



ANNALS OF THE IQSY

INTERNATIONAL YEARS OF THE QUIET SUN

VOLUME 6

Survey of IQSY Observations and Bibliography

General Editor

A. C. Stickland

IQSY Editorial Office

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ANNALS OF THE IQSY
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Foreword

The first two volumes of the Annals of the IQSY contained details of the techniques used and the schedules of observations undertaken during the period of the IQSY. The next three (Volumes 3-5) described the preliminary considerations of results presented at the joint IQSY/COSPAR Symposium held in London in 1967. Volumes 6 and 7 complete the series and include surveys of the type of data available over the period and their main features, complete lists of observing stations and of space probes in flight during the IQSY period, a comprehensive bibliography of publications relating to the IQSY, and a historical account of the planning of the whole IQSY project.

The present volume, Volume 6, contains the historical account, papers reviewing the various types of data required in all the different branches of the subject, and the bibliography, subdivided into these same subject disciplines.

The Data Review papers have been prepared by a number of specialists in the various fields and the IQSY Annals Management Board is greatly indebted to these authors for their cooperation. The Board also acknowledges the assistance of the Committee on Space Research (COSPAR) in contributing to the *Annals* the texts of the articles on current rocket techniques for the study of ionospheric currents and of night airglow, which were in use during the IQSY period.

The basic information contained in the Bibliography was contributed by the IQSY Participating Committees and in this matter the cooperation of IQSY representatives in many countries is gratefully acknowledged. The quite major task involved in the final checking, collation and typing of the more than 5000 references was undertaken entirely by Mrs. Gillian Booth and the IQSY Board wishes to place on record its deep appreciation of the enthusiasm and thoroughness with which she carried out this work.

W. J. G. BEYNON

President,

Special Committee for the IQSY

Aberystwyth May 1969

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Various specimen records

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THE IQSY PROGRAMME



The IQSY Programme: Planning and Organization

C. M. Minnis*

Secretary, Special Committee for the IQSY (1962-1967)

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- 1. Introduction
- 2. The antecedents of the IQSY
- 3. Development of the IQSY programme
- 4. Organization of the IQSY
- 5. Activities of the IQSY Committee
- 6. Implementation of the scientific programme
- 7. The IQSY publications programme
- 8. Dissemination of information about the IQSY
- 9. Relations with UNESCO
- 10. The post-IOSY era

Abstract

The place of the IQSY programme in the historical context of earlier international co-operative projects is outlined and it is shown how the IQSY was planned to take place at solar minimum, so as to provide data which would be complementary to those of the IGY, which coincided with a solar maximum.

The structure and membership of the IQSY Committee are described and the executive responsibilities of the Committee and its various components and associated bodies are outlined.

Although details are given elsewhere, several sections contain brief descriptions of the IQSY scientific and publications programmes, and the plans made for co-ordinated observations and for the central

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collection of the observational data. The financial arrangements made by the IQSY Committee are indicated in summary form for the years 1962–1967 during which the Committee existed.

On the termination of the IQSY Committee in 1967, a new Commission (IUCSTP) took over certain responsibilities from the IQSY Committee for future planning of international scientific research on solar-terrestrial physics.

I Introduction

This review of the IQSY programme has two objectives: first, to trace briefly the links between the programme known as the International Years of the Quiet Sun and previous international enterprises which had somewhat similar objectives; and second, to follow the development of the planning and organization of the IQSY over the period 1958–1967.

A considerable portion of this account must necessarily deal with the Special Committee for the IQSY and its activities, since this central body was responsible to the International Council of Scientific Unions for the international co-ordination of the whole enterprise. The vital part played at a national level by the IQSY Participating Committee can best be judged from the list of stations which contributed observational data in one or more disciplines and from the catalogue of these data submitted to the World Data Centres, both to be found in Volume 7 of this series of *Annals of the IQSY*.

