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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 CEOS/WGCV to the CEOS Task Force

Presented at CEOS Mid-term Principals Meeting, Geneva, Switzerland, May 2005

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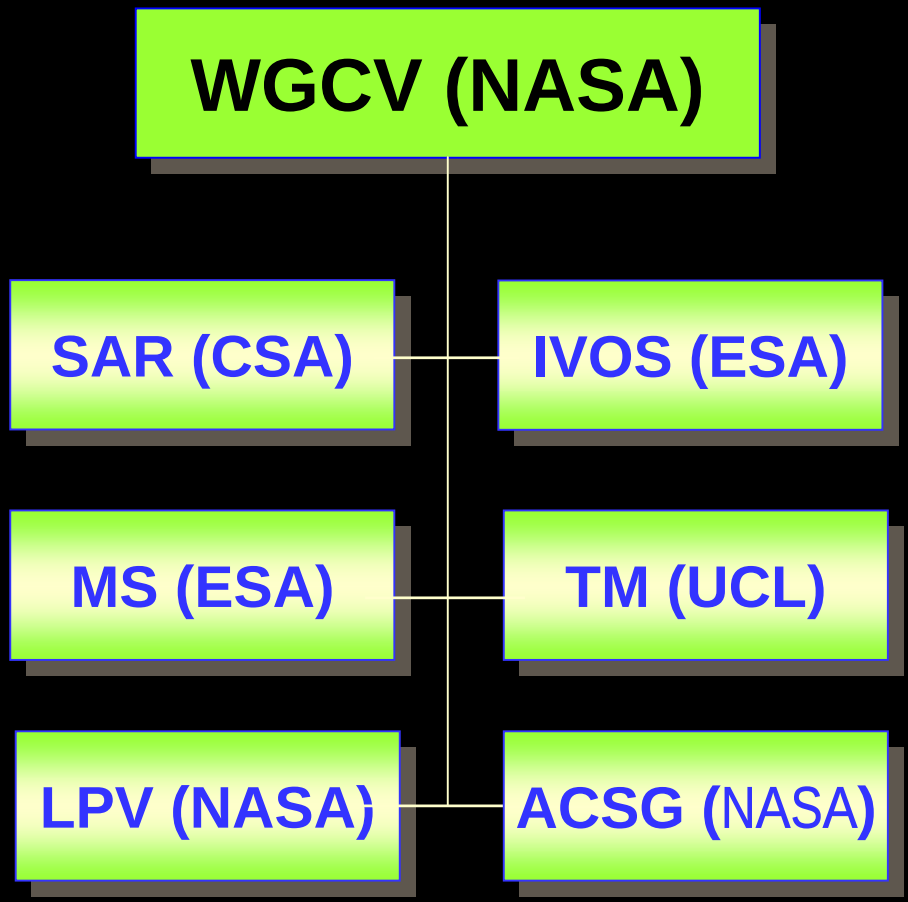
CEOS WGCV Subgroups



- 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

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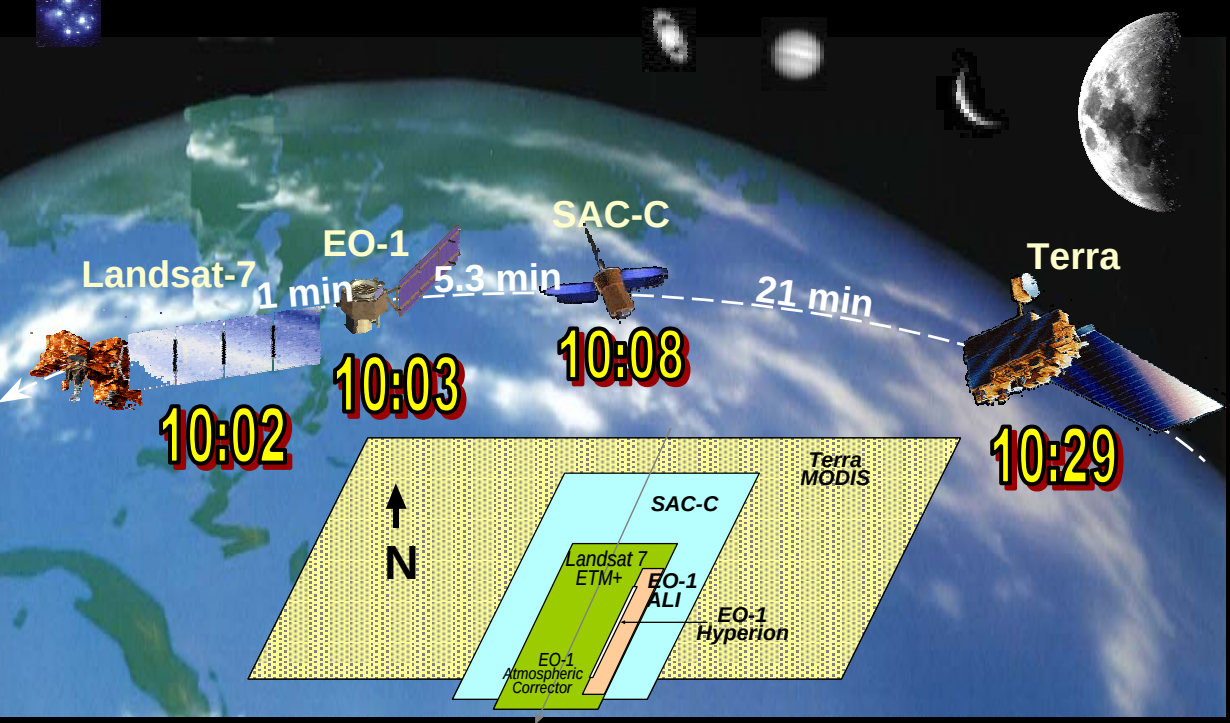
INTRODUCTION TO WGCV

The EOS Morning Constellation Current Alignment (May 2005)



The NASA/CONAE Morning Constellation, formation flying over common ground targets at closely spaced equatorial crossing times as shown below, provides opportunities to compare observations made with a variety of satellite observing systems against each other and contemporaneously obtained ground measurements. CEOS member observing systems include: NASA's MODIS, ETM+, EO-1 ALI and Hyperion; Japan's ASTER; and CONAE's SAC-C MMRS and GOLPE instrument suites.

