

# The VO Scenario for Solar and Solar-Terrestrial Physics

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# Outline of the Talk

- The Electronic Geophysical Year eGY
- The S-T Physical Framework
- The S-T Data Framework
- Data Management Resources in S-T Physics
- Conclusions

# eGY Electronic Geophysical Year

## <http://www.egy.org>



# eGY Aims

**The Electronic Geophysical Year**  
**2007-2008**

Fifty years after the International Geophysical Year, 1957-1958

**An Earth and Space Science Information Commons Initiative:  
International Co-operation for Open Access to Data**

**Upcoming Events**

- eGY News: November 2007
- eGY News: October 2007
- eGY News: July 2007
- Nature Article
- New Declaration Endorsements

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**Important Items**

- eGY Demonstration Projects
- eGY launch videos
- Films of the IGY
- eGY Declaration
- Celimontana Declaration
- eGY-Africa

Education  
Newsroom  
People  
Resources  
Working Groups  
Links  
Contact  
Search

planetearth  
Earth Sciences for Society

# eGY Declaration



## Declaration for a Geoscience Information Commons

“Knowledge is the common wealth of humanity” <sup>1</sup>

### *Preamble*

The Electronic Geophysical Year (eGY) joins with the International Council for Science, the World Summit on the Information Society, and many other bodies in recognizing that knowledge is the common wealth of humanity. We have a shared responsibility to create and implement strategies to realize the full potential of digital information for present and future generations. In the 21<sup>st</sup> century and beyond, access to digital information and new technologies for information integration and knowledge discovery will influence the free and productive development of societies around the world. Providing ready and open access to the vast and growing collections of cross-disciplinary digital information is the key to understanding and responding to complex Earth system phenomena that influence human survival. In the geosciences, as elsewhere, the issues of concern are as follows.

# eGY Declaration Items Specific to Science and Education

## *Article 6: Common standards and cooperation*

Standards for interoperability should be identified, created, and implemented through international collaboration.

## *Article 7: Capability building*

Communities with advanced information technology and communications capabilities should contribute to developing such capabilities elsewhere to reduce the digital divide.

## *Article 8: Education and public outreach*

Students, scientists, decision-makers, and the public should be informed about and be enabled to contribute to our understanding and management of Earth system phenomena that impact human survival.

# eGY Organization

The screenshot shows the website for 'The Electronic Geophysical Year 2007-2008'. The page features a dark blue header with a red 'e' logo and a navigation menu on the left with links for Home, About, Education, Newsroom, People, Resources, Working Group, Links, Contact, and Search. A central white box contains the following information:

**Secretariat**

- Dan Baker, Executive Director
- Bill Peterson, Secretary
- Marissa Rusinek, Communications Manager
- Cheryl Levey, Website Assistant
- Emily CoBabe-Ammann, Media Relations

**International Committee**

- Charlie Barton, Chair
- Guo Huadong, Co-Chair
- Dan Baker, ED ex. officio
- Ferris Webster, WDC Panel
- Alexei Gvishiani/Jean Bonnin, CODATA
- Ed de Mulder, IUGS and Planet Earth
- David Clark, NOAA/NGDC, WGISS
- Mark Parsons, IPY Liaison
- Barbara Thompson, IHY Liaison
- Yohsuke Kamide, CAWSES Liaison
- Peter Fox, AGU (ESSI)/EGU Liaison
- Ralph Baird, SEG Liaison
- Eliot Christian, GEOSS and IEOS Liaison

Below the committee list, there are sections for 'Australia' (listing Charlie Barton and Lesley Wyborn) and 'Canada'.

# eGY National Committees and Representatives

The screenshot shows a website interface with a sidebar on the left containing 'Working Groups', 'Links', 'Contact', and 'Search'. The main content area is titled 'National Committees and Representatives' and lists the following:

- Ed de Mulder, IUGS and Planet Earth
- David Clark, NOAA/NGDC, WGISS
- Mark Parsons, IAPY Liaison

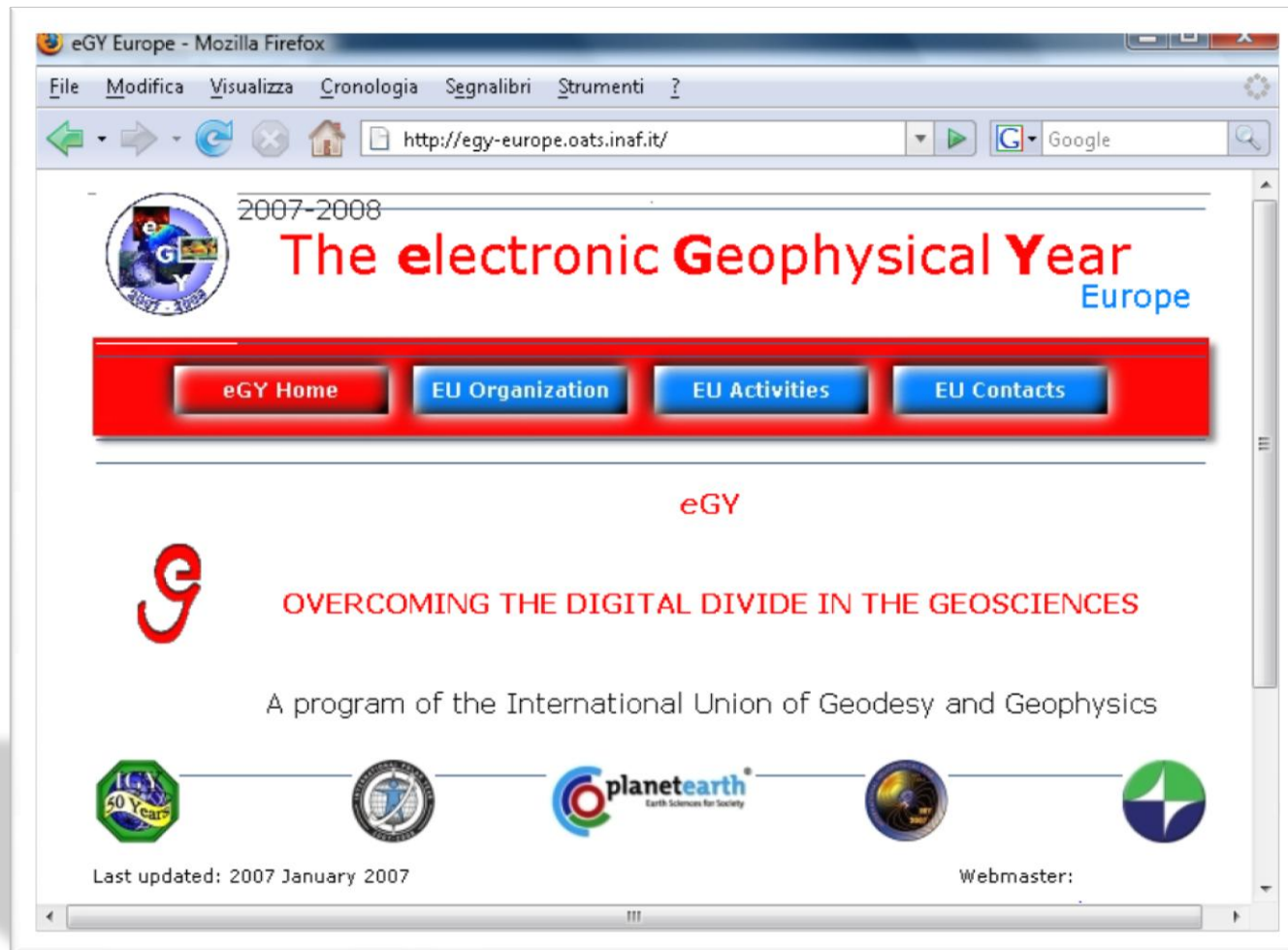
## National Committees and Representatives

