GEOSS Architecture and Data Management

The Second GEOSS Asia-Pacific Workshop

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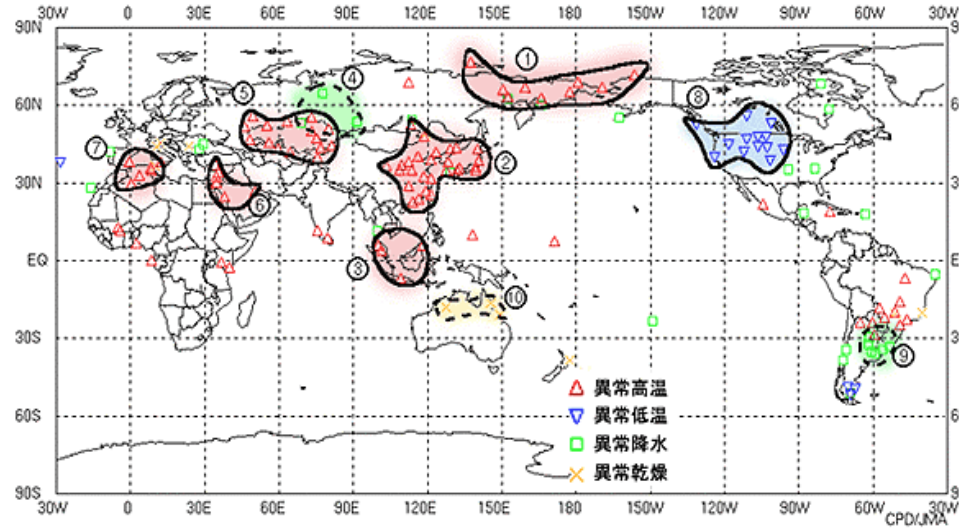
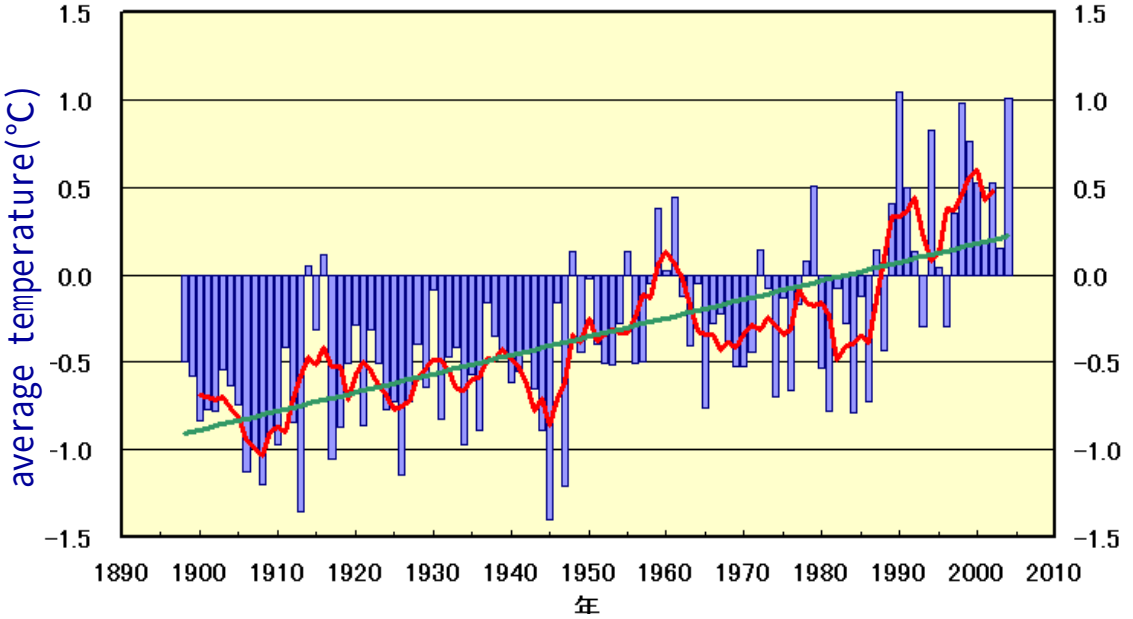
CSIS, Univ. of Tokyo, Japan

ADC co-chair, GEO

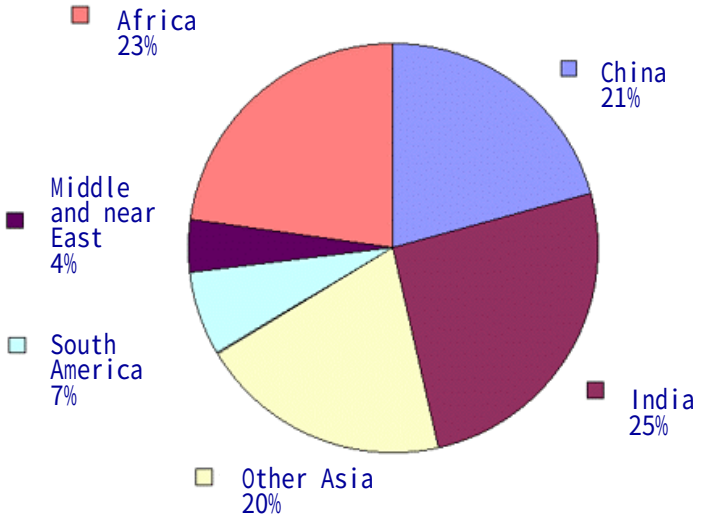
abnormal weather, climate change, flood damages, water or food crisis → **Poverty, health, safety**

