

# SCOSTEP–WDS collaboration to address VarSITI Data Challenges

*Kazuo Shiokawa*  
*(VarSITI Co-chair)*  
*Mustapha Mokrane*  
*(WDS Executive Director)*

## **International interdisciplinary programs in solar-terrestrial physics operated by SCOSTEP**

**1976-1979: IMS (International Magnetosphere Study)**

**1979-1981: SMY (Solar Maximum Year)**

**1982-1985: MAP (Middle Atmosphere Program)**

**1990-1997: STEP (Solar-Terrestrial Energy Program)**

**1998-2002: Post-STEP (S-RAMP, PSMOS, EPIC, and ISCS)**

**2004-2008: CAWSES (Climate and Weather of the Sun-Earth System)**

**2009-2013: CAWSES-II (Climate and Weather of the Sun-Earth System-II)**

**2014-2018: VarSITI (Variability of the Sun and Its Terrestrial Impact)**

# CAWSES-II Task Groups

**TG1: Solar influences on climate**

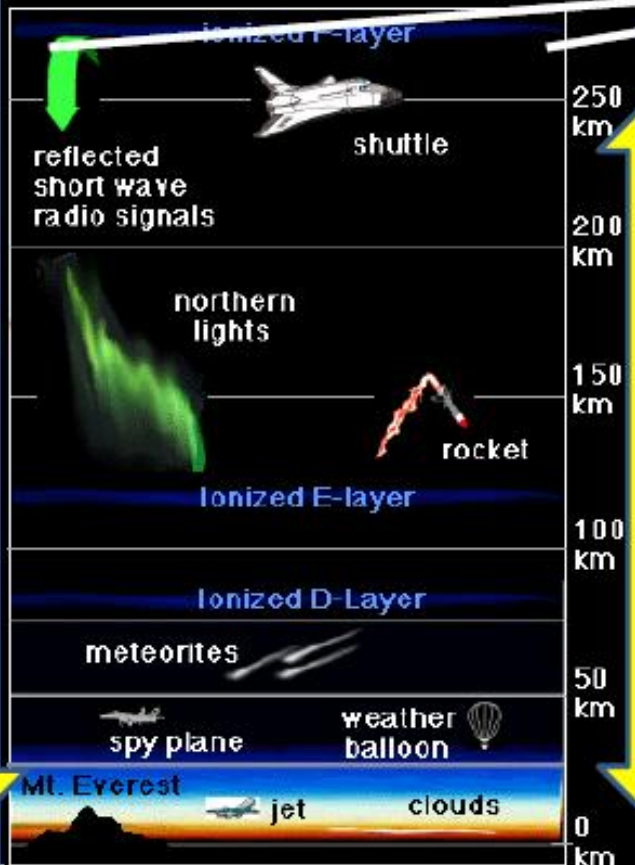
**TG 3 - solar variability affects on geospace**

