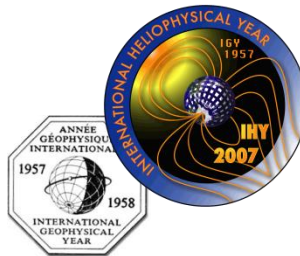


BRIEF HISTORY OF THE INTERNATIONAL HELIOPHYSICAL YEAR (IHY)

Heliophysical: A broadening of the concept "geophysical," extending the connections from the Earth to the Sun & interplanetary space. On the 50th anniversary of the International Geophysical Year, the 2007 IHY activities will build on the success of IGY 1957 by continuing its legacy of system-wide studies of the extended heliophysical domain

*Joseph Davila, Barbara Thompson, Nat Gopalswamy
NASA-Goddard Space Flight Center*

Aug 2017



Early History of the IHY



International Helio-physical Year (IHY)
 A Program of Global Research Continuing the Tradition of Previous International Years

Joseph M. Davis, Arthur I. Poland, O. C. St Cyr*, B. J. Thompson (GSFC) and Richard A. Harrison (RAL)

OVERVIEW

In 1957 a program of international research, inspired by the International Polar Years of 1882-83 and 1932-33, was organized as the International Geophysical Year (IGY) to study global phenomena of the Earth and geospace. The IGY involved about 60,000 scientists from 66 nations, working at thousands of stations, from pole to pole to obtain simultaneous, global observations on Earth and in space. There had never been anything like it before. The 50th anniversary of the International Geophysical Year will occur in 2007. We propose to organize an international program of scientific collaboration for this time period called the International Helio-physical Year (IHY). Like its predecessors, the IHY will focus on fundamental global questions of Earth science.

INTRODUCTION

October 4, 1957, three months after the International Geophysical Year (IGY) began, Sputnik was launched. This was the beginning of the space age. Sputnik 1 and 2 and Explorer 1, along with numerous satellite rocket flights contributed to the tremendous success of the IGY. Space science has made tremendous strides in the last 50 years. We now routinely monitor the Sun, the planetary magnetosphere, and the atmosphere of Earth from space. The IHY will provide a unique opportunity to coordinate observations from 2000+ ground-based facilities, including solar ground-based instruments, ground-based observations, cosmic ray monitor observations, magnetic field observations, ionospheric, meteorological, and other atmospheric observations. Unprecedented simultaneous observations with broad coverage of all associated solar, heliospheric, geospace, and atmospheric phenomena will be obtained. The resulting data will allow global studies of the complex Sun-Earth system.

HISTORY INTERNATIONAL YEARS

The first International Polar Year was the idea of an Austro-Hungarian Naval lieutenant and meteorologist (Dr. V. Weyprecht, from Vienna). Weyprecht's idea was included in the *Annals of the International Geophysical Year*, 1: 1909. Weyprecht had just returned from a polar expedition where he summarized one of the research results. In January 1875 at the Academy of Sciences in Vienna, Weyprecht expressed his ideas to establish an international collaboration to obtain a set of simultaneous observations, extending over a considerable time period, at various stations around the Arctic. The concept was presented again in September 1875 at the meeting of the Association of German Naturalists and Physicists at Götting. In 1877 a detailed program was prepared and submitted to the International Meteorological Congress. In 1879 the International Meteorological Congress met in Rome and recognized the importance of the proposal.

On October 1-5, 1879 the 1st International Polar Conference (IPC) met at Hamburg. It was determined that a maximum of eight arctic stations was needed to obtain observations of at least one year duration. The Conference also established the IPC with representatives from Austria, Hungary, Denmark, France, Germany, The Netherlands, Norway, Russia, and Sweden. Dr. G. Heilmann of Hamburg was the first Conference president. In July 1880 the 2nd IPC met at Bern. There an Italian representative joined the existing representatives, and Prof. H. Wild became second president. On August 1, 1881 the 3rd IPC met at St. Petersburg. The United States joined the group, and a program of observations was adopted. The 13th International Polar Conference (IPC) was held in London in 1932 and continued for 18 months to Sep. 1, 1933. Scientific results and observational data were published in the *Bulletin of the International Polar Commission*. In 1984 and 1989 the 4th and 5th Polar Conferences were convened. Weyprecht did not live to see the culmination of his grand concept. He died on March 29, 1901.

*Also The Catholic University of America

In 1927 Dr. J. Georg of Deutsche Seewarte in Hamburg suggested that a **Second International Polar Year** be conducted for the 50th anniversary of the 1882 Conference. Details of the International Geophysical Year, 1: 1939, 211. A proposal was submitted to the International Meteorological Commission, and then forwarded to Russian Meteorology and Polar Meteorology. The Commission for the Polar Year 1932-1933 was appointed to prepare detailed plans for the observations to be made and the methods for studying them. A collaboration was established between the Commission for the Polar Year and the International Union for Geodesy and Geophysics. At a meeting in Sep 1933 the Commission for the Polar Year, despite being urged to delay due to poor economic conditions worldwide, decided to go ahead with the Polar Year program. On Oct 1-4, 1933 the Second International Polar Year began. It continued until 1 Sep 1933.

A partial list of space missions that could provide data relevant for the IHY. This list is incomplete, and expansion will be made as more satellite launches in the works. Part of the planning effort will be to complete and refine this list, and to arrange for collaborative observations as required.

Image sequence showing a CME from SOHO/LASCO

In 1950, a proposal for the International Geophysical Year: 25 years after the Second Polar Year, was brought before the Mixed Commission on the Ionosphere, which endorsed it. The Mixed Commission on the Ionosphere was formed by the International Council of Scientific Unions (ICSU) under the sponsorship of the International Union for Scientific Radio (IUGS) with the cooperation of the International Geographical Union (IGU) and the International Union for Geodesy and Geophysics (IUGG). The IUGG drew up a tentative program, and adopted a resolution to forward it to the International Council of Scientific Unions (ICSU), which sponsored the event. All bodies endorsed the proposal by 1951.

