IONOSPHERIC NETWORK ADVISORY GROUP (INAG)*

Ionosphere Station Information Bulletin No. 1O**

Note: page numbers are incorrect because, among other things, the page and font sizes were changed.

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

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

I. Guest Introduction

by

A. H. Shapley

The INAG Chairman, Mr. Piggott, has been out of touch with the world at large since the first of the year, so I am getting another chance to write an introduction to this Bulletin.

Mr. Piggott is an expert in practically all aspects of the ionosphere, but he has special interests in the high southern latitudes where there are many keys to the worldwide behaviour of quiet and disturbed ionospheric conditions. The so-called "Halley Bay" book* of IGY results is a classic, and his first draft before he took out many unpublishable speculations is a collector's item. Later he and I collaborated on a survey paper which was published in a symposium volume which is also a bit hard to locate.** From the beginning of the IGY, the U.K. ionospheric teams headed for the Antarctic were trained in or near his group at Slough, and he has guided much of the ensuing data analysis and studies. More recently he has been active in the radio telecommunication work of SCAR, the international Scientific Committee on Antarctic Research, which is holding a conference a few months from now, as has been reported several times in these Bulletins.

Despite all this expertise, Mr. Piggott himself had never visited the Antarctic until just now. His present trip includes Falkland Islands, South Georgia and Signy on his way to Halley Bay. I received a note handwritten from Halley Bay which took 34 days enroute. We can be sure he has been busy and productive both before he wrote and since. Here are excerpts:

> "Am just arriving in Halley Bay. ... Have visited South Georgia and Signy bases. ... South Georgia has night E and lots of micropulsations. Am going back to look at these more closely. The night E is very high -- about 150-170 km, with foE about 1.0-1.5 MHz. Have riometer with me for Halley Bay -- hope it will work 0K!"

> "Lots of seals and Emperor penguins on the pack ice down here. It is fairly open so we are making about 14 knots. This is lucky as it is old ice and very hard. About 36 miles of the coast has broken off this year near Halley Bay so there are some impressive icebergs. It is cleaner here than at Signy (South Orkneys) and we had one day with no ice at all."

Let me also take advantage of having this guest platform to reflect on cooperative work in ionospheric studies in general and the systematic observing effort in particular. Sharing has been the keynote of ionospheric work from the beginning of the experimental phase in the mid 1920s. The crude manual observations of the early years were exchanged among the handful of workers and sometimes published in detail, point by point of the h'f curve. With the early automatic multifrequency ionosondes of the 1930s, the data exchange began to be more in terms of characteristics, and the diurnal, seasonal, solar cycle and geographical variations began to emerge. The behavior of the ionosphere was simple and quite well understood in those days when the "worldwide network" was comprised of about half a dozen stations.

In the late 1940s, there was a great expansion of the network and progress through CCIR and URSI in achieving international standards of ionogram interpretation and reduction. I recall the 1950 URSI report when we gave tenuous blessing to the terms "ionosonde" and "ionogram". Data exchange, however, remained on a private or institutional basis, although publication of monthly medians for the world network by CRPL gave a degree of international cohesiveness. Most stations eventually published data bulletins, as many still do. In preparation for the expansion in the IGY into effective global coverage, the activities of the URSI-IGY ionospheric soundings committee completed the codification of interpretation, reduction and data presentation, and established quality standards which are still basically in use. The other main contribution of the IGY was the establishment of data exchange through the World Data Centers, which made possible a host of studies and researches which otherwise would have been impractical to accomplish. The IGY momentum lasted for a decade, producing an invaluable body of data for a full solar cycle, with really quite good geographical coverage. The need for the new stimulation and coordination being provided by INAG has come about because of the great increase in understanding of the ionosphere and the increased use of the data both for global and regional studies based on the ionospheric soundings themselves, and even more importantly, their use as essential collateral data for other aeronomical ground based experiments, as well as satellite projects.

There has indeed been good progress in the last two or three years in a time when so many institutions are having to tighten their belts. Through INAG, and especially these bulletins, which have stimulated a great deal of correspondence, we have improved the "esprit de corps" among observers and other workers. We know better who our colleagues are, and we are learning from each other's experience with similar problems. The quality of the observations and interpretations is steadily improving, and the revised "Handbook" should help this further. And it is apparent that data exchange and hence data availability are on a more current basis than a few years ago.

That we are engaged in a very worthwhile activity is demonstrated by the bibliography included in these Bulletins and the fact that there is not enough space to print all the references and summaries that are available. And much of the ionosonde data used for radio propagation studies for telecommunications does not appear in this literature survey.

While there are more exciting lines of work involving satellites and incoherent scatter observatories, we should realize that we contribute the foundation for many of these, for particular experiments and for generalizations based on them. But our geophysical environment is so complex and ever-changing, that it is not satisfactory to compare today's satellite experiment (physics or telecommunications) with the ionospheric behavior described by vertical soundings one or two decades ago. There is present need for present ionosonde observations of the best quality with the most meaningful interpretation possible. This is the important role for ionosonde observers of the world network.

* * *

II. Traveling Ionospheric Disturbances

by

Gil. Cairns, Brisbane, Australia

In Figure 1 on page 4 an ionogram recorded by the Ionospheric Prediction Service Division at Brisbane at 0859 Local Time on 2 June 1971 shows evidence of a small ionospheric disturbance on the 0-ray, whereas it is not obvious on the ionogram taken one minute later. Figure 2 shows an ionogram recorded by the Department of Physics, University of Queensland at Bribie Island, approximately 50 km northeast of Brisbane. This ionogram is of the 0-ray, recorded at 0903 Local Time on the same day. The latter ionosonde uses a linear frequency sweep which on this occasion was expanded to record from 3.5 MHz to 7.9 MHz. The Bribie Island ionogram records as a well-defined cusp on the 0-ray trace what is probably the same disturbance as the one just barely detectable on the standard ionogram.

It would appear from these ionograms that for a statistical analysis of the occurrence of traveling ionospheric disturbances (TIDs) many disturbances would not be observed using standard ionograms.

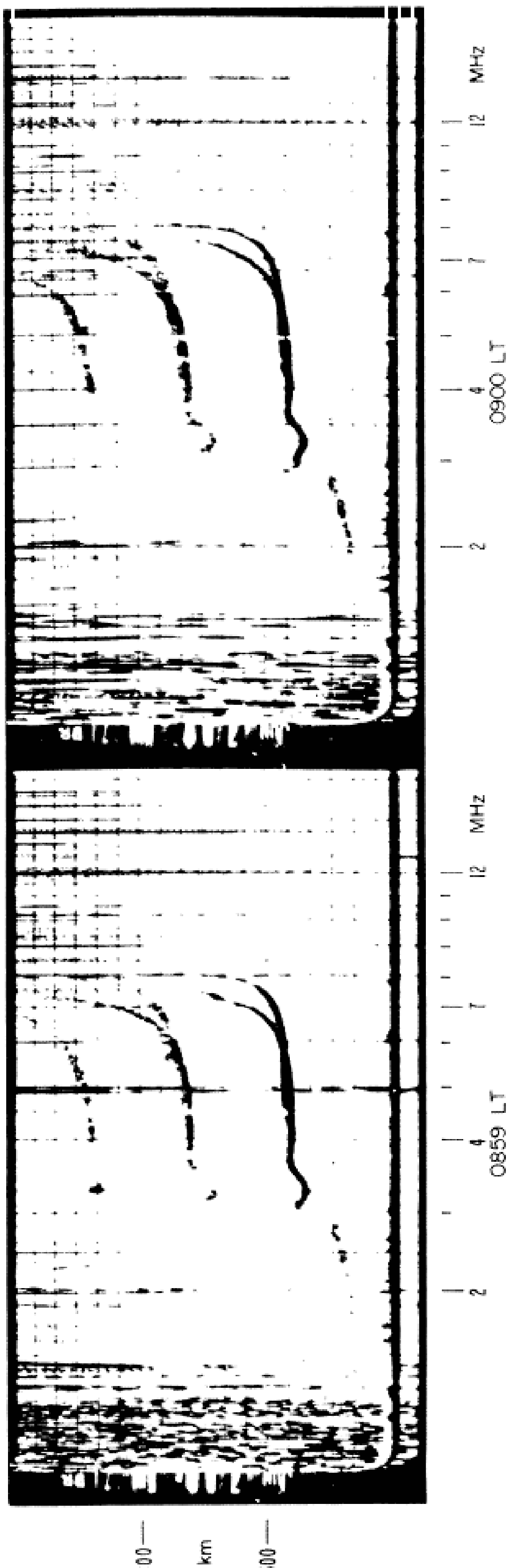


Fig. 1 Standard Ionograms Recorded at Brisbane at 0859 and 0900 LT on 2 June 1971.

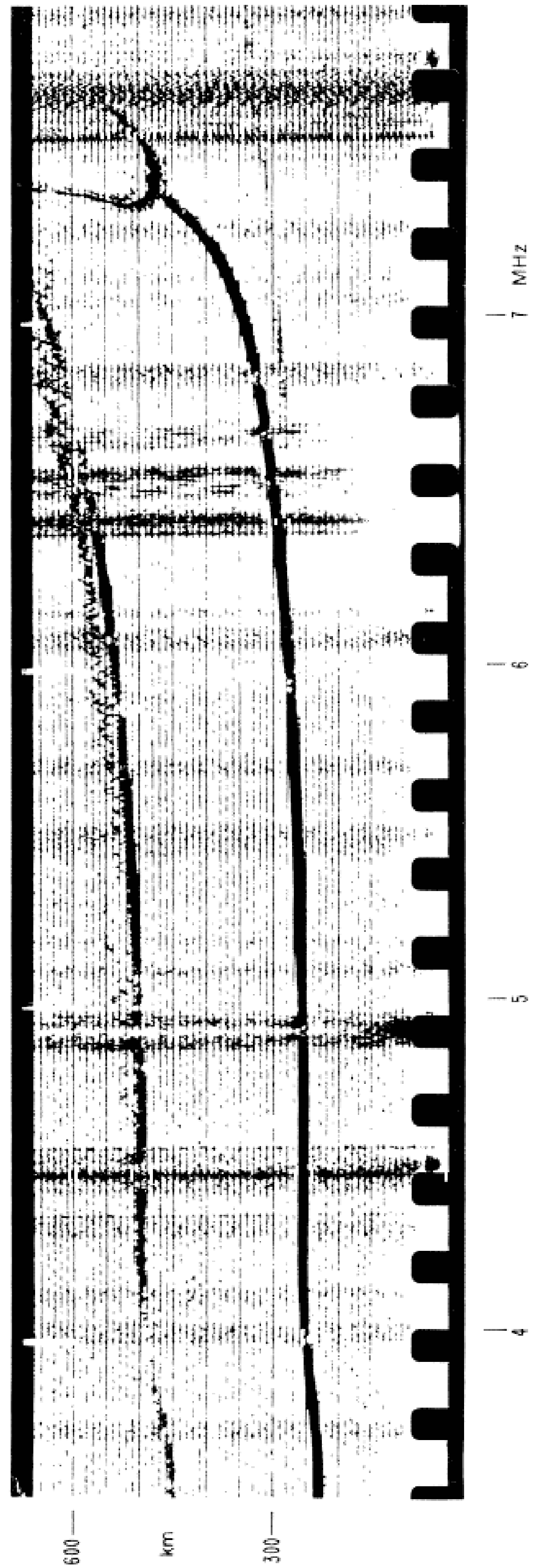


Fig. 2 Ionogram Recorded at Bribie Island at 0903 on 2 June 1971.

