

# Interoperable Earth Observation Services and Their Use in a Variety of Decision Support Contexts

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# Overview

- Introduction to the ESIP Federation
- Services Oriented Architectures
- Open Interoperability Standards
- Sample Implementations from ESIP Federation

## Members

- Earth Data Analysis Center, University of New Mexico
- Space Science Engineering Center, University of Wisconsin
- Global Change Master Directory, NASA
- Information Technology and Systems Center, University of Alabama, Huntsville

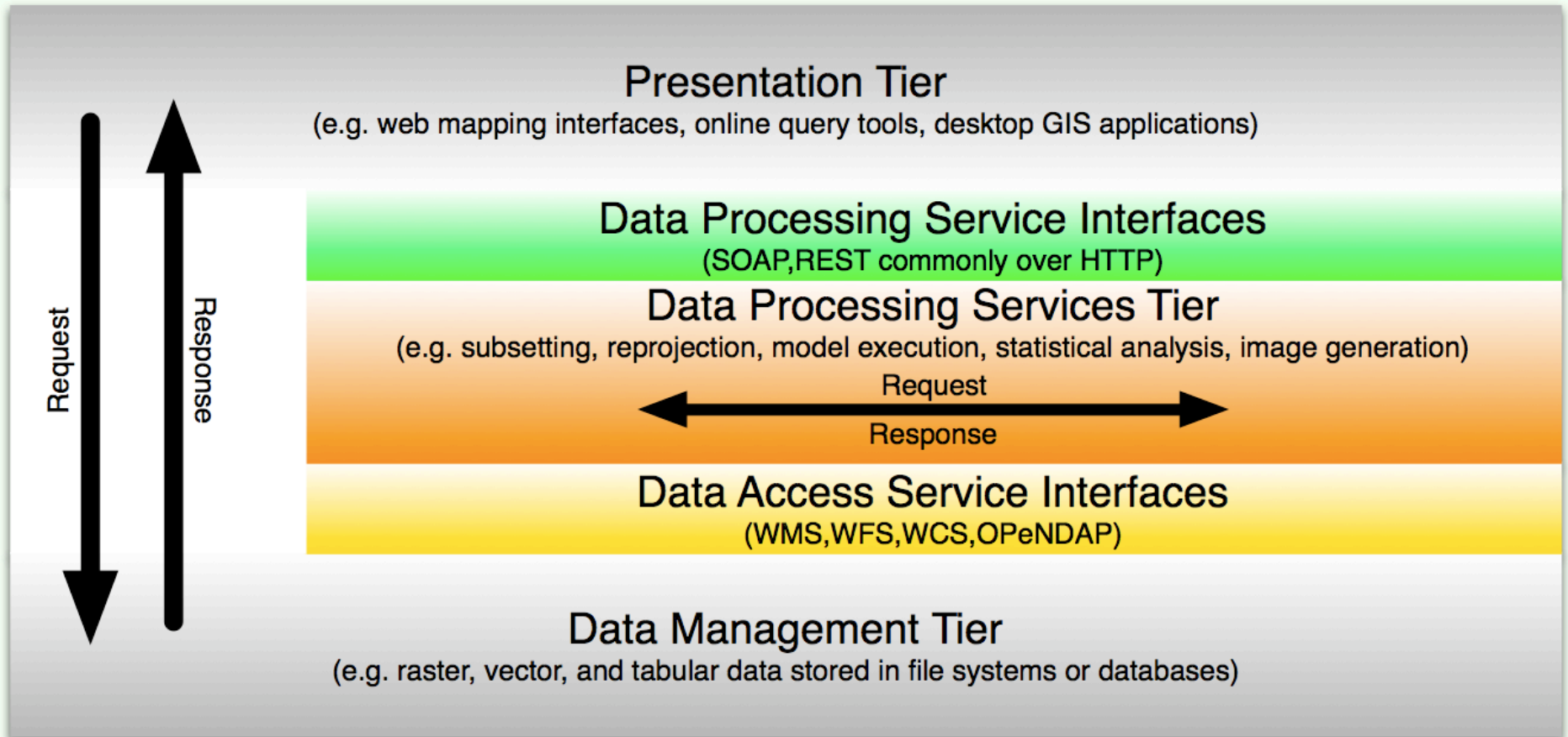


# Federation of Earth Science Information Partners (AKA the ESIP Federation)

- Established in 1998 under a grant from NASA, support is now provided by NASA and NOAA
- Now over 100 member organizations, incl.
  - NASA and NOAA data centers
  - Research labs
  - Education resource providers
  - Technology developers
  - Non-profit and commercial enterprises



