Evolution of Information Systems at the GES DAAC

Are the GES DAAC Envisioned Information Systems contributions to science information management consistent with the needs of the NASA Earth science community?

New NRC Data Paradigm

"To meet important needs, there must be a greater ability to extract information coherently from multiple observations and sensors and to address the already-well-known challenges of data management. Observations without analysis, interpretation, and application are sterile, and it is thus crucial to ensure the vitality of research, analysis, and modeling programs."

--2007 NRC Decadal Survey, p. 69

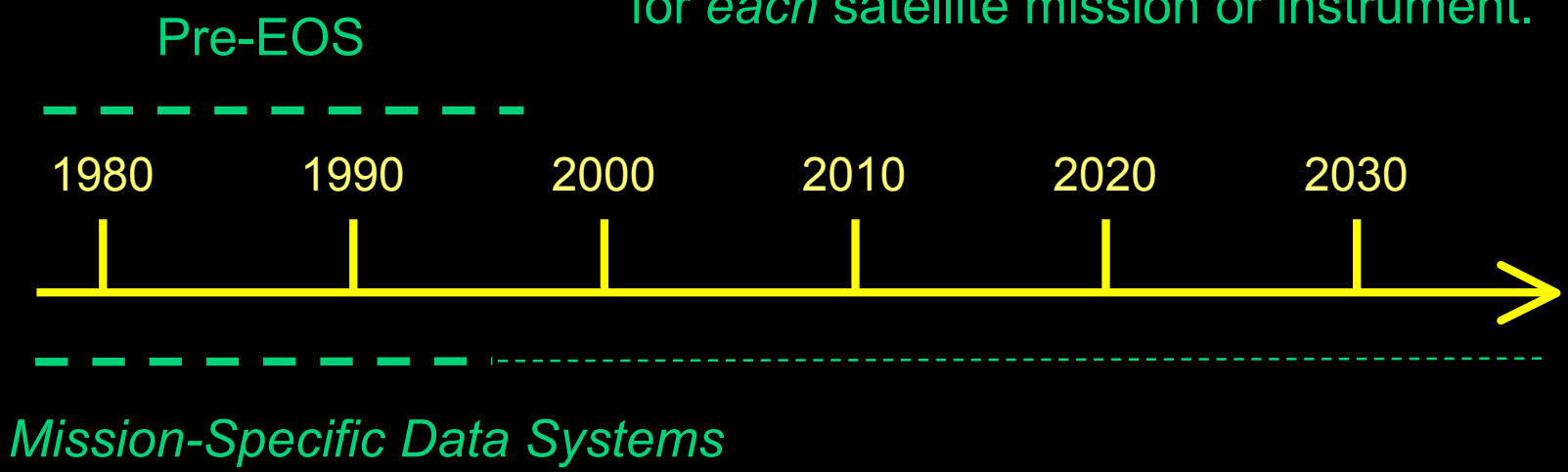
Comprehensive Data Systems

"The space-based components of NASA's Earth science program provide a constellation of satellites to study Earth from space. Sustained observations allow researchers to monitor Earth's climate variables over time to determine trends; however, launching satellites alone is not sufficient. A **comprehensive** data and information system, a community of scientists performing research with the data acquired, and extensive ground and airborne campaigns are all important components. More than any other factor, the commitment to make Earth science data easily available to the research community is critical to mission success."