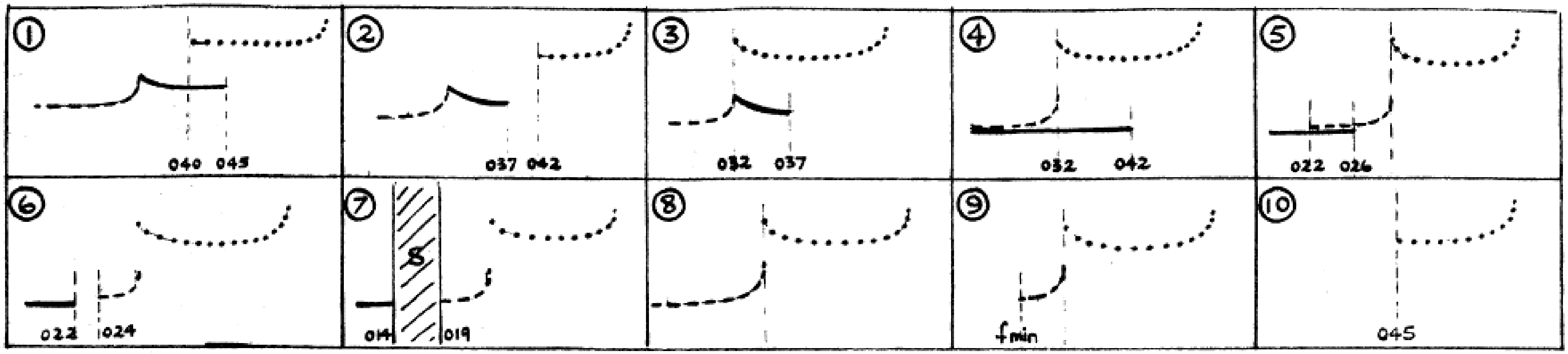
III. Aid to Scaling foEs and fbEs

The two diagrams on pages 5 and 6 were prepared to help British Antarctic Survey trainees to recognize the different possible Es trace types quickly. They may be useful to other groups. They are due to Mr. R. Smith of the Radio and Space Research Station; Slough, U.K.

IV. Status of Revision of URSI Handbook of Ionogram Interpretation and Reduction

The new version of the Handbook is progressing, with much work having been done by Messrs. Piggott and Rawer. The editors are striving for a uniform style or mix of German-English, American-English and English-English.

The first chapter has been typed at WDC-A and is now ready for printing in the English version. It has been sent to Mlle.Pillet and Mine. Mednikova for translation in French and Russian. Chapters 2 and 3 have been typed, but are not yet proofread. Chapters 4 through 8 are edited ready for typing. The remaining Chapters 9 through 15 are in process of final editing for typing, and the resolution of minor questions with Mr. Piggott and Dr. Rawer are in process. It is anticipated that in mid-March, upon his return from Antarctica, Mr. Piggott will resolve any outstanding problems. Therefore, the English version, as one of the UAG Reports of WDC-A, should be in press by the time of the next INAG Bulletin in May 1972.



foEs AND fbEs IN DAYTIME

No.	foEs	fbEs
1	045	040
2	037	037UY
3	037	032EG
4	042	032EG
5	026-G	022-G
6	022-G	022-G
7	014DG	014DG
8	G	G
9	G	G
10	045EB	045EB

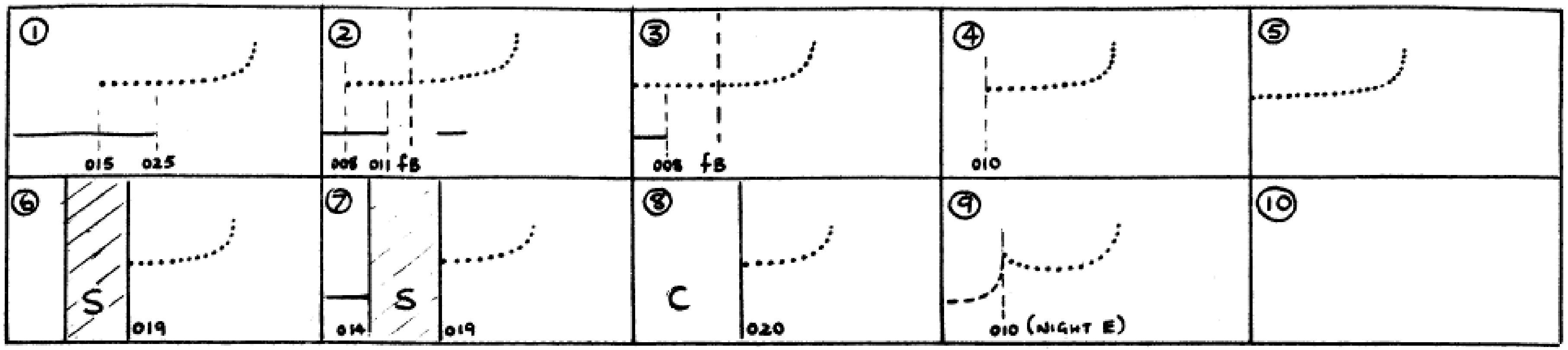
——	Es
- - -	E
. . . .	F

Note:

(a) Diagrams show only the ordinary trace.

(b) For median determination, all values described by G or replaced by G are changed to (foE)EG.

(c) In ② UY replaces UN under new rules.



foEs AND fbEs AT NIGHT

	No.	foEs	fbEs
	1	019JX	015
	2	011	008
	3	008	007EE
	4	010EB	010EB
	5	007EE	007EE
	6	019ES	019ES
	7	014DS	014DS
	8	020EC	020EC
*	9	010EG	010EG
*	10	B	B

—— Es
••• F

f_B = 012

MINIMUM FREQUENCY OF IONOSONDE = 007

Note:

(a) New rule for night E gives foEs = fbEs = (foE)-K.
No.9 will be foES = 010-K, fbES = 010-K.

(b) No.10 correct provided sequence shows foF2 above 007

(c) Diagrams show only the ordinary F trace.

V. Notes from INAG Member

J. Turner
(Excerpts from letter of January 7, 1972 to W. R. Piggott)

"I think we may have someone at the URSI General Assembly in Warsaw who will be able to represent us at INAG meetings. However, in view of the need to restrict members at Warsaw and our tradition of sending university research scientists to URSI, it may not be possible for me to attend. Clarrie McCue will have just returned from CCIR meetings and it is unlikely that be will attend the URSI meeting.

"I cannot make any suggestions about another Southern Hemisphere representative although I agree that it is important to have a reasonable balance in representation from the two hemispheres.

"I believe that the INAG Bulletin was introduced mainly for station operators although it is also very useful for educating users of ionospheric data. If there are absorption and drift station operators who, like the vertical incidence operators, are not always professional people then there might be some value in including material for these types of ionospheric observation.

"All our hourly values of fxI are held on magnetic tape data files. So far I have not carried out any analysis of these data but I think we now have enough to make some analysis worthwhile. If the INAG committee can suggest some analyses which might be useful such as statistics on the occurrence of spreading we would be able to recover and analyze our data.

"The fxI gives information about frequency spreading but some work we are undertaking suggests that observations of range spreading might be useful as well. We are planning to make some range spreading measurements at some of our stations during the next few months. This may lead us to making some suggestions for adding a range spreading parameter. This is connected with some work we are doing on transequatorial propagation and so would be relevant to CCIR problems."

VI. Notes from Station Networks and Individual Stations

Argentina

Although away from LIARA, I (V. Padula-Pintos) am still active in the same field, working for the Ionosphere National Program (which you know), in the Instituto Tecnologico de Buenos Aires (ITBA for short), a private university in which I hold a professorship. Therefore I'll be very glad to help with INAG or any other problems if you consider it convenient.

You say you hope I am enjoying my retirement from LIARA. I am afraid I am now beginning to work!

Australia

The Ionospheric Prediction Service Division has moved to a new location in the Sydney area. Its new postal address is:

Assistant Director, IPS Division
Commonwealth Bureau of Meteorology
Department of the Interior
162-166 Goulburn Street
Darlinghurst, N.S.W. 2010, Australia

or

Post Office Box 702
Darlinghurst, N.S.W. 2010, Australia

Other pertinent information is for TELEPHONE: 61 6791; TELEGRAMS: IPSO SYDNEY; and TELEX: AA 20663.

Boulder

John J. Pitts and Roy M. Schumaker at NOAA in Boulder, Colorado specialize in overhauling and modernizing the aging “C-type” ionosondes owned by NOAA. Two of this type of sounder are used at the NOAA-operated stations at Boulder and Maui, Hawaii, while a number of others are on loan to other stations.

Cachoeira Paulista. Brazil

C. T. Patel informed W. R. Piggott in a letter of November 22, 1971 that the ionosonde would be operative soon at the Cachoeira Paulista site of the Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil.

VI. Notes from Station Networks and Individual Stations (Continued)

Canada

The Canadian Vertical Incidence Ionospheric Program has been transferred in its entirety from the Ministry of Transport (formerly the Department of Transport) to the Department of Communications, effective Oct. 26, 1971. The transfer of responsibility, equipment and buildings is expected to be completed by Feb. 1, 1972. This action brings the vertical ionospheric network into the Department that is responsible for communications research, so that field work, in particular, can be coordinated, and in most cases carried out by one staff.

The vertical incidence sounding station at Shirley Bay, Ontario is to be closed down Feb. 1, 1972 after operating continuously with automatic equipment since early 1948. The Ashton ionospheric station located 15 miles west of Ottawa will provide data related to this area.

Both Ottawa and Resolute Bay are sounding from 250 kHz to 20 MHz; however, due to the limited demand for data below 1 MHz and the special detail usually required by those using low frequency data, all traces below 1 MHz are tabulated as E.

Resolute now provides hourly bulletins of values of fEs, foF2, M(3000)F2 and f min, and Churchill will be providing the same from 8:00 a.m. to 4:00 p.m. local time.

Lwiro

In a letter of October 13, 1971 to WDC-A, Monsieur Guibert stated that the ionosonde of I.R.S.A.C. was very old and was no longer functioning. For budgetary reasons the refurbishing of the installation could not be envisaged. To their great regret it has, therefore, been decided to close the station. The last bulletins of data from 1961-1963, as yet unpublished, will be sent to the World Data Centre.

Maui

Recently, a rebuilt and modernized ionosonde was shipped to Maui to replace the well-worn equipment that has been in use there for many years. The replacement will have the same frequency range, 0.25 to 20.0 MHz, although the antenna system is far from optimum for producing good echoes at the low end of the frequency range. The station personnel are Sadami Katahara and David Tanaka. Mr. Katahara, the engineer-in-charge, has been with the station about 20 years. He is now employed at the station only 1/3 of his time. He spends the rest of his time teaching an electrical power course at the University of Hawaii Community College on Maui to qualify applicants for their journeyman’s license, and is taking a course himself to qualify as an industrial education instructor.

Singapore

Publication of the monthly bulletins of ionospheric data for this station, which closed permanently at the end of July 1971 is almost complete. The bulletins for March through May 1971 will have been issued by the time this note appears, and material for the last two bulletins, for June and July is nearly ready for printing.

Thule/Qanaci

Another old ionosonde is being overhauled at NOAA-Boulder and modernized to replace the one on loan to the Danish station at Thule/Qanaq. The engineer-in-charge at Qanaq is B. Gissel.

Wallops Island

On December 5, 1971 a serious fire occurred in the ionosphere sounding building at NASA's Wallops Island rocket launch facility, but thanks to prompt action by NASA personnel, the ionosonde equipment was not seriously damaged. Subsequent hard work by engineer-in-charge, Robert S. Gray, with assistance from NASA personnel, made it possible for routine operation of the ionosonde to be resumed on December 9. The ionosonde has since been moved into a nearby trailer and will operate there until the building is repaired. The ionosonde is the model J-5 manufactured by Magnetic AB in Sweden.

VII. Notes from WDCs

World Data Centre A for Solar-Terrestrial Physics. Boulder. Colorado. U.S.A.

You will note that a name change is in process. The Geophysics Research Board of the U.S. National Academy of Sciences has approved a restructuring of the two data centers of World Data Centre A concerned with Solar-Terrestrial Physics. These centers are now collocated in Boulder, Colorado in the Environmental Data Service of the National Oceanic and Atmospheric Administration. The Geomagnetic Variations portion of the World Data Centre-A: Geomagnetism, Seismology and Gravity has been merged with World Data Centre-A, Upper Atmosphere Geophysics to create World Data Centre A for Solar-Terrestrial Physics. This latter name conforms with the present international emphasis of the Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP). Working Group 1 of IUCSTP is the lead group for advice to World Data Centers in Solar-Terrestrial Physics.

Coordination of all WDC-A activities remains as before with the Geophysics Research Board of the U.S. National Academy of Sciences, Washington, D. C.

The address of the expanded center is:

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

The Director is Miss J. Virginia Lincoln. Mr. Dale B. Bucknam is Deputy Director. Mr. William A. Paulishak as Chief of the Geomagnetic Variations Services will continue his contacts with the geomagnetic data community.

