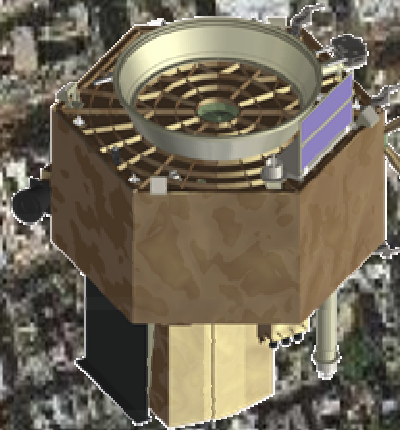


# **Data Quality Guidelines for Satellite Sensor Observations Relevant to GEOSS:** *Calibration and Validation Issues*



**Presented by**

**Stephen G. Ungar, NASA  
Chair CEOS WGCV**

***Recommendations by WGCV to the CEOS-19<sup>th</sup> Plenary***



## The CEOS Working Group on Calibration and Validation

- The Working Group on Calibration and Validation (WGCV) was established in 1984. This resulted from the recognition by CEOS that calibration and validation activities should play a key role in all satellite Earth Observation missions to ensure the clear and quantitative understanding of the data they generate.
- **Calibration:** The process of quantitatively defining the system responses to known, controlled signal inputs.
- **Validation:** The process of assessing, by independent means, the quality of the data products derived from the system outputs.

## CEOS WGCV Subgroups

### WGCV (NASA)

**SAR (CSA)**

**IVOS (ESA)**

**MS (ESA)**

**TM (UCL)**

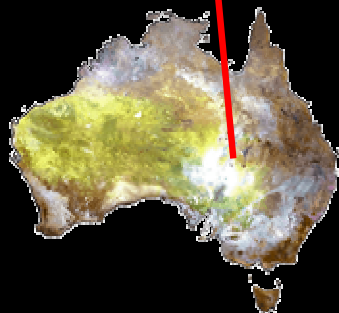
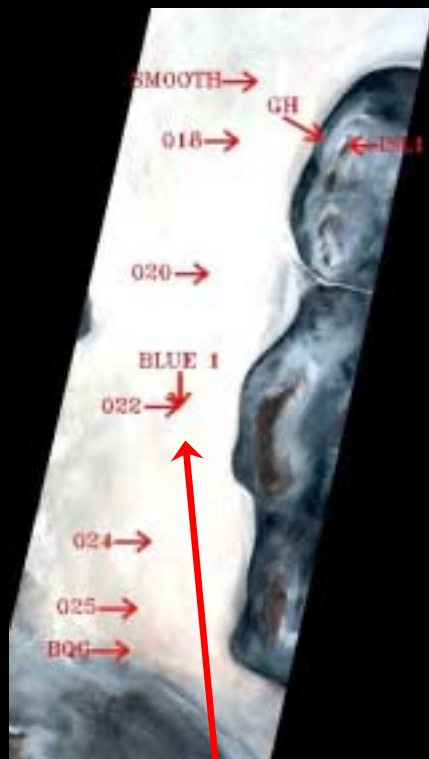
**LPV (NASA)**

**ACSG (NASA)**

- ✧ **Synthetic Aperture Radar (SAR)**  
Chair Dr. S. Srivastava, CSA
- ✧ **Infrared Visible Optical Sensors (IVOS)**  
Chair Dr. M.Rast, ESA
- ✧ **Microwave Sensors**  
*Chair Acting - C. Buck, ESA*
- ✧ **Terrain Mapping (TM)**  
Chair Prof. J. Peter Muller, UCL
- ✧ **Land Product Validation (LPV)**  
Chair Dr. J. Morissette, NASA
- ✧ **Atmospheric Chemistry (ACSG)**  
Chair Dr. E.Hilsenrath, NASA

