Science Mission Directorate

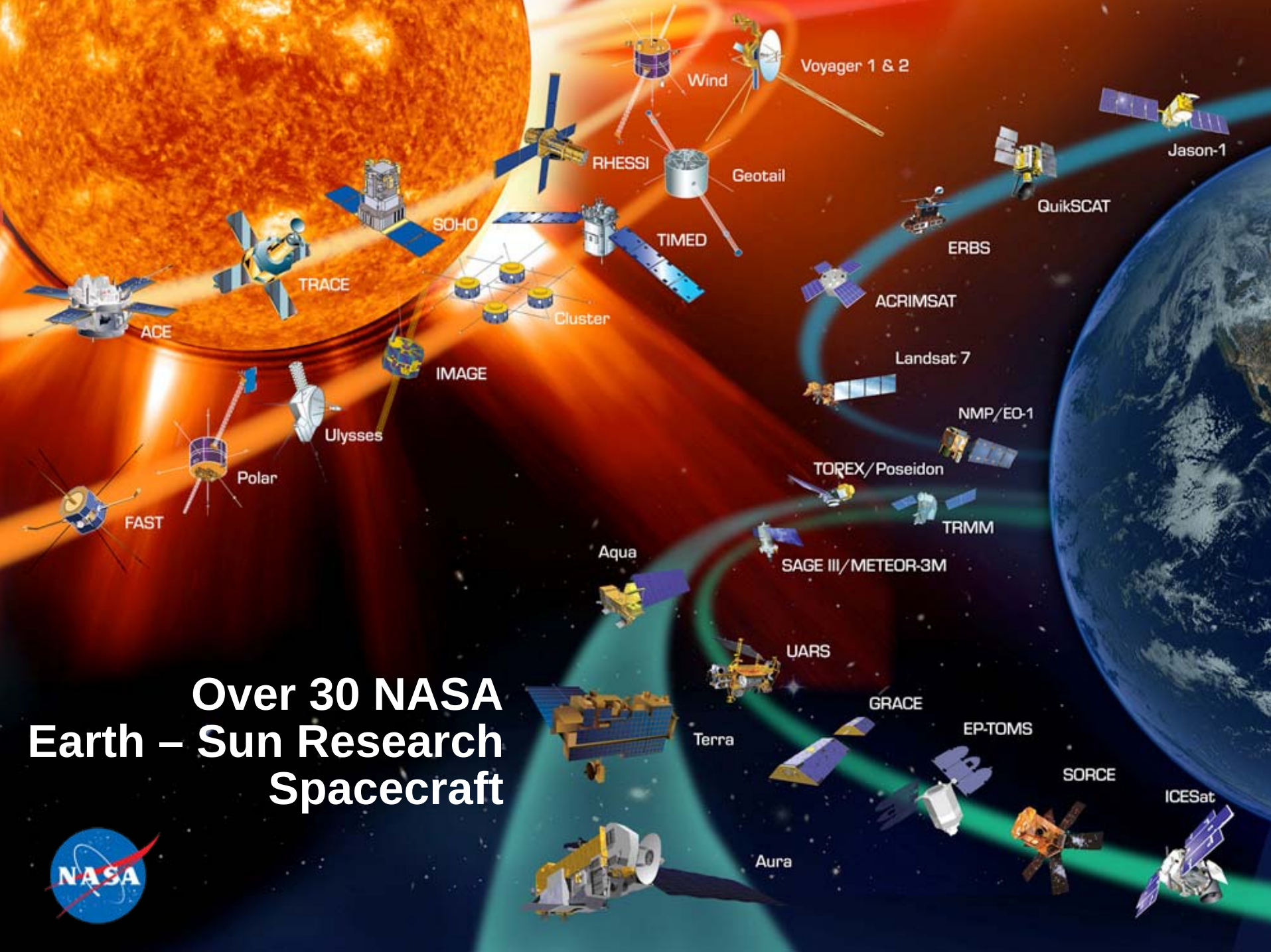
Update on NASA

Presented at the Unidata Policy Committee Meeting

16 May 2005

Michael Goodman
Earth-Sun System Division
NASA Headquarters

With the Launch of Aura, the 1st Series of EOS is Now Complete


Wind
Voyager 1 & 2
RHESSI
Geotail
Jason-1
QuikSCAT
SOHO
TIMED
ERBS
TRACE
ACRIMSAT
ACE
Cluster
Landsat 7
IMAGE
NMP/EO-1
Ulysses
TOREX/Poseidon
Polar
TRMM
FAST
SAGE III/METEOR-3M
Aqua
UARS
GRACE
Terra
EP-TOMS
SORCE
ICESat
Aura
Over 30 NASA Earth – Sun Research Spacecraft
NASA

NASA's Perspective

Earth System Science

a. Interdisciplinary research
b. Global observations

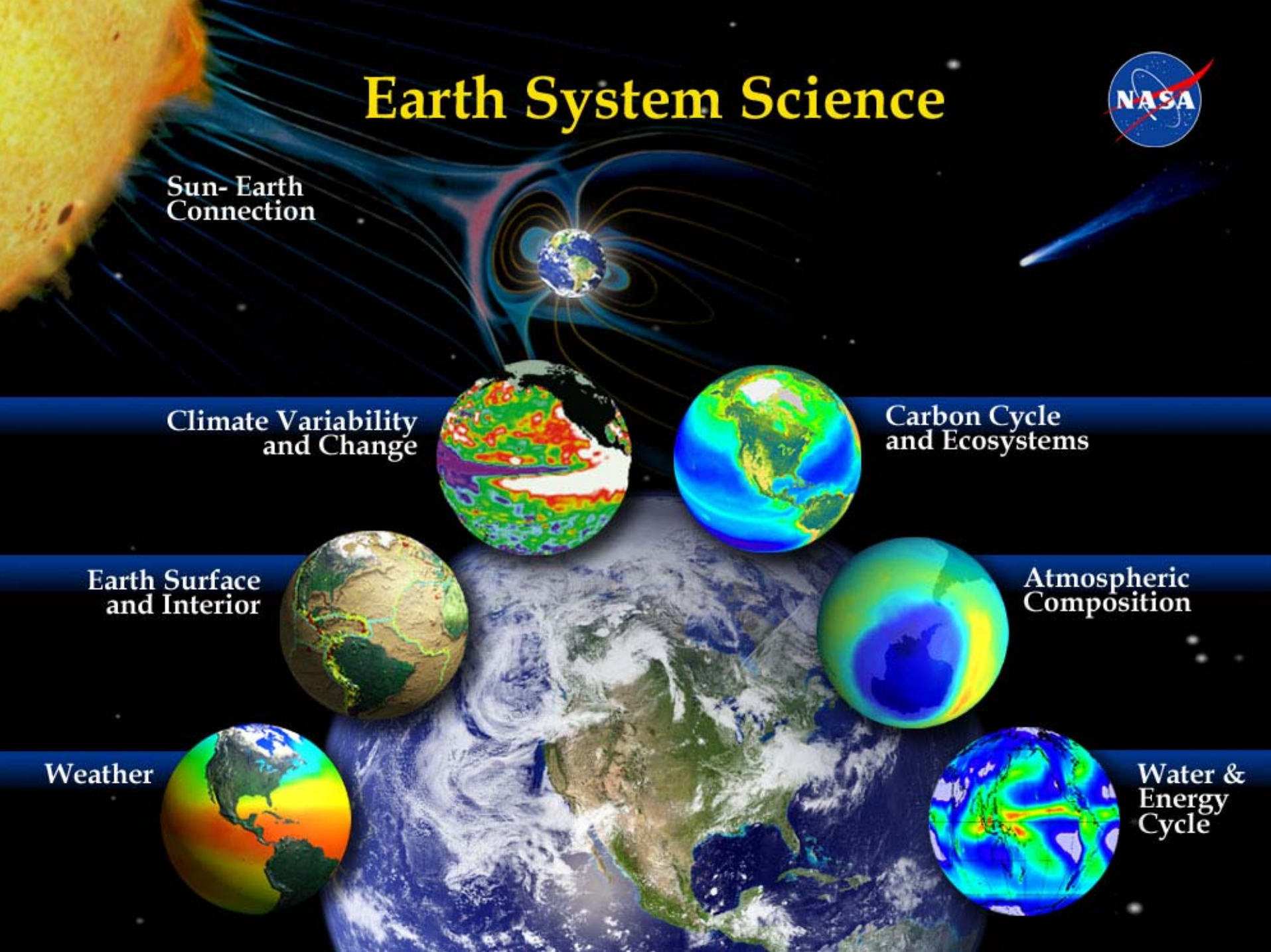
Development of observing capability

a. Innovative technology development
b. Space-based observations

Pioneer use of remote sensing to improve prediction of weather, climate and natural hazards

a. Modeling
b. Integration of Earth observation, advanced technology, and interdisciplinary research

Earth System Science



Earth System Science Research Questions

How is the Earth changing and what are the consequences of life on Earth?