**TG2: Effect of climate change on geospace**

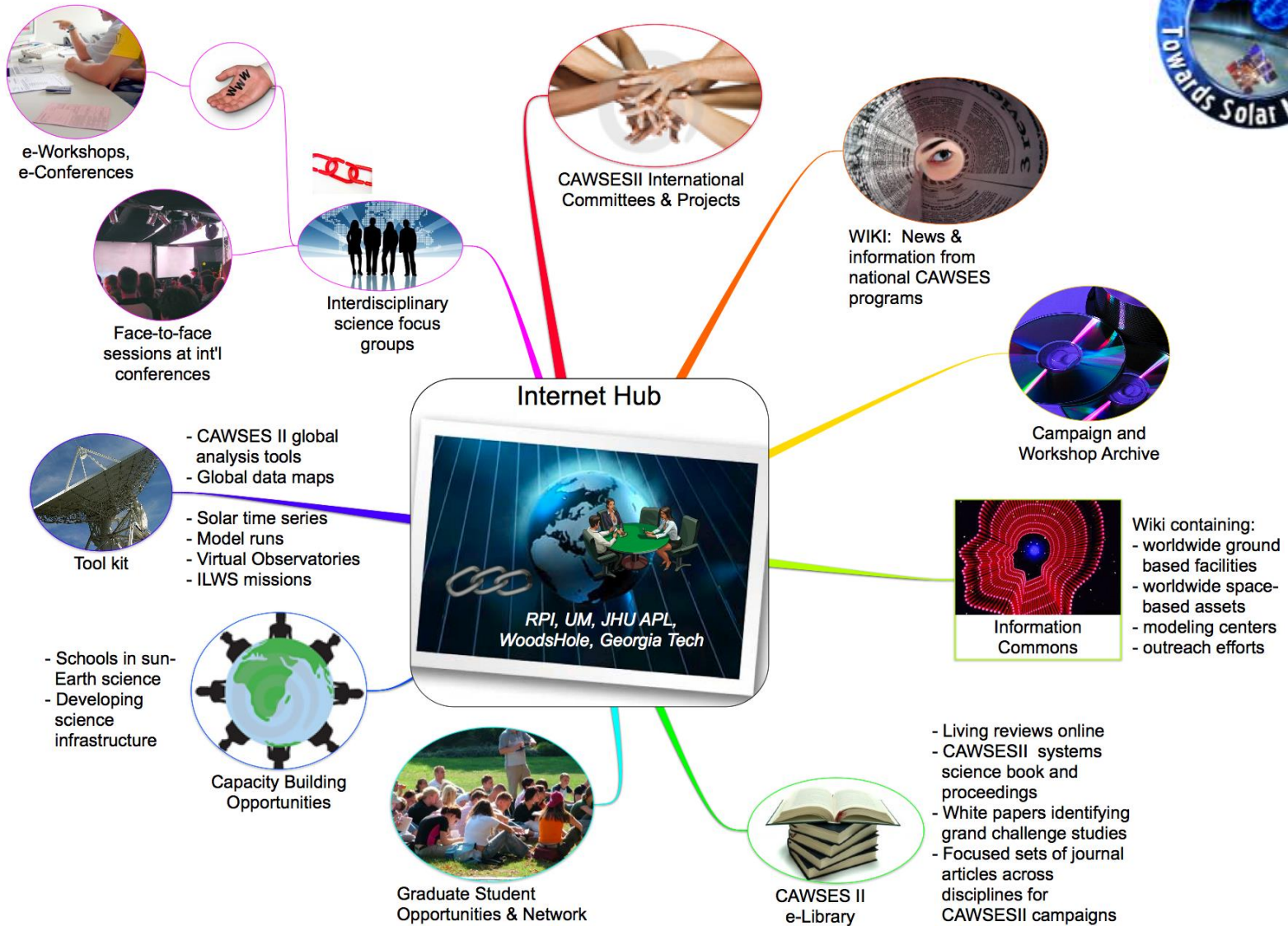
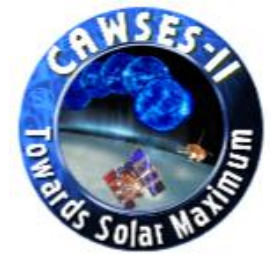
**TG4: Effect of waves on the upper atmosphere**