# WGCV Vicarious Calibration Strategy

**Lake Frome**



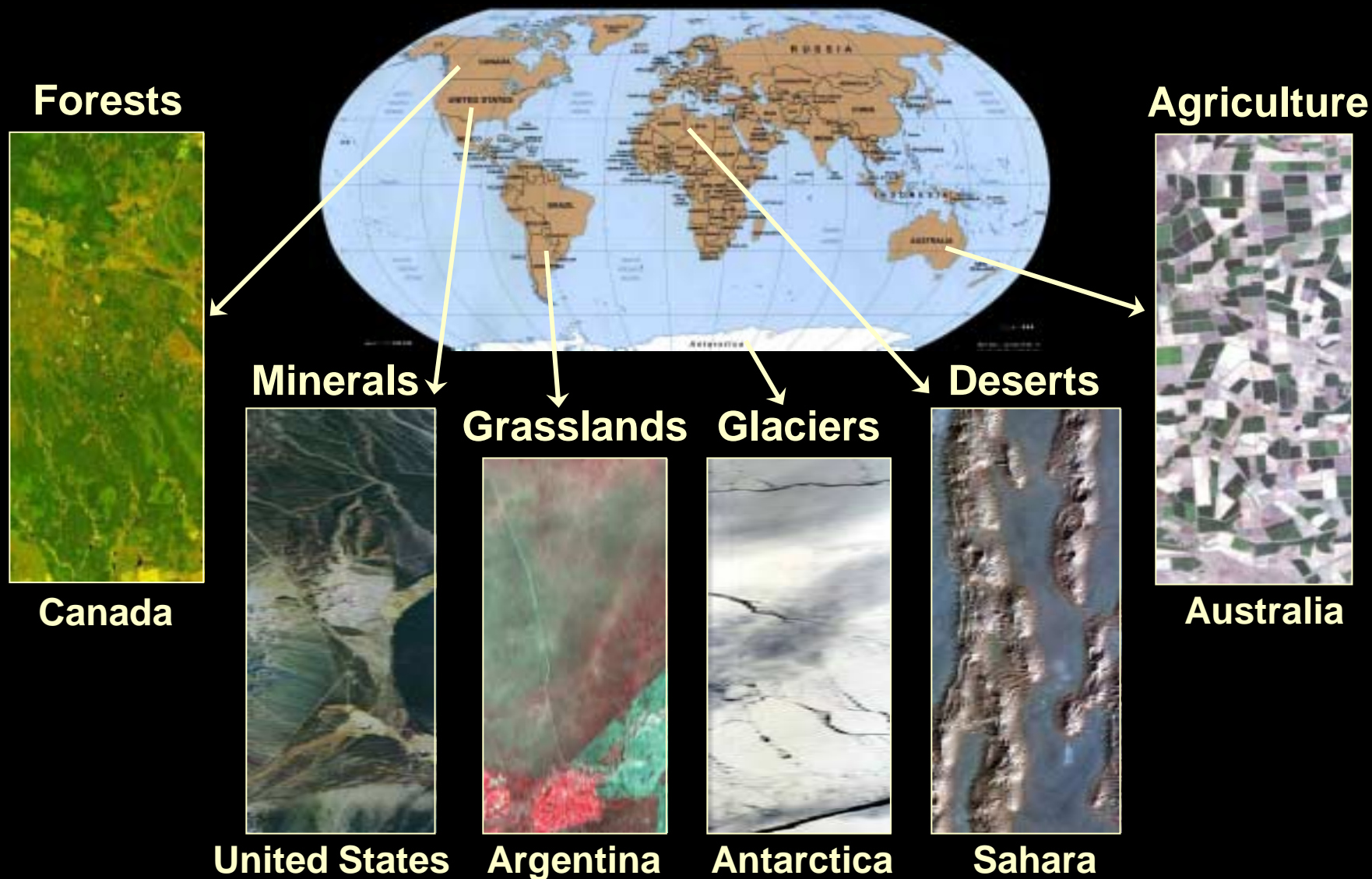
**RR Valley**



**Arizaro/Barreal Blanco**



## WGCV Validation Site Strategy



## Background

# Interoperability is Crucial to GEOSS

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- *In the implementation of GEOSS, harmonization of observations, integration of information from in situ, airborne and space-based observations through data assimilation and models, and early detection of significant and extreme events will be advocated.*
- ***The success of GEOSS will depend on data and information providers accepting and implementing a set of interoperability arrangements, including technical specifications for collecting, processing, storing, and disseminating shared data, metadata, and products.***

(from the GEOSS 10 yr. Implementation plan)

## Background

# Interoperability is Crucial to GEOSS

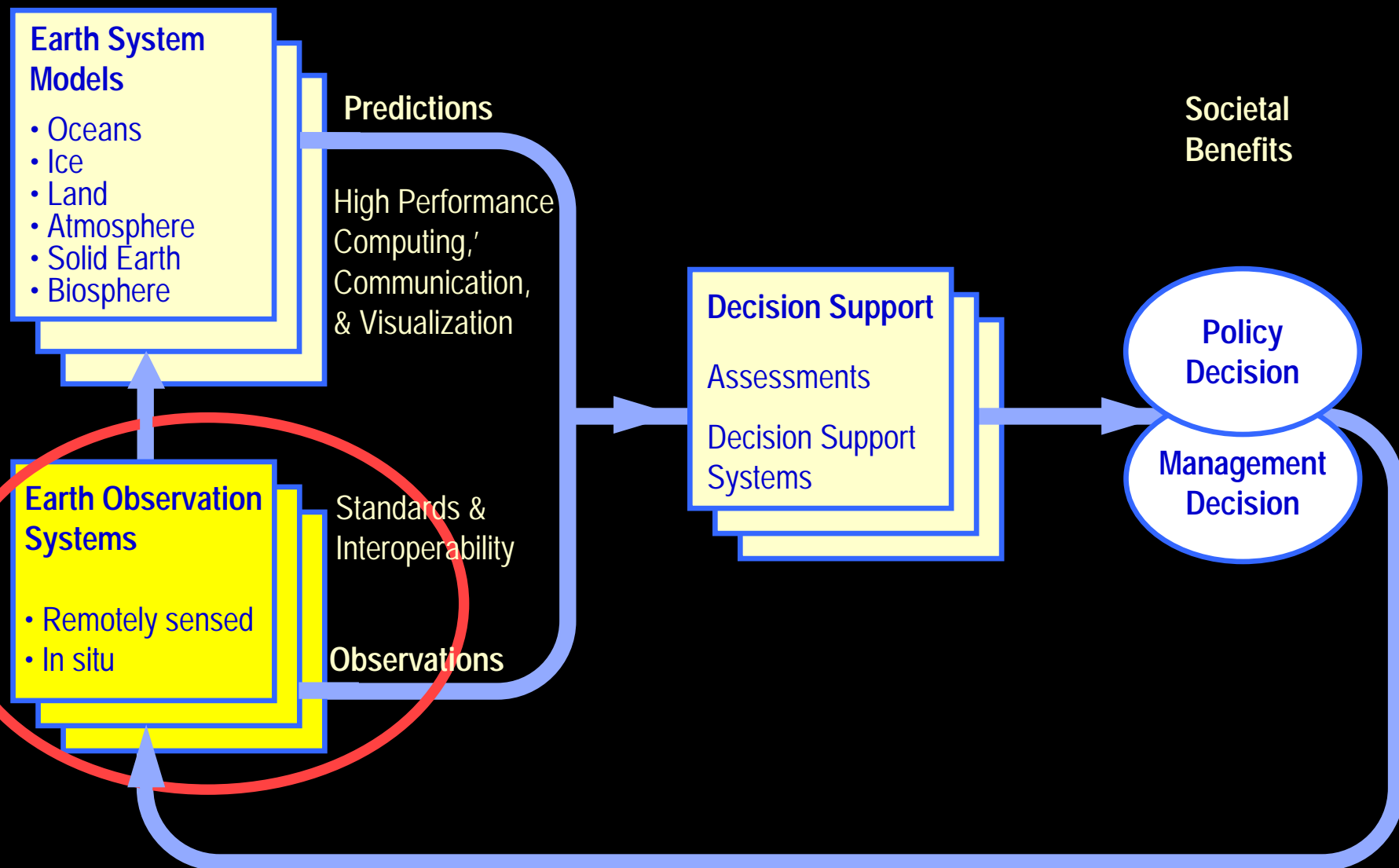
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- *GEOSS interoperability will be based on non-proprietary standards, with preference to formal international standards.*
- *Interoperability will be focused on interfaces, defining only how system components interface with each other and thereby minimizing any impact on affected systems other than where such affected systems have interfaces to the shared architecture*

