

Using the NASA Heliophysics Virtual Observatories (VxOs) to Distribute ISWI Instrument Data

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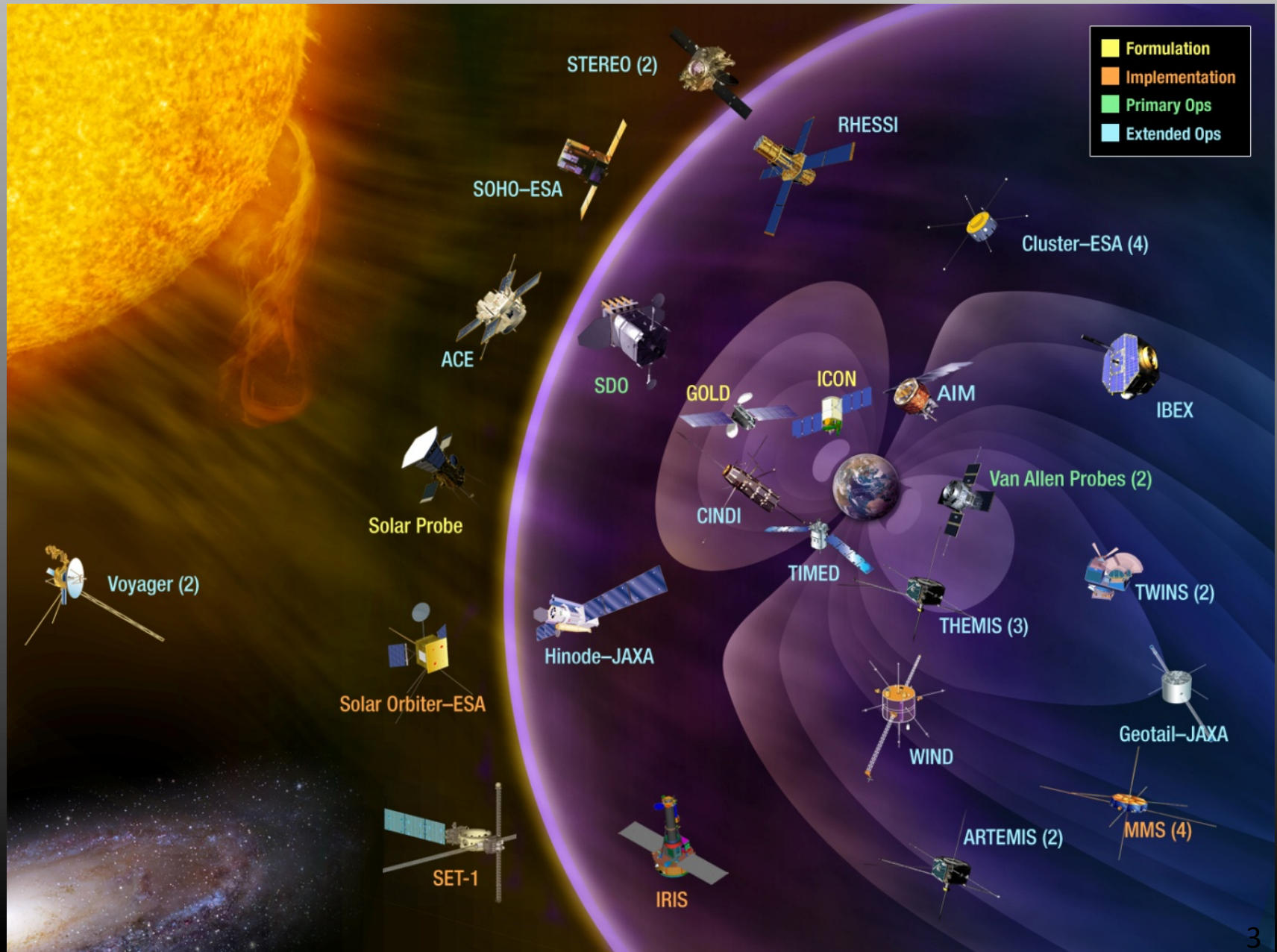
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Outline

- NASA Heliophysics Virtual Observatories (VxOs)
- Key VxO Supporting Technologies
- Data Access and Distribution by VxOs
- Summary

