolini 1661, San Miguel
Buenos Aires, Argentina

It was agreed that ASHAY should last from September 1975 to March 1976. Amongst the proposals and recommendations of special interest to the VI network are the following:

1. Coordinated low frequency (>0.25 MHz) ionosonde operations are needed near the sites of 3914 *A* line measurements to detect ionospheric effects produced by precipitated electrons. Observation sites should be located in South Africa, Rhodesia, Zaire, Kenya, South Brazil, Argentina, Chile, and Easter Island. Simple CW oblique incidence and pulse VI absorption measurements are also required near these sites.

2. A good latitude and longitude coverage by bottomside ionosondes at low latitudes is required to operate in conjunction with the incoherent scatter sounder at Jicamarca. This involves Peru, Brazil, Bolivia, Chile and Argentina.

3. Coordinated bottomside ionosonde, airglow photometers and satellite measurements are required in the Australian, South American and African subauroral sectors.

   At present a net of 7 airglow and 5 ionosondes is being set up in the African sector to cover from Nairobi to Sanae, (South Africa, Lesotho and German Federal Republic). Networks of absorption measurements are needed in the Australian, South American - Palmer Peninsula, and African sectors.

4. Coordinated bottomside and topside soundings, airglow, aurora riometer and rocket experiments are required to study the maintenance of the Antarctic winter ionosphere and the UT control of the Antarctic ionosphere.

WG 1. Resolutions and Recommendations

1. That the ionosphere and airglow stations at present operated by the Max Planck Institut at Tsumeb are essential sources of data on the eastern limit of the anomaly area; every effort should be made to continue their operation after the proposed closing date at the end of 1975, until 1978 at least.

2. That airglow data from Sanae are essential for study of the southern limit of the anomaly area and should be continued without break until 1978 at least.

3. That the ring of ionosonde stations surrounding the anomaly area is essential for the proper study for the ionosphere there and that all stations on the following list be urged to continue normal operation until 1978 at least: Sao Jos6 dos Campos, Tucum~n, San Juan, Buenos Aires, Concepci6n, Trelew, Ushuaia, Port Stanley, South Georgia, Argentine Is., Belgrano, Halley Bay, Sanae, Syowa, Marion Is., Cape Town, Grahamstown, Johannesburg, Tsumeb.

4. That the availability of ionospheric data from the proposed Brazilian chain of stations, Belem, Brasilia and Curitiba, would be of very great importance for the study of the anomaly and the Working Group therefore strongly supports the proposal to establish these stations.

WG 2. 1. The investigation of the dynamics of the so-called equatorial anomaly of the F region in the South American sector. An experiment is proposed in which a network of ionosondes approximately along the 75GW meridian will monitor the ionosphere during a selected set of days at the same time that the electric fields, electron density, and electron and ion temperatures are measured with the Jicamarca radar. Measurements will be made coincident with satellites passes which are instrumented to measure ionospheric parameters of interest like ISIS II and Atmospheric-Explorer. The network of ionosondes shown have stations placed at Jamaica, Bogota, Talara, Huancayo, La Paz, Tucuman, San Juan.

The experiment should be complemented with stations along a Brazilian longitude including Belen, Brasilia, Curitiba, and Buenos Aires. There is also the possibility to have a similar network along an Australian longitude.

WG 2. The investigation of the low latitudes spread-F phenomena. It is proposed that ionospheric observations be made by a (cont'd) network of ionosondes at approximately the same longitude as the Jicamarca observatory at selected times when observations are made at this observatory of the F-region irregularities and of the F—region background parameters.

Resolutions

a. The experiments proposed depend very heavily on the availability of new ionosondes at many locations of the network. Therefore the Argentinian-Peruvian-South African efforts for the development of such an instrument should be considered essential for the success of the proposed project.

b. The participation of groups which have developed numerical models to simulate the equatorial ionosphere is requested.

c. The ASHAY planning conference draws the attention of groups interested in the study of propagation of VHF signal much beyond the horizon to take notice of the coordinated efforts to study and monitor the equatorial anomaly as well as F-region irregularities and strongly encourages such groups to undertake a transequatorial propagation experiment at the same time.

d. The amateur groups interested in the anomalous propagations on VHF are also encouraged to participate.

