

Remote Sensing and International Co-operation for ICT and Environmental Studies

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but first....

- EO Earth Observation
 - Satellite Remote Sensing
 - also embraces aircraft and in-situ sensors
 - includes any local observations that contribute to global (or regional) understanding
- GIS Geographic Information Systems
 - **vector** based (e.g. ESRI ArcGIS (ArcInfo))
 - **raster** based (e.g. ERDAS Imagine; IDL(PV-wave))
 - but functionality now merging

Organisations

- **GEO** Group on Earth Observation
- **GEOSS** Global EO System of Systems
- **OGC** Open Geospatial Consortium
- **CEOS** Committee on Earth Observation Satellites
- **G3OS** Global Observing Systems (x3)
- **GMES** Global Monitoring for Environment and Security
- **APARSEN** Alliance for Permanent Access to Records of Science

But not including

- **CCSDS, ISO TC20/SC13, INSPIRE etc.**

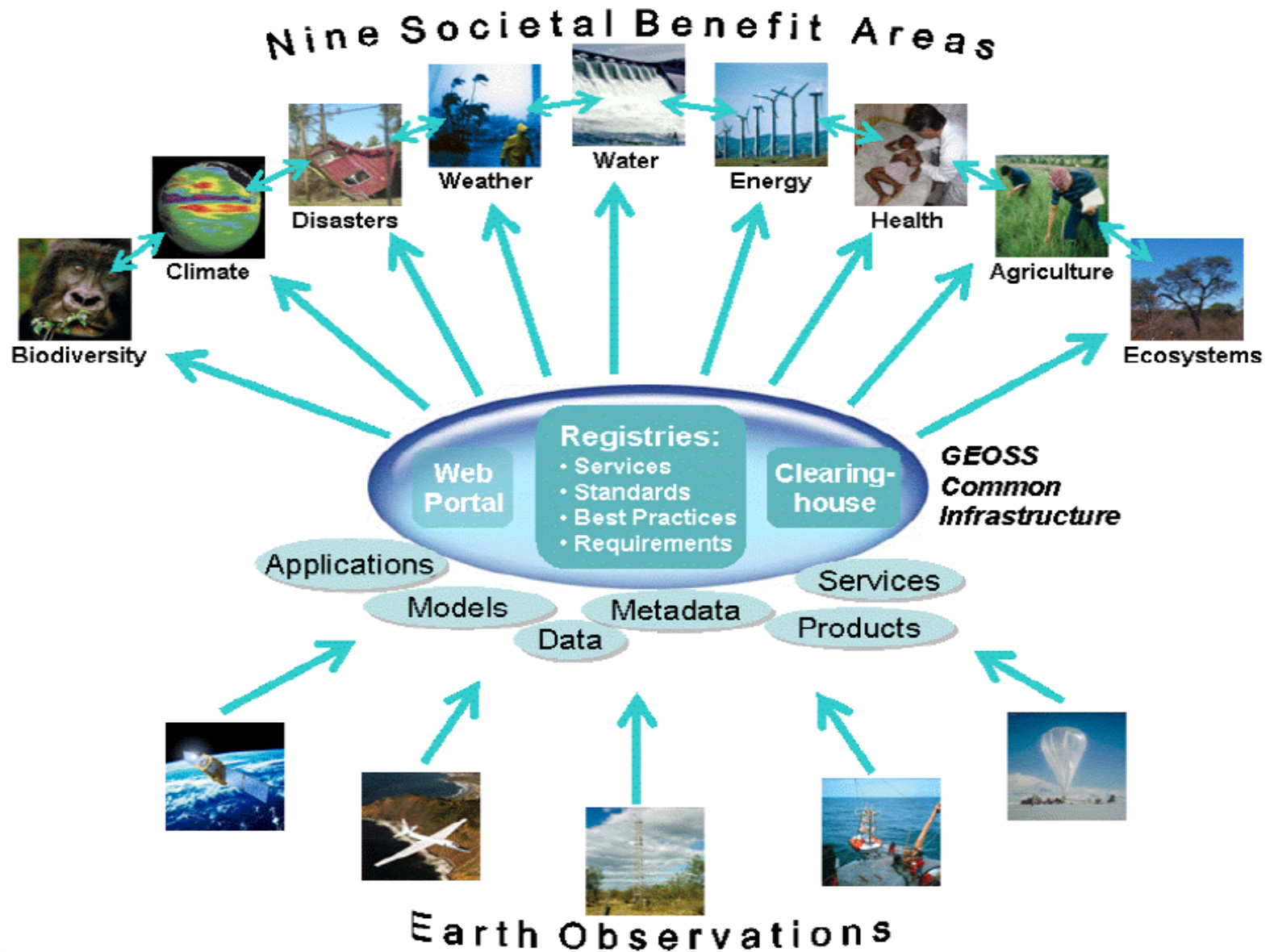
GEO & GEOSS



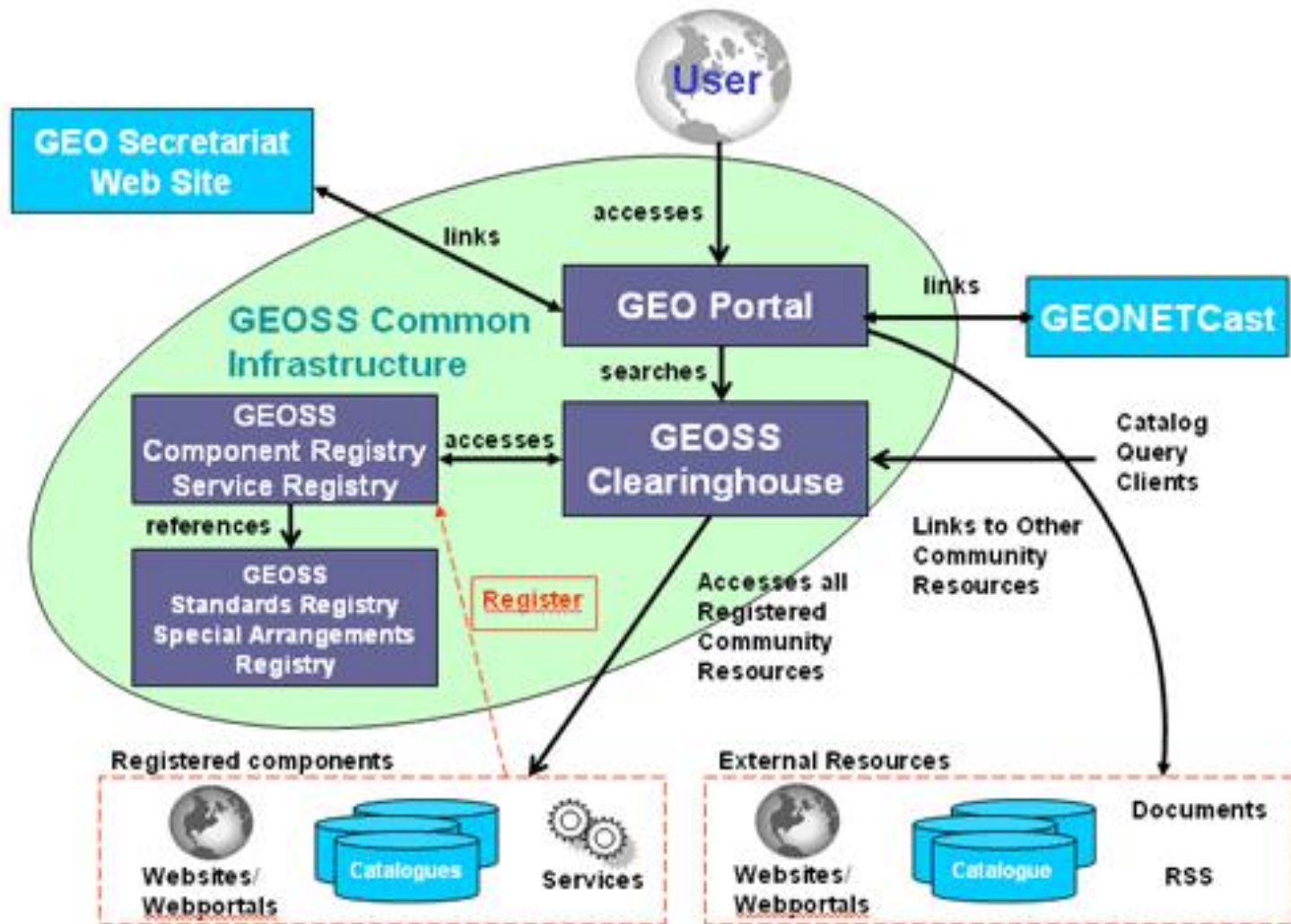
GEO Group on Earth Observation

- Driven at government minister level
- 88 countries (plus European Commission) plus over 50 Participating Organisations
- Open to all UN countries (with subscription)
- Small secretariat & national volunteers
- Working on developing **GEOSS**:
- Global Earth Observation System of Systems
 - 10 year Implementation plan 2005 to 2015

GEOSS – Societal Benefit Areas (SBAs)



GEOSS Common Infrastructure (GCI)



