Reports

International Geophysical Calendar for 1961

Abstract. Coordination of certain types of geophysical observations and analyses throughout the world is accomplished by the advance selection of days and intervals for such work. A committee under the International Council of Scientific Unions has issued the calendar for 1961, together with a brief explanation and examples of how it may be used in planning geophysical programs.

The International Geophysical Calendar 1961 (Fig. 1) (*1*) designates some special days and intervals for special attention for geophysical experiments and analysis. The calendar serves to encourage world-wide coordination of observation or analysis of those geophysical phenomena which vary significantly during the course of a year. These phenomena are mainly in the scientific disciplines dealing with the earth's atmosphere. In some experiments, such as the routine measuring of variations of the earth's magnetic field, the observing and analysis programs at observatories are carried out at a uniform level throughout the year; in these cases the calendar is not needed. However, in many other experiments (for example, rocket experiments) it is not practical or meaningful to carry out the same program every day. Here the calendar can provide a useful mechanism for coordination. Experimenters will know that their colleagues in other laboratories and in other disciplines will tend also to carry out experiments on the days or during the intervals marked on the calendar. In this way, results of experiments may be more easily and usefully compared.

Instructions for preparing reports. Begin the report with an abstract of from 45 to 55 words. The abstract should *not* repeat phrases employed in the title. It should work with the title to give the reader a summary of the results presented in the report proper.

Type manuscripts double-spaced and submit one ribbon copy and one carbon copy.

Limit the report proper to the equivalent of 1200 words. This space includes that occupied by illustrative material as well as by the references and notes.

Limit illustrative material to *one* 2-column figure (that is, a figure whose width equals two columns of text) or to *one* 2-column table or to *two* 1-column illustrations, which may consist of two figures or two tables or one of each.

For further details see "Suggestions to Contributors" [*Science* **125**, 16 (1957)].

In some scientific fields, international scientific organizations have made specific recommendations for programs to be carried out on days or during intervals marked on the calendar. In others, the arrangements are informal or self-evident. Some examples are given below, along with the criteria for selection of dates.

Regular World Days are three consecutive days each month. They always come in the middle or just after the middle of the month, and they include, where possible, the times of equinox and solstice. They come in the middle of the week—Tuesday, Wednesday, and and Thursday. The groups of Regular World Days are evenly spaced through the year so far as this is practical. They include, wherever possible, days of solar eclipse and meteor showers. One Regular World Day each month (always Wednesday) is designated the day of highest priority.

The Regular World Days are intended for experiments or for observational or analysis programs which, as a practical matter, can be carried out only about 10 percent of the time and should be spaced through the year. Further, it is suggested that whenever there are no special reasons for selecting some other days, the Regular World Days be used for unusual or special experiments. This applies perhaps particularly to fields in atmospheric geophysics, including aspects of cosmic rays, meteorology, airglow, ionosphere, geomagnetism, and aeronomy. Examples of such special experimentation in ionospheric physics are oblique incidence pulse transmission and reception; absorption measurements by pulse reflection technique; extended observations of "whistlers" and very low frequency emissions; accelerated vertical sounding observations; detailed reduction of vertical sounding ionograms by f-plot, h'-plot, and so on; and hourly reduction from ionograms of F-region true height parameters hc and qc.

The Regular World Days with highest priority are to be used for work which can be undertaken on only one day each month. All of the foregoing examples apply if the rate of three days per month is unnecessary or proves to be too heavy. A specific example is the recommended program for 1959 and subsequent years of exchange of copies of original ionograms in ionospheric vertical sounding work, made by the International Scientific Radio Union –IGY (URSI–AGI) Committee. This recommends that ionograms for the Regular World Day of highest priority each month (and also for one disturbed period each year) be sent to World Data Centers for interchange.

Reguar World Intervals are ten consecutive days in each quarter year, selected to include the three Regular World Days of the month and also the times of the equinox or solstice. If possible they include days of solar eclipse and meteor showers. Weekends and holidays that are widely observed have, whenever possible, been avoided.

The Regular World Intervals are intended as periods for experiments which for practical reasons cannot be carried on continuously but for which statistics on seasonal variations are especially needed. Ionospheric drift and high-atmosphere wind measurements are two examples. Schedules for interchange of sample detailed data in several disciplines have made use of the Regular World Intervals. In some network observational programs, both the Regular World Intervals and the Regular World Days are used, in order to determine the variations throughout the year but with improved statistics at the equinoxes and solstices.

World Meteorological Intervals are also ten consecutive days each quarter year, but displaced by one month from the equinoxes and solstices. They are intended to cover the times of marked seasonal change in certain meteorological phenomena which tend to come about a month after the equinoxes and solstices. They have been chosen, through World Meteorological Organization (WMO) and Committee on Space Research (COSPAR) channels as 16–25 January, April, July, and October, respectively; the January and October intervals have been designated by COSPAR as the more important ones.