In addition, the bibliography included in the present volume gives a bird's eye view of the many papers, books, etc., which have been published in recent years and which have a direct or indirect bearing on the scientific programme of the IQSY. The work reported in these papers provides striking evidence of the intense and very varied activities of scientists in many of the countries which participated in the IQSY. It would be premature to try to make a final assessment of the progress made and the new knowledge gained during the IQSY. However, a preliminary survey of the whole field of solar-terrestrial physics was the main feature of the Symposium on the Results of the IQSY held in London in 1967. The Proceedings of this Symposium appear in Volumes 3, 4 and 5 of the Annals of the IQSY.

Abbreviations

Abbreviations are used frequently in this Chapter and the list which follows may be useful to readers who are not familiar with all of them.

CCIR Comité Consultatif International de Radio

CIG Comité International de Géophysique COSPAR Committee on Space Research

CSAGI Comité Spécial de l'Année Géophysique Internationale

FAGS	Federation of Astronomical and Geophysical Services
IAGA	International Association of Geomagnetism and Aeronomy
IAMAP	International Association of Meteorology and Atmospheric
	Physics
IAU	International Astronomical Union
ICSU	International Council of Scientific Unions
IGC-1959	International Geophysical Co-operation-1959
IGY	International Geophysical Year
IQSY	International Years of the Quiet Sun
IUCSTP	Inter-Union Commission on Solar-Terrestrial Physics
IUGG	International Union of Geodesy and Geophysics
IUPAP	International Union of Pure and Applied Physics
IUWDS	International Ursigram and World Days Service (of FAGS)
IWDS	International World Days Service
	(later IUWDS)
SCAR	Scientific Committee on Antarctic Research
UNESCO	United Nations Educational, Scientific and Cultural Organization
URSI	Union Radio Scientifique Internationale
WMO	World Meteorological Organization

2 The Antecedents of the IQSY

2.1 Co-operative Geophysical Work

The term International Years of the Quiet Sun (IQSY) is used in two different senses; it is used primarily to refer to the international co-operative programmes in solar-terrestrial physics which were planned for 1964 and 1965, but it refers also to the co-ordination and organization of these programmes and to activities of many kinds which occupied the years 1962–1967. The purpose of this review is to outline the main features of the planning and execution of the IQSY programme, but first it seems desirable to look briefly at the place of the IQSY in the context of scientific co-operation on an international scale in the general field of geophysics.

Scientists working in all branches of geophysics are well aware of the limited value of the observations and measurements which they can make in their own laboratories or observatories. For example, such measurements represent only a small fraction of the information required for the construction of a model, on a worldwide scale, capable of describing a geophysical parameter.

Edmond Halley clearly appreciated this fact when he made his two voyages in the North and South Atlantic Oceans in 1698 and 1700 with the intention of collecting magnetic data from a wide area. Halley's maps of the magnetic declination over the Atlantic represent one of the earliest syntheses of extensive geophysical data, although, in a sense, the geographical maps made in Greece more than 2500 years ago can be regarded as syntheses of the same

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type in the field of cartography. A few years later Halley extended his maps to the Pacific and Indian Oceans by making use of data obtained from other ships, and the resulting maps can truly be regarded as the results of international co-operation.

2.2 The First Polar Year 1882-1883

In more recent times the Göttingen Magnetic Union organized by C. F. Gauss and W. Weber for the years 1836-1841 is an important landmark because it involved a planned programme of carefully timed magnetic observations on certain preselected days at 44 observatories with a worldwide geographical distribution. The importance of this co-operative effort was aptly indicated by Clerk Maxwell who remarked that "the scattered forces of science were converted into a regular army and jealousy and emulation became out of place, for the results of one man were of little value until combined with those of others". The Magnetic Union programme was the forerunner of the First Polar Year of 1882-1883 which owed its origin to the persistence of Karl Weyprecht, a young Austrian who had been a member of an Arctic Expedition in 1875 and who appreciated that isolated series of measurements such as those which he himself had made would be of limited value. In the course of a lecture, he said: "In order to obtain significant scientific results, it will be necessary to organize a number of simultaneous expeditions, the objective of which will be to make comparable observations during one year, at a number of locations in the polar regions, using the same apparatus and following the same instructions. In this way we shall obtain the data necessary to resolve the great problems of nature".