**BROWSE RESOURCES
BY SOCIETAL BENEFIT
AREAS**



DISASTERS



HEALTH



ENERGY



CLIMATE



WATER



WEATHER



ECOSYSTEMS



AGRICULTURE

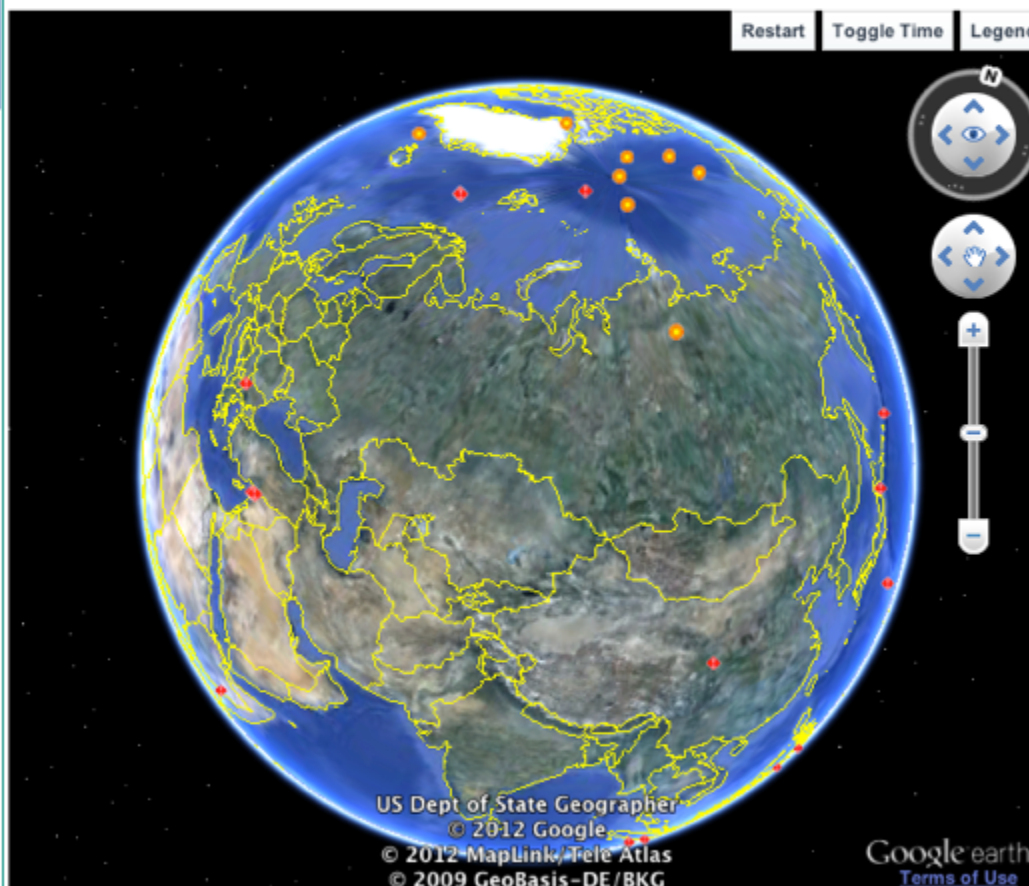


BIODIVERSITY

**CAPACITY
BUILDING**



**GEOSS Resources
for Disasters
SUPERSITES**



Restart

Toggle Time

Legend

**Provide Feedback
to GEO**

**GEOSS Common
Infrastructure**

About GCI

**Register your
Resources**

About Registries

Components &
Services

Standards &
Interoperability

GEOSS URR

Best Practices Wiki

GEO Secretariat

Overview

News

**GEOSS
Augmentation &
Pilot Activities**

Develop and Test
your Services and
Processing
Components

Architecture
Implementation
Pilot Phase - 3

Development and
test area

BREAKING NEWS

M 5.0, south of the Fiji Islands
May 28, 2012 15:39:46 GMT

EO NEWS

CryoSat goes to sea

Some GEO coordination highlights

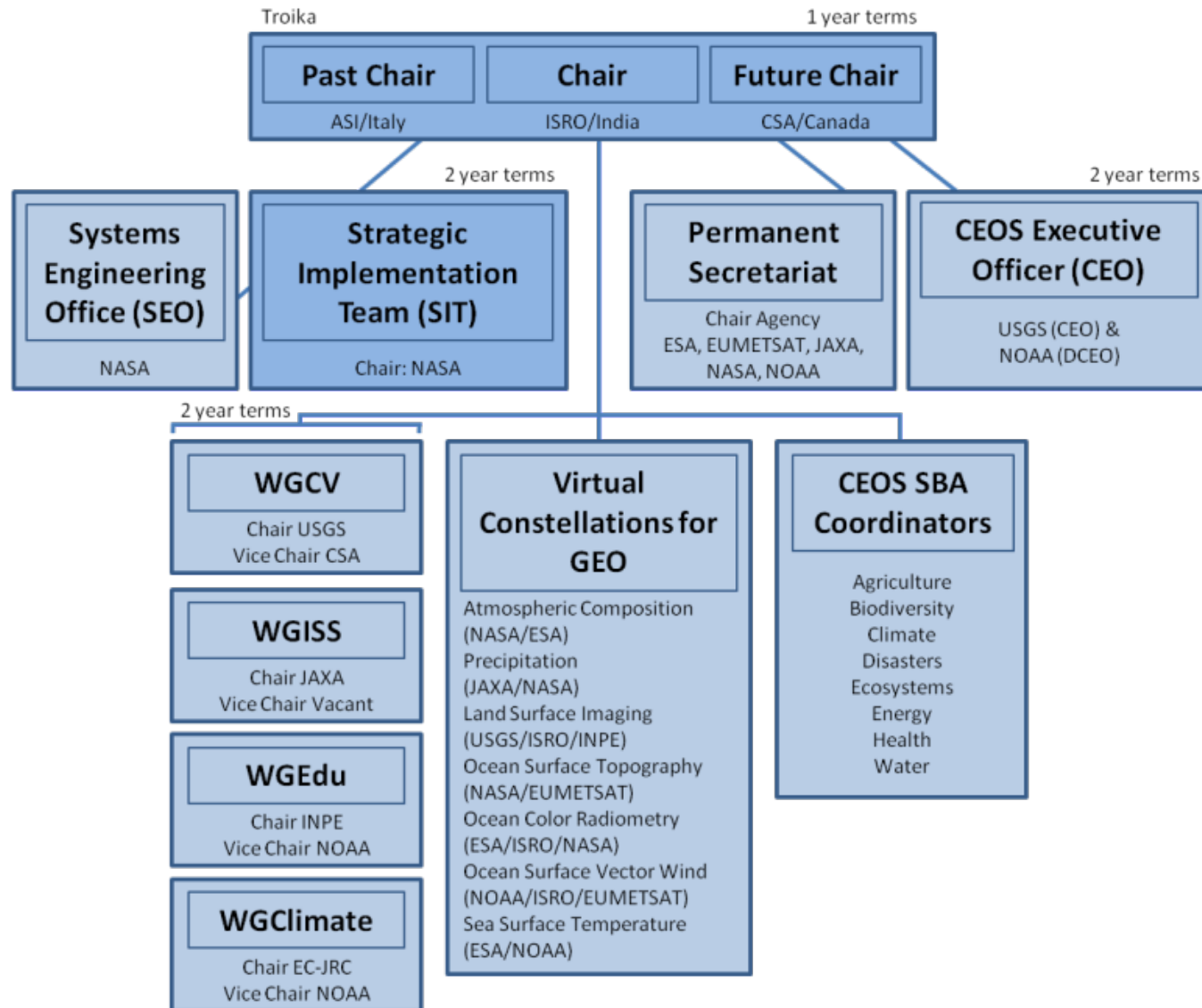
- Biodiversity Observation Network (GEO BON)
- Global Forest Observation Initiative (GFOI)
- Hydrological Applications and Run-off Network (HARON)
- Multidisciplinary Weather, Climate and Earth-System Prediction Project
- GeoNETCast data dissemination system
- GLAM – Global Agricultural Monitoring



CEOS Committee on Earth Observation Satellites

- Established in 1984 as a result of a G7 call for improved co-ordination of Space activities
- 52 Members – Space Agencies that have, or are planning to have, an EO instrument on a satellite. Plus other international organisations
- International co-ordination of Space missions and technical developments.
- Annual CEOS Plenary meetings
- Working group meetings every 6 to 9 months