-- 2006 EOS Science Reference Handbook, p. 2

Mission-Specific Data Systems

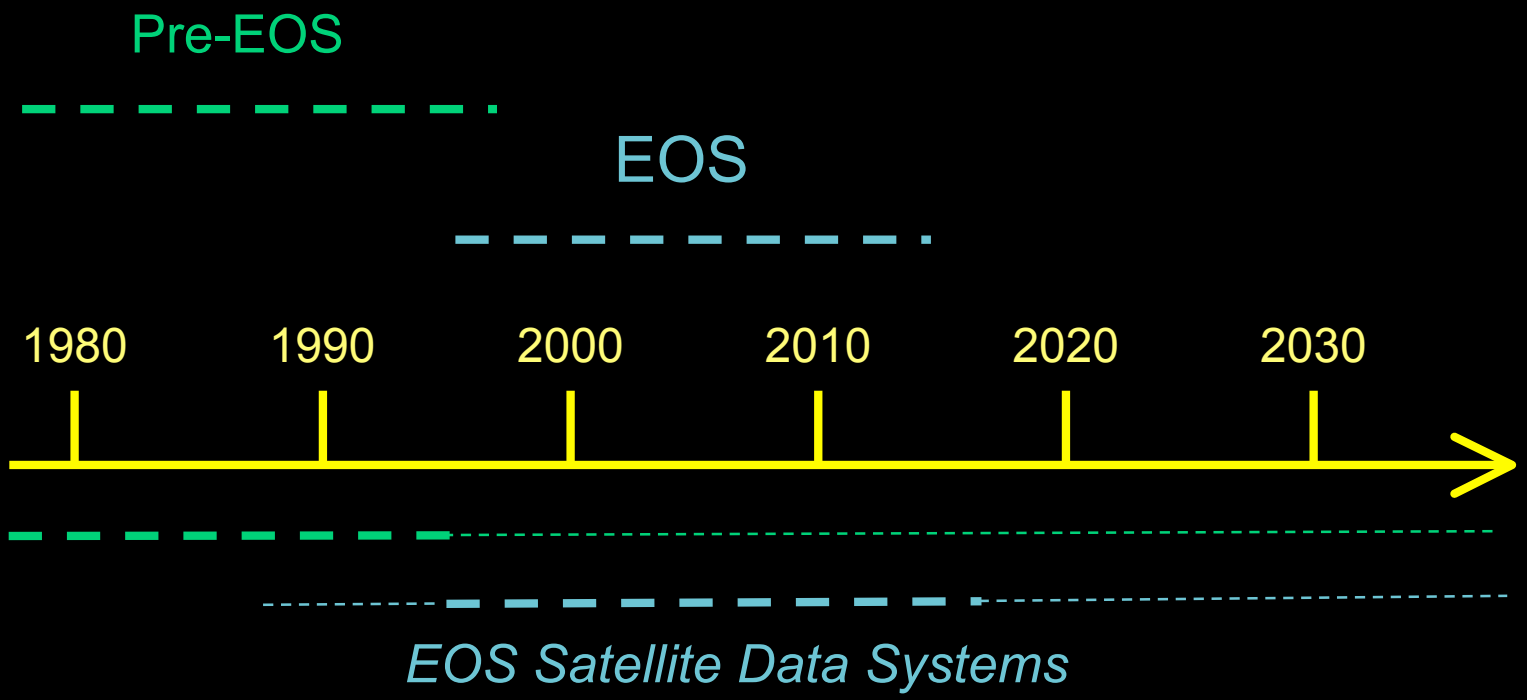
Pre-EOS *Mission-Specific Data Systems* provided a *separate* data access system for *each* satellite mission or instrument.



Pre-EOS SCIENCE PARADIGM:

Science Question → Develop Satellite → Launch Satellite → Collect Data → Address Science Question

