IONOSPHERIC NETWORK ADVISORY GROUP (INAG)*

IONOSPHERIC STATION INFORMATION BULLETIN No. 35**

		Page
1.	Chairman's Introduction	2
2.	INAG Bulletin Subscription and Mailing List - Reminder.	2
3.	Report on Training Seminar, Irkutsk, 20-26 September 1981.	3
4.	World Data Centres and International Data Exchange.	6
5.	Station Notes	7
6.	Atlas of Ionograms for the South American Region	7
7.	UK Sporadic-E Colloquium, 24 February 1981	8
8.	Meeting to Celebrate 25th Anniversary of Opening of Dourbes, 13-14 May, 1982	8
9.	Uncle Roy's Column	8
10.	Obituary - Nadezhda Vitalyevna Mednikova	10
11.	A New Look for the INAG Bulletin	10
12.	International Geophysical Calender for 1982	11
13.	Questionnaire on International Data Exchange.	13

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

**Issued on behalf of INAG by World Data Centre A for Solar Terrestrial Physics, National Oceanic and Atmospheric Administration, Boulder, Colorado 80303, USA.

This Bulletin is distributed to stations by the same channels (but in the reverse direction) as their data ultimately flow to WDC-A. Others wishing to be on the distribution list should notify WDC-A

1. Introduction

by W. R. Piggott, Chairman

I feel that I would like to express my personal sense of loss due to the death of our old colleague and friend, Dr. N. V. Mednikova (see p.10). I remember many happy and productive meetings with her. She was a close friend with whom one would continue the relationship unaffected even by long periods when we did not meet. She was always rather retiring in public and few people realise the large contributions which she made to the efficiency of the network.

We are still developing the new methods of operating INAG - so far I have still been largely involved with the writing with much help from our Secretary, Mr. Alan Rodger. Dr. L. F. McNamara has withdrawn from the post of Vice-Chairman, which has been assumed by Dr. D. G. Cole, with whom I shall be spending some time in Australia during March 1982. He has already contributed a number of valuable suggestions and proposals which we propose to follow up. In particular, we wish to produce a map of stations which are at present operative or will become operative in the near future. This should include both those which contribute to the World Data Centres, those which can be made to operate to special request and especially those which operate, but whose ionograms are reduced only on request. (See INAG resolution, INAG 34, p. 12). Only stations contributing to the World Data Centres are at present listed internationally.

INAG urgently needs feature articles on stations or networks giving, for example, what equipments have been used, the administration responsible, and if possible, some history with dates when data are available or changes in equipment or scaling rules were made. Why not write about your station before this information is lost for ever? Another topic on which there are widely different views is the specification of the optimum ionosonde for your purposes and in particular the weaknesses in your equipment which you would like to see improved (e.g. INAG 31, p. 17-19).

At international meetings, the view of powerful groups with specialised interests in real time use of data, N(h) profiles, and the use of the ionosphere for communications have been well represented. In general, the uses for research, requirements of developing countries, needs of unorganised users of ionospheric data (e.g. ships, aircraft, expeditions) are not brought out. Why do you operate your stations and how do you use the data?

Since my retirement, I have travelled considerably to different parts of the world and looked at current work. It has been very evident to me that most groups do not recognise the peculiarities of their own data and thus do not identify potential research projects. These are often complementary to research done using expensive or elaborate equipment, e.g. incoherent scatter radars, satellites or rockets. The concentration on the latter has certainly advanced our knowledge of the ionosphere, magnetosphere and their interactions considerably and these advances have made it possible to interpret phenomena which can only be studied using ionograms. In my view, the effort has become unbalanced and there are many potentialities for really new work using classical methods or new developments from them. Many of the phenomena discussed and illustrated in the High Latitude Supplement can be found at both medium and low latitudes, though the generating mechanisms may be different to those at high latitudes. Similarly even a superficial comparison of beacon data and ionogram data show that some ridges show on both (e.g. the main equatorial anomaly peaks) but many do not, foF2 increases, but the thickness decreases so that the total electron content is not greatly changed. Where and when does this occur and why?

My own experience in recent months suggests that any really intensive study of ionograms and f-plots, even from a single station, will usually suggest new ideas - there is plenty still to discover. At present, I am concentrating on sub-tropical phenomena as a change from high latitudes.

During the next three years, we are in a period of change in INAG. You can have a great influence on its future, particularly by contacting your nearest INAG member and indicating your interests and problems, things you would like to have discussed, etc. I hope that this will be the last Bulletin with a large contribution from me.

I want to thank Dr. Besprozvannaya for her article on the Operators' Conference at Irkutsk and request your views. In particular, I hope that other INAG members will contribute their views on the discussions in this Bulletin.

2. INAG Bulletin Subscriptions and Mailing List - Reminder

If you have not already paid your subscriptions to the INAG Bulletin for the three years from September 1981, please arrange to do so immediately. An invoice was included in INAG 34, p. 18. The price per set is $20.00 US. Cheques should be in US currency and made payable to the Department of Commerce, NOAA/NGSDC and sent to Raymond 0. Conkright, World Data Centre A for Solar Terrestrial Physics, 325 Broadway, Boulder, CO 80303, U.S.A.

If you are not receiving the correct number of copies of the INAG Bulletin, please inform Raymond Conkright at the address given above.

3. Report on Training Seminar, Irkutsk 20-26 September 1981

by A. S. Besprozvannaya

A seminar, sponsored by the USSR National Geophysical Committee, was held in Irkutsk from 20-26 September 1981. It was attended by 80 specialists from the USSR, German Democratic Republic, Bulgaria and Czechoslovakia. The principal objective of the seminar was to concentrate on the teaching and training of personnel in the use of the URSI handbook.

In particular, three areas have caused difficulties:-

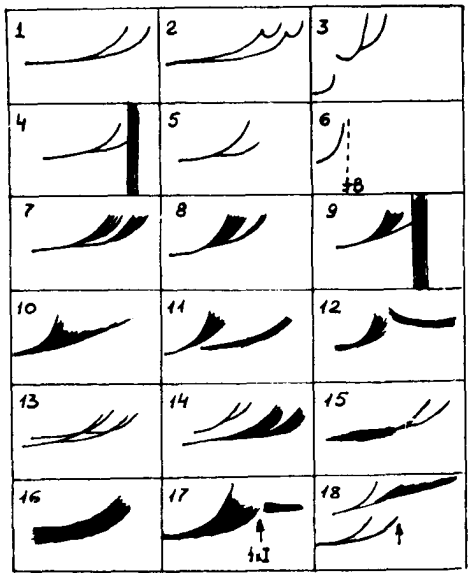
1. Reduction and interpretation of scattered and oblique traces in F-region.

2. Reduction and interpretation of traces of sporadic ionization in E-region (particle E, Es-r, SEC, lacuna).

3. Interpretation of ionograms in the presence of travelling ionospheric disturbances (effects of stratifications in the E-region, E2 layer, FO.5).