- Africa
  - Jean Pierre Tchouankoue
  - Gilbert L. Rochon
- Australia
  - Charlie Barton
  - Lesley Wyborn
- Canada
  - John Manuel
  - John Broome
  - Bill Liu
- Chinese eGY Committee
  - Liu Chang, Chair
  - Liao Shunbao, Chair
  - Yan Baoping
  - Guo Huadong
- European eGY Committee
  - Mauro Messerotti, Chair
  - Bernd Ritschel, Chair
- German eGY Committee



# eGY-Europe

## <http://egy-europe.oats.inaf.it>



# eGY Working Groups

## Working Groups

### **Best Practices**

- Eric Kihn, Chair
- Mark Parsons
- Jeff Love
- Eliot Christian
- Herb Kroehl

### **Data Integration and Knowledge Discovery**

- Paul Berkman, Chair
- Mark Parsons
- David Clark
- Herb Kroehl
- Eric Kihn
- Joe Davila

### **Data Rescue and Preservation**

- Jeff Love, Chair

### **Education and Public Outreach**

- Emily Cobabe-Ammann, Chair

### **Virtual Observatories**

- Peter Fox, Chair
- Aaron Roberts, GSFC
- Steve Nerem, NCAR
- Tomoko Matsuo, NCAR

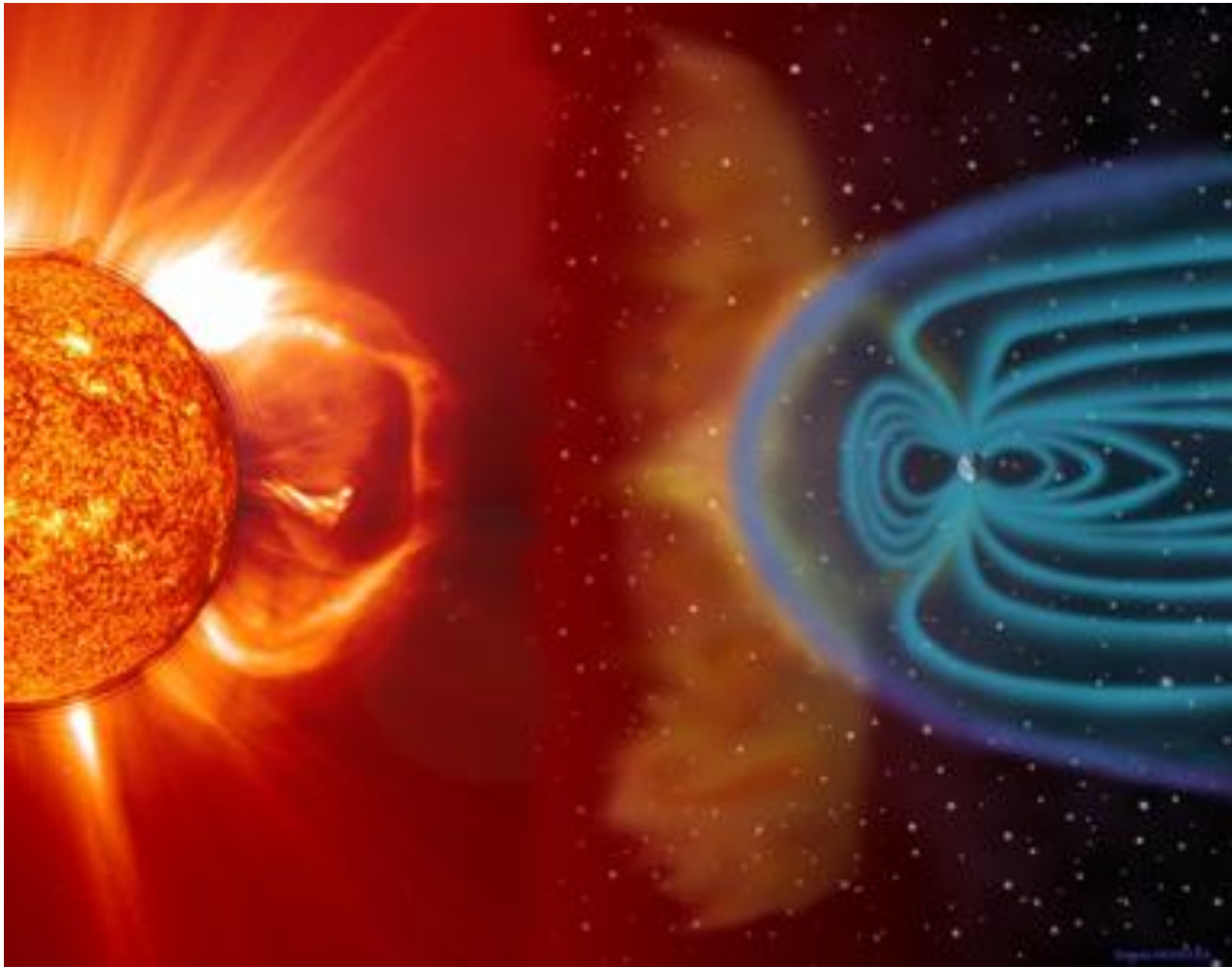
### **Virtual Research Environments**

- Joseph Hardin

- IAC: Charlie Barton
- IAHS: Arthur Askew, Mary Hill

Nerem

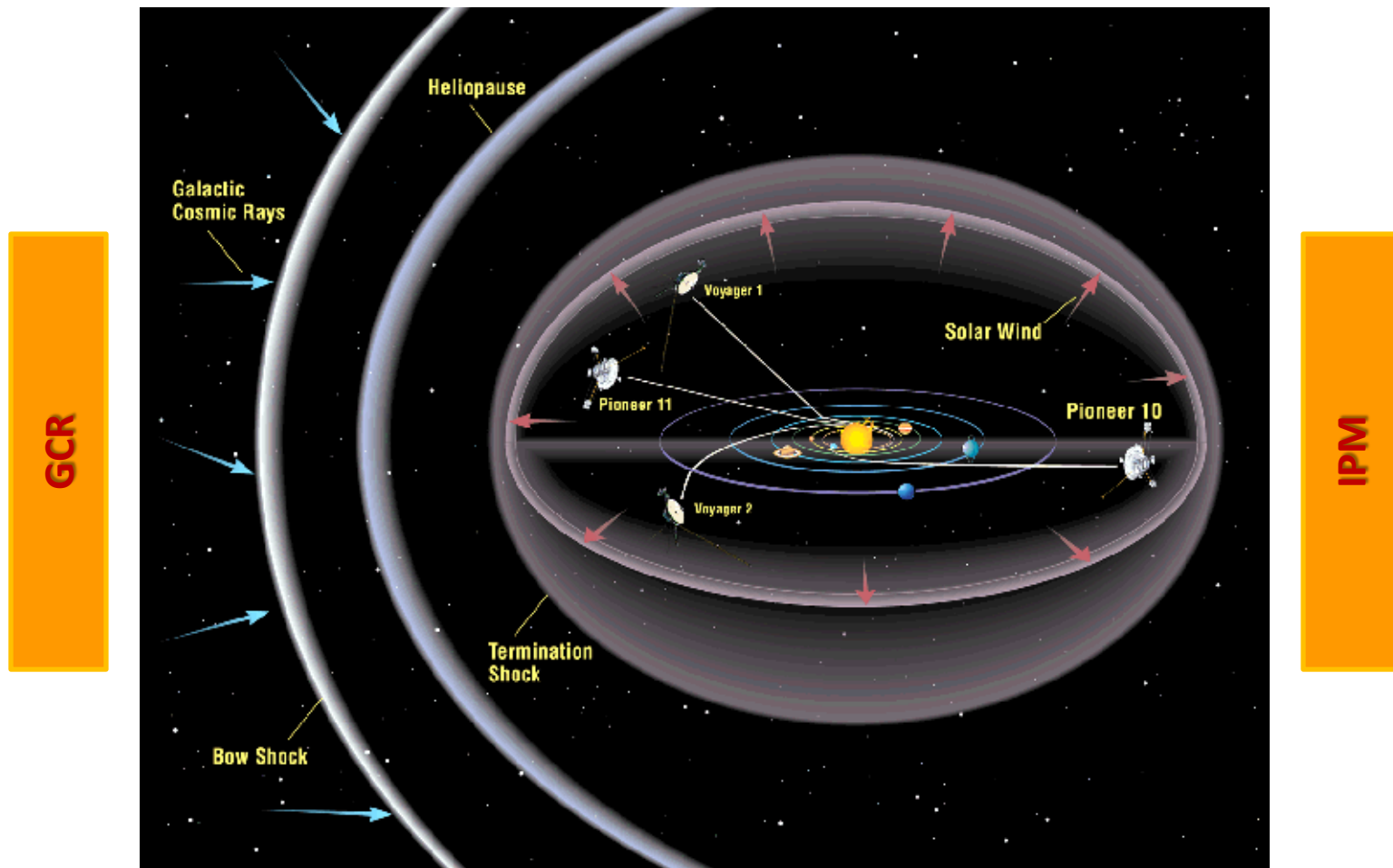
# The S-T Physical Framework: The Sun-Earth Environment