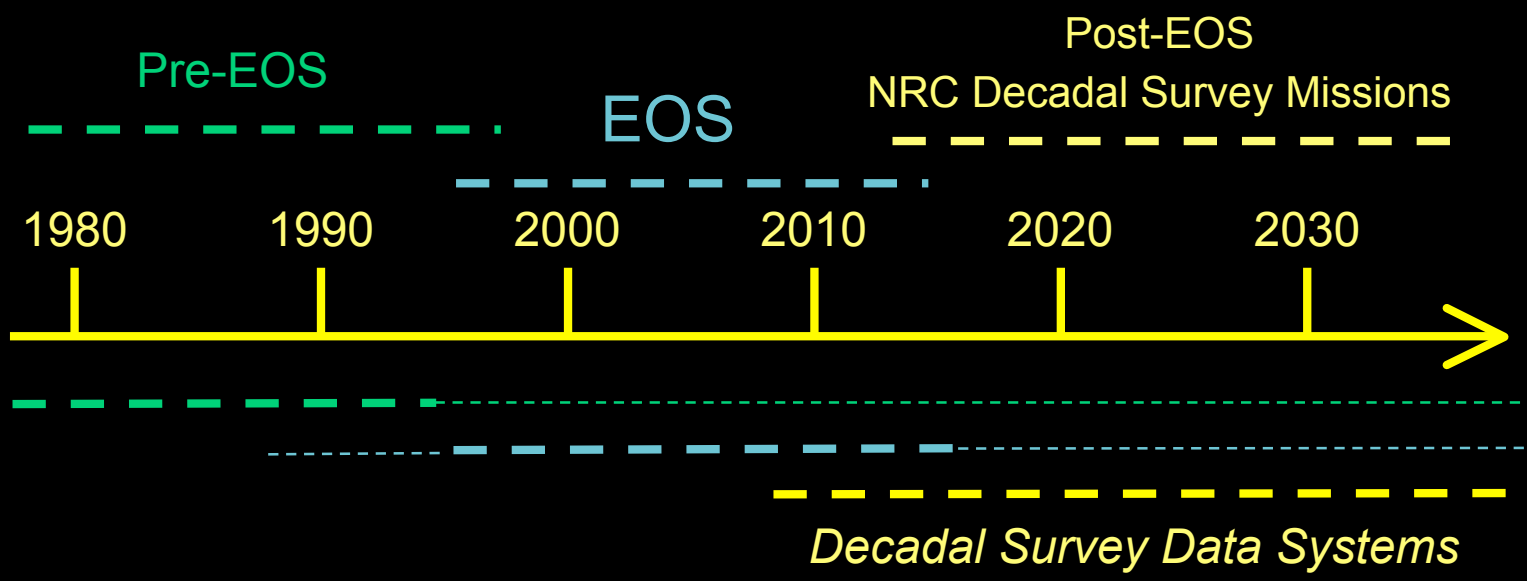
EOS Satellite Data Systems



EOS SCIENCE PARADIGM:

Science Questions → Develop a *Suite or Sequence* of Satellites → Launch Satellites → Collect Data → Address Science Questions

