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SYMPOSIUM ON THE YEARS OF THE QUIET SUN—IQSY

A BRIEF REVIEW OF THE INTERNATIONAL PROJECT

BY INVITATION OF THE COMMITTEE ON ARRANGEMENTS FOR THE ANNUAL MEETING

Presented before the Academy on April 26, 1967

Chairman, MARTIN A. POMERANTZ

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INTRODUCTORY REMARKS

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This symposium is a review of some of the principal results from the world-wide program in solar-terrestrial research known as the International Years of the Quiet Sun (IQSY) and its related activities during the recent solar minimum. It is my privilege to introduce the chairman of this symposium, Dr. Martin Pomerantz, director of the Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania, and chairman of the U.S. Committee for the International Years of the Quiet Sun. Dr. Pomerantz and his speakers will talk not only about those things that they have been doing, but also about the sweep of the IQSY program as an international project.

But first I want to record the personal debt of all of us, as interested scientists, to Dr. Pomerantz and the members of the U.S. Committee for the IQSY for the

time and energy and patience they have put into this vigorous contribution to the world effort. It is important to remember that these efforts are voluntary: they come out of the man himself and his generous willingness to support the things that we mutually consider to be important. This is the real strength of the Academy-Research Council: we are all volunteers, and the initiative comes out of ourselves and our local institutions. We must record as well our gratitude to our universities and research institutions for furnishing the base of operations from which to launch our forays; and of course we remember the generosity and sympathy with which the various government agencies concerned have supported these efforts.

Besides its more direct purpose of reviewing the IQSY, this symposium represents a kind of celebration: it is the tenth anniversary of the International Geophysical Year—the IGY of 1957–58—which was first conceived as a Third International Polar Year, and thus a direct successor of the First and Second International Polar Years, in 1882–83 and 1932–33, respectively. The latter was in John Fleming's time; those of us that were actively involved in it came to know the names and the work of those scientists of the early part of this century, and the contributions and enthusiasm that they put into polar expeditions and other studies of the earth and its relationships to the sun. Now we are looking at the children of the IGY: not only the IQSY that we are reviewing today, but also the international programs connected with such organizations as the Special Committee for Oceanographic Research (SCOR), the Indian Ocean Expedition, the Special Committee for Antarctic Research (SCAR), the Committee for Space Research (COSPAR), the International Hydrological Decade, the Upper Mantle Project, and the International Biological Program, and all the domestic activities related to these programs that are taking place in other countries where our scientific friends live. One cannot help but be impressed by the scope and richness of these current activities.

A good deal of information about the organizational aspects of the International Years of the Quiet Sun is in the pamphlet that has been distributed including, in particular, lists of the countries that were involved and the names of the members of the international committee, established by the International Council of Scientific Unions (ICSU), and of our domestic committee.

One final word: As we are listening today to reviews of results obtained during the IQSY time of solar minimum, we are also already actively looking forward to what is going to happen during the coming solar maximum. Programs for the solar maximum will be worked out internationally with the help of the Inter-Union Commission on Solar-Terrestrial Physics, and in this country by the corresponding committee of the Geophysics Research Board. One of our speakers, Herbert Friedman, is president of the Inter-Union Commission, and we have asked him to be chairman of our domestic committee as well. Thus the IQSY has borne a child, and the IGY a grandchild, to carry on the work.

[*Editorial note:* The pamphlet in the hands of the audience during Dr. Tuve's remarks is reproduced below.]

HISTORY AND ORGANIZATION

The disentangling of the complex phenomena that occur in the Earth's upper atmosphere, magnetic field, and space environment, and of the relationships of these not only with each other but with the electromagnetic and particle emissions from the Sun, requires by its very

nature the collection of data in a way quite different from that required for most scientific problems. The data needed are of many different kinds, and must be gathered at representative observing stations all over the Earth on a time schedule that provides a measure of simultaneity and continuity. These conditions are too much for any one institution or, indeed, any one country to meet; they require an internationally agreed plan for the geographical distribution of different kinds of stations, the responsibility for operating them, the schedule of observations, and a means of pooling or exchanging information.

