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Climate change –

A cross-cutting theme in GEO´s second decade

André Obregón
Technical Expert for Climate

UN/Austria Symposium
Graz, 12-14 Sep 2016

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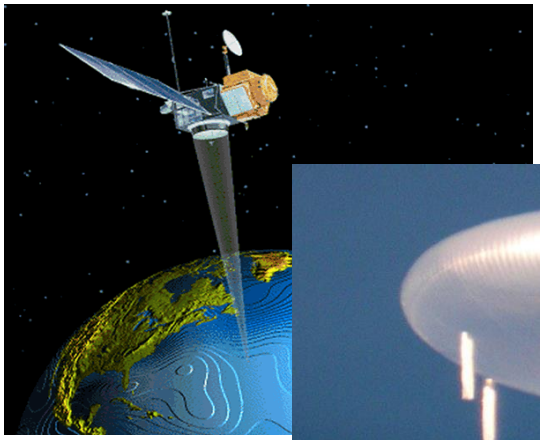
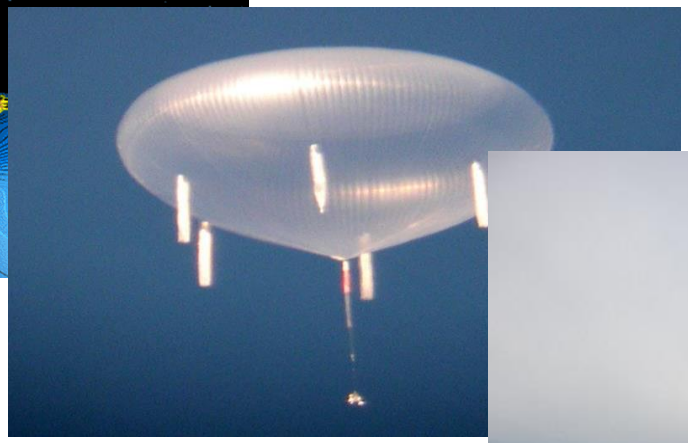
Observations – In, On, and Around the Earth





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GEO Vision

To realize a future wherein decisions and actions, for the benefit of humankind, are informed by coordinated, comprehensive and sustained Earth observations and information

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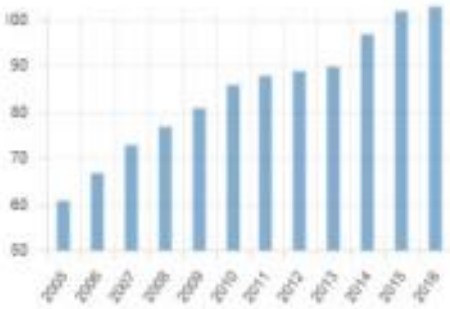
103 GEO Members

Number of Members (2016)

Africa:	27
Americas:	16
Asia/Oceania:	19
C.I.S.:	7
Europe:	34
Total:	103

Number of Members by year



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95 Participating Organizations

AARSE
ACMAD
adie
APN
BELMONT FORUM
Bioversity International
CATHALAC
Convention on Biological Diversity
creative commons
CEOS
CGMS
CODATA
COSPAR
EARSC
EARSeL
ECMWF
EEA
EPOS
esa
SIP
ESSL
EUROPEAN UNION SATELLITE CENTRE
EUMETNET
EUMETSAT
EUREC AGENCY
eurisy
EuroGeoSurveys
The Geological Surveys of Europe
FAO
futurearth
research for global sustainability
GBIF
GCOS
GÉANT
GEM
THE GLOBE PROGRAM
GLOS
GOOS
Global Ocean Observing System
GRSS Geoscience and Remote Sensing Society
GSDI
Global Spatial Data Infrastructure Association
GTOS
IBEC
INTERBALKAN ENVIRONMENT CENTER
IAG
International Association of Geodesy
ICA
ACI
ICIMOD
ICSU
International Council for Science
IEEE
International Hydrographic Organization
IIASA
iisd
International Institute of Space Law
INCOSE
International Steering Committee for Global Mapping
ISDE
isprs
ITC
International Union of Geodesy and Geophysics (IUGG)
IUGS
IWMI 30
International Water Management Institute
JBGIS
Joint Board of Geospatial Information Societies
marine technology SOCIETY
OGC
Open Geospatial Consortium, Inc.
pogo
RCMRD
RDA
RESEARCH DATA ALLIANCE
Regional Centre for Training in Aerospace Surveys
SAON
SUSTAINING ARCTIC OBSERVING NETWORKS
SICA
SPC
Applied Geoscience and Technology Division (SOPAC)
SECURE WORLD FOUNDATION
THE WORLD BANK
NCAR UCAR University Corporation for Atmospheric Research
UNCCD
UNECA
UNEP
UNITED NATIONS ESCAP
UNESCO
United Nations Framework Convention on Climate Change
UNISDR
unitar
UNITED NATIONS Office for Outer Space Affairs
UNITED NATIONS UNIVERSITY UNU-EHS
WCRP
World Climate Research Programme
ICSU WORLD DATA SYSTEM
WMO