WG 3. 1. Trans-polar Transmissions

a. VLF
Monitoring of the NW Cape transmitter in Australia will be done by Argentine scientists. Measurements of phase and amplitude will provide information on PCA and AZA events. A VLF transmitter will be established in Southern Argentina and receivers in Buenos Aires and Antarctica with the view to studying the evolution of PCA and AZA events to lower latitudes.

b. VHF
The possibility exists between South African, Antarctic base and Australia for forward scatter studies of auroral ionization.

2. Unmanned automatic stations

These devices are being investigated in USA and Australia and may be available to provide data from otherwise inaccessible areas.

Resolutions

a. When studying a phenomenon, all possible techniques be brought to bear on it simultaneously. In the past, often only one technique has been used, e.g., magnetometry to study the auroral electrojet. Even though innumerable studies have been done in the past with this technique, it is nevertheless necessary to repeat these studies, but simultaneously with newer techniques.

b. URSI should be encouraged to publish revised procedures for interpretation of riometer data to improve its usefulness.

c. Scientists are strongly encouraged to intercompare with ground-based observations or otherwise use data being taken by the A-E series of satellites. The A-E satellites will have on board mass spectrometers, ion spectrometers, Langmuir probes, retarding potential analysis photometers (in 6 wavelengths) a UV and NO experiment, low energy electron detector.

d. The Working Conference on ASHAY Planning recommends to SCAR to consider all possible means to coordinate the auroral magnetic and ionospheric observations in all existing Antarctic Stations with those in the surrounding Southern Hemisphere at high and middle latitudes in order to achieve the best possible network for southern hemisphere aeronomic studies.

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INAG-18-lq September 1974

<u>New Australian ionosonde</u>

See INAG-17, p. 4, section 5.

The following points are abstracted from a letter from Dr. C. G. McCue:

A set of circuit diagrams for the new ionosonde has been prepared but all other necessary documentation is not complete. More information than that contained in circuit diagrams is needed to enable someone to duplicate the ionosonde. In comparison with the tube—electro-mechanical ionosondes of our previous types, and the CIV type, the solid state ionosonde has much more complex electronics but is relatively simple mechanically. There are several areas of the ionosonde where layout and circuit details are critical, e.g., the receiver, the synthesizer and the transmitter.

Our ionosonde has been in a state of development for three years and we have had a prototype working for more than one year. We are at present constructing the first batch of four intended for field use.

In addition to the matter of documentation in the area of manufacturing drawings, there is as yet no complete description of the operation of the ionosonde. We have also to prepare the essential documentation on alignment and trouble shooting procedures for commissioning and maintaining each newly assembled but untried module. This work requires a high degree of technical ability coupled with a thorough understanding of the principles of operation of each section of circuitry.

Our present resources are inadequate to provide the type of and quantity of drawings to enable outside organizations to duplicate our ionosonde. I can only suggest that the most practical way for ionospheric workers to obtain the expertise necessary to duplicate our ionosonde would be for them to visit us and to spend a few weeks working with our engineering staff and gaining first hand knowledge of the various methods of construction and techniques of initial adjustment. A few weeks are all that would be required by a competent engineer.

Some details of the specifications of the ionosonde are as follows:

<u>IPSD IONOSONDE 4A</u>

Size: 510 mm wide
460 mm deep
590 mm high

Weight: Approximately 45 kilogrammes
Size and weight excluding camera and storage batteries

Power Consumption:
Approximately 140 watts, dependent cn input voltage

Voltage requirements:
22-30 volts, normally supplied by two 12V lead acid automotive batteries. Charging system for batteries included for operation on 240 V 50Hz mains.