NASA's Heliophysics System Observatory



Heliophysics Virtual Observatories (VxOs)

- The NASA Heliophysics Virtual Observatories provide access to a variety of heliophysics discipline “x” data, metadata, and tools.
- Current VxOs includes
 - Virtual solar observatory, *VSO* <http://sdac.virtualsolar.org/>
 - Virtual heliospheric observatory, *VHO* <http://vho.nasa.gov>
 - Virtual energetic particle observatory, *VEPO* <http://vepo.gsfc.nasa.gov>
 - Virtual magnetospheric observatory, *VMO* <http://vmo.nasa.gov>
 - Virtual radiation belt observatory, *VirBO* <http://virbo.org>
 - Virtual ionosphere-thermosphere-mesosphere obs., *VITMO* <http://vitmo.jhuapl.edu/>
 - Virtual wave observatory, *VWO* <http://vwo.nasa.gov>
 - Virtual model repository, *VMR* <http://vmr.engin.umich.edu/>
- *VxOs are NOT* data centers, but are “middleware”/ interfaces for accessing *electronically* heliophysics discipline data stored in *distributed* archives.
- Keys to supporting remote access are application programming interfaces (*APIs*) and metadata standards.

Key VxO Supporting Technologies

- Application Programming Interface (*API*)
 - Standard routines/protocols for passing operations & data between computers through the Web
- Space Physics Archive Search and Extract (*SPASE*)

Space Physics Archive Search & Extract: *SPASE*

A Heliophysics community-based project to support the development of efficient Heliophysics data management & dissemination systems with:

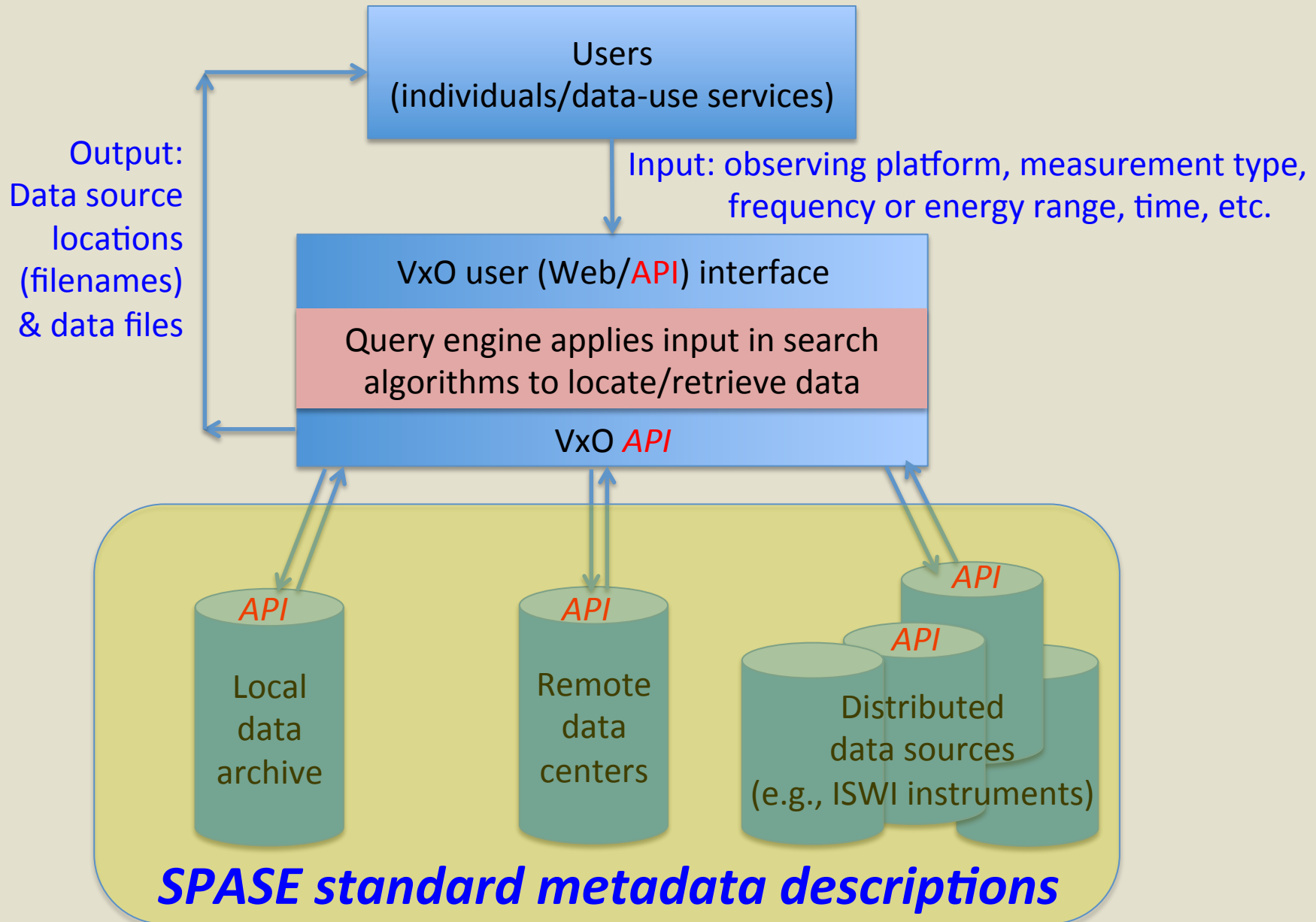
- A common metadata language , *i.e.* lingua Franca, for interoperability
 - A standard metadata model for data organization
 - A data dictionary for Heliophysics data terms
- Discipline-oriented data search and retrieval capability
- Tools and services to facilitate data sources to join the Heliophysics data environment
 - Standard description templates
 - Filename convention
 - Standards for time-series data under development

