

IONOSPHERIC NETWORK ADVISORY GROUP (INAG)*

Ionosphere Station Information Bulletin**I Introduction

This is the first issue of a bulletin which, if you desire, could continue to serve the stations collaborating in ionosphere research and, in particular, the Vertical Incidence (V.I.) Network.

As some of you may know, the modern era of active coordination of international research on the ionosphere by vertical soundings started with a special regional effort by the International Union for Radio Science (URSI) special Committee on high latitude work which attempted in 1954-55 to obtain uniform interpretation and analysis procedures for the difficult case of high latitude ionograms (URSI Information Bulletin, No. 96, p. 440, 1955). These recommendations laid the groundwork for the much more comprehensive observation, interpretation and analysis methods developed by the URSI Special Committee on the World Wide Soundings (WWSC -- popularly known as the Wine Women and Song Committee). The WWSC, appointed in September 1955, undertook this similar work for the whole world and prepared for the cooperative efforts of the International Geophysical Year (IGY 1957-58). The WWSC recommendations have served also for the International Cooperation Year (IGC 1959) and the International Years of the Quiet Sun (IQSY 1964-65). They continue to be the main basis for the continuing monitoring program coordinated by IUCSTP Working Group 1 and the URSI-STP Committee, in particular for the International years of the Active Sun, 1969-1971.

In the WWSC work the approach was to obtain the opinions of all possible workers in the field at V.I. stations and elsewhere, to balance these using a small expert group and then to explain to the many consultants why their suggestions were or were not accepted. As a result it was generally agreed that an acceptable system had been developed and this has been in use ever since. The results of the WWSC work are fully covered in the "Handbook of Ionogram Interpretation and Reduction" by Piggott and Rawer, 1961; this is now out of print but a revised edition is scheduled for the near future. The WWSC was dissolved in 1961 and the continuing needs of the network have been met through the mechanism of an URSI Vertical Incidence Network Consultant to answer queries, give advice and generally

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

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report on the condition of the world interchange of ionospheric data. This post has been held by W. R. Piggott, Radio and Space Research Station, Slough, Bucks, England, since the dissolution of the WWSC.

At the Munich General Assembly of URSI (1966) it was decided to set up a special working party both to consider and propose answers to questions raised by the CCIR which is the official body which considers the technical needs of the International Telecommunication Union (I.T.U.), and to identify the needs of the scientific community. Many of us have been involved in this exercise, the results of which were discussed at length in a series of special meetings in London in January 1969 and supported by a representative meeting of the URSI-STP Committee held during the URSI General Assembly at Ottawa, August 1969, and will be published in the URSI Information Bulletin. They are also being brought to your attention in this Bulletin.

At the recent meeting of the URSI-STP Committee at Ottawa in August 1969, it was decided that the importance of the network justified the formation of a small advisory group to carry on and extend the work of the V.I. Consultant by providing more help and advice than can be given by a single person. This group is known as the Ionosphere Network Advisory Group (INAG). The names and addresses of the members of this group are as follows:

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We hope that this group, the INAG, will act up to its initials and NAG the administrations, the users and the unfortunate makers of these data until the data are first class and it is clear to all how and where they are being used. We hope that station observers and others will NAG the INAG in their turn. Let's not be shy!

W. R. Piggott

II Description of the Contents of this Bulletin

You have already read the Introduction which traces some of the steps leading up to the formation of the INAG. In the sections which follow, we first give the most important of the recent recommendations concerning Vertical Incidence Soundings and the network, made by or under the auspices of the URSI-STP Committee which has spent much time (three meetings in less than a year) on these problems. One of their recommendations is for a new parameter (fx1) to aid research and practical studies involving Spread F. So that it will not get lost, we treat this subject in a separate section. For the same reason another separate section contains the URSI-STP comments on improved absorption parameters from V.I. observations. Then we quote some IUGSTP recommendations on V.I. work in conjugate point studies. In the section after this one, we give a provisional answer to "What is the Present Active V.I. Network", and ask your help in correcting and completing the station list attached at the end of this INAG bulletin. Following this we give a partial list of the reports and books which in the ideal world should be available to each station -- and ideally! in your own language; these are documents we will refer to from time to time. Then there are some notes from the WDCs -- not many this time because there has not been time to approach, let alone to hear from all the WDCs for material for this bulletin. There is a concluding section on philosophy and on the future of INAG activity. The latter depends on the reaction and response from the world V.I. network. Finally, a footnote with some explanations or apologies about the compilation of this first hurried bulletin, and why it is so hurried.

