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**International Centre
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From the IGY to the ISWI: a perspective view of the importance of international cooperation in geo-heliophysics

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**The United Nations/United States of America Workshop on the International
Space Weather Initiative: The Decade after the
International Heliophysical Year 2007
Boston College, 31 July – 4 August, 2017**

Two concepts guide my talk

A look to the past to strengthen
the vision of the future

“There is no national science just as there is
no national multiplication table.”

Anton Chekhov (Note Book 1892-1904)

International collaboration in geo-heliophysics

1st
International
Polar Year
(IPY)
1882-1883

2nd
International
Polar Year
(IPY)
1932-1933

**International
Geophysical
Year
(IGY)
1957-1958**

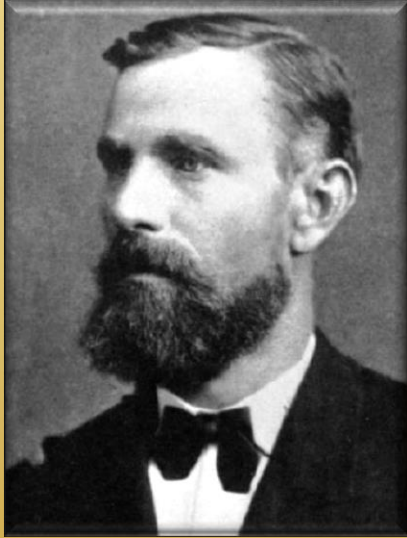
International
Quiet Sun
Year
(IQSY)
1964-1965

International
Heliophysical
Year
(IHY)
2007

**International
Space
Weather
Initiative
(ISWI)
2017**

1st International Polar Year (IPY)

1882-1883



- ✓ Karl Weyprecht, officer of the Austro-Hungarian Navy, arctic explorer and promoter of international cooperation for scientific polar exploration, was the inspirer of the 1st International Polar Year.
- ✓ **12** countries jointly completed thirteen polar expeditions in the Arctic and two in the Antarctica.
- ✓ *The 1st IPY triggered the key idea of a collaborative, international scientific effort to study geophysics.*



The Dutch ship *Varna* stuck in pack ice in January 1883 during the first IPY. Though the ice crushed the vessel, the scientists were able to continue their research by creating an ad-hoc observatory on the ice. (pictures from <http://icestories.exploratorium.edu>)

2nd International Polar Year (IPY) 1932-1933



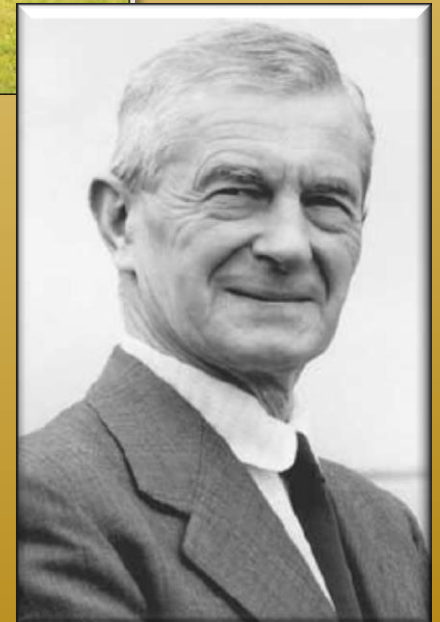
Johannes Georgi at the Eismitte Station
in Groenland



- ✓ In 1927 Johannes Georgi at the Deutsche Seewarte (German Naval Meteorological Research Observatory) in Hamburg suggested that a Second IPY be conducted on the fiftieth anniversary of the first.
- ✓ A commission for the IPY 1932-1933 was appointed and a collaboration between the Commission and the IUGG, established in 1919, was agreed.
- ✓ **40** countries participated in the programme, despite requests to delay it due to poor economic conditions worldwide.
- ✓ *The Commission introduced the concept of "International Days". The scientific objective was to study phenomena on the largest possible scale with simultaneous observations in different locations.*
- ✓ The most significant new development that affected the programme was the advent of radio communications.