A study undertaken in January for the purpose of documenting the activities of the WDC-A revealed some interesting statistics regarding the data center's activities in the ionospheric data discipline.
During July 1970-June 1971, 2832 station-months of ionospheric data were received (176 from NOAA, 168 from other U.S., and 2488 from foreign stations). Compared to this, in response to 309 requests (78 from NOAA, 132 from other U.S., and 99 from foreign sources) 16492 station-months of data were sent out (11% were from NOAA, 21% from other U.S., and 68% from foreign sources).

The 16492 station-months of ionospheric data disseminated during those twelve months can be compared with 13966 station-months already disseminated from July through December 1971. At this rate an estimated total of 28000 will be sent out in the twelve months ending June 1972. This reflects continued high use of ionospheric data and healthy growth in the use of the capabilities of the data center at Boulder.

World Data Centre - C1, Radio and Space Research Station, Ditton Park, Slough 5L3 9JX, England

A new ionospheric catalogue was issued by WDC-C1 in December 1971. It is the most comprehensive catalogue which this WDC has issued for several years and contains detailed lists of the data held at Slough for the period 1 July 1957 until late 1971. Readers of the INAG bulletins who require this catalogue but are not already on the circulation list are invited to write to the WDC at the above address to request being placed on their circulation list.

VIII. Spanish Translation of INAG-9

The translation of INAG-9 into the Spanish language has been done by Professor Maria Cristina Bustos of the Seccion Aeronomia, Instituto de Fisica, Universidad de Concepcion, Concepcion, Chile. It has been printed by WDC-A and distributed to the Spanish speaking stations. If a copy did not reach your group, please request one through the INAG Secretary, Miss J. Virginia Lincoln.

IX. New Time and Frequency Service on NBS Radio Stations WWV and WWVH

Notice is hereby given that the National Bureau of Standards in cooperation with the National Aeronautics and Space Administration, is now operating an experimental time and frequency service by satellite. Operating at a frequency of 135.625 MHz, these signals are available to North and South America and major portions of the Atlantic and Pacific Oceans. A format of voice announcements, ticks, tones, and time code are included. The experimental service operates between the hours of 1700-1715 and 2145-2200 Greenwich Mean Time. Information regarding this experimental service can be obtained by sending a postcard to: Code 3, Section 273.01, National Bureau of Standards, Boulder, Colorado 80302.

X. Abstracts from URSI Information Bulletins

A. From No. 180, September 1971, pp. 24-25:

The following Report was presented by Prof. Rawer to Panel 4B on 25 June 1971 during the XIV COSPAR Meeting in Seattle. It supplements the Report published in URSI Information Bulletin, No. 179, pp. 18-28.

Present Status of International Reference Ionosphere (IRI)

We tried, during the last half year, to assemble significant data to build up preliminary models of electron density and temperature. These will correspond to the locations of the three incoherent scatter stations at Jicamarca, Arecibo and St. Santin (to be combined possibly with Millstone Hill). While for the maximum electron densities of the different layers data are well at hand, and at least some data on profiles are available, there are still difficulties concerning:

1. the lower ionosphere (D- and lower E-regions), where different methods seem to give disagreement;
2. electron and ion temperatures, for the same reason, and also because of the scarcity of data;
3. ion composition, because of inadequacy of data;
4. conditions at high latitudes (to be described for a possible fourth location).

With respect to Items 2 and 3, we hope to obtain provisional decisions in the open session on 1 July (reports by Pfister and by Taylor). As far as Item 1 is concerned, we may probably come out with concurring models provisionally. We are still looking for consistent data relating to Item 4.

It is intended to produce a very preliminary set of tables for 3 locations by the end of this year. This will, however, not be a first Reference Ionosphere, but only a report to be used as a starting point for obtaining criticism after circulation in the Working Group.

The notes of the session on 1 July are to be circulated afterwards to all participants of the group (almost 100 people) by the URSI Secretariat.

B. From No. 181, December 1971, pp. 29-32:

URSI-STP Committee, Minutes of Third Meeting, July 1971

1. Ionospheric Vertical Soundings

1.1 Ionospheric Network Advisory Group.

Mr. W. R. Piggott reported on the activities of INAG since its inception in Ottawa (1969). No formal meeting of the whole group has been held, but much work has been done by correspondence and ad hoc meetings. It is hoped that all INAG members will be in Warsaw in 1972; to this end, the URSI-STP Committee urges member committees to include INAG members in their national delegation to the XVII General Assembly of URSI.

It was agreed that a USSR specialist in high-latitude studies be invited to replace Dr. C. A. M. King, who has resigned from the Group, and that the question of representation from the southern hemisphere, along with other modest changes of membership, should be agreed by Mr. Piggott in consultation with Prof. Beynon.

Eight numbers of the INAG Bulletin have been issued. Thanks were expressed to Mr. A. H. Shapley and WDC-A organization for funding the production and distribution of the first six issues; beginning with Bulletin No. 4 the printing costs are supported by a grant from URSI. The Bulletins have been well received: the value of direct mailing to stations was emphasized. Although selective translations into French and Russian have been made available through the kindness of Drs. Pillet and Mednikova respectively, the Committee draws attention to the continuing need for this service and to the desirability of a translation into Spanish.

It was agreed that problems related to sporadic-E ionization would be dealt with by INAG and that Mr. Piggott would make contact with Dr. E. K. Smith on this matter. In view of this, the suggested appointment of a separate Es consultant (item 8(b) of previous Minutes) was considered unnecessary. It was also agreed that the INAG Bulletin could be usefully used for the dissemination of information in associated fields (e.g. ionospheric absorption, drifts) at the discretion of the relevant consultant.

1.2 Vertical Soundings Network

At present about 140 stations contribute to the world ionosonde network, and intermittent ad hoc measurements (e.g. support for rocket experiments) are made at a further 10-15 stations. Thus, although there was an initial decline in the number of stations from the IQSY total of 155 $\pm$ 5, there has been a slow recovery. It is, however, anticipated that there will be a slow decrease in the number of active stations over the next few years. Measurements are restricted to F-region parameters and foEs at some 20 stations within the network.

Data flow continues to be rather irregular. Increasing number of stations are converting to computerization of data presentation. It was noted that this change has tended to result in the cessation of publication of station booklets of data, a move which is to be deprecated since it will inevitably reduce the use made of data and will introduce selectivity of stations for many workers who use only the data they receive. The importance was stressed of maintaining reasonable data exchange in modern form when conventional station booklets are withdrawn. It was felt that perhaps a lead could be given in this matter by the USA and USSR through WDCs A and B respectively.

The morale at network stations has improved enormously over the last year, partly due to the visits of experts to stations in Africa and South America, and partly to the circulation of the INAG Bulletin. The main weakness at stations at present is in the training of operators and staff for analysis.

Prof. Beynon reported that, in response to an enquiry, it was evident that there was little enthusiasm for a second meeting of network operators, in 1970/71, along the lines of the previous meeting held in January 1969 (see item 3.1 of previous Minutes). It was agreed that a statement be inserted in the INAG Bulletin to enquire whether there is a need for such a meeting in association with the next URSI Assembly in Warsaw.

1.3 Visits to Stations.

Following the previous recommendations of URSI and CCIR, visits of vertical incidence experts to two areas were sponsored by UNESCO. Dr. C. M. Pillet made contact with some 13 stations in Africa in January-February 1970, and subsequently Mr. W. R. Piggott visited or saw representatives of 15 stations in South America. Full reports of both these visits will be published soon by UNESCO; some points which emerged are summarized below.

Problems arise where stations are operated by non-scientists, or by persons not themselves interested in the data produced. In general, stations work well where they are manned by the organizations responsible for their operation. There is frequently no natural use of the data locally, partly through ignorance of what could be done. Many stations have no access even to standard journals, in addition to which there are serious language problems in some areas. It is imperative to stress, through literature citations, reference lists, etc., the overall importance and use made of the ionospheric data obtained. It was agreed that the need for maintaining the African network should be emphasized at the forthcoming Equatorial Aeronomy Conference.

In general, the standard of ionosonde maintenance was satisfactory. In some cases considerable ingenuity in electronic adaptation had maintained equipment in operation. Instruction in ionogram interpretation was, however, often lacking; a central training school where analysis staff could discuss their own records would be the best solution to this problem. In some cases, also, there were long delays in the manual handling of data. Data Centers are urged to help as much as they can to obtain missing data from stations; e.g. they could perhaps agree to accept the original data sheets direct. Ultimately, it may be necessary to consider central coordination of the activities of the network by an international organization.

1.4 High Latitude Problems.

A very successful seminar on the interpretation and reduction of high-latitude ionograms was held in Leningrad in May 1970. INAG has also discussed the matter at a meeting immediately preceding this URSI-STP Committee in Brussels, and a further meeting to finalize the international rules will be held in Warsaw in 1972. It was agreed that any changes of the rules should be endorsed by Commission III at that time. It is proposed subsequently to issue a high-latitude supplement to the Handbook of Ionogram Interpretation.

1.5 IF2 Index.

On the request of CCIR, the desirability of adding more stations to those employed in deriving this index was investigated by INAG. It has been agreed that as from 1 January 1971 three southern hemisphere stations (Johannesburg, Mundaring, Port Stanley) and one northern (Moscow) be added to the list of contributors.

1.6 Parameter fxI.

A recent sample survey shows that this new Spread index is regularly measured at about one third of the stations, with nearly complete coverage at high and low latitudes. This response is considered very good. The attention of scientists is drawn to a growing need for an investigation of the interpretation of this parameter.

1.7 Electron Density Profiles.

Systematic determination of electron density profiles is carried out at less than 10% of stations, while 25% of stations still measure the parameter hpF2. Very few stations measure hc and qc systematically. For CCIR purposes there is a need to devise a quick and simple procedure for the determination of an estimate of the height of the maximum density of the F2 layer. It was agreed that this matter be referred to INAG (see also Section 5.).

1.8 Monthly-Median Ionospheric Data.

Mr. A. H. Shapley reported that a major effort had been made to reduce the delays of publication in the "Ionospheric Data" series of monthly-median vertical soundings data, and he invited comments on the present form of these booklets, e.g. content of data, method of presentation, usefulness of graphs, etc. Any views should be sent direct to Mr. Shapley.

3. Publications

3.1 Atlas of Ionograms.

The new Atlas of Ionograms, edited by A. H. Shapley, was published in May 1970 as UAG Report No. 10 issued under the auspices of WDC-A. In addition to the large number of ionograms illustrated for individual seasons and times, the Atlas includes station lists, details of ionosondes, and examples of ionogram sequences illustrating various special phenomena. The Committee wishes to place on record its thanks to Mr. Shapley and his colleagues for undertaking this work.

3.2 Revised Ionogram Handbook.

Prof. Rawer and Mr. Piggott reported that the text of the revised Handbook was nearly complete, apart from some details. It will be published by WDC-A as a UAG Report (in the style of the Atlas) before the Warsaw Assembly. The need for speeding publication was stressed. The scaling of high-latitude ionograms will be discussed in a Supplement to be issued later.

It is essential to translate the Handbook into French, Spanish and Russian, and it was agreed to invite URSI to encourage the preparation of such translations. The Chairman was requested to take the necessary action. Mr. Shapley offered the services of WDC-A for the printing of any such translations, but it was appreciated that WDC-B would probably wish to undertake the production of the Russian version.

3.3 Absorption Manual.

Prof. Rawer reported that this would be published before the Warsaw Assembly, again as a UAG Report issued by WDC-A. There have been a few changes in authorship since the original list of contributors, but all papers are now to hand. Dr. Minnis agreed to edit the English where necessary.

3.4 International Reference Ionosphere.

Progress reports on the status of the IRI were published by Prof. Rawer in URSI Information Bulletin No. 179 (June 1971), pp. 18-28 and No. 180 (September 1971), p. 25. Good progress has been made with the assembling of bottom-side electron density data, although some problems remain to be decided, particularly for the lower ionosphere. For electron temperature data, it is necessary to rely almost entirely on incoherent scatter observations, which are not conclusive at heights above about 800 km. Ion composition is reliably determined by mass spectrometry for individual constituents, but difficulties arise in intercomparisons between ions. It is recognized that the first edition of the IRI will necessarily be tentative; it is hoped to publish preliminary tables giving data for three locations by the end of this year.