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WGCV Validation Site Strategy

Forests

Canada

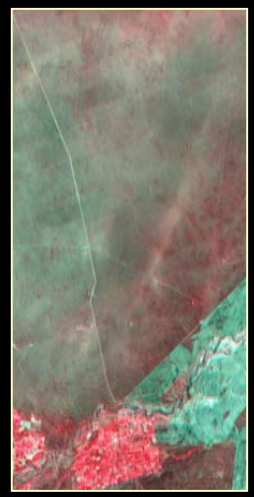
Agriculture

Australia

Minerals

United States

Grasslands



Argentina

Glaciers

Antarctica

Deserts

Sahara

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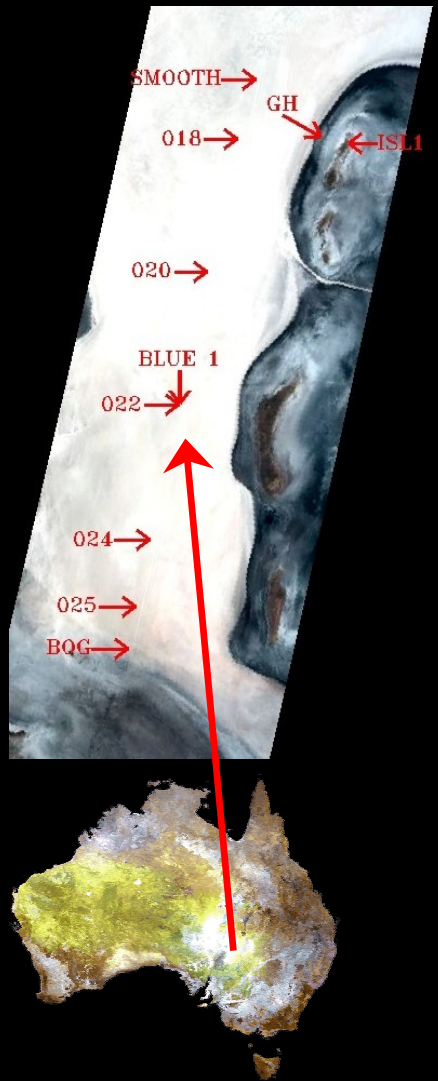
WGCV Vicarious Calibration Strategy

Lake Frome



RR Valley

Arizaro/Barreal Blanco

Background

Interoperability is Crucial to GEOSS

- *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)

Interoperability is Crucial to GEOSS

- *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)

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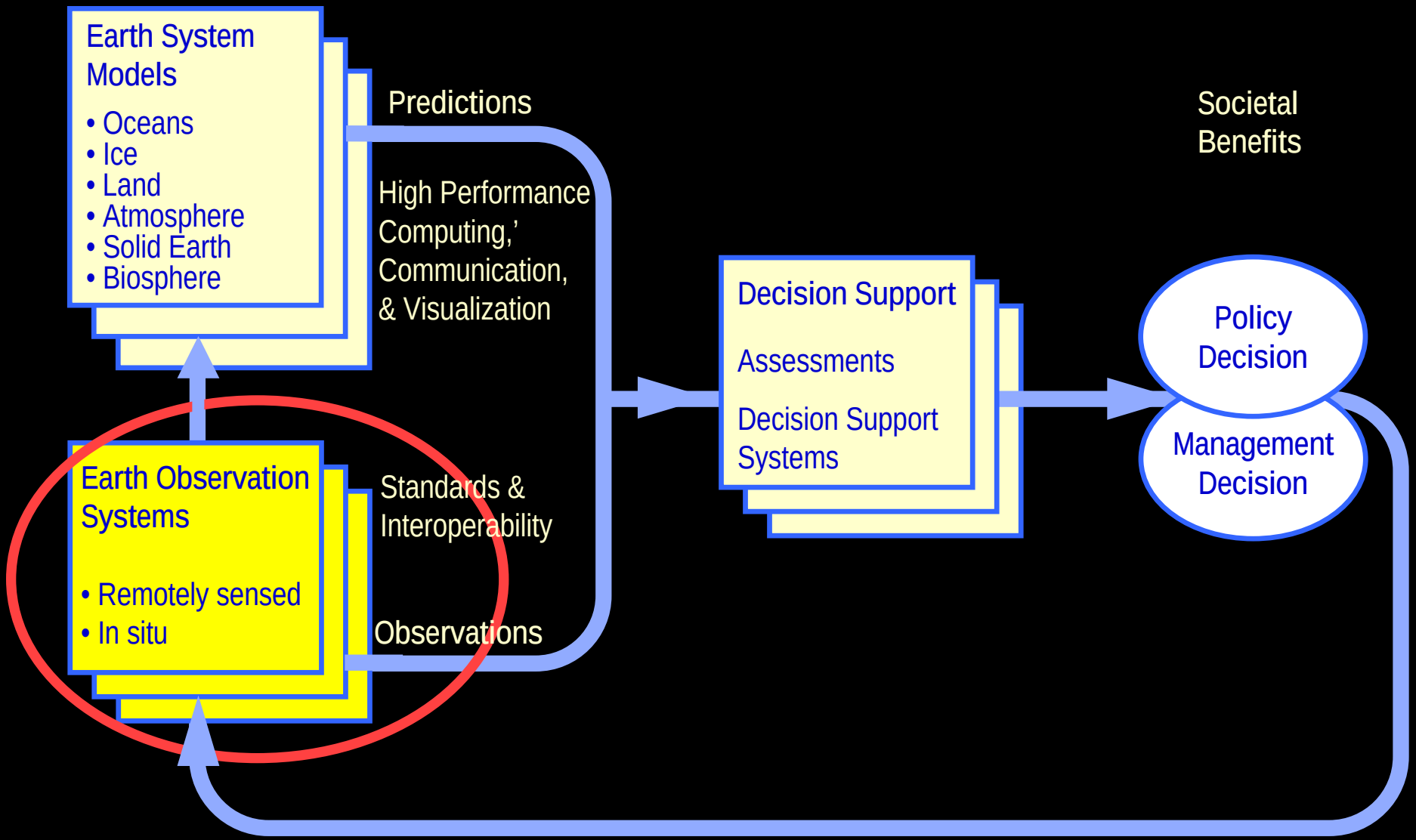
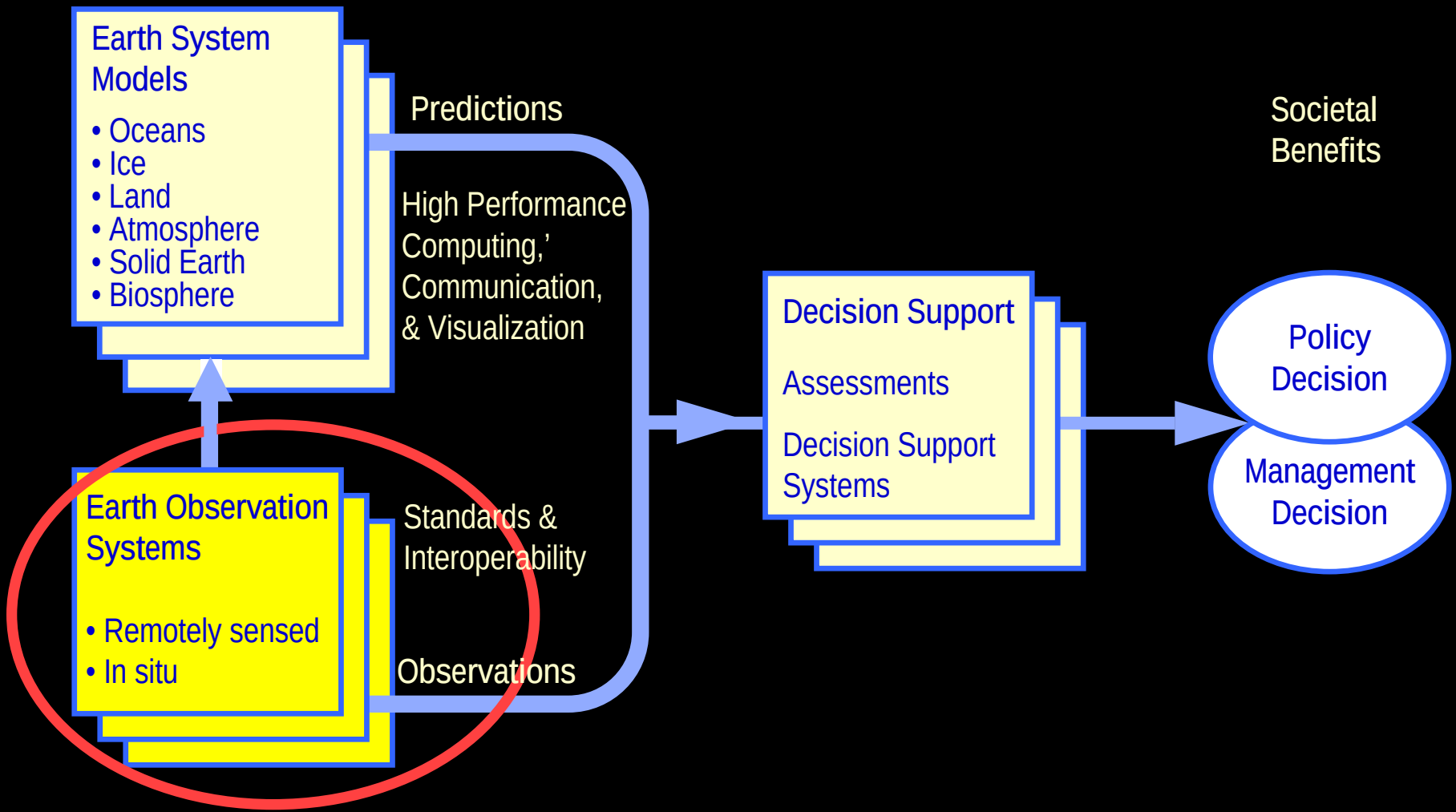
GEOSS Architecture