The IGY was a tremendous success. The newly developed space-flight capability was used to discover and explore Earth's radiation belts, to study the magnetosphere, and to provide the first observations of the aurora from the Sun's corona. Public interest in the scientific results of the IGY was high. The IGY provided a forum and a backbone for discussing the importance of geospace influences on Earth.

THE CASE FOR THE IHY

Like the IGY, and the two previous International Polar Years, the scientific objective of the International Helio-physical Year is to study phenomena on the largest possible scale with simultaneous observations from a broad array of instruments. However, unlike previous International Years, today's observations are routinely received from a vast armada of sophisticated instruments in space that continuously monitor solar activity, the interplanetary medium and the Earth (See Table). These spacecraft together with ground level observations and atmospheric probes, could provide an extraordinary view of the Sun, the heliosphere, and their influence on the near-Earth environment. The IHY is a unique opportunity to study the coupled Sun-Earth system. The recent explosion of interest in Space Weather has excited the media and the general public, as well as many industrial colleagues, and it has also highlighted the fact that we know relatively little about the true Sun-Earth relationship. Thus, the IHY provides a method for satisfying the growing demands in this area.

CURRENT ACTIVITIES

- Encourage IUGG, SCOSTEP and COSPAR to petition ICSU for a resolution declaring the year 2007 as the beginning of the IHY, and to establish a Multi-disciplinary Planning Commission for the IHY.
- Seek the endorsement and participation of the space agencies of the world (ESA, NASA, ISRO and ISAE).
- Arrange for a special session at the World Space Congress in Houston in October 2002 to discuss planning for the IHY.

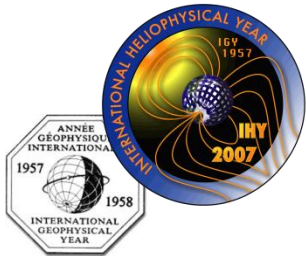
CONCLUSION

The World Space Congress session at Houston will provide a forum for open discussion on the nature of the IHY. It will be used to form the basic IHY working plan. Additional sessions are planned after the World Space Congress to continue to develop the working plan. The 50th anniversary of the International Geophysical Year is a tremendous opportunity to advance our understanding of the Sun-Earth system, and to demonstrate the beauty, relevance and significance of Earth science to the peoples of the World.

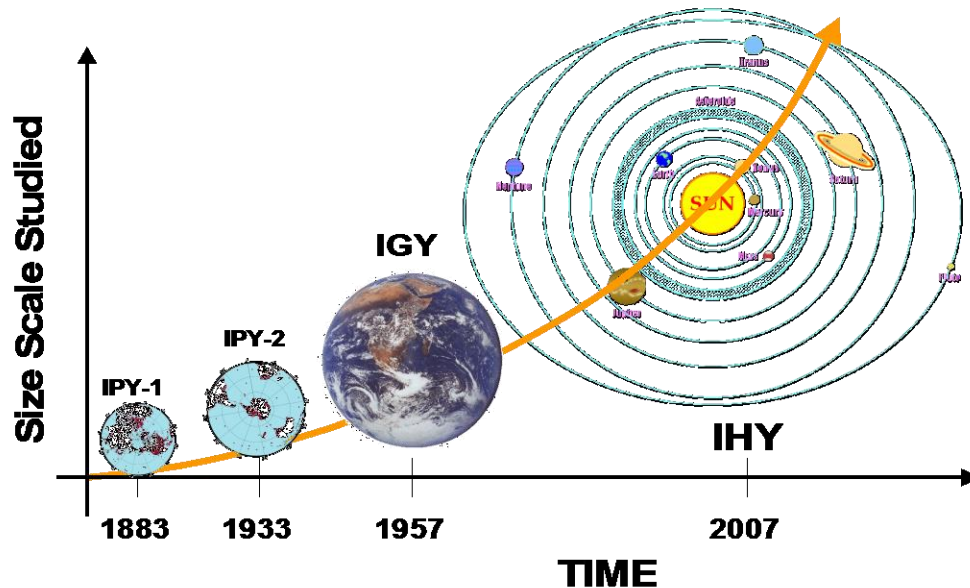
REFERENCES

- Chapman, S. (ed.), *Annals of the International Geophysical Year*, Pergamon Press, New York, Vol. 1, 1959.
- Johnson, Walter, *Aurora on the Unknown*, McGraw-Hill, New York, 196.
- Hyde, Margaret O., *Exploring Earth and Space*, McGraw-Hill, New York, 1957.

- In 1999 I began to talk to people about ideas to commemorate the IGY 1957 on its 50 year anniversary in 2007
- We decided to begin to promote the idea at the 2002 World Space Congress in Houston
- A series of community workshops were organized to define the activity
- In 2004 Hans Haubold committed the UN-BSS program to IHY for the next five years