(from the GEOSS 10 yr. Implementation plan)



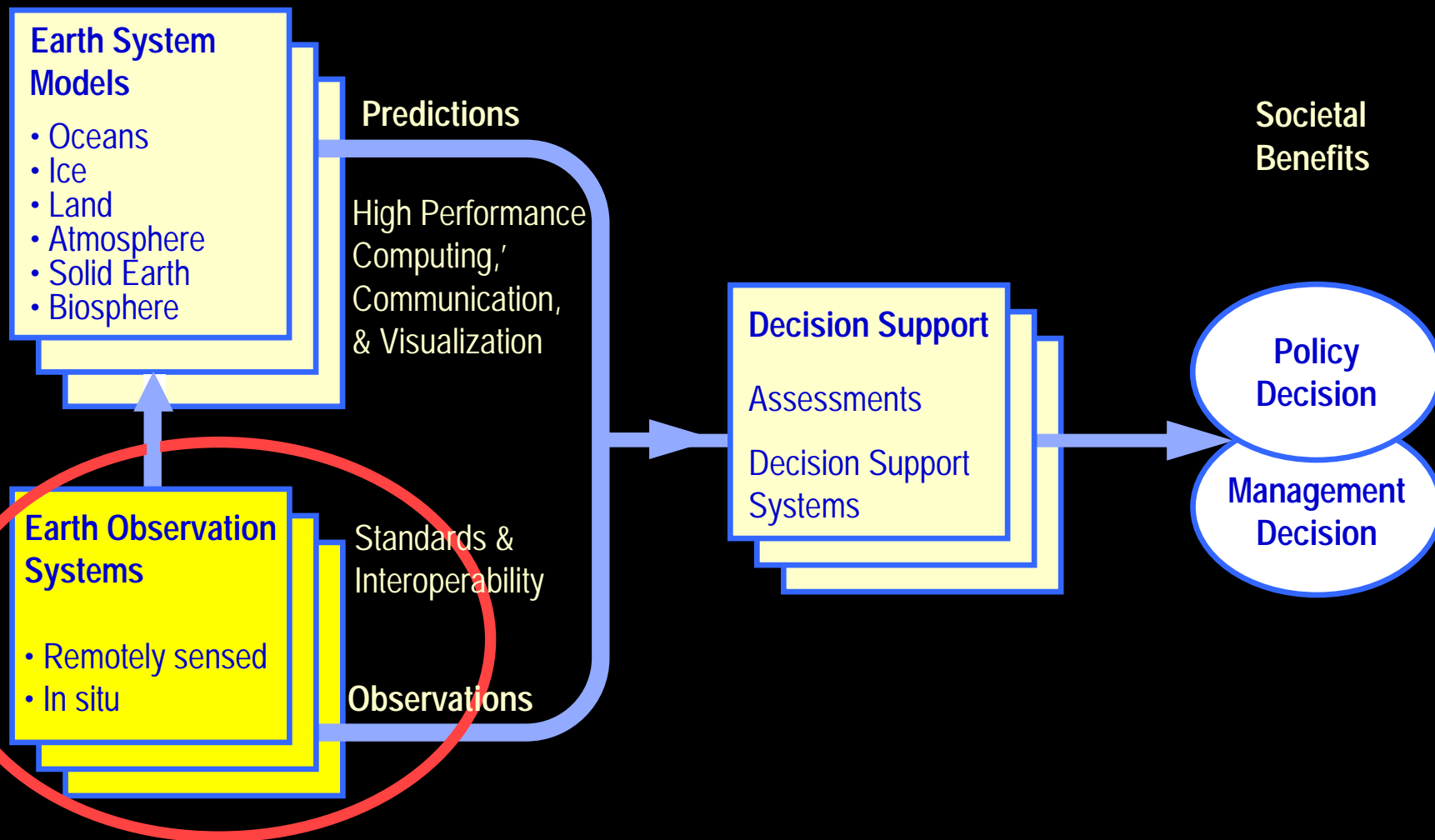
## GEOSS Architecture



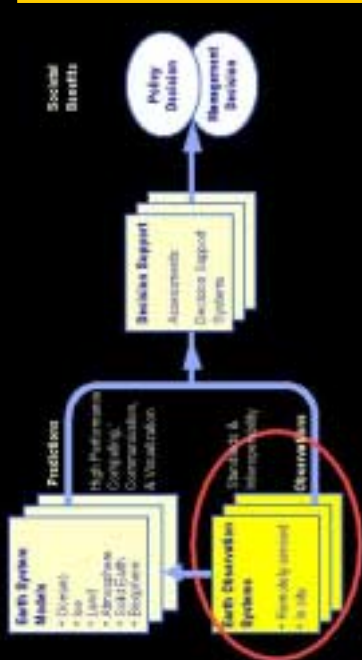
*From: The Architecture of GEOSS (GEO4DOC 4.1 [2]; April 5, 2004)*