The ionogram Atlas, prepared by A. S. Besprozvannaya and T. I. Shchuka as a manual for high latitude ionogram interpretation, was used as the basis for discussion of the first two items. The Atlas describes the existing practice of ionogram interpretation in the Arctic and Antarctic Research Institute at Leningrad.

fxI

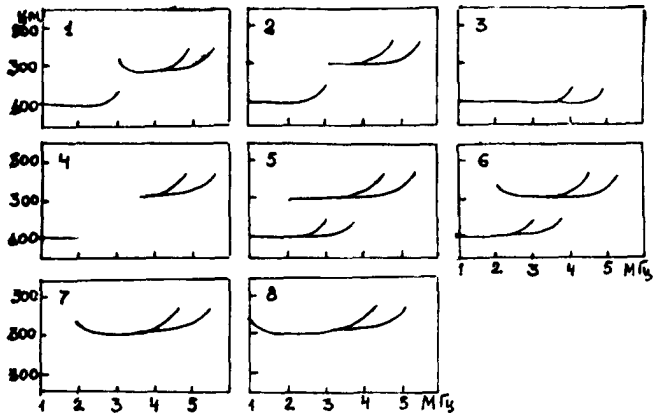


N/N	foF2	fxI	h'F	type F	N/N	foF2	fxI	h'F	type F
1	044	052-X	250	X	10	035-F	070	250	PF
2	044-H	052-X	250-H	Y	11	035-F	070	250	PF
3	03BEG	046-X	250	X	12	035-F	070	250	PF
4	044	0520X	250	X	13	044	053-X	250	Q1X
5	044	0520X	250	X	14	044-F	060	250	Q1F
6	010	0170B	250	X	15	044	052-X	250-Q	XQ
7	044-F	054	250	F	16	F	060	250-Q	FQ
8	044-F	0560B	250	F	17	044UF	060	250	F
9	044-F	0560S	250	F	18	044	052-X	250	X

The scaling of fxI made according to the scheme shown in Fig. 1, which is in essence the same as the one proposed by Alan Rodger, INAG Bulletin 32, page 33. An additional example was introduced to describe the situation where distinct oblique traces are observed at frequencies below foF2 (examples 13 and 14). The Australian group have suggested the term resolved range spread for this class of event. This situation occurs regularly in the vicinity of the main ionospheric trough and their presence has been indicated by use of the symbol Q1 in the Spread-F table. Thus, important information on the horizontal structure of the ionosphere has been conveyed.

Particle E and Es-r Scaling

Fig. I

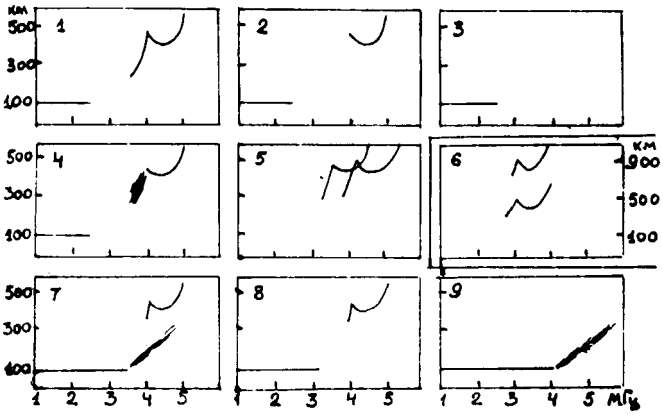


N/N	Tabulation			f plot	
	ONO	fbEs	type Es	fbEs	type Es
1	030-K	030-K	r	-o-	o
2	030-K	030- -	r	– • –	o
3	040-K	040AA	r	– • –	o
4	Y	Y	r	y	o
5	030- -	020- -	r	– • –	•
6	030- -	020-K	r	-o-	•
7	020EB	020EK	-	-	-
8	010EE	010EK	-	-	-

Fig. 2

The scaling and interpretation of particle E and Es-r was made in accordance with the scheme shown in Fig. 2. Any anomalous ionisation in the E-region causing an Es trace with group retardation is considered to be a sporadic layer of type Es-r. The descriptive letter 'K' in foEs scaling is used to indicate that the Es-r layer blankets the overlying layers up to foEs. The descriptive letter 'K' in fbEs is used to show that there is group retardation at the low frequency end of the F-region trace. This scaling scheme takes care of the particle E which is considered as a specific case of Es-r, and thus the indication of particle E in the Es-type column is redundant. The main advantage of this scheme is that it is much easier for the operator to learn and use whilst from the scientists viewpoint, all the information conveyed by the rules described in the Handbook is still available.

Slant E Condition and Lacuna



N/N	f min	foE	foEs	fbEs	foF2	foF1	h'F2	h'F	type Es
1	010	Y	030EG	030EG	050	040	400	250EY	-
2	010	Y	030EG	030EG	050	040UY	400	Y	-
3	010	Y	030EG	030EG	Y	Y	Y	Y	-
4	010	Y	030EG	030EG	050	040UY	400	250EY	-
5	Y	Y	B	B	045	035	450	Y	-
6	Y	Y	B	B	040	030	450	Y	-
7	010	A	035	Y	050	040	400	Y	fs
8	010	A	Y	Y	050	040	400	Y	r
9	010	A	Y	Y	A	-	-	A	rs

Fig. 3

The interpretation and scaling of ionograms which show slant E condition and lacuna was discussed and an example scaling sheet has been produced (Fig. 3). Scaling is in accordance with the Handbook rules (page 99, UAG-23A) with the exception of examples 5 and 6. It is suggested that it would be more convenient and more correct to use the replacement letter Y for fmin instead of a numerical value qualified by E and described by Y. Also, letter B should be restricted for use with Es parameters only, rather than all E-region parameters as indicated on page 93 of UAG-23A.

One further area which causes difficulty is the interpretation and scaling of sequences affected by travelling ionospheric disturbances. The scheme proposed in INAG Bulletin 30, page 12, does not agree in all details with that described in UAG-23A, page 48. In particular, the identification of foE in the presence of a stratification can be very controversial and the meeting requested that INAG should provide further guidance on the scaling of these difficult cases.

The seminar participants also discussed other problems related to the interpretation of complex ionograms and the use of ionospheric data to determine some of the aeronomic characteristics of the ionosphere and magnetosphere. These will be described in a later INAG Bulletin.

Comments from Chairman

The submission of the training aids by the USSR groups is rather heartening, after my numerous requests for these valuable documents, which, to a large extent, have gone unheeded. These aids are of great benefit to other groups, stimulate useful discussion, and enable controversial points to be clarified. It sometimes happens that a practice which is possible in one part of the world, gives trouble when applied generally.

fxI Scaling (Fig. 1)

Use of X. The use of X to denote no spread-F in the Spread-F type tables is clearly excellent and should be encouraged at all stations producing Spread-F tables.

Resolved range spread. The difference between unresolved and resolved range spread is essentially a problem of horizontal scale. At one extreme is the case where the traces seldom, if ever, overlap, such as those associated with mid-latitude and high-latitude troughs (Examples 12-14, Fig. 1). The other limit is where the range spread shows as a slight broadening of the F trace.