Distribution of abnormal weather, March 2002





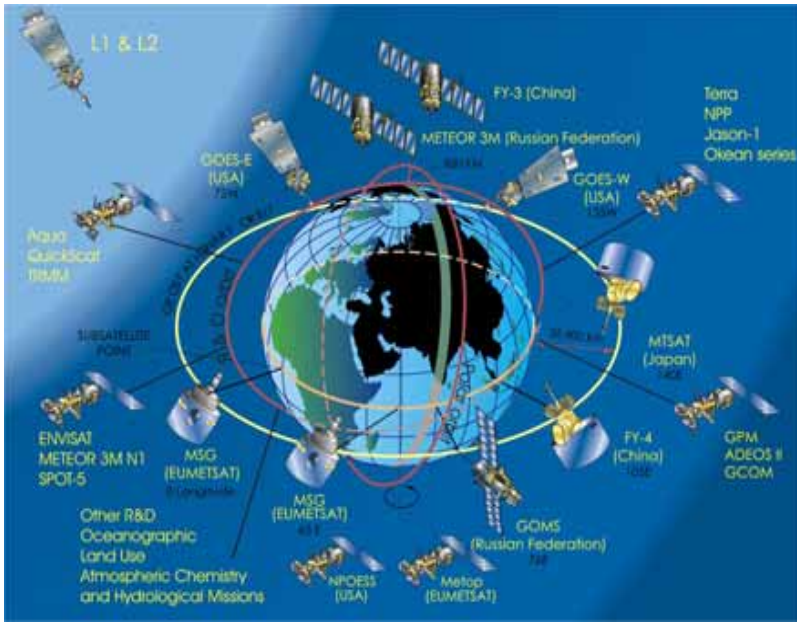
Malnutrition Population

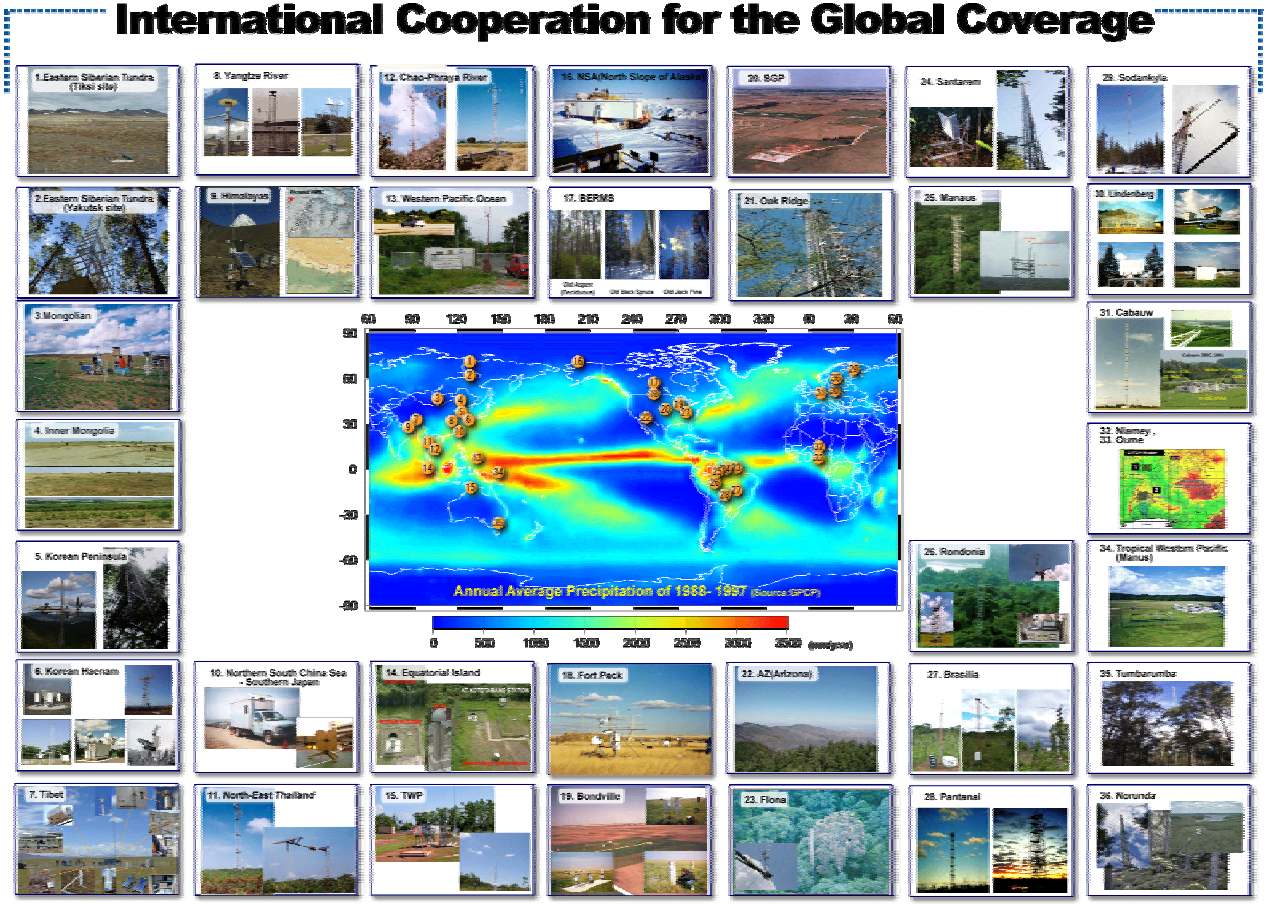


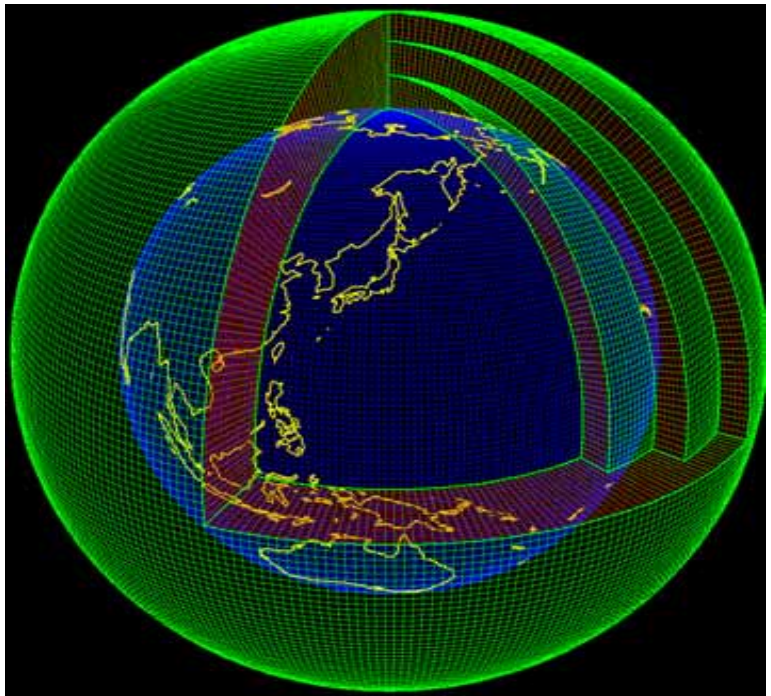
An understanding and prediction of an earth system

Group on Earth Observations

Global Observation Networks and Model Simulation Capabilities



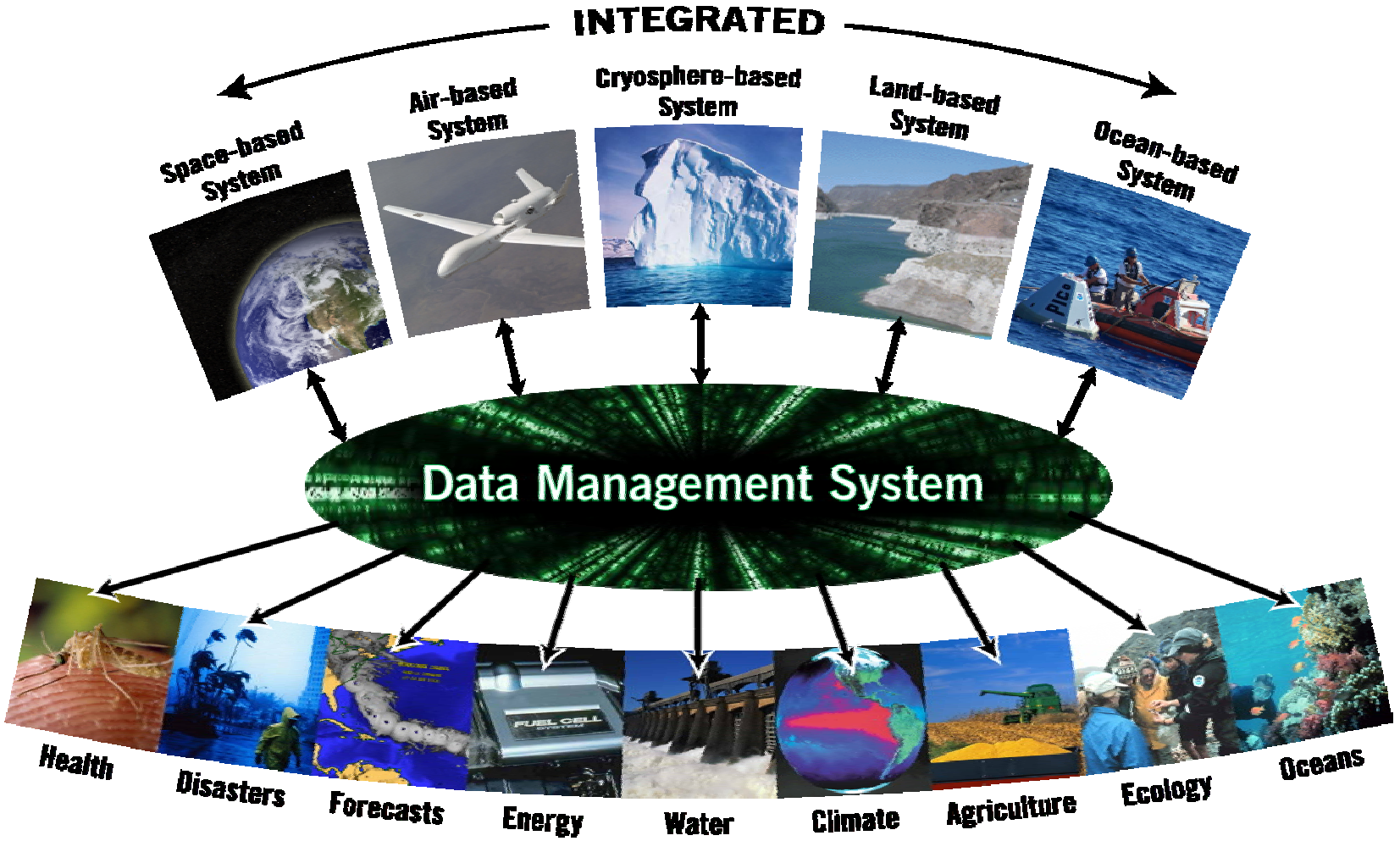




V1

Group on Earth Observations

A Global Earth Observation System of Systems
GEOSS



Nine Societal Benefit Areas

- **EOS I**
  - July 31, 2003, Washington, D.C.
  - 34 Countries and 20 International Organizations

EOS I

- **EOS II**
  - April 25, 2004, Tokyo, Japan
  - 47 Countries and 26 International Organizations

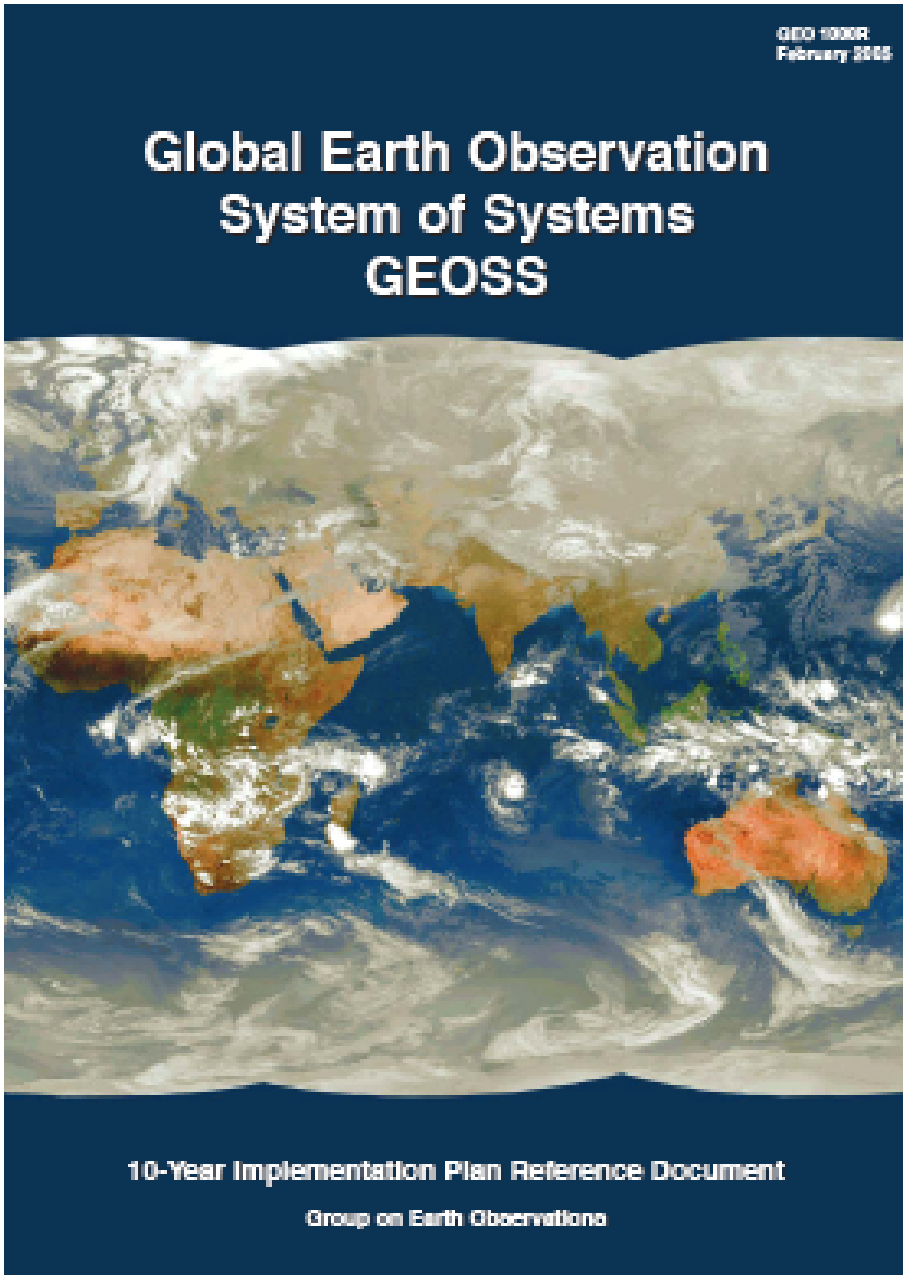
EOS II

- **EOS III**
  - February 2005, Brussels
  - Nearly 60 Countries, EC and over 40 International Organizations

EOS III

2005

- **GEO formally established**
- **10-Year Implementation Plan Endorsed**
- **GEO Secretariat established in Geneva, located at WMO**



What Will GEOSS do?

- Improve and Coordinate Observation Systems
- Provide Easier & More Open Data Access
- Foster Use through Science and Applications

through "Tasks" defined in the work plan.