III Some of the Recommendations of URSI-STP Meeting
on the Vertical Soundings Network 1969

* Copies of the report of the special meeting (London, January *
* 1969) on problems connected with the V. I. Ionospheric Soundings *
* Network have been circulated to all station administrations with *
* copies for all known stations in the network. If you have not *
* received a copy, please write to the Secretary of INAG, Miss J. *
* Virginia Lincoln, World Data Center A, Upper Atmosphere Geophysics, *
* Environmental Science Services Administration, Boulder, Colorado *
* 80302, U.S.A., who will make sure that you get one and are included *
* in any future circulation. *

* The report is too long -- 60 pages -- for a Bulletin such as *
* this one. We give here some of the main points of interest to *
* stations. As you may know, the half-day meeting itself was attended *
* by some 27 people from 11 countries. It was preceded by a sub-group *
* meeting (many of the same people and others) which was in more or *
* less continuous session over a period of three days during the *
* IUCSTP General Meeting which was preparing for the International *
* Years of the Active Sun, 1969-1971. Even before this there had been *
* rather extensive correspondence and also a detailed questionnaire, *
* in which many of you participated. *

* Here are the general conclusions of the meeting: *

The Chairman of the URSI-STP Committee, Prof. W. J. G. Beynon, said there was a clear consensus of this quite broadly representative meeting:

(a) The existing network ought to be maintained at about its present size, but that steps should be taken for improvement of performance; chief among these are visits by experts to stations, and an even more active URSI mechanism for guidance to stations, including the provision of comments, on request, regarding planned opening or closing of stations.

(b) Some stations should be strongly encouraged to obtain highly accurate vertical soundings data, in particular stations which are in support of rocket work or Thomson scatter installations, or which are at large and complex research institutions.

(c) Synoptic stations should be strongly encouraged to obtain as complete numerical data as possible; to this end, URSI-STP will re-examine the present "accuracy" rules in order to maximize the amount of numerical data available for synoptic purposes.

(d) Vertical soundings measurements are not being used to their full potential for network purposes for study of ionospheric absorption; URSI-STP should prepare some detailed recommendations.

(e) Improvements should be made in the handling of vertical soundings data in computer-compatible form. Again recommendations and action are needed by URSI-STP or by IUCSTP WG1 and the WDCs.

(f) Design and plans should begin to be developed for the vertical soundings network of the mid 1970s.

(g) The detailed recommendations and proposals of the sub-group as given in Appendix 1 should be supported.

* The bulk of the report is comprised of four *
* Appendices, whose titles indicate their scope: *

Appendix 1. Summary Conclusions and Detailed Recommendations of Ionosonde Network Sub-group of IUCSTP

Appendix 2. "Future of Vertical Incidence Soundings Network," report compiled by Vertical Soundings Consultant, January 15, 1969

Appendix 3. Circular and documents 1-4 issued by Vertical Soundings Consultant

Appendix 4. Collected Comments on Vertical Incidence Soundings Network

* Of the 15 Recommendations in Appendix 1, the *
* following are of special interest. The others may *
* be treated in a later INAG Bulletin, if any. Here *
* the term "Working Group" (or "WG") is synonymous *
* with the "sub-group" referred to above. *

WG Rec. 1 Size of Network

The Working Group noted the views of consultants summarized in the circulated document, considered the use being made at present of data from high, low, and temperate latitude stations, felt that this use fully justifies the maintenance of the existing network at least for the period of the IASY and strongly recommends that stations already operating be maintained for this period.

WG Rec. 2 Redeployment

The Working Group considers that the scientific value of proposals to alter the deployment of stations should be balanced against the cost

and recommends the setting up of a small ad hoc group of experts, with knowledge of conditions in widely separated parts of the world, for the following purposes:

- (a) to examine methods of determining where stations should be maintained or set up;
- (b) on request, to consider and examine proposals for redeployment, closing or opening of stations, so that the organizations involved can be given a balanced brief for such proposals;
- (c) to consider methods whereby the data required in the future could be more economically obtained paying special attention to the different logistic and technical needs in advanced and developing countries;
- (d) to report to the URSI-STP Committee within two years.

The WG notes that certain weather ships and meteorological stations exist at sites which would be very valuable for obtaining ionospheric data for scientific and operational purposes, and further recommends that the possibility of planning ionosondes or other ground-based monitoring instruments at these stations be investigated by the administrations involved.

WG Rec. 3 High Accuracy Stations

The Working Group draws attention to the need for data with a higher accuracy than is usually obtained at rocket ranges, near Thomson scatter stations and where intensive studies of solar-terrestrial, ionospheric or magnetic problems are active; noted that some investigations using ionosondes demand an accuracy which is only available at one or two stations (e.g., Lindau); and draws attention to the need for a few more stations with this accuracy.