# GEOSS Information Flow



# GEOSS Information Architecture



**Cal/Val strengthens the base as shown in the following slides**

**Societal benefits**

Decisions  
policy  
management

**Recommendations**

Decision support:  
Assessments and Systems

**Predictions**

Earth System Models:  
Atmosphere, Oceans, Ice, Land/Biosphere

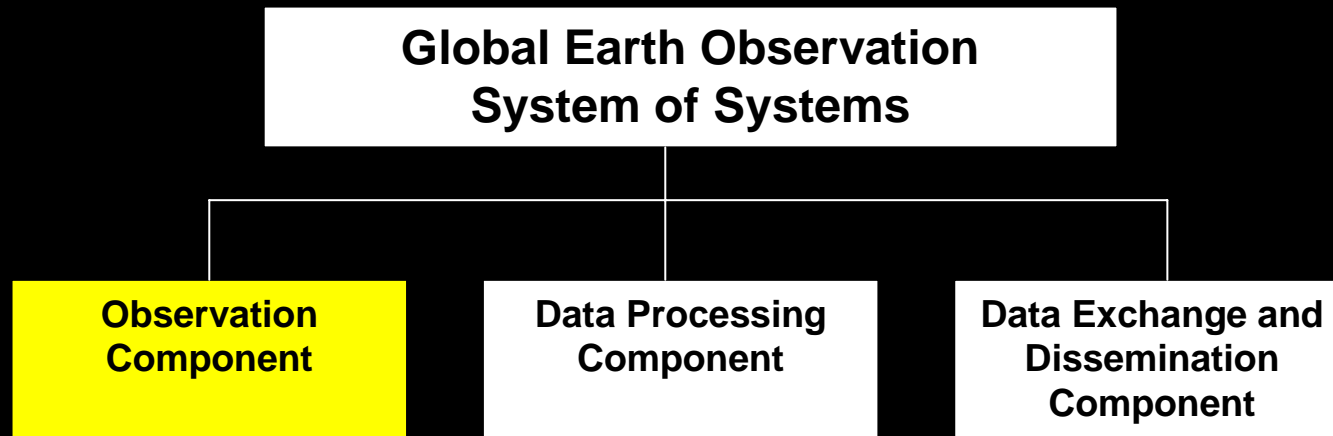
Data,  
Standards and Interoperability

Earth Observation Systems

Remote Sensing observations      *In situ* surveys and measurements

# Components of GEOSS Architecture

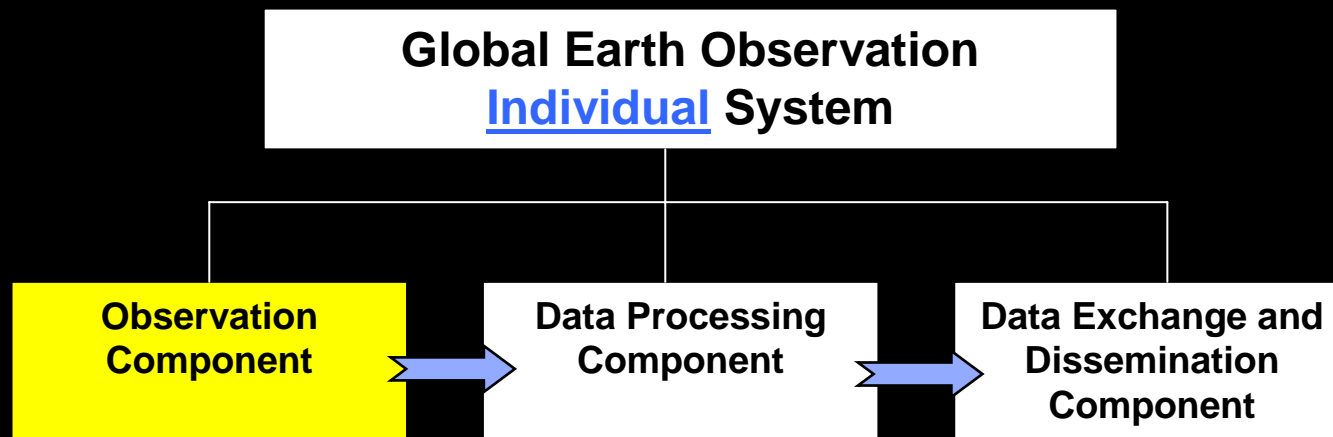
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GEOSS architecture builds incrementally on existing systems to create a distributed system of systems, incorporating:

- ✧ an observation component
- ✧ a data processing and archiving component
- ✧ a data exchange and dissemination component

# Components of GEOSS Architecture



GEOSS architecture builds incrementally on existing systems to create a distributed system of systems. *WGCV* activities contribute to the following GEOSS components:

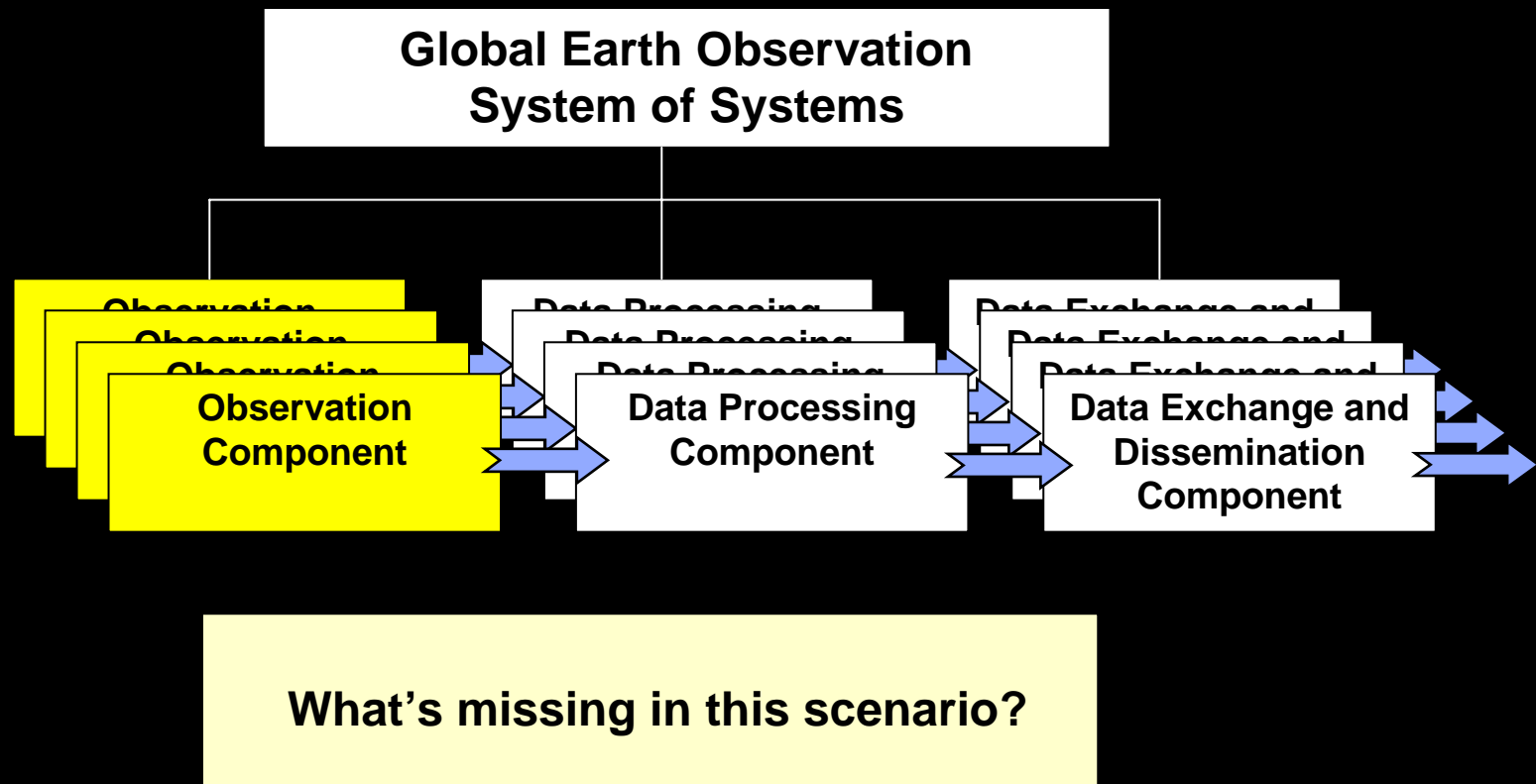
- ✧ Observation component
- ✧ Data processing and archiving component

To ensure:

- ✧ data and products interoperability, exchange and dissemination

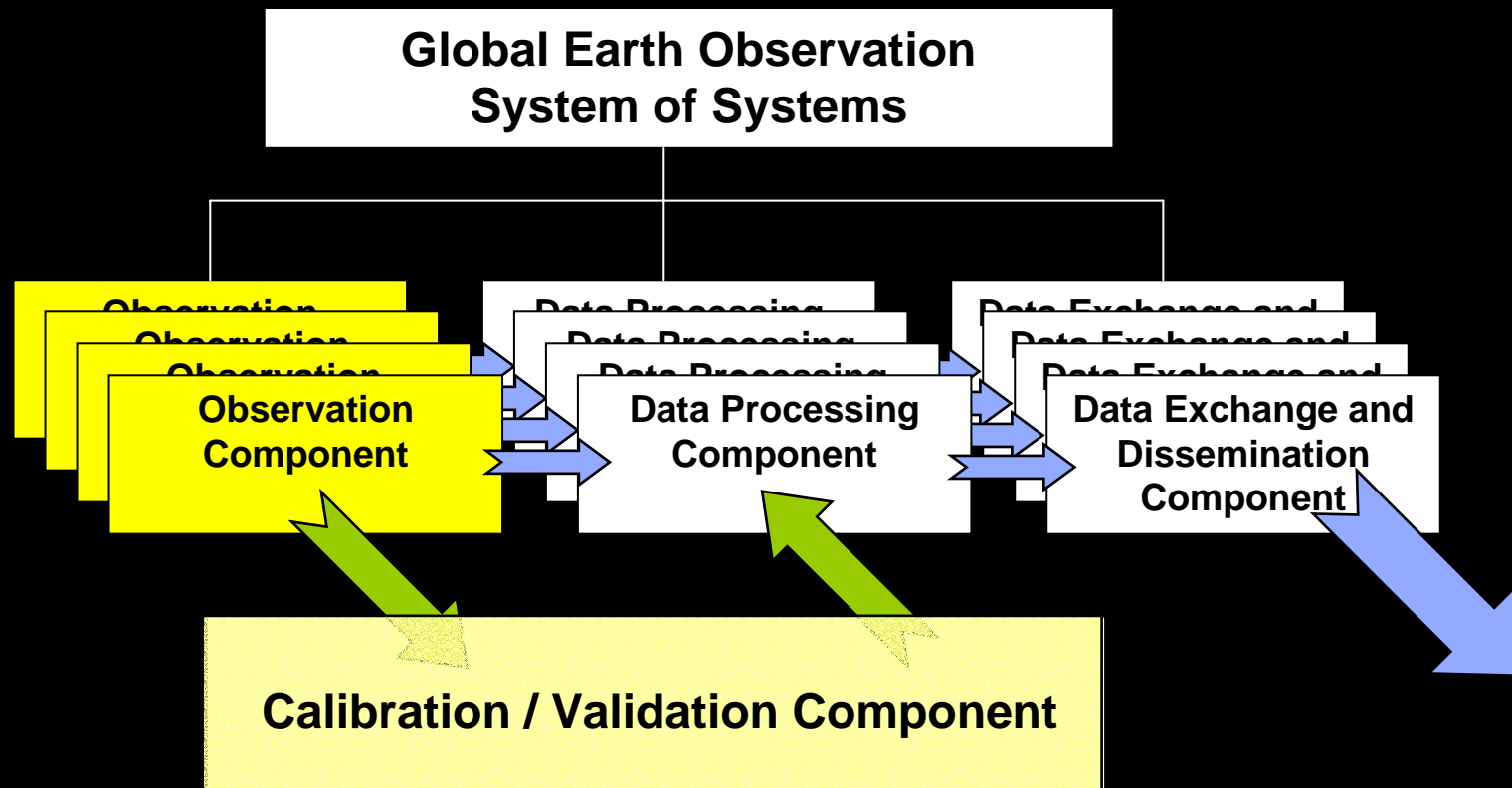


# Inadequate Cal/Val in GEOSS Architecture



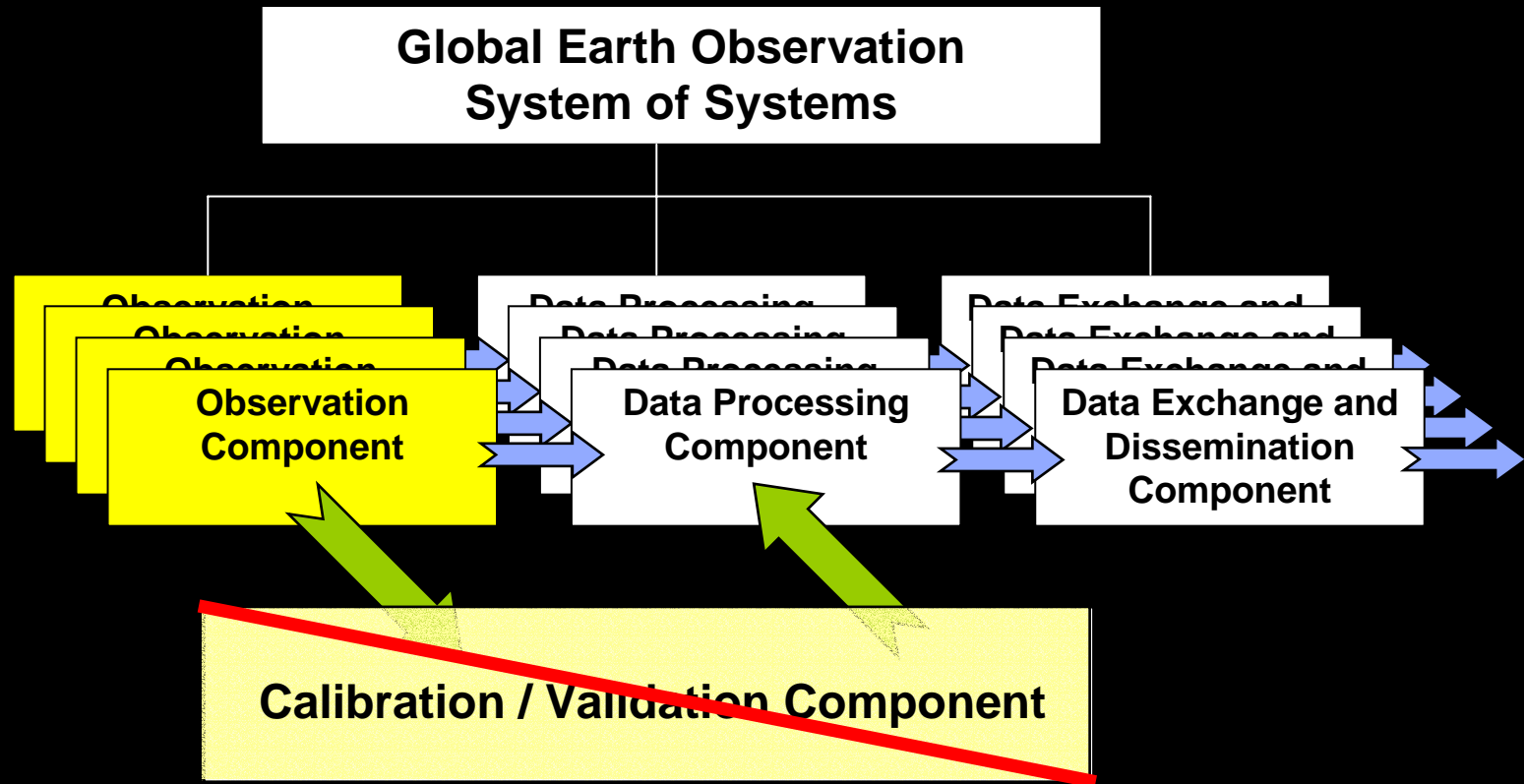
***A simplistic view of a System of Systems results in the need to deal with potentially disparate information forcing policy makers to “choose” their outcomes.***

# WGCV contribution to GEOSS Architecture



***Role of WGCV in a true System of Systems where the operating space must cut across individual Systems to provide integrated data for decision models***

# Inadequate Cal/Val in GEOSS Architecture



***Inadequate integration of data sources can lead to disparate model outcomes, introducing uncertainty into the decision process***

# Establishing Calibration and Validation guidelines is a necessary ingredient in achieving Data Interoperability

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**WGCV proposes to establish Calibration and Validation guidelines, to ensure interoperability of GEOSS member satellite data sources, based on the current space agencies collaboration agreements, common formats and standards.**