The International Years of the Quiet Sun, or IQSY, is the designation of such a voluntary cooperative international program in which such a plan was carried out. Scientists from seventy-odd countries agreed to make observations of solar, interplanetary, and geophysical phenomena during the years 1964–65, which bracketed the most recent interval of minimum solar activity.

The IQSY was only the latest in a series of similar cooperative programs going back to the time of Gauss and Weber, who formulated a plan of global geomagnetic observations to be carried out at 40-odd well distributed observatories in 1836–41. These were followed later by the two "Polar Years": the first, in 1882–83, included meteorological and auroral as well as geomagnetic observations, performed by geophysicists from 11 countries; the second, fifty years later, almost worldwide in scope, added systematic observations of the ionosphere to the agreed program, and involved investigators from 44 countries. It was, however, the International Geophysical Year (IGY) which revolutionized geophysics and thereby paved the way for the IQSY and probably all such programs for some time to come. For that reason, it is worth detailing some features of the IGY, which established the pattern for the IQSY.

The observational period of the IGY (July 1957 through December 1958) was chosen because it would be a time of high solar activity. The IGY marked a new, much more extensive and organized approach, for which the international geophysical community, working within the framework of ICSU and the scientific academies in their own countries, secured special support from their respective governments. Although during the planning phase, the proposed program began as a third "Polar Year," 25 years after the previous one, in its final form it was truly global—indeed, three-dimensional—for during the IGY satellites and probes first successfully reached into space. In the United States the IGY was publicly recognized by a presidential statement; it was coordinated by an Academy Committee, and supported by a series of special appropriations of some $43 million over several years, administered through the National Science Foundation. The scientific program included the disciplines, for which the Sun is important—meteorology, geomagnetism, aurora, airglow, the ionosphere, and cosmic rays, as well as of the Sun itself—and others in which the Sun has little effect.

The IGY accomplished several things: first of all, it allowed us to reach a much greater understanding of our immediate physical environment and to discover many new things; but also it engendered a much higher level of activity in geophysical research which has largely continued; and it set up some devices to accomplish this research—for example, networks of observing stations and a system of World Data Centers, through which data are filed and exchanged. These have not only continued but have evolved in response to changing scientific demands and interest. Furthermore, our present large-scale programs in Antarctic studies and space research are an outgrowth of the IGY.

The IQSY was a sequel to the IGY and its beneficiary in that, when the program was formally proposed in 1960, it met with immediate enthusiasm on the part of the geophysical community. Many of the individual research programs and data collection nets already existed. It remained chiefly to tie these together into a coherent program with well-defined objectives, and to fill in the gaps with new programs.

Although discussions and studies about a proposed program for the solar minimum interval

went on during the years 1958 through 1961 at Union assemblies and other scientific meetings, it formally came into being in September 1961, when ICSU recognized the program and issued invitations to national organizations, like the National Academy of Sciences in this country, to organize national committees and otherwise plan to participate. At the first General Assembly (March 1962, Paris), which scientific delegates from 26 countries attended, the objectives of the IQSY were defined to be: (1) a comparison of atmospheric and geomagnetic parameters under conditions of minimum solar activity with those prevailing during the high maximum of 1957–58, in order to clarify the effects of the solar cycle; (2) studies of isolated solar events and their interplanetary and terrestrial consequences, not complicated by the overlapping of immediately preceding or following events; (3) studies best undertaken when interference from solar activity is minimal, for example, the mapping of the Earth's intrinsic magnetic field by the World Magnetic Survey. The International Committee for the IQSY was set up, a provisional detailed program was developed, and agreements were reached. The IQSY Committee, first established under ICSU's International Geophysics Committee (CIG), was later changed into a Special Committee of ICSU (for its membership, see below). In this country, the counterpart of the international Committee is the U.S. Committee for the IQSY, first established in 1961 as a panel of the Geophysics Research Board in the Academy-Research Council, and still a part of the GRB complex. (Its membership is also given below.) In September 1962 in a letter to the National Science Foundation, President Kennedy officially recognized the program.