Antenna Requirements:
Nominal 50 0 co-axial output to antenna

Performance:
Power output 1-2 kW

Pulse length	40 µsec
PRF	3 pulses with 5.3 msec interval then 10.6 msec interval
Frequency span	1.000 to 22.628 log, or linear sweep.
Frequency steps	576 (1.000 to 22.628 MHz)
Duration of scan	12 seconds
Rx sensitivity	Approximately 1 Ωv @ 50 Ω Rx is fitted with a memory device, each frequency step is pulsed three times, the receiver output is stored is a 512 bit memory and an echo is recorded only if it is present on each of the three occasions.
Dynamic Range	Will handle signals up to 100 mv without serious cross modulation.
Spurious Responses	Three only above 3 µv

Features of Ionosonde

1. Solid state except for final stage of four tubes and display tubes. No relays.
2. Ionogram identified with hours, minute, day of year, year, and station number. Digital clock and character generator controlled by quartz crystal.
3. Frequency steps are generated by a synthesizer. Each step is a precisely known frequency and corresponds to a 10 bit code. Deviation from a true logarithmic progression is less than 0.2%.
4. Noise rejection memory circuit.
5. 16 mm film recording.
6. Gated AGC.

Before reception of an echo, the receive channel is monitored for noise and extraneous signals. The receiver gain is adjusted to ensure that effects of cross modulation and overload are minimised and the optimum conditions exist for the detection of an echo.

Mechanical Consideration

A. Display Section

The ionosonde consists of four standard 480 mm wide modules, panels 133 mm high, housed in a cabinet 590 mm high.

The display section has two cathode ray tubes one of which is devoted entirely to recording. The other display has a multi—purpose function as follows:

1. "A" scan display.
2. One shot ionogram. Press button for one ionogram. Does not affect record section.
3. Numerical Indicator. Displays date and time, i.e., digital clock.
4. For use with separate additional camera, displays one ionogram every 15 minutes, one minute or every 20 seconds.
5. Set up provides a fine dot matrix for camera focus and CRT focus purposes. This facility is also available on record CRT.
6. The record display section can be switched to operate 15, 5, 1 or 20 sec. every 15 minutes. This may be changed by the insertion of suitable links on the program card.

B. Integrated Circuit Section

This section consists of 16 printed circuit boards 254 x 128 mm removable from the front. Includes synthesizer.

C. Receiver and Power Supply Sections

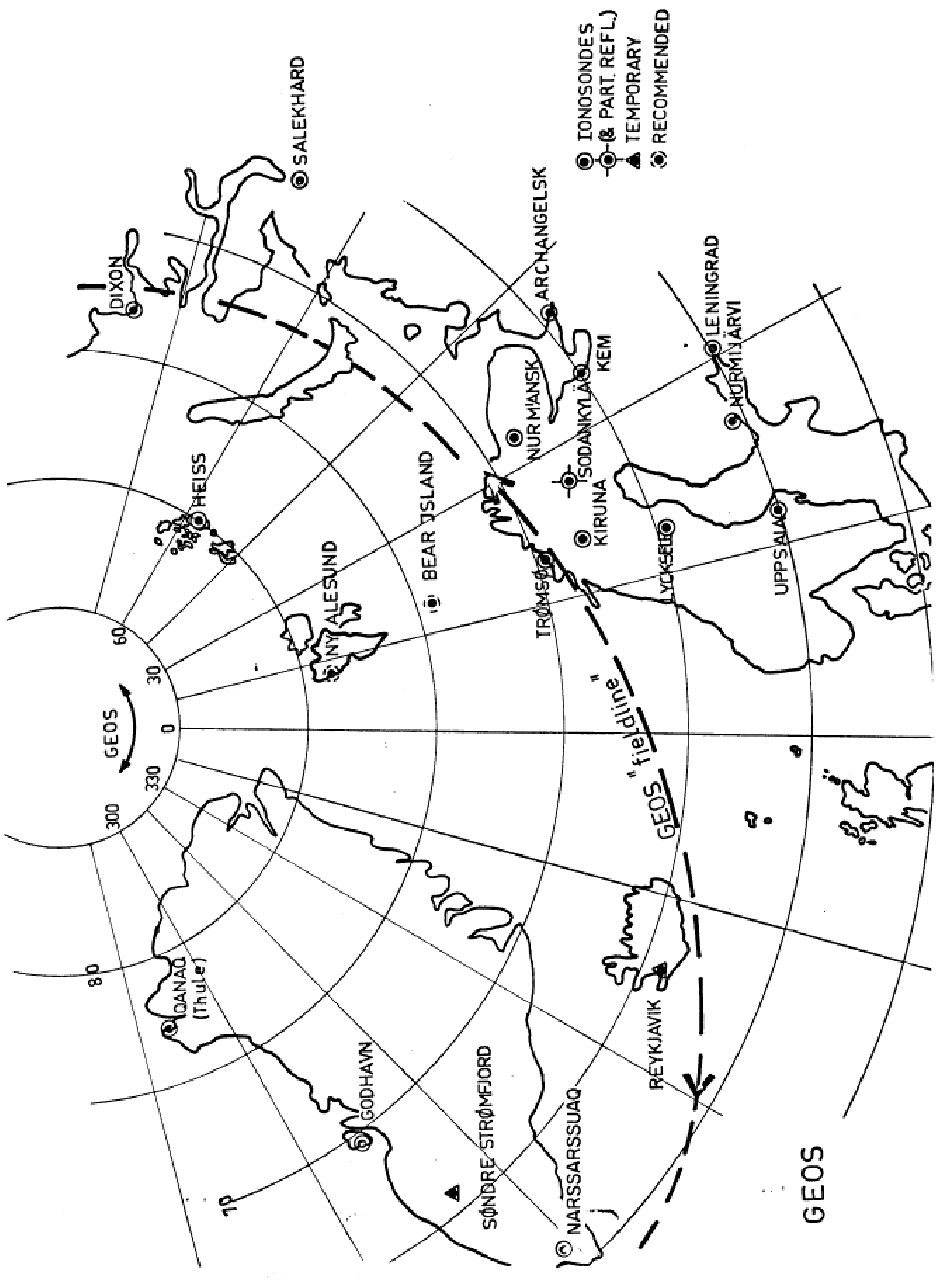
Mounted side by side, independent slide—out modules.