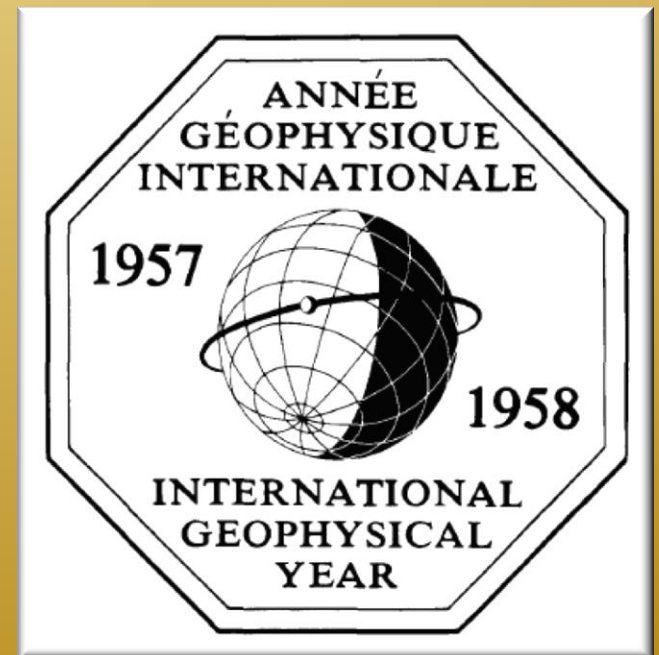
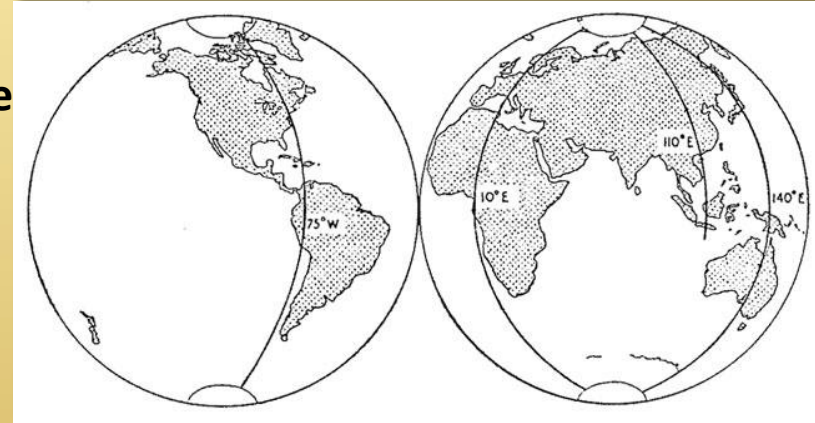
International Geophysical Year (IGY) 1957-1958

- On April 5, 1950 a small group of scientists met in James Van Allen house, in Silver Spring, Maryland, with Sydney Chapman, a visiting scientist from England.
- The conversation turned to geophysics and the role of the sun in Earth processes.
- Someone suggested that with the new tools available: rockets, radar, and computers, it was time for a coordinated, worldwide study of the Earth system.
- There was planted the seeds of what would be called the International Geophysical Year (IGY).
- Chapman observation that 1957–58 would be a period of maximum solar activity fixed the time frame of the International Geophysical Year.



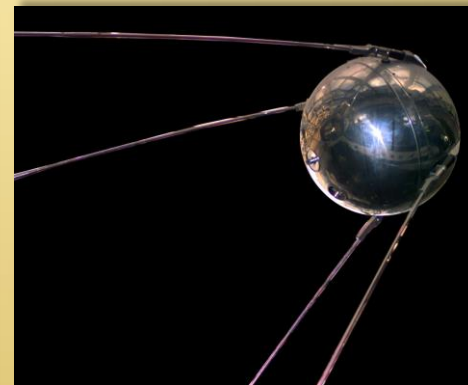
IGY 1957-1958

- ✓ A special Committee, led by Prof. Sidney Chapman, was established by the International Council of Scientific Unions (ICSU) to organize the activities.
- ✓ **67** countries, more than 4,000 observatories and about 60000 scientists participated in the IGY.
- ✓ Their efforts were concentrated in the Polar Regions, along the equator, and along several geographic lines joining Pole to Pole.
- ✓ The contribution of amateur scientists to the International Geophysical Year (IGY) was substantial, especially in the arena of spotting artificial satellites.
- ✓ *The IGY included projects in geomagnetism, glaciology, gravity, ionospheric physics, precision mapping, meteorology, oceanography, seismology, solar activity, and others.*