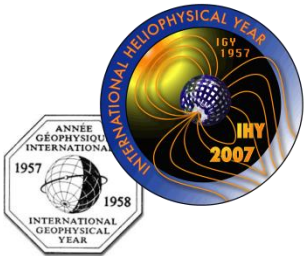


IHY is Natural Evolution of IGY

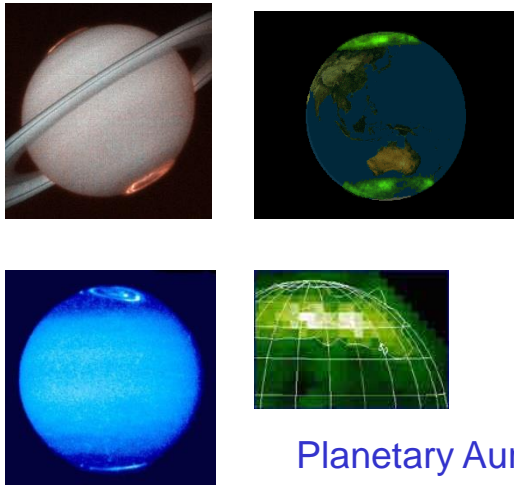


Synoptic observations and Global processes on solar system scale

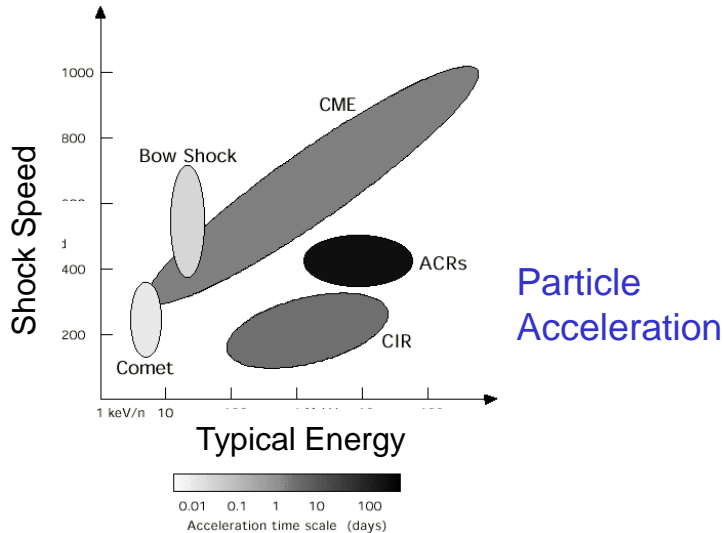
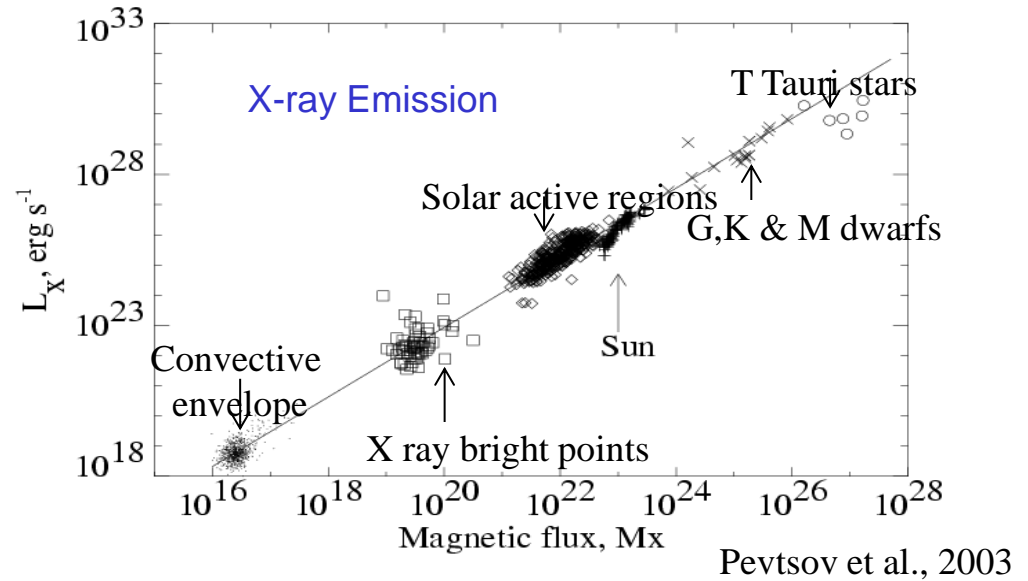
- *Unprecedented international fleet of spacecraft located throughout the heliosphere*
- *Networks of sophisticated ground based observatories*