CEOS Structure



Virtual Constellations

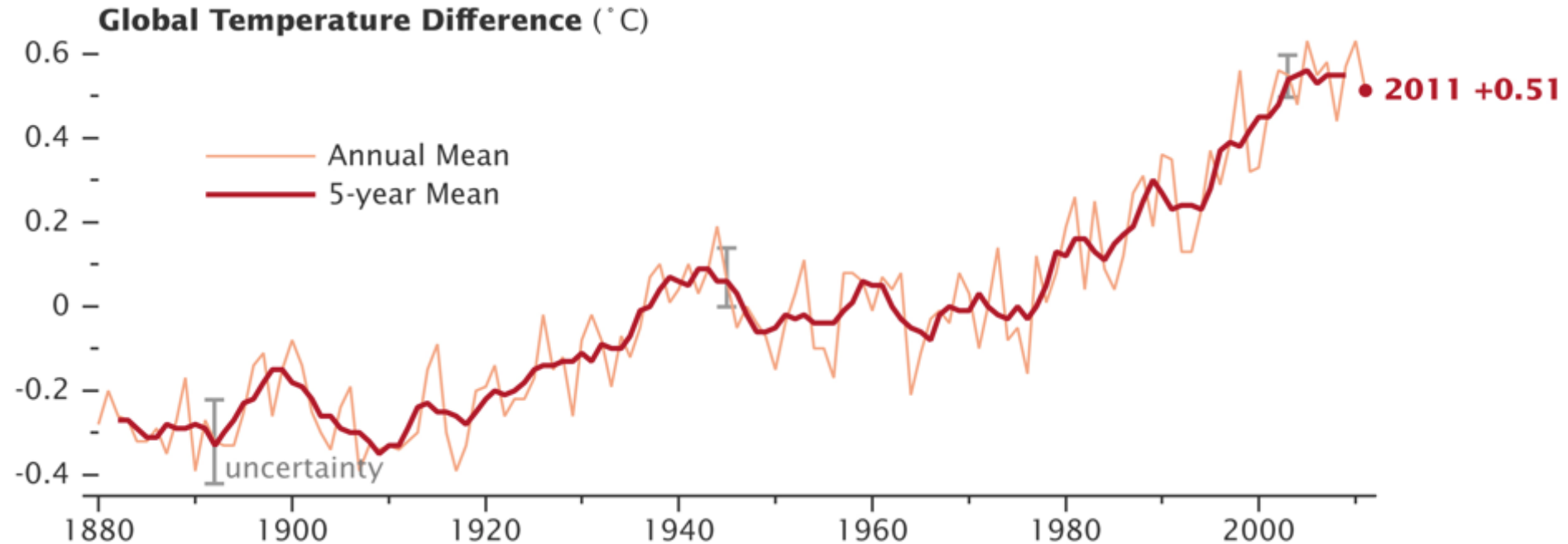
- Atmospheric Composition (NASA/ESA)
 - Precipitation (JAXA/NASA)
 - Land Surface Imaging (USGS/ISRO/INPE)
 - Ocean Surface Topography (NASA/EUMETSAT)
 - Ocean Colour Radiometry (ESA/ISRO/NASA)
 - Ocean Surface Vector Wind (NOAA/ISRO/EUMETSAT)
 - Sea Surface Temperature (ESA/NOAA)
-
- Theme based rather than sensor based

CEOS achievements

- Space Agency co-operation and sharing
- Contributions to GEO & GEOSS
- Virtual Constellations (theme based)
- IDN – International Directory Network
(based on NASA's GCMD)
- Developing CEOS WGISS Integrated Catalogue (CWIC) as a contribution to the GEOSS Common Infrastructure (GCI)

IDN/GCMD example search

Climate Diagnostics Directory – text search on temperature:
NASA GISS Global Temperature Difference 1880-2011





Open Geospatial Consortium

Open versus Closed Systems

- Closed
 - Proprietary
 - Protected through secrecy, or the courts
 - e.g. Microsoft Office, GIF
- Open
 - Consensus development
 - Freely available – freedom not price
 - (Free speech – not free beer)
 - often uses GNU licence
 - e.g. Open Office, PNG

OGC Open Geospatial Consortium

- International voluntary consensus standards organisation, founded in 1994.
- >400 commercial, governmental, nonprofit, research organisations collaborating to produce Open standards
- Subscription based financing
 - Commercial from \$55,000 to \$2200 to 500\$
 - University memberships are similar
- Develops frameworks and interface specifications
- Make progress through
 - Interoperability Testbeds
 - Compliance Testing
 - Promotional activities

OGC Open Geospatial Consortium

Geospatial and location standards for:

Aviation

Built Environment & 3D

Business Intelligence

Defense & Intelligence

Emergency Response &
Disaster Management

Geosciences & Environment

Government &
Spatial Data Infrastructure

Mobile Internet &
Location Services

Sensor Webs

University & Research

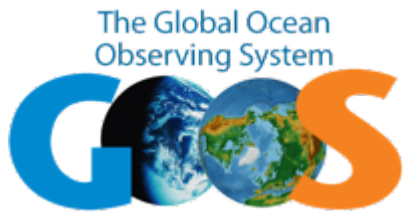


- Broad range of topics covered

OGC Data and Service Specifications

- Data
 - GML Geographic Markup Language
 - O&M Observation and Measurement
 - SensorML Sensor Markup Language
- Map Services
 - WMS Web Map Services
 - WFS Web Feature Services
 - WCS Web Coverage Services
- Sensor Web Services
 - SOS Sensor Observation Service
 - SPS Sensor Planning Service
 - SAS Sensor Alert Service
 - WNS Web Notification Service