C. From No. 181, December 1971, pp. 38-39:

Satellite Radio Beacons

As you know, one of the techniques for studying ionospheric effects is through the use of radio beacons placed on satellites. Dr. K. Davies of NOAA reports the following information:

1. The provisional date of launch of the beacon satellite ATS-F is May 1973. After about 12 months in the Western Hemisphere it will be relocated at longitude 34^0E (not 15^0E) in May 1974. It will be visible at an angle of elevation exceeding 3O° over the African continent, southern Europe, the Black and Caspian Seas, Arabia, Iran, and most of India and Pakistan.

2. Anyone in this region who is interested in recording the radio signals is invited to make contact with Dr. C. Hartmann, Max-Planck-Institut far Aeronomie, 3411 Lindau/Harz, Federal Republic of Germany, who is organizing an observational program, at Lindau, covering the frequency band 40-360 MHz. He is also investigating (with NASA) the possibility of observations of signals in the 1-4 GHz using the transponders in ATS-F and would be glad to hear from those interested in receiving them.

3. NASA has approved a beacon for ATS-G, almost identical with that in ATS-F, which is due to be launched in 1975.

Symposium 1972

A Symposium on the Future Application of Satellite Beacon Measurements will be held in Graz, Austria, from 22-26 May 1972. The dates have been selected so that participants can attend the Symposium and also the Annual COSPAR Meeting in Madrid (29 May - 2 June). The following topics, at least, will be discussed in Graz:

1. Study of ionospheric and tropospheric inhomogeneities; scintillations.
2. Measurements of exospheric electron content by combining measurements of group delay on ATS-F signals and dispersive Doppler data of NNSS signals at 150 MHz/400 MHz.
3. Travelling ionospheric disturbances and other dynamic phenomena.
4. Receiving equipment for existing and future satellite beacons.
5. Standardization and interchange of data, experiments in data processing.

Further suggestions for topics and all enquiries concerning the Symposium should be sent to:

Dr. R. Leitinger
Institut fur Meteorologieund Geophysik
Universitat, A - 8010 Graz, Austria

COSPAR Panel 1B has recently formed a Working Party on Satellite Beacon Activities with Dr. Leitinger as Convenor and as the representative of the participants at the Lindau 1970 Symposium on Beacon Satellites. Prof. P. F. Checcacci (Italy) represents the Joint Satellite Study Group and the USSR will designate a representative of the Intercosmos Group.

XI. Meeting Announcement

IUCSTP Commission Meeting, London, March 6-9, 1972

The Inter-Union Commission on Solar-Terrestrial Physics is proceeding with preparations for a meeting with invited participants at the Royal Society of London, 6-9 March 1972. The purpose of the meeting is to decide on the substance of a first draft of a program document for the coming years, including a proposed set of new or revised cooperative projects.

Besides discipline members of the Commission and its representatives from SCAR, IUWDS, WMO and UNESCO, the following have been invited to take part in the meeting: IUCSTP Working Group Leaders, special representatives of the Unions, COSPAR and IAGA, and several other persons for special purposes. In addition, national STP committees were notified of the meeting and were invited to send an observer-participant, if they wished, but they were not urged to do so because the Commission has plans for a general meeting with national representatives in early 1973.

XII. Literature Citations

It has been our policy to fill out the INAG Bulletins with literature citations involving the use of vertical incidence ionospheric data. There are always many more available than there is printing space. Anyone interested may write to the INAG Secretary, Miss J. Virginia Lincoln for the as yet unpublished citations from the selection of journals reviewed at WDC-A.

CHIN' KHONG T'YEN 1971 Statistical Correlations of the Es Layer at Conjugate Points, Geomagnetizm i Aeronomiya, Vol XI, No. 2, 339-341.

It is generally recognized the Es layers of plane types observed in the middle latitudes are not of corpuscular origin so that the conjugate point phenomenon may not be observed. However, plane Es, at least in the polar regions, also react to the injection of corpuscular streams. Accordingly, the author studied the correlation of the probability of appearance of Es of different types at conjugate points. In order to exclude the asymmetry of solar illumination, ionospheric parameters were investigated for the equinoctial months. Data were used for Sogra, an expeditionary station on the Dvina River, and Kerguelen Island in the Indian Ocean. The first step was to estimate the probability of random coincidence of Es at each pair of stations. It was found that there is a correlation in the appearance of Es of all types at the magnetically conjugate points. One of the characteristics reacting to the leakage of particles in fbEs. The author determined the correlation coefficient between the fbEs values for all types of Es for the station pairs Kerguelen-Sogra and Kerguelen-Salekhard. It was found that the fbEs correlation between the two conjugate stations is high, sometimes 0.90. Its mean value is 0.60. This indicates that Es at the magnetically conjugate points are closely interrelated. It is shown that the energy of particles in both hemispheres is almost identical but that the flux densities vary greatly, the latter evidently being attributable to inaccuracy in computations.

(Sogra, Kerguelen Island, Salekhard)

DOLGOVA, YE. I. 1971 Equatorial Scattering in the Atlantic, Geomagnetizm i Aeromiya, Vol XI, No. 2, 342-343.

The equatorial zone is characterized by the appearance of signals reflected from the F2 layer during the unilluminated hours of the day. On ionograms this scattering usually occupies the frequency region from f_{min} to 6-12 Mc/sec. During the entire voyage of the schooner "Zarya" in the Atlantic during 1965-1966 equatorial scattering was observed virtually every day in the region with an inclination I ≤ ±35°. According to "Zarya" data, the width of the equatorial scattering zone did not remain constant during the night and was maximum at 2200 LT, whereas the minimum was observed early in the morning and evening. The duration of registry of equatorial scattering during the day was minimum (0000-0200 hours) at the boundary of scattering and maximum in the neighbourhood of the magnetic equator (0800 hours). The maximum frequencies of scattering fm(F) were observed at the time of maximum width of the zone of equatorial scattering, at 2200 LT. Minimum fm(F) were registered somewhat south of the magnetic equator, I = 3-4°S, and the maximum at I = 20^0N, 20^0S, that is, at the latitudes of the crest of the F2-layer magnetic anomaly. Scattering in the F2 layer at the equator is attributable to Rayleigh scattering of radio waves on inhomogeneities of electron density. It is possible if the dimensions of these inhomogeneities are small in comparison with the wavelength of the sounding pulse. In actuality, scattering is registered from f_{min} to some maximum frequency fm(F), which for the "Zarya" varied in the range 5-12 Mc/sec (station frequency range 1-20 Mc/sec). When f > 11 Mc/sec the scattered signal attenuates because with an increase in frequency the dimensions of the electron density inhomogeneities become comparable to the wavelength of the sounding pulse and instead of scattering, the ordinary refraction of radio waves should be observed; but since the electron density of the layer is below the corresponding fm(F), for frequencies greater than fm(F) the ionosphere is transparent and there will be no reflected wave. The observed decrease in fm(F) from 10 Mc/sec at I = ± 20° to 6 Mc/sec near I = 3-4°S, in the case of Rayleigh scattering, would correspond to an increase in the dimensions of electron density inhomogeneities from 30 m at I = ± 2O° to 50 m at I = 3-4°S.

PERELYGIN, V. P. 1971 Small Scale Inhomogeneity of the Ionospheric F Region, Ceo-magnetizm i Aeronomiva, Vol XI, No. 2, 336-338.

The author made a detailed study of small-scale inhomogeneities in the F region and their movements by the spaced reception method simultaneously with radioastronomical observations and vertical sounding. The observations were made at Tomsk during 1965-1966. The data were processed by the correlation analysis and statistical methods. During the radio-astronomical observations data were processed applying to the passage of the radio source Cassiopeia through the upper culmination. Measurements during vertical sounding were made near the critical frequencies for one of the magnetoionic components. The results are given in a table. This table gives the mean drift velocities V, the velocity of random changes Vc, characteristic dimensions of inhomogeneities Δ,time correlation radius $\tau_{0.5}$, the correlation radius of random variability τ_c, the fading period T, the degree of anisotropy e in form of inhomogeneities, degree of turbidity β standard deviations, asymmetries and excesses are also given. It is shown that the V, Vc, e, β, values, drift directions and Vc/V and $T/\tau_{0.5}$ ratios coincide when using both observation methods. The mean Δ, $\tau_{0.5}$, τ_c, T values obtained from radioastronomical observations are approximately four times greater than the corresponding values obtained by vertical sounding. The dimensions of inhomogeneities determined by the radioastronomical method are comparable to the results obtained using artificial earth satellites. The parameters of ionospheric inhomogeneities obtained during vertical sounding by the spaced reception method in the presence of diffuse reflections agree well with the results obtained by S. A. Bowhill (J. Atmos. and Terr. Phys., 1956, 129).

(Tomsk)

CHERNYSHEVA, S. P., A. M. MOZHAYEV, V. M. SHEFTEL' and I. K. RYSS 1971 Sporadic Formations in Ionospheric F Region, Geomagnetizm i Aeronomiya, Vol XI, No. 2, 338-339.

The presence of electron concentration inhomogeneities in the ionosphere, in dependence on the spectrum of inhomogeneities and their localization, is reflected in the degree of complexity of the altitude-frequency characteristics, In the presence of R-inhomogeneities, leading to F scattering, diffusion is observed, frequently having a multiplet structure. Ionograms for Rostov-on-Don station reveal clearly expressed splittings. These are usually quadruplets with a difference between the critical frequencies of the ordinary and extraordinary components equal to half the gyrofrequency $1/2f_H$. The appearance of such characteristics in ionospheric surveys is usually associated with the presence of a sporadic F layer. The principal υ(Fs) maximum falls in the midnight hours: in addition, there is an additional υ(Fs) maximum during the daytime hours (Moscow time). The υ(Fs) maximum in the seasonal variation falls in winter and the minimum at the end of spring and summer. In a year of low solar activity (1965) there was 1.5 times more cases of registry of Fs than in a year of higher activity (1967). The daytime υ(Fs) maximum is formed due to Fs of types d,e,f shown in this article. At nighttime it is primarily Fs of types a,b,c which is observed. Daytime Fs is frequently related to moving disturbances and the maximum frequency of appearance of these disturbances falls at midnight. For daytime Fs there is a considerably greater splitting of characteristics than for nighttime Fs. They are characterized by the absence of diffusivity of reflections and are formed at lower altitudes. Nighttime Fs is frequently observed simultaneously with slant reflections. The mechanisms of formation of daytime and nighttime Fs are different. Internal gravitational waves may be responsible for the formation of daytime Fs; these cause large-scale ionospheric turbulence and appear on the ionograms as moving disturbances. The largest of the R-inhomogeneities may be responsible for nighttime Fs.

(Rostov-on-Don)

SMOL'YANINOV, V. M., M. V. SOROCHINSKIY, YU. V. FEOFANOV, L. I. FILIPPOV and P. V. CHERNOV — 1971 — Some Ionospheric Effects in Propagation of Short Waves During the Period of the Solar Eclipse on 22 September 1968, Geomagnetizm i Aeronomiya, Vol XI, No. 2, 354-355.

The conditions for reflection of short radio waves from the ionosphere are dependent on solar activity. The least investigated phenomenon is the frequency drift of oscillations occurring during reflection. Experiments show that in evening with sunset the frequency of the reflected signal decreases, whereas it increases at sunrise. It is natural to assume that similar effects are observed during a solar eclipse. On 22 September 1968 observations were made of the propagation of short waves along a latitudinal trajectory with the reflection point at a place with the coordinates 59^0N, 53^0E in the zone of almost total solar eclipse (maximum phase 0.95). Instrumentation insured a tie-in of standard time at the reception and transmission points with an instability ~$2.1O^{-10}$, making it possible to measure the lag $\Delta\tau$ in signals and the frequency shift Δf with a high accuracy and resolution. A figure shows the experimental curve of change in frequency shift f_{sh} of the transmitted signal at the reception point. During the period 1330 through 1530 there was a marked deviation of the frequency shift from the usual mean square level ~0.1 cps and a marked change in the lag $\Delta\tau$ with the total absence of reception during the period from 1345 to 1445 hours. Another figure shows the variation in the ratio of f_{sh} to the maximum usable frequency f_{MUF} of the F2 layer for a particular trajectory. The f_{MUF} frequency was measured at Sverdlovsk, quite distant from the reflection point. The time of appearance and disappearance of the reflected signal agree satisfactorily with variation of the f_{sh}/f_{MUF} ratio. The nature of the changes in the frequency shift, signal lag time, and critical frequency of the F2 layer were similar to the nature of their changes with transition from day to night and night to day.