**TG5: Capacity building**

**TG 6 e-science and Informatics**



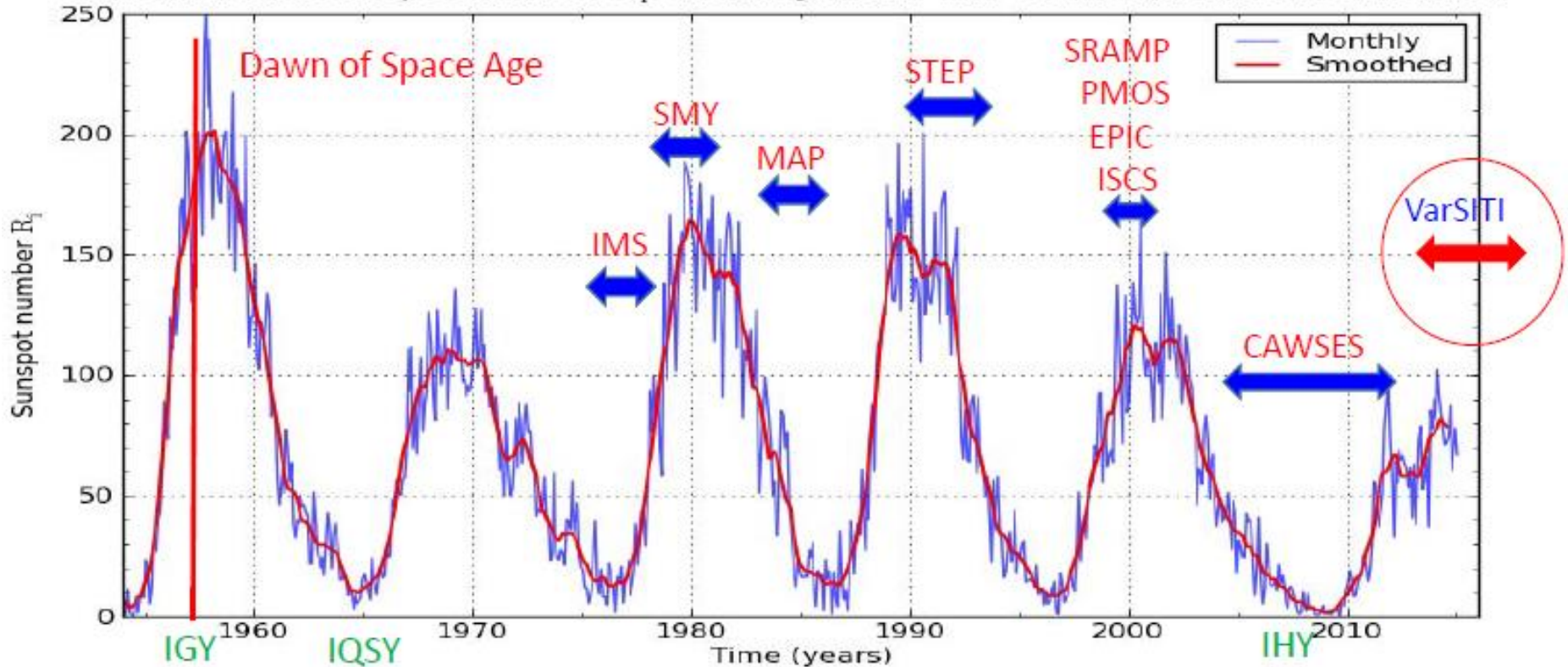
# CAWSES II Worldwide Virtual Institute



Schematic of the key elements of the CAWSES- Virtual Institute essential to carry out interdisciplinary system-level research

# Solar Variability and SCOSTEP Scientific Programs

International sunspot number  $R_i$ : monthly mean and 13-month smoothed number



Nat Gopalswamy UNCOU052015

SILSO graphics (<http://sidc.be>) Royal Observatory of Belgium 2015 February 1

**VarSITI** will focus on the **solar activity variability and its consequences on Earth**, for various times scales from the order of **thousands years to milliseconds**, and for various locations and their connections from the **solar interior to the Earth's atmosphere**.

# Four Projects of VarSITI

Role Of the Sun and the Middle atmosphere/thermosphere/ionosphere In Climate (**ROSMIC**)

International Study of Earth-Affecting Solar Transients (**ISEST**)/MiniMax24

Solar Evolution and Extrema (**SEE**)

Specification and Prediction of the Coupled Inner-Magnetospheric Environment (**SPeCIMEN**)

# **VarSITI (Variability of the Sun and Its Terrestrial Impact) 2014-2018**

**We encourage more communication between solar and heliosphere scientists and Earth's magnetosphere, ionosphere, and atmosphere scientists.**

- Campaign data analysis from the Sun to the Earth**
- Web pages ([www.varsiti.org](http://www.varsiti.org))**
- Mailing lists (currently 674 mail addresses are registered)**
- Newsletters**
- Meetings (financial support is available)**