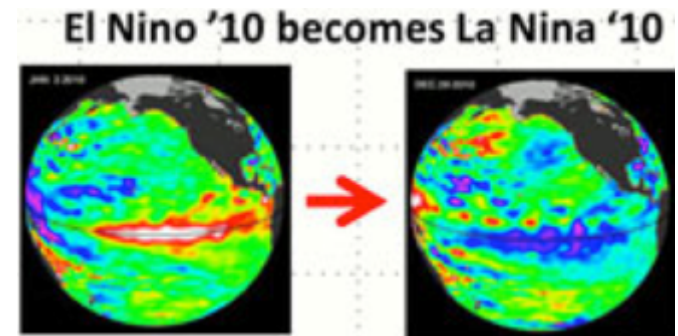
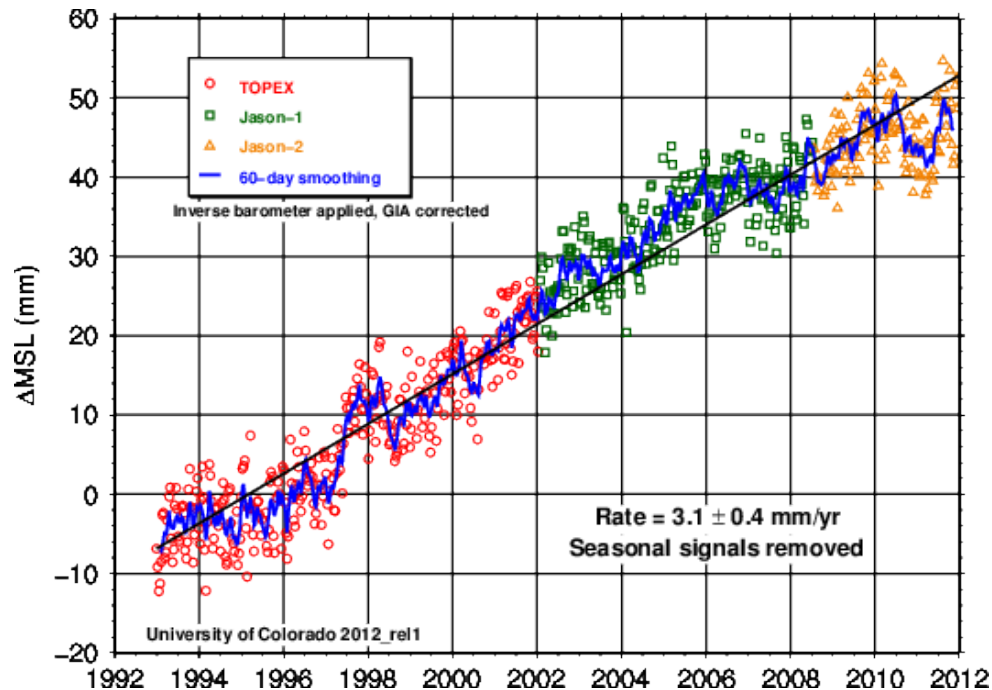
G3OS



G3OS – Global Observation System

- GOOS Global Ocean Observing System
- GTOS Global Terrestrial Observing System
- GCOS Global Climate Observing System
- supported by several international organisations such as WMO, UNESCO, UNEP, FAO etc.
- Voluntary participation by research and other organisations
- Aims to co-ordinate existing Programmes
- Provide common information systems

Example: GOOS Sea Level Watch



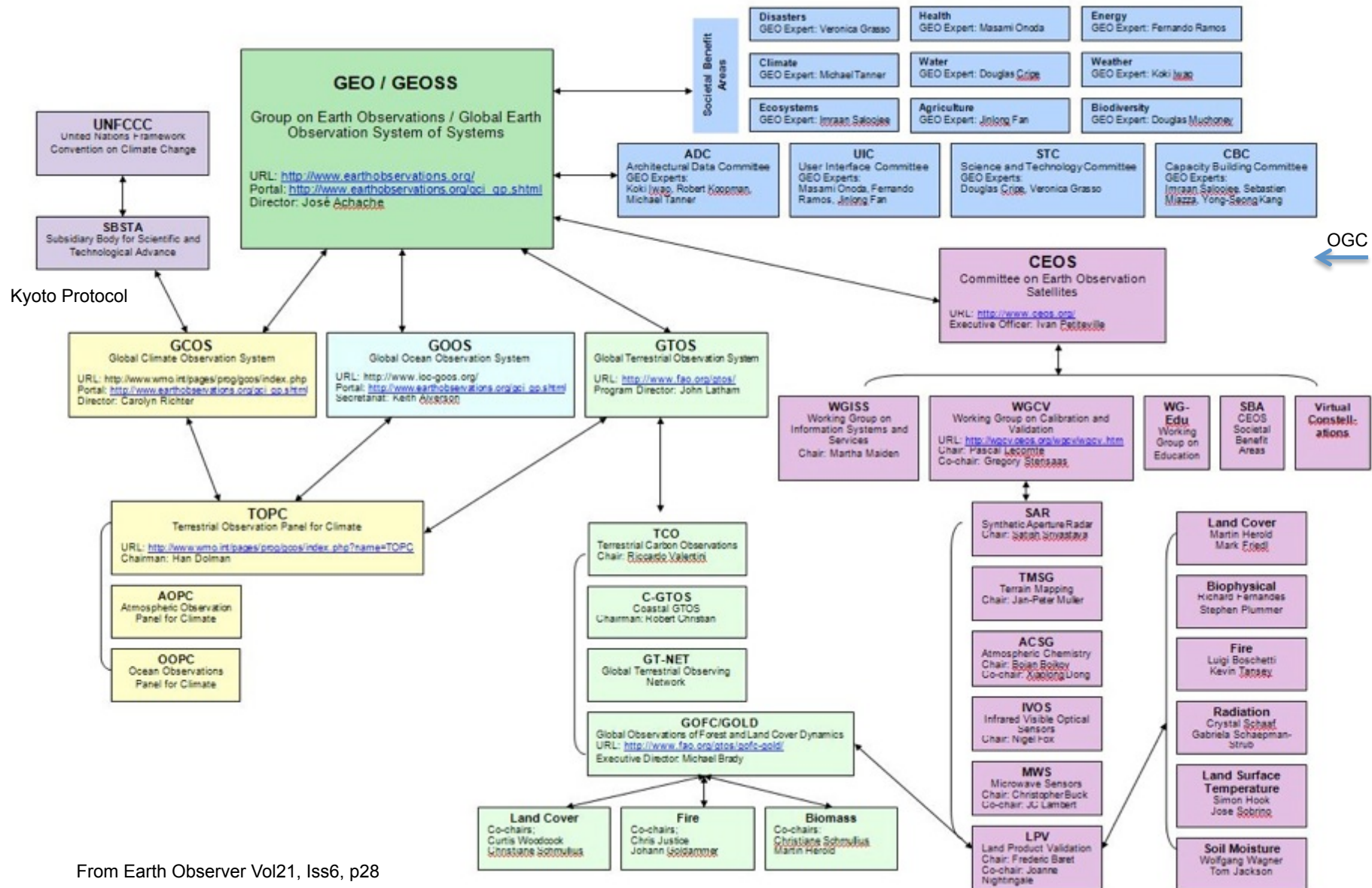
6 cm increase in sea level over 20 years

6 mm drop in 2010 due to extensive flooding during 2010 El Nina

Example: GTOS GOFC GOLD

- GOFC – Global Observation of Forest Cover
- GOLD – Global Observation of Land Dynamics
- Feeding into UNFCCC REDD+ Programme
- Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
- GOFC GOLD Sourcebook – contains useful guidelines for processing RS data for forest monitoring.