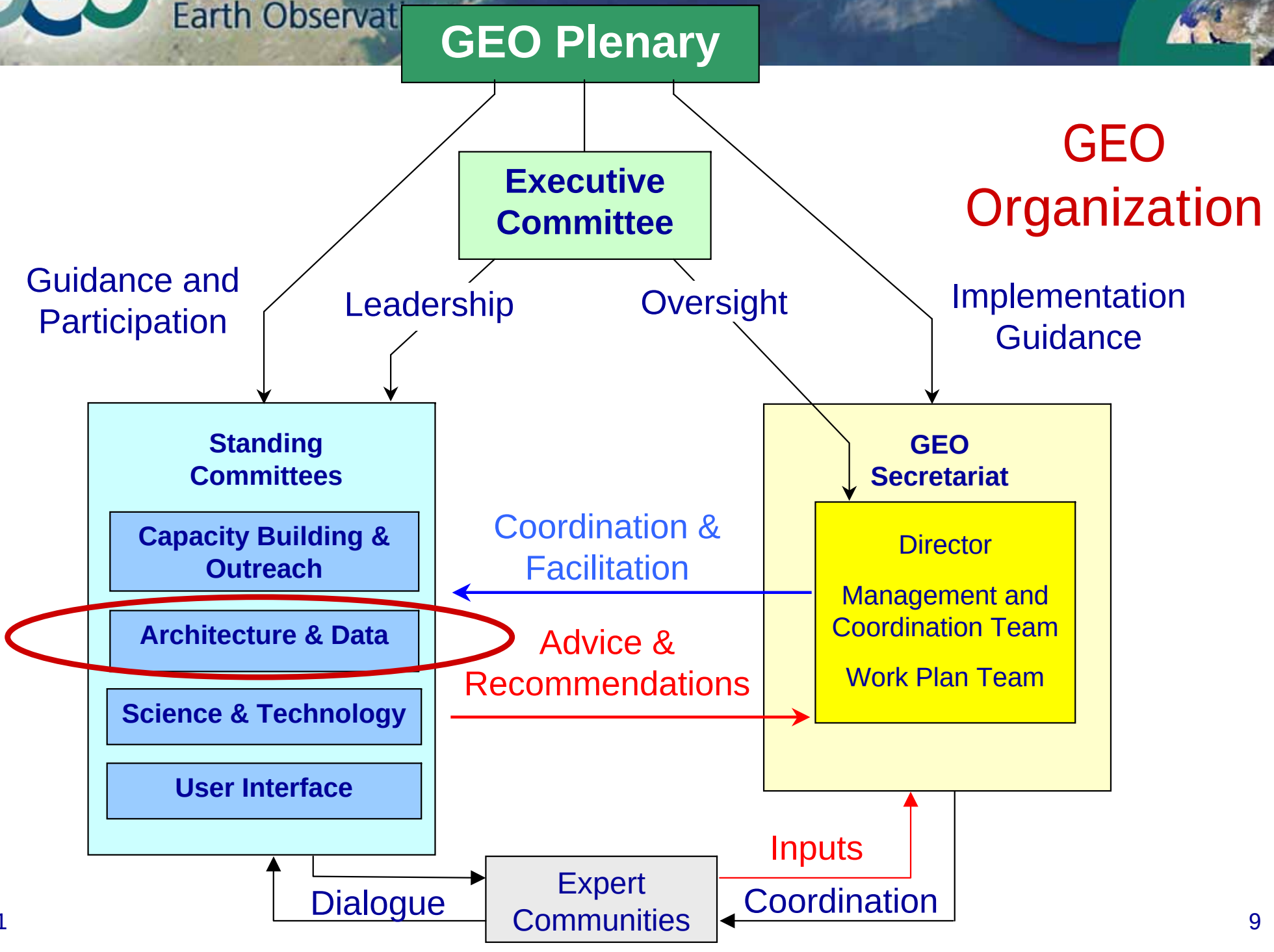
for better-informed decision making
in nine Societal Benefit Areas

Contributions of GEOSS

Nine Societal Benefit Areas

1. **Reduction and Prevention of Disasters**
2. **Human Health**
3. **Energy Management**
4. **Climate Change**
5. **Water Management**
6. **Weather Forecasting**
7. **Ecosystem**
8. **Agriculture**
9. **Biodiversity**

GEO Organization



ADC 2008


A. Annoni


I. Deloatch


D. Hinsman

Purpose

Support GEO in all *architecture and data management aspects of the design, coordination, and implementation* of GEOSS for comprehensive, coordinated, and sustained Earth observations.

Objectives are to enable GEO

–to facilitate the *participation in* GEOSS,

–to promote the use of standards and references, intercalibration, and data assimilation.

–to converge or harmonize observation methods,

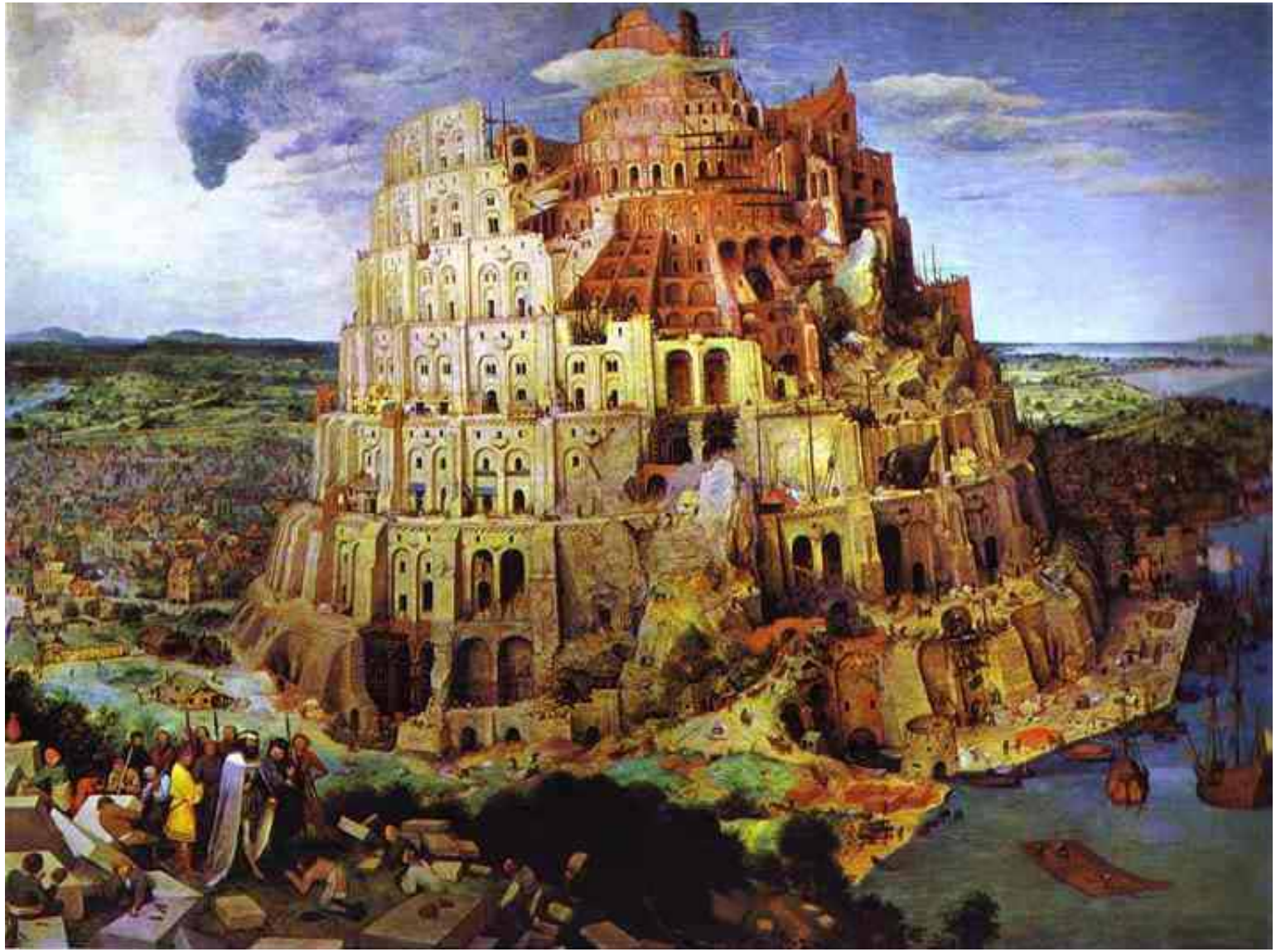
based upon user requirements and building on existing systems and initiatives


J. Pearlman


I. Petiteville


R Shibasaki

Solving the “Tower of Babel” problem



Characteristics of GEO

- A voluntary partnership of national governments and international non-profit organizations.
  - GEO cannot force members to do something.
- GEO itself can provide NO financial support and human resources to develop GEOSS.
  - The mission of GEO is limited to the coordination of activities to facilitate the development such as organizing meetings and making outreach.
- But it receives strong international political endorsement.
  - 72 Governments and the European Commission. In addition, 46 intergovernmental, non-profit organizations.

Group on
Earth Observations

GEO MINISTERIAL SUMMIT

Cape Town

30 November 2007

How to realize GEOSS?

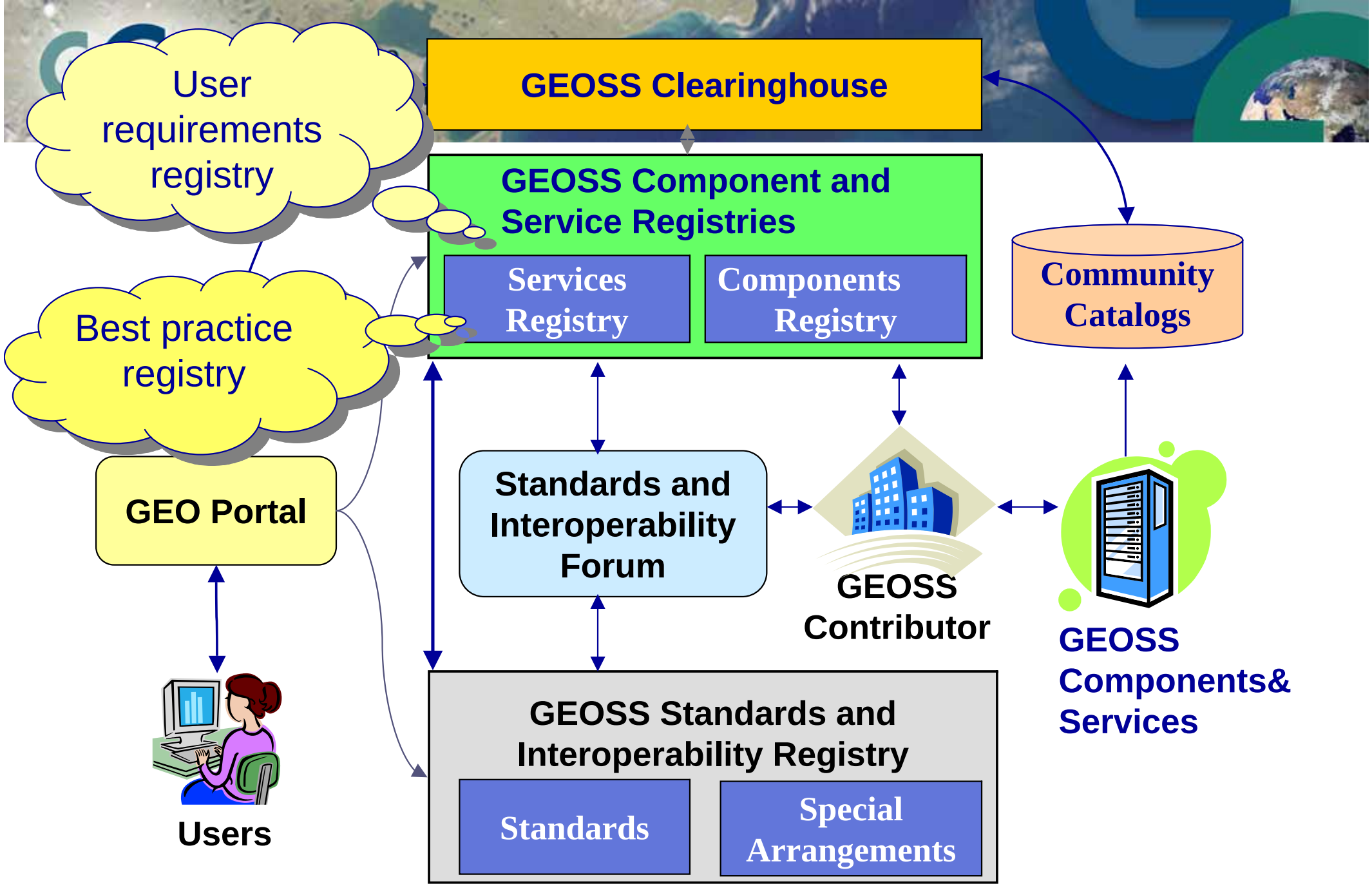
- System of Systems Engineering (SoSE) approach
  - Integrate existing systems to create added values.
  - NASA case
    - James N Martin (2007) Value Assessment of GEOSS; Using an Architectural Model, IEEE GEOSS Workshop –Implementing a System of Systems, 15 April 2007
- GEO, however, cannot "order" or "force" the members to work to realize the overall architecture.....