# Synopsis of S-T Physical Domains

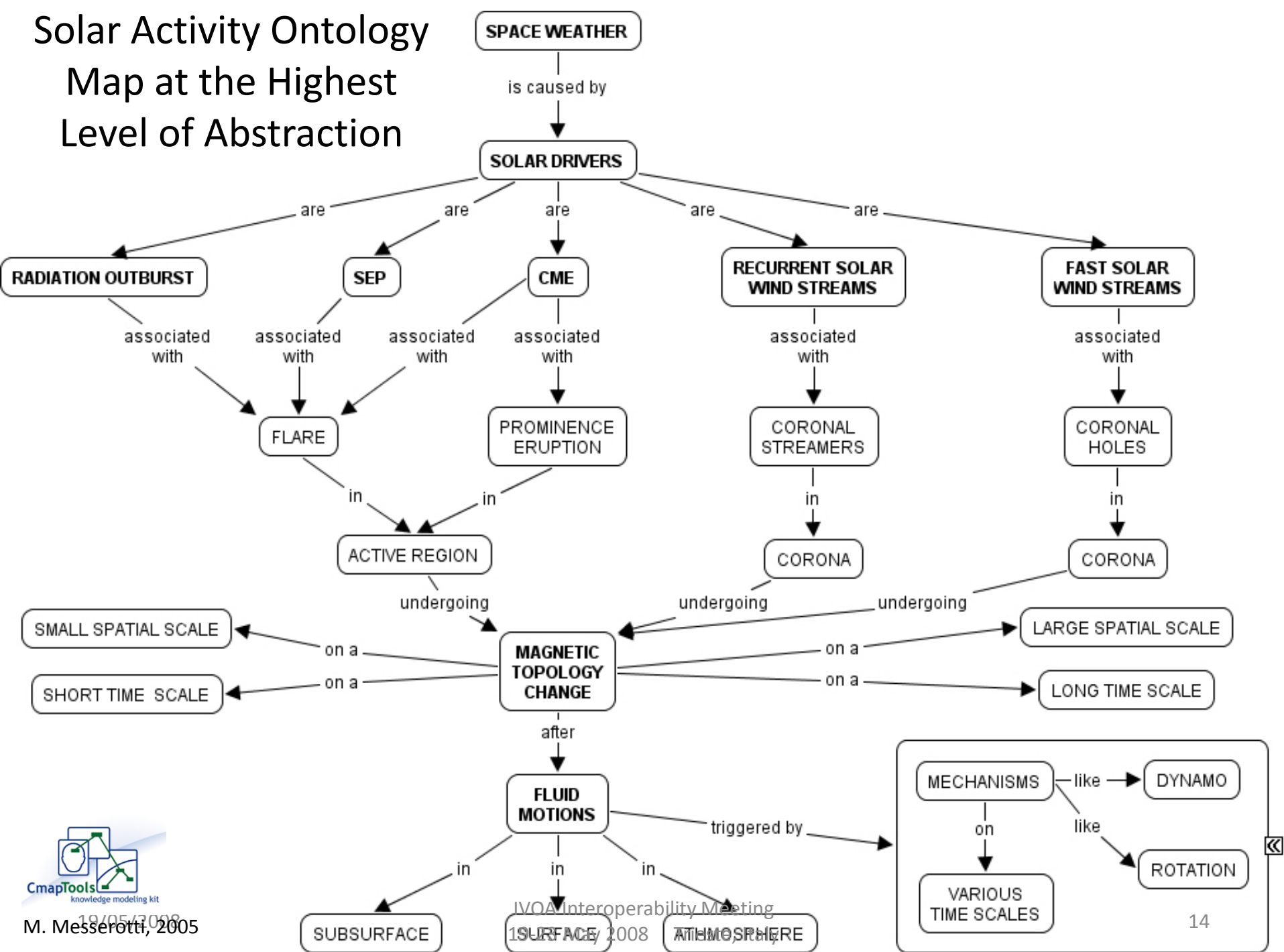


# The Extended S-T Physical Framework: The Heliospheric Environment

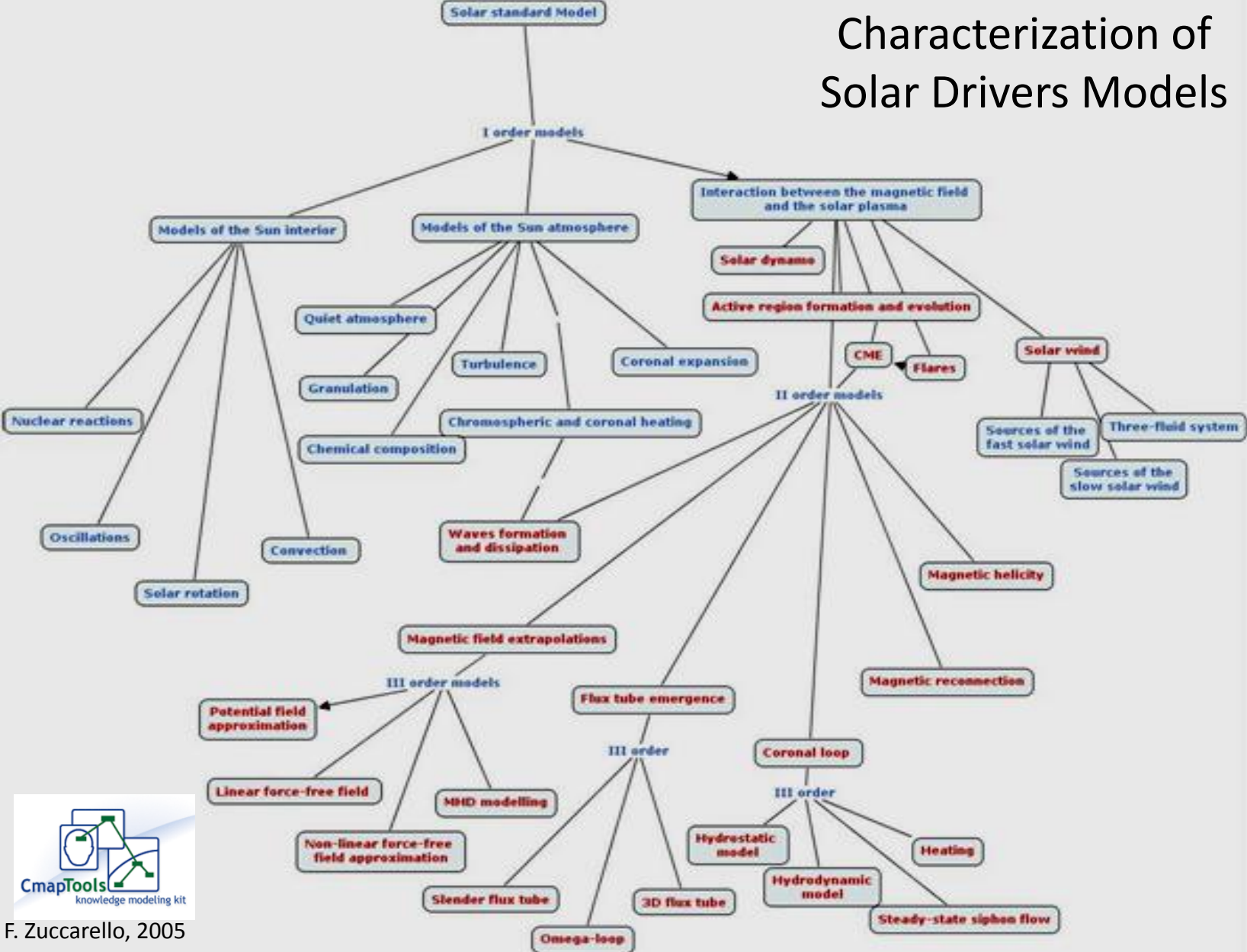


# Solar Activity Ontology

## Map at the Highest Level of Abstraction



# Characterization of Solar Drivers Models



F. Zuccarello, 2005

# S-T Observations and Data Typology

- Multi-domain ground- & space-based observations produce:
  - Time series of multi-wavelength images
  - Time series of multi-wavelength light curves
  - Time series of multi-energy particle counts
  - Time series of magnetograms
  - Time series of ionograms
- High space, energy, time resolution
- Near-real-time