Linkages between International Programs



From Earth Observer Vol21, Iss6, p28



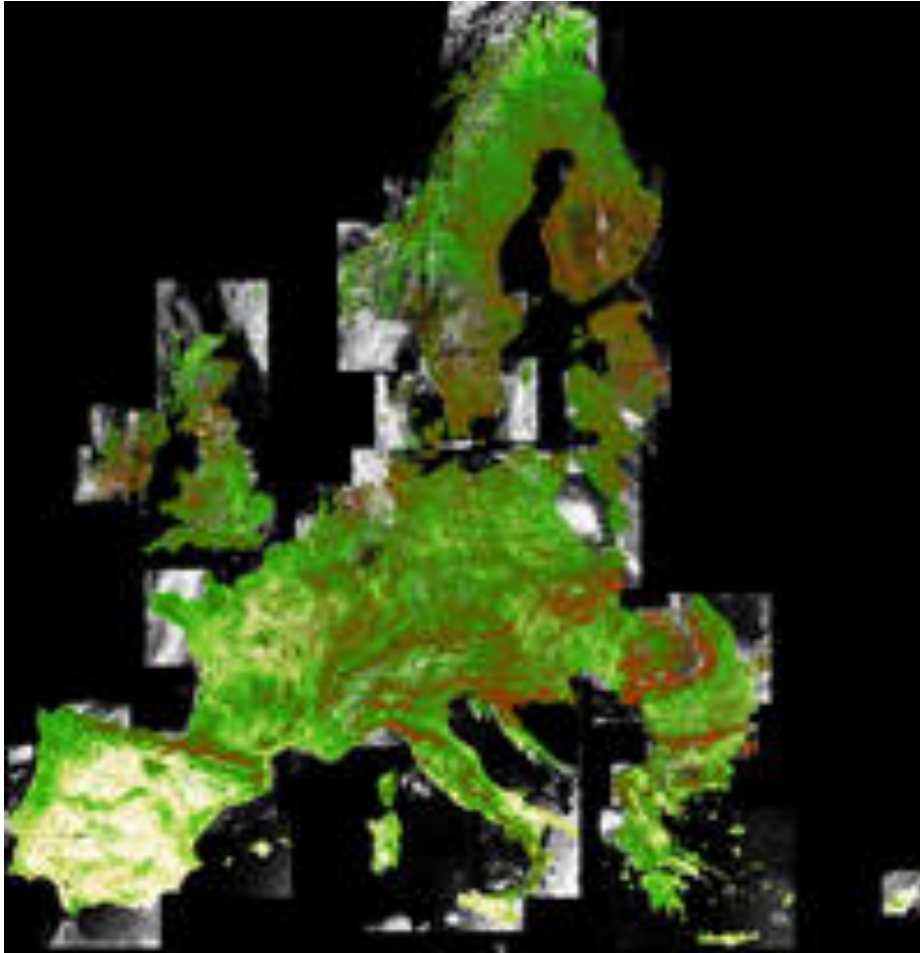
GMES Global Monitoring for Environment and Security

- European initiative to make EO satellites be driven by operational(/commercial) requirements, rather than just science.
- Developing operational services for
 - Land (Geoland2)
 - Ocean (MyOcean)
 - Atmosphere (MACC)
 - Disasters (SAFER)
 - Security (MOSAIC)
- From 2013, supported by Sentinel missions

Sentinel Missions

- Following on from EO satellites:
 - ERS 1 (1991-2000)
 - ERS 2 (1995-2011)
 - Envisat (2001- 2012)
- ESA, starting in 2013, plan to launch:
 - Sentinel 1 SAR (C-band)
 - Sentinel 2 Multispectral Optical (10m res) (land)
 - Sentinel 3 IR and microwave (marine)
 - Sentinel 4 Atmosphere - geostationary orbit
 - Sentinel 5 Atmosphere - polar orbit

GeoLand example product



NRT MERIS products (300m res)

Every 10 days covering:

- Leaf Area Index (LAI)
- Green Cover Fraction
- Brown Cover Fraction
- FAPAR (Veg light absorption)
- Canopy Shadow Factor
- Chlorophyll Content
- Fraction of Soil
- Fraction of Snow
- Fraction of Water

Cooperation between EU and Russia on GMES exploitation
(e.g. GMES-Russia and many FP-7 Programmes)

APARSEN



APARSEN

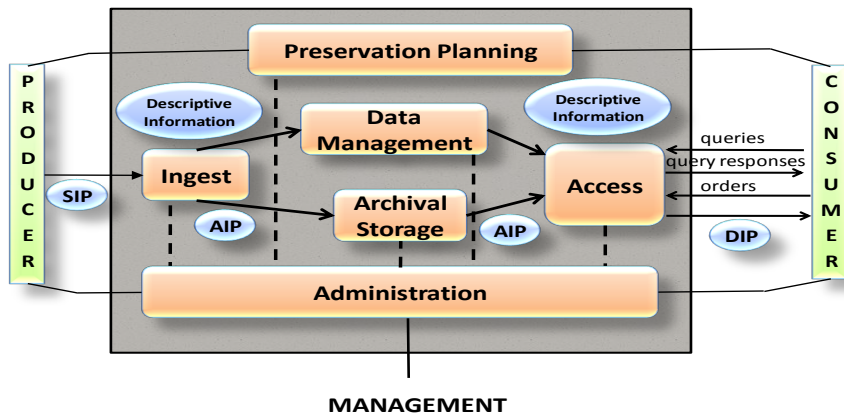
- Alliance Permanent Access to the Records of Science in Europe network
- 4 year FP7 Project to develop a sustainable Network of Excellence for long term preservation of digital data
- Ensure state of the art is maintained and expert advice is available
- Led by STFC in the UK and includes companies such as Microsoft, IBM, Airbus and organisations such as ESA and IKI RAN

Open Archival Information Systems (OAIS) Reference Model (ISO 14721)