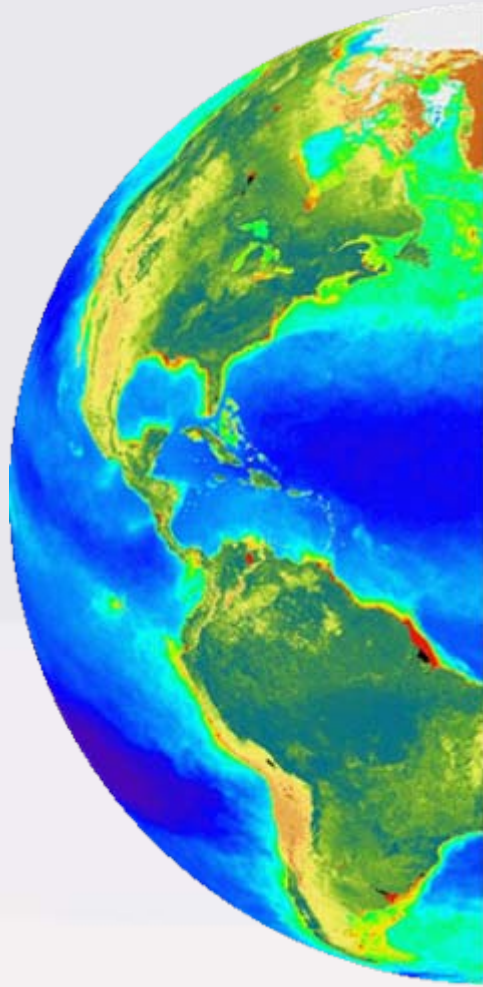
How is the global Earth system ***changing***?

What are the primary **forcings** of the Earth system?

How does the Earth system ***respond*** to natural and human-induced changes?

What are the ***consequences*** of changes in the Earth system for human civilization?

How well can we ***predict*** future changes in the Earth system?