The Working Group recommends that action be taken to fill these needs.

The Working Group also stresses the need for synoptic data from these stations, and recommends that such stations be operated regularly and the data obtained circulated even if it is not needed by the particular experimenters involved. In particular, groups using published data on rocket or satellite observations often need to know the synoptic conditions when the observations were made.

WG Rec. 4 Information Bulletin

The Working Group felt a need to improve communication between the stations, the scientists using the data, the International Unions involved, e.g., URSI, IAGA, IUCSTP, and recommends the regular circulation of an Information Bulletin addressed to the stations of the network and all

others concerned. The Bulletin should include all International Recommendations involving its recipients, notices of Retrospective World Intervals and other special study periods, information on outstanding Solar-Terrestrial phenomena, discussions on scaling or other problems at stations, suggestions for Regional studies, and notes on new projects or techniques, particularly when they involve interdiscipline cooperation. There should be a section where inexperienced workers could raise their difficulties and request advice. A particular need at present was to interchange information on shipboard and aircraft techniques.

[This bulletin is an attempt to satisfy Rec. 4. Your comments would be welcome.]

WG Rec. 5 Visiting Experts

The WG considers that the most urgent STP requirement is to improve the operation at stations in the existing network which apart from other important uses is valuable for STP monitoring, and recommends:

- (a) That suitable experts be sent to visit the stations, particularly in the developing countries, to give advice on the analysis of ionograms, instrumental problems and to improve morale by drawing attention to the current intensive use of the data produced particularly in support of other projects, often in other disciplines. Initially special efforts should be made to visit the South American and African stations.
- (b) That international interchange of station staff be encouraged.
- (c) That young graduates be encouraged to spend a year or more as operators at V.I. stations both to help the station and to obtain first-hand knowledge of the characteristics of the ionosphere in different parts of the world.

WG Rec. 10 Centralized Processing of Data

The Working Group feels that centralization of some steps in the handling of data from stations is rapidly becoming essential since all the data will be needed in computer compatible form and it is inefficient and inaccurate to process data by hand when it will eventually be computerized. The Working Group recommends that all organizations having access to computer processing should use it both for interchange and, where desired, for the production of tables.

WG Rec. 12 Revised Recommendations for Spread F Parameter

(See Section IV of this INAG Bulletin for full text)

WG Rec. 15 Monitoring of Absorption by Ionosondes

(See Section V of this INAG Bulletin for full text)

* Another group of recommendations made originally *
* by the URSI-STP Committee at an earlier (Brussels, *
* September 1968) meeting was supported by the London *
* sub-group of V.I. specialists. To keep things *
* straight, we identify them here as Br (Brussels) *
* Recommendation. They have also been printed in URSI *
* Information Bulletin No. 169, December 1968, pp. 55- *
* 59. Here are some of them: *

Br Rec. 3 New Ionosondes

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

Depending on local conditions, the main requirements are for:

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

(b) A larger number of cheap observatory-type instruments capable of high reliability.

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

Br Rec. 4 Use of V.I. Data

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

Br Rec. 5 Synoptic Network for V.I. Soundings

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

Br Rec. 6 Spread F Index

(See Section IV of this INAG Bulletin for full text)

IV Spread F Index -- A New Parameter, fxI

* As noted above, the URSI-STP Committee (Brussels, *
* September 1968) has recommended the introduction of a *
* new parameter which will give a measure of Spread F. *
* The full text on this matter is given here; but note *
* that the London Working Group revised and extended *
* this recommendation in their WG Rec. 12, which is *
* given at the end of this section. *

Br Rec. 6 Spread F Index

The URSI-STP Committee, noting that a measure of the top frequency of Spread F is urgently required for CCIR purposes and also has scientific interest, and that a proposal to introduce such an index has been widely supported by those responsible for stations, recommends that a new ionospheric parameter denoted fxI (with computer symbol 51) be adopted for international analysis, tabulation and normal circulation through WDCs and other publication methods, defined and applied according to the instructions following. It is recommended that all stations at high latitudes or subject to equatorial spread F tabulate and circulate this parameter, and that stations at other latitudes be invited to volunteer to analyze the parameter as a trial. Tests are particularly important at stations where the spread of frequencies of spread F often exceeds $fH/2$ at certain hours.

The URSI-STP Committee further recommends that stations report the properties of the new parameter in the scientific literature, through STP Notes, or through the URSI V.I. Consultant (Mr. W. R. Piggott, Radio and Space Research Station, Slough, Bucks, U.K.), and that its operation be reviewed at the next General Assembly of URSI where any suggested modifications can be considered and approved. It is recommended that this resolution be brought to the attention of CCIR, who should request administrations to adopt this index.