Challenges of GEOSS

1. To maximize the participation of governments and the other organizations,
2. To encourage voluntary activities such as the contribution of data and systems, promotion of system integration to achieve GEOSS targets,
3. To coordinate the activities efficiently to build usable and reliable GEOSS.

Approaches for GEOSS

1. Visualizing Available Resources.
   - Registries and clearinghouse
2. Providing Incentives and reducing Cost of contribution and of integration of components.
   - Providing opportunities for demonstration in GEO arena.
   - Promoting/coordinating interoperability standards and arrangements
3. Promoting Coordination and Evolution of Tasks through the Work Plan.
   - Visualizing and evaluating how each task contributes to overall GEO objectives.



Initial Operating Capabilities of GEO

GROUP ON EARTH OBSERVATIONS

GEOSS Registry Search

*This public search page is provided as a convenience to allow users to browse and search the GEOSS Component and Service Registry. The information found here is intended to assist software developers and data integrators in identifying registered GEO resources at a high level. The information stored in this Registry is used by the GEOSS Clearinghouse to develop a more comprehensive list of GEO Resources. The GEOSS Web Portal candidates are required to support search into detailed Clearinghouse and Registry resources.

Find Components

Find Services

GEOSS Registry System

Designed, developed and maintained by:
The Global Earth Observation System of Systems (GEOSS), Architecture Task AR-07-01
The Center for Spatial Information Science and Systems (CSISS), George Mason University
The Federal Geographic Data Committee (FGDC), USA
Data Archiving and Distribution Technical Committee of IEEE Geoscience and Remote Sensing Society (DAD-TC)

Last updated: Thursday, October 11, 2007

Main Menu

REGISTRY & SERVICES

USER SUPPORT

SCC 40

STANDARDS & INTEROPERABILITY FORUM

NEWS & INFORMATION

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Password

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GROUP ON EARTH OBSERVATIONS

GEOSS Standards Registry

HOME

WELCOME TO THE GEOSS STANDARDS AND INTEROPERABILITY REGISTRY

PRINT PDF

The intergovernmental Group on Earth Observations (GEO) is leading a worldwide effort to build a Global Earth Observation System of Systems (GEOSS). GEOSS builds upon, and adds value to, functioning Earth observation systems by supporting their interoperability, among other objectives. The added value primarily comes from interoperability facilitating the creation of datasets from disparate observation systems that can be used to obtain vital information for the benefit of society.

Interoperability in GEOSS will be achieved primarily by specifying how GEOSS components exchange data and information at their interfaces. The GEOSS strategy is to realize a system of systems through adoption of selected international standards that enable interoperability.

Central to these goals is the maintenance of various databases describing GEOSS components and their interfaces, and the standards, protocols and other specifications enabling interoperability between them.

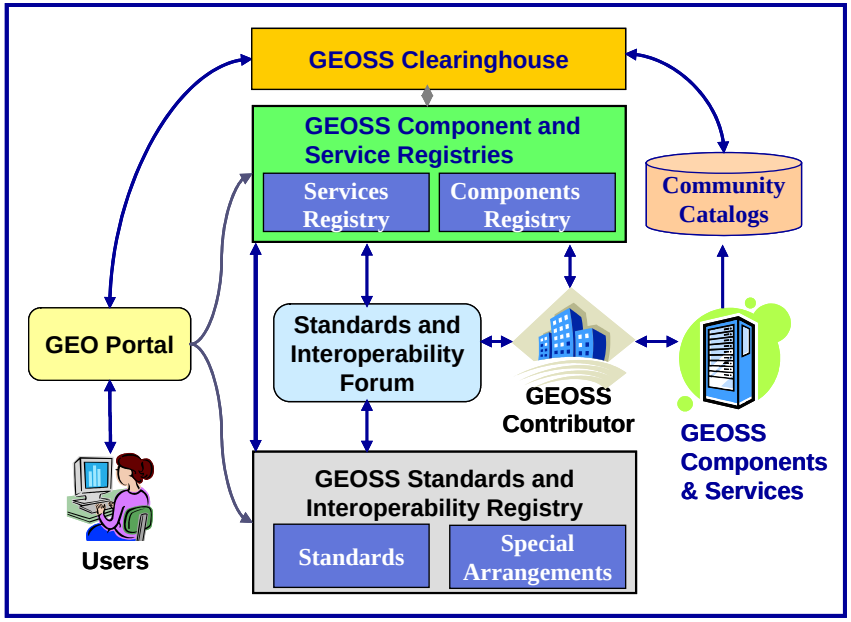
This website hosts the GEOSS Standards and Interoperability Registry. Click here to search the Registry. The GEOSS Components and Services Registries can be searched here .

Last Updated (Tuesday, 16 October 2007)

Enabling Deployment of GEOSS Architecture

Major Accomplishments:

- Registry of contributed GEOSS components and services is operational (77 services to date)
- Registry of standards and interoperability arrangements is operational



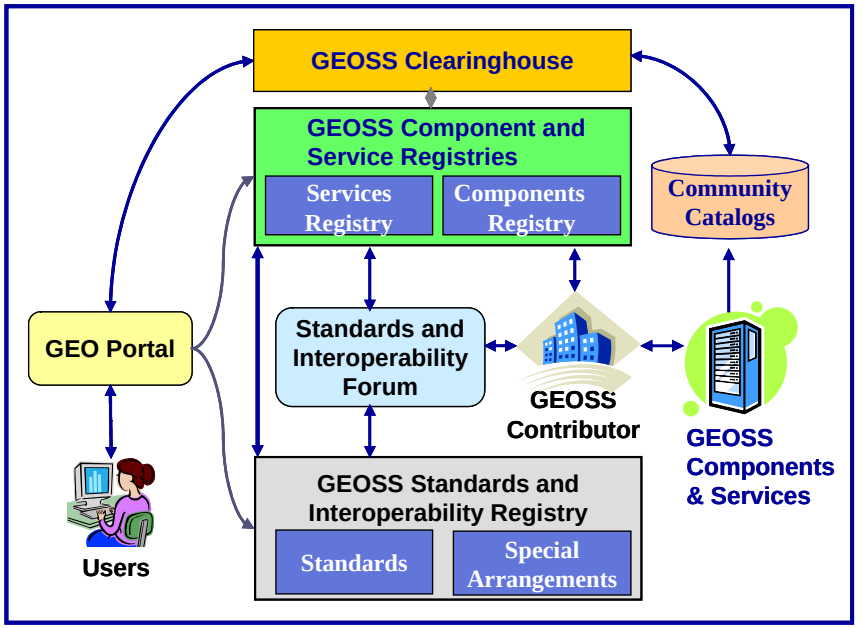
•GEOSS Strategic Guidance and Tactical Guidance Documents (Geo IV Document 24 and 25) were issued

Task AR-07-01

Architecture Implementation Pilot (AIP)

Major Accomplishments:

- AIP Call for Participation (CFP) elicited more than 100 participants
- Three GEO Web portals & three clearinghouses were offered; all were found technically capable



- Interoperability was validated through a pilot implementation
- Seven scenario exercised (wildland fires, biodiversity, disaster responses) and are demonstrated for you in the exhibition

Task AR-07-02

Approaches for GEOSS

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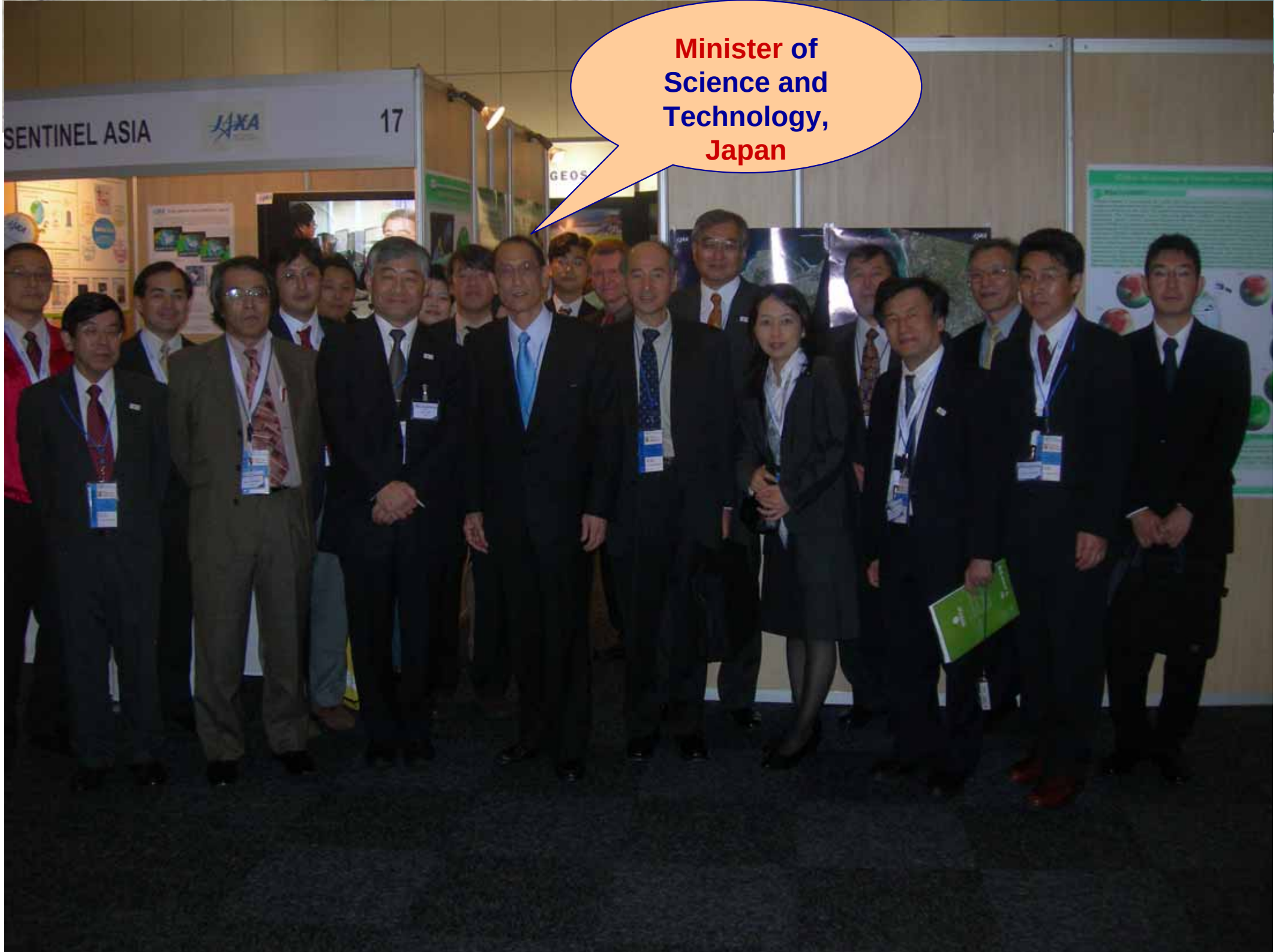
Minister of Science and Technology, Japan
SENTINEL ASIA
JAXA
17
GEOS