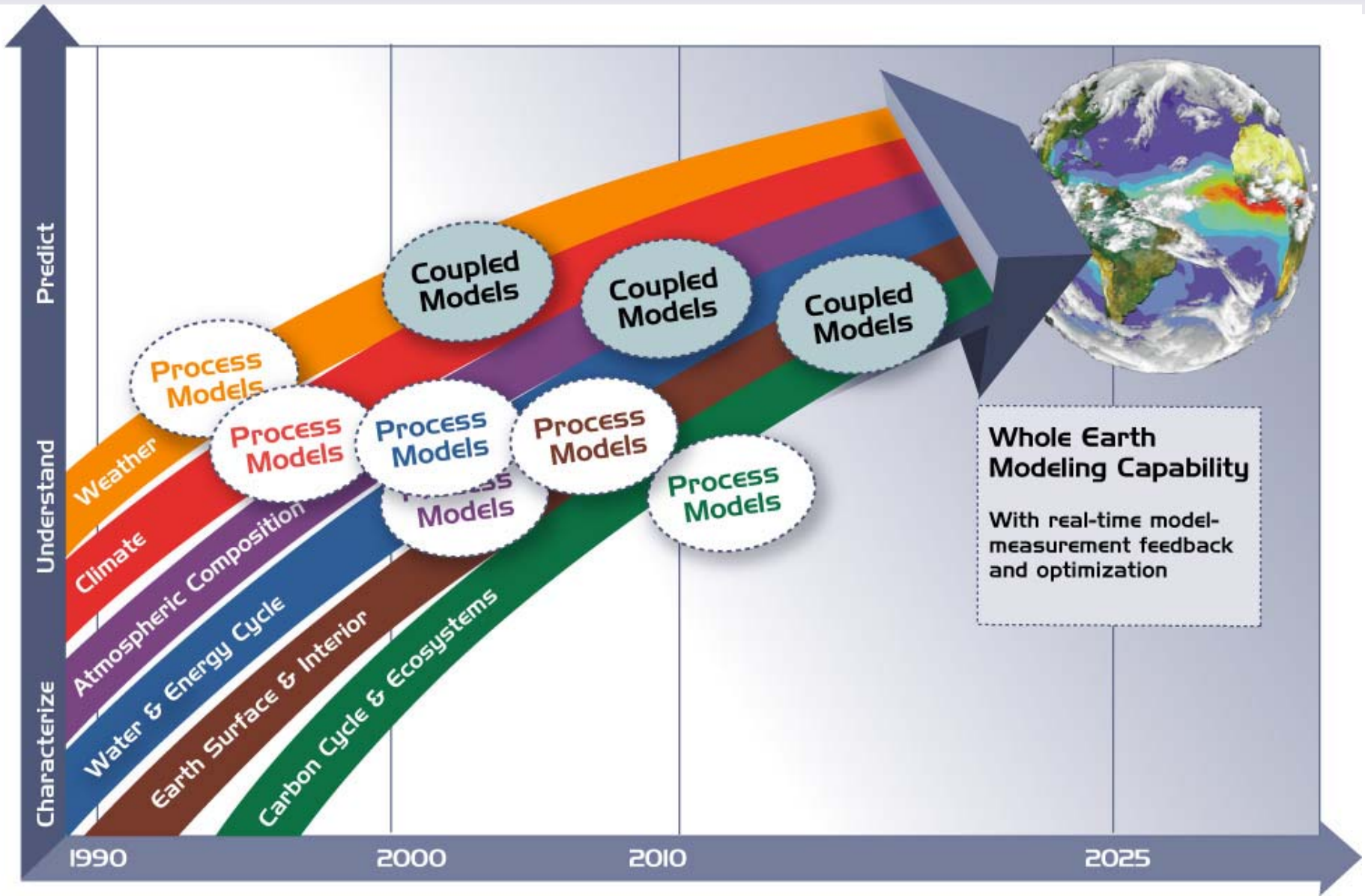


Science Questions and Focus Areas

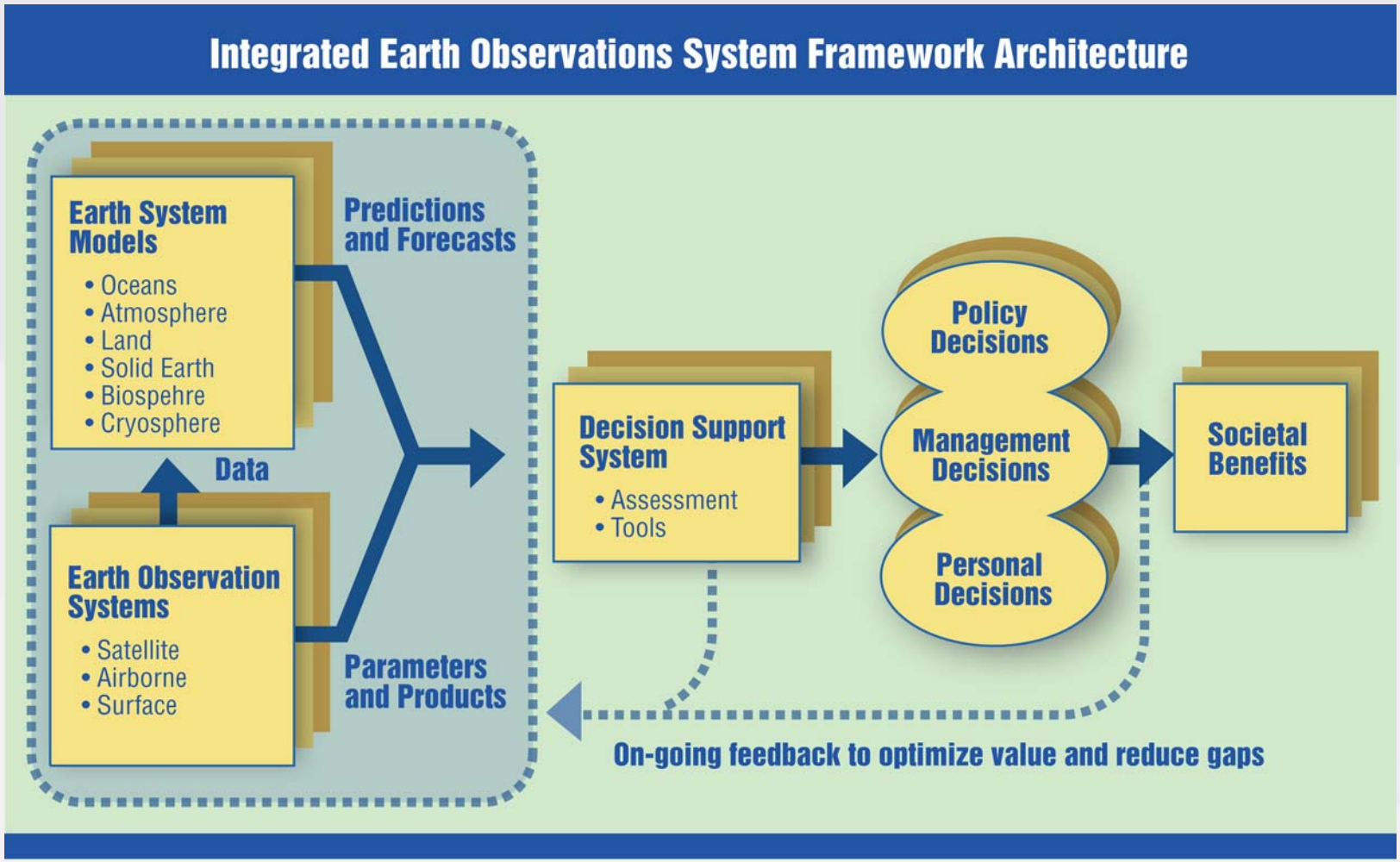
Variability	Forcing	Response	Consequence	Prediction
Precipitation, evaporation & cycling of water changing?	Atmospheric constituents & solar radiation on climate?	Clouds & surface hydrological processes on climate?	Weather variation related to climate variation?	Weather forecasting improvement?
Global ocean circulation varying?	Changes in land cover & land use?	Ecosystems, land cover & biogeochemical cycles?	Consequences of land cover & land use change?	Improve prediction of climate variability & change?
Global ecosystems changing?	Motions of the Earth & Earth's interior?	Changes in global ocean circulation?	Coastal region impacts?	Ozone, climate & air quality impacts of atmospheric composition?
Atmospheric composition changing?		Atmospheric trace constituents responses?	Regional air quality impacts?	Carbon cycle & ecosystem change?
Ice cover mass changing?		Sea level affected by Earth system change?		Change in water cycle dynamics?
Earth surface transformation?				Predict & mitigate natural hazards from Earth surface change?

Climate Variability and Change
Atmospheric Composition
Carbon Cycle and Ecosystems
Weather
Water and Energy Cycle
Earth Surface and Interior