The parameter fxI

Definition

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

Scaling Rules

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

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

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

- (a) If the scatter traces disappear as a result of high absorption, use replacement letter B.
- (b) If f_{min} is above the top frequency seen (see foEs rules), add $fH/2$ to the top frequency, and add qualifying letter O, descriptive letter B.
- (c) If f_{min} is high, showing large absorption, but the value of f_{min} cannot easily be determined, use qualifying letter M (interpretation doubtful: reading may be foI instead of fxI) and descriptive letter B.
 - (i) When the signal/noise ratio is low, fxI is power sensitive; when high, it is independent of power as far as is known at present. For ionosondes with low signal/noise ratio for normal absorption the extra work in computing fxI from foI may not be justified.
 - (ii) Special care is needed when foI is near or below fH, since absorption can then hide fxI.

WG Rec. 12 Revised Recommendations for Spread F Parameter

The Working Group endorses the proposal to establish a new international index for spread F (URSI Bulletin No. 169, December 1968, URSI-STP Rec. 6, p. 56) and discussed details of rules for this index and for the interchange of related parameters which may be circulated in the future. It was concluded that some confusion of the originally suggested nomenclature with the satellite parameter fxS (extraordinary mode plasma frequency at the satellite) was likely and that the nomenclature should be changed to avoid this.

The Working Group recommends the following changes and additions to URSI-STP Rec. 6:

(a)	<u>Codes:</u>	<u>Computer Code</u>	<u>Explanation</u>
		50	Reserved for foI if required
		<u>51</u>	<u>fxI</u> , (previous nomenclature fxS, 41)
		52	fmI, lowest frequency of spread (in use at some stations only)
		53	M(3000)I, factor deduced from spread (in use at some stations on experimental basis only)
		54	h'I, minimum slant range of spread (in use at some stations only)

Only fxI is recommended for general use at present but data available for the other parameters in punched form should conform to the recommended code.

- (b) Missing values of fxI. The WG recommends that, for hours when spread F is usually present, the value of fxF2 with descriptive letter X be included when spread is absent so that the count and median can be representative of communication conditions for the month as a whole.
- (c) Treatment of slant F. Pending further investigation, the WG suggests that slant F be treated like a polar spur for obtaining the value of fxI.
- (d) Frequency spread dfS. For scientific work, where the spread of the conventional scatter pattern is most important, the WG draws attention to the use of frequency spread at a number of stations and proposes that this be a recognized international parameter for interchange on a voluntary basis. The code 57 and symbol dfS is suggested for this and comments are invited from all concerned in time for acceptance, modification or rejection at the URSI General Assembly August 1969.

V Improved Absorption Parameters?

* The London sub-group spent a long time dis- *
* cussing both the need for and the possibilities of *
* obtaining better measures of ionospheric absorption *
* from ionosonde observations. The result was the *
* following recommendation: *

WG Rec. 15 Monitoring of Absorption by Ionosondes

The Working Group notes that the variation of absorption with position and time appears to be more complicated than can be adequately monitored by existing absorption stations and recommends that all V.I. stations attempt to produce a parameter which is dependent on the absorption present.

The following techniques can be used to obtain an improved measure of absorption for synoptic purposes and the Working Group recommends that they be adopted, as appropriate.

- (a) At stations where f_{min} is mainly determined by absorption, at least when it is appreciable, the operation of the ionosonde should be examined and changed where needed to make the f_{min} values more consistent. In particular in any month diurnal gain changes should be made at fixed times of day only and the gain at fixed time be kept as constant as possible. Where possible the times and gain changes in dB should be recorded and circulated with the f_{min} data.

At stations where the f_{min} for the second order trace, f_{m2} , is mainly determined by absorption, measurements of f_{m2} will usually show absorption changes more accurately than f_{min} and be less sensitive to interference and equipment characteristics. The Working Group encourages stations to compare f_{min} and f_{m2} (or f_{m3} if usually available) and to report their findings either in the literature or through the V.I. or Absorption Consultants.

- (b) At high sensitivity stations where f_{min} is not usually a measure of absorption, the Working Group recommends that f_{m2} be reduced and circulated instead of or in addition to f_{min} . Note in this case the appropriate value of f_{min} should always be shown in tables of other parameters when the parameter is below f_{min} , e.g., ...EB; ...ES cases. The Working Group encourages the substitution of f_{m2} for f_{min} at stations in group (a) when local experience shows that this gives a better description of absorption changes.