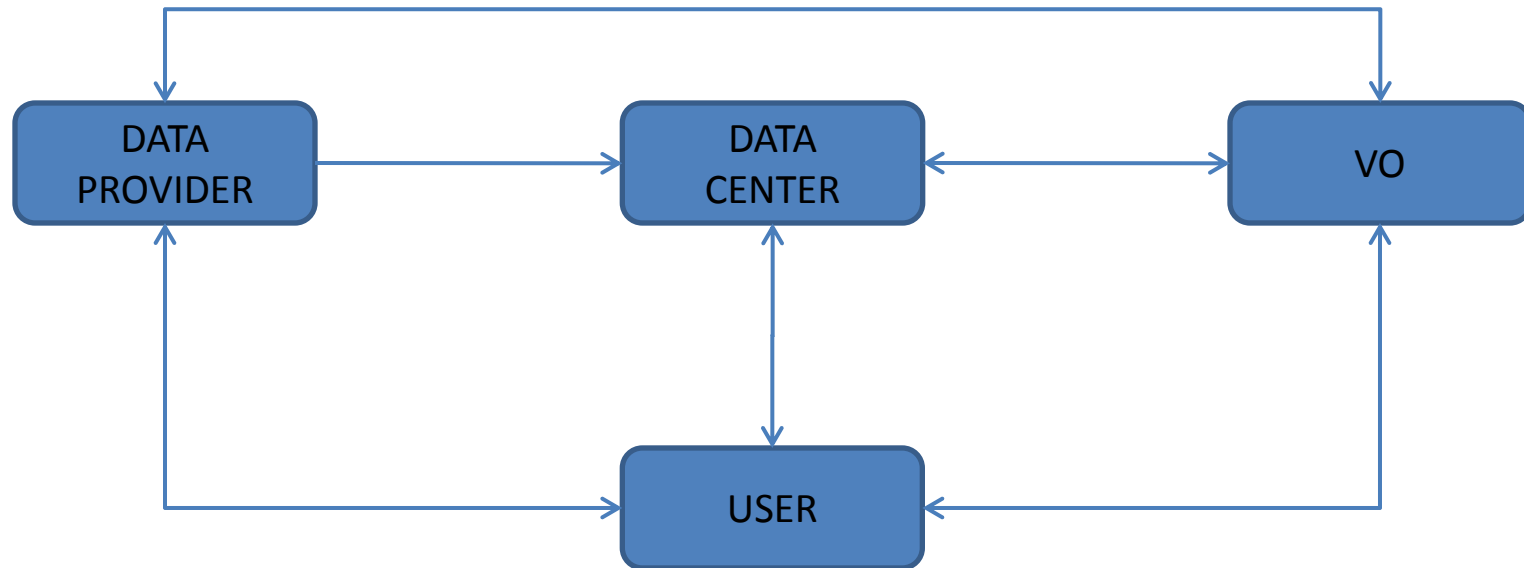
# S-T Modelling Requirements

- Near-real-time data availability
- Complex multi-domain data access and search via a unified tool
- Complex multi-domain data visualization and analysis via a unified tool
- Domain model running via a unified tool
- VOs are the proper tools to achieve the above goals

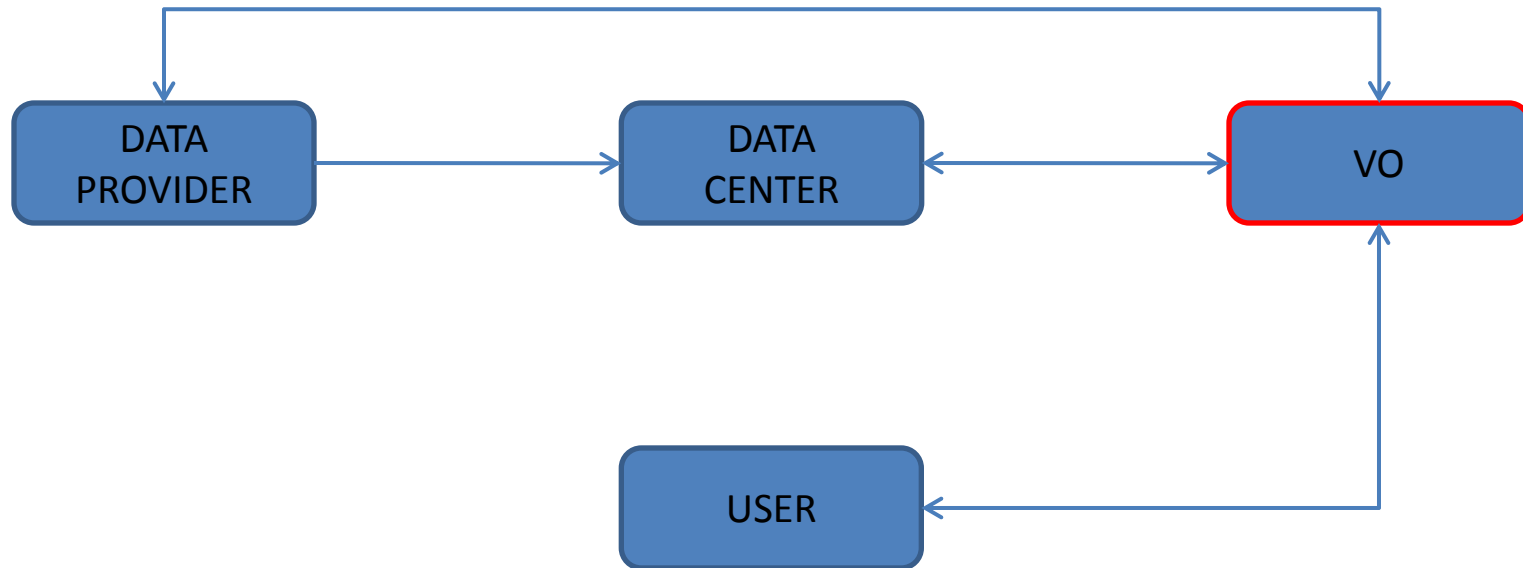
# S-T Data Management: The User's Perspective