During the First Polar Year eleven countries took part in the operation of fourteen stations which made geomagnetic, auroral and meteorological observations. Since these observations were of several different kinds, the First Polar Year thus represents the first major interdisciplinary programme carried out on an international scale.

2.3 The Second Polar Year 1932-1933

The Second Polar Year of 1932–1933 was concerned mainly with the same disciplines as the first, but it provided also a powerful stimulus for the establishment of the first few pioneer ionospheric observatories. In fact the stations which took part in the Second Polar Year were distributed quite widely throughout the World and the Danish President of the organizing committee, Dr. D. la Cour, suggested that the name "World Year" would have been more appropriate than "Polar Year".

2.4 The International Geophysical Year 1957-1958

The International Geophysical Year of 1957–1958 was originally conceived in 1950 as the Third Polar Year. However, under the imaginative inspiration of Lloyd Berkner, Sydney Chapman and others, it quickly developed into a

very much more extended project to which la Cour's description "World Year" was certainly applicable. Also, for the first time, the planned scientific programme covered many different aspects of geophysics including the rapidly developing field of solar-terrestrial physics, solid-earth studies, oceanography and investigations of the earth's atmosphere.

2.5 The International Years of the Quiet Sun 1964-1965

The IGY observations coincided with a period when solar activity was extremely high, and it soon became clear that they were incomplete in themselves and that, in certain disciplines, it would be desirable to acquire complementary data from observations made under conditions of low solar activity. Weyprecht would undoubtedly have added: "... comparable observations... using the same apparatus and following the same instructions". In 1959 the evident need for these complementary data in the disciplines concerned with solar-terrestrial physics led to the proposal for a new programme, which was to be timed to extend over the period of minimum activity in the solar cycle expected in 1964: the International Year of the Quiet Sun (IQSY). However, although "comparable observations" were certainly included in the planned programme, the rapid scientific and technical progress since the IGY led to the addition of many new types of observations. Moreover, the dramatic developments in the use of rockets and artificial satellites opened up new possibilities for acquiring data by direct measurement in the atmosphere. the ionosphere, the magnetosphere and far beyond.

3 Development of the IQSY Programme

3.1 First Suggestions

The IGY had been organized by an ICSU Committee, the Comité Spécial de l'Année Géophysique Internationale (CSAGI). After the end of the IGY, CSAGI was dissolved and its remaining responsibilities were transferred to the Comité International de Géophysique (CIG), an Inter-Union Committee administered on behalf of ICSU by IUGG with the participation of four Unions: IUGG, IAU, URSI and IUPAP. The main object of CIG was to ensure the fullest possible exploitation of the IGY and IGC-1959 data. In addition, CIG was responsible for the development and co-ordination of "international plans for the furtherance of co-operation in geophysics and related sciences, especially those of an interdisciplinary nature".

At the First CIG Meeting in The Hague in November 1959, a resolution was adopted which referred to the IGY and IGC-1959 programmes and which continued:

- "cognizant of the necessity and value of the execution of similar world-wide efforts resolves:
- 2. that the observational and experimental efforts during [1960 and 1961] shall be maintained as much as possible at least at the level characterizing

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the IGC-59, especially in those fields characterized by synoptic observations."

Another resolution adopted in 1959 stated:

"special notice is take of the World Magnetic Survey, initially proposed during the IGY by Professor Sydney Chapman, and scheduled for a quiet interval in the solar cycle. The Committee... believes that adjoint programmes in the field of upper atmospheric research should be considered for conduct during the same period."

It is now well known that the impetus which had been given by the IGY to regular geophysical observational programmes was very strong and that, in fact, the diminution of such activity after the end of the IGY was not great. The report of the Second CIG Meeting held in Paris in March 1960 indicates that, in general, activity in 1959 showed only a slight reduction as compared with the IGY period, and also that most of the National Committees intended to continue at this level during 1960.