Focus Area Integration via Earth System Modeling



Integrating Knowledge, Capacity and Systems into Solutions



UNITED STATES GROUP ON EARTH OBSERVATIONS

Focus on Societal Benefits

Reduce Losses From Disasters

Protect Water Resources

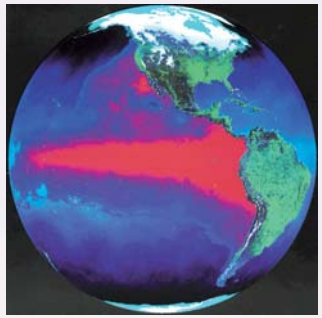
Ecological Forecasts

Human Health & Well-Being

Manage Energy Resources

Sustainable Agriculture And Forestry

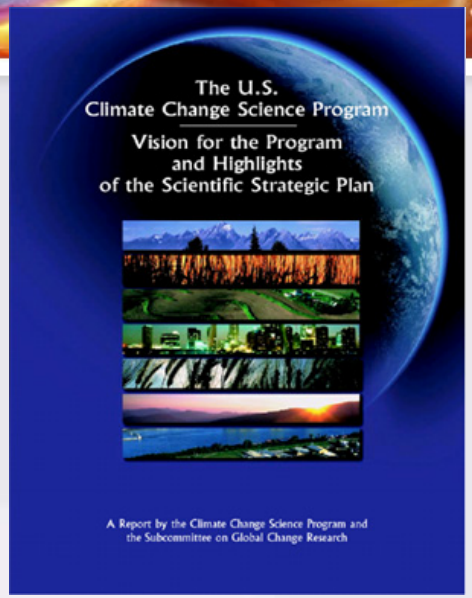
Improve Weather Forecasting

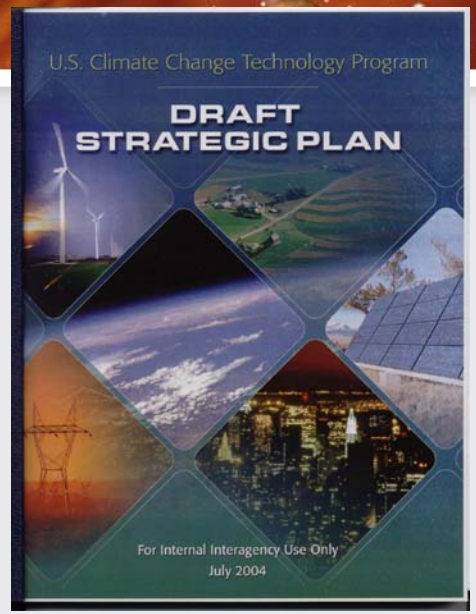


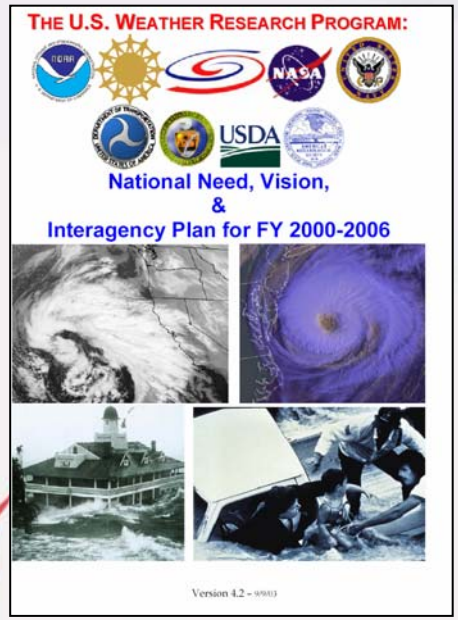
Climate Variability & Change

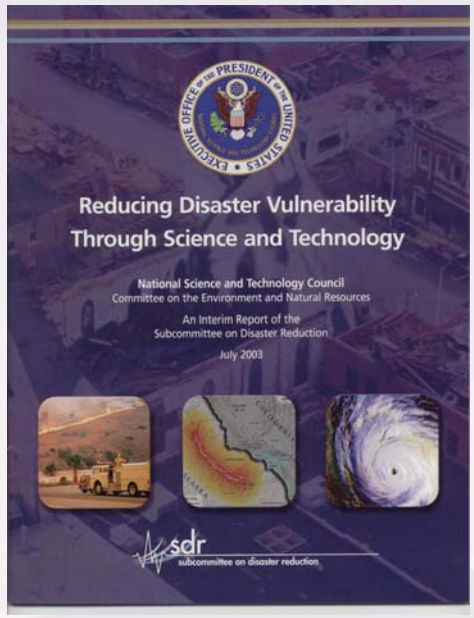
Protect Ocean Resources

U.S. Plans for Extending NASA Science Results







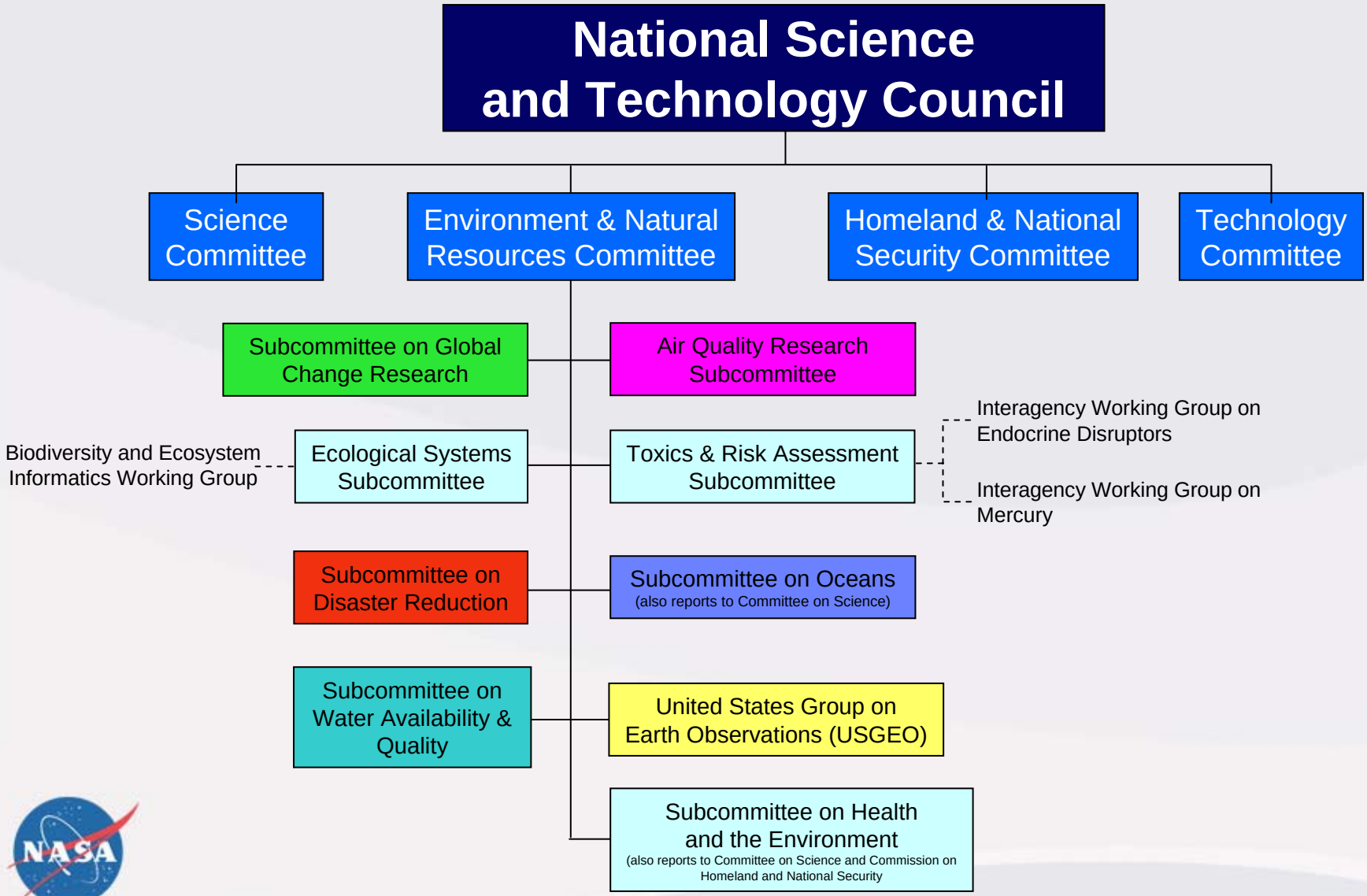


U.S. Commercial Remote Sensing Space Policy: Civil Agency Implementation Plan

December 12, 2003

Implementation Plan Working Group (IPWG)

NSTC Structure



US GEO – An Interagency Effort

Co-chaired by:

- Ghassem Asrar (NASA)
- Teresa Fryberger (OSTP)
- Greg Withee (NOAA)

U.S. Agencies Related To Societal Benefit Areas

TABLE KEY

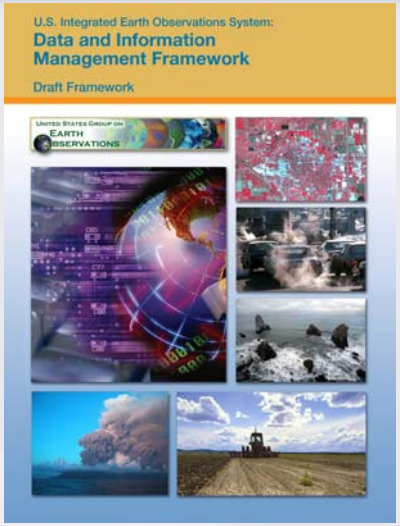
P = primarily provides data

U = primarily uses data

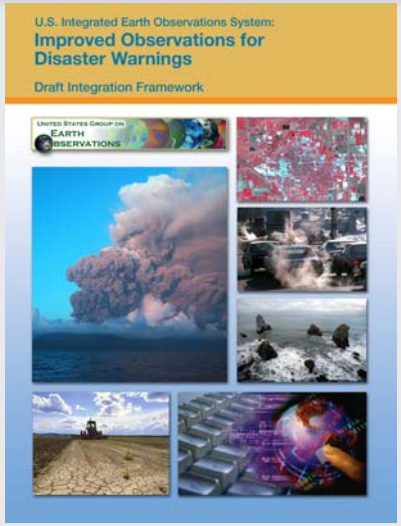
B = uses/provides data

Societal Benefit Areas	U.S. AGENCIES															
	DOC/NIST	DOC/NOAA	DOD	DOE	DHHS/NIEHS	DHS/FEMA	DOI/USGS	DOS	DOT	EPA	NASA	NSF	Tennessee Valley A.	Smithsonian	USAID	USDA
Weather	B	B	U	U	U	U		B	U	B	U	U	U	B	B	
Disasters	P	U	U	U	U	B	U	U	U	P	B	U	U	U	U	
Oceans	B	B	B	U	U	B			U	P	B		U	U		
Climate	B	U	B	U	U	B	U	U	U	B	B		U	B	U	
Agriculture	P		U	U	U	P	U		P	P	B		U	B	P	
Human Health	P		P	B			U		B	P	B		U	B		
Ecology	B		B	U		B	B		B	P	B		B	B	B	
Water	B		B	U	U	B	B	U	B	P	B		U	B	U	
Energy	P		B	U	U	B	P	U	B	P	U	B	U	U		