GEO-XII Plenary & Ministerial Summit
Mexico City 9-13 November 2015

- Ministerial Declaration that focuses on harnessing critical environmental observations
- Adoption of a ten year Strategic Plan (2016-2025)

"GEO will supply the requisite Earth observations in ***support of effective policy responses*** *for* ***climate change adaptation, mitigation*** *and other impacts across the SBAs."*

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New Societal Benefit Areas (SBAs)

Climate change and its impacts cut across all SBAs

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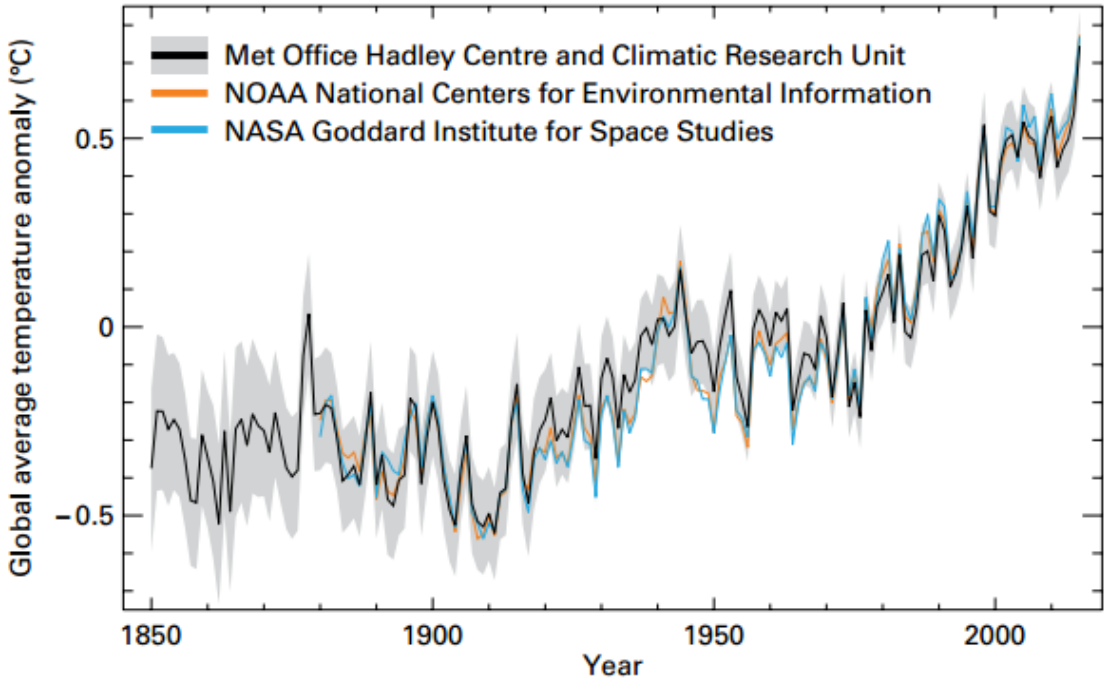
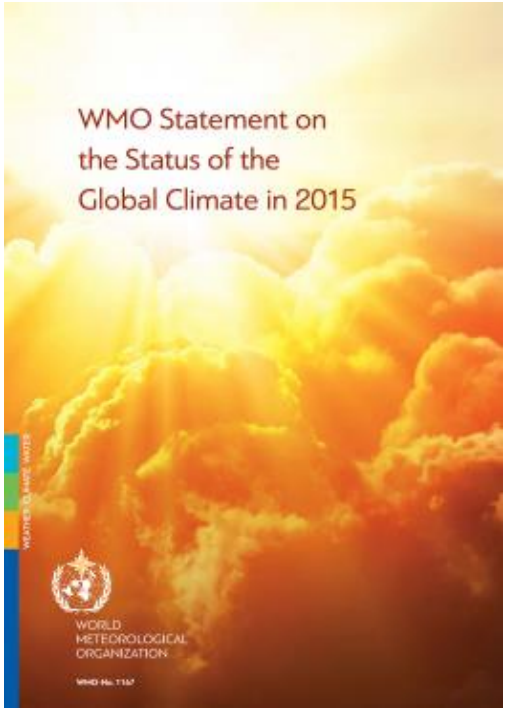
Observed indicators of a changing climate





