

# Amateur Observations of Atmospheric Phenomena During the IGY

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The fiftieth anniversary of the International Geophysical Year (IGY) provides an opportunity to look back at a scientific program which is now almost forgotten. Many of the research fields of the IGY required large numbers of observers around the world, far more than could be provided by the staffs of established institutions and university research groups. It became necessary to recruit men and women from outside the normal scientific net, but with an interest in astronomy and the physics of the planet.

Sydney Chapman, L. V. Berkner, M. Nicolet, V. V. Belousov, J. Coulomb, E. Larsen, and others took a leading role in the planning of the IGY. Chapman had a personal interest in luminous phenomena of the upper atmosphere. One focus of Chapman's research had been collecting historical observations of auroras at low and middle latitude areas such as the Indian subcontinent, Greece, and the Pacific Ocean. He therefore consulted specialists such as C. W. Gartlein (Cornell University), James Paton (Edinburgh), Cuno Hoffmeister (Sonneberg), and N. Grisin, V. V. Sharonov, I. A. Khvostikov, earlier from the USSR, and others to plan and coordinate an international program of observations of auroras and other luminous phenomena of the upper atmosphere. At about this time his interest in noctilucent clouds (NLCs) was also suddenly aroused by a review containing photographs by George Witt (Sweden) that appeared in the journal *Tellus*.

## Auroral Program

The main emphasis was on auroras, and here Chapman focused on the lack of data from middle and low latitudes. There were a few existing catalogues, including one well known by Hermann Fritz (1873), and a compilation for the Southern Hemisphere by the German astronomer Wilhelm Boller, published in *Gerlands Beiträge zur Geophysik* at the end of the nineteenth century. But there were many blank years when no auroras were recorded. This motivated Chapman to suggest the collection of data, especially from southern middle and low latitudes, through a systematic visual and photographic program. This was to be staffed by teams of amateur astronomers and other volunteer observers recruited by Paton, Hoffmeister, and the Soviet Academy of Sciences. Their task was to scan the sky on any clear nights for the occurrence of auroras,

NLCs, and enhanced airglow (the last named being a particular interest of Hoffmeister). It was important that a standardized procedure should be followed by all observers, and a manual was prepared and distributed to all national IGY committees. In the USSR the observational program was organized most efficiently by the Geophysical Committee of the Soviet Academy of Sciences, and the work done by Soviet volunteers provided a large collection of visual and photographic recordings of atmospheric phenomena. German observations were coordinated by Hoffmeister, who published instructions for making observations in the popular astronomical journal *Die Sterne* in 1957. Monthly reports by each observer were sent to Sonneberg Observatory, but due to the unfortunate death of Hoffmeister in 1968 the data were never analyzed and published in full. Later, some papers were published on IGY auroras in *Gerlands Beiträge zur Geophysik* by other authors.

More positive was the program organized by James Paton in cooperation with volunteer observers and the British Astronomical Association. Edinburgh became one of the World Data Centers for visual auroral observations, along with Moscow and Cornell University (Gartlein and Sprague), and collected data not only from land-based volunteers but also from aircraft and ships. These valuable collections were available to all scientists and used extensively.

Their analysis provided new insight into the distribution of auroras at middle and low latitudes. Great progress was made by ama-

teurs in the observational programs. New information was obtained as to the frequency and morphological variations of auroras and their relationship to magnetic disturbances. A few auroras, notably those of February 1958, July 1958, July 1959, and January 1957, were seen down to the lowest latitudes. It was also found that auroras were sometimes observed during periods of lower magnetic disturbances (i.e., low *Kp* index). Paton published an annual table of observed auroras in *The Meteorological Magazine*. A comprehensive study of middle-latitude auroras over Germany appeared in *Journal of Geophysical Research* in 1972; similar French work was published by Daniel Barbier [see *Petitdidier and Blamont*, 2005].

In the USSR the Academy of Sciences organized several meetings to discuss results of the IGY auroral program, and this was later extended to include earlier data. In previous years the visual registration of the various optical phenomena in the atmosphere was really casual and came only from amateur observations. However, during the IGY in the USSR the Geophysical Committee of the Academy of Sciences organized various professional observations of auroras and noctilucent clouds. Registration of the auroral forms and their spectra was carried out at high latitudes with the help of all-sky-cameras of a design by A. I. Lebedinsky. (Similarly, all-sky cameras were also deployed in the Western Hemisphere.) Additional help and support came from the volunteer observers in different groups and societies. There was a broad program of volunteers associated with



Fig. 1. Sydney Chapman (right) and Ludwig Biermann, both supporters of amateurs' work during the International Geophysical Year.

the Academy of Sciences. Conferences were held; the data were published in the journals of the Academy and societies and were available to interested scientists.