- (c) The Working Group draws attention to the use of amplitude measures on selected ionograms (e.g., hourly) and of simple attachments to ionosondes which enable crude measure of amplitude to be monitored (e.g., 1967 Rawer & Suchy, Handbuch der Physik XLIXL/2, pp. 248-250; 1964 Paul, A.K., Electron Density Distributions in the Ionosphere, ed., Trane E North Holland, pp. 17-20). All such methods can be misleading in particular circumstances which often depend on local conditions, as can fmin or fm2.

VI Ionosondes in Conjugate Point Studies

* Some pertinent recommendations have been made *
* by Working Group 5, on Conjugate Point Experiments, *
* of the Interunion Commission on Solar Terrestrial *
* Physics (IUCSTP). Background information and details *
* appear in STP Notes No. 1, 2 and 3. Of particular *
* interest is General Recommendation No. 15 (proposed by *
* WG 5) of the London, January 1969, meeting of IUCSTP *
* as follows (STP Notes No. 4, page 26): *

"Recognizing that comprehensive studies of the conjugate behavior of the ionosphere require continuous records from an extensive network of ground stations,

The IUCSTP

Urges that operation of the world-wide ionosonde station network be continued, and that existing gaps in conjugate coverage be remedied, whenever possible, with the establishment of new, conveniently located stations."

* Further, IUCSTP Working Group 5 made on its *
* own authority several specific recommendations *
* about new measurements needed at some stations, *
* or desirable locations for important new work. *
* One such recommendation which mentions an iono- *
* sonde is as follows (STP Notes No. 4, page 62, WG 5 *
* recommendation (6)):

- "Considering (1) that Arecibo Ionospheric Observatory (Puerto Rico) has a conjugate point near an easily accessible area in Argentina,
- (2) that the said Observatory is appropriately equipped to study a maximum number of parameters relevant to conjugate photoelectron effects, and
- (3) that the field geometry is particularly well oriented for studies of winter-summer comparisons,

WORKING GROUP 5

Recommends that a station, equipped with a photometer and eventually an ionosonde, be set up as close as possible to the theoretical conjugate point of Arecibo."

* These IUCSTP actions are noted here to give an *
* indication of the interest of scientists in other *
* fields of solar terrestrial research, scientists who are *
* not themselves engaged in V.I. observations but who are *
* users of the data in their researches. *

VII What is the Present Active V.I. Network?

STP Notes No. 6, a special issue, is in press as this is being written. In addition to the "Guide for International Exchange of Data in Solar Terrestrial Physics (1969)", it also contains "Provisional Lists of Observing Stations for the International Years of the Active Sun (IASY) 1969-1971". These lists compiled from national reports to IUCSTP, from the most recent WDC catalogs and from information received less formally by IUCSTP, represents the best available list of active stations in the disciplines covered. We reproduce the list for Ionospheric Vertical Soundings (Program B.1) as an Appendix to this INAG bulletin. Yet members of INAG know, very informally, that a number of other stations are in operation. Some of these "lost" stations run regularly or quite regularly, others operate on an intermittent basis. We would especially appreciate it if recipients of this INAG bulletin would help make the list of V.I. stations correct and complete. Please write to the INAG Secretary or to any member. Corrections to station coordinates would also be most helpful.

VIII List of Useful Reference Materials

Here is a recapitulation of some of the useful reports and documents which the INAG hopes are available to or at each station. If everyone has the same reference material, we have gone a long way towards achieving a useful degree of uniformity in observation, interpretation and analysis. Some of the material is rather old, but should still be valuable. Other items are new (some only just now being issued) and will not yet have reached stations. In the course of the next year we would hope that all of these reference materials will be available to each station. We will reprint and extend this list in future (if any) issues of these INAG bulletins.

(1) URSI "Handbook of Ionogram Interpretation and Reduction", by W. R. Piggott and K. Rawer. The original was published by Elsevier in 1961 but is now out of print. It is intended that a revised edition will be issued in the coming months as a UAG Report of World Data Center A, Upper Atmosphere Geophysics. This is the detailed guide for Vertical Sounding work and provides the basis for uniformity of data from the world network. It also includes many suggestions for analysis and research for individual station or groups of stations.

(2) IGY "Manual on Ionosphere Vertical Soundings", by J. W. Wright, R. W. Knecht and K. Davies. This was published in Annals of the IGY, Vol. III, Part I, Pergamon Press, 1957.

(2a) IQSY Instruction Manual "Ionosphere - Vertical Incidence Soundings", written by W. R. Piggott and L. Bossy. This includes material which brought up to date for IQSY the material in the IGY guide. The IQSY manual was published in Volume 1 of Annals of the IQSY, pages 58-73, the MIT Press, 1968.