# Examples of VarSITI-related databases (comprehensive datasets)

database/mission name	description	type	region	SEE	IEST	SPeCI MEN	ROSMI C
CDAWeb	interactive data plotting tool on web-browser for all NASA satellite data in STP	database-comprehensive	sun, heliosphere, magnetosphere, ionosphere			0	
MADRIGAL	IS radars, MST radars, coherent-scatter radars, TEC, Fabry-Perot and Michelson interferometers, meteor and MF radars, airglow imagers, Ozone radiometers, Lidars, and ionosondes	database-comprehensive	ionosphere, thermosphere, mesosphere, and stratosphere		0		0
Space Weather Expert Service Center	current space weather conditions (solar, space radiation, ionospheric, geomagnetic)	database-comprehensive	sun, heliosphere, magnetosphere, ionosphere	0	0	0	
WMO Space Weather Portal	solar, solar wind, ionospheric, atmospheric, geomagnetic data	database-comprehensive	sun, heliosphere, magnetosphere, ionosphere	0	0	0	0
National Climate Data Center	Climate records, climate indicators, solar forcing reconstruction	database-comprehensive	ionosphere, thermosphere, mesosphere, and stratosphere	0			0
SWENET, COSPAR catalogue	data, models, forecasts	database-comprehensive	ionosphere, thermosphere, mesosphere, and stratosphere	0	0	0	0
SPIDR	web-based data visualization tool	database visualisation tool	magnetosphere and ionosphere			0	
ERGWAT	interactive data analysis tool on web-browser	database visualisation tool	magnetosphere and ionosphere			0	
Autoplot	data visualization tool	database visualisation tool	magnetosphere and ionosphere			0	
SPEDAS	data visualization tool	database visualisation tool	magnetosphere and ionosphere			0	
OMNI	continuous solar wind and IMF data at 1AU	database-multi	interplanetary	0	0	0	0
ACE Lists of Disturbances and Transients	Shocks, magnetic clouds, counterstreaming electrons, magnetic holes, terrestrial foreshocks	database-multi	magnetosphere and ionosphere	0	0	0	0
Spaceweather	general space weather	database-multi	magnetosphere and ionosphere	0	0	0	0
IUGONET	metadata database of Japanese ground-based observations	database-multi	ionosphere, thermosphere, and middle atmosphere	0	0	0	0
GEF	Conjunction Event Finder	data analysis resources	magnetosphere			0	
SPIDER	Conjugate Finder	data analysis resources	magnetosphere			0	
SPENVIS	WWW interface to models of the space environment and its effects	data analysis resources	magnetosphere	0	0	0	
ERG-science center TDAS portal	THEMIS/ERG data analysis software with plug in source codes	data analysis resources	radiation belts			0	
CCMC	various modeling softwares	model	magnetosphere and ionosphere	0	0	0	0



# Examples of VarSITI-related database (satellite observations)

database/mission name	description	type	region	SEE	ISEST	SPeCIMEN	ROSMIC
SOHO	images of the sun and heliosphere	satellite observation	sun and heliosphere	0	0		0
STEREO	images of the sun and heliosphere	satellite observation	sun and heliosphere	0	0		0
SDO	images of the sun and heliosphere	satellite observation	sun and heliosphere	0	0		0
Hinode	images of the sun and heliosphere	satellite observation	sun and heliosphere	0	0		0
ACE	solar wind plasma, B, E	satellite observation	interplanetary		0	0	0
ACE	solar wind plasma, B, E	satellite observation	interplanetary		0	0	0
WIND	solar wind plasma, B, E	satellite observation	interplanetary	0	0	0	0
THEMIS	magnetosphere plasma, E, B	satellite observation	magnetosphere		0	0	
GOES	geosynchronous orbit plasma, B	satellite observation	magnetosphere		0	0	0
Van Allen Probes	radiation belt plasma, E, B	satellite observation	radiation belts		0	0	0
POES	precipitating plasma at LEO	satellite observation	ionosphere		0	0	0
TOPEX Altimeter TEC	ionospheric total electron content below the LEO satellite	satellite observation	ionosphere		0		0
JASON Altimeter TEC	ionospheric total electron content below the LEO satellite	satellite observation	ionosphere		0		0
COSMIC	ionospheric total electron contentthrough LEO satellite occultation	satellite observation	ionosphere		0		0
DMSP	ionospheric plasma density, temperature, auroral particles	satellite observation	ionosphere		0	0	0
C/NOFS	ionospheric plasma density, temperature, E, B	satellite observation	ionosphere		0		0
DSX	radiation belt plasma, E, B	satellite observation (future)	radiation belts		0	0	0
ERG	radiation belt plasma, E, B	satellite observation (future)	radiation belts		0	0	0
RESONANCE	radiation belt plasma, E, B	satellite observation (future)	radiation belts		0	0	