Universal Process Exemplars

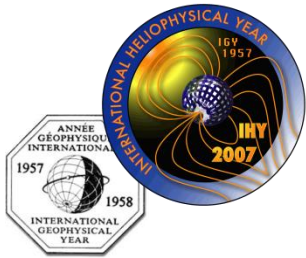


Planetary Aurorae

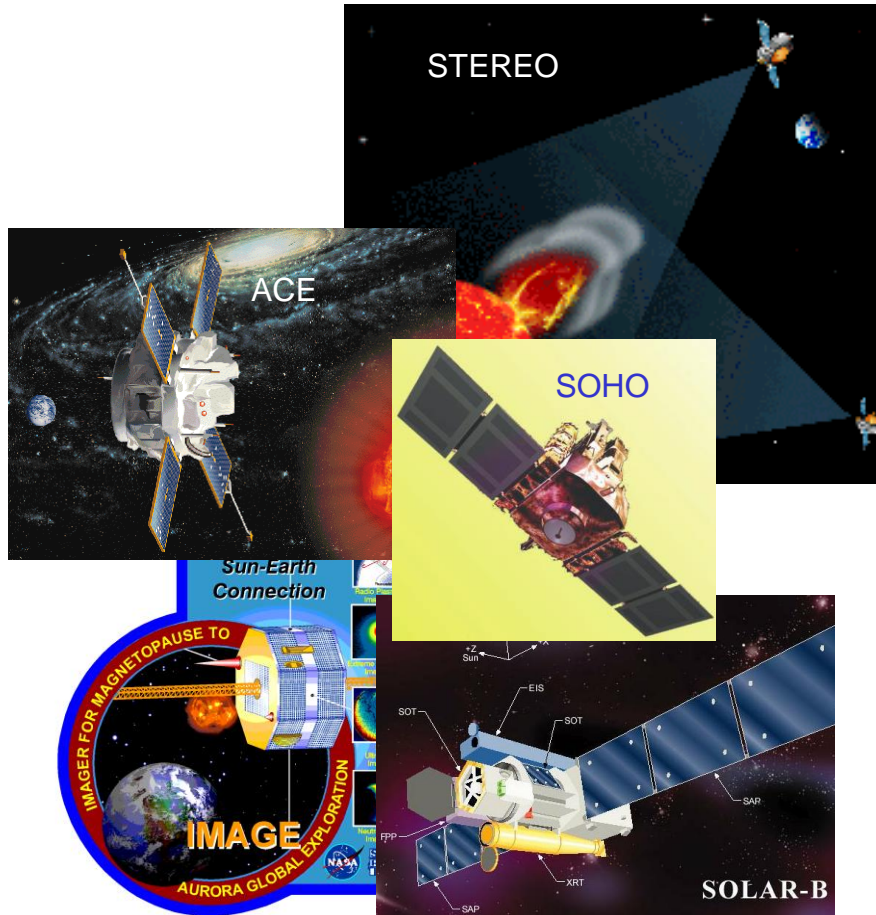


Universal Heliophysical Processes Meetings

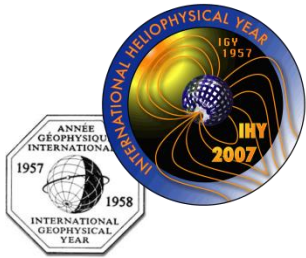
- IAU Symposium, Ioannina Greece, Sep 15-19, 2008
- Chapman Conference, Charleston, SC, Nov 10-14, 2008



Why IHY 2007?



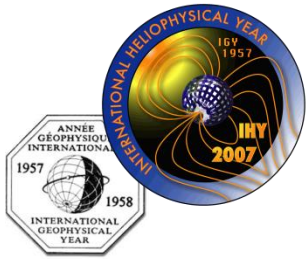
- A large armada of existing or planned spacecraft are in place to provide the most comprehensive global measurements of the sun-earth interplanetary system yet obtained
- Earth based resources can provide measurements of terrestrial effects at the poles and elsewhere
- International collaboration is easier today than in previous international years with abundant and cheap electronic communication available
- No single country has sufficient resources to obtain all required observations for Space Weather
- The time is ripe for IHY global studies.



IHY GOALS



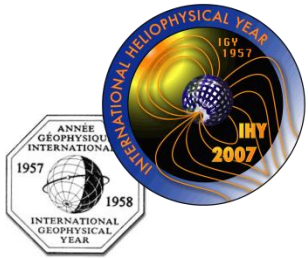
- Develop the basic science of heliophysics through cross-disciplinary studies of **universal processes**.
- Promote research on the Sun-heliosphere system outward to the local interstellar medium - **the new frontier**.
- **Foster** international scientific **cooperation** in the study of heliophysical phenomena now and in the future.
- **Preserve the history** and legacy of the IGY on its 50th Anniversary.
- **Communicate** unique IHY **results** to the scientific community and the general public.



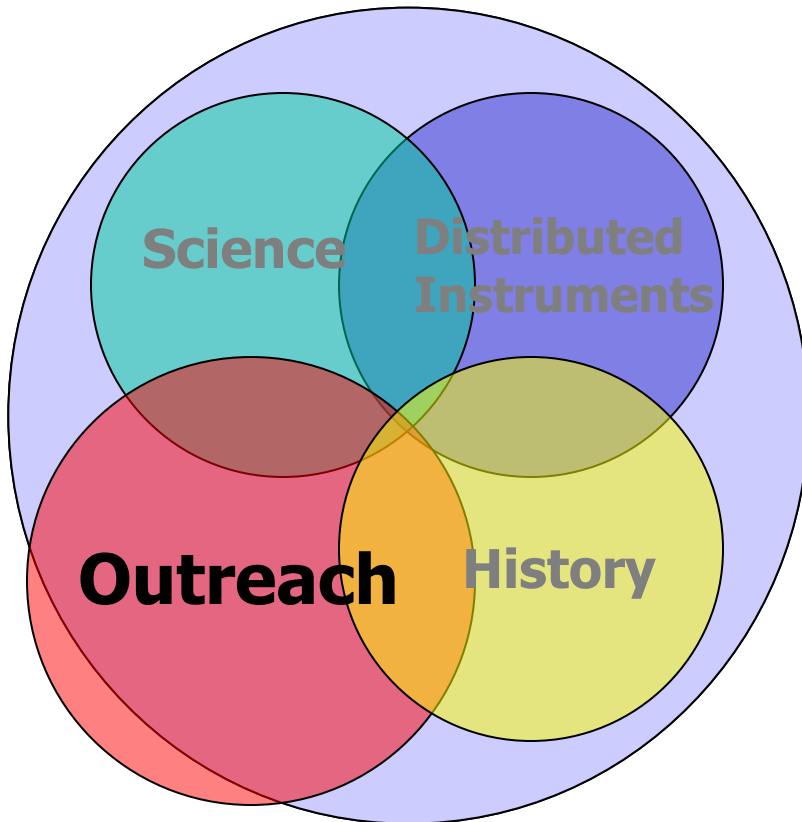
IHY



- **Cooperative international program**
- **Started Feb 2007, Ends Feb 2009**
- **71 countries with National committees**
- **Thousands of scientists**
- **200 Observatories**
- **65 Coordinated Investigation Plans (CIPs)**
- **Secretariat supported by UN, NASA, US-DOS**

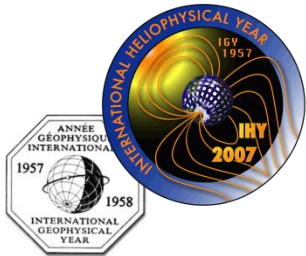


Four Elements of the IHY Program



- **Coordinated Investigation Programs (CIPs)**
 - *Scientific Research*
- **Distributed small instrument program**
 - *New observational capability*
- **Education, outreach**
 - *Promoting space science*
- **IGY History preservation**
 - *Preserving the history of space physics*

See website at <http://ihy2007.org> for more information.