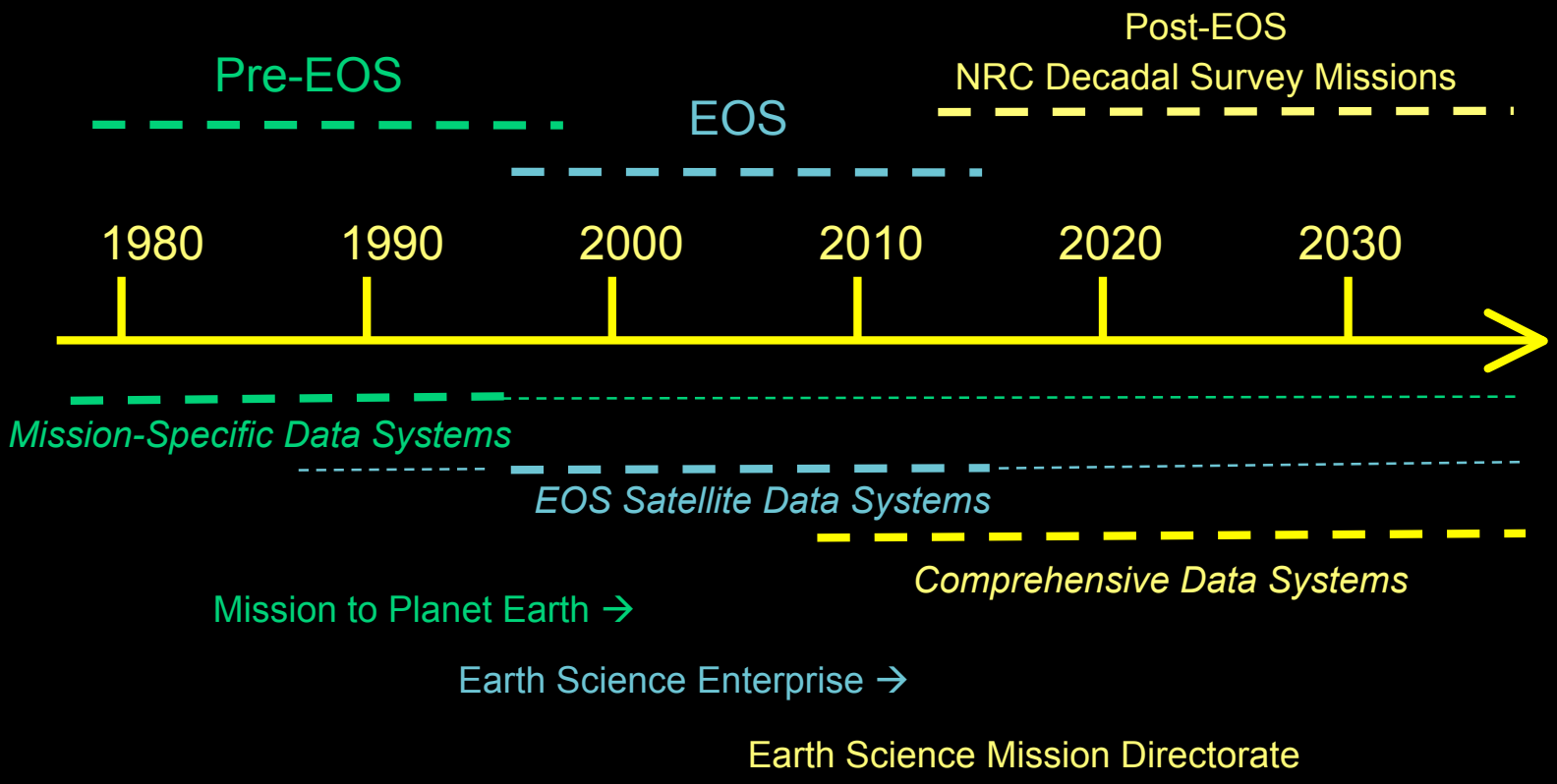
Decadal Survey Missions Data Systems



Post-EOS NRC SCIENCE PARADIGM:

Science Questions → Develop a Suite or Sequence of Satellites, *plus Ground-Based and Field Campaign Observations, and Models* → Launch Satellites → Collect Data → Address Science Questions

Data System Evolution Overview



Vision

To be a Lead Contributor to the Advancement of Information Systems to Facilitate Earth Science Research and Applications

Strategic Sectors

Strategic Sectors	Description
Mission Support	Provide and operate data systems that support current and future science missions and instrument teams
Data Services	Develop and provide advanced interoperable services for scientific data
Multi-Sensor & Model Data Intercomparisons	Develop/Implement multi-sensor data management, including intercomparison, merging/fusion algorithms.
Technology Infusion	Infuse and incubate emerging technologies for scientific data management and analysis
Measurement Based System Support	Collaborate with producers to archive, distribute, and provide services for long-term climatic measurements
Data Broker	Provide data management and value added services for external data.

Mission Support

- Provide and operate data systems that support current and future science missions and instrument teams
- Examples
  - TRMM
  - Aqua/AIRS
  - Aura
  - Glory, SMAP…

Data Services

- Develop and provide advanced interoperable services for scientific data

- Examples
  - Giovanni
  - HTTP Services
  - OPeNDAP
  - OGC
  - etc.

Multi-Sensor and Model Data Intercomparisons

- Develop and implement multi-sensor data mangaement including merging/fusion algorithms, sensor web, etc.
  - A-Train
  - Specific Giovanni instances
  - Hurricane Portal(?)

Technology Infusion

- Infuse and incubate emerging technologies for scientific data management and analysis
- Examples
  - Semantic Mirador
  - Multi-sensor Data Synergy Advisor
  - Smart Assistant for Mining
  - OPeNDAP

Measurement-Based System Support

- Collaborate with producers to archive, distribute and provide data services for long-term climatic measurements
- Examples
  - MERRA
  - MEaSUREs
  - Aerosol Giovanni