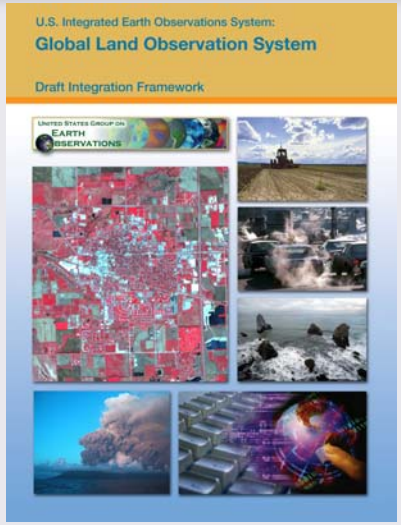
Near-Term Opportunities



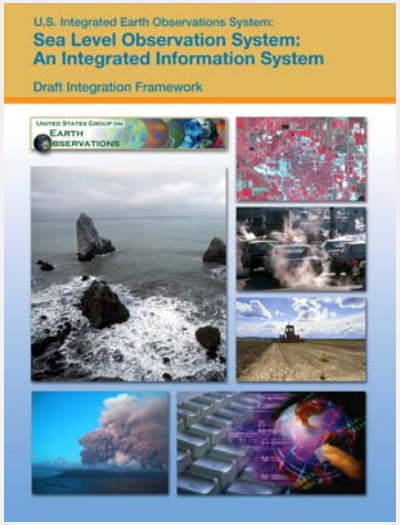
A. Data Management



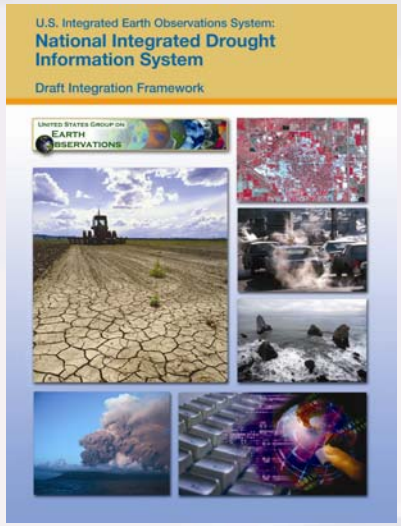
B. Disaster Warnings



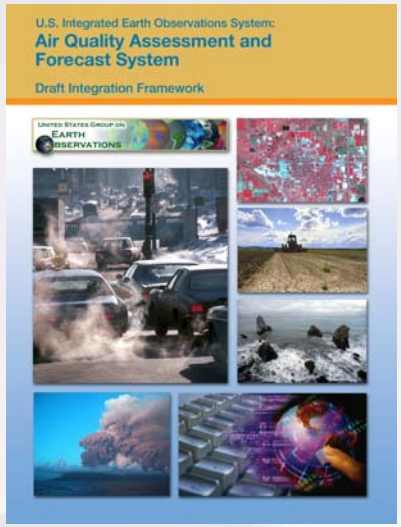
C. Global Land System



D. Sea Level System



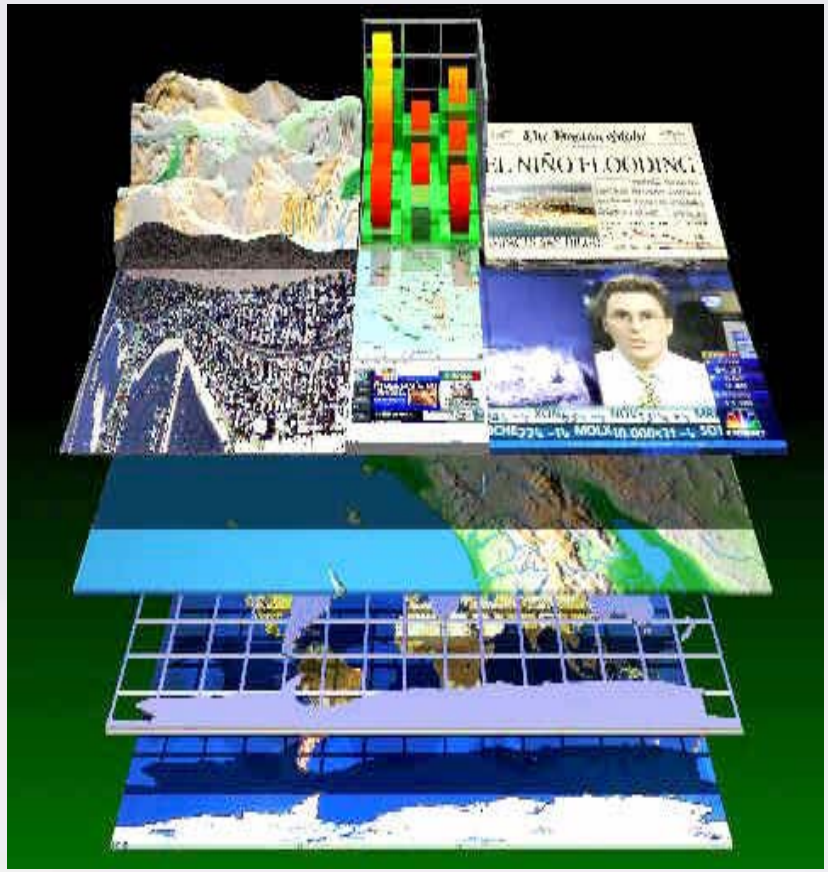
E. Drought System



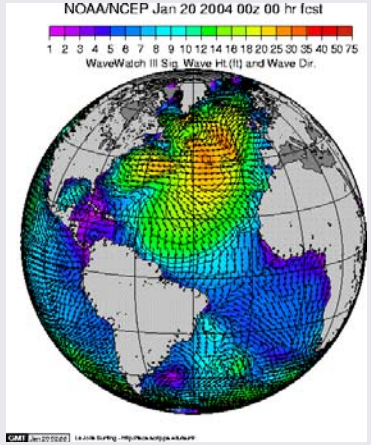
F. Air Quality System

A. Data Management System for Earth Observations

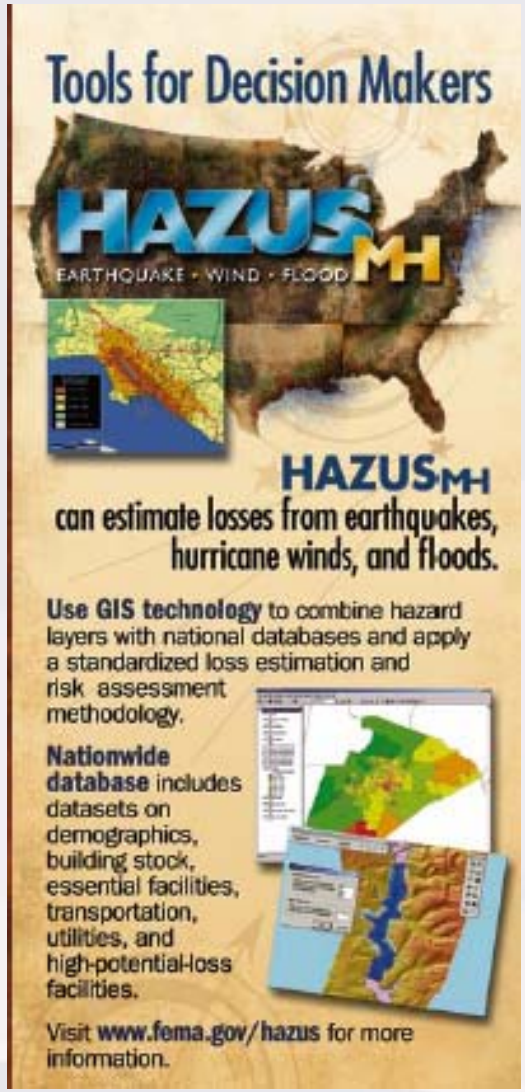
- Data Sharing
- Processing facilities
- Access and archival
- Data transfer
- Web services
- Standards and Interoperability



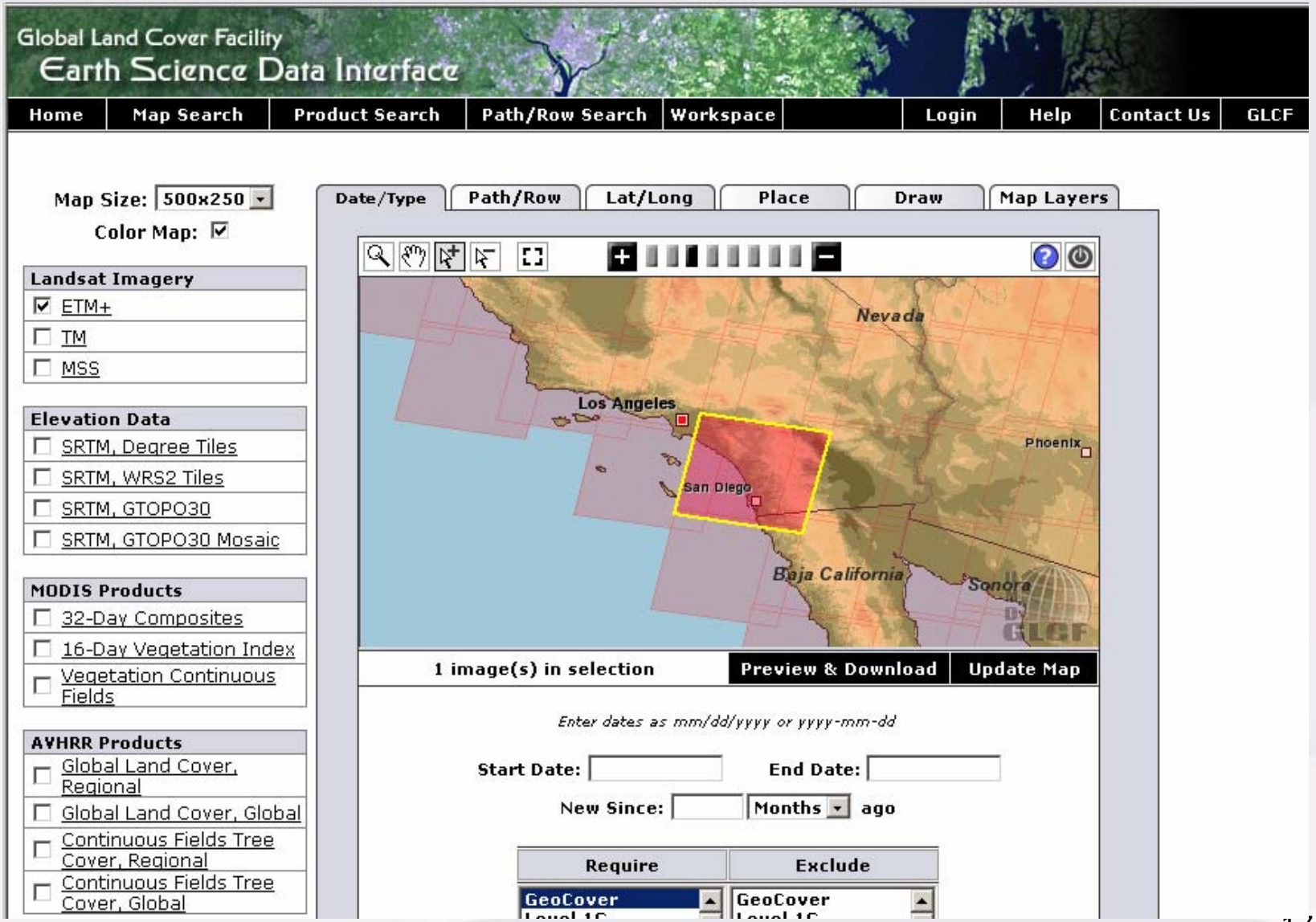
B. Improved Observations for Disaster Management