IHY Outreach



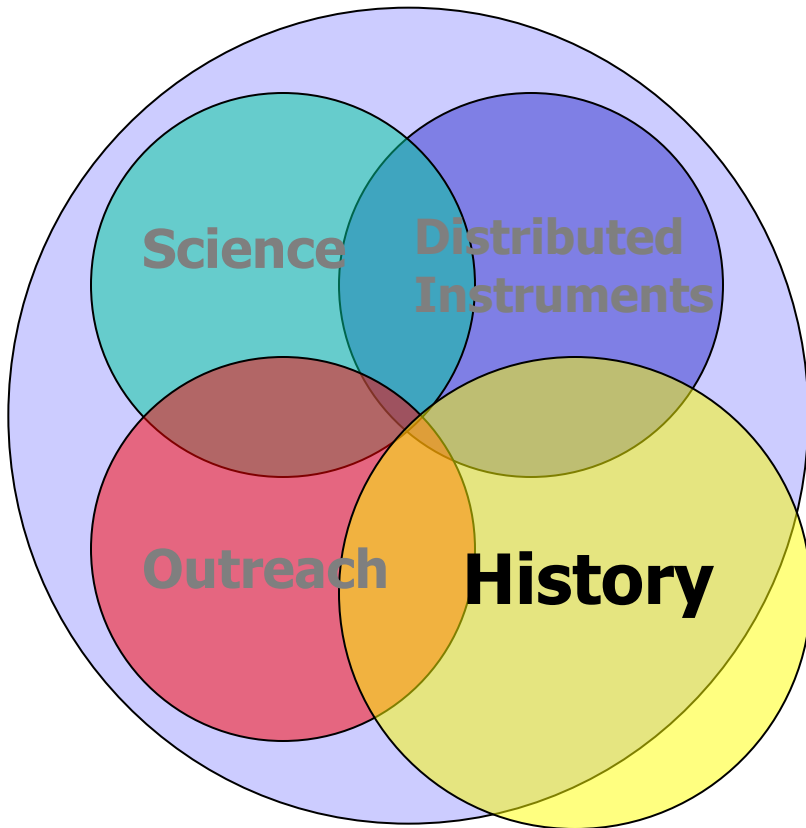
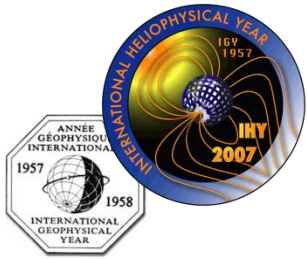
- Teacher workshops in conjunction with major meetings
- Translation of educational materials
- World-wide Observatory open doors day
- Traveling science displays
- Yuri's night
- US, India, Brazil, Africa, China
- Summer schools
- Special emphasis on outreach in African countries

الشمس والأرض
 الشمس هي النجم الذي نرى في السماء ليلاً ونهاراً. وهي من النجوم التي تسمى النجوم النجمية. وهي تتكون من الغازات والمواد الصلبة. وهي تسمى النجوم النجمية لأنها تضيء وتنتج الحرارة. وهي تسمى النجوم النجمية لأنها تضيء وتنتج الحرارة. وهي تسمى النجوم النجمية لأنها تضيء وتنتج الحرارة.

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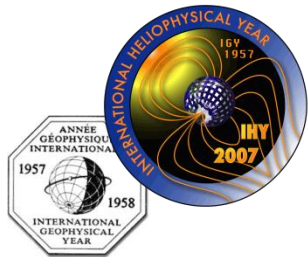
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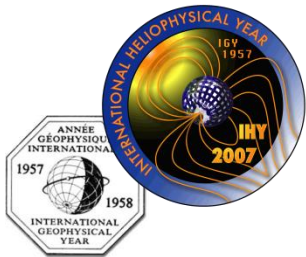
History - IGY Gold Program



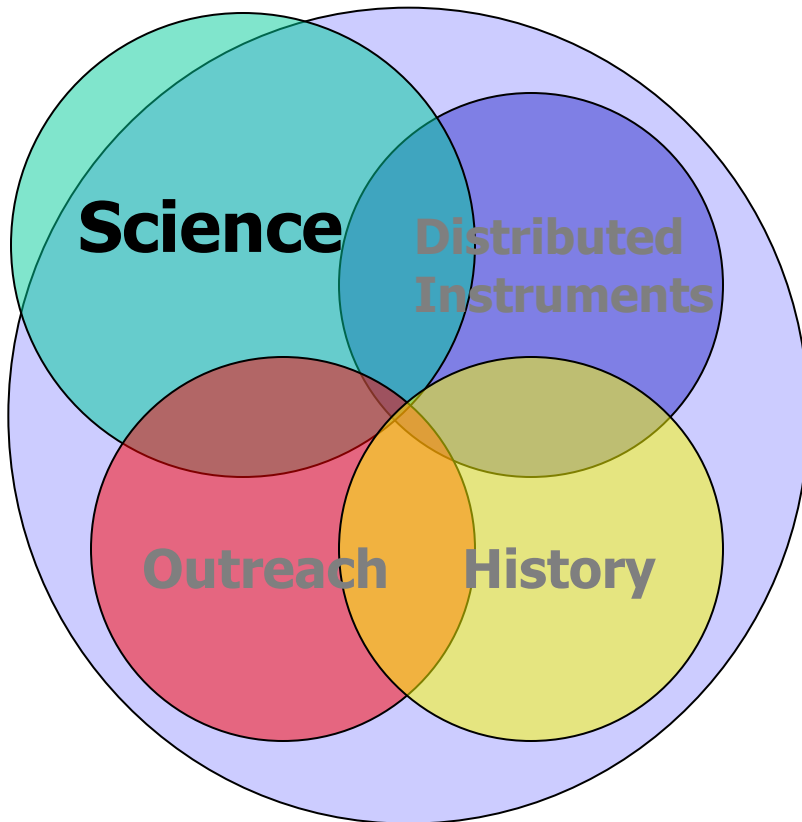
- Sponsored by IUGG
- Managed by IHY for all International Years
 - *Certificates available in IHY, IPY, eGY, and Planet Earth formats*
- Recipient must
 - *Have participated in the IGY in some capacity*
 - *Provide an artifact of historical interest*
 - *Agree to have name made public on website*



Some notable recipients: Prince Phillip, James Van Allen, Alan Shapley, and approximately 300 others.