# Services Oriented Architectures



# Open Interoperability Standards

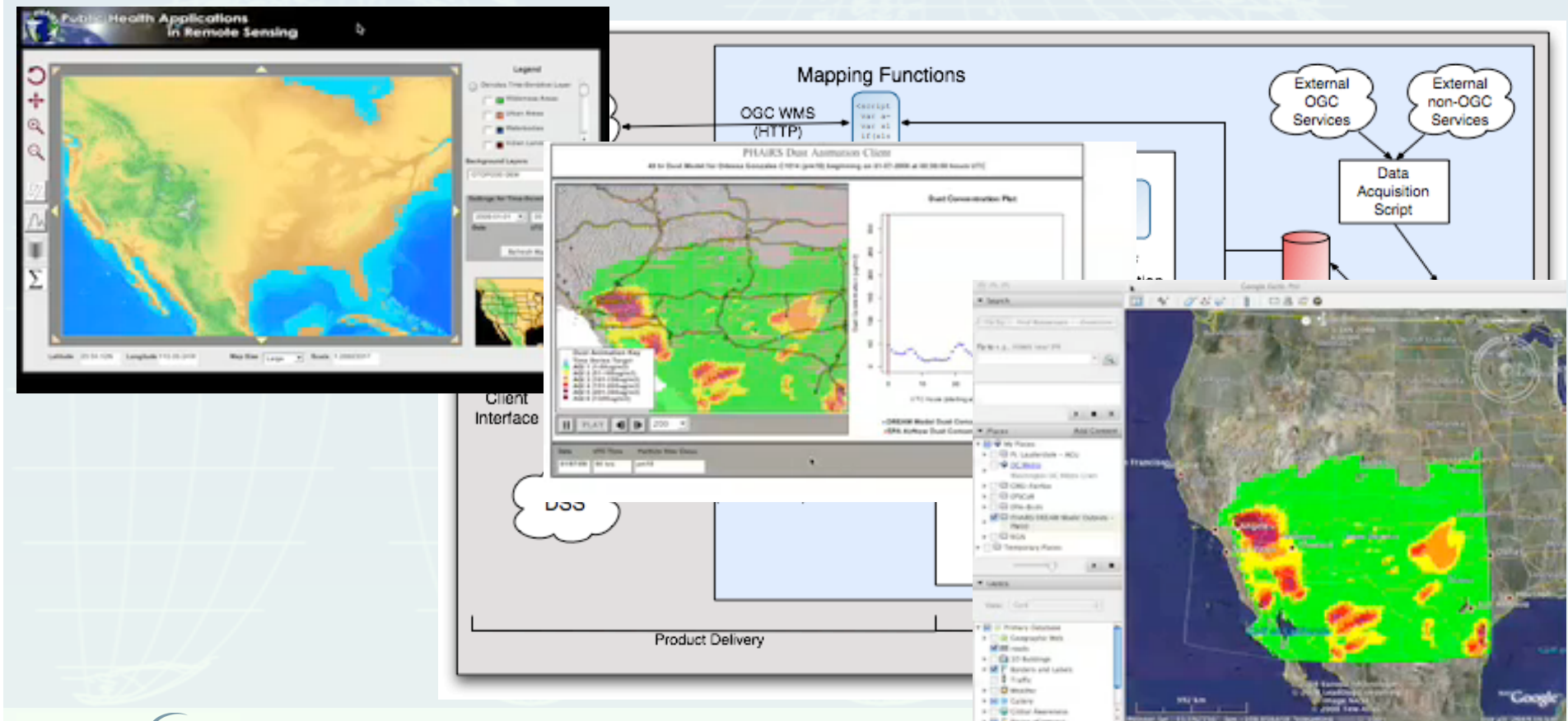
- Key standards implemented by Federation members
  - Open Geospatial Consortium: WMS, WFS, WCS, KML, CAT & others
  - World Wide Web Consortium (W3C): HTTP (REST), SOAP, XML
  - ISO: 19115
  - FGDC: Metadata Standard for Geospatial Data
  - Others ...