- IPCC: Global warming is unprecedented and unequivocal
- Multiple indicators for a changing climate (sea ice, glaciers, ocean heat content, sea level, land cover…); many observed by satellites

Information Value Chain

Data providers




Value-Added providers



Downstream users





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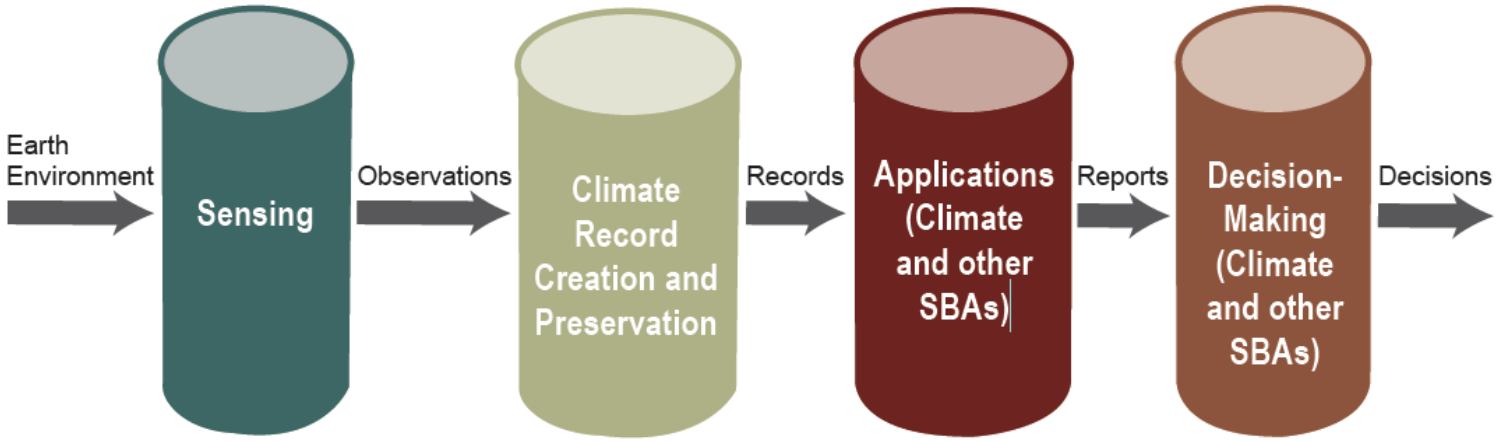
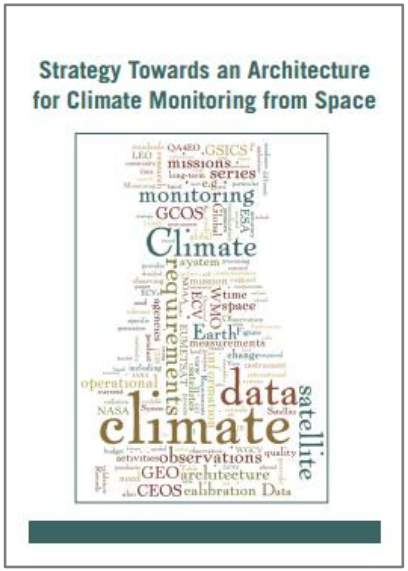
Architecture for Climate Monitoring from Space



CEOS CGMS WMO



→ Systematic end-to-end approach

→ CEOS/CGMS WG Climate: coordinates implementation and further development of the Architecture