D. Transmitter

Solid state amplifier and tube power stage. Independent slide-out module.

European Cooperation for the IMS

The Committee for Coordination of Observatories associated with the GEOS satellite (CCOG) held a meeting at Uppsala 22-24 October 1973 at which the CCOG reporters explained the present status of ground-based observations. Coordinated experiments are also planned for the conjugate areas in Antarctica. The present status of the planned ionospheric VI network is summarized below. In addition a network of 38 riometers has already been deployed and further riometer stations are planned. This is part of a major cooperative effort extending over at least 15 disciplines. The



SALEKHARD
DIXON
HEISS
ARCHANGELSK
IONOSONDES
(& PART. REFL.)
TEMPORARY
RECOMMENDED
LENINGRAD
NURMIJÄRVI
KEM
SODANKYLÄ
MURMANSK
KIRUNA
LYCKSELE
UPPSALA
TROMSØ
BEAR ISLAND
NY ALESUND
GEOS
0
30
60
330
300
80
70
GEOS "fieldline"
QANAQ (Thule)
GODHAVN
SØNDRE STRØMFJORD
NARSSARSSUAQ
REYKJAVIK
GEOS

reporter for ionospheric soundings is W. R. Piggott; for riometers, J. Oksman; backscatter, G. LangeHesse; incoherent scatter, F. du Castel; ELF-VLF, A. Egeland:

Network of Ionosonde Stations:

1. Western operational range (Greenland position)

stations	(approx. positions)		operating country	remarks
- QANAQ (THULE)	77°30N	69°12W	GREENLAND	
- GODHAVN	69 16N	53 30W	"	D1 observations from 1966-1969
- REYKJAVIK	64 08N	21 47W	ICELAND	Temporary operation by Univ. of Iceland
- SØNDRE STRØMFJORD (rocket station)	(67 N	50 W)	GREENLAND	Rarely operated
- NARSSARSSUAQ	61 11N	45 25W	"	Additional back scatter obs. on 12.7 MHz

2. Eastern operational range (Scandinavian position)

- TROMSØ	69°39N	18°57E	NORWAY
- MURMANSK	68 57N	33 03E	SOVIET UNION
- KIRUNA	67 50N	20 26E	SWEDEN
- SODANKYLÄ	67 22N	26 39E	FINLAND
- KEM	(65 N	35 E)	SOVIET UNION
- LYCKSELE	64 37N	18 40E	SWEDEN
- ARCHANGELSK	(64 N	41 E)	SOVIET UNION
- NURMIJÄRVI	60 30N	24 39E	FINLAND
- LENINGRAD	59 57N	30 42E	SOVIET UNION
- UPPSALA	59 48N	17 36E	SWEDEN