The World Meteorological Intervals now are primarily periods for carrying out synoptic meteorological rocket programs, with stations obtaining atmospheric profiles up to 50 kilometers or more at least once daily during the 10-day intervals. The intervals have also been used during and since the IGY for balloon-sounding programs involving either special instruments or launchings to unusually high altitudes for balloons.

International Rocket Weeks chosen for 1961 by COSPAR are 12–18 February and 16–22 July. The first of these includes the time of the total solar eclipse of 15 February and is intended for study of solar effects. The second was selected for study of summer atmospheric structure (Northern Hemisphere).

The International Rocket Weeks provide two periods during the year when rocket studies of the atmosphere and of the sun will be on as nearly a synoptic basis as is possible at this stage of the science and technology (*2*).

The 1961 calendar marks the days of solar eclipse—15 February (total) and 11 August (annular). Some special programs may be expected to be carried out in appropriate parts of the world to study effects of the eclipses on the earth's atmosphere. It is especially important that the record of solar activity during and near the times of eclipse be as full as possible. Many solar-activity observatories issue specially detailed reports of their observations on days of eclipse to assist in the interpretation of the geophysical efforts. Ionospheric stations customarily increase their observing programs on such days, even if the magnitude of eclipse at their location is small.

Also shown on the 1961 calendar are days when meteor shower activity is unusually high. Geophysicists using meteor techniques often intensify their observing programs on these days. Attention is also called to these days because ionization produced by meteors may account for unusual effects in other geophysical experiments.

The International Geophysical Calendar marks only those dates which can be selected long in advance, either by general agreement or, in the case of eclipses and meteor showers, by reliable long-term prediction. Periods of great magnetic, auroral, and ionospheric disturbance are also of great geophysical interest, and world-wide coordination of observation is clearly desirable. This is also accomplished under the auspices of the International World Day Service (in close collaboration with the URSI Central Committee on URSIgrams), in the program for the immediate designation of Geophysical Alerts and for selection, on a current basis, of Special World Intervals. Arrangements for receipt of such information by telegram or radio broadcast can be made, as may be practical, with one of the solar-geophysical Regional Warning Centers, whose telegraphic addresses are as follows: (Western Hemisphere) AGIWARN WASHINGTON (U.S.A.); (Western Pacific) AGI KOKUBUNJI (Japan); (Eurasia) NIZMIR MOSCOW (U.S.S.R.); (Western Europe) either IONOSPHARE DARMSTADT (G.F.R.), GENTELABO PARIS (France), or AGI NEDERHORSTENBERG (Netherlands).

The meteorological telecommunications network coordinated by the World Meteorological Organization carries such information once daily, soon after 1600 U.T. A description of the Geophysical Alerts and Special World Intervals plan can be obtained from these centers or from the secretary of the International World Day Service (IWDS). Many geophysical stations increase their programs or carry on special experiments during disturbed periods; the Geophysical Alerts and Special World Intervals program serves to coordinate these activities on a world-wide basis and is especially useful for stations not near the auroral zones, in regions where the beginning of a major disturbance may not be immediately apparent from local observations.

The IWDS, in close collaboration with the URSI Central Committee on URSIgrams, also fosters arrangements for prompt notification of major solar flare events which have important and sometimes long-lasting geophysical effects. These notifications are also made through the Regional Warning Centers.

A summary record of significant solar and geophysical events is being prepared as a "Calendar Record" for the IGY period and also for 1959. This work is now under IWDS auspices. If these volumes prove to serve a useful purpose, similar calendar records may be compiled for 1960 and 1961.

The International World Day Service was established in 1958 by the International Council of Scientific Unions (ICSU) and is administered by the International Scientific Radio Union, 7 Place Emile Danco, Brussels 18, Belgium. The IWDS Steering Committee consists of A. H. Shapley (URSI), M. Nicolet