There has been relatively little interest in classifying range spread in the past, so it has seldom been discussed seriously by INAG. It has always been an INAG policy not to ask scalers to produce para meters or make distinctions which did not appear to have potential or active interest. Therefore, we have to ask whether significant extra information can be obtained easily and whether it will be used, if obtained. This is debatable and INAG would like to have more views. If it is not going to be used, Q is perfectly adequate for both unresolved and resolved range spread, including all satellite traces. This is the current practice recommended by INAG.

I have often felt that it would be useful to identify cases of resolved range spread and in particular the presence of additional main traces since it is not possible to show the critical frequencies of both traces on the standard tables. However, the view has been put forward that if one is really interested in this type of situation special analyses of all critical frequencies and ranges would be needed. My experience supports this, and Q is sufficient identification of possible periods of interest.

In practice, the design of the ionosonde can have a significant effect on the traces seen, so that identical rules can give different interpretations when the ionosonde is changed. For example, both the pulse-width of the transmitted signal, and the differentiating time constant of the display circuitry can have a significant bearing on whether a broadening of a single trace (unresolved range spread) or two discrete traces (resolved range spread) is observed. However, the separation of these two classes at a single station can provide useful information on the size of oblique structures and their distance from overhead.

While I would prefer to have another letter rather than Q1 (single symbol indicators are usually better), the proposed technique gives no difficulty at the stations which produce Spread-F type tables. Unfortunately very few do - most Spread-F typing is done using the normal fxI, foF2 and h'F tabulations. Now that letter M has been dropped for cases where the x and o-traces are indistinguishable, it might be possible to use this instead of Q in the h'F table to denote the presence of satellite traces (Q1). I would like to have this discussed. As far as I know M has never been used at any station in conjunction with h'f so there is little chance of confusion. If this, or a similar suggestion was acceptable, we should try to use the same convention in Spread-F type tables.

A few minor comments should be made on Fig. I for clarification:-

Example 2 - The presence of the stratification is already shown by the foF2 entry, so I would not use the descriptive letter H with h'F; the stratification does not affect the measurement of the parameter and is not near the frequency where h'F is measured. Thus H on foF2 shows an effect near foF2, H on h'F one near fminF.

Example 3 - This example is intended to show a G condition (see UAG-23A, pp 73-82).

Example 14 - The order of Spread-F types should be F, Q1, as fxI is scaled from a trace showing frequency spread-F.

Example 17 - The presence of an auroral Es trace at great obliquity is shown in this example. Adjacent ionograms would distinguish this example from example 12 - Es changes rapidly in time, polar spurs slowly.

Particle E and Es-r Scaling (Fig. 2)

I would like comments from other groups and individuals on the interpretations and scalings provided in Fig. 2, which differ significantly from the rules given in the Handbook and the examples in the High Latitude Supplement. I should point out that departures from the URSI guidelines can make comparison of data from different stations and nations very difficult; after all, this was one of the main reasons for writing both editions of the Handbook. The question for INAG to discuss is whether the simplicity of the teaching of these rules proposed by Dr Besprozvannaya and her colleagues outweighs the disadvantages this scheme would introduce, if adopted. For convenience and comparison, the standard handbook conventions are given below.

Tabulation depending on presence of spread or multiple traces at foEs.

It was agreed at the Washington meeting that Es-k and Es-r could be combined to form one class, Es-r, by groups who wished to simplify their scaling procedures.

Example 2 This is a difficult case, which is very rarely observed in practice. Normally it occurs only when both the Es and F layers are tilted. Thus the use of the descriptive letter K with foEs is clearly misleading, as there is no group retardation near fminF. I do not agree with the f-plot symbol for fbEs, as the layers are tilted, I would prefer a downward arrow (less than) symbol.

Example 4 Lacuna is usually seen in daytime when normal E is present and the horizontal trace is therefore normally part of the normal Es trace. There
is no evidence on this ionogram of the presence of Es of any type so there can be no entries in the Es type table or on the f-plot. When Es is seen it is usually h, c, 1, and, if the sensitivity is adequate, s. I have not seen r type with lacuna yet and feel that r is most improbable.

Examples 7 and 8 These cases need general discussion because similar traces are frequently seen near sunrise and sunset when the retardation can be due to normal E, E2 or FO.5. The presence of the critical frequency can be indicated for example 7 on the f-plot by scaling fmin with a solid line with an open circle if likely to be within the accuracy rules.

Slant E Condition and Lacuna (Fig. 3)

Lacuna and Slant E condition must be one of the most discussed problems in the Bulletin. (See INAG 31, page 19; INAG 29, page 11 and the references therein). The principal point for discussion is the scaling of examples 5 and 6. The general guideline for use of replacement and descriptive letters is that the feature which has caused the greatest difficulty in interpretation or scaling should be indicated. Obviously there are a small number of exceptions to this, such as letter X on fxI when Spread-F scaling. On a number of occasions, it is difficult to decide which letter should have priority, e.g. in example 6, the choice is between letter B indicating D region absorption and letter Y to show the presence of lacuna. Both are important. Where two letters are of roughly equal importance, a good rule is to use the one which is least common - the rarer phenomenon is more interesting.

Example 5 - fmin is clearly much lower than the limit of the lacuna, since this is shown on both o and x traces. In general, fmin is larger than normal when lacuna is present so that one must agree that replacement letter Y is most appropriate for fmin. However, this causes trouble when the data are handled by computers which demand a numerical value for all cases except total blackout. In view of the general transference of data to computer format, we sacrifice logic for convenience. Also data entry systems usually have built in tests to check against scaling errors which often demand a numerical value for fmin.

Example 6 - the x-mode is absent (and for most ionosondes the o-mode second order would be absent) so fmin is near the lacuna boundary, and the scaling (fmin)EY would be most appropriate. I think that this proposal is probably not acceptable for world-wide use but would like to hear other views.

Some other points are as follows:-

Examples 1-4 and 7-9 - fmin should be scaled 010EE.

Examples 8 and 9 - there is no indication in the line drawings that there is retardation at the high frequency end of the Es trace, so no evidence for Es-r. They are most likely Es-l as drawn. When the normal E cusp is lost due to lacuna c and h types of Es are also destroyed at the same time. Sequence would show whether the Es of example 7 rose from normal E or from an Es layer. The analysis suggests night. I have seen Es-s rise from a thick layer (Es-k) at night and from Es-f, but when lacuna starts the cusp is usually lost, as in the daytime. Also, there is little evidence that foEs and fbEs values are significantly more affected by lacuna, than example 7.

foE

From the world point of view, it is probably unimportant to set up rules for the detailed study of foE at sunrise and sunset or when TIDs are present - the hourly data tabulated are not adequate for serious work under these circumstances and even the f-plots can get very cluttered when all possible Es cusps are shown - the best current technique available.