(Sverdlovsk)

BEN'KOVA, N. P., C. V. BUKIN, ZH. VAL'TER and SH. TAYEB — 1971 — Lower-Ionosphere Disturbances and Leakage of Auroral Partides During the Substorms of 24 and 30 March 1968, Kosmicheskiye Issledovaniva, Vol IX, No. 2, 300-304.

The paper cited is a continuation of studies describing the ionospheric manifestations of substorms occurring during this period. It was found that change in ionization of the lower ionosphere (D layer, H region) reacts clearly to the leaking of auroral particles with energies 10-150 keV. The f_{min} changes correlate well with the counting rate for bremsstrahlung X-radiation. The appearance of a dense Esr layer makes it possible to estimate the energy and density of auroral electrons. It is felt that the now generally accepted idea that sporadic layers of plane types are not of corpuscular origin, particularly in the subauroral latitudes (where Kerguelen and Arkhangel'sk are situated), must be reexamined. The great variability of the E region is also an indicator of the injection of auroral fluxes.

(Kerguelen, Arkhangel' sk)

ANTSILEVICH, M. C., I. M. VILENSKIY, C. I. CERASIMOV, L. V. CRISHKEVICH, YU. N. YELIZAR'YEV, A. K. KARPENKO, L. YE. KOLOKOLOV, M. V. LEVIN, L. N. LESHCHENKO, 0. 0. OVEZCEL'DYYEV, N. A. SAL4OROKIN and A. N. SUKIIODOL'SKAYA — 1971 — Effect of the Solar Eclipse of 22 September 1968 in the F2 Layer, Ceomagnetizm i Aeronomiya, Vol XI, No. 3, 540-542.

A total solar eclipse was observed over the territory of the Soviet Union on 22 September 1968. The line of the central eclipse passed from north to south along the Urals and ended in the Kazakhstan region. At ionospheric altitudes the total solar eclipse continued from 1030 to 1210 hours (UT). In studying ionospheric behavior during the eclipse, a special program was implemented during the period 15-30 September 1968 for carrying out vertical soundings. A number of ionospheric stations participated in the experiment, both those situated in the zone of the solar eclipse and those situated in regions where the solar eclipse was not observed at ionospheric altitudes. Two expeditions also operated in the zone of the total solar eclipse. The program provided for very frequent ionospheric soundings on individual days of the control period and on the day of the eclipse. This paper describes the results of a preliminary analysis of the observed phenomenon in the F2 layer. Each 15 minutes for the time interval 1000-1500 UT on 22 September the authors constructed isoline maps of deviations of the critical frequency of the F2 layer from the median value determined for the control period. Prior to onset of the total eclipse at ionospheric altitudes ΔfoF2 did not exceed -1.5 Mc/sec. After onset of the total eclipse and movement of the lunar shadow into the southern hemisphere a zone of increased negative disturbance appeared corresponding to ΔfoF2 greater than -2.0 Mc/sec. At 1100 the zone of increased F2-layer disturbance and the projection of the lunar penumbra at an altitude of 300 km virtually coincided in space, whereas at 1145 and 1200 the projection of the lunar penumbra was situated somewhat to the south of the zone of increased disturbance, In the case of the total solar eclipse of 30 June 1954 it was noted that the lag time of F2 layer reaction during the maximum phase of the eclipse increases with an increase in geomagnetic latitude. However, no such phenomenon was observed in the case of the solar eclipse of 22 September 1968; instead, the greater the latitude, the lesser was the lag time of the solar eclipse effect. Here the principal role was evidently played by the solar zenith angle and also the rate of recombination processes in the F2 layer. With the development of the solar eclipse the dimensions of the disturbed region and the intensity of the disturbance first increase and later again decrease. The change in extent of the disturbed region is also evidently dependent on solar zenith angle. Accordingly, despite the fact that the total phase of the solar eclipse transpired in the second half of the day, when the solar zenith angle for most stations was not less than ~50° and when the end of the total eclipse coincided with sunset, the solar eclipse effect in the F2 layer was clearly detectable.

LAVROVA, YE. V. 1970 Solar and Geophysical Activity from 20 March Through 24 April 1969, Leningrad, Issledovaniya Atmosfery i lonosfery v Period Povysh. Solnechn. Aktivnosti. Cidrometeoizdat, 82-95.

This paper discusses geomagnetic and ionospheric disturbances associated with two active regions in the sun's northern hemisphere. The entire period is divided into three active periods: 20-31 March, 1-9 and 10-24 April. The article includes a table of the principal characteristics of active regions on the sun, a list of large chromospheric flares and phenomena accompanying them, as well as solar synoptic maps. The change in foF2 for a number of stations is examined.

ROMANOVSKIY, YU. A. 1970 Effect of a Solar Flare on F2-Region Ionization, Leningrad, Issledovaniya Atmosfery i lonosfery v Period Povysh. Solnechn. Aktivnosti, Cidrometeoizdat, 101-107.

During the period of a mass-spectrometer experiment aboard the "Kosmos-274" artificial earth satellite (25-31 March 1969) there were two types of ionospheric disturbances which were caused by solar flares during this time and which were accompanied by substantial changes in the distribution of ionospheric ionization in the low and middle latitudes at an altitude of 200-300 km. After a solar flare, which led to the occurrence of a magnetic storm, the formation of deep drops in ion concentration (to 5.10^2 ions/cm^3) was noted in the equatorial and subauroral regions, caused by a decrease in the concentration of 0+ ions, the principal ion component in the F2 region; this was on the nighttime side of the earth, In the case of an ionospheric disturbance after a solar flare (which, however, did not cause geomagnetic disturbances), a drop in the concentrations of atomic and molecular ions was formed in the middle latitudes on the illuminated side of the hemisphere. All these experimental data indicate a different nature of the processes which caused formation of these drops.

)LOMIYTSEV, 0. P. and —~, A. KUMINOV 1970 Effect of a Solar Flare on the Ionospheric F-2 Layer, Leningrad. Issledovaniya Atmosfery i lonosfery v Period Povysh. Solnechn. Aktivnosti, Gidrometeoizdat, 62-68.

An attempt was made to relate changes in the ionosphere observed after solar flares to solar corpuscular radiation and the state of the neutral atmosphere at the altitudes of the F-layer maximum in the middle latitudes. The composition, concentration and density of the neutral atmosphere, as well as the energy flux from a corpuscular ionization source were studied. It was found that the energy flux from this source at the altitudes of the F-2 layer maximum is ~O.5 erg.cm^{-2}.sec^{-1} and that the source caused an increase in the total density of the neutral atmosphere by ~l7%.

KALINOVSKAYA, C. P. 1970 Annual Variation of Absorption Determined from fmin Data, Irkutsk. Issledovaniya PO Ceomagnetizmu, Aeronomii i Fiz. Solntsa, No. 6, 61-66.

On the basis of an analysis of the diurnal variation in fmin and the geomagnetic field H-component by the method of expansion of the fields in natural orthogonal components the authors examine the annual variations in these parameters. It was established that the annual variation in absorption and H is determined by the combination of the two components: a double annual wave and a simple wave. The changes in both H expansion components are closely related to the corresponding changes in absorption during all seasons, In the annual variation of absorption in the upper and lower parts of the D-layer one can trace a correlation with the peculiarities of behavior of the neutral atmosphere. Anomalous winter absorption is characterized by a combination of the two components of expansion of annual variation, differing in their properties.

FREYZON, A. A. and B. S. SHAPIRO 1970 Variations in Parameters of the N(h) Profiles Over Moscow During the Period 18-23 April 1969, Leningrad, Issledovaniva Atmosfery i lonosfery v Period Povysh. Solnech. Aktivnosti, Gidrometeoizdat, 69-81.

On the basis of data from surface vertical sounding at Moscow a study was made of the general state of the ionosphere during the period of rocket experiments of 18-23 April 1969. This period was characterized by an appreciable increase in ionization in the F2 and H layers; all positive disturbances can be identified with flares on the sun with a time shift of 39 hours, which corresponds to corpuscular velocities of 1,100 km/sec. Absorption bursts during SID periods can be traced from fmin data for the o- and x-components. Absorption peaks are also detected in the hours after sunset on 19, 20, 21 and 23 April. The paper gives the results of detailed computations of N(h) profiles (for one and two magnetoionic components) at the times of rocket launchings. The authors discuss variations in altitudes, layer thicknesses, and widths of the interlayer E-F region during these periods.

(Moscow)

KUMINOV, A. A. 1970 Results of Radiosonde Investigations of the Ionosphere, Leningrad, Issledovaniva Atmosfery i lonosfery v Period Povysh. Solnechn. Aktivnosti, Gidrometeoizdat, 48-61.

This paper gives an analysis of vertical sounding of the atmosphere in the middle latitudes for the purpose of studying the effect of a solar flare on a number of ionospheric characteristics. The observations were made on the days after solar flares: 18 April (importance 2+) and 21 April (importance 3+) in 1969, that is, 18, 19, 21, 22, 23 and 25 April. As a comparison the author used ionograms obtained on 17 April, The ionograms were used in constructing vertical profiles of electron concentration. The state of the ionosphere on 21 and 23 April differs appreciably from the state on 18 and 19 April. During active periods there are higher values of the critical frequencies of regular ionospheric layers and altitudinal gradients of electron concentration and the altitude of sporadic formations in the E region decreases appreciably.

OVEZCEL'DYYEV, 0. and 1971 The Sporadic E Layer and Chromospheric Flares, Ashkhabad,

M. B. OSTANINA — Izvestiya Akademii Nauk Kurkmenskoy SSR. Seriya Fiziko-Tekhnicheskikh. Khimicheskikh i Geologicheskikh Nauk, No. 3, 48-52.

Optical observations of solar flares were made for determining the dependence of Es on chromospheric flares. Information was used on optical flares published in the solar data bulletins together with ionospheric data for Ashkhabad station. The authors took into account all flares of importance 1-3+. This was supplemented by data on radio bursts with λ=10 cm on the basis of measurements at Ottawa and on the basis of Es data for Washington. In order to clarify whether a flare causes an effect in the Es layer the authors examined the 15-minute values of the limiting reflection frequency foEs before, during and after a flare. This made it possible to determine whether the particular flare is accompanied by an increase in foEs and after what time from flare occurrence this foEs increase is observed. The foEs values were examined for the day after flare onset. As intense Es cases the authors used those cases when the foEs values increased in comparison with the ordinary diurnal variation by not less than 2-3 Mc/sec. During 1962 and 1964 a total of 140 optical flares was studied, together with about 100 radio bursts with λ=10 cm.

Among the 140 optical flares 74 were accompanied by an foEs increase; in 65 cases there was no increase in Es intensity after a flare. Most (up to 3/4) of the flares not accompanied by an effect in Es were in the autumn and winter months, On the other hand, study of all cases of observation of intense Es revealed many cases of Es with a marked increase in foEs without any correlation with chromospheric flares (most of these cases were in the summer months). Thus, this entire analysis revealed that in 45% of the cases flares are not accompanied by an effect in Es, particularly in the autumn and winter months; vice versa, there are cases of the appearance of intense Es, most frequently in summer, without correlation with flares. This suggests that the coincidence of an increase in Es intensity, that is, an increase in foEs with the observed solar flares, is a random phenomenon. PEs values for different time intervals after chromospheric flares do not exceed the monthly PEs values for all frequencies, that is, it can be assumed that there is a random coincidence between a sudden foEs increase and flares. It is concluded that chromospheric flares can exert a definite effect on the sporadic E layer only under minimum solar activity conditions.

(Ashkhabad, Washington)

CONCHAROV, YE. YE., V. V. KOSHELEV, L. A. SHCHEPKIN and L. A. YUDOVICH — 1971 — Preliminary Results of Numerical Modeling of the Ion Structure of the Disturbed Fl Region, Geomagnetizm i Aeronomiya, Vol XI, No. 3, 479-482.