2002, updated 2011

The OAIS Reference Model

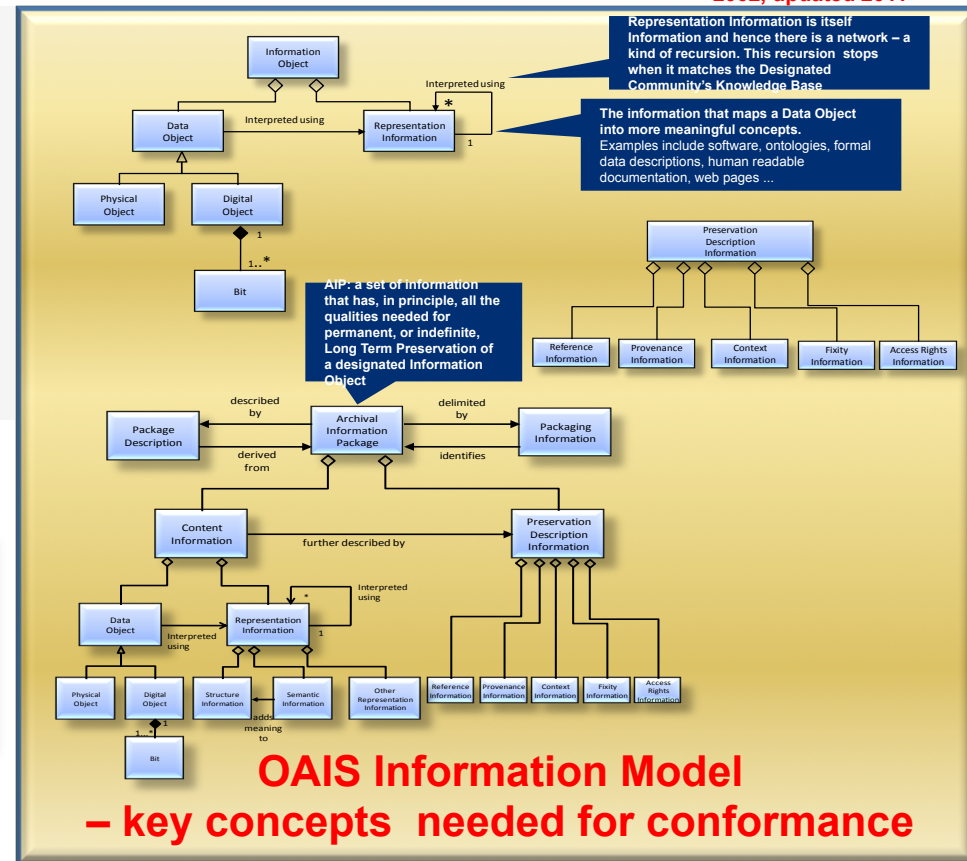
- is concerned with the Long Term preservation of information
- provides vital concepts that are necessary to preserve digitally encoded information
- provides testable mandatory responsibilities
- provides useful vocabulary and check-lists
- is widely used in the design and description of archives and libraries.
- forms the basis of a number of follow-on standards which are being developed.



OAIS Functional Model – useful terminology

Long Term Preservation:

The act of maintaining information, Independently Understandable by a Designated Community, and with evidence supporting its Authenticity, over the Long Term.



OAIS Information Model – key concepts needed for conformance

“Open Archival Information System (OAIS), now adopted as the “de facto” standard for building digital archives” NSF:
[Cyberinfrastructure Vision for 21st Century Discovery](http://www.alliancepermanentaccess.org/membership/member-resources/oais)

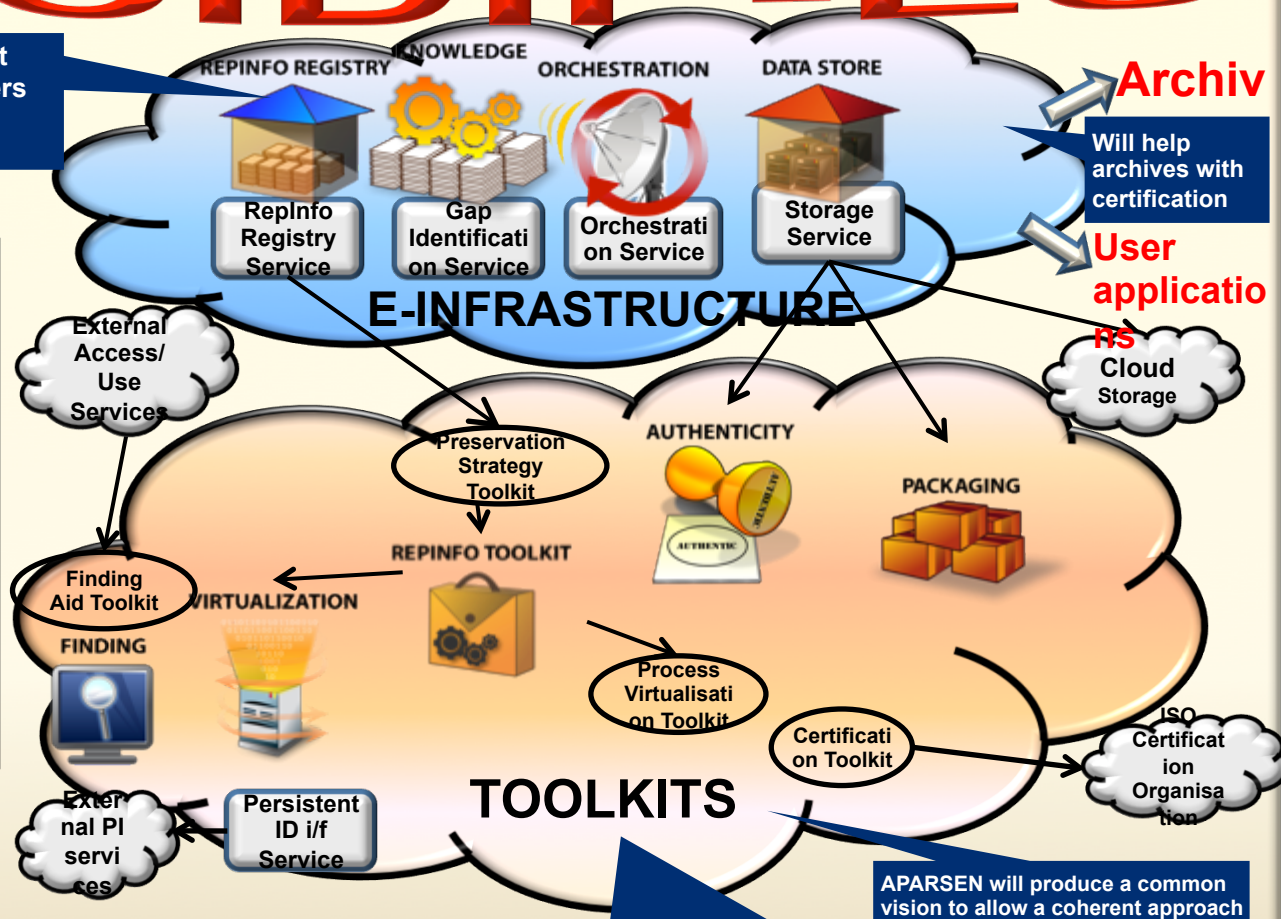
Available free from <http://www.ccsds.org> , for more information see <http://www.alliancepermanentaccess.org/membership/member-resources/oais>