Data Assimilation & Modeling

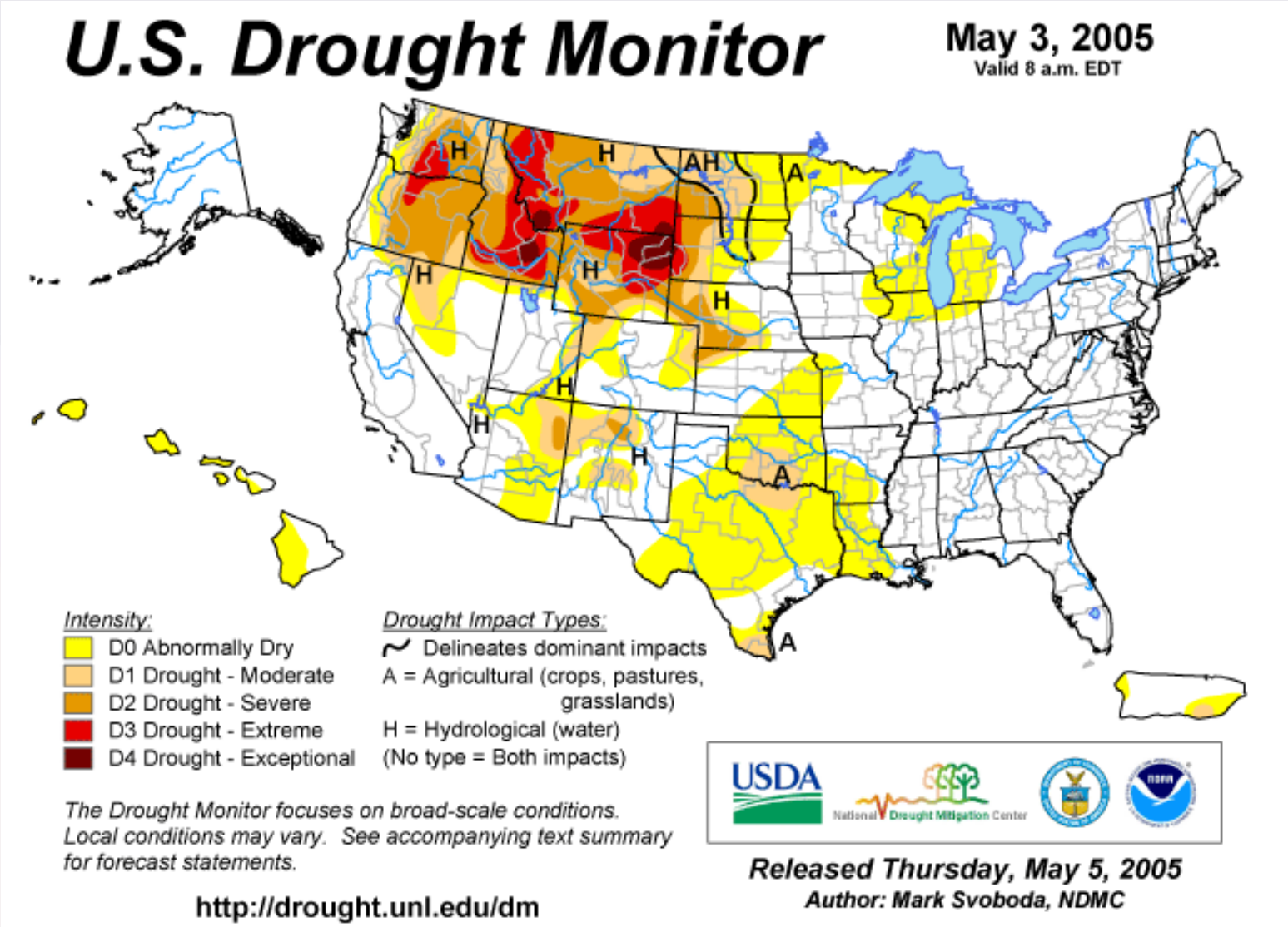


C. Global Land Observation Systems

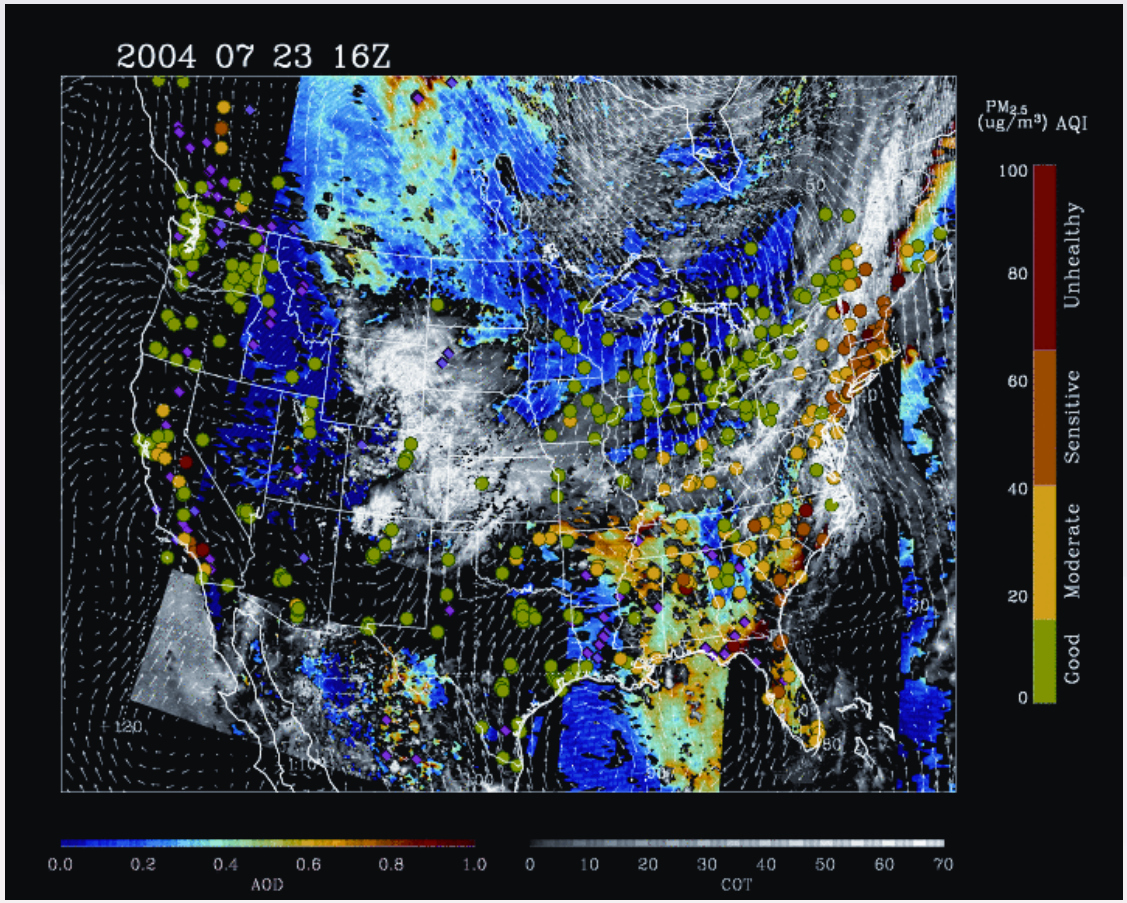


D. Sea Level Observation Systems

E. National Integrated Drought Information System



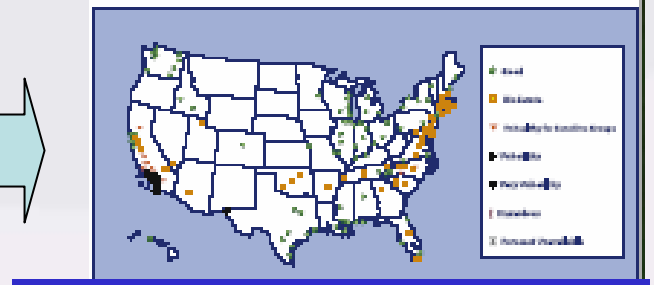
F. Air Quality NowCast



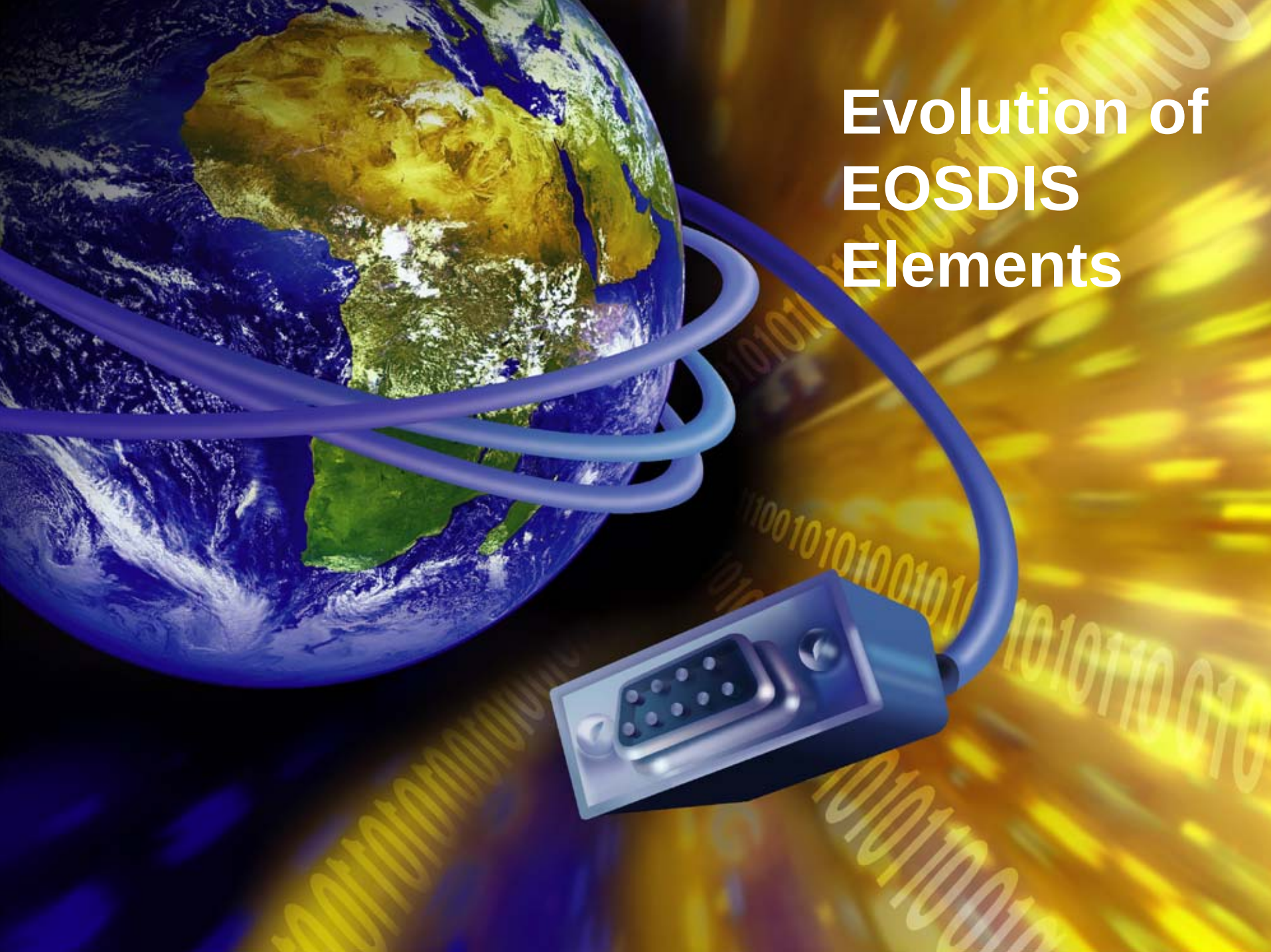
AIRNOW
www.epa.gov

The U.S. EPA has developed the AIRNow website to provide the public with easy access to national air quality information. This website offers daily Air Quality Index forecasts as well as real-time conditions for over 300 cities across the U.S.

Ozone and PM2.5 Forecasts



NASA NOAA EPA


Evolution of
EOSDIS
Elements

Data Acquisition to Data Access

Data Acquisition

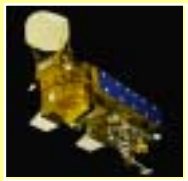