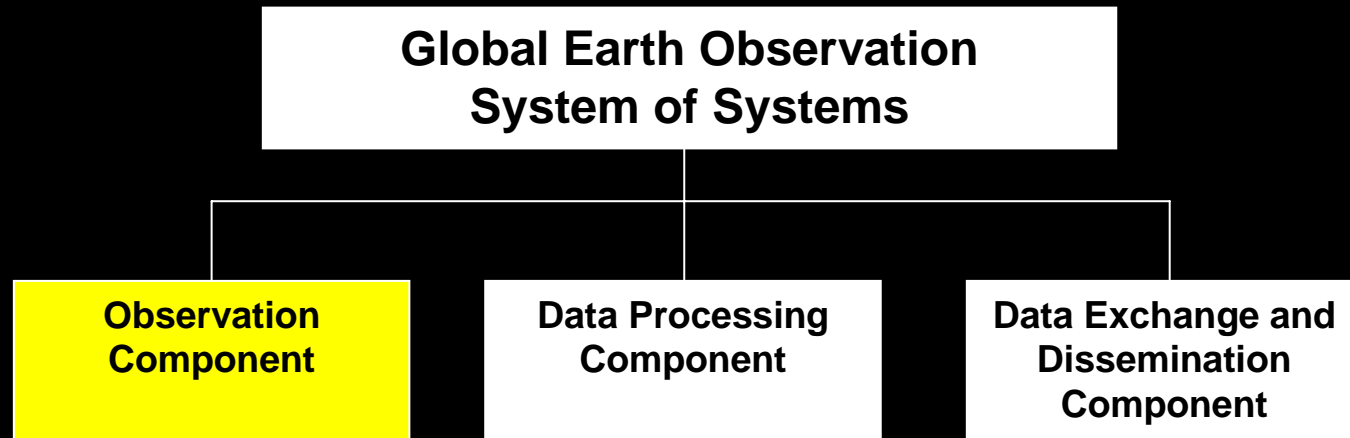
- **WGCV proposes that all GEOSS partners participate in the establishment of the following common practices:**
  - ✧ Document the methodologies used to derive and further process satellite measurements.
  - ✧ Create and maintain, in conjunction with WGISS, an internet-accessible information database containing, on an instrument or satellite basis, links to all instrument characteristics needed for insuring inter-operability.
  - ✧ Provide/publish Cal/Val reference methods in a readily accessible form.

***These activities will ensure that the various data are integrable.***



# Components of GEOSS Architecture

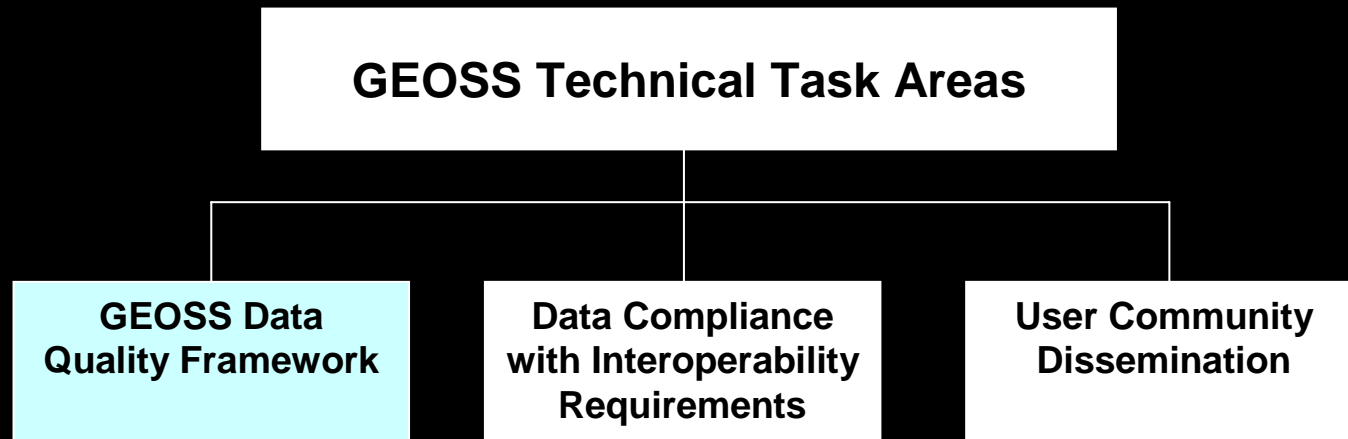
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The high level GEOSS **architecture** is a componentization of a structure required to accomplish the GEOSS objectives which is consistent with the structure of most contemporary Earth Observing data systems. There is a need to define the components of GEOSS **functionality** required to enable the fulfillment of GEOSS objectives through this architecture.