- Data Providers Search, Vis., Limited Proc.
- World Data Centers Search, Vis., Limited Proc.
- Monitoring Centers Search, Vis., Limited Proc.
- Modeling Centers Extended Vis. and Proc.
- Virtual Observatories All features

# The Typical Information Flow



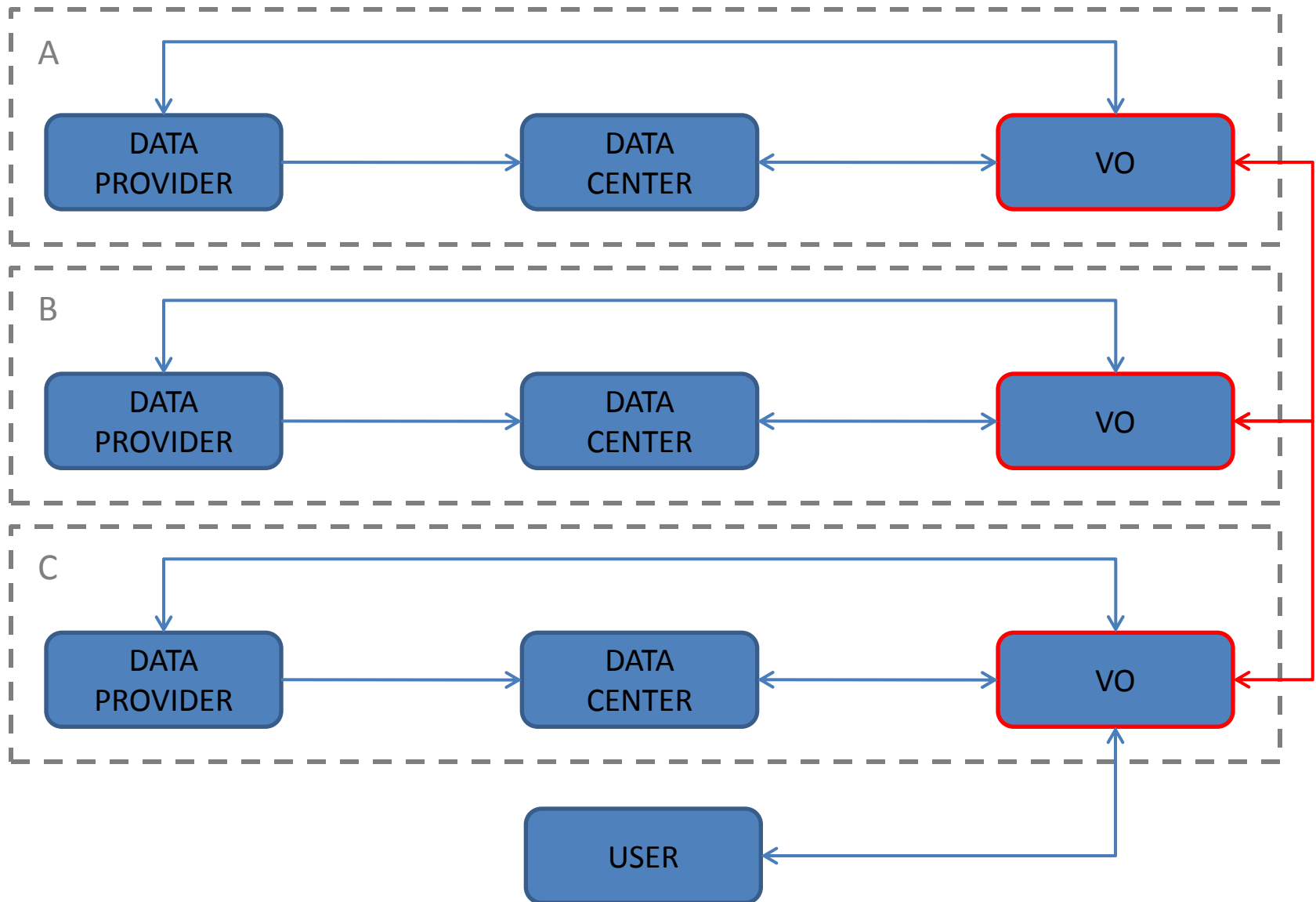
# The Optimal Information Flow



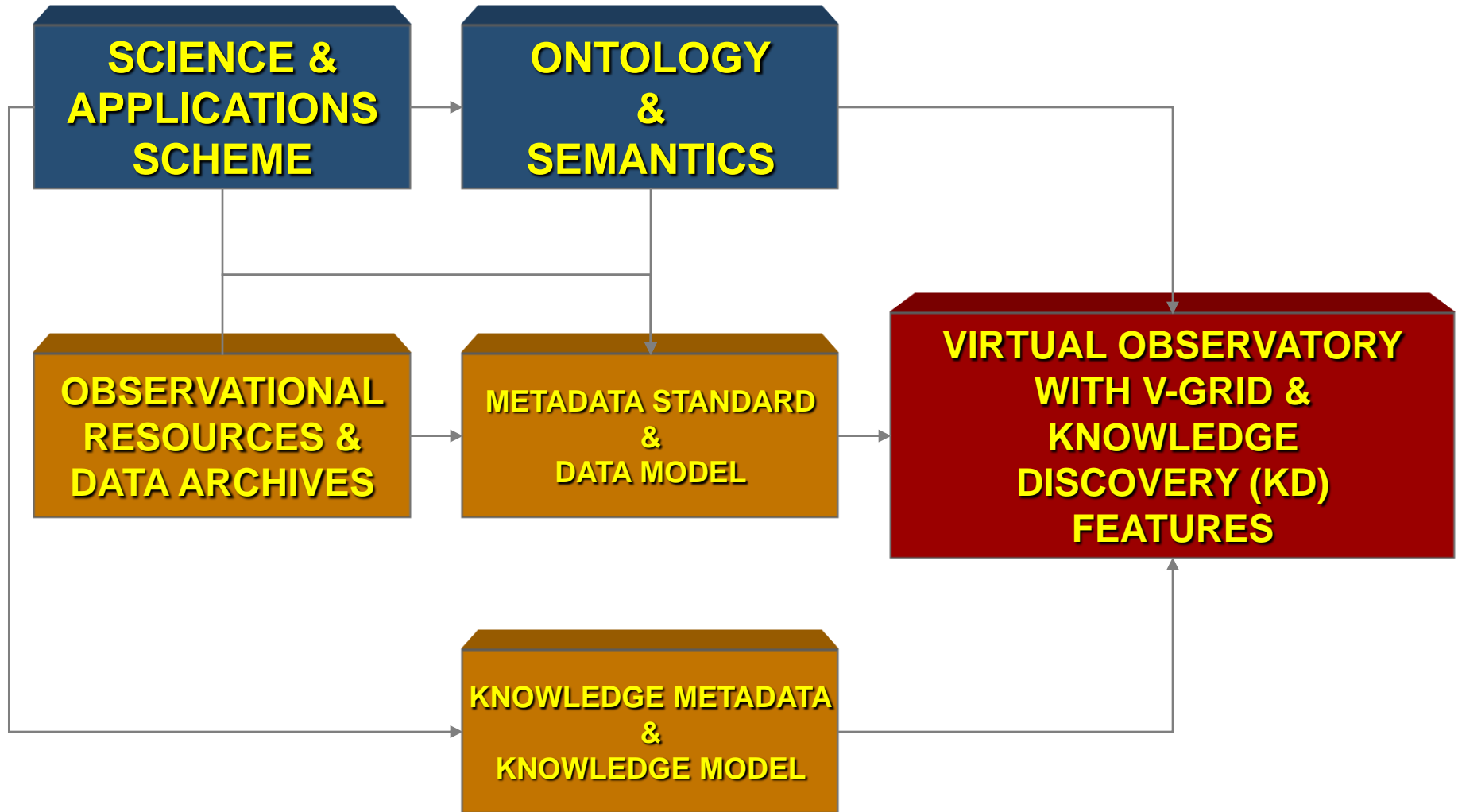
# The VO Infrastructure

- THE VO INFRASTRUCTURE CAN ACT AS A LOW TO HIGH LEVEL