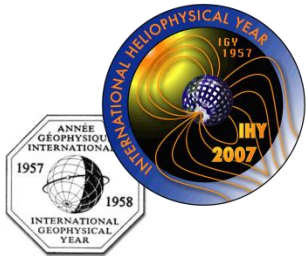


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CIPs

(Coordinated Investigation Programs)

Registration
Required to enter
CIP

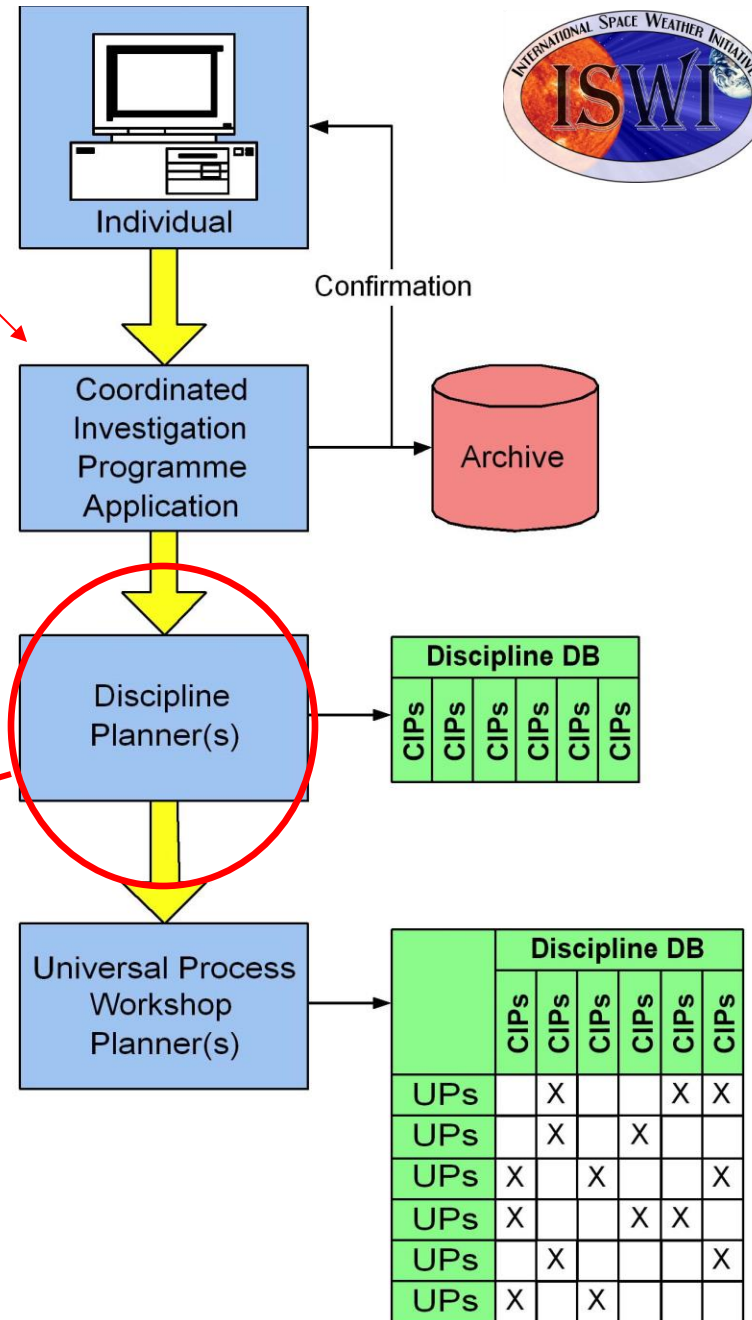


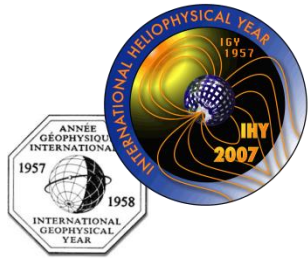
- **Richard Stamper (RAL)** is CIP coordinator
- **Regional representatives to nominate Discipline planners in following categories**
 - *Solar*
 - *Heliosphere*
 - *ITM*
 - *Magnetosphere*
 - *Climate*
 - *Heliobiology*
- **65 CIPS currently in process**

Registered individuals fill out specific Coordinated Investigation Programme (CIP) Applications through a web interface on the IHY site(s).

A discipline planner reviews the CIP Applications and coordinates them with other CIPs.

A Universal Process (UP) Workshop Planner identifies the relevant UP to begin planning the summary workshop.





Whole Heliospheric Interval (WHI)



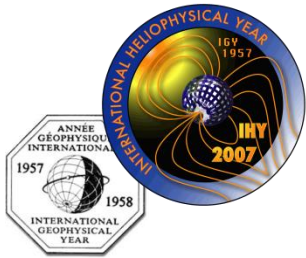
Primary Goals:

- Characterize the 3-D solar minimum heliosphere
- Trace the effects of solar structure and activity through the solar wind to the Earth and other planetary systems