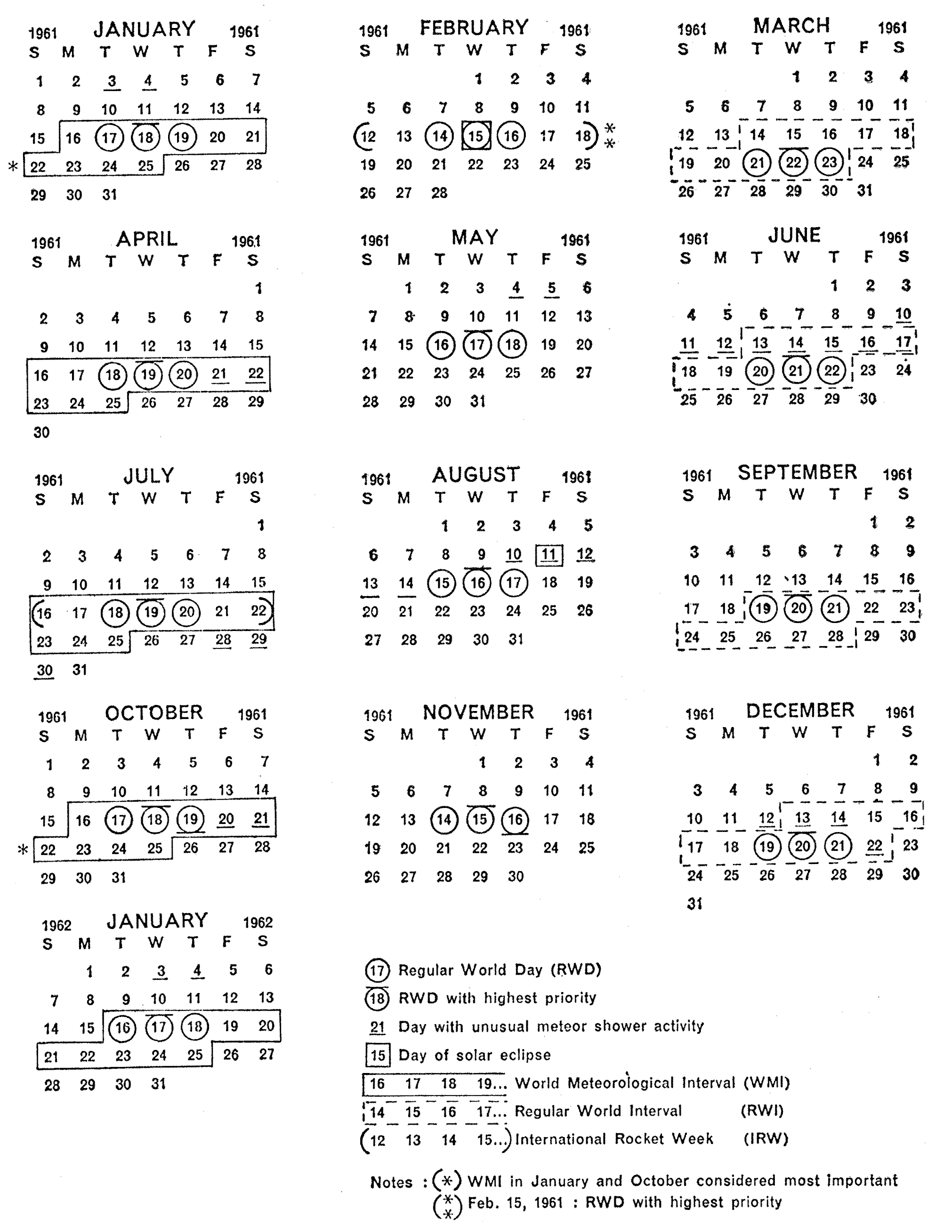

Fig. 1. International Geophysical Calendar 1961. The calendar was issued November 1960 by the International World Day Service under the auspices of the International Scientific Radio Union.

[International Union of Geodesy and Geophysics (IUGG)], and J. F. Denisse [International Astronomical Union IAU)], with R. Coutrez (URSI) as secretary. The IWDS obtains nominal support from the ICSU Federation of Astronomical and Geophysical Services. Shapley serves as spokesman for IWDS and as its correspondent to other ICSU groups such as the International Committee on Geophysics (CIG) and the Committee on Space Research (COSPAR).

The International Geophysical Calendar for 1961 was drawn up by Shapley and J. V. Lincoln in consultation with URSI, IUGG, and IAU, both directly and through CIG and COSPAR. Recommendations also have come from representatives of WMO and from interested individual scientists. A similar calendar was issued for 1960 along the lines of the calendars for the IGY and International Geophysical Cooperation 1959, issued under the auspices of the ICSU Special Committee for the International Geophysical Year and described in the "IGY Instruction Manual for World Days and Communications" (*3*).

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References and Notes

1. Copies of the calendar are available upon request to the Secretary General, International Scientific Radio Union, 7 Place Emile Danco, Brussels 18, Belgium.
2. More detailed recommendations by working group 2 of the Committee on Space Research (J. Bartels, chairman) appear in the *COSPAR Information Bulletin.*
3. *IGY Annals* (Pergamon, New York, 1959), vol. 7.

25 November 1960

Suppressive Effects of 2-Thiouracil on Differentiation and Flowering in Cannabis sativa

Abstract. The pyrimidine, 2-thiouracil, partly annuls the effect of photoperiodic induction in the short-day plant, *Cannabis sativa* L., when it is supplied at the onset of the dark period in quantities of 15–30 μg per plant. This treatment also produces aberrations in cellular differentiation in the leaves. Tracer studies show that 2-thiouracil becomes bound in cellular ribonucleic acid, which suggests that the effects on morphogenesis are due to interference with nucleic acid metabolism.