DATA SYSTEM INTERFACE BY OVERCOMING THE STANDARDIZATION AND THE INTEROPERABILITY ISSUES
- THE VO INTRINSIC INTERLINKING CAN PROVIDE USER-TRANSPARENT MULTI-DOMAIN ACCESS

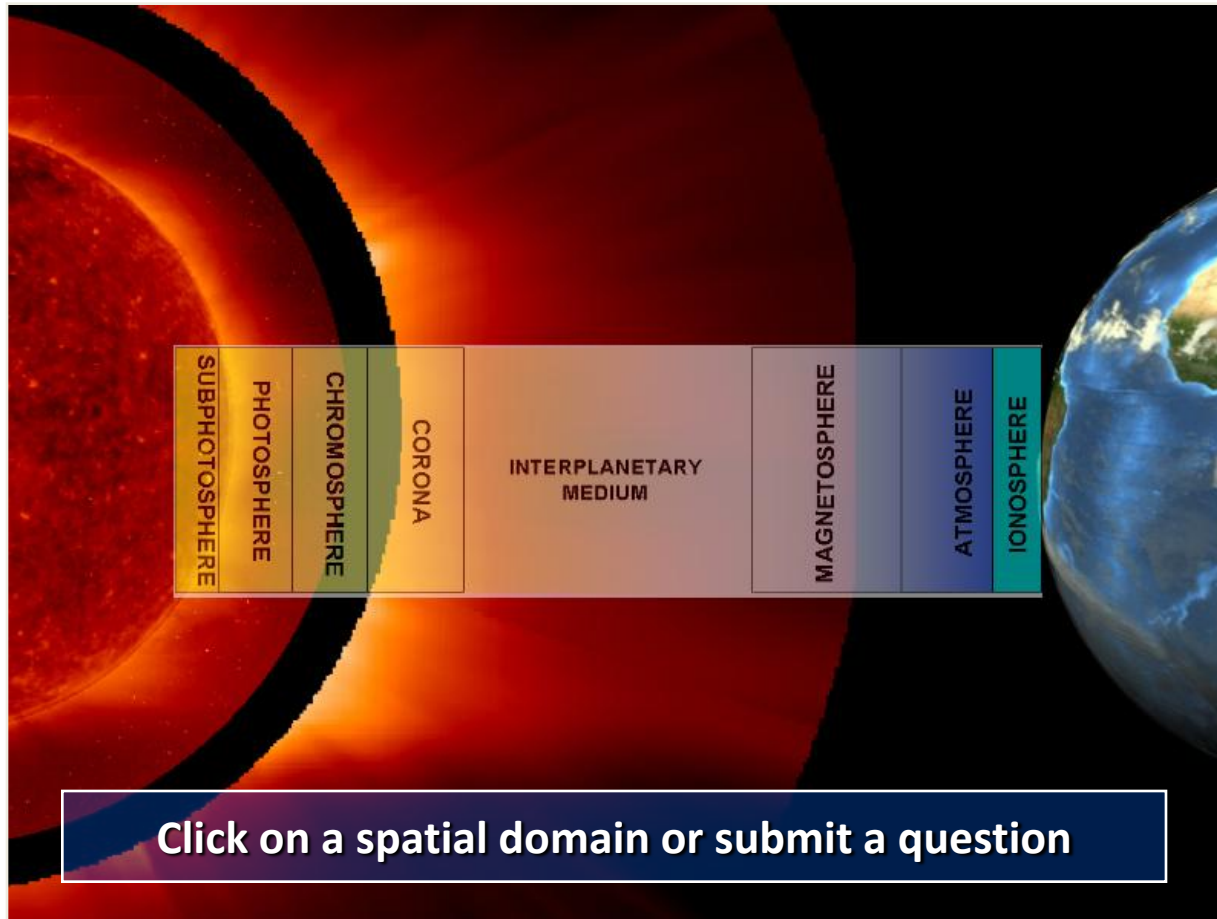
# User-Transparent Multi-Domain Access



# The Ideal S-T VO: The Semantic VO



# An Advanced Intelligent GUI



## A MULTI-DOMAIN SPATIAL GUI

- **AJAX Asynchronous Javascript & XML**
  - XHTML + CSS for visuals
  - DOM Document Object Model