3. Additional stations (East of the field line)

- HEISS	80°37N	58°03E	SOVIET UNION
- DIXON	73 30N	80 24E	SOVIET UNION
- SALEKHARD	66 32N	66 32E	SOVIET UNION

4. Proposed sites for additional stations

There have been discussions about putting additional ionosondes at one or two of the following positions:

- NY ALESUND (Spitzbergen)	(78° N	11° E)	NORWAY
- BJØRNØYA (Bear Island)	(74° N	20° E)	NORWAY

It appears that ionosondes are available for such additional stations (e.g., from UK - RSRS and FRG - MPI), however the problems of manpower and operational costs are still open.

Relations with other Organizations

In view of the progressive increase in the interdisciplinary character of scientific research and the proliferation, outside the ICSU family, of international organizations concerned with specific scientific topics,

recommends that: (i) the Secretary General invite the Scientific Unions to examine their programmes with the object of exposing those of possible interdisciplinary character and to take the initiative in establishing appropriate inter-union liaison at the working level;

(ii) in each Union, formal liaison should be actively promoted, by association or affiliation, with non-ICSU bodies whose interests are closely related to its own so that conflicts of interest can be avoided, and that the ICSU Secretariat be kept informed of these actions.

20. International Association of Geomagnetism and Aeronomy New Structure

At its Scientific Assembly in September 1973, IAGA adopted a new structure which will take effect on 1 January 1974. The former Commissions and Working Groups will be dissolved and replaced by five Divisions and several other bodies which are listed below, The name of the Chairman of each Division precedes those of the three Co-chairmen some of whom had not yet been confirmed at the time of printing IAGA Bulletin No. 12.

Division 1. - Internal Magnetic Fields.

J. C. Cain (USA)
K. M. Creer (UK), W. D. Parkinson (Australia), T. Yukutake (Japan).

Division II - Aeronomic Phenomena

B. A. Tinsley (USA)
M. Ackerman (Belgium), H. Rishbeth (UK), A. Vallance-Jones (Canada).

Topics:

1. Structure, composition and dynamical processes of neutral and ionized constituents.
2. Solar fluxes, and photochemistry of ionized and neutral constituents, including excited species.
3. Atmospheric quantal emissions, including auroral processes and airglow.
4. Ionospheric irregularities, including small-scale auroral structures.
5. Ionosphere-magnetosphere interactions, including large-scale auroral structures.
6. Upper atmosphere-lower atmosphere interactions.
7. Aeronomy of other planetary atmospheres.
8. Laboratory experiments of aeronomical interest.

Division III. - Magnetospheric Phenomena

C.-G. Falthammar (Sweden)
R. Gendrin (France), T. Obayashi (Japan), D. J. Williams (USA)

Topics:

1. Magnetic fields, electric fields and current systems, including relevant ground observations.
2. Magnetosheath, magnetospheric boundary and plasma penetration.
3. Distribution and properties of magnetospheric plasmas.
4. Energetic particle population including cosmic ray entry.
5. Magnetic oscillations, waves and wave-particle interactions.
6. Magnetic storms and substorms, including aurora-magnetosphere relations.
7. Magnetosphere-ionosphere interactions.
8. Magnetospheres of other planets.
9. Laboratory experiments of magnetospheric interest.

Division IV. - Solar Wind and Interplanetary Magnetic Field
Officers to be designated later.

Topics:

1. Structure of the solar wind and the interplanetary field.
2. Interplanetary plasma physics.
3. Interaction of the solar wind with unmagnetized bodies.

Division V. - Observatories, Instruments, Indices and Data
P. H. Serson (Canada)
P. N. Mayaud (France)
R. Pastiels (Belgium)

N. Sugiura (USA)

Interdivisional Working Group. - Relations between External and Internal Magnetic Variations.