(3) "Atlas of Ionograms". This was issued in 1957 under the auspices of the WWSC and later reprinted as U. S. National Bureau of Standards Technical Report No. 5097. It has been long out of print. A successor volume has been in preparation for many years. It is expected to be issued in the near future as a UAG Report of World Data Center A, Upper Atmosphere Geophysics.

(4) "Guide for International Exchange of Data in Solar Terrestrial Physics (1969)", STP Notes No. 6 (Special Issue), 1969. The Guide includes the general recommendations on international data exchange and the workings of the WDC system. Section B.1 gives the particular recommendations for Ionosphere Vertical Soundings. STP Notes are available through national committees adhering to IUCSTP, or inquire of the IUCSTP Secretariat, % U.S. National Academy of Sciences, 2101 Constitution Avenue, Washington, D. C., U.S.A., 20418. This revised "Guide" replaces that in Annals of IQSY, Vol. 1, pages 314-377, 1968, and IGY Annals, Vol. VII, Part II, pages 143-373, 1959.

(5) Catalogs of the World Data Centers which receive, archive and distribute V.I. data. The catalogs indicate what data are available through the WDCs. Because of interchange among the centers, each center holds the same basic collection, although each center usually has more complete data -- more than the internationally recommended minimum -- for stations in its primary region of coverage.

Catalogs covering V.I. data are available from:

World Data Center A
Upper Atmosphere Geophysics
ESSA
Boulder, Colorado, U.S.A., 80302

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

World Data Center-B2 Solar-Terrestrial Physics
Izmiran
P/O Akademygorodok
Moscow Region, USSR

World Data Center-C2 for Ionosphere
Radio Research Laboratories
Ministry of Posts and Telecommunications
2-1, Nukui-Kitamachi 4-chome
Koganei-shi
Tokyo 184, Japan

(6) IUWDS "Synoptic Codes for Solar and Geophysical Data". This second revised edition 1969 (yellow cover) is available from IUWDS secretaries, P. Simon, Ursigrammes Observatoire, 92 Meudon, France, or Miss J. V. Lincoln, Upper Atmosphere Geophysics, ESSA, Boulder, Colorado, U.S.A., 80302. It contains the standard codes for transmission of selected V.I. data by telegram to network headquarters or to Regional Warning Centers. The booklet also explains in detail the international schemes for Alerts and forecasts of solar and geomagnetic disturbances and other timely information used by many V.I. stations.

(7) Periodicals giving timely information. While some fraction of the contents of STP Notes and URSI Information Bulletin are of interest to individual V.I. stations, it is not practical, nor probably helpful, for each station to have all this information. Instead, the INAG plans to arrange to copy excerpts from these periodicals and distribute them as part of these INAG bulletins. For example, the URSI STP reports covered in this INAG Bulletin already have or will appear in the URSI Information Bulletin. Also, the list of V.I. stations is taken from STP Notes No. 6. We will intend to continue this practice in the future, if you desire.

IX Notes from the WDCs

The addresses of the four WDCs which handle V.I. data appear in Section VIII, immediately above, so we do not use up more space to repeat them here. Presumably each station is familiar with the address of at least one of the WDCs, since the WDCs are the main mechanism for bringing together the worldwide data from the network for research and practical analyses.

The latest catalog of WDC-C1 (Slough) for data from 1 July 1957 - 30 June 1968 is in a new format especially adapted to the user. It takes over and extends some of the arrangements of recent WDC-A catalogs.

According to the June 1969 Catalog of WDC-A (Boulder), at least some of the V.I. data from 61 different stations are available in computer format. WDC-A is now regularly receiving data from about 30 stations on punched cards or magnetic tape. Five "customers" have standing orders for all computerized V.I. data available, and in recent months fifteen other requests have been filled with data in computer form.

The Chairman of URSI-STP Working Group on Radio Science Data Centers, Mr. A. H. Shapley, calls attention to the revised "Guide" now being distributed as STP Notes No. 6. As regards V.I. data, it is quite similar to the draft widely circulated in January 1969 and discussed at the London IUCSTP meeting that month. During the course of completion of the "Guide," many improvements were made as a result of visits by Mr. Shapley to WDC-B and WDC-C1, as well as a visit by Mr. Piggott and others to WDC-A.

Many stations (and V.I. organizations) are sending notes or logs along with their data to the WDCs. This is to be most strongly encouraged. In particular it is helpful (and saves much correspondence and frustration) if the WDCs regularly know when equipment is out of operation for repair, when a station is closed temporarily or permanently, when it is moved or is to be moved to a new location, etc. The WDCs should be able to tell users or potential users of data whether a blank in the catalog means "no data exist" or only that data are delayed for some reason.