## A NATURAL LANGUAGE INTERFACE

- **NL Parser**
- **Query Builder**
- **Query Processor**



# Advanced S-T Data Centers

Denomination	Acronym	URL	Reference	Type	Domain
Cluster Science Data System	CSDS	<a href="http://sci2.estec.esa.nl/cluster/csds/csds.html">http://sci2.estec.esa.nl/cluster/csds/csds.html</a>	ESA	DR	S-P
Cluster Active Archive	CAA	<a href="http://caa.estec.esa.int/caa/home.xml">http://caa.estec.esa.int/caa/home.xml</a>	ESA	DR	S-P
SOHO Long.Term Solar Archive	SOLAR	<a href="http://solar.to.astro.it/">http://solar.to.astro.it/</a>	INAF	DR	S-T
Integrated and Distributed Information System	IDIS	<a href="http://www.europlanet-idis.fi/">http://www.europlanet-idis.fi/</a>	EuroPlanet	DR	S-P
Centre de Données de Physique des Plasmas	CDPP	<a href="http://cdpp.cesr.fr/">http://cdpp.cesr.fr/</a>	CNES	DR	SS-P
Multi Experiment Data and Operation Centre	MEDOC	<a href="http://idc-solar.ias.u-psud.fr/index.jsp">http://idc-solar.ias.u-psud.fr/index.jsp</a>	IAS	DR	S-T
Planetary Science Archive	PSA	<a href="http://www.rssd.esa.int/index.php?project=PSA">http://www.rssd.esa.int/index.php?project=PSA</a>	ESA	DR	SS-P

S-P      Space Physics  
 S-T      Solar-Terrestrial Physics  
 SS-P     Solar System Physics

# Advanced S-T Data & Service Centers

Denomination	Acronym	URL	Reference	Type	Domain
The Space Environment Information System	SPENVIS	<a href="http://www.spenvis.oma.be/">http://www.spenvis.oma.be/</a>	ESA	DR+SRV	S-T
Space Weather European Network	SWENET	<a href="http://esa-spaceweather.net/swenet/index.html">http://esa-spaceweather.net/swenet/index.html</a>	ESA	DR+SRV	S-T
World Data Centre for Solar-Terrestrial Physics	WDC-C	<a href="http://www.ukssdc.ac.uk/wdcc1/wdc_menu.html">http://www.ukssdc.ac.uk/wdcc1/wdc_menu.html</a>	UK	DR+SRV	S-T
BAse de données Solaire Sol 2000	BASS2000	<a href="http://bass2000.bagn.obs-mip.fr/pageac_ang.htm">http://bass2000.bagn.obs-mip.fr/pageac_ang.htm</a>	INSU	DR+SRV	SOL
Space Environment Center	SEC	<a href="http://sec.noaa.gov">http://sec.noaa.gov</a>	NOAA	DR-SRV	S-T

S-T      Solar-Terrestrial Physics  
 SOL      Solar Physics

# S-T Virtual Observatories

Denomination	Acronym	URL	Reference	Type	Domain
Virtual Solar Observatory	VSO	<a href="http://umbra.nascom.nasa.gov/vso/">http://umbra.nascom.nasa.gov/vso/</a>	NASA	VO	SOL
Virtual Space Physics Observatory	VSPO	<a href="http://vspo.gsfc.nasa.gov/">http://vspo.gsfc.nasa.gov/</a>	NASA	VO	S-P
Virtual Solar-Terrestrial Observatory	VSTO	<a href="http://vsto.hao.ucar.edu/">http://vsto.hao.ucar.edu/</a>	HAO	VO	S-T
Collaborative Sun-Earth Connector	CoSEC	<a href="http://cosec.lmsal.com/">http://cosec.lmsal.com/</a>	LMSAL	VO	S-T
European Grid of Solar Observations	EGSO	<a href="http://www.egso.org/">http://www.egso.org/</a>	EC FP5	VO	SOL
Space Physics Archive Search and Extract	SPASE	<a href="http://www.spase-group.org/">http://www.spase-group.org/</a>	CDPP	VO-PROT	
SOLar Archive NETwork	SOLARNET	<a href="http://solarnet.oato.inaf.it:8080/portal/">http://solarnet.oato.inaf.it:8080/portal/</a>	INAF	VO-BASIC	SOL
Astrogrid		<a href="http://www.astrogrid.org">http://www.astrogrid.org</a>	EC FP6	VO	ASTRO

S-P      Space Physics  
 S-T      Solar-Terrestrial Physics  
 SOL      Solar Physics  
 ASTRO      Astrophysics

# S-T VO Projects

Denomination	Acronym	URL	Reference	Type	Domain
Virtual HelioSpheric Observatory	VHO	<a href="http://vho.nasa.gov/">http://vho.nasa.gov/</a>	NASA	VO	H-P
Virtual Magnetospheric Observatory	VMO	<a href="http://vmo.nasa.gov/">http://vmo.nasa.gov/</a>	NASA	VO	M-P
Virtual Radiation Belt Observatory	VRBO	<a href="http://virbo.org/virbo/">http://virbo.org/virbo/</a>	NASA	VO	RB-P
Virtual Ionosphere-Thermosphere-Mesosphere Observatory	VITMO	<a href="http://vitmo.jhuapl.edu/">http://vitmo.jhuapl.edu/</a>	NASA	VO	ATM-P
Virtual Global Magnetic Observatory	VGMO	<a href="http://mist.nianet.org/">http://mist.nianet.org/</a>	Virginia Tech	VO	GEOMAG
Italian Virtual Observatory for Sun-Earth Connections	IVOSEC	<a href="http://ivosec.oats.inaf.it/">http://ivosec.oats.inaf.it/</a>	INAF	VO-PRJ	S-T
European Space Astronomy Centre	ESAC	<a href="http://www.esa.int/SPECIALS/ESAC/">http://www.esa.int/SPECIALS/ESAC/</a>	ESA	VO-TBD	SP-D

H-P Heliospheric Physics  
 M-P Magnetospheric Physics  
 RB-P Radiation Belt Physics  
 ATM-P Atmospheric Physics  
 GEOMAG Geomagnetic Field Physics  
 SP-D Space Data

# Conclusions

- The set of S-T VOs is ever increasing
- No coordination organization/group exists to date
- An effective coordination forum is desirable for:
  - Minimizing development efforts
  - Avoiding duplications
  - Defining common standards
  - Sharing tools
  - Ensuring interoperability
  - Exploiting multi-domain data search, visualization, analysis and modeling specific to STP
  - Embedding knowledge management and discovery



THANK YOU FOR YOUR ATTENTION