In studying the behavior of the ionospheric ion structure during disturbances the authors carried out numerical modeling of quiet and disturbed conditions by selecting the optimum solution on an analog computer, employing the method described earlier by V. V. Koshelev. The analysis was based on $n_e(h)$ distributions at fixed levels during the illuminated hours of the day as determined from vertical sounding at Moscow on 28 September 1965 and 7 October 1964 (disturbed days), 23 September 1965 and 22 October 1964 (control quiet days). The disturbance of 28 September occurred during the recovery phase of a moderate geomagnetic storm and a negative disturbance (Δ foF2 ~-5O%) was observed in the middle-latitude ionosphere. The weak ionospheric disturbance of 7 October 1964 was preceded by a moderate recurrent geomagnetic storm; 23 September 1965 and 22 October 1964 were quiet magnetoionospheric days. The Jacchia model was used as a model of the neutral atmosphere. The results show that during a disturbance the conditions for development of the Fl layer are more favorable. This is confirmed by a detailed examination of a series of ionograms for quiet and disturbed periods; it is clearly seen that the Fl layer is more clearly expressed on a disturbed day.

(Moscow)

STRUIN, 0. N. and A. V. SHIROCHKOV — 1970 — Ionospheric Effects of Solar Proton Flares in 1968 (Based on Observations for Vostok Station), Informatsionnyy Byulleten" Sovetskoy Antarkticheskoy Ekspeditsii, No. 78, 54-61.

This paper describes polar cap absorption on the basis of data for Vostok station for 1968 and gives an analysis of some peculiarities in individual cases of PCA. Vostok is an ideal point for conducting such research due to its great remoteness from the auroral zone and the insignificant geomagnetic cutoff for solar cosmic rays. Table 1 in the text gives a summarized listing of all registered cases of polar cap absorption. Only two of these events (9-11 June and 18-21 November) are examined in detail. The first of these was observed during the polar night when the lower ionosphere was completely darkened and nevertheless, according to riometer data (30 Mc/sec) absorption exceeded 1 dB. The second case was for conditions of a stable daytime equilibrium state of the ionosphere. Like for the conditions of a stable nighttime state of the ionosphere, temporal variations in radio wave absorption during PCA periods are determined by variations in the intensity of solar cosmic rays. The data on PCA for 1968 make it possible to investigate the quantitative ratio between riometer absorption at 30 Mc/sec and the corresponding minimum frequency of ionospheric station reflection fmin. The fmin value is dependent on the technical characteristics of the set, especially on response and to some degree on deflecting absorption. Nevertheless, it is desirable to have an empirical relation between fmin, observed using a standard ionospheric station with a standard antenna system, and riometer absorption at the commonly employed frequency 30 Mc/sec. Such a relation can serve as a guide for evaluating the intensity of absorption on the basis of data on fmin. A total blackout (absence of reflections) usually appeared for an AIS-1 ionospheric station when the mean absorption for the riometer at 30 Mc/sec was about 1.70 dB.

(Vostok)

ZHEREBTSOV, C. A. and V. A. KURILOV	1971	Duration of Continuous Es Reflections of Different Types in the High Latitudes, Geomagnetizm i Aeronomiya, Vol XI, No. 4, 718-720.

In this paper the authors evaluate the possible errors arising in the usual approach to the use of ionospheric data for studying Es layers. This study is a continuation of earlier work by the authors (Geomagn. i Aeronomiya, 9, 1099, 1969) which was an investigation of the dynamics of Es reflections, the replacement of one type of Es layer by another, and change in the structural parameters of the Es layer during auroras. Ionospheric sounding was under a continuous (each minute) program with an ionospheric station during the equinoctial period of 1966-1967 at Noril'sk. Data were analyzed for 100 hours of continuous sounding in the presence of auroras both at the zenith and at the margins of the sky. During auroras it is common to observe reflections from Es layers of types s, r, f and less frequently s. An analysis revealed that the physical processes transpire so rapidly and the replacement of Es reflections of one type by another occurs so frequently that even five-minute ionospheric sounding does not make possible any reliable solution of the problem of autocorrelation of two successive images on the ionograms. The time of continuous reflection from Es layers of one type is very short. The more active the aurora, the shorter is the time of continuous reflections. It was concluded that in the interpretation of ionograms in the case of an Es layer of indeterminate form (in the case of a 15-minute sounding interval) it is impossible to classify this layer on the basis of a preceding or subsequent ionogram as recommended by other authors because such an approximation leads to a spurious lifetime of an Es layer of the determined type. Taking into account that during winter the polar ionosphere is disturbed a large part of the time, it must be concluded that existing methods for studying the ionosphere (15-minute ionospheric sounding intervals) and data processing must be improved.

(Noril ' sk)

KAZIMIROVSKIY, E. 5., V. F. LOGINOV and C. I. SUKHOMAZOVA	1971	Variations in Ionospheric Parameters and Stratospheric Circulation, Geomagnetizm i Aeronomiya, Vol XI, No. 4, 727-728.

This paper gives an evaluation of the correlation between meridional circulation in the stratosphere and the critical frequencies in the F2-foF2 region at local midday on the basis of data for 80 to 90 stations in the world network for March, June, September and December 1958. It was possible to determine the Δ foF2 deviations from the mean monthly pattern of the global distribution of midday foF2 values. These deviations were later compared with the indices of meridional circulation I_M. It was found that the lag in variations in ionospheric parameters varies in a broad range but the least lag (averaging about three days) occurs in March. Sufficiently strong stratospheric meridionality and marked restructuring form the best conditions for interaction between the upper and lower layers. Such conditions exist only in March. In December a strong meridionality develops in the atmosphere but powerful westerly flows block the upward penetration of energy, whereas in September the conditions for the upward penetration of energy are optimal, but on the other hand atmospheric meridional circulation is extremely weak. The paper gives experimental confirmation of the presence of a correlation between stratospheric circulation and F2 region parameters, whose closeness becomes maximum during the following periods: 1) development of meridional processes in the stratosphere and 2) restructuring of circulation from the winter to the summer types.

VELINOV, PET'R, GEORGI NESTOROV and TSVETANA PASHOVA	1971	Effect of Corpuscular Streams on the Nightime Ionosphere During Geomagnetic Disturbances During the Quiet Sun Period, Sofia. Izv. Ceofiz. In-ta B'lg. AN, 16, 75-89.

A study was made of the state of the nighttime E layer during geomagnetic storms on the basis of data from measurement of radio wave absorption at 593 kc/sec (Pleven-Sofia path) and 155 kc/sec (Brashov-Sofia). The authors analyzed 29 cases of anomalous absorption during 1964-1966. It was concluded that: 1. During the main phase of the disturbance there is additional ionization of the nighttime E layer causing absorption of medium waves. 2. After ionospheric normalization there is a second absorption maximum associated with penetration of corpuscular streams; the particles attain 90-95 km, whereas their absorption maximum occurs at 100-120 km. 3. The mean electron flux, according to an estimate based on the additional absorption, corresponds to the flux based on rocket measurements in the middle latitudes at nighttime.

BABAYEV, A.	1971	Structural Characteristics of the Screening and Semitransparent Types of Es Layer, Ashkhabad. Izvestiya Akademii Nauk Turkmenskoy SSR, Seriya Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk, No. 4, 95-96.

The sporadic E layer does not always screen the above-lying layers of the ionosphere. Sometimes it is completely transparent, but in most cases it is partially transparent. In order to clarify the mechanism of Es formation and the role of this layer in maintaining communications in the short- and ultrashort-wavelength range the author studied the structural peculiarities of the screening and semitransparent types of Es layer. The author analyzed the parameters β and θ_0 characterizing the fine structure of the layer. Separation of Es into screening and semitransparent types was on the basis of semitransparency. In comparing the parameters β and θ_0 of the screening and semitransparent Es types one must take into account the position of the working frequency relative to the screening frequency. The author processed 281 measurement periods for the summer of 1966; 110 of these correspond to the screening type and 171 correspond to the semitransparent type. The mean and median β values for the screening type are twice as large as for the semitransparent type. The Bramley formulas were used in computing the angular scatter of a beam of scattered wave θ_0. A total of 160 measurement periods were processed, of which 80 correspond to the transparent type and 80 to the screening type. The median and mean values show that θ_0 for the screening type of Es is approximately 2.5 times less than for the semitransparent type. [β is the degree of turbidity and θ_0 is the angular scatter of the beam of scattered waves.]

FATKULLIN, M. N.	1971	Common Characteristics in the Vertical Distribution of the Seasonal Anomaly and Disturbance Effect in the Daytime Outer Ionosphere in the Middle Latitudes, Geomagnetizm i Aeronomiya, Vol XI, No. 4, 711-713.

Citing several examples, the author demonstrates the presence of common features in the vertical distribution of the storm effect in the outer ionosphere during the near-midday hours in the middle latitudes and the seasonal anomaly in electron concentration in the outer part of the F region. The vertical distribution of the season anomaly effect in the outer ionosphere was examined using data from the "Alouette-l" satellite, together with the critical frequencies of the F2 layer for the corresponding conditions. The study is limited to the near-midday hours under magnetically quiet conditions in June and December 1963. The selection of corresponding ne(h) profiles for summer and winter conditions, completely coinciding in coordinates and time of observation, was difficult. Nevertheless, it was possible to select a number of cases for comparison. A study of different cases reveals that in the outer ionosphere the winter ne value is greater than the summer values only at altitudes h≤ 500 km and farther aloft the seasonal anomaly is absent. The altitudes of the levels below which a seasonal anomaly in ne in the outer ionosphere is observed are evidently dependent on latitude and time of day and can change from day to day. Negative disturbances are observed in ne at altitudes lying directly above hmF2. However, only positive disturbances are observed above some levels (h_t) where n_e in the outer ionosphere does not change during a magnetic storm. The maximum h_t values are no greater than 500-600 km when I≈ 70^0N. Accordingly, a comparison of the near-midday vertical distributions of the disturbance effect in the outer ionosphere and the seasonal anomaly in middle latitude electron concentration shows that the seasonal anomaly, like negative disturbances, affects only the altitudes directly adjacent in an upward direction to the altitude of the F2 layer maximum. The season anomaly is also absent at quite great altitudes (400-500 km) where positive disturbances in ne are observed. This probably indicates that negative disturbances and the seasonal anomaly in the F2 region have a common mechanism.

KOLOMIYTSEV, 0. P. 1971 Seasonal Variations of Electron Concentration in the F2 Layer of the Circumpolar Ionosphere in the Southern Hemisphere, Doklady Mezhduvedomstvennoy Komissii P0 Izucheniyu Antarktiki AN SSSR za 1968. Izd-vo "Nauka", 59-74.

This paper gives the results of an analysis of behavior of the F2 layer under magnetically quiet conditions in the southern hemisphere polar cap. The author discusses diurnal and seasonal changes in the principal parameters of the F2 layer, as well as those associated with a change in the solar activity level. The analysis includes the electron concentration maximum n_em, altitude of the maximum hm, vertical gradient of electron concentration $\partial n_e/\partial h$, and the quarter-thickness of the parabola $y_m/2$. It is shown that the diurnal changes in electron concentration at fixed altitudes (n_e(h) profiles) and changes in maximum ne in the polar region have a well-expressed seasonal dependence on the solar activity cycle and can be classified into three types:
1) summer, 2) winter, 3) equinoctial. Taking into account conditions for illumination of the polar atmosphere, an attempt was made to relate the peculiarities in F2 layer behavior in the polar cap to changes in the neutral composition of the atmosphere. The seasonal variations in neutral composition of the atmosphere in the middle and high latitudes are compared. The conclusion is drawn that variations in the neutral composition of the atmosphere in the middle latitudes differ from the corresponding variations in the high latitudes. This is attributable to the fact that an additional ionization source is present in the high latitudes. Estimates show, for example, that for a winter night under magnetically quiet conditions the energy flux of this source is ~0.25 $erg.cm^{-2}sec^{-1}$.

KOKOUROV, V. D., E. S. KAZIMIROVSKIY, V. N. ZAKAROV and YE. I. ZHOVTIY 1971 Synchronous Measurements of Ionospheric Drifts During Vertical and Slant Radiosonding, Ceomagnetizm i Aeronomiya, Vol.. XI, No. 4, 720-722.