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GEOSS Implementation Requires: *Data Sharing Principles*

- **Full and Open Exchange of Data --** Open by Default

- **Data and Products at Minimum Time Delay and at Minimum Cost**

- **Free of Charge or Cost of Reproduction**

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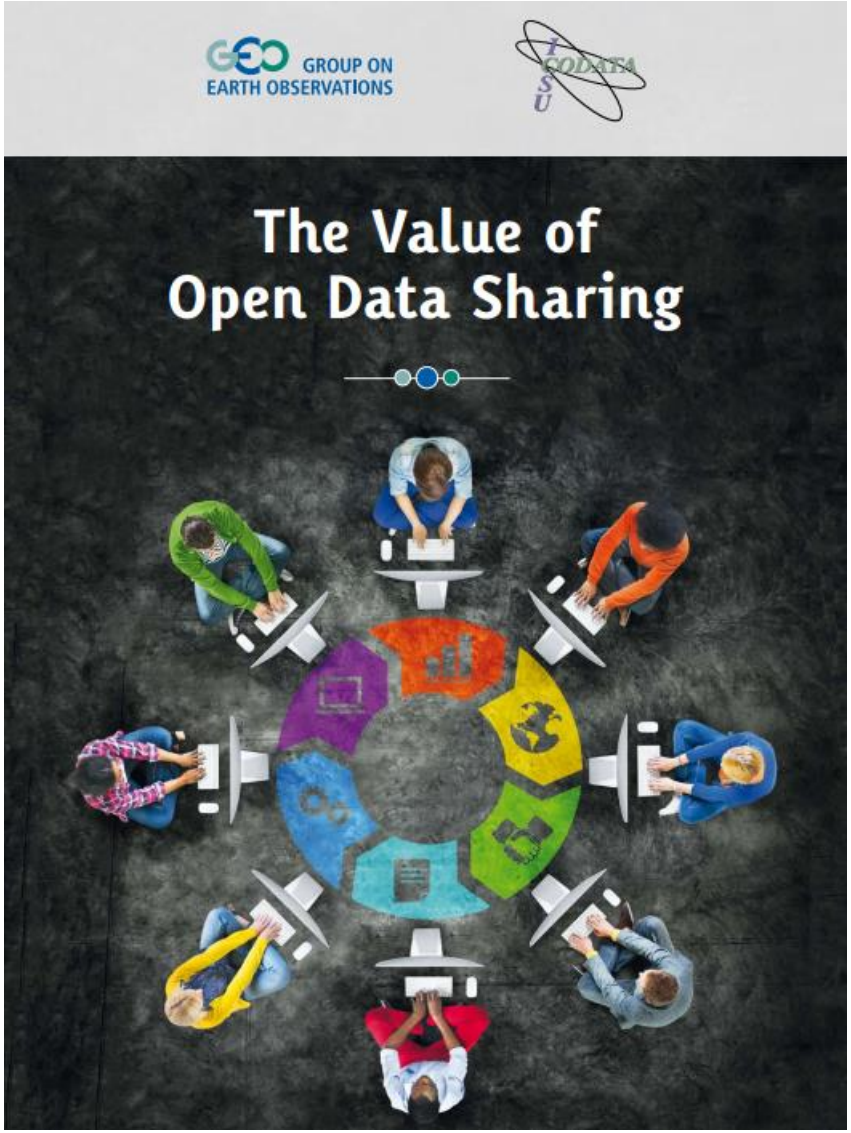
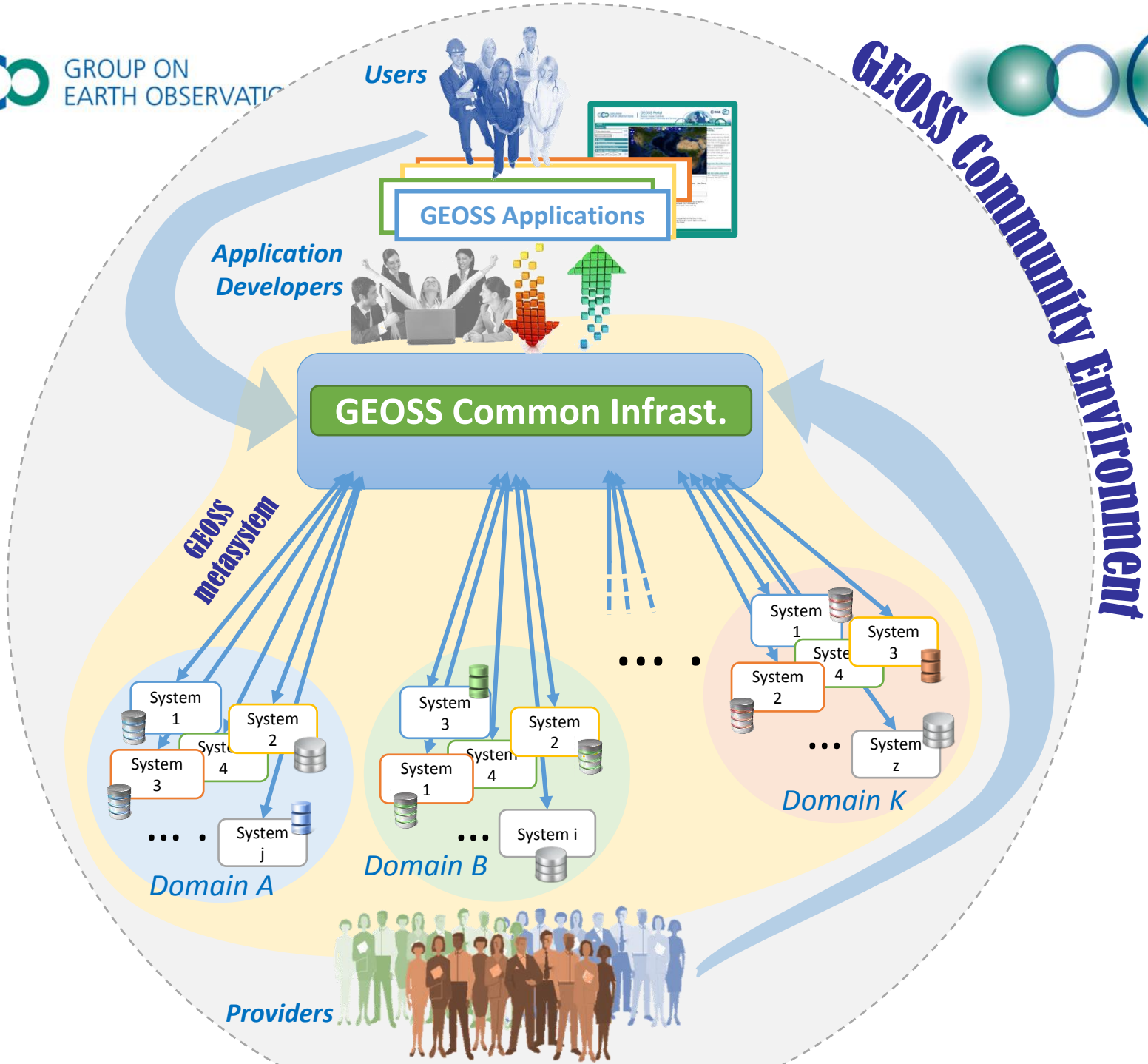
The Value of Open Data Sharing