In order to make progress, it is necessary to study foE in such cases at a number of stations and see whether there are any general rules which could be used. My own work suggests that the scientific gain is not sufficient to justify the effort, but I have studied rather difficult cases. I am inclined to the view that we are trying to identify the most important cusp on the E-layer structure. This means that we should ignore small cusps and try to pick the one nearest hmE. In some cases this is impossible. All published data are based on observing the lowest in frequency large cusp, i.e. the one which would deter mine the maximum usable frequency, (MUF), for the E layer. It is not obvious that this is physically the most important value - I feel that it often is not as the ionograms always exaggerate small changes in height. Until studies have demonstrated a more useful criterion we have no basis for any change. It would be interesting, for example, to compare classical foE values with fminF. One difficulty is, of course, the question of why we want the data made better. What are your views?

4. World Data Centres and International Data Exchange

During the URSI General Assembly an open letter and questionnaire was circulated by the Secretary General of URSI on the future of data centres and data exchange. Mr. Alan Shapley is still collecting questionnaires, a copy of which is attached at the end of this Bulletin. If you have not already done so, please fill this in and send it to:-

Mr. A. H. Shapley
NOAA/EDIS
325 Broadway, 1-3409
Boulder, Colorado 80303
USA

The following letter has been received from James Lander, the acting Director of the National Geophysical and Solar Terrestrial Data Center in Boulder, U.S.A., and confirms the good news reported in INAG 34, p. 3, that WDC-A for STP is to continue:- "I am happy to inform you that a core program in STP data services will be maintained with NOAA staff. It will consist of the continuation of World Data Center-A for STP, the publication of Solar-Geophysical Data, and most routine data services. We will strive to arrange for the continuance of the other important activities with which we have been concerned, including: operation of ionosondes, preparation of UAG special data reports and international news letters, production of AE indices, some advanced data product development and support for some data producing activities. Some of these activities may be operated or supported by other US agencies or accomplished with the help of visiting scientists.

"To help replace funds lost in the reduction it will be necessary to raise our user fees, but we will continue to meet our exchange agreements under the WDC system and with contributors. Many of the several hundred supporters who wrote letters to us and our management indicated that increased fees were preferable to lost services.

"I take this opportunity to notify you that our longtime friend, Miss J. Virginia Lincoln, the first Director of the complex WDC-A for STP, fully retired
on May I from her Government position. We appreciate her staying on the job for over a year beyond her planned retirement date. She has been prominent in STP work since 1942 and we all owe her thanks for her many contributions, particularly in STP data services, for nearly four sunspot cycles. We are glad she has agreed to finish several data reports, catalogs and other projects which she had started in the last year or so. Mr. Joe H. Allen will now be Acting Director of WDC-A for STP.

"Also, Mr. Alan Shapley, Director of NGSDC (which includes the WDC-A for STP) from its formation until January 1981, now serves as the EDIS Senior Advisor on Scientific and International Programs. His efforts with the Data Center are gratefully acknowledged by all of us here and, I am sure, by many of you as well. "We look forward to continuing the operation of WDC-A for STP and the national STP data services. The recent comments from the community have clearly demonstrated their value."

5. Station Notes

US Supported Stations

All the following stations, which are supported from NOAA, Boulder, USA, will be restricted to hourly operation in future, owing to financial stringency partly brought about by a very large increase in the cost of recording film.

Boulder	Manilla
College/Eielsen	Narssarssuaq
Godhavn	Qanaq
Huancayo	Concepcion
Maui	Bankok

Some stations may obtain funding, in addition to that supplied by NOAA, and continue the 15-min. sweep schedule. INAG would like to hear from other stations who are being compelled to reduce programmes owing to financial difficulties. Some groups are considering changing to 16 mm film as used in the Australian ionosondes.

Brazil

Seven stations are operational:- Fozaleza, Cachoera Paulista, Blumeninua, Brazilia and three other locations.

Djibouti

Closed on 31 July 1981.

Hamburg

Expects to open early in 1982.

Pole Station

IPS-42 deployed and working at Amundsen-Scott, 90°S.

Scott Base

A D-region electron density polarimeter has been added. Drift measurements, using the Mitra method applied to partial reflection signals, are planned for this year. A similar drift equipment is planned for Mawson Station, Antarctica.

China

Station	Latitude (°E)	Longitude (°N)	Opened
Hainan	110° 02'	20° 00'	Sep 56
Guangzhou	113° 21'	23° 08'	Mar 55
Chongqing	106° 25'	29° 30'	May 53
Lanzhou	103° 55'	36° 01'	Nov 56
Beijing	116° 18'	40° 00'	Feb 53
Changchun	125° 16'	43° 50'	Jun 56
Manzhouli	117° 27'	49° 35'	Nov 54
Wuhan	114° 20'	30° 36'	1937

Sodankyla

From January 1982, Sodankyla ionospheric observatory will produce 5-minute f-plots for the days during which the European Incoherent Scatter Radar (EISCAT) will be running the 'common mode programmes'.

Kiruna and Lycksele

The responsibility for the Kiruna ionosonde will be transferred to the Kiruna Geophysical Institute on I July 1983. The ionosonde receiver will be rebuilt so that it is similar to that at Sodankyla, used by Dr. Turenen, The new receiver will be installed in 1983. The receiver for the ionosonde at Lycksele will also be rebuilt in a similar fashion, but at a later date. Responsibility for the operation of the ionosondes at the two stations will be taken by
Ove Klang formally from I July 1983, but in practice earlier.

La Reunion

Opened on October 15, 1981 - The equipment is that previously located at Djibouti.

6. Atlas of Ionograms for the South American Region

Professor Radicella presented to the INAG meeting at Washington copies of the new 'Atlas of Ionograms for the South American Region'. The Atlas is the conclusion of a project which began in 1976 when Raymond Conkright, sponsored jointly by the Pan American Institute of Geography and History and the National Program of Radio Propagation of Argentina, gave an instruction course on ionogram interpretation and reduction in Buenos Aires, and has been forcefully pursued by Leila Kurban in discussion with her South American colleagues and with Dr. Piggott. The Atlas was produced to show the use of the international scaling rules with South American ionograms and describe some local adaptations of the rules.

Ionograms for 9 South American stations, representing 6 countries, are reproduced in the Atlas, ranging from Panama. (90°N) in the north to Port Stanley (51°S) in the south. These are used to illustrate ionospheric conditions for different local times and seasons for medium solar activity. There is also a section showing multiple stratifications in the E-region, which are very frequently seen in the region and one showing the evolution of sporadic-E layers. The Atlas provides a useful additional manual for ionogram scalers in South America, and also a guide to workers elsewhere of some of the characteristics of the ionosphere over South America.

INAG congratulates Marta Moset de Gonzalez and Leila Kurban for their efforts in producing this interesting and helpful atlas, which is now available in English.

7. UK Sporadic-E Colloquium, February 24, 1981

A one-day colloquium on 'Sporadic-E and its implications for Radio Communications' was held at the Rutherford and Appleton Laboratory, Slough, England, on 24 February 1981. There were 50 participants including scientists, engineers, and network administrators. The object of the colloquium was to discover how much interest there was in Es problems, particularly as applied to practical communications.