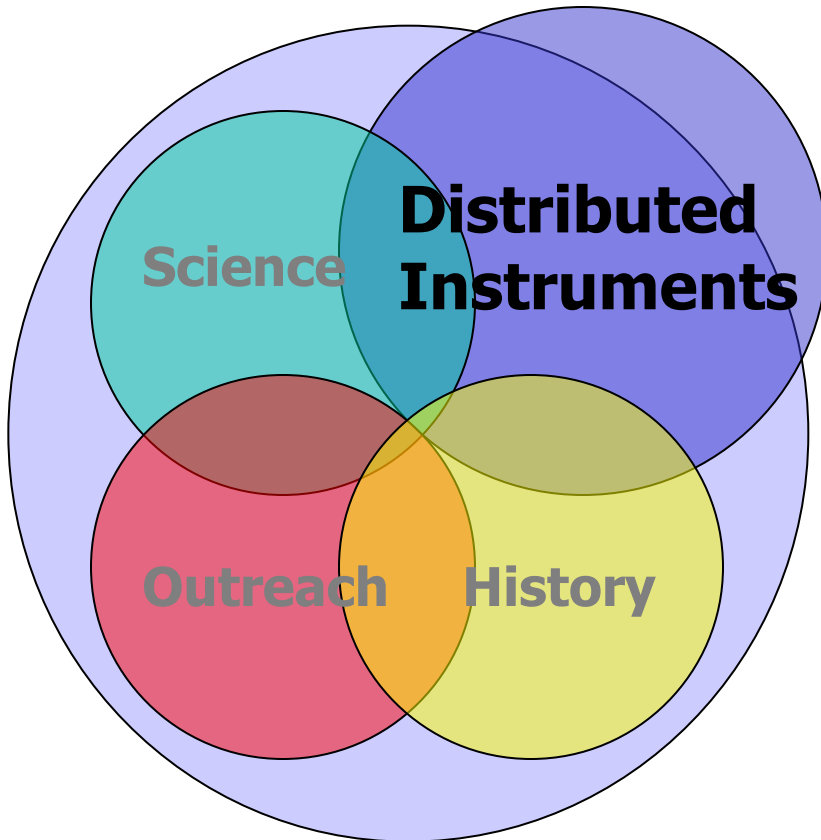


WHI takes advantage of new capabilities in observations and models to advance our understanding of the 3-D interconnected heliophysical system. The campaign will begin with the origins of solar structure and variability and will trace their impact to the outer reaches of the heliosphere.

Go the IHY Website to join and for additional information !

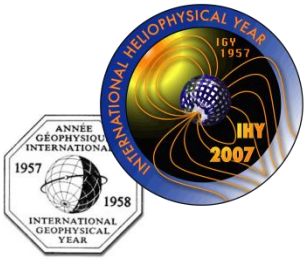


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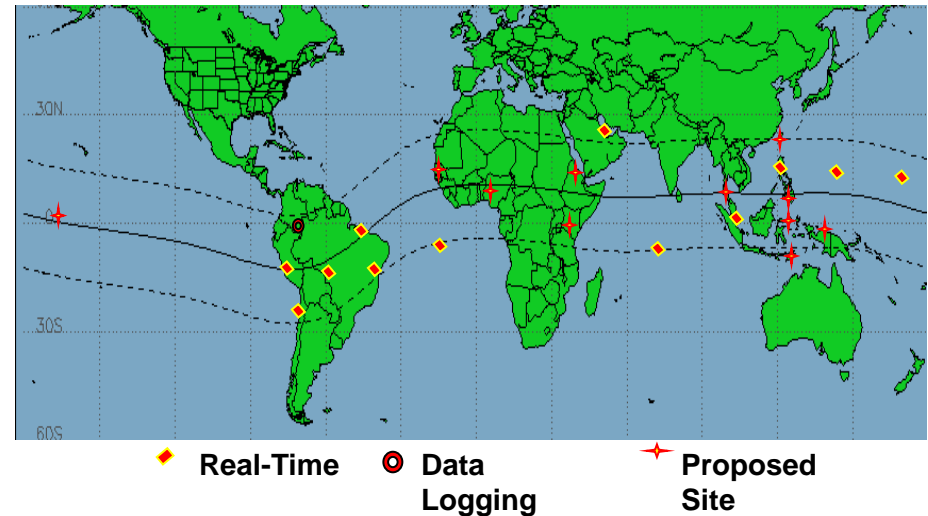
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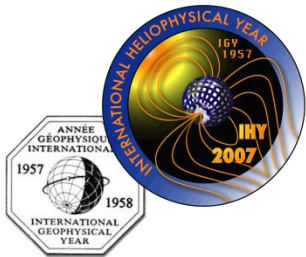


Distributed Instruments: Basic Concept



- The lead scientist or principle investigator will provide instrumentation (or fabrication plans)
- The host country provides the workforce, facilities, and operational support typically at a local university.
- Host scientists become part of science team
- All data, and data analysis activity is shared
- All participate in publications and meetings
- UN-BSS dedicated to the program at least thru 2009