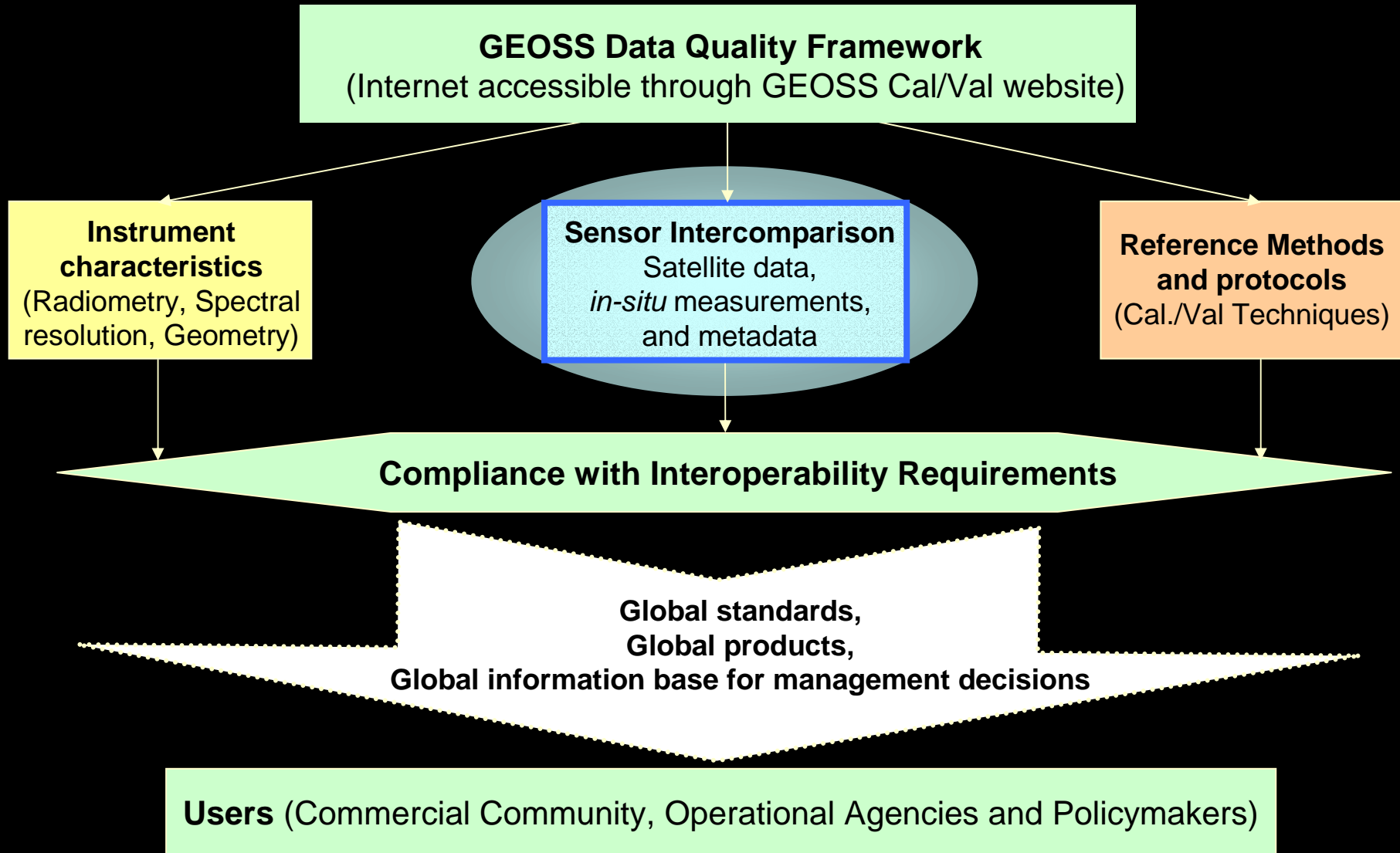
# Components of GEOSS Functionality

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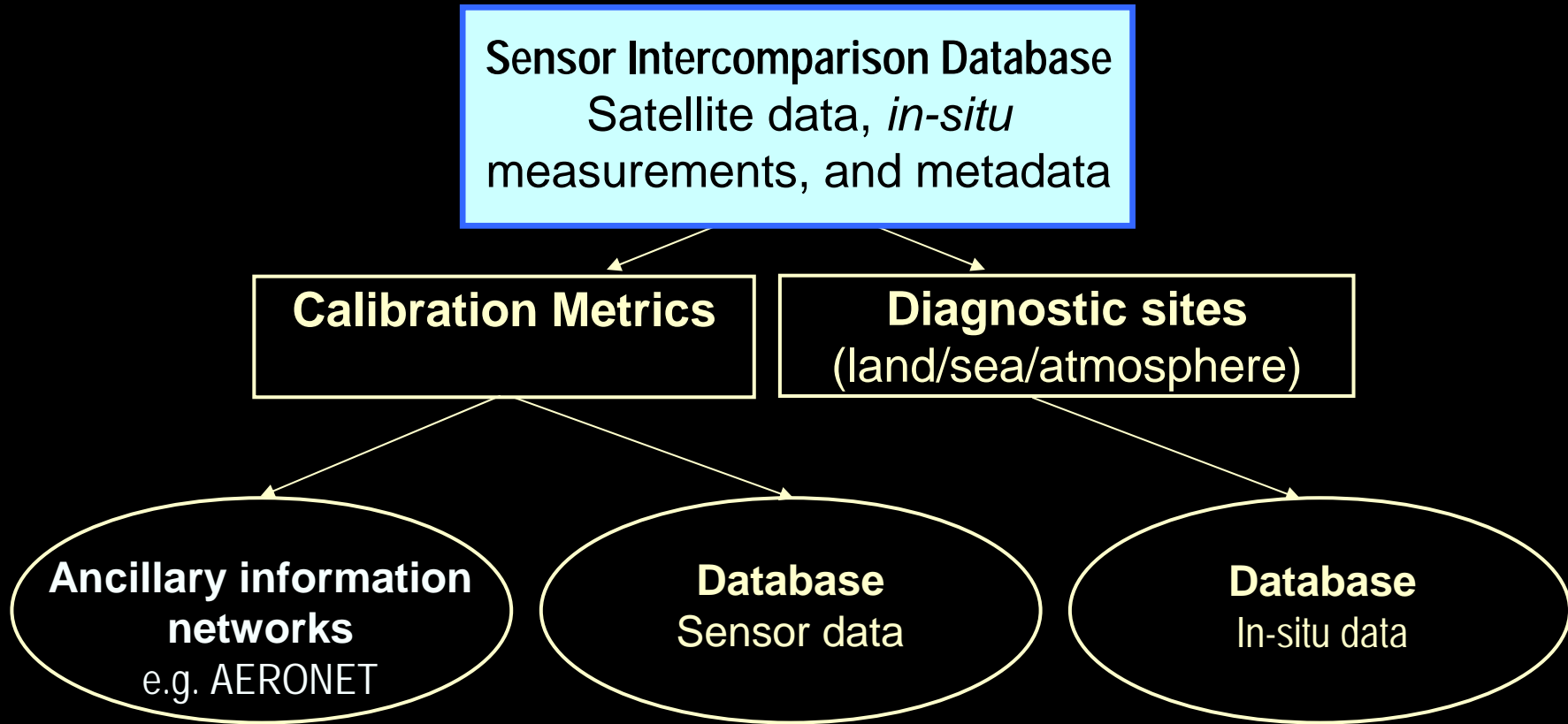
The high level GEOSS **functionality** componentization introduces a structure which ensures accomplishment of required GEOSS objectives within the proposed GEOSS **architecture**. There is a need to specify **functionality** for the components of GEOSS **architecture** to enable the fulfillment of GEOSS objectives through this architecture.

***These components are designed to ensure data integrability and interoperability.***



# WGCV Proposal GEOSS Cal/Val Data Framework

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## Conclusion

The approach outlined in the WGCV White Paper entitled “Data Quality Guidelines for Satellite Sensor Observations Relevant to GEOSS: Calibration and Validation Issues” has been crafted to ensure the quality assessment of space-borne instrument data in the context of a service driven global operational Earth observation remote sensing system.

This approach exploits ongoing work and available expertise among the CEOS working group members, and provides a mechanism for further development over the 10-year timescale of the GEOSS Implementation Plan.