A. A. Ashour (Egypt)
C. A. Onwumechili (Nigeria)

Interdivisional Commission on History

E. J. Chernosky (USA)

Interdivisional Commission on Antarctic Research
T. Nagata (Japan)

Inter-Union and Inter-Association Working Groups

1. (with URSI) The auroral oval and its extension into space.
2. (with URSI) Physics of the plasmapause.
3. (with IAMAP) Stratospheric and Mesospheric processes.

* * * * * *

<u>Resolutions</u>

Among the Resolutions adopted at the II Scientific Assembly of IAGA, the following are of interest to URSI:

2. - IAGA, recognizing the importance of the continued study of natural electromagnetic phenomena and the fact that man-made sources of electromagnetic energy continue to increase in a way that tends to obscure these natural phenomena, recommends that adhering countries make an effort to set aside reservations in which man—made sources of electromagnetic energy in the frequency range of interest to IAGA are excluded so as to preserve such areas in which natural electromagnetic phenomena can be studied in years to come.

3. - IAGA, considering that SI Units are achieving international recognition as a single standard for worldwide use, recommends adoption of SI Units in the field of geomagnetism. Specifically IAGA recommends that:

(1) (a) Values of the geomagnetic “field” be expressed in terms of the magnetic induction B (SI Unit tesla = weber/metre^2).
(b) If it is desired to express values in gamma, a note should be added stating that “one gamma is equal to one nanotesla”.

(2) (a) Values of “intensity of magnetization” be expressed in terms of magetization M (SI Unit ampere/metre).
(b) If it is desired to express values in e.m.u., a note should be added stating that “one e.m.u. is equal to 10^3ampere/metre”.

(3) (a) Values of susceptibility be expressed as the ratio between magnetization M and the magnetic field H.
(b) If, during the transitional period, it is desired to use values of susceptibility in e.m.u., a note should be added stating that “χ_{SI} is equal to $4\pi\chi_{e.m.u.}$”.

10. - IAGA, recommends the use of the term “magnetic pulsation”, or simply “pulsation”, instead of “micropulsation” for the following reasons:

(a) The amplitude of pulsations is often large with respect to the main field in the outer magnetosphere.
(b) The wavelength of pulsations may be large with respect to the size of the Earth.

11. - IAGA, recommends the addition of two classes of pulsations to the existing classification: Pc6 for continuous pulsations with periods longer than 600 seconds and Pi3 for irregular pulsations with periods longer than 150 seconds.

21. - IAGA, recognizing that data and records of observations made in previous epochs will be of great importance in the study of the long-term variation of the aeronomic and geomagnetic aspects of the earth and its environment, recommends that each country take appropriate action to catalogue and to preserve such historically important data and to advise the scientific community of their availability.

Symposia: Grenoble 1975.

In accordance with IUGG rules, most of the scientific sessions at the IUGG General Assembly will be on topics of joint interest to two or more of the Associations in IUGG and do not deal with topics of interest to URSI. JAGA proposes, however, to arrange two special 1-1/2 day symposia jointly with

URSI and COSPAR on:

1. Transport phenomena and structure in the thermosphere and exosphere (proposed conveners: A. F. Nagy and H. Rishbeth).
2. Physics of the plasmapause (proposed convener: T. R.Kaiser).

A Symposium on Analysis Techniques for Non-stationary Signals has also been proposed, to be arranged after consultation between URSI and IAGA.

21. Staff

Members of INAG have occasionally been asked whether there are any trained station staff available and have been approached by staff with experience asking whether posts are available. INAG would like to know the extent of the market for suitable staff and invites comments. It is not possible for INAG to interview potential staff so that this service would be intended to be purely informational.

At present the following is available:

Michael Brum: Ionospheric Station DK3953, Godhavn, Greenland (Airmail only), Engineer. Four years experience in scaling ionograms and running Ionosonde type J5W, riometers, scintillation receivers, spectrum photometer, fluxgate magnetometer, communications transceivers.

22. URSI Bulletin

BEACON SATELLITES

A Symposium will be held in Moscow, USSR, from 30 September - 4 October 1974 on Beacon Satellite Investigations of Ionospheric Structure, and ATS-F Data under the sponsorship of URSI and COSPAR. The meetings will take place at the Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation of the Academy of Sciences of the USSR (IZMIRAN), about 40 km south of Moscow.