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IMAGE MATTERS
Locate. Innovate.
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HIU
HUMANITARIAN INFORMATION UNIT
U.S Department of State
hiu_info@state.gov
http://hiu.state.gov
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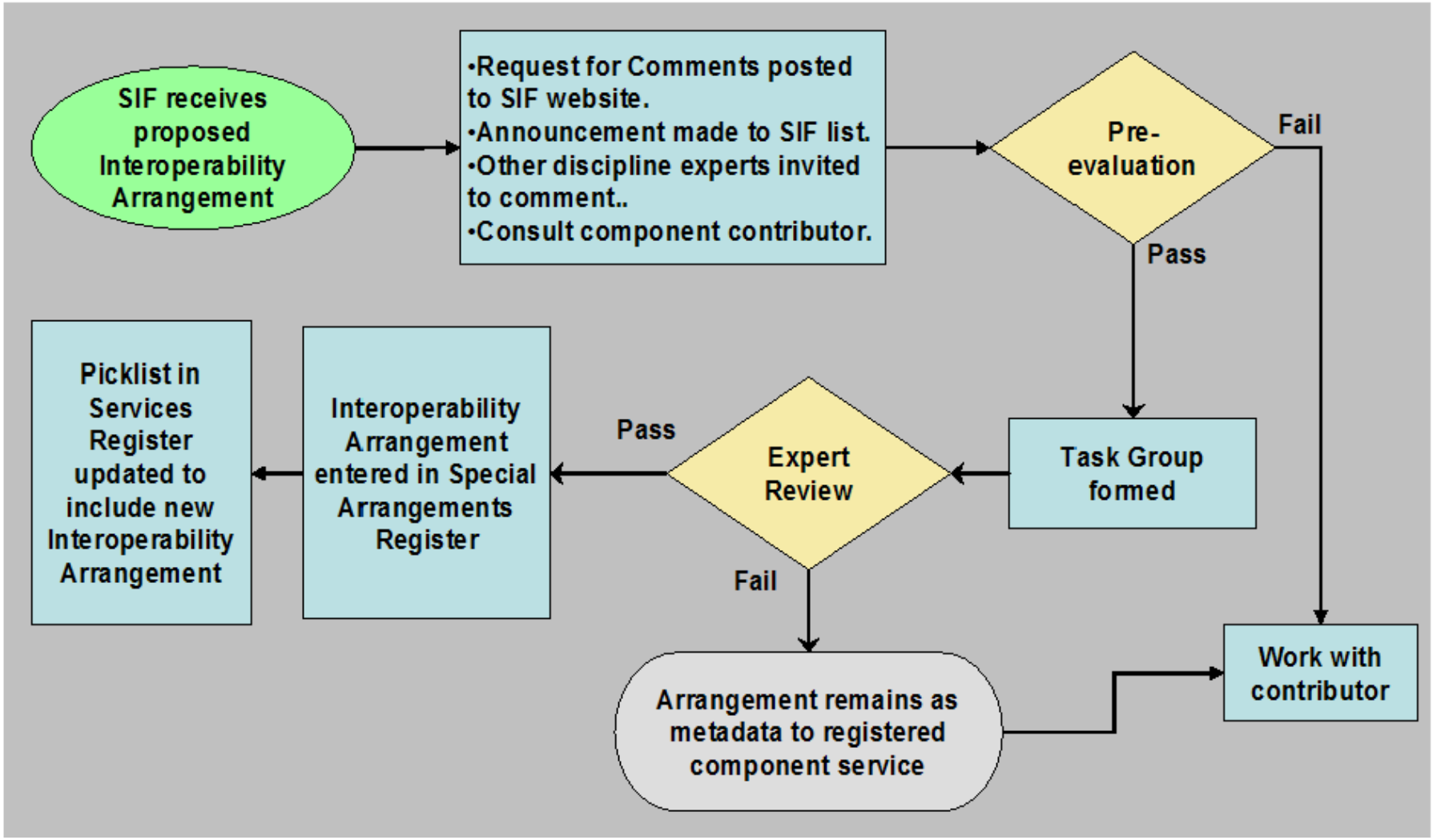
OGC®
Open Geospatial Consortium, Inc.
Federal Agency for Cartography and Geodesy
NOAA
FAO
Science & Technology Facilities Council
Rutherford Appleton Laboratory
NASA
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
INCOSE
International Council on Systems Engineering
unidata
esa
USGS
science for a changing world
JAXA
Japan Aerospace Exploration Agency
ies
Institute for Environment and Sustainability
OSIRIS
ThalesAlenia Space
A Thales / Finmeccanica Company
FederalGeographicDataCommittee
fgdc
EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre
КОСМІЧНЕ АГЕНТСТВО УКРАЇНИ
GBIF
GeoConnections
GéoConnexions
Mapping the future together online
Cartographions l'avenir en ligne
ESRI
COMPUSULT
THE UNIVERSITY OF TOKYO
GEOmon
Global Earth Observation and Monitoring
JPL
Jet Propulsion Laboratory
California Institute of Technology
meraka
INSTITUTE
African Advanced Institute for Information & Communications Technology
GEORGE MASON UNIVERSITY
MINES PARIS
ParisTech

Group on Earth Observations

SIF (Standards and Interoperability Forum)



Voluntary experts to help register/apply standards and interoperability arrangements.

Approaches for GEOSS

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Group on Earth Observations

The Global Earth Observation System of Systems (GEOSS)
10-Year Implementation Plan

(As adopted 16 February 2005)

Preamble

Understanding the Earth system—its weather, climate, oceans, atmosphere, water, land, geodynamics, natural resources, ecosystems, and natural and human-induced hazards—is crucial to enhancing human health, safety and welfare, alleviating human suffering including poverty, protecting the global environment, reducing disaster losses, and achieving sustainable development. Observations of the Earth system constitute critical input for advancing this understanding.

Interested countries and organizations have collaborated to develop this Plan to ensure comprehensive and sustained Earth observations. It builds on and adds value to existing Earth observation systems by coordinating their efforts, addressing critical gaps, supporting their interoperability, sharing information, reaching a common understanding of user requirements and improving delivery of information to users.

1 Purpose of this Plan

The purpose of this Plan is to summarize the essential steps to be undertaken, over the next decade, by a global community of nations and intergovernmental, international, and regional organizations, to put in place a Global Earth Observation System of Systems (GEOSS).

2 Vision for GEOSS

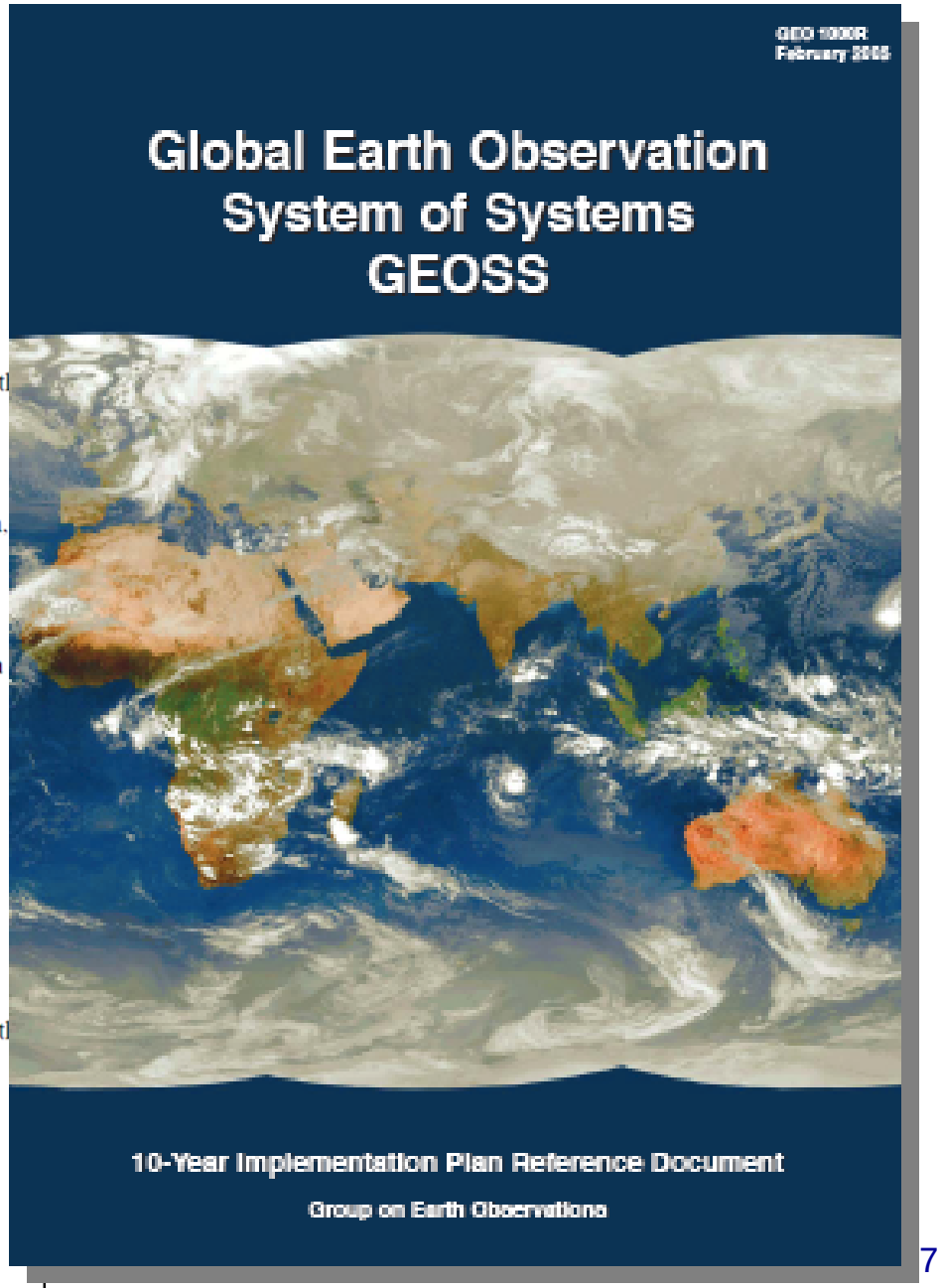
The vision for GEOSS is to realize a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information.