Flight Operations, Data Capture, Initial Processing & Backup Archive

Data Transport to DAACs

Science Data Processing, Data Mgmt., Data Archive & Distribution

Distribution, Access, Interoperability & Reuse

Spacecraft



Tracking & Data Relay Satellite (TDRS)

Ground Stations

Polar Ground Stations

Data Processing & Mission Control

NASA Integrated Services Network (NISN) Mission Services

EOSDIS Science Data Systems (DAACs and SIPS)

Data Pools

REASoNs

Science Teams

Measurement Teams

WWW IP Internet

Research

Education

Value-Added Providers

Interagency Data Centers

Earth System Models

Use in Earth System Models

Benchmarking DSS

TECHNOLOGY

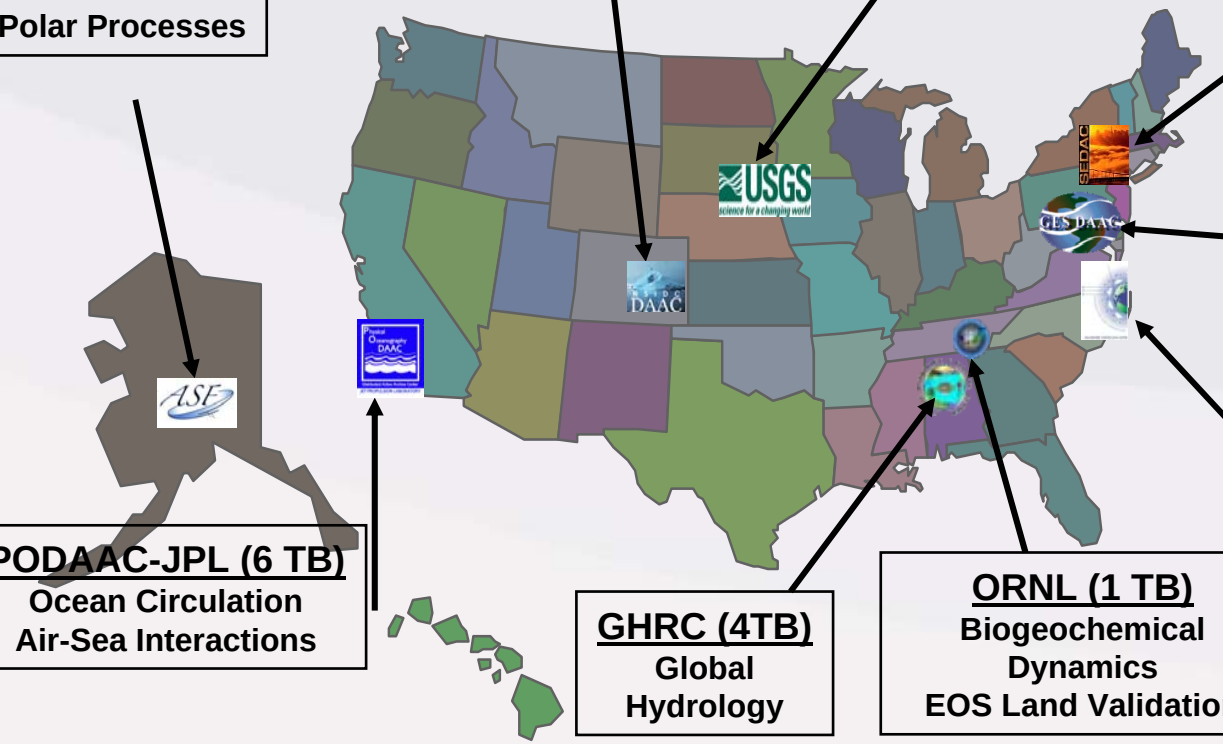
Earth System Data Resides in Distributed Active Archive Centers (DAAC)