# Examples of VarSITI-related database (ground-based observations)

database/mission name	description	type	region	SEE	ISEST	SPeCI MEN	ROSMI C
SIDC	Sunspot number time series, solar butterfly diagram	ground observation	sun and heliosphere	0			0
Royal Observatory Greenwich	Sunspot are time series, solar butterfly diagram	ground observation	sun and heliosphere	0			0
CALLISTO	solar radio bursts	ground observation	sun and heliosphere	0	0	0	
SEVAN	cosmic rays	ground observation	sun and heliosphere		0	0	
MAGDAS	magnetic field	ground observation	magnetosphere and ionosphere		0	0	
CARISMA magnetometers	magnetic field	ground observation	magnetosphere and ionosphere			0	
SGO magnetometers	magnetic field	ground observation	magnetosphere and ionosphere			0	
SuperMAG	magnetic field	ground observation	magnetosphere and ionosphere			0	
INTERMAGNET	magnetic field	ground observation	magnetosphere and ionosphere		0	0	
SAMBA-AMBER Magnetometers Data Center	magnetic field	ground observation	magnetosphere and ionosphere			0	
STEL magnetometer data	magnetic field	ground observation	magnetosphere and ionosphere		0	0	
VELOX	VLF/ELF emission	ground observation	ionosphere			0	
ABOVE	VLF/ELF emission	ground observation	ionosphere			0	
STEL VLF/ELF data	VLF/ELF emission	ground observation	ionosphere			0	
SID AWESOME	VLF/ELF emission	ground observation	magnetosphere and ionosphere		0	0	
Automatic Whistler Detector and Analyzer network	plasmaspheric density from whistlers	ground observation	ionosphere			0	
Geomagnetic indices	AE, Kp, Ap, Dst, SymH, etc.	ground observation	ionosphere	0	0	0	0
AARDDVARK	Narrowband VLF observations of radiation belt losses through precipitation	ground observation	ionosphere			0	
GLORIA	riometer absorption	ground observation	ionosphere			0	
Canadian riometers	riometer absorption	ground observation	ionosphere			0	
SGO riometers	riometer absorption	ground observation	ionosphere			0	
SOPAC GPS RINEX Database	ionospheric total electron content	ground observation	ionosphere		0		0
NASA GPS RINEX Database	ionospheric total electron content	ground observation	ionosphere		0		0
South Africa GPS RINEX Database	ionospheric total electron content	ground observation	ionosphere		0		0
UNAVCO GPS RINEX Database	ionospheric total electron content	ground observation	ionosphere		0		0
Position of GPS satellites in X,Y,Z Cord.	GPS position data	ground observation	ionosphere		0		0
NASA's GNSS satellite biases	GNSS satellite biases	ground observation	ionosphere		0		0
OMTI	airglow imagers, Fabry-Perot interferometers, photometers	ground observation	ionosphere, thermosphere, and mesosphere		0	0	0

# database needs for VarSITI

- **Quality assurance:** The data should be reliable for long-term trend analysis
- **Interdisciplinarity:** The data should be accessible and usable for scientists in the neighbouring field. → QL plots and visualization tools are essentially needed.

# WDS Goals

- Enable universal and equitable access to **quality-assured** scientific data, data services, products and information
- Ensure **long term** data stewardship
- Foster compliance to agreed-upon **data standards and conventions**
- Provide **mechanisms to facilitate and improve access** to data and data products