3 Purpose and Scope of GEOSS, and the Group on Earth Observations

3.1 Purpose of GEOSS

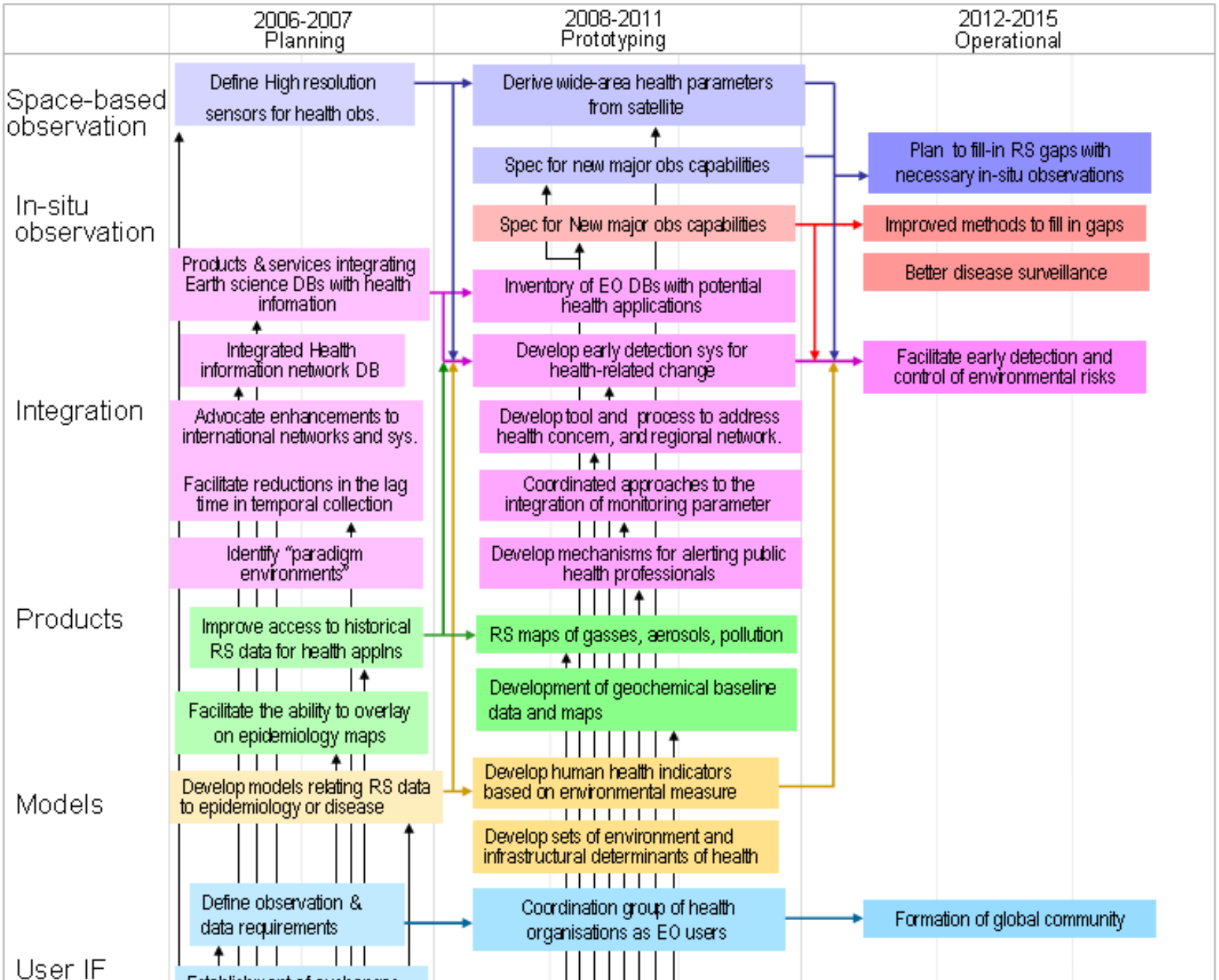
The purpose of GEOSS is to achieve comprehensive, coordinated and sustained observations of the Earth system, in order to improve monitoring of the state of the Earth, increase understanding of Earth processes, and enhance prediction of the behavior of the Earth system. GEOSS will meet the need for timely, quality long-term global information as a basis for sound decision making, and will enhance delivery of benefits to society in the following initial areas:

- Reducing loss of life and property from natural and human-induced disasters;
- Understanding environmental factors affecting human health and well-being;
- Improving management of energy resources;



Group on Earth Observations

GEOSS IP Targets - Health

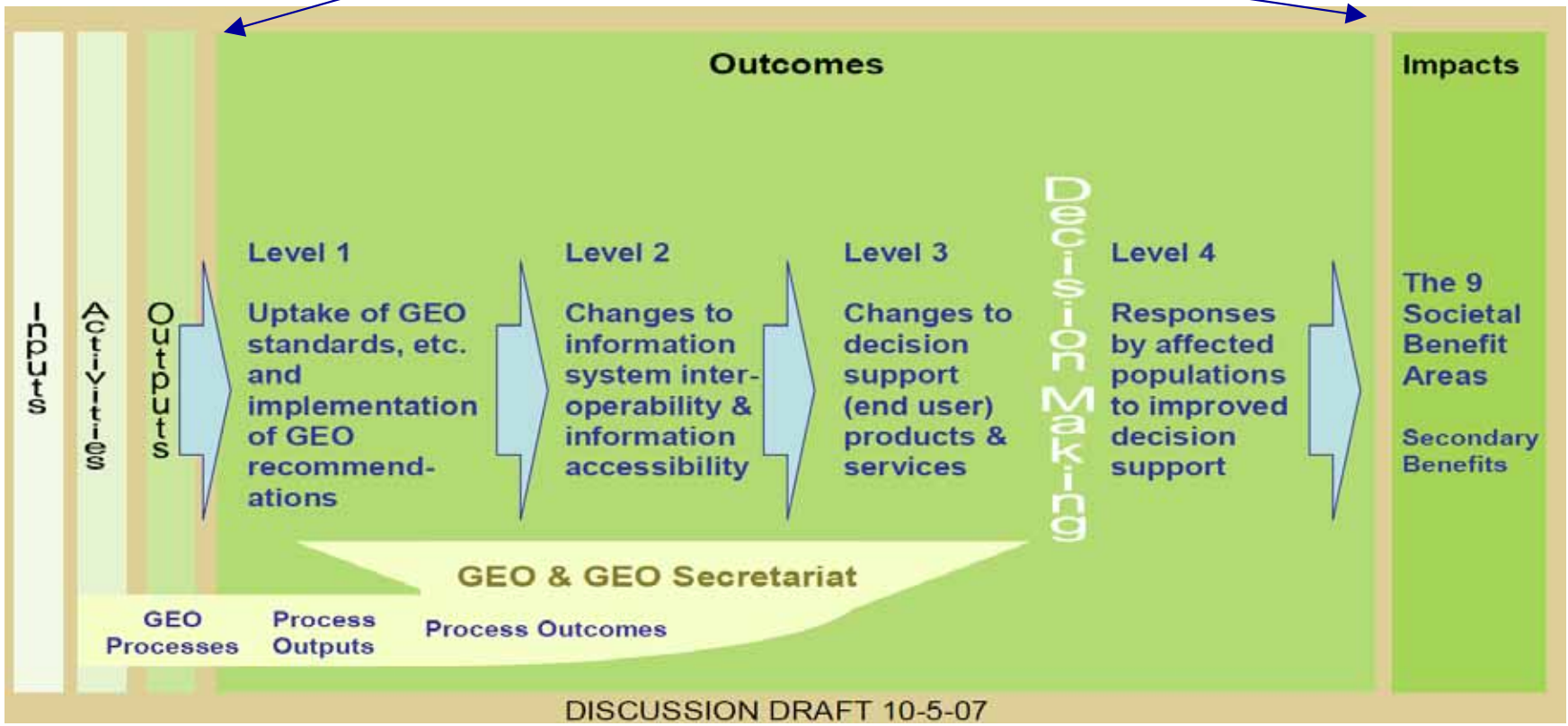


Performance Indicators

Development of performance indicators is usually based on a "results chain" or "value chain" that describes the sequence of stages of influence necessary to achieve the desired societal benefits.

Inputs	Activities	Outputs	Outcomes	Impacts
The financial, human, material, technological and information resources used by the defined activities to produce the outputs.	The actions taken or work performed through which inputs are mobilised to produce specific outputs.	The products and services which result from the completion of the specified activities.	The intended or achieved short-term and medium-term effects of the outputs, usually requiring the collective effort of partners.	The long-term intended benefits to society that represent the ultimate reasons for undertaking the initiative.

DISCUSSION DRAFT 10-5-07



Performance Indicators of outcomes

(GEO (2007) GEOSS Outcome Performance Indicators, Document 26, submitted to GEO-IV for information)

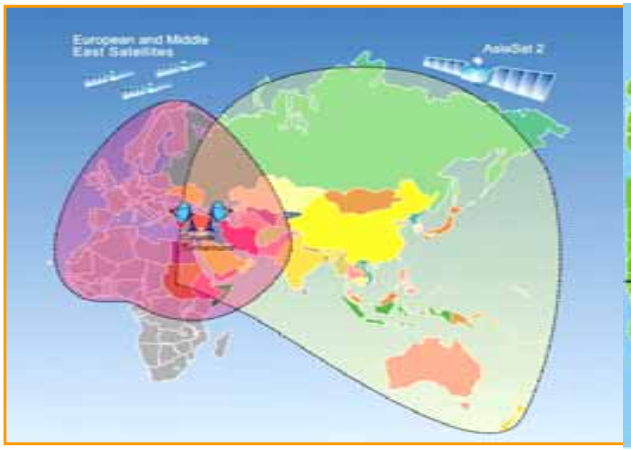
What Will GEOSS do?