Nine papers were given, dealing with data, theory, backscatter productions, long-term modelling, and user requirements, followed by discussions. INAG was represented by your Chairman, who discussed some of the differences between high, middle and low latitude Es. The symposium showed that there was continuing wide interest in Sporadic-E and a number of theoretical problems remained, as well as difficulties in practical communications.

8. Meeting to Celebrate 25th Anniversary of Opening of Dourbes Station, 13-14 May 1982

it is proposed to hold a two-day symposium in Brussels and Dourbes, Belgium on 13-14 May 1982, immediately before the COSPAR meeting, to celebrate the 25th anniversary of the opening of the Dourbes station. Those interested should inform Dr. L. Bossy, Institut Royal Meteorologique, Avenue Circulaire 3, 1180 Brussels, Belgium, as soon as possible.

The ionospheric station of the Institut Royal M4t6orologique at Dourbes will shortly have been in operation for 25 years. In addition, the Digisonde is being modernized by installing a new central system: the Digisonde DGS 256.

These two events provide a good reason for organising a short meeting in Brussels and Dourbes. An additional reason for such a meeting is that it is appropriate to discuss the value, at the present time, of conventional and more sophisticated ionospheric measurements using ionosondes, especially at the moment when some stations are in danger of being closed.

Tentatively, the topics of this meeting would be:

1. The past of ionospheric observations using ionosondes, and their contribution to the development of the external geophysics.

2. The present state of the techniques available at ground stations for the exploration of the ionosphere, and the scientific interest of routine observations.

3. Modern programs of remote sensing via the ionosphere, and of the ionosphere itself.

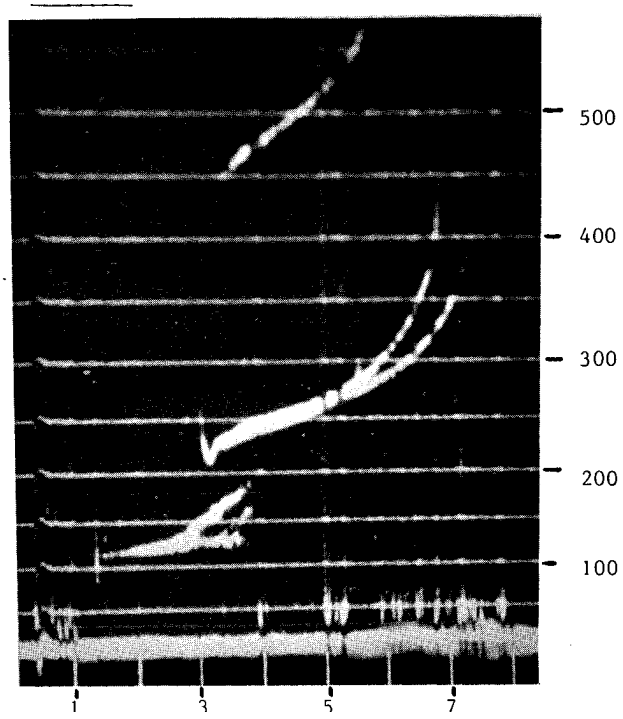
Active participation from both European colleagues and those from elsewhere is desired.

9. Uncle Roy's Column

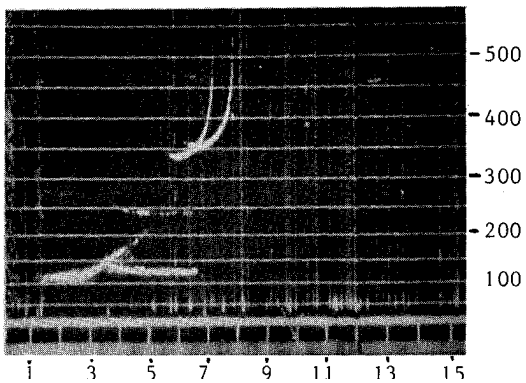
In this article, I have selected a few ionograms obtained at the Wuchang station in Wuhan, Hubai, People's Republic of China, at a latitude of 30°N (dip. lat. 22.5°N), showing similar phenomena to those discussed in the High Latitude Supplement.

Slant Es

09.15, 7 October 1977. Slant Es is very common at Wuchang, particularly in solar minimum years when the D and E region absorption is least. This is a typical example of Es-s rising from foE, though the trace is somewhat more solid than usual. Part of the x-trace of normal E is also present. The interesting point scientifically is that Wuchang is much too far from the magnetic equator for this to be generated by the equatorial Es-q mechanism, widely discussed in the literature, so there must be a very turbulent E or Es layer present near Wuchang.

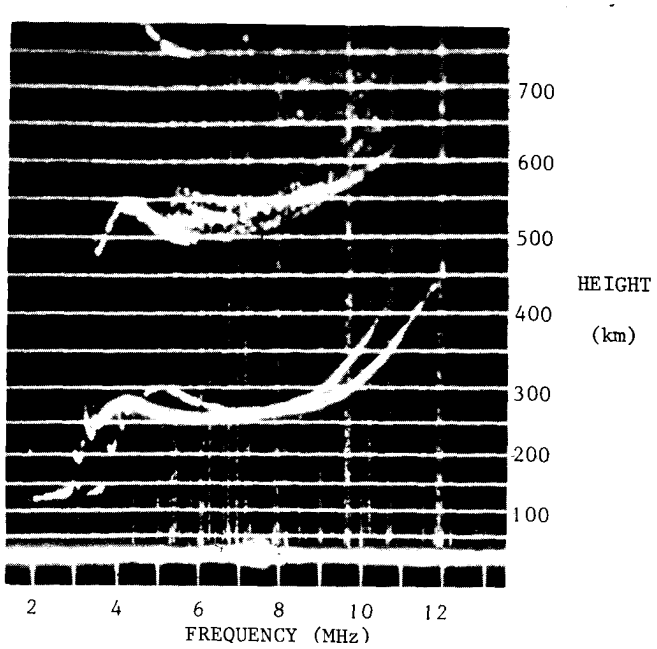


10.00, 25 July 1966. This ionogram, taken on a different ionosonde, also shows very nicely that the slant Es is not blanketed by the overhead cusp type Es. In some cases there is a small gap near foE in this type of situation.