SCIDIP-ES

Domain independent
Infrastructure counters
threats identified by
PARSE.Insight

SCIDIP-ES in brief

- Upgrade CASPAR prototype components into scalable, robust e-infrastructure components to support digital preservation of all types of digital objects



Archiv

Will help
archives with
certification

**User
applicatio
ns**

Cloud
Storage

ISO
Certificat
ion
Organisa
tion

APARSEN will produce a common
vision to allow a coherent approach

DIGITAL PRESERVATION RESEARCH needed to create the tools
needed to create the "metadata" used by the e-infrastructure and user
applications. Tools may be domain dependent.
Must include Rep. Info. Network of the metadata



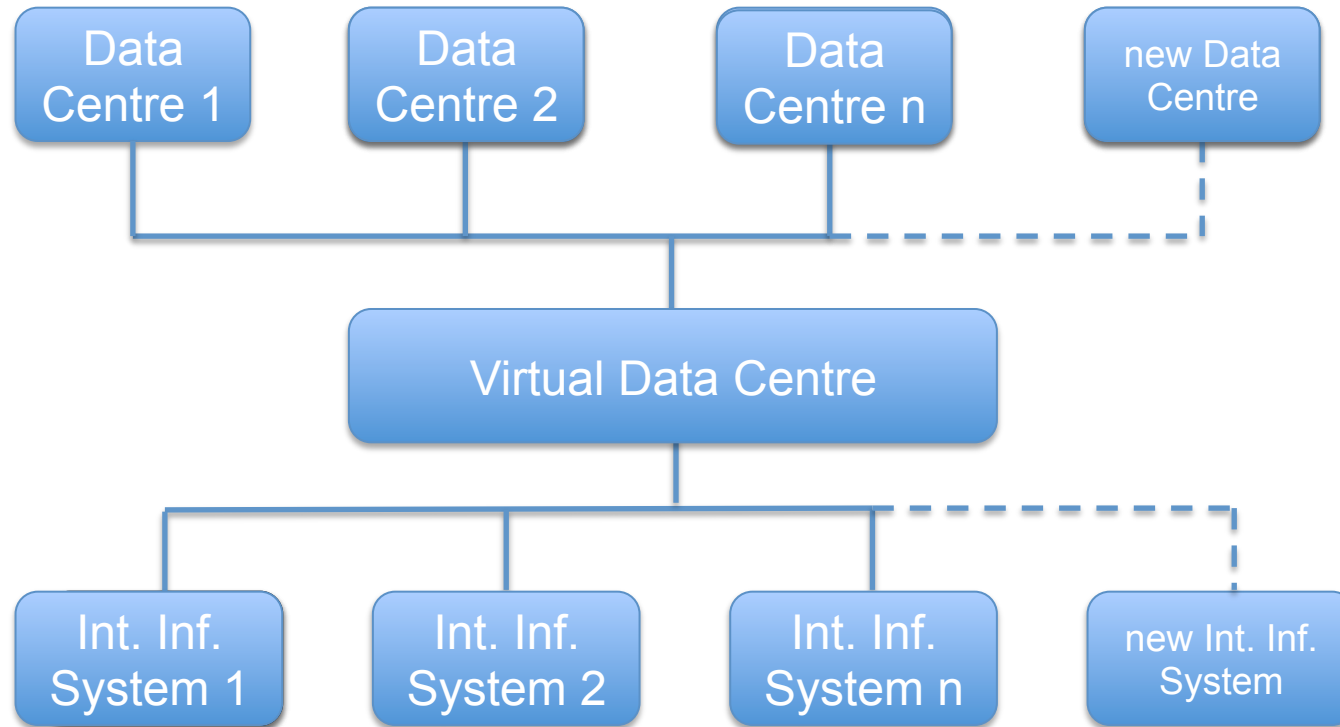
SCience Data Infrastructure for Preservation – with focus on Earth Science

Led by ESA. Currently in negotiation with EU. For more information see

<http://www.alliancepermanentaccess.org/current-projects/scidip-es>

Virtual Data Centres

Information Service Integration



- Service to Networks approach
- Easy to add new Data Centres
- Easy to connect to new International Information Systems

Virtual Data Centre Benefits

- Access to services (national and international)
- Advice on interfaces and data preservation
- Develop common Strategic and Tactical Plans
- Develop common resources (hence reduce costs)
- Provide international advocacy and standards watch
- Joint international working parties /Task forces
- Present best practice and encourage improvement
- Provide translation services
- Enable staff exchanges
- Inform policy and regulatory development
- Focus for sustainable long-term support

Conclusions

- Broad range of international programmes aiming to improve the exploitation of global Earth Observation
- Integration of information systems requires the adoption of international standards and other interoperability measures.
- A Russian Virtual Centre of Remote Sensing Data could help strengthen Russian contribution to global research and operational environment systems.
- Developments in ICT mean that distance is no longer a barrier to participating in international co-operatative activities.