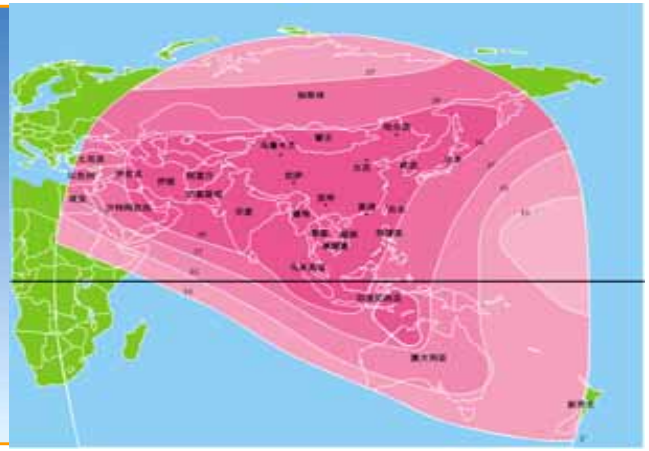
- Improve and Coordinate Observation Systems
- Provide Easier & More Open Data Access
- Foster Use through Science and Applications

through "Tasks" defined in the work plan.

for better-informed decision making
in nine Societal Benefit Areas

2006 Highlights: Access and Efficient Use





Coverage Areas (Proposed)

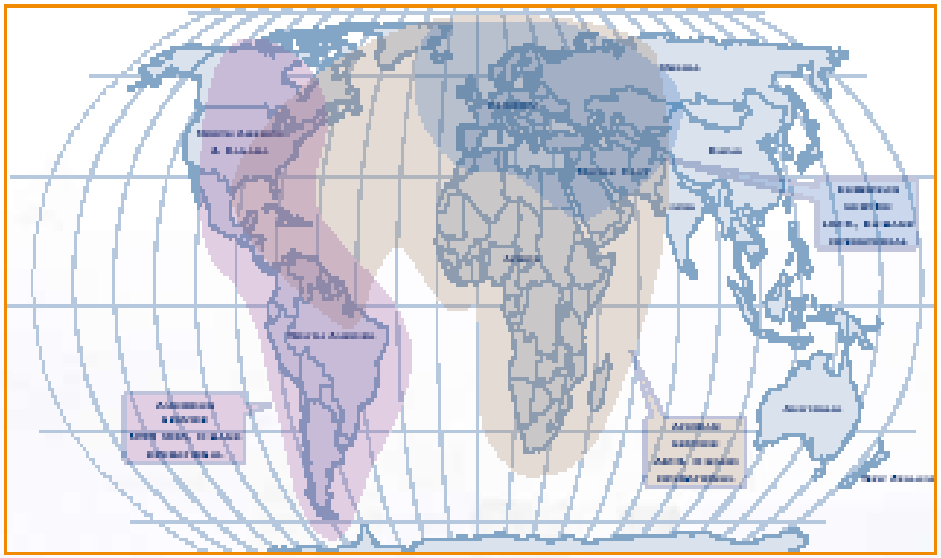


Figure 1 - GEONETCast/EUMETCast coverage zones

GEONETCast

WMO WIS

ESA DDS

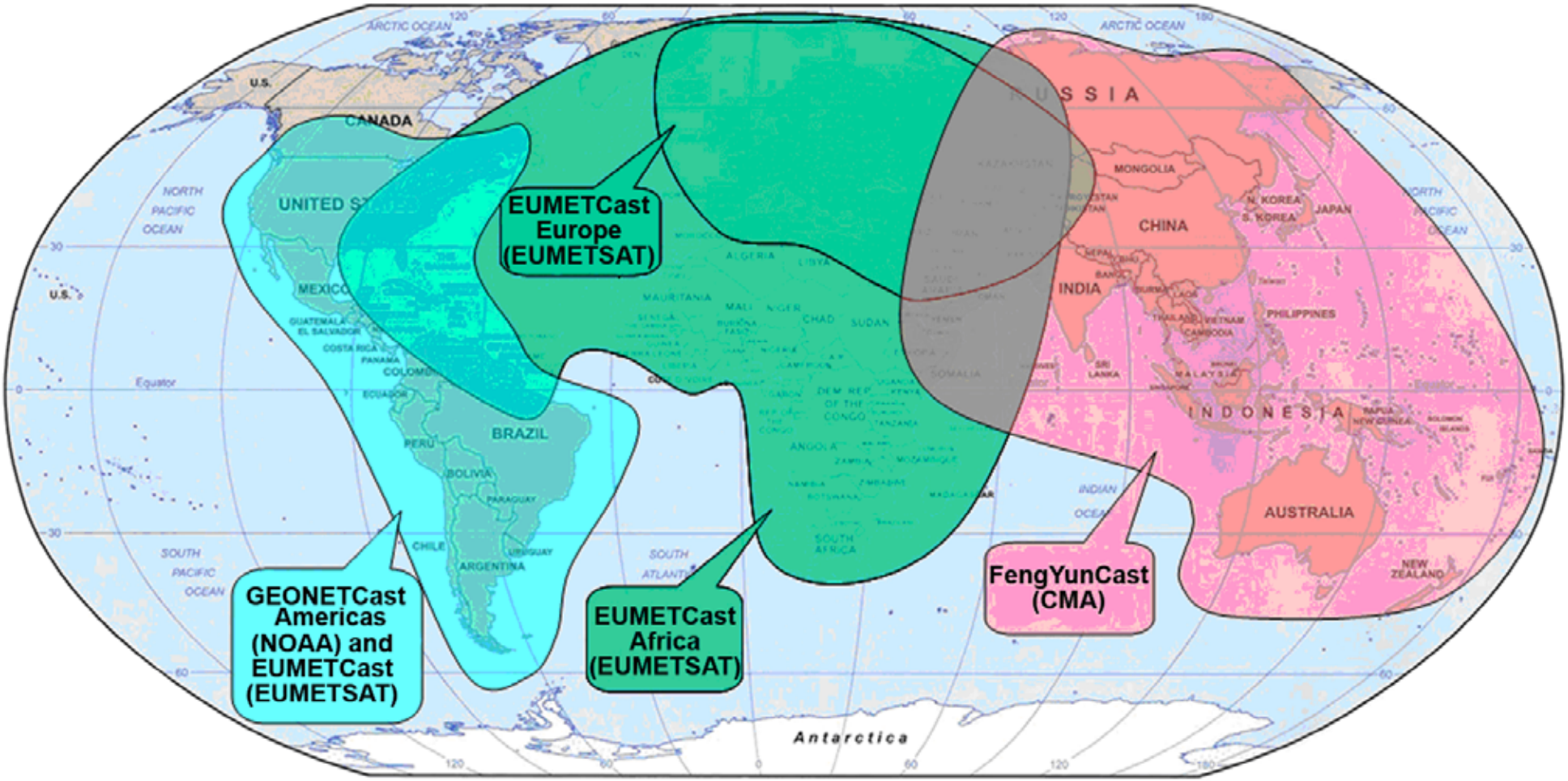
NASA EOS

Others

EUMETCast

Contributors

GEONETCast – information across the Globe



Task CB-06-04

Virtual Constellations (CEOS)

In order to harmonize efforts between space agencies to deploy Earth observation missions and with the aim to close emerging data gaps, the Committee on Earth Observation satellites (CEOS) has established the concept of Virtual Constellations for GEO, whereby a number of satellites or instruments and their observations, when coordinated in their operation and exploitation, have the potential for integration/merging of data and derived information to contribute to a (quantitative) analysis/measurement goal. The essence and greatest benefit of constellations concept is in providing (standards) for design and development of systems to meet observation

using
leading
stellation,
n flying or coordinated
operation

The concept of a Virtual Constellation is to use multiple data sets from similar or diverse sensors to provide integrated information products.

Four Virtual Constellations (CEOS)

A virtual Constellation can provide better temporal, spatial and spectral resolution and related data management/dissemination

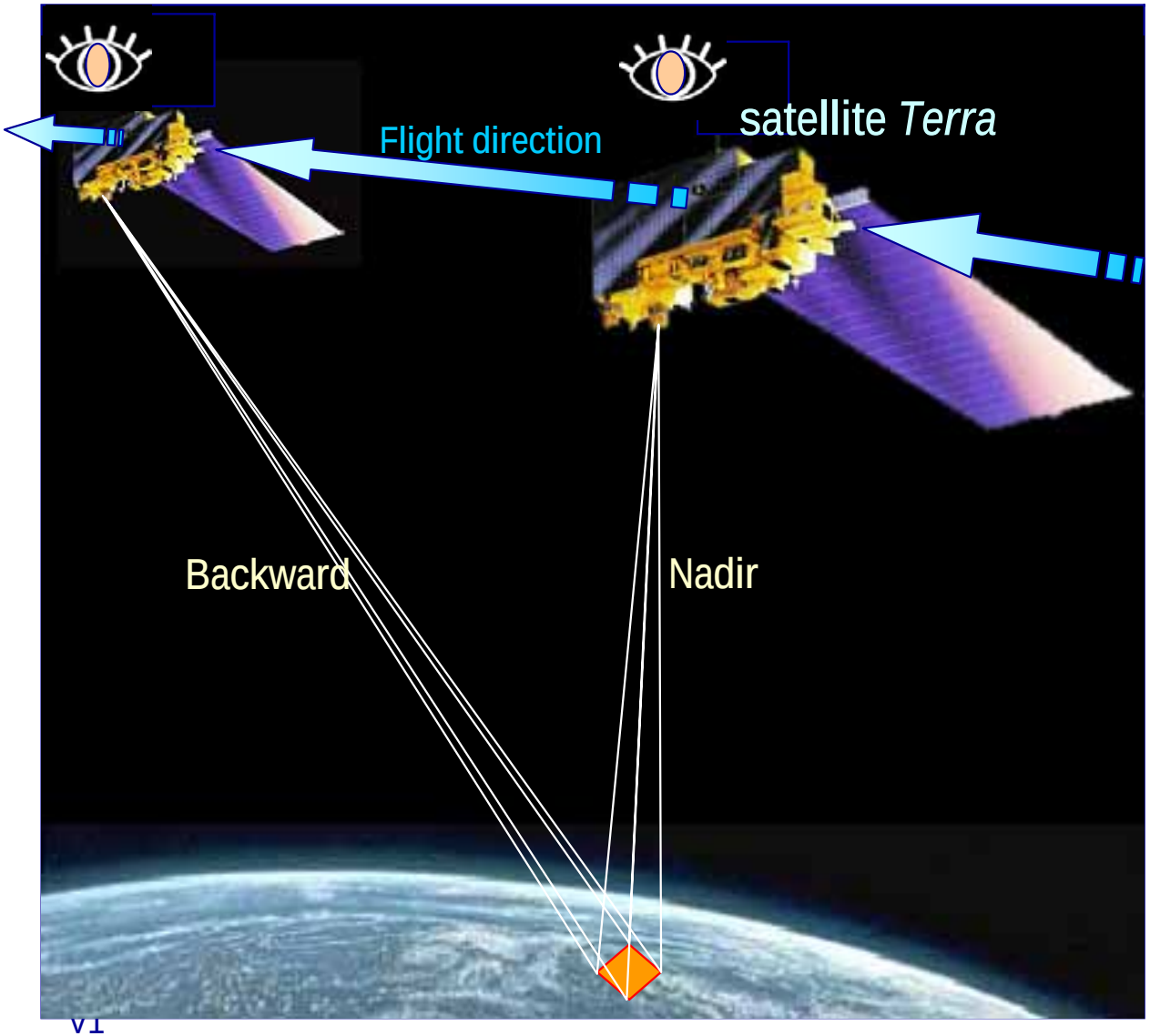
Atmospheric Composition Constellation - example:

Aviation and Volcanic Eruptions

- Previously, the US (NASA, USGS, and NOAA) and ESA (PROMOTE) provided national alerts based on their satellite data in their own formats
- Through GEOSS, regional services are being combined to provide a global service

ASTER G-DEM

- International joint project between METI and NASA
- Earth observing sensor developed by Japan (METI) flying on Terra
- Launched in December 1999, in stable operation for more than 7 years



ASTER provides:

1) Surface condition

The earth surface is observed in visible to thermal infrared (invisible to human eyes) spectral regions to obtain detailed information on the condition and distribution of the surface (vegetation, geology, etc.).