Thousands of scientists from the countries listed below participated in research programs connected with the IQSY. In the U.S.A. there were some 200 projects and programs, many specially funded by the National Science Foundation and other agencies. Some 300 stations made systematic observations of the Earth's upper atmosphere and magnetic field, solar radiations and patterns of activity. These systematic observations were supplemented by many special programs, including those using rockets and space vehicles.

Although the analysis of the data obtained during the IQSY period 1964–65 and the publication of the results will of course continue for some time, the formal committee structure is scheduled to end this year. The station networks, World Data Centers, and many of the individual programs will go on, however, with cooperation and coordination as before, and with help as necessary from other ICSU organizations.

Although the special National Science Foundation funds earmarked for the IQSY were only about one-third the amount for the IGY, this figure is deceptive; for the IGY started from almost nothing, while the IQSY included extensive research programs that were already in being, for example those in the National Aeronautics and Space Administration, Environmental Science Services Administration, the Department of Defense, to name only a few. Altogether, the number of persons involved and the resources available actually far exceeded those in the IGY. In terms of the attention it has attracted, the IQSY has had perhaps less impact, but that is probably only because the idea of large-scale cooperative programs has now become familiar. This in itself is a healthy sign.

National Participation in the IQSY

Argentina	Congo Rep. (Léopoldville)	Greece	Japan
Australia	Cuba	Guatemala	Korea, Dem. Rep.
Austria	Czechoslovakia	Hungary	Korea, Rep.
Belgium	Denmark	Iceland	Laos
Bolivia	East Africa	India	Malagasy Rep.
Brazil	Ethiopia	Indonesia	Mexico
Bulgaria	Finland	Iran	Mongolia
Burma	France	Iraq	Netherlands
Canada	German Dem. Rep.	Ireland	New Zealand
Ceylon	Germany, Fed. Rep.	Israel	Nigeria
Chile	Ghana	Italy	Norway
Colombia		Jamaica	Pakistan

Peru	Senegal	Switzerland	USSR
Philippines	Sierra Leone	Taiwan (Rep. China)	Venezuela
Poland	South Africa	Thailand	Vietnam, Dem. Rep.
Portugal	Spain	United Arab Rep.	Vietnam, Rep.
Rhodesia	Sudan	United Kingdom	Yugoslavia
Rumania	Sweden	USA	Zambia

U.S. Committee for the IQSY: Martin A. Pomerantz, *Chairman;* R. Grant Athay, J. W. Chamberlain, Herbert Friedman, Joseph Kaplan, William W. Kellogg, Peter Meyer, Hugh Odishaw (ex officio), M. A. Tuve (ex officio), E. H. Vestine, A. H. Waynick, Edward R. Dyer, Jr., *Executive Secretary; Consultant and Liaison Members:* Stanley Ruttenberg, J. Steger, Clayton Clark, T. D. N. Douthit, J. Wallace Joyce, L. O. Quam, D. Z. Robinson, N. W. Rosenberg, Henry Smith, L. S. Wilson.

ICSU Special Committee for the IQSY: W. J. G. Benyon, *President;* M. A. Pomerantz, N. V. Pushkov, G. Righini, *Vice Presidents;* W. L. Godson, Rev. J. O. Cardús, F. F. Roach, J. Paton, W. Dieminger, R. Michard, S. N. Vernov, M. Nicolet, H. Friedman, *Reporters;* F. Jacka, D. C. Martin, J. Blamont, Z. Svestka, A. H. Shapley, O. M. Ashford, H. Odishaw, V. Burkhanov, T. Nagata, S. Manczarski, F. de Mendonça, A. Onwumechilli, K. R. Ramanathan, J. Van Mieghem, Gen. G. Laclevère, M. Gazin, C. M. Minnis, *Secretary,* IQSY Secretariat, 6 Cornwall Terrace, London NW 1.