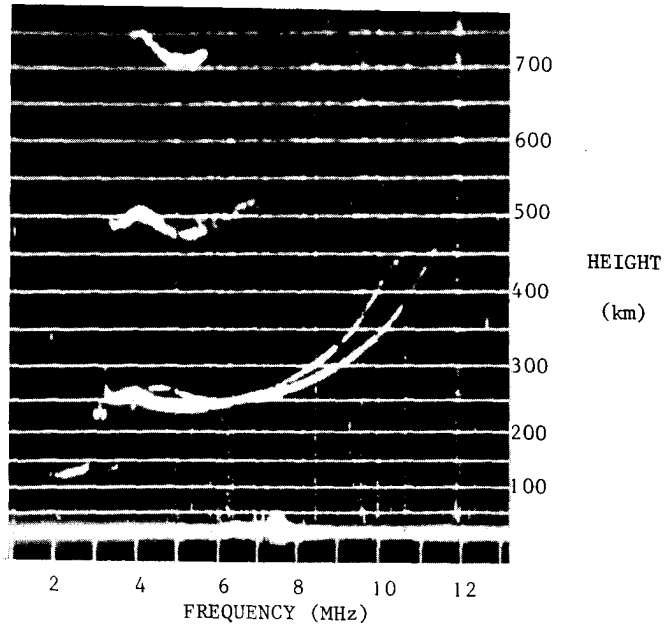


Tilted F Layers at Low Latitudes. Letter Symbol Y.

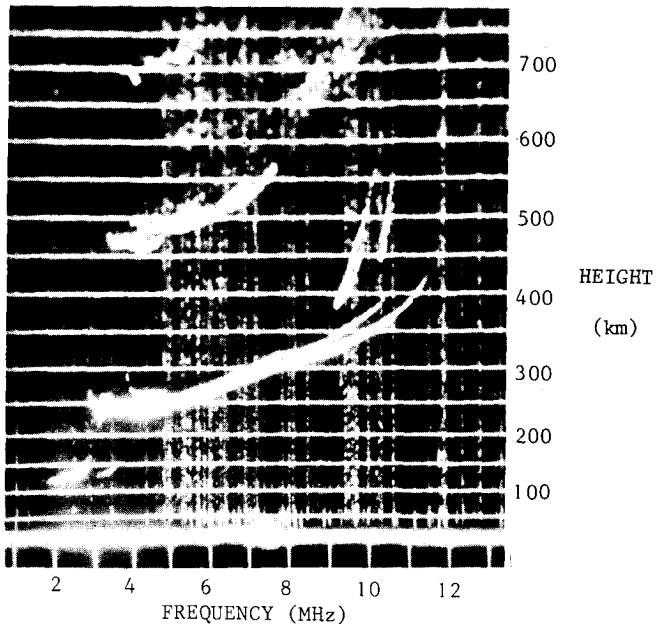
Slowly moving ridges and troughs of ionisation are very common in the sub-tropical and tropical zone. At Wuchang, such ridges often recur at nearly the same time for several days. The tilts produced are very large - giving ionograms which are often similar to those seen at high latitudes. These features have not received the attention they deserve as they are usually known only to the scalers at the stations involved.



14.31, 13 December, 1977. The F2 layer trace is distorted as described in the Handbook; foF2 should be scaled as 100 EY and M(3000)F2 as Y. The layer is horizontal below 6 MHz as shown by the heights and strengths of the multiple traces. Note that the second order trace shows much range spread and many satellite traces and is very distorted near foF2.



14.48. The multiple orders are greatly weakened by defocussing, the reflecting surfaces are highly convex as seen by the ionosonde.



15.00. The layer is now horizontal for frequencies less than 8 MHz, but there are severe gradients, near hmF2, giving typical oblique incidence traces from a lower, but less dense, layer. This is nearer overhead than the reflection which gives the continuous F trace, as indicated by the height of the second order traces. The quite normal shape of the latter trace is a warning to consider the analysis carefully, foF2 = 100 UY. This is preferable to 108 EY given by the continuous trace.

10. Obituary - Nadezhda Vitalyevna Mednikova.

It is with profound sorrow that we report the death, on November 8 1981, of Dr. N. V. Mednikova, after a long illness.

Nadezhda Vitalyevna Mednikova was one of the pioneers of ionospheric investigations in the USSR. She worked at Izmiran from 1941, and for a long time was the head of the Ionospheric Station and the Ionospheric Department of the Institute. N. V. Mednikova made an outstanding contribution to the creation of the Soviet ionospheric network, selecting the personnel, compiling handbooks and methodical guides, and publishing the observational results. She played an active role in the organisation and realisation of ionospheric observations during IGY and subsequent international programmes, such as IASY and IQSY. She made a significant contribution to the organisation of ionospheric studies in Cuba, Poland, Bulgaria and Czechoslovakia.

Dr. Mednikova was one of the seven founder members of the World Wide Soundings Committee (WWSC) appointed in 1955. Her great experience, common sense and judgement were invaluable in the discussions of the WWSC which resulted in the publication of its three Reports, the first documents detailing the conventions and programmes to be used world wide during the IGY.

Several groups produced Handbooks based on these reports for use at their stations, but inevitably these differed on the interpretation of controversial ionograms. Dr. Mednikova contributed greatly to the resolving of these discrepancies and thus to the definitive World Wide Handbook, the URSI Handbook of Ionogram Interpretation and Reduction, published in 1961. After the dissolution of the WWSC in 1961, Dr. Mednikova helped the URSI Vertical Incidence Network Consultant (W. R. Piggott) on many controversial points. In 1969, Dr. Mednikova took part in the informal discussions which led to the formation of INAG, and has played an active part in INAG actions and discussions from its inception. In recent years,

Dr. Mednikova's wisdom, particularly on policy matters, has been invaluable to INAG, and was recognised at the Washington reorganisation of INAG by making her an Honorary Member.

N. V. Mednikova will be remembered by all who knew her, as an outstanding scientist, a highly competent expert on vertical incidence soundings, a dear friend and a charming person. She will be greatly missed by those who had the privilege to know her.

A New Look for the INAG Bulletin

Our Chairman has said that INAG is moving into a new era. One alteration which has already occurred is the layout of the INAG Bulletin is different from previous issues; each page has two half page columns rather than one extending across the whole page. It is hoped that this presentation will make the Bulletin easier to read, and more attractive to the eye. An additional advantage is that space can usually be used more effectively, thus reducing reproduction costs. It would be most helpful to know which format you prefer. Also, constructive criticism on the Bulletin production would be very welcome. Please write to:

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British Antarctic Survey
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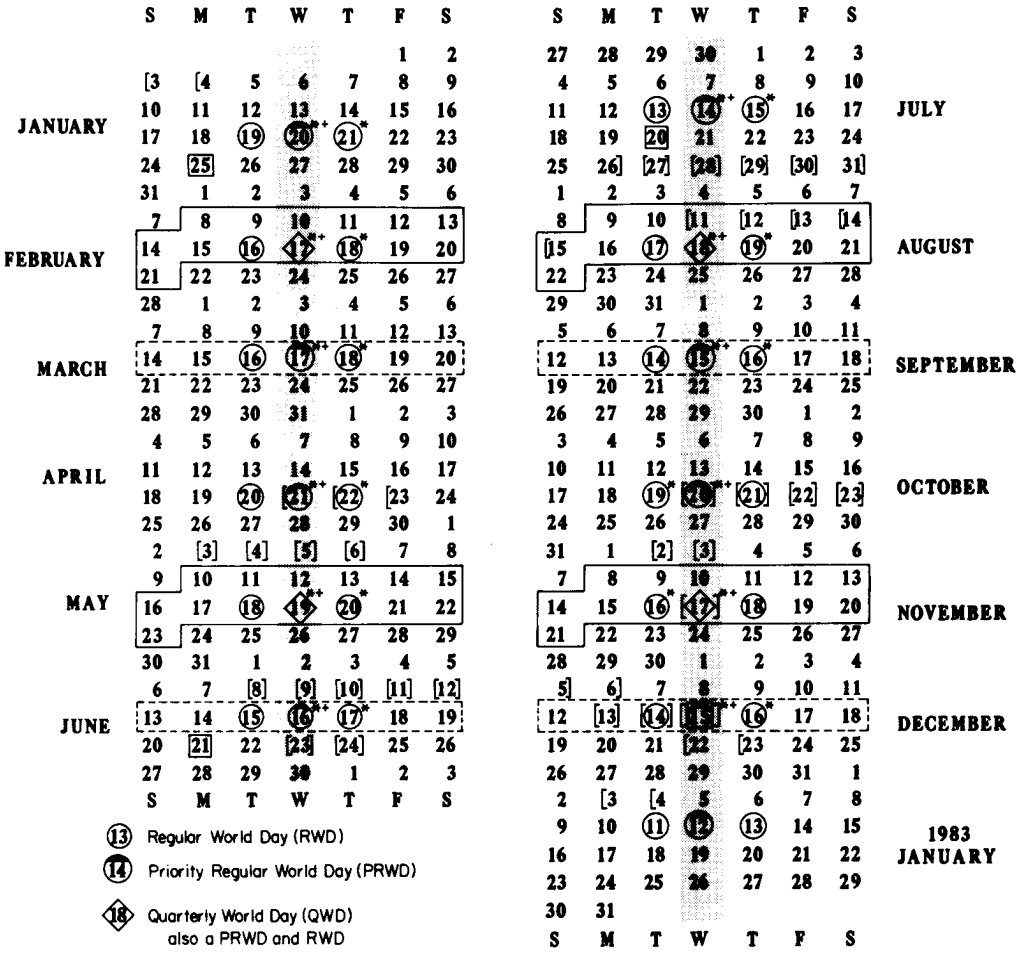
International Geophysical Calendar for 1982



NOTES:

1. An Alpine Experiment (ALPEX), of the WMO/ICSU World Climate Research Program, continues from 1 January 1982 through 30 September 1982.

2. Post-SMY STIP INTERVAL XIII (started 1 December 1981) runs through 31 January 1982; and STIP INTERVAL XIV is 20 May through 20 July 1982.

3. Middle Atmosphere Program (MAP) begins 1 January 1982 and runs through 1985.

OPERATIONAL EDITION, September 1981

EXPLANATIONS

This Calendar continues the series begun for the IGY years 1957-58, and is issued annually to recommend dates for solar and geophysical observations which cannot be carried out continuously. Thus, the amount of observational data in existence tends to be larger on Calendar days. The recommendations on data reduction and especially the flow of data to **World Data Centers (WDCs)** in many instances emphasize Calendar days. The Calendar is prepared by the **International Ursigram and World Days Service (IUWDS)** with the advice of spokesmen for the various scientific disciplines. For greater detail concerning explanations or recommendations your attention is called to information published periodically in **IAGA News, IUGG Chronicle, URSI Information Bulletin** or other scientific journals.

The definitions of the designated days remain as described on previous Calendars. **Universal Time (UT)** is the standard time for all world days. **Regular Geophysical Days (RGD)** are each Wednesday. **Regular World Days (RWD)** are three consecutive days each month, always Tuesday, Wednesday and Thursday near the middle of the month. **Priority Regular World Days (PRWD)** are the RWD which fall on Wednesdays. **Quarterly World Days (QWD)** are one day each quarter and are the PRWD which fall in the **World Geophysical Intervals (WGI)**. The **WGI** are fourteen consecutive days in each season, beginning on Monday of the selected month, and normally shift from year to year. In 1982 the **WGI** will be February, May, August and November.

The **Solar Eclipses** are January 25 (partial) beginning in South Atlantic Ocean skirting the Antarctic continent, crossing the Antarctic peninsula and ending in South Pacific Ocean south of New Zealand; June 21 (partial) beginning in South Atlantic Ocean, passing south of Africa and ending in Indian Ocean; July 20 (partial) beginning over Kamchatka peninsula, crossing Siberia, southern Finland, Denmark and ending in Portugal; and December 15 (partial) beginning west of Portugal in Atlantic Ocean, crossing England, Norway, Sweden, Finland, USSR, and ending in China north of Pakistan.

Meteor Showers (selected by P. M. Millman, Ottawa) include important visual showers and also unusual showers observable mainly by radio and radar techniques. The dates are coded to indicate whether the shower is observable in the northern or southern hemisphere.

The occurrence of unusual solar or geophysical conditions is announced or forecast by the IUWDS through various types of geophysical "**Alerts**" which are widely distributed by telegram and radio broadcast on a current schedule. Stratospheric warmings **(STRATWARM)** are also designated. The meteorological telecommunications network coordinated by WMO carries these worldwide Alerts once daily soon after 0400 UT. For definitions of Alerts see IUWDS "Synoptic Codes for Solar and Geophysical Data, Third Revised Edition 1973" and its amendments. **Retrospective World Intervals** are selected and announced by MONSEE and elsewhere to provide additional analyzed data for particular events studied in the ICSU Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) programs.

RECOMMENDED SCIENTIFIC PROGRAMS
OPERATIONAL EDITION

(The following material was reviewed in 1981 by spokesmen of IAGA, WMO and URSI as suitable for coordinated geophysical programs in 1982.)

Airglow and Aurora Phenomena. Airglow and auroral observatories operate with their full capacity around the New Moon periods. However, for progress in understanding the mechanism of, inter alia, low latitude aurora, the coordinated use of all available techniques, optical and radio, from the ground and in space is required. Thus, for the airglow and aurora 7-day periods on the Calendar, ionosonde, incoherent scatter, special satellite or balloon observations, etc., are especially encouraged. Periods of approximately two weeks' duration centered on the New Moon are proposed for high resolution studies of ionospheric, auroral and magnetospheric observations at high latitudes during northern winter.

Atmospheric Electricity. Not-continuous measurements and data reduction for continuous measurements of atmospheric electric current density, field, conductivities, space charges, ion number densities, ionosphere potentials, condensation nuclei, etc., both at ground as well as with radiosondes, aircraft, rockets; should be done with first priority on the **RGD** each Wednesday, beginning on 6 January 1982 at 1800 UT, 13 January at 0000 UT, 20 January at 0600 UT, 27 January at 1200 UT, etc. (beginning hour shift six hours each week, but is always on Wednesday). Minimum program is at the same time on PRWD beginning with 20 January at 0600 UT. Data reduction for continuous measurements should be extended, if possible, to cover at least the full RGD including, in addition, at least 6 hours prior to indicated beginning time. Measurements prohibited by bad weather should be done 24 hours later. Results on sferics and ELF are wanted with first priority for the same hours, short-period measurements centered around the minutes 35-50 of the hours indicated. **Priority Weeks** are the weeks which contain a PRWD; minimum priority weeks are the ones with a QWD. The World Data Centre for Atmospheric Electricity, 7 Karbysheva, Leningrad 194018, USSR, is the collection point for data and information on measurements.