For information on *SPASE*, see <<http://www.spase-group.org>>

For *SPASE* Tutotials, see <<http://www.spase-group.org/school>>

SPASE - View of VxO Middleware

inside



Data Access and Distribution* by VxOs

Data need to be:

- Network-accessible via Web or API
 - ISWI instrument sites, or
 - Data archives (providing backups)
- Documented with up-to-date metadata
- Compatible with *SPASE* metadata model
 - “Design by convention” approach [<http://spase-group.org/docs>](http://spase-group.org/docs)
 - Standard Resource ID format: *unique path to data/descriptions for Resource Type*
spase://NameAuthority/ResourceType/Project/Observatory/InstrumentType/...
(e.g., spase://VMO/NumericalData/IGPPLANL/CRT/Magnetometer/...)
 - Plain text descriptions stored in XML documents
 [<http://www.spase-group.org/docs/conventions/Text-Normalization-and-Mark-up-v1.pdf>](http://www.spase-group.org/docs/conventions/Text-Normalization-and-Mark-up-v1.pdf)
- Registered with appropriate discipline VxOs
- Maintained by instrument teams

* Open data access assumed

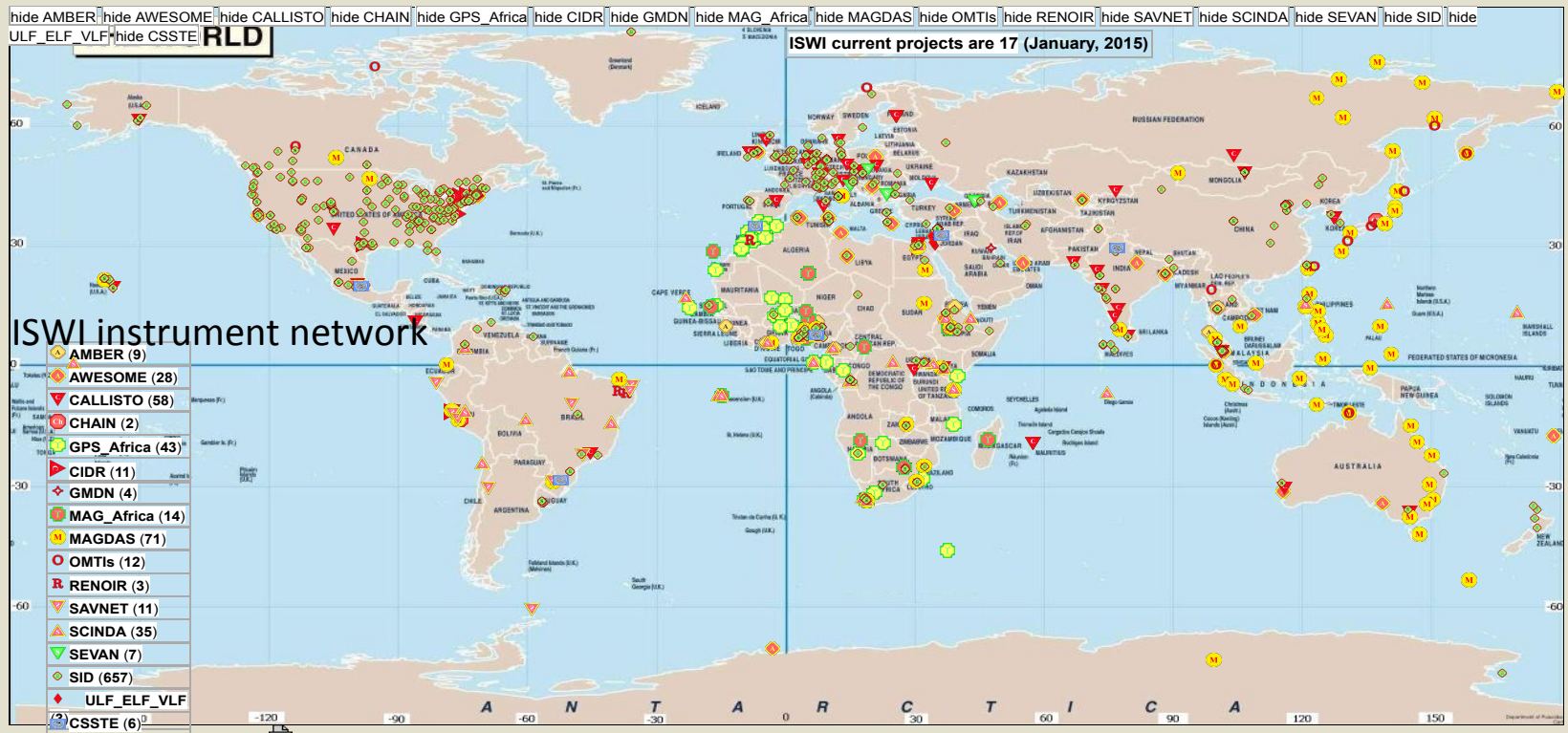
ISWI Instruments*	Measurement Types	VxOs
AMBER	magnetic field, wave	VMO, VWO
AWESOME-SID	ELF/VLF wave	VWO
CALLISTO	radio wave	VSO, VWO
CHAIN	solar imaging	VSO
CIDR	UHF/VHF radio wave	VWO
GIFDS	VLF wave	VWO
GMDN	energetic particles	VEPO