- Research & Innovation
- Education
- Capacity Development
- Effective Governance & Policy Making
- Social Welfare
- Economic Growth

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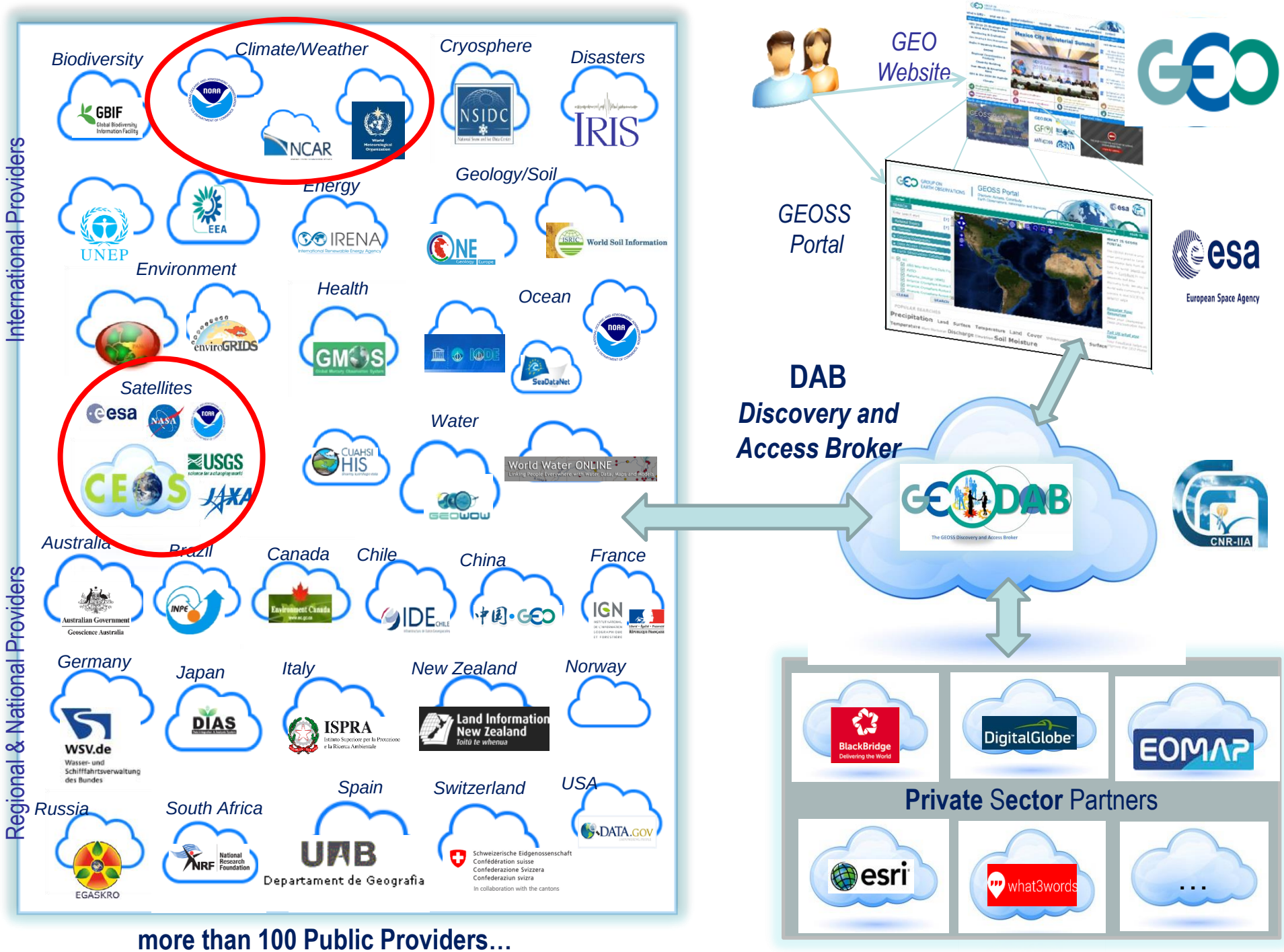
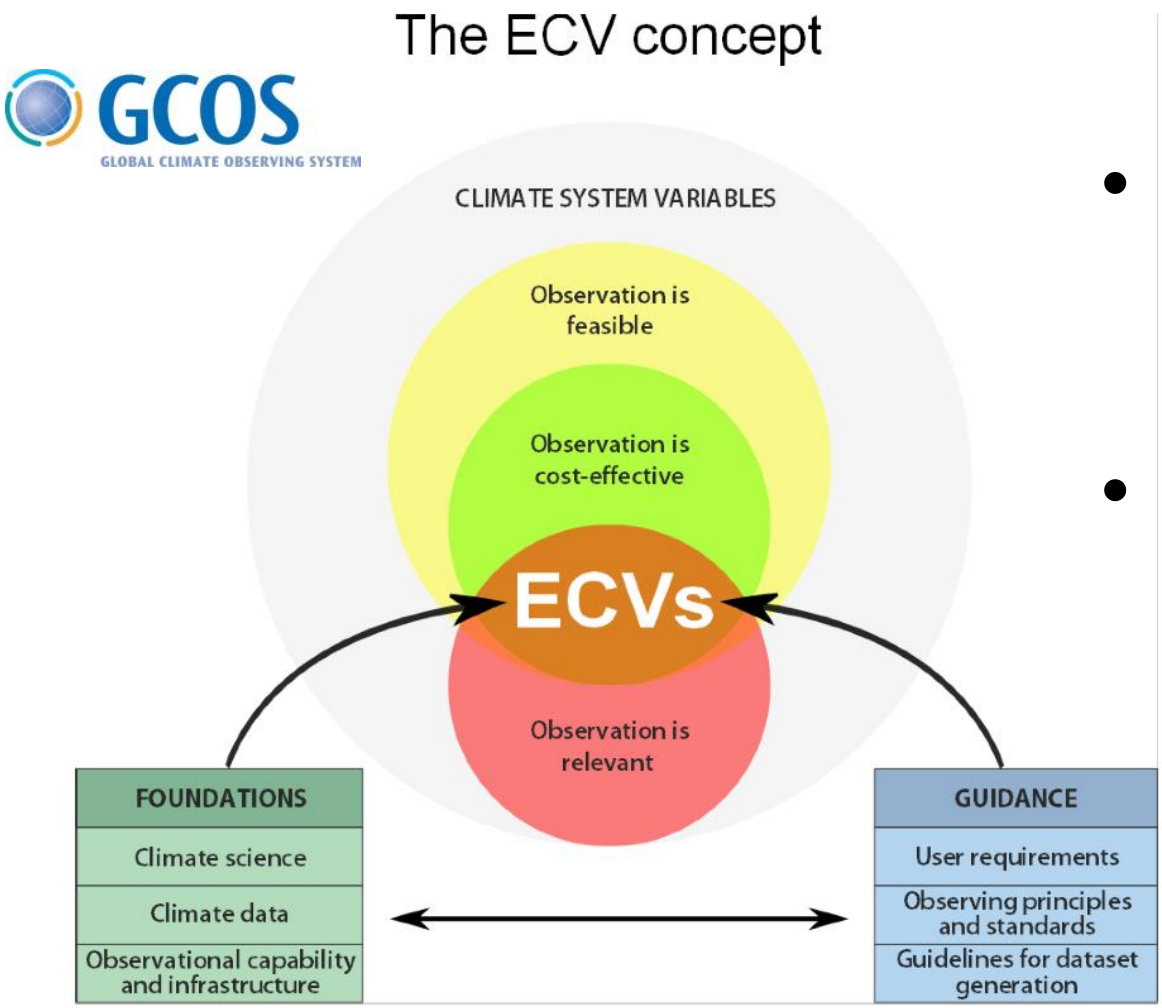
GEOSS Community Environment
Users
GEOSS Applications
Application
Developers
GEOSS Common Infrast.
GEOSS
metasystem
System
1
System
2
System
3
System
4
System
j
Domain A
System
3
System
2
System
1
System
4
System i
Domain B
System
1
System
3
System
2
System
4
System
z
Domain K
Providers