# SCOSTEP-related WDS

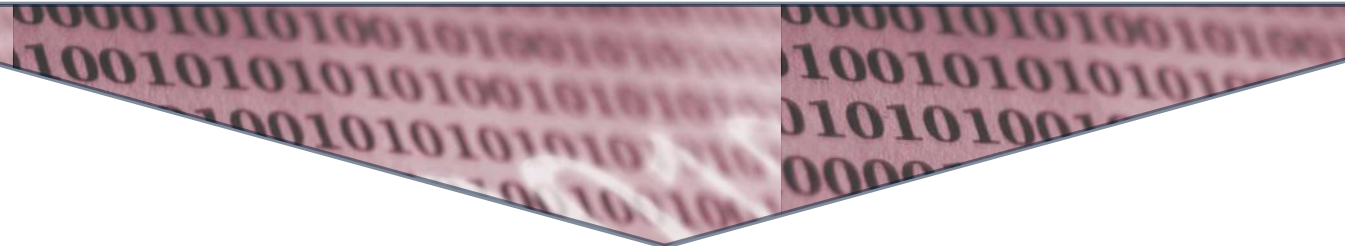
## Members



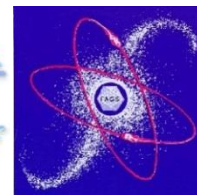
1	DKRZ- WDC Climate
2	WDC - Meteorology, Asheville
3	Centre de Donnees astronomiques de Strasbourg (CDS)
4	WDC - Rockets, Satellites and Earth Rotation
5	Australian Antarctic Data Centre
6	Chinese Astronomical Data Center
7	WDC - Solar-Terrestrial Physics, Moscow
8	WDC - Sunspot Index and Long-term Solar Observations (SILSO)
9	WDC - Remote Sensing of the Atmosphere
10	WDC - Geomagnetism, Copenhagen
11	World Data Services for Geophysics (NCEI/NGDC)
12	International Service of Geomagnetic Indices
13	WDC - Geomagnetism, Edinburgh
14	WDC - Meteorology, Obninsk
15	WDC - Solar Activity / BASS2000

16	WDC - Geomagnetism, Kyoto
17	Atmospheric Science Data Center (Distributed Active Archive Center)
18	WDC - Ionosphere and Space Weather
19	Ukrainian Geospatial Data Center
20	Paleoclimatology Branch, NOAA's National Climatic Data Center
21	Goddard Earth Sciences Data and Information Services Center (GES DISC)
22	Chinese Space Science Data Center
23	Italian Centre for Astronomical Archive - IA2
24	WDC - Geomagnetism, Mumbai
25	Canadian Astronomy Data Centre/ Canadian Virtual Observatory
26	Alaska Satellite Facility
27	Environment Climate Data Sweden
28	International Virtual Observatory Alliance (IVOA)
29	International Space Environment Service (ISES)
30	INTERMAGNET

# International Geophysical Year 1958–59



ICSU WDCs



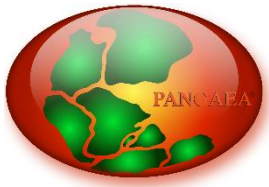
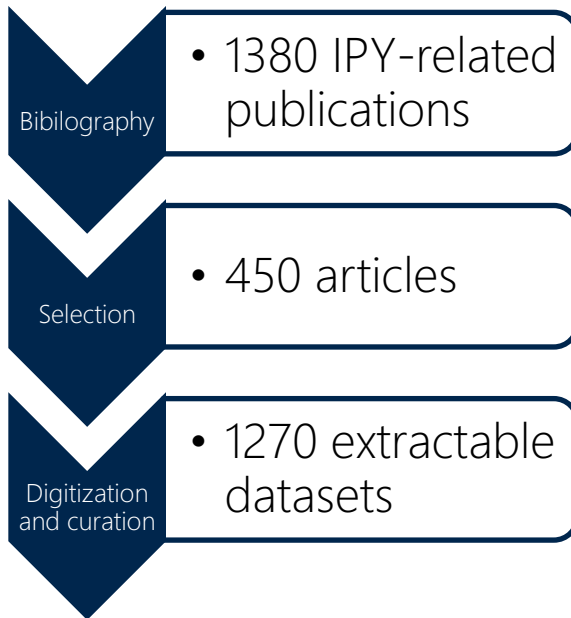
FAGS



# International Polar Year 2007–08



# IPY data legacy fail!



Earth Syst. Sci. Data, 7, 239–244, 2015  
www.earth-syst-sci-data.net/7/239/2015/  
doi:10.5194/essd-7-239-2015  
© Author(s) 2015. CC Attribution 3.0 License.