ASF (256 TB)
SAR Products
Sea Ice
Polar Processes

NSIDC (67 TB)
Cryosphere
Polar Processes

LPDAAC-EDC (1143 TB)
Land Processes
& Features

SEDAC (0.1 TB)
Human Interactions in
Global Change



GES DAAC-GSFC (1334 TB)
Upper Atmosphere
Atmospheric Dynamics, Ocean Color, Global Biosphere, Hydrology, Radiance Data

PODAAC-JPL (6 TB)
Ocean Circulation
Air-Sea Interactions

GHRC (4TB)
Global
Hydrology

ORNL (1 TB)
Biogeochemical
Dynamics
EOS Land Validation

ASDC-LaRC (340 TB)
Radiation Budget,Clouds
Aerosols, Tropospheric
Chemistry

Evolution of EOSDIS Goals & Objectives

Goal: assess the current state of EOSDIS in order to identify the components that:

- can/must evolve,
- need to be replaced because of the rapid evolution of information technologies, and
- require a phase-out strategy because they are no longer needed.

This study should provide findings and options for evolution of elements of EOSDIS in order to:

- Increase end-to-end data system efficiency and operability
- Increase data usability by the science research, application, and modeling communities
- Provide services and tools needed to enable ready use of NASA's Earth science data in the next-decadal models, research results, and decision support system benchmarking
- Improve support for end users

Evolution of EOSDIS Vision 2015

NASA's research communities have access to all EOS data through services at least as rich as any contemporary science information system, for example:

- Data access latency is no longer an impediment
- The physical location of data storage is irrelevant
- Finding data is based on common search engines (e.g., Google2015)
- Services are primarily invoked by machine-to-machine interfaces
- Multiple data and metadata streams can be seamlessly combined
- Custom processing (e.g., subsetting, averaging, reprojection) provides only the data needed, the way they are needed
- Open interfaces and best practice standard protocols are universally employed

The research and value-added provider communities use EOS data interoperably with any other relevant data sources (e.g., NPOESS, METOP, GPM, numerical models, *in situ* systems) and systems (e.g., Global Earth Observation System of Systems).

Vision (cont'd)

The EOS archive holdings are regularly peer reviewed for scientific merit:

- Procedures for such reviews have been developed and tested over a decade
- Derived products that are not deemed scientifically useful are phased out.

Mechanisms to collect and preserve the pedigree of derived data products are readily available.

Processing and data are mobile: processing can be moved to data and/or data can be moved to processing.

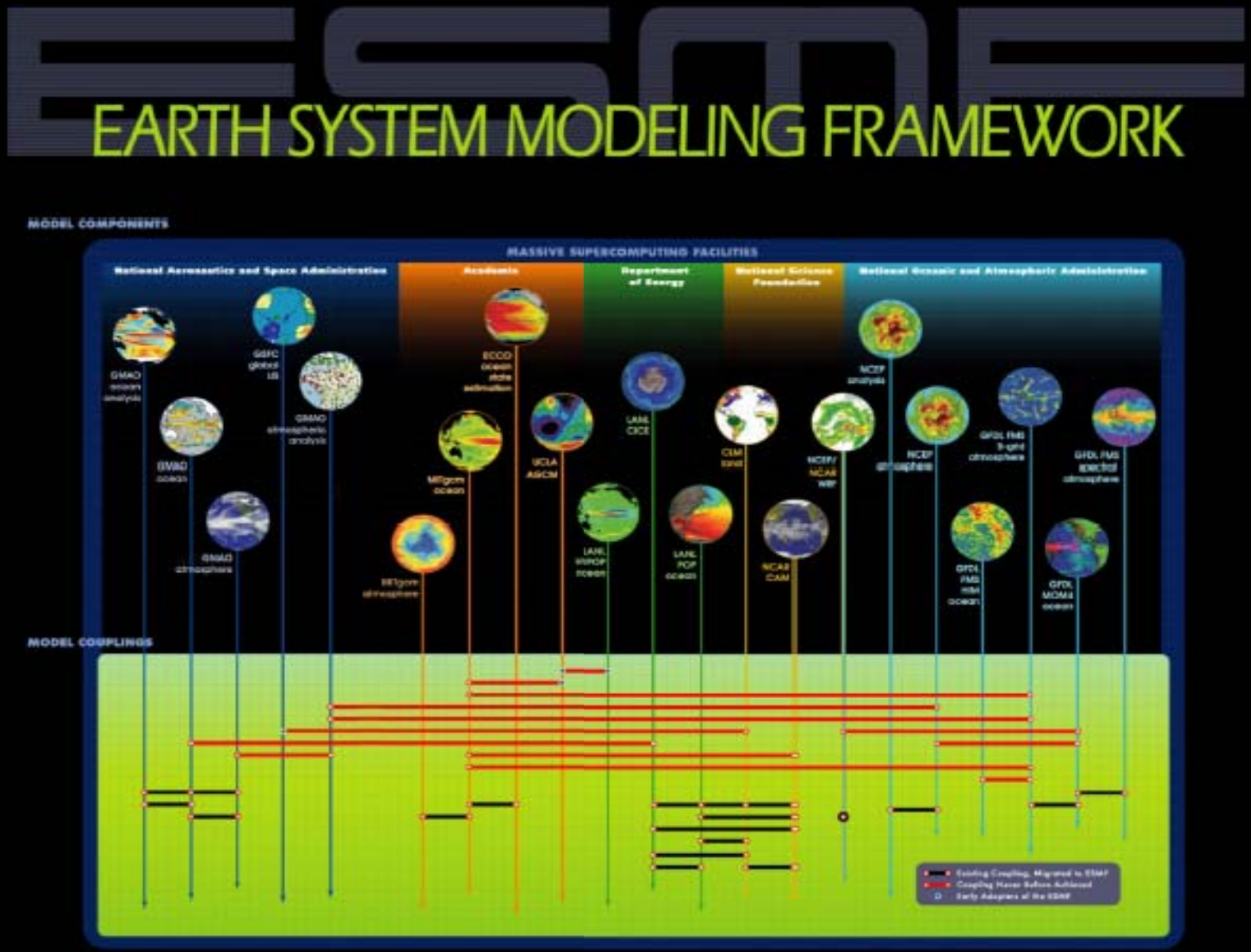
NASA data systems have evolved into components that allow fine-grained control over cost drivers.

Expert knowledge is readily accessible to enable researchers to understand and use the data.


“Accelerating the realization of
economic and societal benefits from
NASA science, information, and technology …”

BACKUP

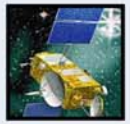
Earth-Sun System Models



Next Generation Missions

NPOESS Preparatory Project

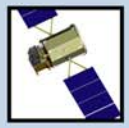
Landsat Data Continuity Mission Instruments



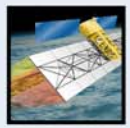
Ocean Surface Topography Mission

Ocean Vector Winds Mission

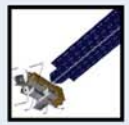
Global Precipitation Measurement



Aerosol Polarimeter Sensor Instruments



Synthetic Aperture Radar



Chemistry/Climate Mission

Cryosphere Monitoring Mission

Calipso

Cloudsat

Hydros

Orbiting Carbon Observatory

Aquarius

Blue Horizons

Restless Planet

Aiolos

Candidate Future Missions
In Formulation/Preformulation or in Development

Next generation systematic measurement missions to extend/enhance the record of science-quality global change data

Research missions to probe key Earth system processes globally for the first time

Future research Measurements