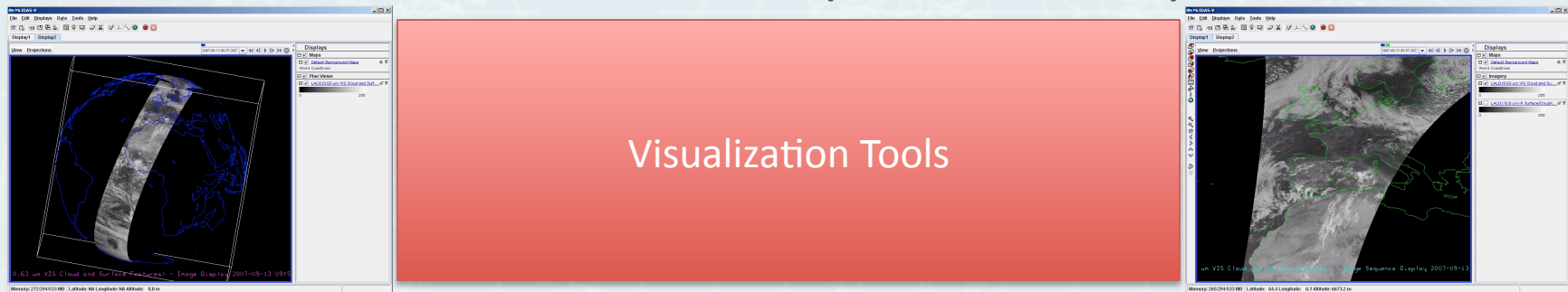
# Sample Implementations: Earth Data Analysis Center

## Public Health Application in Remote Sensing (PHAiRS)



# Sample Implementations: Space Science Engineering Center

## 3-Tiered Satellite Data Collection, Delivery and Visualization (XML, CCSDS)

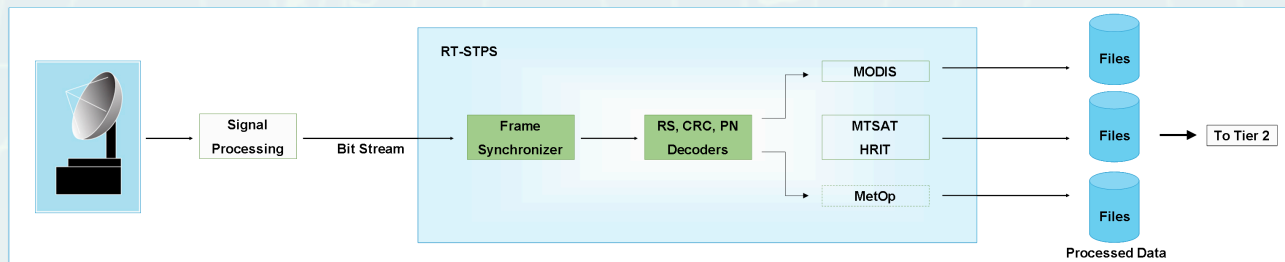


ADDE Server Protocol

NEXRAD

MODIS

Others ...



# Sample Implementations: Global Change Master Directory

## Standards-based data and services registry & portals

The image displays five side-by-side screenshots of the Global Change Master Directory (GCMD) interface, illustrating various views and search capabilities. Each screenshot features the NASA logo and the text "GODDARD SPACE FLIGHT CENTER" and "Global Change Master Directory Discover Earth science data and services".

- Panel 1:** Shows a "Find Data" section with a vertical list of categories: Agriculture, Atmosphere, Biosphere, Biological Classification, Climate Indicators, Cryosphere, Human Dimensions, Data Centers, Projects, Instruments / Sensors, and Platforms / Sources. A search bar is at the bottom.
- Panel 2:** Shows a "Find Data Services" section with a vertical list of categories: Data Analysis And Visualization, Data Management/Data Handling, Education/Outreach, Environmental Advisories, Hazards Management, Metadata Handling, Models, Reference And Information Services, Display Feature Guide, Earth Science Links, Portal Collaborations, Help Center, and Questions?.
- Panel 3:** Shows a "Find Data Services" section with a vertical list of categories: Data Analysis And Visualization, Data Management/Data Handling, Education/Outreach, Environmental Advisories, Hazards Management, Metadata Handling, Models, Reference And Information Services, Display Feature Guide, Earth Science Links, Portal Collaborations, Help Center, and Questions?.
- Panel 4:** Shows a "Find Data Services" section with a vertical list of categories: Data Analysis And Visualization, Data Management/Data Handling, Education/Outreach, Environmental Advisories, Hazards Management, Metadata Handling, Models, Reference And Information Services, Display Feature Guide, Earth Science Links, Portal Collaborations, Help Center, and Questions?.
- Panel 5:** Shows a search interface with "Refine by Category" and "Refine by Full text" buttons. Below the buttons is a search bar with a "Go" button. The results section shows "21 Times Match Your Query" and "Showing 1 through 21 of 21". Three results are listed: 1. American Meteorological Society DataStreams Atmosphere JAMS\_DATASTREAM, 2. Environmental Mercury Mapping, Modeling, and Analysis (EMMMA) USGS EMMMA, and 3. NOAA - Real-time Environmental Applications and Display sYstem (READY) NOAA READY DISGUISE.