Open Access  
Earth System  
Science  
Data

## The IPY 2007–2008 data legacy – creating open data from IPY publications

A. Driemel<sup>1</sup>, H. Grobe<sup>1</sup>, M. Diepenbroek<sup>2</sup>, H. Grüttemeier<sup>3</sup>, S. Schumacher<sup>1</sup>, and R. Sieger<sup>1</sup>

<sup>1</sup>Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany

<sup>2</sup>Marum – Center for Marine Environmental Sciences, Bremen, Germany

<sup>3</sup>Institut de l'information scientifique et technique, Centre National de la Recherche Scientifique, Vandœuvre-lès-Nancy, France

*Correspondence to:* H. Grobe (hannes.grobe@awi.de)

Received: 21 May 2015 – Published in Earth Syst. Sci. Data Discuss.: 22 June 2015

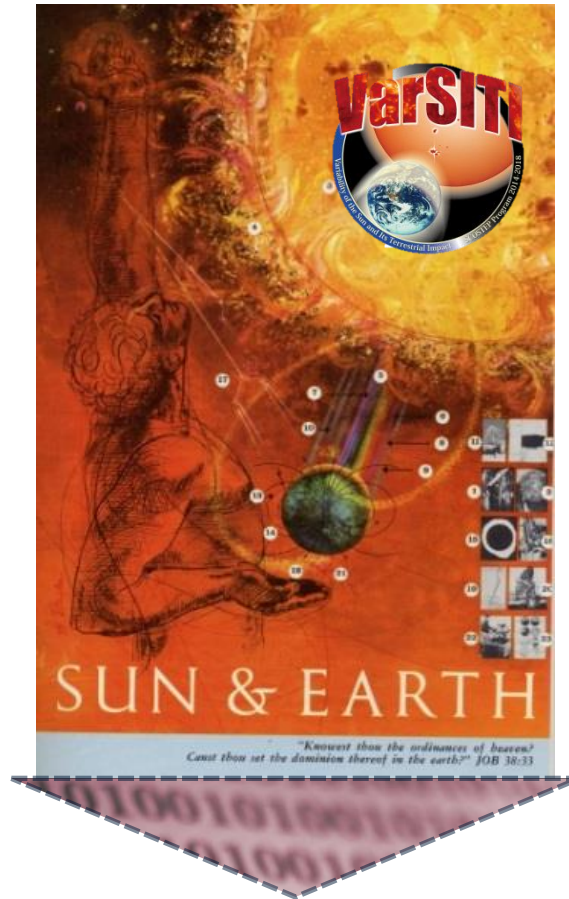
Revised: 26 August 2015 – Accepted: 27 August 2015 – Published: 8 September 2015

**Abstract.** The International Polar Year (IPY) 2007–2008 was a synchronized effort to simultaneously collect data from polar regions. Being the fourth in a series of IPYs, the demand for interdisciplinarity and new data products was high. However, despite all the research done on land, people, ocean, ice and atmosphere and the large amount of data collected, no central archive or portal was created for IPY data. In order to improve the availability and visibility of IPY data, a concerted effort between PANGAEA – Data Publisher for Earth and Environmental Science, the International Council for Science (ICSU) World Data System (WDS), and the International Council for Scientific and Technical Information (ICSTI) was undertaken to extract data resulting from IPY publications for long-term preservation.

Overall, 1380 IPY-related references were collected. Of these, only 450 contained accessible data. All data were extracted, quality checked, annotated with metadata and uploaded to PANGAEA. The 450 articles dealt with a multitude of IPY topics – plankton biomass, water chemistry, ice thickness, whale sightings, Inuit health, alien species introductions by travellers or tundra biomass change, to mention just a few. Both the Arctic and the Antarctic were investigated in the articles, and all realms (land, people, ocean, ice and atmosphere) and a wide range of countries were covered. The data compilation can now be found with the identifier doi:10.1594/PANGAEA.150150, and individual parts can be searched using the PANGAEA search engine ([www.pangaea.de](http://www.pangaea.de)) and adding “+project:ipy”. With this effort, we hope to improve the visibility, accessibility and long-term storage of IPY data for future research and new data products.



# SCOSTEP-VarSITI



# Questions to the panelists:

- 1. Data needs:** what other databases should be used or built to encourage sun-earth interdisciplinary research?
- 2. Data access:** what efforts are required to make VarSITI generated/needed data open?
- 3. Data quality:** what efforts are required to make VarSITI generated data reusable?
  - Unify data and metadata formats?
- 4. Data legacy:** where will VarSITI data be preserved?
  - How WDS should treat VarSITI project observation data satisfying/not satisfying the WDS criteria?