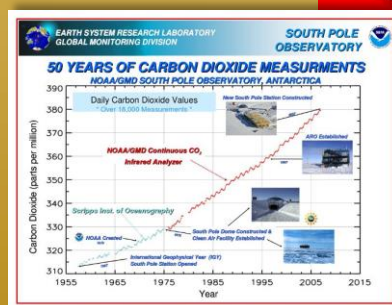
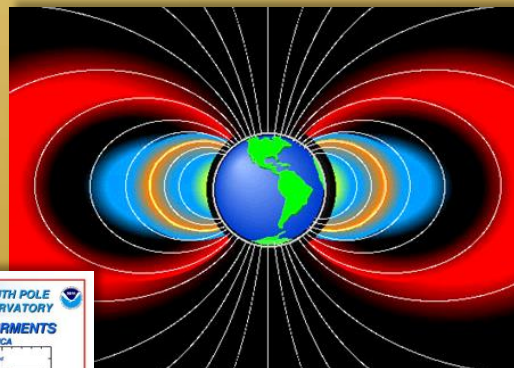


IGY Legacies

“Visible legacies of the IGY include the launch of the first artificial Earth-orbiting satellites, the Antarctic Treaty, the World Data Center system, the discovery of the Van Allen belts, and the monitoring of atmospheric carbon dioxide and glacial dynamics. The IGY also led to the establishment of Earth sciences programs in many developing countries. Surely this was a grand scheme in a world that was still recovering from a devastating world war.” (From: *The birth of the International Geophysical Year*, by FAE L. KORSMO)



**Big achievements in Science and
in International Collaboration**



International Quiet Sun Year (IQSY) 1964-1965

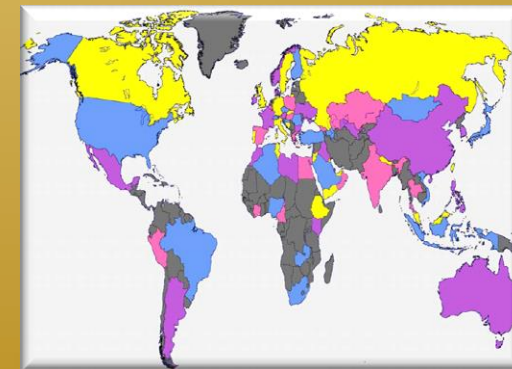
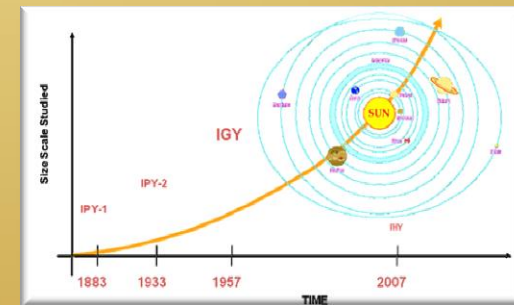
- ✓ During the analysis of the IGY data it was clear the need to compare the results with data from a period of low solar activity.
- ✓ A Special Committee, led by Prof. W. J. G. Beynon, was established by the International Council of Scientific Unions (ICSU) to organize the new activities.
- ✓ **68** countries participated in the scientific programme of the IQSY with representatives in the “Council for the IQSY”.
- ✓ The scientific areas covered were: Meteorology, Geomagnetism, Aurora, Airglow, Ionosphere, Solar Activity, Cosmic Radiation, Aeronomy.
- ✓ *Comparison of the data of the IQSY with those obtained during the IGY made possible to study the dependence of solar-terrestrial phenomena on the solar activity cycle.*