Data Broker

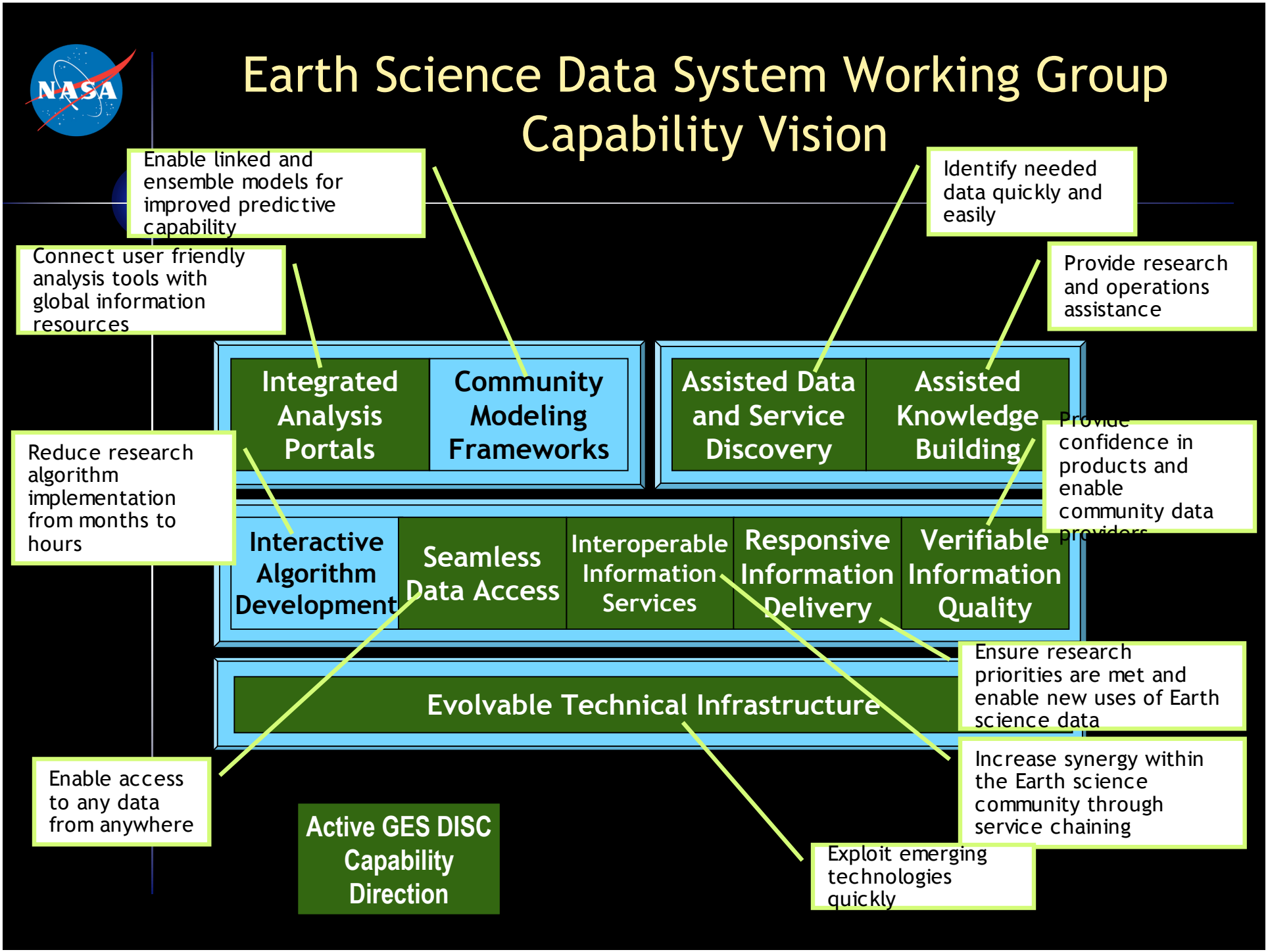
- Provide data management and value-added services for external data
- Examples
  - TES, CERES
  - Atmospheric Composition Constellation

Evolution of Information Systems at the GES DAAC

Are the GES DAAC Strategic Sectors aligned with the needs of the NASA Earth science community?

Backup

Earth Science Data System Working Group Capability Vision



Capabilities <-> Directions Map

	Mission Ops	Data Services	Multi-sensor Data Synergy	Data Broker	Measure-ment-based System	Technology Infusion
Integrated Analysis Portals		Giovanni	Giovanni	Giovanni		Workflow Engine
Assisted Data and Service Discovery		Mirador	MDSA	Mirador		Semantic Web
Assisted Knowledge Building		SAM				Semantic Web, Social Workflows
Seamless Data Access	MRI, Mirador OpenSearch	Mirador		Mirador		Semantic Web
Interoperable Information Services		OPeNDAP, WCS, HTTP Svcs, Giov.		OPeNDAP, OGC		OPeNDAP, OpenSearch, OGC WCS
Responsive Information Delivery	NRT	WMS				OGC WMS
Verifiable Information Quality	?	ACCESS 2009	MDSA	MDSA	MDSA	Semantic Web
Evolvable Technical Infrastructure	S4PM Kits					Blade servers

EOSDIS 2015 Vision Tenets

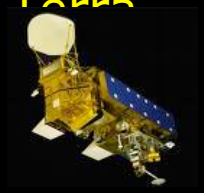
Vision Tenet	Vision 2015 Goals
Archive Management	▪ NASA will ensure safe stewardship of the data through its lifetime. ▪ The EOS archive holdings are regularly peer reviewed for scientific merit.
EOS Data Interoperability	▪ Multiple data and metadata streams can be seamlessly combined. ▪ Research and value added communities use EOS data interoperably with other relevant data and systems. ▪ Processing and data are mobile.
Future Data Access and Processing	▪ Data access latency is no longer an impediment. ▪ Physical location of data storage is irrelevant. ▪ Finding data is based on common search engines. ▪ Services invoked by machine-machine interfaces. ▪ Custom processing provides only the data needed, the way needed. ▪ Open interfaces and best practice standard protocols universally employed.
Data Pedigree	▪ Mechanisms to collect & preserve the pedigree of derived data products are readily available.
Cost Control	▪ Data systems evolve into components that allow a fine-grained control over cost drivers.
User Community Support	▪ Expert knowledge is readily accessible to enable researchers to understand use the data. ▪ Community feedback directly to those responsible for a given system element.
IT Currency	Access to all EOS data through services at least as rich as any contemporary science information system.