2-Thiouracil is highly effective in suppressing or retarding certain processes of development and differentiation in the short-day plant *Cannabis sativa* (hemp) in concentrations which do not immediately inhibit normal cell extension growth. In the experiments in which these effects have been observed, hemp plants were grown in growth rooms in light at 900 to 1000 ft-ca, with air temperature regulated at 22°C and relative humidity at 70 percent. The plants were kept in a vegetative condition in a daylength of 18 hours to ages of 3 to 4 weeks, after which photoperiodic induction was given by transfer to a daylength of 8 hours. The 2-thiouracil was supplied by painting standard areas of the upper epidermis of the youngest fully expanded leaves with an aqueous solution containing 100 μg/ml, the area being adjusted to establish the required dosage. Traces of detergent ("Teepol") were added to aid wetting.

In hemp, a dioecious species, exposure to seven or more short days at an age of 3 weeks induces the formation of fertile flowers at several successive nodes of the main stem in both sexes (*1*). Daily dosages of 2-thiouracil in the range of 15 to 30 μg per plant, supplied just before the onset of the dark period, severely reduced the flowering response of male plants to an induction period of 10 short days, and almost abolished the response of female plants. In one experiment, short-day induction began at an age of 25 days with batches of eight plants, the first 2-thiouracil treatment being given just before transfer to the first dark period. In the control plants of genetically male sex, the first fertile flowers were differentiated uniformly at the sixth node of the main stem; in male plants receiving 2-thiouracil, the first distinguishable buds appeared at node 8, but these were always without anthers. Among the female plants, the mean node number for the first fertile flowers in the controls was 7; of the plants of this sex receiving 2-thiouracil, only one formed a distinguishable bud during the 4 weeks following induction, and this, at the ninth node, was without gynoecium.

In this experiment plants of both sexes showed some retardation in general development as a result of treatment during photoperiodic induction. Although in part the reduction in flowering response may be attributable to this, it seems likely that the effect is more specific since there was little flowering during the recovery period, and the plants ultimately resumed vegetative growth. This suggests a partial blocking of the developmental processes involved in flowering, and it is significant that in some of these experiments it was accompanied by histological aberrations suggesting a parallel effect on cellular differentiation. Thus, with daily dosages of 10 to 30 μg of 2-thiouracil, striking modifications of leaf structure were initiated. During protracted periods of treatment, abnormalities became progressively more severe from node to node, leaves showing first a reduction of pigmentation attributable to a diminution of chloroplast population, then modifications in mesophyll structure, then a failure of the lamina to expand normally, accompanied by abnormalities in epidermal features such as stomata, and finally aberrations in vasculation.

This increasing severity of symptoms from node to node indicates a relationship with the age of leaf primordia, and the readiest interpretation of the sequence of effects is that it represents in inverse order that order in which the processes of cellular differentiation normally do occur in the leaf. The remarkable extent to which mesophyll differentiation is affected can be seen in Fig. 1, in which sections of the lamina of a normal leaf and that of one developed in the presence of 2-thiouracil two nodes above that of treatment are compared. In the modified leaf, while cellular growth has hardly been impaired, extension has been practically isodiametric in the cells of all layers, so that at their final volume the cells differ greatly in shape from their homologues in the normal leaf.

The fate of 2-C^{14}-2-thiouracil introduced through the leaf was followed autoradiographically. In one experiment, three doses were given at daily intervals. The upper leaves were then removed from one sample of plants to observe the immediate fate of the tracer, while another sample was permitted to grow on for 3 weeks to determine the final distribution. From autoradiographs prepared in the usual manner on Ilford x-ray film, it was found that the labeled 2-thiouracil became rapidly distributed in all growing tissues above the level of application, the accumulation in young leaf primordia being especially marked. After this early incorporation there was little subsequent redistribution, for the bulk of the tracer remained bound in the tissues which were actively growing at the time of treatment.

The chemical distribution of the bound 2-C^{14}-2-thiouracil was examined to determine what proportion could be associated with ribonucleic acid. The leaves were killed and thoroughly extracted with boiling 70 percent ethanol, and then defatted in ether. Samples of the alcohol and ether extracts were plated for counting. The leaves were then dried, pulverized, and the thoroughly homogenized powder was divided into two equal portions. One portion was suspended in distilled water, and the other in 0.01 percent ribonuclease (crystalline analytical grade, Biochemica Boehringer), and both samples were incubated overnight at 37°C. The undigested residues were centrifuged, and samples were taken of the supernatants for counting. The