In 1953 an IGY planning document mentioned auroral observing groups of the American Association of Variable Star Observers (under Gartlein) and the British Astronomical Association (under Paton). In AGU's Geophysical Monograph 2 (1958), pp. 92–96, Gartlein summarized some auroral observing history:

*Since 1930 several observational programs have run more or less continuously. A group began in New Zealand in about 1934 and has continued.... A group in England of the British Astronomical Association has been in operation since 1940, but most active since 1952. The group in northern United States and southern Canada reporting to Cornell University began in 1938 under the sponsorship of the National Geographical Society. It later had support of the U.S. Signal Corps and U.S. Information Agency. The group consisted of volunteer observers from amateur and professional astronomical societies and had help from certain U.S. Weather Bureau stations. The present IGY program of the United States and Canada is an outgrowth of this program. Many reporting programs have been tried and found wanting.*

Two months before the IGY, on 1 May 1957, the U.S. National Committee presented a report on the IGY at National Science Foundation (NSF) hearings before the subcommittee of the U.S. House of Representatives Committee on Appropriations, 85th Congress. On page 39 of that report it is said, "The visual observations of the aurora will be made by a network of amateurs and professional observers under the guidance of Dr. Carl W. Gartlein of Cornell University.... [O]ver 120 U.S. Weather Bureau stations are operating as a regular observing network for this program in USA and Alaska. In addition some 56 volunteer stations reporting...[D]esign was done in cooperation with Dr. P. M. Millman of the Canadian Data Center."

Gartlein published a series of newsletters every month for observers. The U.S. National Committee for the IGY published a "Review of the first eleven months of the IGY" on 2 June 1958, which was presented at NSF hearings before the subcommittee of the U.S. House of Representatives Committee on Appropriations. At this time more than 16,000 positive reports of aurora had been received from some 424 volunteer observers (p. 24). In general, a wealth of data have been received from volunteers and the

cooperating weather bureau observers during the time of increased auroral activity.

It follows that the groups in United States and Canada were very active before the IGY, and they intensified their work during the IGY. In 1960 in the United States the IGY World Data Center A published a 103-page document (IGY General Report 11, "Report on IGY visual auroral observations"), which was also available through other data centers (Moscow and Edinburgh). There were many auroral visual reports during the IGY because it was a period of extremely high auroral activity.

#### *Noctilucent Clouds and Airglow*

Noctilucent clouds were another field of considerable interest. They had been discovered in 1885 following the great Krakatoa volcanic eruption [Schröder, 2001]. Later observations were made in Germany by Wegener, Archenhold, and Hoffmeister, by Astapowitsch in Russia, and in the late 1950s from Scandinavia by G. Witt. A first review by Ludlam and Witt aroused the interest of Chapman in this topic, and discussions followed with them and later with Benson Fogle of the North American network. During the IGY, amateur astronomers and the Weather Bureau in the United States also paid attention to noctilucent clouds, but there was no regular observational program. Such a program was started in 1963 under Benson Fogle.

Other scientists involved with the implementation of the IGY program included Paton, Schröder, Hoffmeister, and the scientists of the former USSR: Sharonov, Khvostikov, Grishin, Astapowitsch, Fast, Dirikis, and others. In Germany the NLC program of routine observations was started in 1957 at the Roennebeck Observatory and has continued up to the present day. In the United Kingdom, Paton had been interested in the topic before the IGY and had published results of both auroral and NLC observations. A British program using volunteers and members of the British Association of Astronomy was developed during the IGY and continued afterward. It also included observations from ships and aircraft. The Soviet Geophysical Committee of the Academy of Sciences was responsible for the Soviet upper atmosphere program. The Academy later organized an excellent series of conferences (e.g., in Moscow, Tallinn, and Riga) at which both volunteers and scientists were able to discuss results and photographs. Detailed studies were published by Villmann, Dirikis, Sharonov, Fast, and others in the form of catalogues and mono-

graphs [cf. *Shefov and Semenov*, 2005]. Outside the USSR, IGY results were published through the good office of Hoffmeister in *Die Sterne*, a German astronomical journal, and of Hans Ertel in *Gerlands Beiträge zur Geophysik* and *Zeitschrift für Meteorologie*, both internationally known journals. Paton's results appeared in publications by the British Astronomical Association and HM Royal Weather Service. Later the *Annals of the IGY* became a major medium for publication for many of the IGY programs.

#### *Conclusion*

There is no doubt that our knowledge of the various luminous phenomena of the upper atmosphere was significantly advanced by the worldwide observational program of the IGY and subsequent years. A vital role in this program was played by amateur astronomers and other volunteer observers, without whom it would not have been accomplished.

This was an innovative experience in international science, and we are indebted to leading scientists of the time such as Chapman, Paton, Hoffmeister, Barbier, members of the Soviet Academy, and Gartlein and Millman for having the vision to introduce successfully many thousands of volunteers into important scientific work.

#### *Acknowledgments*

I am grateful to N. J. Skinner for assistance with translation. J. Van Allen helped with literature. I acknowledge comments by S. I. Akasofu and M. Rycroft and the help of the referees.

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