Similarly in Edinburgh in 1958 the URSI Committee for the IGY had already agreed that it would be advantageous to make intensive observations with vertical-incidence ionospheric sounders during the next solar minimum and that, if necessary, a less intensive programme should be undertaken during the interim period. Later, at its September 1959 meeting in Brussels, the same Committee recommended the maintenance of a substantial world network of ionospheric vertical-incidence sounding stations "up to at least the next sunspot minimum period". It recommended also the continuance of ionospheric drift measurements during a complete solar cycle, and both these resolutions were endorsed at the Second CIG Meeting in March 1960.

Thus by early 1960, in both national and international circles the desirability of long-term synoptic-type observations had already been admitted; in addition, several general references had been made to the need for particular types of observation during the approaching solar minimum period.

3.2 Proposal for a Solar Minimum Programme

At its Second Meeting in March 1960, CIG received from Dr. N. V. Pushkov "a proposal for carrying out complex geophysical observations co-ordinated by the countries during the period of the nearest minimum of solar activity (1964–1966)." Resolution No. 9 of that Meeting asked the interested ICSU bodies to examine the observational programmes for 1964 and 1965:

"The CIG

noting that the next solar minimum may be expected in 1964/65 and that, following the worldwide study made in 1957/59 (IGY-IGC) during a time of intensive solar activity, it appears advisable to make arrangements, if necessary, for an additional co-operative effort in the years 1964/65:

considers that it will be of great scientific value to study, during minimum conditions, solar activity as well as its effects on geophysical phenomena such as geomagnetic variations, ionospheric and aeronomic conditions, aurora and airglow, cosmic radiation etc., also on conditions in the interplanetary space, and that even in phenomena in which solar-terrestrial relationships are hard to find, such as in meteorology, the less frequent occurrence of solar events during minimum may help in such investigations;

notes that the permanent observational programmes in the various branches of solar physics and space science will provide the main part of the necessary observational data;

proposes to the Unions, and Committees concerned, such as COSPAR, that they examine whether these programmes might need temporarily supplementation for the years 1964-65."

The first practical step towards the realization of a solar minimum programme was taken at an informal CIG meeting held in Helsinki in August 1960 at which several future programmes of geophysical research were considered. One of these was the "Solar Activity Minimum Programme", and a working group consisting of W. J. G. Beynon (convener), M. A. Ellison, C. T. Elvey, V. Laursen, M. Nicolet and S. N. Vernov was formed to discuss the programme and to present a report to the next meeting of CIG. In addition to those just named, J. Bartels, W. Dieminger, M. Minnaert and A. H. Shapley assisted in the preparation of the Report.

This Report was presented by Professor Beynon to the Third CIG Meeting in Paris in January 1961 and it recommended a sunspot minimum programme covering geomagnetism, airglow and aurora, ionosphere, solar activity, cosmic rays, space research, and aeronomy. Meteorology was excluded because IAMAP had expressed the opinion that "the present routine measurements in the field of meteorology are completely sufficient for studying possible changes in the general circulation, ozone distribution etc. No recommendations for extra or supplementary observations are made". After subsequent discussions between IAMAP and WMO, and reconsideration of a meteorological programme at the IQSY Assembly in 1963, the WMO Congress in 1963 approved this programme (see *Ann. IQSY*, 1, 215).

The Report recommended also that the project should be called "The International Year of the Quiet Sun 1964–1965 (IQSY)" and that the planning group should be called "The IQSY Committee of the CIG". The observational period selected was 1 April 1964–31 December 1965. In late 1962 after the period of observation had been extended to cover two full years (see Sec. 4.1) the title was changed to "The International Years of the Quiet Sun".

In the relevant resolutions adopted in January 1961

"The CIG

17. calls the attention of the Executive Board of ICSU to the proposals for the IQSY and asks the Board to use its influence to ensure the maximum