All WDCs would be able to say that the largest number of requests are for recent data, data within the past year or less. Many studies -- individual or regional or network -- are restricted in scope and significance because the necessary raw materials got stuck in the data-flow pipeline. However a recent special effort, made through WDC-A, received very broad cooperation with positive responses from 85% of the stations contacted for data only two months old.

X Philosophy and Future

This bulletin quotes recommendations by authoritative international scientific groups. However it should be clearly understood that they are only recommendations, made with the hope of increasing the value of the work in scientific research and technical activities. We are calling them to your attention so that you can know the international standards, and can ask for advice or help when needed. You should note that the international advisory group, INAG, is not responsible for your station. INAG should not, cannot and does not give "instructions". Sometimes there are local needs or difficulties which are best met by departing from these international "rules" or recommendations. Thus, you should never alter the procedure you are using without first asking permission of your administration. At the same time, sometimes departure from the international "standard" has been unintentional. Frequent changes in staff do unavoidably result in gradual changes in procedures and methods. It is hoped that INAG and this information bulletin will help to check this.

The members of INAG are anxious to help. Please write to any member, or to the INAG secretary, with any questions or suggestions or information. Please write anyway to give your opinion on whether and what INAG should undertake. Its future activities will be based on the response during the coming months.

[Note: This first INAG Bulletin is being issued before there has been time for all INAG members to exchange their ideas by correspondence. There was, however, an informal meeting at Ottawa at the end of August of four members and people who are close to three others; among these there was a good consensus on how to start -- and start we have.

[This group thought that if we were going to try out the mechanism of an information bulletin, we should try to start it in time to reach (translated if possible) the loneliest and most isolated of us all, the observers at Antarctic stations, before their expeditions set sail this (austral) summer. So we have compiled this first effort in something of a hurry. In fact, in the week after the URSI Assembly several of the substantive sections were put together in the full tradition of the WWSC (see page 1) during a meeting on ionospheric forecasting in Canada where the timely use of V.I. data was one of the important serious topics. Thus, started by Piggott, Pillet and Lincoln, the completion was by the Boulder addresses, with "ex officio" taking ultimate responsibility and blame in the absence of the Secretary in Geneva at the plenary CCIR Study Group VI, where the V.I. network, its health and well being is again a prominent topic.]

B.1 IONOSPHERE VERTICAL SOUNDINGS

B.1 CONTINUED

	GEOGRAPHIC			GEOGRAPHIC	
	LAT	E LONG		LAT	E LONG
*ABERYSTWYTH	52.	356.	*HAIFA	32.82	34.98
*ABRA PAMPA	-23.	294.	HALLEY BAY	-75.5	333.40
AHMEDABAD	23.00	72.60	HEISS IS.	80.60	58.00
AKITA	39.70	140.10	HOBART	-42.9	147.20
*AKROTIRI	34.	32.	HUANCAYO	-12.0	284.70
ALMA ATA	43.20	76.90	HYDERABAD	17.30	78.50
*ARCHANGELSK	64.	40.	IBADAN	7.40	3.90
ARGENTINE IS.	-65.2	295.70	IRKUTSK	52.50	104.00
ASHKhabAD	37.90	58.30	JAMAICA	18.00	283.20
ATHENS	38.00	23.60	JOHANNESBURG	-26.1	28.10
AUCKLAND	-37.0	175.00	JULIUSRUH/RUGEN	54.60	13.40
BANGKOK	13.70	100.60	*KALINIGRAD	54.	20.
*BARILOCHE	-41.	289.	*KARAGANDA	49.	73.
BEOGRAD	44.80	20.50	*KAZALINSK	45.	62.
BILLERICA	42.60	288.70	*KAZAN	55.	48.
BOMBAY	19.00	72.80	KERGUELEN	-49.4	70.30
BOULDER	40.00	254.70	KERMADEC	-29.2	182.10
BRISBANE	-27.5	152.90	KHABAROVSK	48.50	135.10
BUDAPEST	47.40	19.20	*KIEV	50.	30.
BUENOS AIRES	-34.5	301.50	KIRUNA	67.80	20.40
BYRD STATION	-80.0	240.00	KODAIKANAL	10.20	77.50
CALCUTTA	23.00	88.60	*LANCASTER	53.	358.
CAMPBELL IS.	-52.5	169.20	LA PAZ	-16.5	291.90
CANBERRA	-35.3	149.00	LENINGRAD	60.00	30.70
CAPE SCHMIDT	68.90	179.50	LINDAU	51.60	10.10
CAPE ZEVGARI	34.60	32.90	LULEA	65.60	22.10
CAPETOWN	-34.1	18.30	LYCKSELE	64.70	18.80
CASABLANCA	33.60	352.40	MADRAS	13.10	80.30
CHURCHILL	58.80	265.80	*MAGADAN	60.	151.
COCOS IS.	-12.2	96.80	MANILA	14.70	121.10
COLLEGE	64.90	212.20	MAUI	20.80	203.50
CONCEPCION	-25.1	356.45	MAWSON	-67.6	62.90
DAKAR	14.00	17.00	MEXICO CITY	19.40	260.30
DELHI	28.60	77.10	MIEDZESZYN	52.20	21.20
DE BILT	52.10	5.20	MIRNY	-66.5	93.00
DIXON	73.50	80.40	MOSCOW	55.50	37.30
DJIBOUTI	11.50	42.80	MUNDARING	-32.0	116.20
DOORBES	50.10	4.60	MURMANSK	69.00	33.00
*DUSHANBE	38.	68.	NAIROBI	-1.3	36.80
ELLSWORTH	-77.7	318.90	NARSSARSSUAG	61.20	314.60
*EMMABODA	56.	15.	NATAL	-5.7	324.80
FREIBURG/BREISACH	48.10	7.60	NORFOLK IS.	-29.0	168.00
GARCHY	47.30	3.10	*NORILSK	69.	88.
GENOVA	44.60	9.00	*NOVOSITVISK	55.	82.
GODHAVN	69.30	306.50	NURMIJARVI	60.50	24.60
GODLEY HEAD	-43.60	172.80	OKINAWA	26.30	127.80
GORKY	56.10	44.30	OTTAWA	45.40	284.10
GRAND BAHAMA	26.60	281.80	OUAGADOUGOU	12.40	358.50
GRAZ	47.10	15.50	PARAMARIBO	5.80	304.80