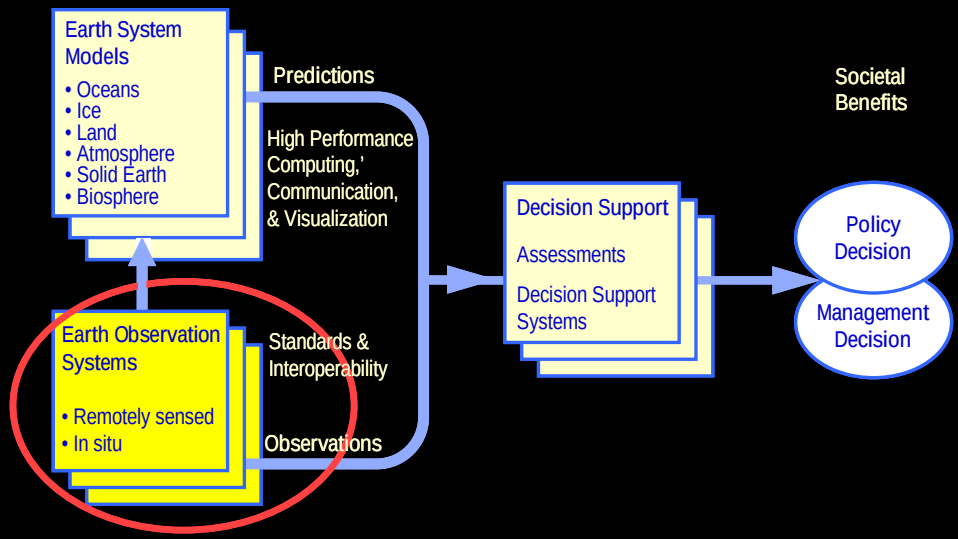


From: The Architecture of GEOSS (GEO4DOC 4.1 [2]; April 5, 2004)

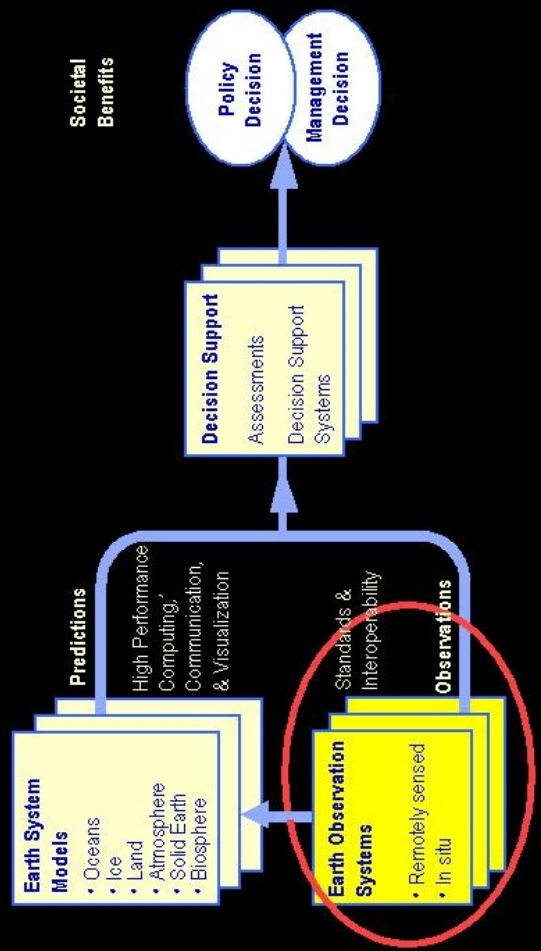
GEOSS Information Flow



GEOSS Information Flow



GEOSS Information Flow



GEOSS Information Architecture

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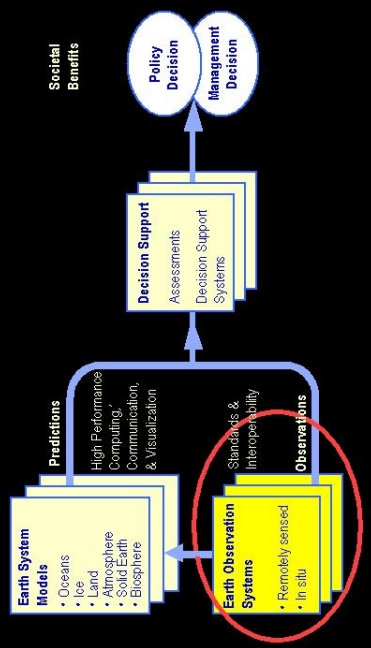