EOSDIS 2015 <-> Directions Map

	Mission Ops	Data Services	Multi-sensor Data Synergy	Data Broker	Measurement-based System	Technology Infusion
Archive Management	S4PA				S4PA	
EOS Data Interoperability		SAM	Giovanni, MDSA	Giovanni	Giovanni	Workflow Engines
Future Data Access and Processing	S4PA, NRT	Mirador, OPeNDAP, OGC			S4PA, S4PM, Semantic Mirador	Semantic Web, Social Workflows
Data Pedigree	S4PM	MDSA	MDSA	MDSA	MDSA	Semantic Web
Cost Control	S4PA, S4PM	OPeNDAP, OGC		OPeNDAP, OGC		OpenSearch, OGC
User Community Support		ACCESS 2009		?	?	?
IT Currency		Giovanni, OPeNDAP, OGC, HTTP Svcs	Giovanni, MDSA	Giovanni, MDSA	MDSA	Semantic Web

EOS Satellite Data Systems

SeaWiFS → Giovanni Online Visualization and Analysis → Ocean Color Giovanni



TRMM

→ Giovanni Online Visualization and Analysis → TOVAS

Aqua

MODIS → Giovanni Online Visualization and Analysis → MOVAS

AIRS → Giovanni Online Visualization and Analysis → AIRS Giovanni

Aura

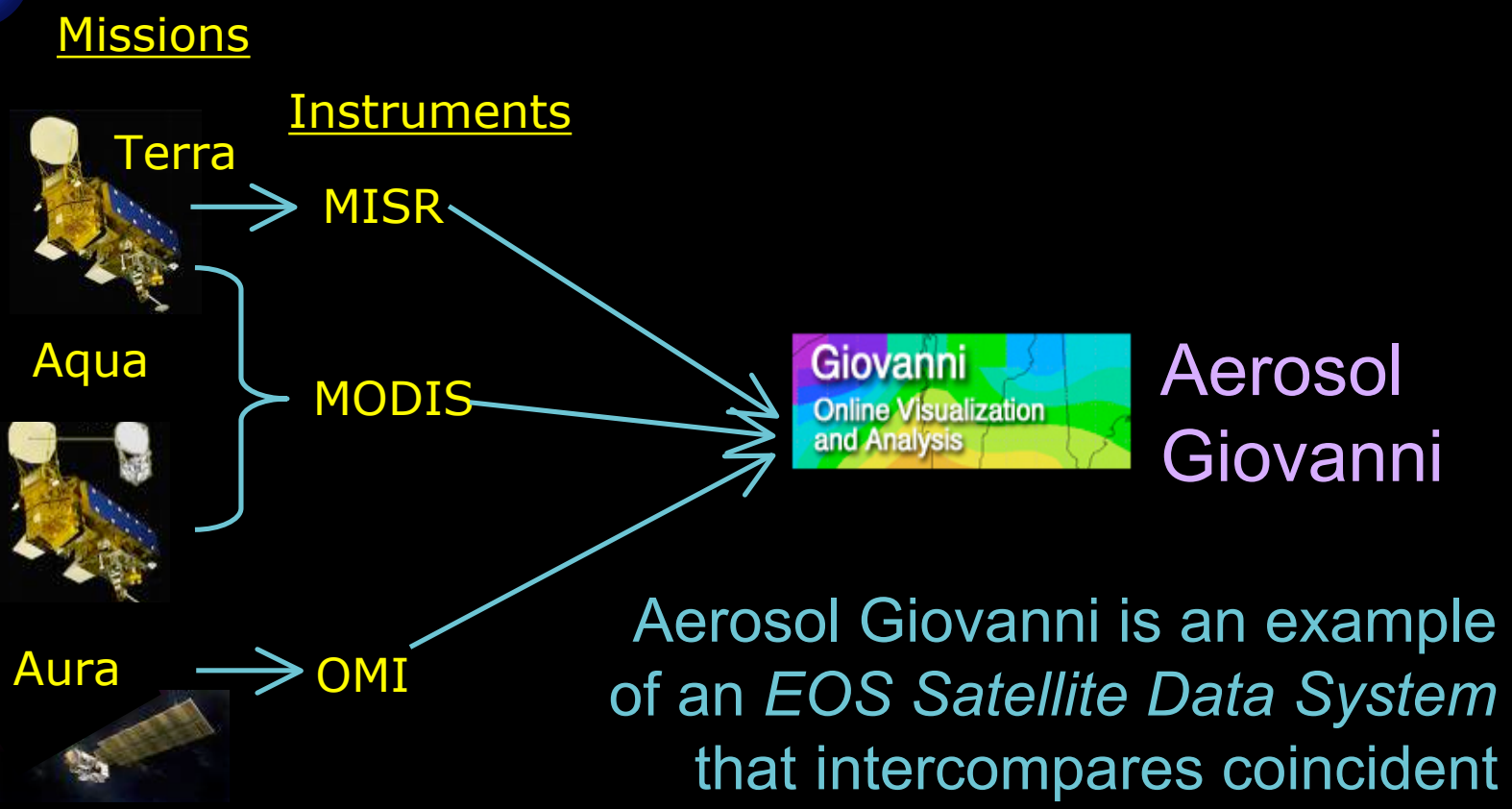
OMI → Giovanni Online Visualization and Analysis → OMI Giovanni