This communication is devoted to an analysis of a year-long cycle of observations made during the period from 7 June 1968 through 7 April 1969 around-the-clock during four-month intervals with two five-minute observations hourly. A total of about 5,500 observations were made and the velocity and direction of the ionospheric drift were computed for 2,056 periods. Processing was by the similarity method. Data computed using F-region reflections were assigned to the upper ionosphere and reflections from E and Es were assigned to the lower ionosphere. Most statistics were accumulated for the winter season during vertical sounding and the fewest for the summer season during slant sounding. The predominant direction for all seasons was movement toward the west in the upper ionosphere at the two stations for which data were used. In the lower ionosphere during the equinoctial period there is a great variability in directions associated with restructuring of the nature of atmospheric circulation. During the solstice periods there is a predominance of movement to the east in summer and to the west in winter in the lower ionosphere. The most common shears S are insignificant in comparison with the velocity (80-100m/sec) itself and the difference in directions usually does not exceed 20-3O°. The measurements revealed that the mean statistical characteristics of drifts measured during vertical and slant radiosonding fit well into the pattern of general circulation of the atmosphere at ionospheric levels.

BABAYEV, A. 1971 Investigation of the Interrelationship of Frequency Parameters of the Sporadic E Layer, Ashkhabad, Izvestiya Akademui Nauk Turkmenskoy SSR, Seriya Fiziko-Tekhnicheskikh, Khimicheskikh i Ceologicheskikh Nauk, No. 4, 92-95.

In contrast to regular ionospheric layers, the sporadic E layer is characterized by two frequency parameters: fscEs (screening frequency) and foEs (limiting reflection frequency). The fscEs parameter characterizes the plasma frequency and foEs is determined by the fine structure of the E layer. It is of scientific and practical interest to study the interrelationship of these frequency parameters. Such a study was made using data from 12 ionospheric stations during the summer of 1958. The cross-correlation coefficient between foEs and fscEs was computed. For nine stations this coefficient p was computed for each hour of the day and for the others only for the day as a whole. The p values for stations at geomagnetic latitudes below ~51° are given. There is a high correlation between the two parameters at high-latitude stations. In the latitude zone from 5 to 3O°Φ the daily variation of ρ is characterized by a pre-midday minimum, whereas at stations above 3O°Φ the cross-correlation coefficient of the frequency parameters of the Es layer does not have a clearly expressed diurnal variation. The smoothest daily variation is observed at Ashkhabad. The coefficient is dependent on season. The variation is not identical during different seasons and the minima are observed in winter. The mean daily ρ values for summer, equinox and winter are 0.84, 0.82 and 0.71 respectively. During all seasons the daytime ρ value is somewhat greater than at nighttime. The highest correlation between the two parameters is at middle-latitude stations, In the equatorial region and in the high latitudes the correlation of Es frequency parameters is very low, On the basis of the nature of correlation between the two parameters the earth can be divided into three zones: equatorial (no dependence), high-latitude (weak dependence) and middle latitudes (clearly expressed linear dependence).

(Ashkhabad)

ROMANYUK, A. P. 1971 Variability in the High-Latitude Regular F2 Layer, Leningrad, Ceofizicheskiye Yavleniya v Avroral'n. Zone, Izd-vo "Nauka", 3-10.

This paper is a discussion of the high-latitude F2 layer and stability of the curve of diurnal variation of foF2. The F2 layer in the high latitudes is more local in comparison with the middle latitudes; the correlation coefficient drops below 0.5 already at a distance of 500 km during the nighttime hours during the winter and equinoctial months. The decrease in the auto-correlation coefficient with time is more rapid than in the middle latitudes: it decreases to below 0.5 when $\Delta\tau = 1.5$ hours.

FATKULLIN, M. N., A. D. LECEN'KA and A. V. ROMANENKO 1971 Disturbance Effects in the Outer Ionosphere Electron Concentration on the Earth's Nighttime Side, Ceomagnetizm i Aeronomiya, Vol XI, No. 5, 901-903.

This paper gives the results of a study of the behavior of the outer ionosphere on the earth's nighttime side during the magnetic storm of 14 September 1963. Conditions on the preceding day were considered quiet. Data from the Alouette 1 satellite were used. Particular attention was given to the NmF2 and $n_e(h)$ profiles in the outer ionosphere and the total electron content NT. The following phenomena were noted: a) the latitudinal distribution of NmF2 during the nighttime hours under quiet conditions has several peculiarities: a middle-latitude dip at $I \approx 70\text{-}72^0$N and an equatorial anomaly. The equatorial anomaly maxima fall at I≈+200. Under quiet conditions the center of the equatorial anomaly dropoff coincides with the inclination equator. Under disturbed conditions the equatorial anomaly in NmF2 disappears and the NmF2 values in the region of the middle latitude nighttime dropoff almost do not differ from quiet conditions, but a very substantial NmF2 decrease is observed during the storm in the zone 22°N≤ I≤ 40°N. b) The NT latitudinal distribution in the outer ionosphere under quiet conditions has the same characteristics as NmF2. North of the middle-latitude dip one observes positive disturbances in NT and with I≈75-80°N Δ NT≈100-160%. This is a natural result of the storm-induced increase in the electron concentration both at the F2-layer maximum and in the entire thickness of the outer ionosphere. Another peculiarity in NT changes under disturbed conditions is disappearance of the equatorial anomaly and near the magnetic equator ΔNT≈140%. c) A comparisn of n_e(h) profiles shows that reliably discriminated positive disturbances in ne in the outer ionosphere are observed only at latitudes where I > 42º, In the high latitudes the disturbance effect is more clearly expressed at higher levels. Disturbances in outer ionosphere ne are difficult to detect with certainty.

(Alouette 1)

ALIMOV, V. A., L. M. YERUKHIMOV and T. S. PYRKOVA	1971	On the Theory of the Ionospheric F spread Phenomenon, Ceo-magnetizm i Aeronomiya, Vol XI, No. 5, 790-797.

A study was made of the mechanism of the origin of diffusivity of a pulsed sounding signal as a result of radio wave scattering on electron concentration inhomogeneities (with dimensions λ~1-5 km) in the ionosphere. On the basis of the results of the diffraction theory of scattering of pulsed signals in a randomly inhomogeneous medium and data on the parameters of inhomogeneities in the ionospheric F layer obtained by radioastronomical and satellite methods the authors computed characteristic curves showing the dependence of the altitude interval of diffusivity on the working frequency during ionospheric sounding from the earth and artificial earth satellites at different latitudes. The results of these computations agree well with the corresponding experimental data. The analysis presented here may indicate a uniform nature of the F-layer inhomogeneous formations responsible for the radio scintillation of extra-terrestrial sources and artificial earth satellite signals and the F spread phenomenon. A number of peculiarities in the F spread and scintillation phenomena can be understood within the framework of the local distribution of inhomogeneities and variations in their altitudinal distribution.

SHAPIRO, B. S. and N. I. POTAPOVA	1971	Dependence of qc on Altitude and Frequency and Temperature of Particles in the Summer Daytime F Region, Geomagnetizm i Aeronomiya, Vol XI, No. 4, 713-716.

Variations in the quarter-thickness qc of parabolic F2 and F1 ionization maxima in the summer daytime N(h) profile reflect the temporal variations and latitudinal distribution of electron temperature Te and the temperature difference of electrons and neutral particles Te - Tn during the impairment of thermal equilibrium at the altitude of the level of maximum concentration hmax. This paper gives the results of studies of the altitudinal and frequency dependences of qc and their possible correlation with the temperature of neutral particles and electrons. The authors analyzed hmax and qc values for the summer period of high (1959-1960) and low (1964-1965) solar activity using data from WDC-B2 and the results of special computations of these parameters. The dependence of qc and (Te - Ti) on Nm is clear. For example, for large Nm one observes thermal equilibrium (Te - Tn = 0, qc ≈ 0.9 Hn) and the qc values, despite a Nm decrease, remain almost identical. When Nm decreases below a definite boundary value (Nm)I, thermal equilibrium is impaired (Te - Tn ≠ 0, qc > Hn) and the Te - Tn and qc values begin to increase with a decrease in Nm. With a further decrease in Nm there is an onset of conditions with a nonequilibrium temperature. In the case considered thermal equilibrium sets in when (Nm)I = (60-40).10^4 electrons.cm^3 (foF2 = 7.0-6.0 Mc/sec) for high and low solar activity respectively. With a solar activity decrease the temperature (Tn)I decreases whereas (Te)II for altitudes hmax ≥ 200 km remains approximately the same or even increases. The paper shows that the dependence qc (hmax) makes it possible to determine the altitudinal distribution of the minimum neutral temperature (Tc)I and the maximum electron temperature (Te)II in the summer daytime F region. The dependence qc(Nm) for different hmax altitudes makes it possible to determine the Nm values at which there is an impairment in thermal equilibrium and conditions with a nonequilibrium temperature.

(WDC-B2)

BEN'KOVA, N. P., C. V. BUKIN and CHIN' KHONG T'YEN	1971	Conjugate Nature of Disturbances in the Ionospheric F2 Region, Geomagnetizm i Aeronomiya, Vol XI, No. 4, 602-607.

A study was made of the vertical ionization profiles at several pairs of magnetically conjugate stations during disturbances. The stations used were Sogra-Kerguelen and Washington-Port Stanley. Computations of

N(h) profiles revealed that on days of in-phase disturbances electron density variations occur at all levels of the F2 region identically at both ends of the tube of force whereas on days of antiphase disturbances the electron density in the lower and upper parts of the F2 region changes differently at the northern and southern ends of the tube of force. It is noteworthy that the level at which the N(h) profiles intersect coincides with the boundary between the "middle ionosphere," whose state is determined for the most part by photochemical processes, and the upper ionosphere," in which the decisive role is played by dynamic processes. These and other conclusions drawn concerning the similarity and difference in the course of disturbance in the F2 region in the northern and southern hemispheres must be taken into account in discussing possible conjugate mechanisms. Both the aerodynamic and electromagnetic concepts of ionospheric storms are examined in some detail. It was found that both the aerodynamic and electrodynamic hypotheses explain the conjugate nature of disturbances in the F region, although purely mirror cases of the appearance of disturbances are difficult to explain on the basis of the aerodynamic hypothesis. The authors favor the electrodynamic hypothesis. However, only direct measurements of T and E can finally reveal which is preferable and possibly will provide quantitative data for formulating a generalized model synthesizing both hypotheses.

(Sogra, Kerguelen, Washington, Port Stanley)

MIKHNEVICH, V. V. and A. D. DANILOVA 1970

A 214 page collection of articles on the atmosphere and ionosphere has been published in Russian under the title "Atmospheric and Ionospheric Studies During the Period of Increased Solar Activity (March-April 1969) edited by V. V. Mikhnevich and A. D. Danilova, Leningrad, Gidrometeorologicheskoye Izdatel'stvo, 1970. This collection of articles gives the results of measurements of characteristics of the atmosphere and ionosphere obtained by rocket, radiosonde and ground methods during the period of high solar activity in March-April 1969. Rocket measurements were made using instrumentation carried aboard Mr-12 meteorological rockets and M-1OO rockets. Ground observations were made at stations where ionospheric radiosondes are employed and using meteor trail radars, In addition, data from the network of aerological and meteorological stations were used. A correlation was established between solar activity, corpuscular streams, ionospheric ionization and circulation and structure of the earth's lower and upper atmosphere. The results are of interest for specialists working in the fields of meteorology, physics of the upper atmosphere and ionosphere, weathermen, and individuals interested in the effect of solar activity on the atmosphere.

KOMRAKOV, C. P., V.C. KHRYIJKIN and YLJ. K. CHASOVITIN 1971 Electron Concentration and Temperature Profiles in the Altitude Range 80-170 km, Moscow, Kosmicheskiye Issledovaniya, Vol IX, No. 5, 791-793.