Societal benefits

Decisions
policy
management

Recommendations

Decision support:
Assessments and Systems

Predictions

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

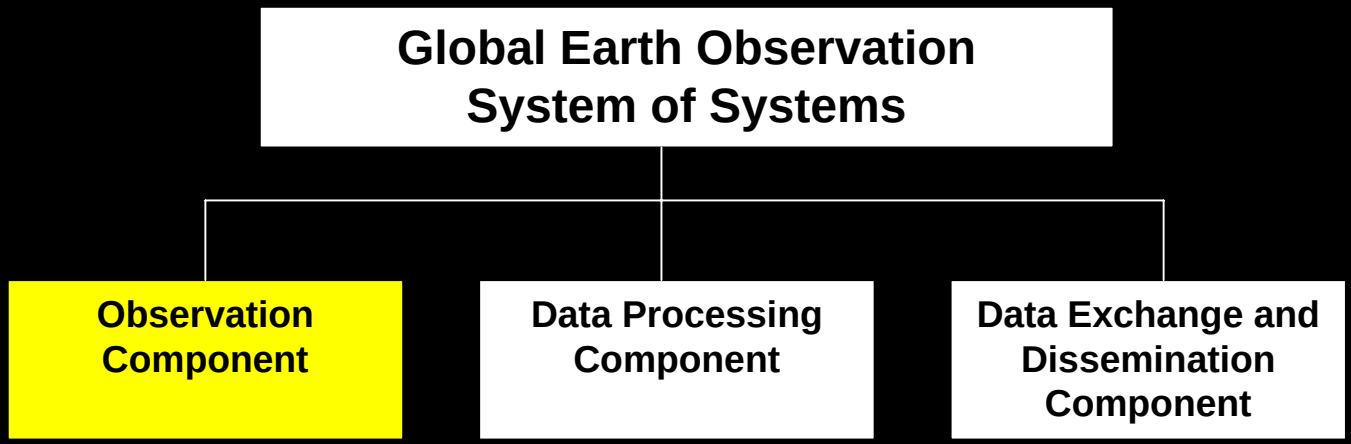
Data,
Standards and Interoperability

Earth Observation Systems

Remote Sensing observations *In situ* surveys and measurements

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

Components of GEOSS Architecture

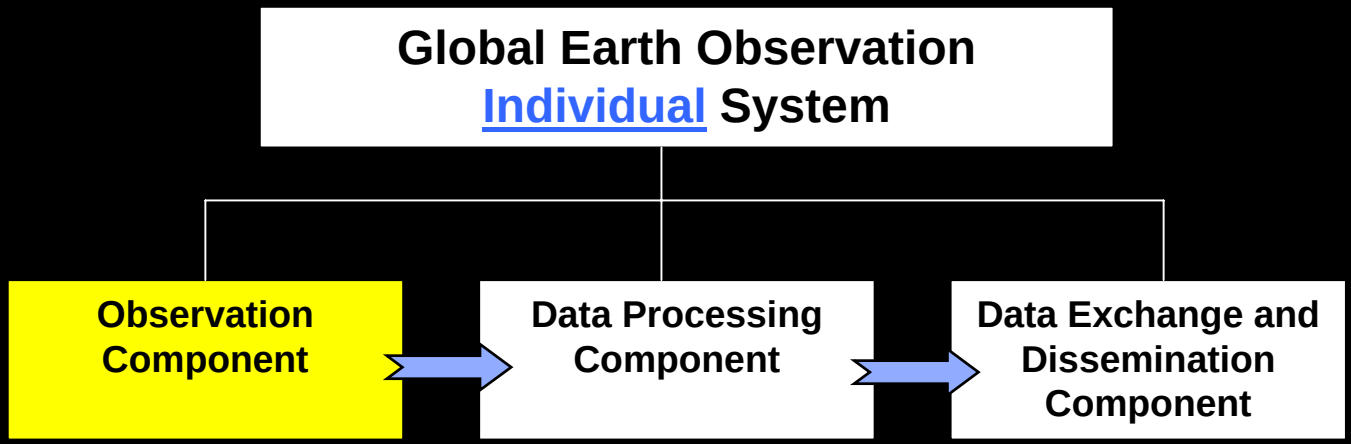


GEOSS architecture builds incrementally on existing systems to create a distributed system of systems, incorporating:

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

From: The Architecture of GEOSS (Global Earth Observation System of Systems); GEO4DOC 4.1 (2); 4.5.2004

Components of GEOSS Architecture



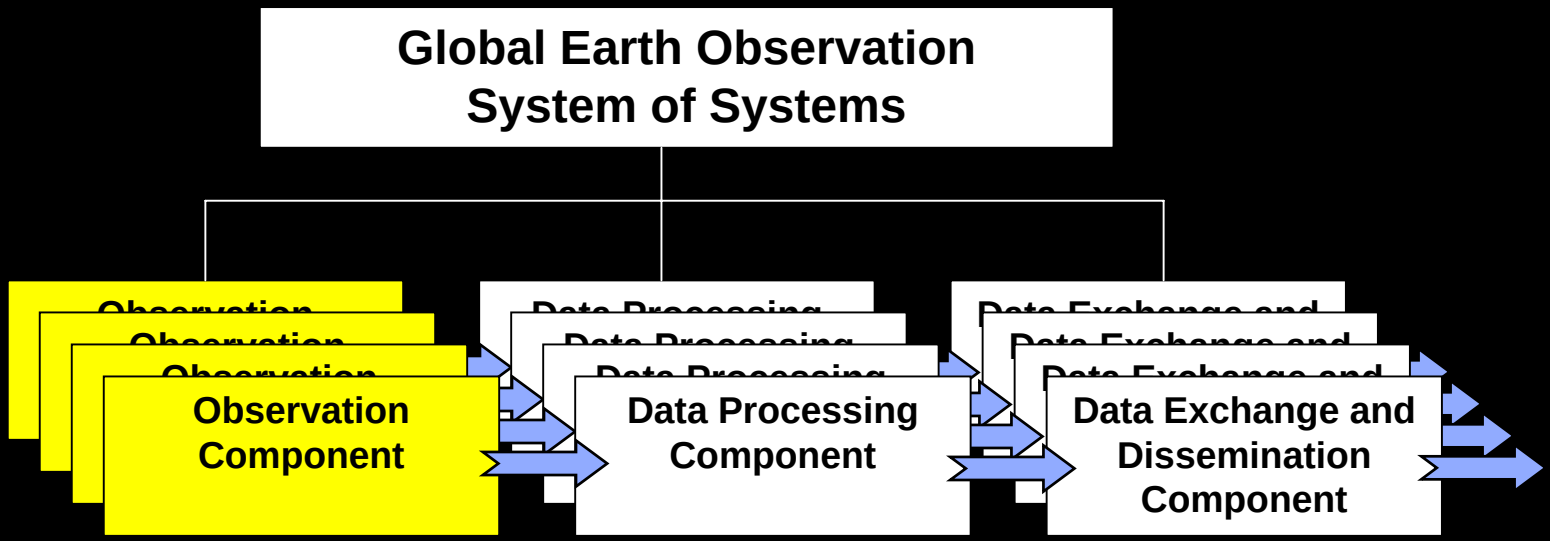
GEOSS architecture builds incrementally on existing systems to create a distributed system of systems. WGCV activities contribute to the following GEOSS components:

- Observation component
- Data processing and archiving component

To ensure:

- data and products interoperability, exchange and dissemination

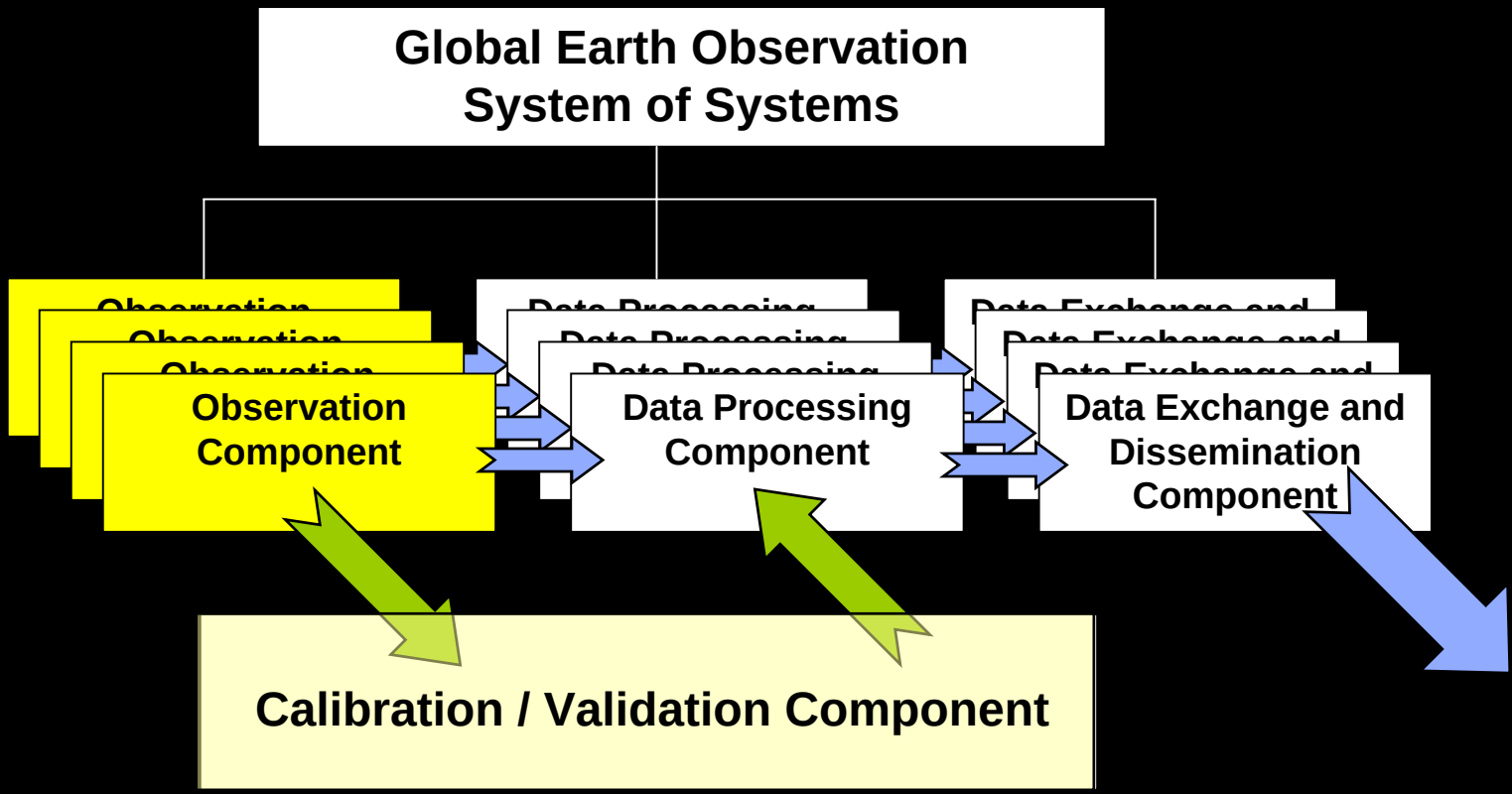
Inadequate Cal/Val in GEOSS Architecture



What's missing in this scenario?

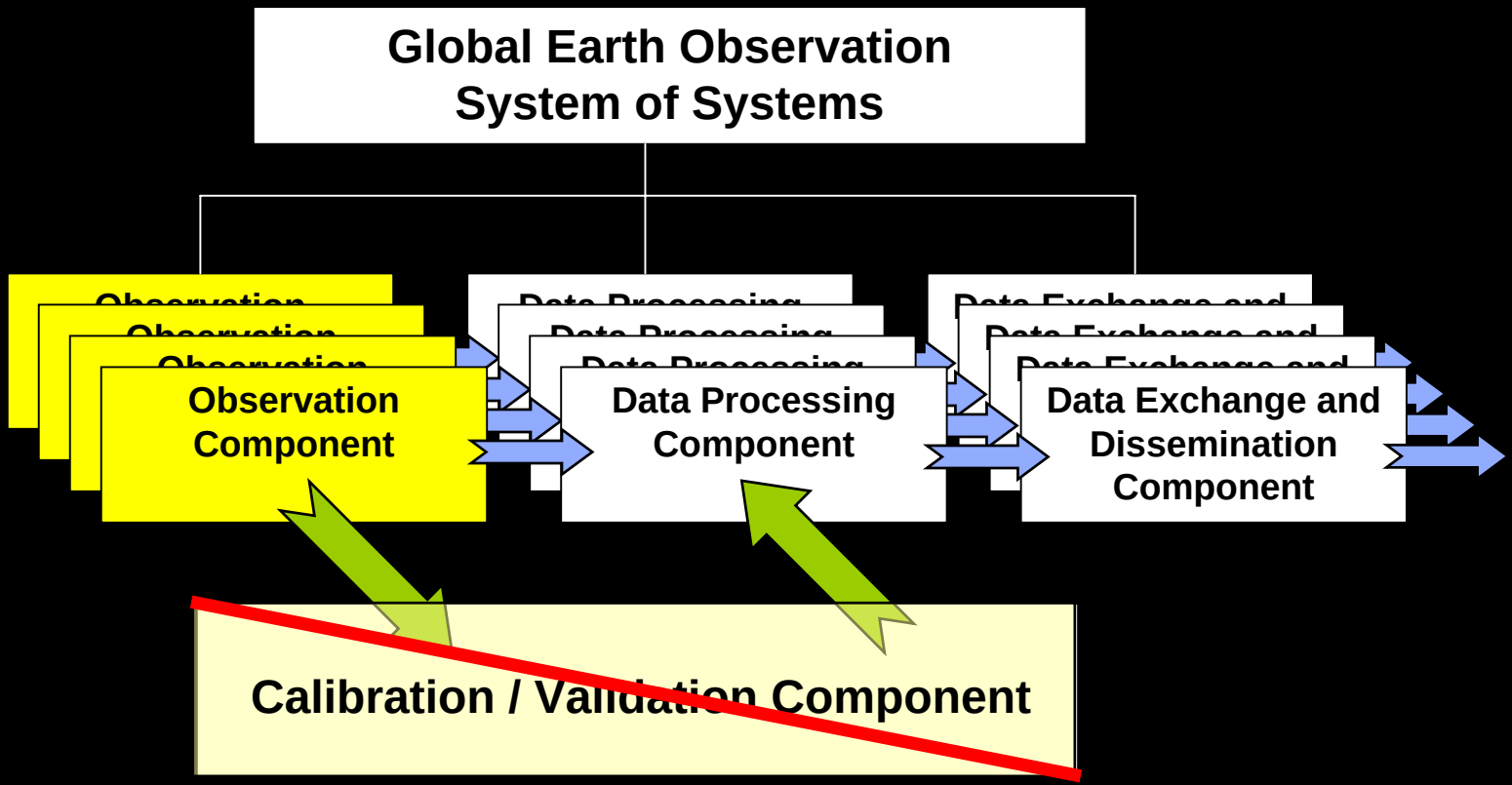
A simplistic view of a System of Systems results in the need to deal with potentially disparate information forcing policy makers to "choose" their outcomes.