2) Surface temperature

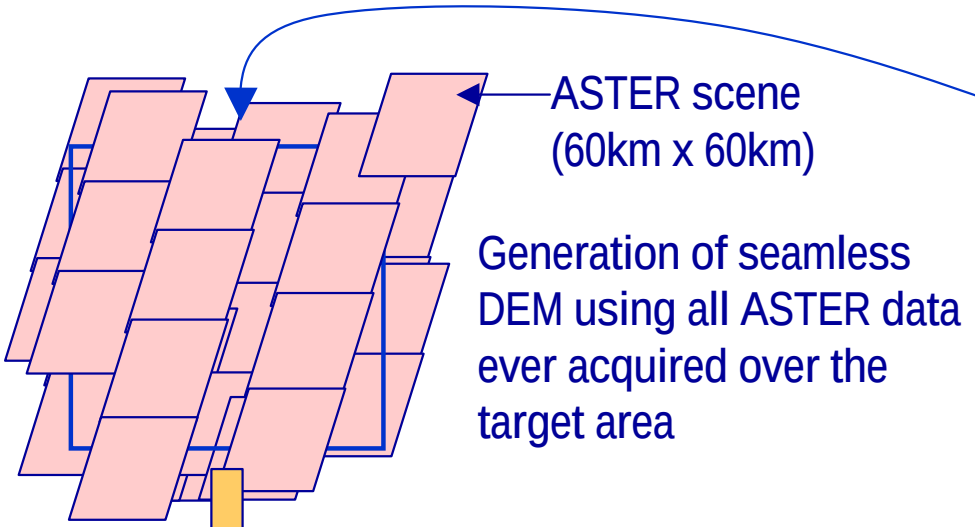
The distribution of surface temperature is observed by the thermal infrared sensor to study the urban heat island effect and other phenomenon in detail.

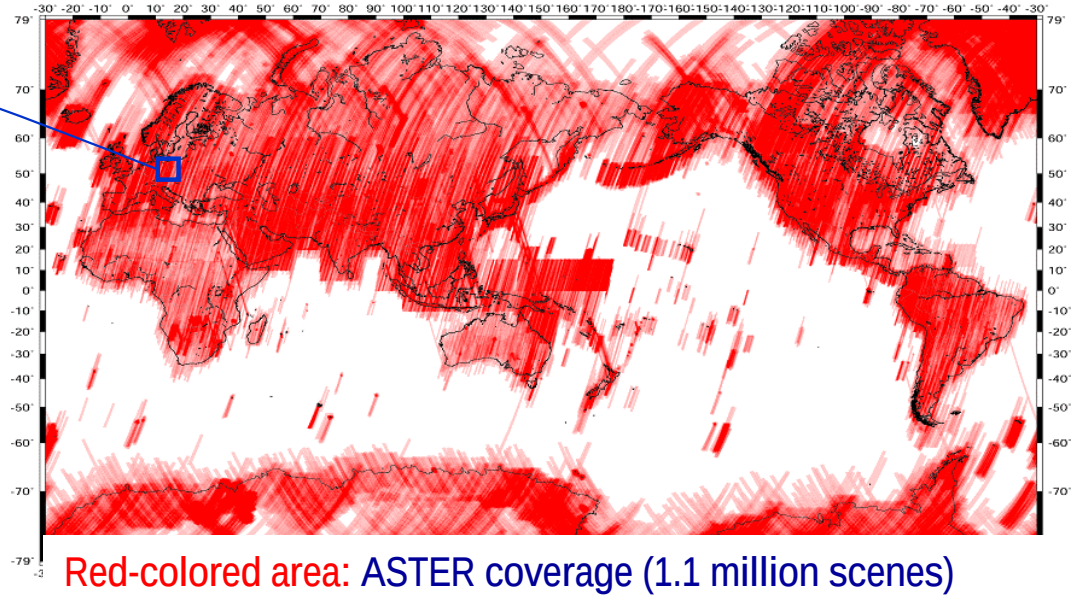
3) DEM

DEM is derived from a stereo-pair of images over a single area acquired in nadir and backward viewing angles.

Features of ASTER G-DEM

- Joint project between METI and NASA
- Generation of global land DEM based on the ASTER coverage
- Enhanced accuracy due to the use of multiple ASTER data over one region
- User friendly with the capability for selective cropping





Red-colored area: ASTER coverage (1.1 million scenes)
Deeper red indicates more frequent observations, thus providing higher accuracy.

applied to all land area → ASTER G-DEM → Easy to use, allowing for selective cropping

Comparison with other DEMs

	ASTER G-DEM	SRTM3 Shuttle Radar Topography Mission Data at 3 Arc-Seconds	GTOPO30 Global 30 Arc-Second Elevation Data Set
Data source	ASTER	Space shuttle radar	From organizations around the world that have DEM data
Generation and distribution	METI of Japan / NASA	NASA/NGA/USGS	USGS
Release year	2009 ～ (planned)	2003 ～	1996 ～
Data acquisition period	2000 ～ ongoing	11 days （in 2000）	
DEM resolution	30m	90m	1000m
DEM accuracy (stdev.)	±7m	±10m	±30m
DEM coverage	83 degrees north ～83 degrees south	60 degrees north ～56 degrees south	Global
Area of missing data	Areas with no ASTER data due to constant cloud cover	Topographically steep area (due to radar characteristics)	None

NGA：National Geospatial-intelligence Agency
USGS：United States Geological Survey

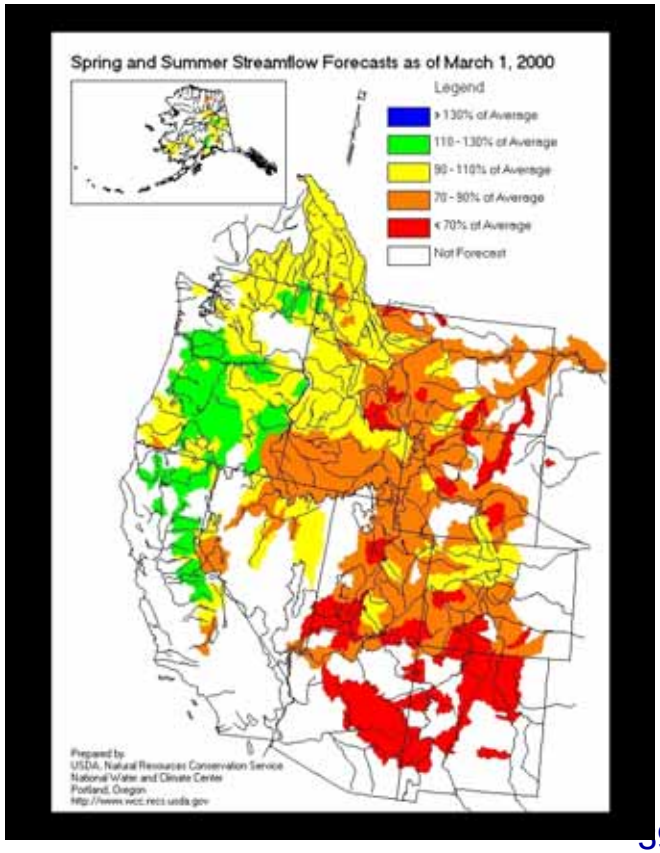
The ASTER G-DEM is the only sophisticated global coverage DEM, which will be widely used as the global standard.

2007-2009 Planning: Highlights

Global Continental Water-Level Observations

Strengthening satellite and in situ monitoring networks of estuaries, rivers, lakes, reservoirs, and groundwater levels:

- For flood risk management
- For improving water resource management
- For understanding sea-level rise



2007-2009 Planning: Highlights

Global Vegetation and Land Cover Observations

Produce a high-resolution global land-cover change data set and report, integrating existing data sets and reprocessing historic data:

- For monitoring landcover change over time
- For detect the effects of specific vegetation stressors (insects, pathogens, water, and chemical)
- Other applications

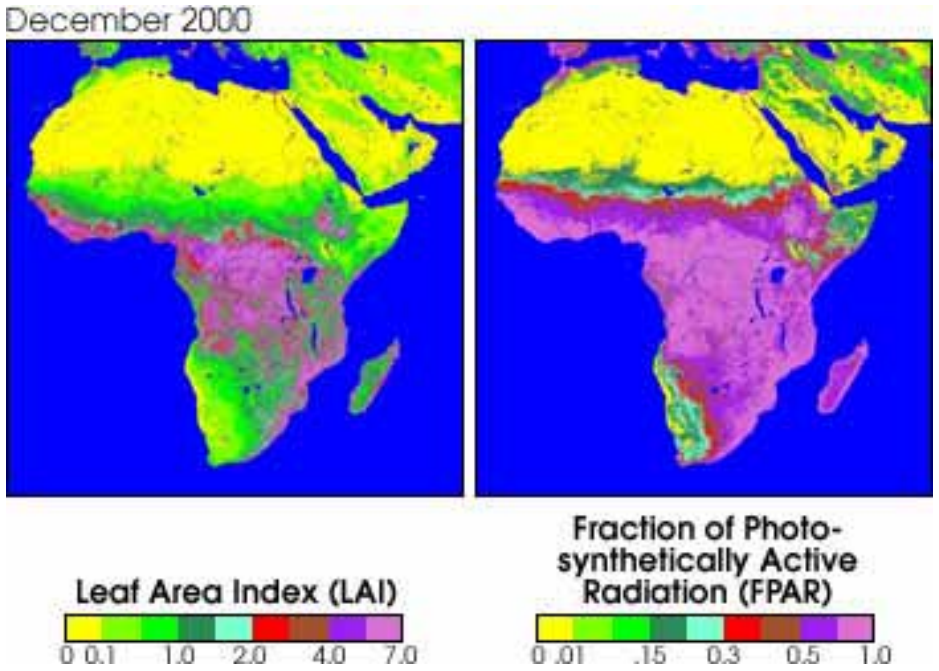


Image courtesy of NASA

2007-2009 Planning: Highlights

Renewable Energy – Managing Uncertainty

- Developing applications for monitoring renewable energy sources
- Improving forecasting of fluctuations and intermittency
- Promoting collaboration among users and providers

Not many Ocean components...

End