

The Future of IHY Campaigns: Transition to the International Space Weather Initiative

Jean-Pierre Raulin¹, Joseph M. Davila², Thomas Bogdan³, Kiyohumi Yumoto⁴ and John Leibacher⁵

¹CRAAM/EE, Universidade Presbiteriana Mackenzie, São Paulo, Brazil
email: raulin@craam.mackenzie.br

²NASA - Goddard Space Flight Center, Greenbelt, MD, USA
email: joseph.m.davila@nasa.gov

³NOAA - Space Weather Prediction Center, Boulder, CO, USA
email: Tom.Bogdan@noaa.gov

⁴SERC - Kyushu University, Fukuoka, Japan
email: yumoto@serc.kyushu-u.ac.jp

⁵NSO - National Solar Observatory, Tucson, AZ, USA
email: jleibacher@nso.edu



Circulated as
Volume 3, Number 9
on 22 January 2011.

Abstract. We will present the relevant activities performed during the International Heliophysical Year (IHY) program during the 5 year period 2004 - 2008. The IHY was a major international effort that involved the deployment of new instrumentation, new observations from the ground and in space, and a strong education component. Under the United Nations Office for Outer Space program called Basic Space Science Initiative (UNBSSI), instrument arrays have been deployed to provide global measurements of heliophysical phenomena. As a result, significant scientific and educational collaborations emerged between the organizing groups and the host country teams. In view of the great successes achieved by the IHY during these years, we propose to continue the highly successful collaboration with the UN program to study the universal processes in the solar system that affect the interplanetary and terrestrial environments, and to continue to coordinate the deployment and operation of new and existing instrumentation arrays aimed at understanding the impacts of Space Weather on Earth and the near-Earth environment. To this end, we propose a new program, the International Space Weather Initiative (ISWI). The ISWI strongly complements the International Living With a Star (ILWS) program, providing more attention nationally, regionally, and internationally for the ILWS program. Based on a three-year program activity, the ISWI would provide the opportunity for scientists around the world to participate in this exciting quest to understand the effect of space disturbances on our Earth environment.

Keywords. astronomical data bases: miscellaneous, Sun: general, solar-terrestrial relations, solar system: general.

1. Introduction

The International Heliophysical Year (IHY) started in February, 2007 and was a major international effort with three main objectives: (i) to advance the understanding of fundamental heliophysical processes that govern the Sun, Earth and heliosphere, (ii) continue the tradition of international research and advancing the legacy of the International Geophysical Year (IGY) in 1957, and (iii) demonstrate the beauty, relevance and significance of space and Earth science to the world. IHY marks the 50th anniversary of IGY 1957 which was one of the most successful international science program of all times by establishing a new basis for the development of new space science and technology. IHY

therefore extended the concept and frontiers of Geophysics to Heliophysics, by studying not only atmospheric and solar-terrestrial physics, but also other planets and the outer reaches of the heliosphere and how it interacts with the interstellar medium.

2. Main Achievements of IHY

IHY science objectives were reached through the study of universal processes. A major scientific activity was developed with the Coordinated Investigation Programs (CIP) when thousands of scientists worldwide from 6 regions and 71 countries interacted for a better understanding of heliophysical processes. As a result 65 CIPs from 200 international institutions in North and South America, Europe, Africa, Asia and Australia were proposed, and many regional and international workshops took place.

One of the main components of the IHY was the collaboration with the United Nations through the United Nations Basic Space Science Initiative (UNBSSI). This initiative was dedicated to the establishment of observatories and instrument arrays for increasing the understanding of space science and the viability of space science research, engineering and education in developing countries and regions not yet involved in space research. As a result IHY provided the framework for the deployment of arrays of small instruments to perform global measurements of space physics-related phenomena. The framework of the UNBSSI/IHY collaboration was defined and established in a series of international workshops held by UNOOSA (United Nations Office for Outer Space Affairs) in cooperation with the space agencies NASA, ESA and JAXA. During these planning meetings held during the period 2005 - 2009 in the United Arab Emirates, India, Japan, Bulgaria and South Korea, scientists from developing and industrialized nations met to discuss and develop collaborative projects. Low-cost scientific instruments were provided by scientists from developed countries to scientists from developing nations, and the latter provided sites for the instruments, to maintain them and control the data quality. As a result, 14 arrays of simple and low cost instruments were installed in all continents, to provide observations of the Sun and its varying activity, the solar wind and solar wind-planetary relationship, space weather, solar variation impacts on the Earth atmosphere, cosmic rays and the limits of the heliosphere.