WGCV contribution to GEOSS Architecture



Role of WGCV in a true System of Systems where the operating space must cut across individual Systems

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

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 at-satellite radiance.
  - Create and maintain 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.

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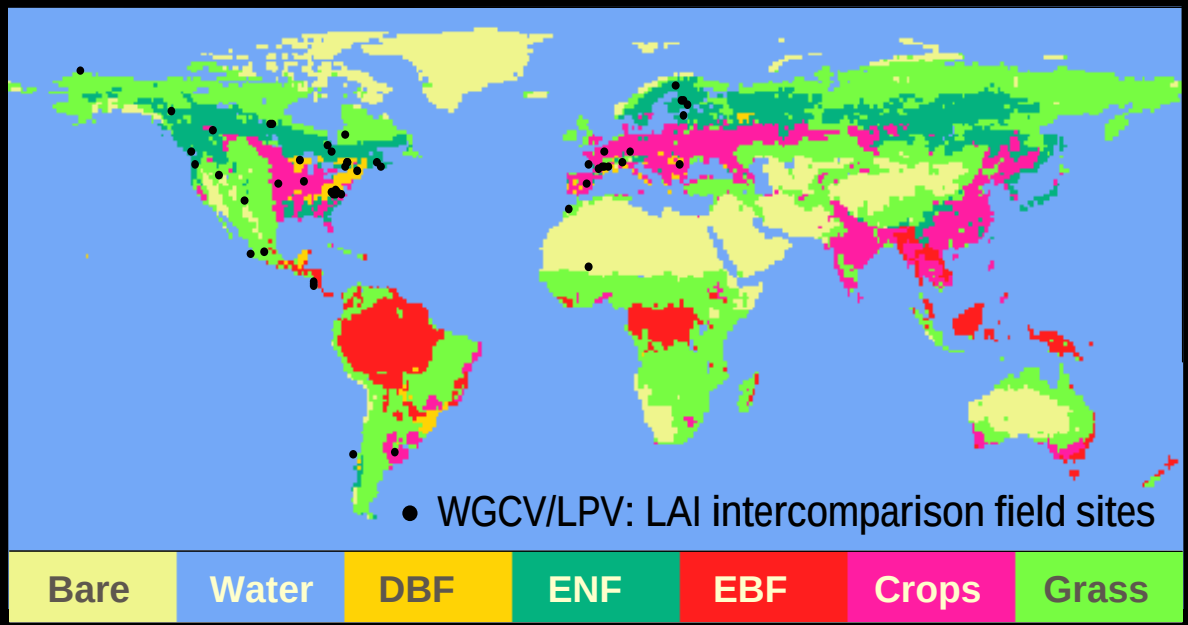
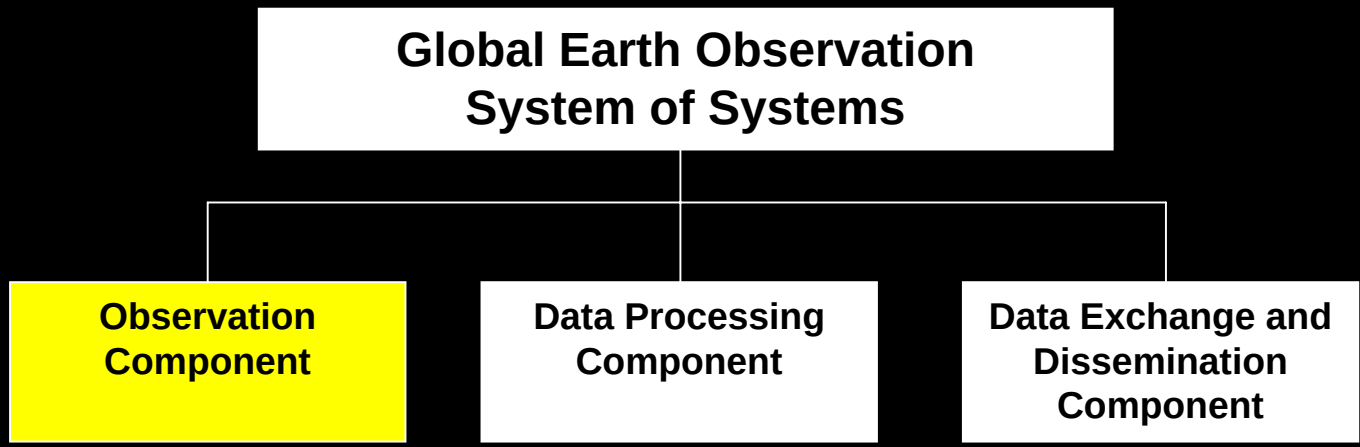
GEOSS must provide Cal/Val reference methods

Participating data providers are to provide reference ("best practice") methods in a readily accessible form. These Cal/Val materials should address pre and post launch calibration, geo-referencing, geocoding (including orthorectification, where required), radiative transfer computation, validation and data merging etc. The database should also include validation site characteristics, image and vector maps and ancillary (meta-) data (e.g., WGCV/LPV LAI intercomparison field sites).