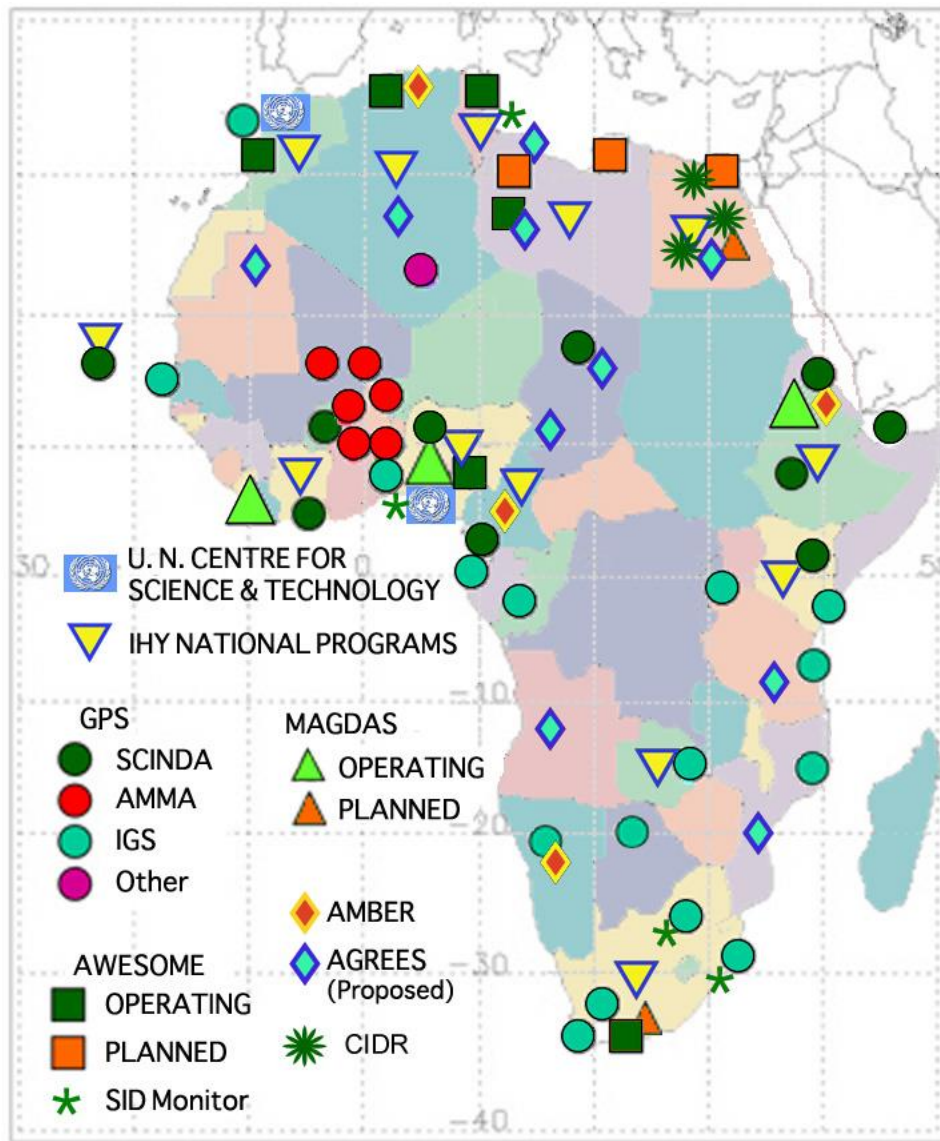
UN-NASA Workshop Series



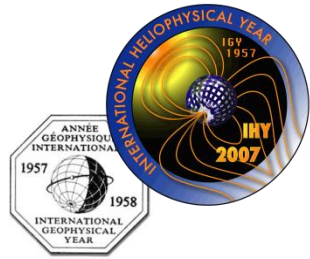
- First Workshop
 - Al Ain, UAE: November 20-23, 2005
 - UN, ESA, NASA, and UAE Government sponsored
 - Approximately 120 participants from 27 countries
- Second Workshop
 - Bangalore, India: November 27-December 1, 2006
 - UN, NASA and Indian Government sponsored
 - Approximately 120 participants from 30 countries
- Third Workshop
 - Tokyo, Japan: June 18-22, 2007
 - UN, NASA and Japanese Government sponsored
 - Focused on data issues
- Fourth Workshop
 - 2009: Hosted by IHY-Bulgaria
 - Sponsored by JAXA, ESA, NASA & United Nations



These Workshops have been highly successful at establishing new collaborations between instrument providers and hosts



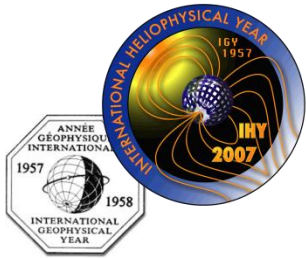
- AWESOME space weather monitors are being deployed worldwide. Instruments were installed in Turkey, Algeria and Morocco, Libya, Egypt and South Africa, among others.
- IHY-Japan has made significant progress towards the completion of its 51-magnetometer MAGDAS global network with a new installation site on MacQuarie Island, Ethiopia, Ivory Coast, Nigeria, and Malaysia.
- The RENOIR ionospheric observing station program has received support for development, and will be making plans for instrument host sites later this year (e.g. Cape Verde).
- The deployment Latin-American SAVNET VLF receiver chain began in 2006 with the target of being operational this year.
- The SCINDA scintillation network will double the size of their equatorial network, instrumenter's meetings July 2006 in (Cape Verde) and November 2007 (Ethiopia) in preparation for new deployments.
- CALLISTO Radio spectrometer network deployment in Japan, India, US, Switzerland, Korea, Mexico (in progress). First light in India February 2007, operational in Korea too.
- Armenian SEVAN space environment monitor is being deployed in Croatia & Bulgaria.
- AMBER Magnetometer network funded, AGREES pending.



International Space Weather Initiative (ISWI)



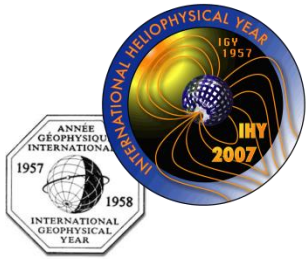
- Follow-on to the IHY to continue to build space physics in developing countries
- Joint NASA, UN, JAXA, ESA effort
- Approved by the UN Committee for Peaceful Uses of Outer Space, will be formally adopted by the General Assembly this fall.



Preliminary ISWI Objectives



- **Develop the scientific insight necessary to understand the science, and to reconstruct and forecast near-Earth space weather**
 - ***Instrumentation***
 - Expand and continue deployment of new and existing instrument arrays
 - ***Data analysis***
 - Expand data analysis effort for instrument arrays and existing data bases
 - ***Coordinate data products to provide input for physical modeling***
 - Input instrument array data into physical models of heliospheric processes
 - Develop data products that reconstruct past conditions in order to facilitate assessment of problems attributed to space weather effects
 - ***Coordinate data products to allow predictive relationships to be developed***
 - Develop data products to allow predictive relationships that enable the forecasting of Space Weather to be established
 - Develop data products that can easily be assimilated into real-time or near real-time predictive models
 - **Education, Training, and Public Outreach**
 - ***University and Graduate Schools***
 - Encourage and support space science courses and curricula in Universities that provide instrument support
 - ***Public Outreach***
 - Develop public outreach materials unique to the ISWI, and coordinate the distribution
- IHY (<http://ihy2007.org>)



Summary



- **IHY outreach and history programs have contributed to a better public understanding of space science**
- **IHY left a legacy of instrumentation networks that will continue to provide unique data sets for years to come**
- **ISWI continues this work and will have an even larger impact on international space weather science and forecasting**