International Heliophysical Year(IHY) 2007



- ✓ The IHY 2007 coincided with the fiftieth anniversary of the IGY in 1957 and continued the legacy of the previous events, extending global synoptic study to the heliosphere, with the leading support of the **United Nations**.
- ✓ **Dr. Joseph Davila and Dr. Nat Gopalswamy** among others have been inspiring and leading scientists for the success of the IHY that joined more than **60** countries in a scientific collaborative effort .
- ✓ *The objectives were: (1) Advancing our Understanding of the Fundamental Heliophysical Processes that Govern the Sun, Earth and Heliosphere; (2) Continuing the tradition of international research and advancing the legacy on the 50th anniversary of the IGY; (3) Demonstrating the Beauty, Relevance and Significance of Space and Earth Science to the World.*
- ✓ During the same period other international scientific activities were carried out: The International Polar Year 2007-2008, the Electronic Geophysical Year (eGY) and the Planet Earth International Year (2007-2009).
- ✓ Several individual countries within Africa have been organizing IHY initiatives.



International Space Weather Initiative (ISWI) 2017



These days we are learning a lot about this last and important step in International Collaboration in our field of science. No reason for me to say more about it.

Let us not forget that...

These outstanding examples of international collaboration started with the vision of one or few persons

The advent of International Collaboration

It can be said that the IGY, rooted in the previous IPYs, represents the beginning of the Age of International Science.

Sidney Chapman called the IGY: *“the greatest example of world-wide scientific cooperation in the history of our race”*.

A good measure of the success of this *new era* is the growth of international collaborative co-authorship of research papers with the participation of scientists from all countries.

In addition to the outstanding scientific results, the legacy of IGY goes from the *Antarctic Treaty* to the establishment of *ICSU World Data System*, permanent examples of international collaboration.

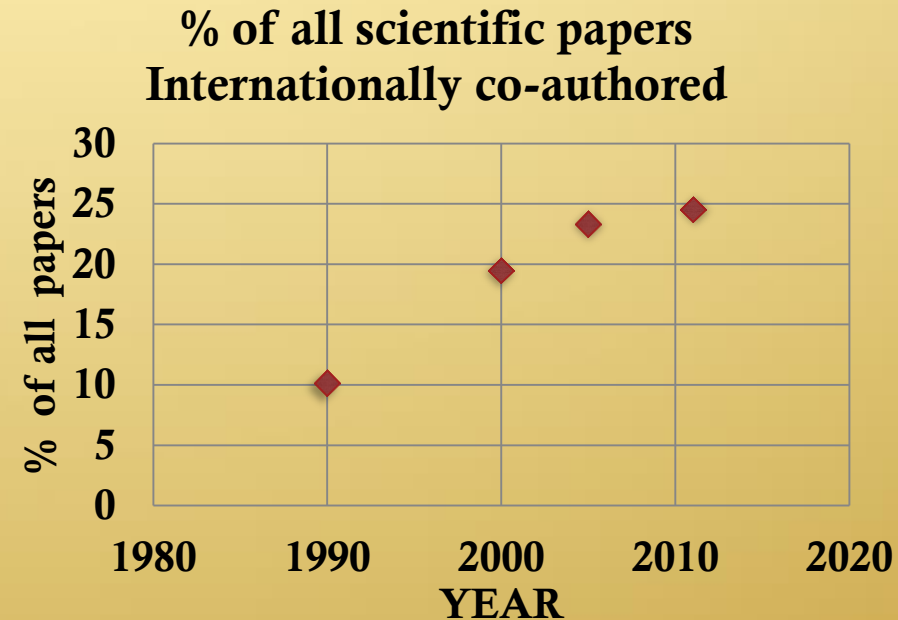
Initiatives like the IHY and the ISWI are excellent examples of the continuous increase of international collaboration in Geo-heliophysics and Space Weather studies.