An MR-12 rocket was launched at Volgograd on 10 July 1969 at 1104 LT; it carried instruments for measuring the electron concentration Ne and the electron temperature Te in the ionosphere. During this launching the Es layer was present in the ionosphere. The electron concentration was measured using a high-frequency impedance probe and electron temperature was determined using a cylindrical Langmuir probe. The measurement accuracy was approximately 15 percent for the electron concentration and ± 100°K for electron temperature. The electron concentration profile shows that the Ne values registered in the D region are somewhat lower than are usually observed in summer and in the daytime at these altitudes. A clearly expressed E layer was observed at altitudes 100-114 km; the electron concentration at its maximum was $1.3.10^5$ cm^{-3}. The rocket launching was accompanied by vertical sounding of the ionosphere. The Ne value determined from the critical frequency of the E layer (foE) was $1.5.10^5$ cm^{-3}. At 109 km there was a thin sporadic E layer; the electron concentration at its maximum was $3.25.10^5$ cm^{-3}, 2.5 times greater than the electron concentration in the E region. The Es layer was registered on the ionogram. The Ne values determined from the limiting frequency (foEs) and from the screening frequency (fbEs) were $3.7.10^5$ cm^{-3} and $3.0.10^5$ cm^{-3} respectively. There is a completely satisfactory correspondence between rocket and ground data (the Ne differences do not exceed the measurement error). Approximately to 155 km the electron temperature increased more or less uniformly and then increased rapidly to 2,600°K at an altitude of 170 km. At all altitudes the summer Te values increased by a factor of 1.5-2 above the winter values. This reflects the seasonal changes in electron temperature. Both winter and especially summer Te values everywhere are considerably greater than the temperature of neutral gas. This indicates an absence of thermal equilibrium in this region of the ionosphere.

LUKASHKIN, V. M. 1970 Regular Absorption of Radio Waves Determined from Riometer Observations at Vostok Station, Leningrad. Informatsionnyy Byulleten' Sovetskoy Ekspeditsii, No. 80, 74-80.

This paper gives the results of measurements of regular absorption in the entire ionosphere at a frequency of 30 Mc/sec at the Antarctic station Vostok. The analysis was based on data from year-long observations made during the period April 1965 through March 1966. Graphs of daily variations in absorption for each month were constructed. The diurnal variations in absorption are rather poorly expressed. This is attributable to the fact that with an increase in geographic latitude solar control of regular absorption is weakened. The small difference between daytime and nighttime values is attributable to small changes in ionospheric illumination during the day, especially during summer when the sun does not appear over the horizon. Seasonal variations in absorption, such as near midday and near midnight, are expressed far more sharply. Absorption decreases from 0.45 dB at summer midday (χ= 55°) to 0.2 dB during the equinoctial months (χ = 78°) and decreases almost to zero in winter when the sun is constantly below the horizon. During winter the critical frequencies decrease from 5.0 Mc/sec in May to 2.9 Mc/sec in July despite constant residual absorption. During this period absorption variations do not exceed 0.02 dB. The contribution of the F region is unimportant and most absorption is concentrated in the D and E regions. There is a linear correlation between absorption at frequencies of 30 Mc/sec and 6.2 Mc/sec. This is evidence that the regular absorbing layer along the Vostok-Mirnyy line is quite uniform. Computations revealed that during September-November the propagation of a frequency of 6.2 Mc/sec occurred during reflection from the E region and most of the nondeflecting absorption was concentrated in the D region. A table gives the ratio of absorption measured by the A3 method to absorption measured by a riometer, that is, the ratio of absorption in the D region to total absorption. The contribution of this region to absorption averages about 40%, whereas the contribution of the E region is about 60%. Computations of screening frequency and the propagation mode were made without allowance for curvature of the ray in the E region accompanying reflection from the F region. Allowance for this circumstance will lead to some increase in contribution of the D region.

(Vostok)

UTLAUT, WILLIAM F. and ROBERT COHEN 1971 Modifying the Ionosphere with Intense Radio Waves, Science, 174, 245-254.

Appreciable local perturbations of the ionosphere are now being produced by the action of powerful radio waves directed vertically upward. These modifications are transitory and selfreversible, having lifetimes of the order of seconds, minutes, or hours, but not days. The modified region is about 100 kilometers in diameter, centered at a height between 250 and 350 kilometers, and shaped in the form of a spheroid, prolate along the lines of the geomagnetic field.

CLOSS, R. L. 1971 Redistribution of ionization in the auroral and equatorial ionosphere, Radio Science, 6, No. 11, 939-943.

It is shown that the electric fields that can exist in the auroral and equatorial ionospheres should produce a convergent flow of metallic ions. It is suggested that this convergent flow of ions is responsible for some of the sporadic E with high fbEs observed in these regions. It is further suggested that the existence of meridional currents in the equatorial ionosphere might be detected by their production of sporadic E, whereas in the auroral ionosphere the direction of the electric field and the molecular weight of the ions responsible for the Es layer can be found from height measurements and the separation between the striations in the sporadic layer.

VILA, PAUL 1971 New dynamic aspects of intertropical F2 ionization, Radio Science, 6, No. 11, 945-956.

Diurnal changes in F2 ionization distribution as measured during June and July 1966 over the Tamanrasset meridian reveal two types of asymmetric phenomena distorting the crest-and-trough system (formerly known as the equatorial F2 ionization anomaly). The first type corresponds to a general time variation of the latitude asymmetry. Our observations yield four independent parameters of this asymmetry; for 80% of the time, the variation can be attributed to ion drag due to a time-varying meridian air wind. Magnetic activity is correlated with the amplitude of this wind, and the low-altitude thermospheric circulation is discussed. Day-to-day fluctuations of the diurnal evolution pattern suggest a possible long-term control of the equatorial electric field by the general dynamo current system. A second type of asymmetry shows more intense, local, and short-lived phases superimposed on the fountain and neutral wind fluctuations. It has the character of a transitory forced-diffusion process. We believe that the factor responsible is electron temperature gradients produced by conjugate photoelectron heating.

(Tamanrasset)

CICERONE, R. J. and S. A. BOWIIILL	1971	Photoelectron fluxes measured at Millstone Bill, Radio Science, 6, 957-966.

Measurements of the intensities of plasma lines in the radar incoherent-scatter spectrum are reported. The measurements were performed with the UHF radar at Millstone Hill, Massachusetts, on February 9, 1969. Theory of the plasma lines is reviewed, and problems of data interpretation are discussed. The plasma-line intensities are interpreted in terms of photoelectron upward and downward flux components at 560 km. The net upward flux there is found to be 3.6 x 10^8 cm^{-2} sec^{-1}, From the measured fluxes and a simplified picture of photoelectron transport, the escape flux and the arriving conjugate-point flux are found, In addition, the opacity of the protonospheric field tube connecting Millstone Hill and its conjugate point is estimated as 0.85 for photoelectrons.

(Millstone Hill)

SHAR.MA, R. P. and R. C. RASTOCI	1971	Lunar-Solar Tides in Electron Density at Fixed Heights of the Ionosphere, Planet. Space Sci., 19, 1349-1357.

Lunar tidal variations in the electron density N at fixed heights of the ionosphere for different solar hours have been computed at the equatorial station Huancayo, and the mid-latitude station Puerto Rico. It is found that the tidal amplitudes increase rapidly with altitude between 180 and 250 km. At Huancayo the phase i.e. time of maximum positive deviation of lunar semi-diurnal variations in N is 07-08 lunar hr for the lower regions (below 180 km); it changes sharply at heights around 200 km, above which it is 03-04 lunar hr. The amplitude of the tide at heights around 200 km is independent of solar hr. At Puerto Rico, the phase is continuously retarded with increasing height; it is about 01 lunar hr in E-region heights and changes to about 09-10 lunar hr at heights near h_{max}. It is seen that lunar oscillations in the E- and F1-regions, at both the places, are in phase with corresponding magnetic field variations. Various observed results are explained as due to lunar variations in the magnetic field through the variations in the vertical electrodynamic drift velocities.

(Huancayo, Puerto Rico)

WALKER, C 0, and S. D. TING	1972	Electron content and other related measurements for a low latitude station obtained at sunspot maximum using a geo-stationary satellite, J. Atmos. and Terr. Phys., 34, 283-294.

Electron content measurements have been made at Hong Kong (lat. 22.2^{0}N, dip 30°) for the period July 1967-December 1968 by continuously recording the polarization angle of a signal from a geostationary satellite Syncom 3. Monthly median peak diurnal contents exhibited a semi-annual variation with maxima occurring at the equinoxes and a “winter anomaly” effect was noted during the daytime. However this latter effect was not apparent for midnight values, though the semi-annual variation remained. The rate of increase in content with solar flux since 1964-5 was greatest for the winter and during this season the measured scale heights were also greatest, thus possibly implying a seasonal increase in the composition ratios [0]/[02] and/or [0]/[N2]. Good short term correlation between the daily peak electron content and the daily solar flux has been established. The equivalent thickness exhibited a broad daytime increase during the summer but at other seasons sharp peaks occurred after sunset and before sunrise. The present results showed no seasonal variation of equivalent thickness, in contrast with the summer maximum obtained using data from lower height transit satellites; and also appreciably higher winter content values have been obtained with geosatellite data. A possible explanation of these facts may be that there is a significant increase of ionization above 1000 km during the winter season. No increase of equivalent thickness was observed between sunspot minimum and maximum. The integrated production rate for an overhead sun roughly followed a similar seasonal variation to that of the peak content if allowance was made for the solar flux control, which was found significant only during the winter. The zenith angle of the Sun corresponding to initial ionization was observed to vary between 97.0° in winter to 93.5° in summer. After sunset the ionosphere was found to decay in two stages giving two distinct effective loss rates with different seasonal variations. In interpreting these results it has been considered likely that after sunset during the equinoxes Mitra drifts of ionization occurred moving ionization from the magnetic equator to Hong Kong and around midnight during the summer a further appreciable influx of ionization occurred.

(Bangkok, Taiwan)

RISHBETH, H. 1972 Thermospheric winds and the F—region: A Review, J. Atmos. and Terr. Phys., 34, 1—47.

This review deals with the neutral—air winds that blow in the upper atmosphere at heights above about 150 km. Starting from a discussion of the forces acting on the air, the equations of motion are set up and solved, enabling various properties of the wind systems to be deduced. The effects of the winds on the ionospheric F2—layer are considered in some detail.

(Victoria, St. John’s)

KANE, R. P. 1972 Day—to—day variability of the quiet—day daily range of equatorial geomagnetic field and its relationship with ionospheric dynamics, J. Atmos. and Terr. Phys., 34, 73—84.

To study the day-to-day variability of the daily range ΔH = Hmax-Hmin of the H component of geomagnetic field at the Equator, quiet days (Ap = 0—8) in the quiet sun year 1964 were divided into four ranges viz. 0-69 gamma, 70-89 gamma, 90-109 gamma and 110 or more gamma of ascending ΔH values at Trivandrum for the three seasons J, D, E separately. Average daily variation patterns of several parameters for these 12 groups were studied. It was found that enhanced ΔH at Trivandrum was well related with the northern Sq current strength only in winter when the latter was weak. ΔH at Trivandrum was poorly correlated with ΔH at Alibag as also with solar radiation parameters (10.7 cm and X—ray fluxes) in all seasons, and moderately correlated with the southern component of interplanetary magnetic field Bz. In contrast, ΔH at Alibag was moderately correlated with the Bx and By components. Several other peculiarities of corresponding ΔY and ΔZ components and associated upheavals in ionospheric F—region parameters at equatorial and middle latitudes are presented and discussed. It is concluded that the day—to—day variability of ΔH at equatorial and middle latitudes is primarily connected with ionospheric upheavals which seem to be connected with different interplanetary parameters for different latitudes.

(Kodaikanal, Alma—Ata, Ahmedabad, Hyderabad)

RUSH, CHARLES M. 1972 F—Region Behavior above North America during the Magnetic Disturbance of May 28, 1970, J. Geophys. Res., 77, No. 4, 757—760.

In this letter we present some results of an analysis of the electron density variation in the F region above North America for a period of time surrounding a geomagnetic disturbance that occurred on May 28, 1970. The data used in this study were obtained directly from vertical incidence ionograms observed at the ionosonde locations. The stations can be considered midlatitude stations, with the exception of Godhavn, which is a high—latitude station. Also, the latitudes of the stations in the western portion of the network are similar to those of the eastern stations, and thus ready comparisons of the data can be made with respect to longitudinal effects.

(Codhavn, Ottawa, Highgate Springs, Errol, Hanover, Billerica, Boulder, Wallops Island, Vandenberg AFB, White Sands, Grand Bahama Island)