LISN	magnetic field, TEC, radio sounding	VITMO, VWO, VMO
GPS (AMMA, AGREES)	TEC, wave	VITMO, VWO
MAGDAS	magnetic field, wave	VMO, VWO
OMITS	imaging	VITMO
RENOIR	imaging, TEC	VITMO
SAVNET	VLF wave	VWO
SCINDA	drift, UHF wave	VITMO, VWO
SEVAN	energetic particles	VEPO
SOFIE	VLF wave	VWO
ULF/ELF/VLF Network	wave	VWO

VxOs with
SPASE:
inside
VWO, VHO,
VMO, VEPO

*As of April 30, 2014 <http://newserver.stil.bas.bg/ISWI/Projects/Instrument_Area.html>

Summary

- Supported by standards, VxOs can search and locate data from distributed sources.
- VxOs can help with access and distribution of ISWI data.
- VxOs can also promote use of ISWI data along with other heliophysics data sets.



Abstract

The NASA Heliophysics virtual observatories (VxOs) are discipline (x)-oriented web portals designed for accessing heliophysics data and information served by distributed data archives or data providers. The operational model of heliophysics virtual observatories can thus be utilized to enable globally distributed users to search and access the data taken by various ISWI instruments. This presentation will introduce the concept of virtual observatories and describe how the VxO infrastructure can facilitate rapid access of ISWI data and comparison of the data to existing data sources, including space mission data, and will dramatically increase the impact of ISWI science measurements.