International collaborative co-authorship

“By 2014, 86% of scientific articles were the fruit of international scientific collaboration in low-income countries (compared to 82% in 2005) and almost 38% in lower middle-income countries (up from 32%). In high-income countries, one in three (34%) articles had a foreign co-author by 2014, up from 28%.” (UNESCO, http://www.unesco.org/new/en/natural-sciences/science-technology/single-view-sc-policy/news_international_scientific_collaboration_has_become_a_must_sa/)

International collaborative co-authorship and the Internet

A fact: The percentage of all scientific papers internationally coauthored has doubled from 1990 to 2000.



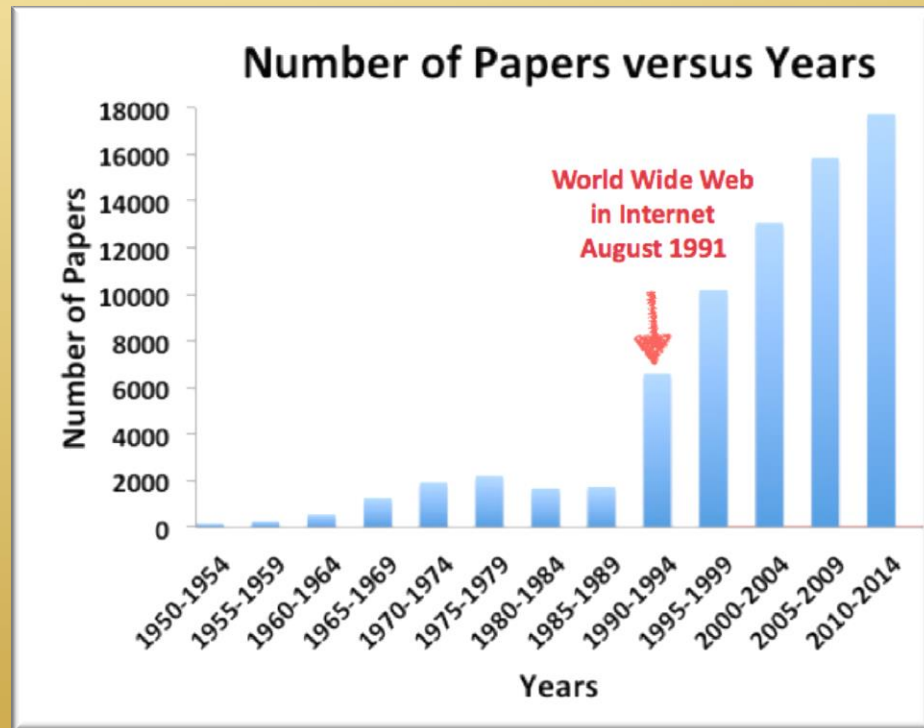
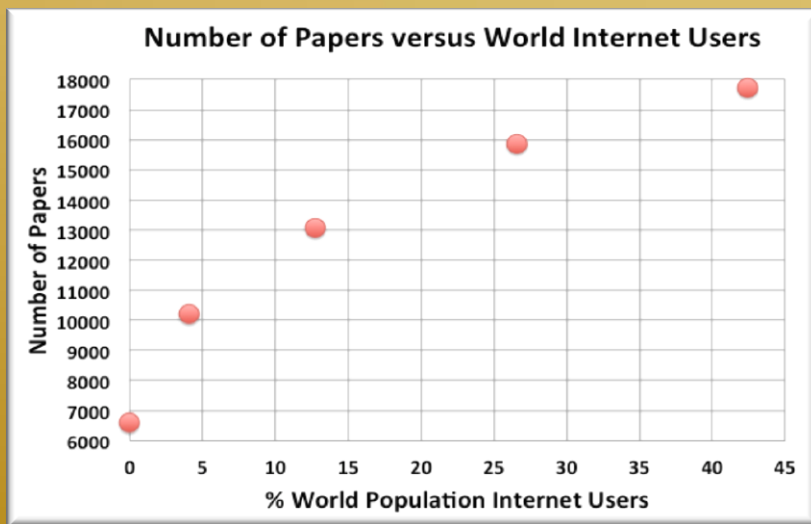
A link between the use of the World Wide Web in the Internet from August 1991 and the increase of international collaboration in science appears evident.