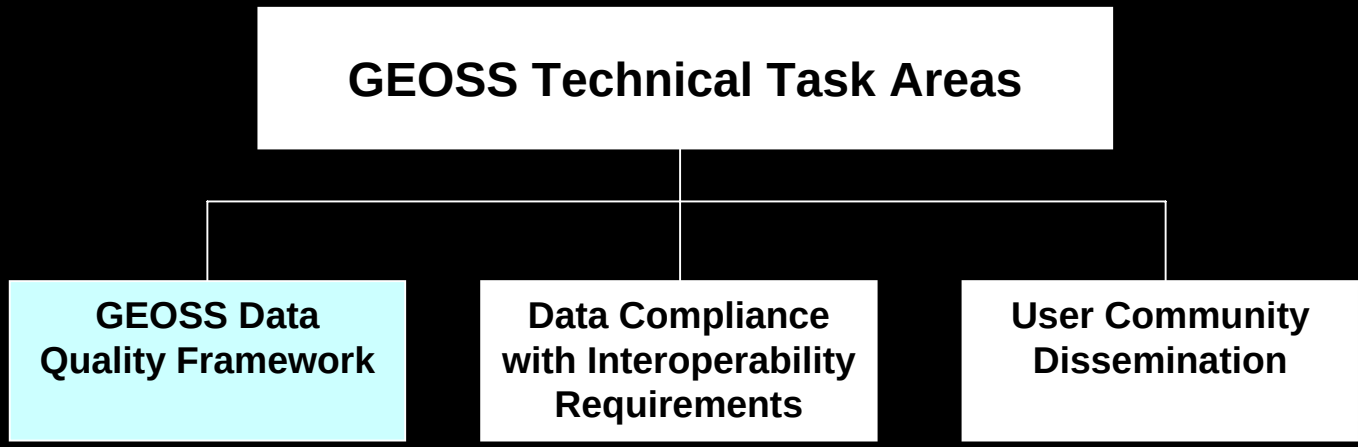


Components of GEOSS **Architecture**



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.