SORCE → Mirador Data Access Made Simple → Mirador

Examples of *EOS Satellite Data Systems* at the GES DISC.

Current GES DISC Implementation

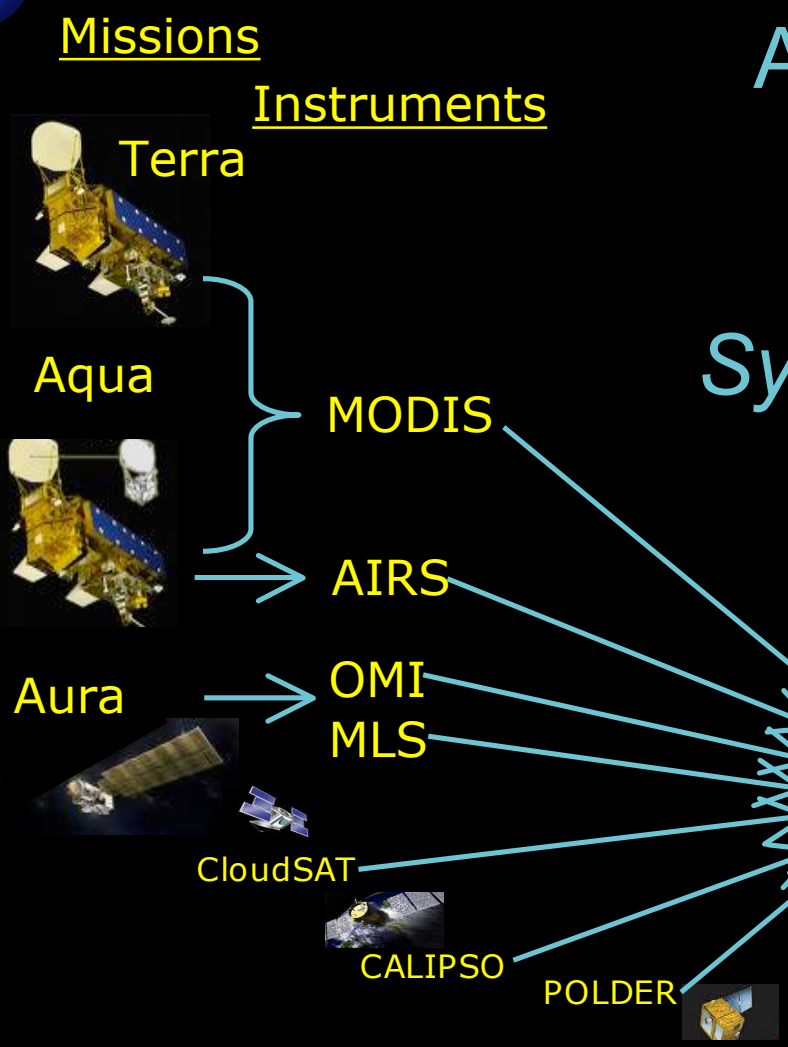
EOS Satellite Data Systems



Aerosol Giovanni is an example of an *EOS Satellite Data System* that intercompares coincident satellite observations.