B.1 CONTINUED

	GEOGRAPHIC	
	LAT	E LONG
PARIS-SACLAY	48.10	2.30
*PETROPAVLOVSK	52.	158.
POINT ARGUELLO	35.60	239.40
POITIERS	46.60	0.30
*PORT LOCKROY	-64.8	296.50
PORT MORESBY	- 9.4	147.10
PORT STANLEY	-51.7	302.20
PRUHONICE	50.00	14.60
RABAT	33.90	353.20
RAROTONGA	-21.2	200.20
RESOLUTE BAY	74.70	265.10
ROME	41.80	12.50
ROSTOV	47.20	39.70
SALEKHARD	66.50	66.70
SALISBURY	-34.7	138.60
*SAN JUAN	-31.	292.
*SAO JOSE DOS CAMPOS	-23.	315.
SANAE	-70.3	357.60
SCHWARZENBURG	46.60	6.70
SCOTT BASE	-77.8	166.80
SINGAPORE	1.30	103.80
SLOUGH	51.50	359.40
SODANKYLA	67.40	26.60
*SOFIA	42.	23.
*SOUTH GEORGIA	-55.	322.
SOUTH POLE	-90.0	0.00
STANFORD	37.40	237.80
ST. JOHNS	47.60	307.30
SVERDLOVSK	56.70	61.10
TAHITI	-17.7	210.70
TAIPEI	25.00	121.20
TAMANRASSET	22.80	5.50
TANANARIVE	-18.8	47.50
*TASHKENT	41.	69.
TBILISI	41.70	44.80
TERRE ADELIE	-66.7	140.00
THULE/KANAK	77.50	290.80
THUMBA	8.60	76.90
TIRUCHIRAPALLI	10.80	78.70
TIXIE BAY	71.60	128.90
TOGO	10.80	0.00
TOKYO	35.70	139.50
TOMSK	56.50	84.90
TORTOSA	40.80	0.30
TOWNSVILLE	-19.3	146.70
TRELEW	-43.2	294.70
TROMSO	69.70	19.00
TSUMEB	-19.2	17.70
TUCUMAN	-26.9	294.60

B.1 CONTINUED

	GEOGRAPHIC	
	LAT	E LONG
*TUNGUSKA	61.	90.
*UNIV QUEENSLAND	59.	17.
USHUAIA	-54.8	291.70
VOSTOK	-78.4	106.90
WAKKANAI	45.40	141.70
WALLOPS IS.	37.90	284.50
WHITE SANDS	32.30	253.50
WILKES	-66.9	110.50
WINNIPEG	49.80	265.60
WOOMERA	-31.0	136.30
YAKUTSK	62.00	129.60
YAMAGAWA	31.20	130.60
YUZHNO SAKHALI	47.00	143.60
*ZARIA	11.	7.