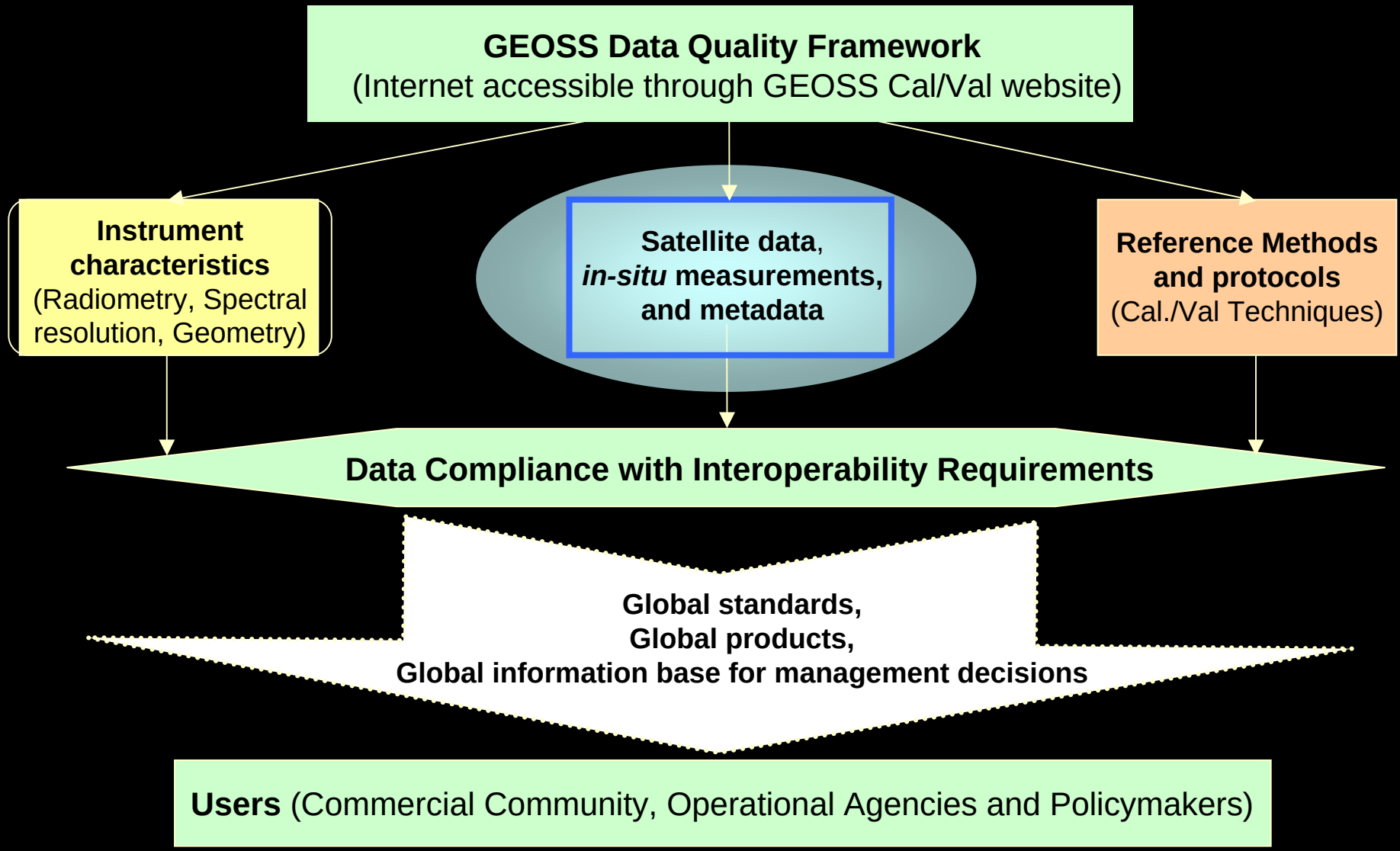
Components of GEOSS **Functionality**



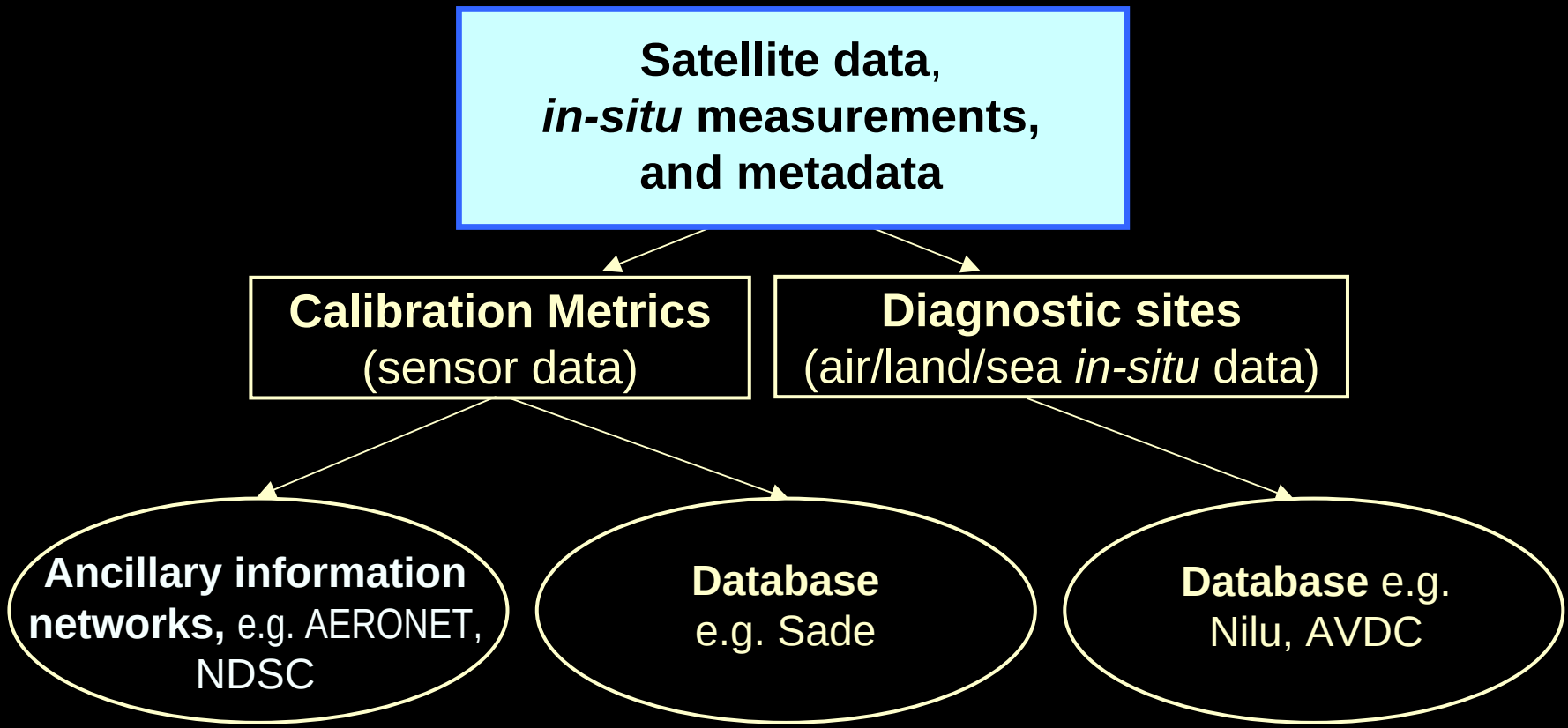
The high level GEOSS **functionality** componentization introduces a structure whch ensures accomplishment of required GEOSS objectives within the proposed GEOSS **architecture**. There is a need to specify **functionality** for the components of GEOSS **architecture** to enable the fulfillment of GEOSS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

These components are designed to ensure data integrability and interoperability.

WGCV Proposal



WGCV Proposal GEOSS Cal/Val Data Framework



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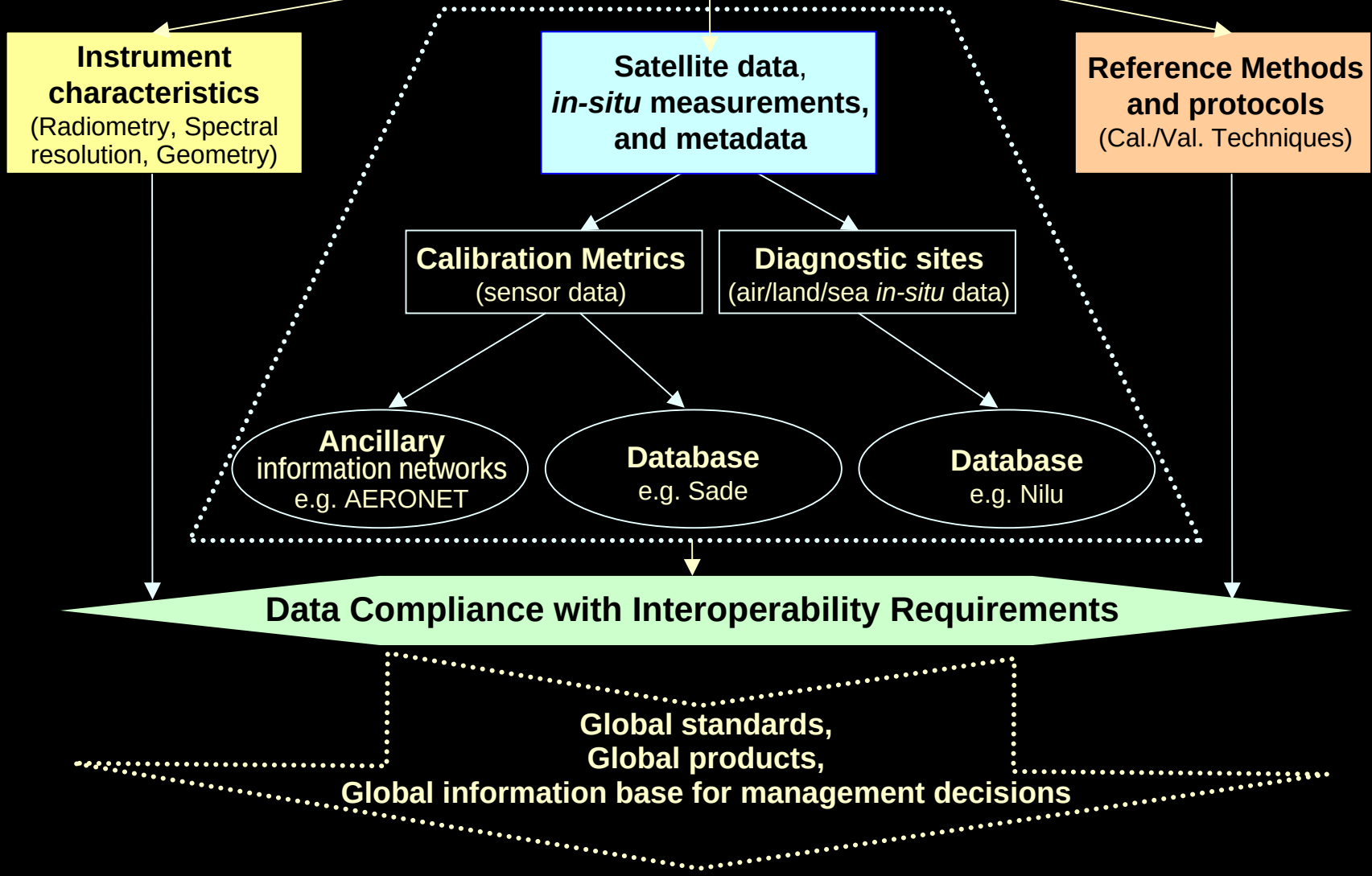
GEOSS Data Quality Framework

(WWW accessible throughout GEOSS cal/val website)

WGCV Proposal



Users (Commercial Community, Operational Agencies and Policymakers)

Presented at CEOS Mid-term Principals Meeting, Geneva, Switzerland, May 2005

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Conclusion

The approach outlined in this presentation will ensure the quality assessment of space-borne instrument data in the context of a service driven global operational Earth observation remote sensing system.

It 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.