The immediate impact of the WWW in the Internet:

- ✓ Transition to online publishing and e-journals
- ✓ Development of citation tracking
- ✓ Massive extension of bibliographic reach
- ✓ Use of email for scientific collaboration

Increase of research papers and the web-internet age

Number of Papers in:
“solar activity”, “solar wind”,
“ionosphere” and “magnetosphere”.
(from Web of Science Core Collection).



The birth and growth of the **www-internet age** have strongly impacted also in the increase of research papers in **Geo-Heliophysics and Space Weather**.

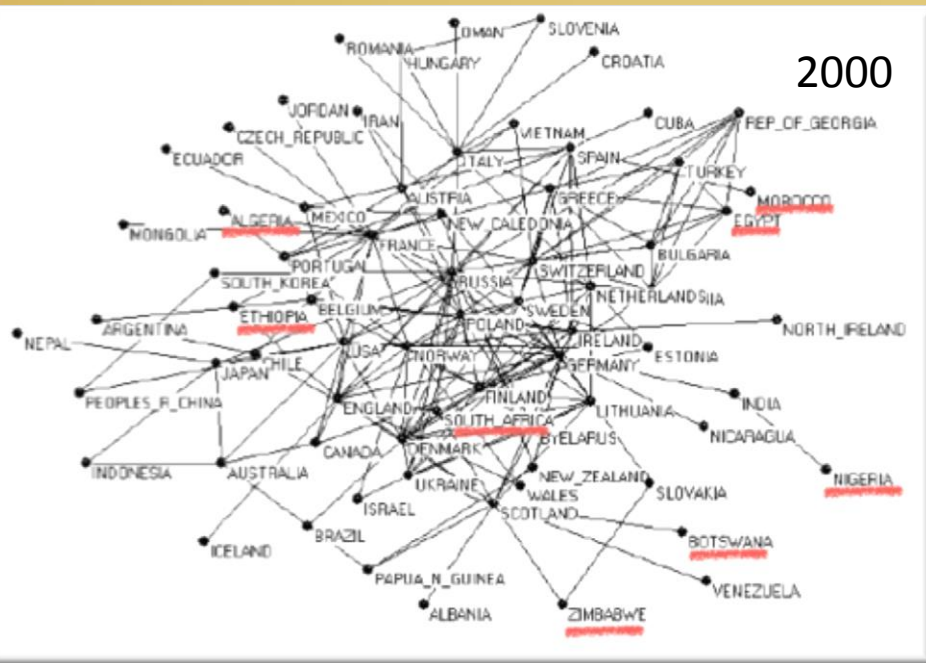
Increase of international co-authorship and the www-internet age: Africa

International collaboration in the subfield of **Geophysics** in a cluster of related journals and counting international co-authorships within them. From *C. S.WAGNER, Scientometrics, Vol. 62, No. 1 (2005) 3–26*



Only one African country (Kenya) in the network of international co-authorship

In 1990 the internet penetration in % of population in Africa was almost 0. In 2000 the total internet penetration of: Algeria, Botswana, Egypt, Ethiopia, Morocco, Nigeria, South Africa and Zimbabwe (marked below) reached 1,8.



Eight African countries in the network of international co-authorship

In summary

The IGY, following the path of the previous IPYs, has started the *Era of International Collaboration in Science*.

The IHY and the present ISWI are excellent followers of the way marked by the IGY.

The Web-Internet advent has given a renewed strength to the international collaboration in science in general and also in Geo-heliophysics and Space Weather.

Regions like Africa, that are emerging in the world of scientific research, benefit from the general growth of international collaboration supported by their continuous and formidable increase of Internet usage.

(Africa Internet usage percentage increase between 2000 and 2017 = **7,722.1 %**, against **936 %** worldwide)

**THANK YOU FOR YOUR
ATTENTION**