Current GES DISC Implementation

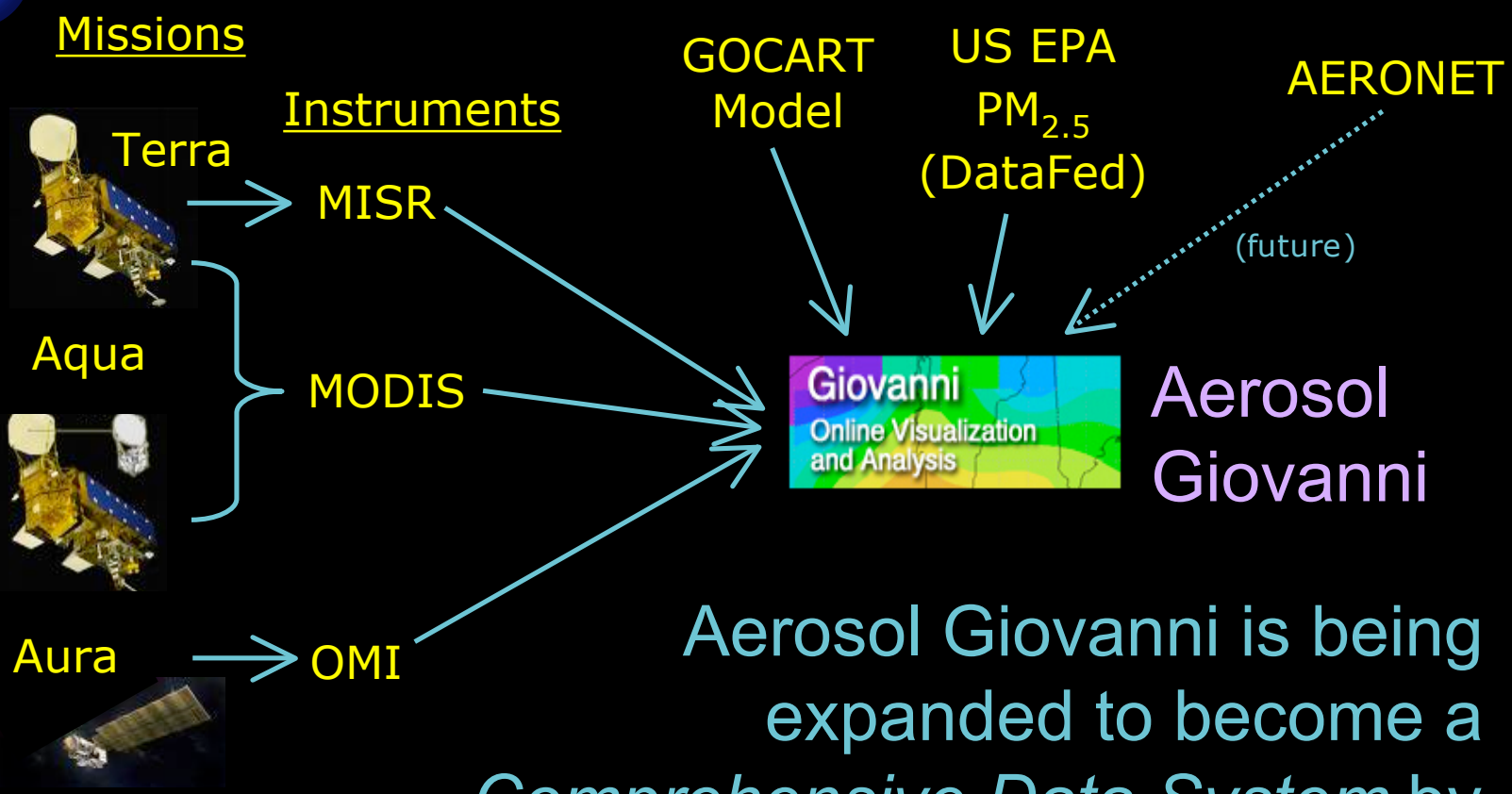
Comprehensive Data Systems



A-Train Data Depot the first example of a *Comprehensive Data System* that continues to evolve.

Current GES DISC Implementation

Comprehensive Data Systems



Aerosol Giovanni is being expanded to become a *Comprehensive Data System* by including more models and coincident ground-based datasets.

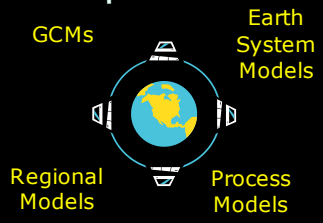
Comprehensive Data Systems

Current Satellites (NASA, NOAA, ESA, JAXA)

Legacy Satellites

Ground-Based Observations

Computer Models



Comprehensive Data Systems provide an environment for working with *all* sources of relevant data (satellite, ground-based and models) across the full range of temporal and spatial scales.

Future GES DISC Implementation

Comprehensive Data Systems