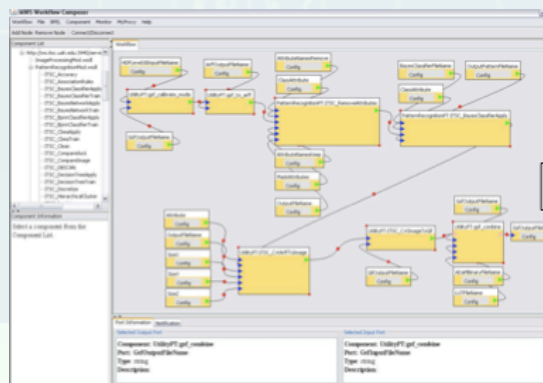


# Sample Implementations: Information Technology and Systems Center

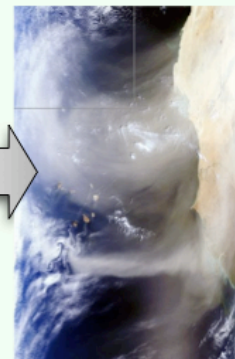
## OGC WMS and WFS Services / SOAP Processing

The screenshot shows the GHRC Data Pool website interface. On the left, there are navigation links like 'HOME', 'ABOUT US', 'DOCUMENTS', 'IMAGERY', 'DATA', and 'CONTACT US'. The main content area displays a list of data products for the AMSU-A 15 channel, including dates and file names. An arrow points from this list to a world map showing a color-coded overlay representing dust concentration, with a significant plume of dust visible over the Atlantic Ocean and parts of Africa and South America.

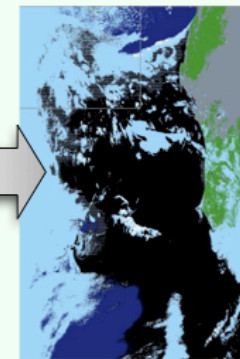
Example WMS output for AMSU-A 15, 50299.91MHz channel on Jan 30, 2008, layered on country boundaries.



Mining Workflow Composer showing Bayes classification workflow



True Color MODIS showing dust blown off the coast of Africa



Result of Bayes classification using MWS to generate thematic map detailing dust

# Contributors & Contact Information

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# Additional Information About Common Standards

- **AJAX** - Asynchronous JavaScript and XML - [http://en.wikipedia.org/wiki/Ajax\\_\(programming\)](http://en.wikipedia.org/wiki/Ajax_(programming))
- **CSW** - OpenGIS Catalogue Service Implementation Specification - <http://www.opengeospatial.org/standards/cat>
- **DIF** - Directory Interchange Format - <http://gcmd.nasa.gov/User/difguide/difman.html>
- **FGDC** - FGDC Content Standard for Digital Geospatial Metadata - [http://www.fgdc.gov/standards/standards\\_publications/](http://www.fgdc.gov/standards/standards_publications/)
- **HTML/XHTML** - Hypertext Markup Language - <http://www.w3.org/MarkUp/>
- **ISO 19115** - ISO Standard for Geographic Information Metadata - [http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=26020](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=26020)
- **JavaScript** aka ECMAScript - Scripting language commonly used in web applications - <http://en.wikipedia.org/wiki/JavaScript>
- **REST** - Representational State Transfer- [http://en.wikipedia.org/wiki/Representational\\_State\\_Transfer](http://en.wikipedia.org/wiki/Representational_State_Transfer)
- **SERF** - Service Entry Resource Format - <http://gcmd.nasa.gov/User/serfguide/>
- **SOAP** - Simple Object Access Protocol - <http://www.w3.org/TR/soap12-part1/>
- **WCS** - OpenGIS Web Coverage Service - <http://www.opengeospatial.org/standards/wcs>
- **WFS** - OpenGIS Web Feature Service - <http://www.opengeospatial.org/standards/wfs>
- **WMS** - OPenGIS Web Map Service - <http://www.opengeospatial.org/standards/wms>