The last objective of the IHY was to communicate the unique scientific results of the program to the scientific community and to the public. As mentioned earlier, several workshops were organized to present and discuss the results obtained from about 65 coordinated investigation programs proposed all over the world. The educational outreach during IHY and the dissemination to a larger public were also important. Many students got their graduate and/or post-graduate degrees by being involved in the instrument arrays installation and in the data analysis and interpretation, and these will in turn be able to raise the interest and curiosity of younger people to the beauty of space physics phenomena. During the IHY period about 15 summer schools were organized in North and Latin America, the Asian-Pacific region, Europe and Africa, and the Balkan-Black Sea-Caspian region, with most of the schools exceeding 100 students.

3. International Heliophysical Year to International Space Weather Initiative

IHY 2007 which has strengthened the mark of 50 years of space exploration officially came to an end on February 2009. During these few years, this program has been dedicated to the study of the heliosphere as an integrated system composed of the Sun, the interplanetary medium, the planets and the Earth environment. At the same time that

humanity is celebrating the International Year of Astronomy in 2009, many of the IHY 2007 participants hope for an amplification of their efforts.

To build on the legacy from the IHY achievements, a new UN initiative has been adopted by the UNOOSA: the International Space Weather Initiative (ISWI). The goal of the ISWI is to continue the highly successful collaboration with the UN to encourage new and existing scientific collaborations to study the universal processes in the heliosphere and their interaction with planetary environments, and to continue to coordinate the deployment and operation of new and existing instrumental arrays. Finally, ISWI will strongly complement the International Living With a Star (ILWS) program providing more attention nationally, regionally and internationally for ILWS activities.

IHY has allowed establishing and deploying many instrumental programs to study heliospheric physics, a discipline which includes solar physics as well as planetary magnetospheric and ionospheric physics. However, and because of this multi-disciplinary environment, there is a strong need for data access to and further analysis by a broader scientific community. To this end, universal data access and analysis systems are required. Similarly, virtual observatories should be of great help to address scientific questions that span disciplinary boundaries. In practice, such observatory networks should be able to facilitate science research performing through different heliospheric domains, and broaden significantly the user base.

During the new ISWI program emphasis should be given to space weather studies and their implications on human life and technology both in space and on the surface of the Earth. Understanding extreme events in our solar system is a necessary condition for safe human space travel to planets in the future. Such an effort to derive practical applications of science is also important for developing countries to get better local support for ground based observations of space phenomena and data transfer and handling. The resulting data products also need to be coordinated to allow predictive relationships that enable the forecasting of space weather to be established.

During ISWI a large effort will be made to support and encourage space science courses and curricula in academic institutions that provide support to instrumental arrays. Similarly it will be important to develop public outreach material unique to the ISWI program, and to coordinate its distribution.

A three-year plan for ISWI has been presented, discussed and recommended by the Science and Technical Subcommittee (STSC) to the UN COPUOUS (Committee on the Peaceful Uses of Outer Space). As a result, this first plan for ISWI will be part of an upcoming UN General Assembly resolution.

4. Conclusions

The International Heliophysical Year was a major program of scientific collaboration which led to great achievements. To build upon this success, the community proposes a new initiative: the International Space Weather Initiative to provide the opportunity for scientists around the world to participate in this exciting quest to understand the effect of space disturbances on our terrestrial environment.

Acknowledgements

JPR would like to acknowledge the support of CNPq (Grant 304433/2004-7), FAPESP (Grant 2006/02979-0) and MACKPESQUISA agencies.