The topics for discussion are:

(a) improvements of beacon methods for investigating the ionosphere, and recent results;
(b) structure and formation of the ionosphere related to beacon observations;
(c) preliminary results of ATS-F beacon experiment, and applications of beacon investigations.

Abstracts of papers must be submitted, so as to arrive not later than 31 May 1974, to Dr. R. Leitinger, Institut fUr Meteorologie und Geophysik, Universitat, A-8010 Graz, Austria, from whom advance registration forms are available. Abstracts, in English, should be 150-200 words in length and will be photocopied. They should be clearly typed, using single spacing, and the length of the line must not exceed 17 cm. Abstracts relating to the ATS-F satellite will be accepted up to 10 September 1974.

Local arrangements in Moscow are being coordinated by IZMIRAN and additional information is obtainable from:

Dr. Ya. L. Alpert,
IZMIRAN,
P0 Akademgorodok,
Moscow Region, USSR.

BEACON SATELLITES, Moscow, 25-29 November 1974.

The date of the Symposium on Beacon Satellite Investigations of Ionosphere Structure, and ATS-F Data has been postponed because of the delay in the date of launch of the ATS-F satellite: now 1 June 1974. Abstracts of papers should arrive in Graz before 10 July 1974, but those dealing with data from ATS-F will be accepted up to 8 November 1974. Further information is available from:

Dr. R. Leitinger
Institut fUr Meteorologie und Geophysik,
Universit~t Graz,
Halb~rthgasse 1,
A-8010 Graz, Austria.

SOLAR EVENTS : AUGUST 1972

A Resolution (111.5) of the URSI General Assembly in 1972 recommended the designation of the period 26 July - 14 August 1972 as a Retrospective World Interval in view of the exceptional solar and geophysical events which occurred during the period 2-8 August.

On the initiative of the URSI Committee in India, 10 scientific observatories and other organizations in India have jointly cooperated in the preparation of a booklet **(1)** containing numerous data for the above period.

A set of three volumes of data for this period has been prepared by World Data Center A for Solar-Terrestrial Physics **(2).**

DATA ON SOLAR-TERRESTRIAL PHYSICS

World Data Center A for Solar-Terrestrial Physics has prepared a 317-page Catalogue of data relating to solar, interplanetary, ionospheric and geomagnetic phenomena, flare-associated events, aurora and airglow, and cosmic radiation **(3)**. The Catalogue refers to data received since 1957 when WDCs A, B and C were established in connection with the IGY. It contains full information about the various formats in which the data are available and about the cost of obtaining copies.

INTERNATIONAL DATA EXCHANGE

In December 1973, the ICSU Panel on World Data Centres published the Third Consolidated Guide to International Data Exchange through the World Data Centres. This volume replaces the second edition published by the Comit6 International de G6ophysique in November 1963, and Supplements No. 1 (December 1964) and No. 2 (July 1965).

The new edition deals with various solar and geophysical data, but it does not cover data in meteorology, volcanology and geothermics; these subjects will be covered in a future supplement. Copies of the Guide are being widely circulated by the Secretary of the Panel

Dr. E. R. Dyer,
National Academy of Sciences,
2101 Constitution Avenue, N.W.,
Washington, D. C. 20418, USA.

(1) 5. Aggarwal and P. K. Pasrica (compilers). Ionospheric and Geophysical Data from India related to the Solar Events of August 1972. Scientific Report No. 85. Issued by Radio Science Division NPL and Indian National Committee for URSI, New Delhi, August 1973.

(2) Helen E. Coffey (ed.) Collected Data Reports on August 1972 Solar-Terrestrial Events, Parts 1, 2 and 3. Report UAG-28, July 1973. Obtainable from National Climatic Centre, Federal Building, Asheville, NC 28801, USA.

(3) Catalogue of Data on Solar-Terrestrial Physics: Report UAG-30, October 1973. Copies are available at $1.75 from National Climatic Center (Publications), Federal Building, Asheville, N. C. 28801, USA.