Geomagnetic Phenomena. It has always been a leading principle for geomagnetic observatories that operations should be as continuous as possible and the great majority of stations undertake the same program without regard to the Calendar.

Stations equipped for making magnetic observations, but which cannot carry out such observations and reductions on a continuous schedule are encouraged to carry out such work at least on **RWD** (and during times of **MAGSTORM** Alert).

Ionospheric Phenomena. Special attention is continuing on particular events which cannot be forecast in advance with reasonable certainty. These will be identified by Retrospective World Intervals. The importance of obtaining full observational coverage is therefore stressed even if it is possible to analyze the detailed data only for the chosen events. In the case of vertical incidence sounding, the need to obtain quarter-hourly ionograms at as many stations as possible is particularly stressed and takes priority over recommendation (a) below when both are not practical.

For the vertical incidence (VI) sounding program, the summary recommendations are: (a) all stations should make soundings at least every quarter hour. Stations which normally record at every quarter should, if possible, record more frequently on **RWDs**; (b) all stations are encouraged to make f-plots on **RWDs**; f-plots should be made for high latitude stations, and for the so-called "representative" stations at lower latitudes for all days (i.e., including **RWDs** and **WGIs**). (Continuous records of ionospheric parameters are acceptable in place of f-plots at temperate and low latitude stations); (c) copies of hourly ionograms with appropriate scales for **QWDs** are to be sent to WDCs; (d) stations in the eclipse zone and its conjugate area should take continuous observations on solar eclipse days and special observations on adjacent days. See also recommendations under **Airglow and Aurora Phenomena.**

For incoherent scatter observation program, every effort should be made to obtain measurements at least on the **Incoherent Scatter Coordinated Observation Days**, and intensive series should be attempted whenever possible in **WGIs** or the **Airglow and Aurora Periods**. The need for collateral VI observations with not more than quarter-hourly spacing at least during all observation periods is stressed. Dr. M.J. Baron (U.S.A.), URSI Working Group G.5, is coordinating special programs.

For the ionospheric drift or wind measurement by the various radio techniques, observations are recommended to be concentrated on the weeks including **RWDs**.

For traveling ionosphere disturbances propose special periods for coordinated measurements of gravity waves induced by magnetospheric activity, probably on selected **PRWD** and **RWD**.

For the ionospheric absorption program half-hourly observations are made at least on all **RWDs** and half-hourly tabulations sent to WDCs. Observations should be continuous on **solar eclipse** days for stations in eclipse zone and in its conjugate area. Special efforts should be made to obtain daily absorption measurements at temperate latitude stations during the period of Absorption Winter Anomaly, particularly on days of abnormally high or abnormally low absorption (approximately October-March, Northern Hemisphere; April-September, Southern Hemisphere).

For back-scatter and forward-scatter programs, observations should be made and analyzed on all **RWDs** at least.

For synoptic observations of mesospheric (D region) electron densities, several groups have agreed on using the **RGD** for the hours around noon.

For ELF noise measurements involving the earth-ionosphere cavity resonances any special effort should be concentrated during the **WGIs**.

It is recommended that more intensive observations in all programs be considered on days of **unusual meteor activity**.

Meteorology. Particular efforts should be made to carry out an intensified program on the **RGD** — each Wednesday, UT. A desirable goal would be the scheduling of meteorological rocketsondes, ozone sondes and radiometer sondes on these days, together with maximum-altitude rawinsonde ascents at both 0000 and 1200 UT.

During **WGI** and **STRATWARM** Alert Intervals, intensified programs are also desirable, preferably by the implementation of **RGD**-type programs (see above) on Mondays and Fridays, as well as on Wednesdays.

Middle Atmosphere Program (MAP). MAP runs from 1 January 1982 through 1985. Techniques for observing the middle atmosphere should concentrate or center their observations on the RGDs, PRWDs, and QWDs. It is recommended that observing runs for studies of planetary waves and tides be at least 10 days centered on the PRWDs and QWDs. Non-continuous studies of stratospheric warmings and the effects of geomagnetic activity on the middle atmosphere must be initiated by STRATWARM and MAGSTORM alerts, respectively. For more details see the "Recommended Scientific Programs" on the reverse of the **Middle Atmosphere Dynamics Calendar for 1982**, which will be published as a special edition of the **IGC for 1982.**

Solar Phenomena. Observatories making specialized studies of solar phenomena, particularly using new or complex techniques, such that continuous observation or reporting is impractical, are requested to make special efforts to provide to WDCs data for **solar eclipse** days, **RWDs** and during **PROTON/FLARE ALERTS**. The attention of those recording solar noise spectra, solar magnetic fields and doing specialized optical studies is particularly drawn to this recommendation.

Space Research, Interplanetary Phenomena, Cosmic Rays, Aeronomy. Experimenters should take into account that observational effort in other disciplines tends to be intensified on the days marked on the Calendar, and schedule balloon and rocket experiments accordingly if there are no other geophysical reasons for choice. In particular it is desirable to make rocket measurements of ionospheric characteristics on the same day at as many locations as possible; where feasible, experimenters should endeavor to launch rockets to monitor at least normal conditions on the **Quarterly World Days (QWD)** or on **RWDs**, since these are also days when there will be maximum support from ground observations. Also, special efforts should be made to assure recording of telemetry on **QWD** and **Airglow and Aurora Periods** of experiments on satellites and of experiments on spacecraft in orbit around the Sun.

For URSI/IAGA Coordinated Tidal Observations Program (CTOP) contact Dr. R. G. Roper (USA) for the 1982 calendar.

The International Ursigram and World Days Service (IUWDS) is a permanent scientific service of the International Union of Radio Science (**URSI**), with the participation of the International Astronomical Union and the International Union Geodesy and Geophysics. IUWDS adheres to the Federation of Astronomical and Geophysical Services of the International Council of Scientific Unions. The IUWDS coordinates the international aspects of the world days program and rapid data interchange.

This Calendar for 1982 has been drawn up by J. V. Lincoln, of the IUWDS Steering Committee, in close association with A. H. Shapley, Chairman of MONSEE of SCOSTEP, and spokesmen for the various scientific disciplines in SCOSTEP, IAGA and URSI. Similar Calendars have been issued annually beginning with the IGY, 1957-58, and have been published in various widely available scientific publications.

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Additional copies are available upon request to IUWDS Chairman, Dr. P. Simon, Ursigrammes Observatoire, 92190 Meudon, France, or IUWDS Acting Secretary for World Days, Miss H. E. Coffey, WDC-A for Solar-Terrestrial Physics, NOAA, D63, 325 Broadway, Boulder, Colorado 80303, U.S.A.