International Providers
Regional & National Providers
Biodiversity
GBIF
Climate/Weather
NOAA
NCAR
World Meteorological Organization
Cryosphere
NSIDC
Disasters
IRIS
UNEP
EEA
Energy
IRENA
Geology/Soil
ONE
ISRIC
World Soil Information
Environment
enviroGRIDS
Health
GMOS
IODE
Ocean
NOAA
SeaDataNet
Satellites
esa
NASA
NOAA
USGS
CEOS
JAXA
Water
CUAHSI HIS
World Water ONLINE
GEOWOW
Australia
Australian Government
Geoscience Australia
Brazil
INPE
Canada
Environment Canada
Chile
IDE CHILE
China
GEO
France
IGN
Germany
WSV.de
Wasser- und Schifffahrtsverwaltung des Bundes
Japan
DIAS
Italy
ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale
New Zealand
Land Information New Zealand
Norway
Russia
EGASKRO
South Africa
NRF National Research Foundation
Spain
UAB
Departament de Geografia
Switzerland
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
In collaboration with the cantons
USA
DATA.GOV
more than 100 Public Providers…
GEO Website
GEO
GEOSS Portal
esa
European Space Agency
DAB
Discovery and Access Broker
GEO DAB
The GEOSS Discovery and Access Broker
CNR-IIA
BlackBridge
Delivering the World
DigitalGlobe
EOMAP
Private Sector Partners
esri
what3words
...

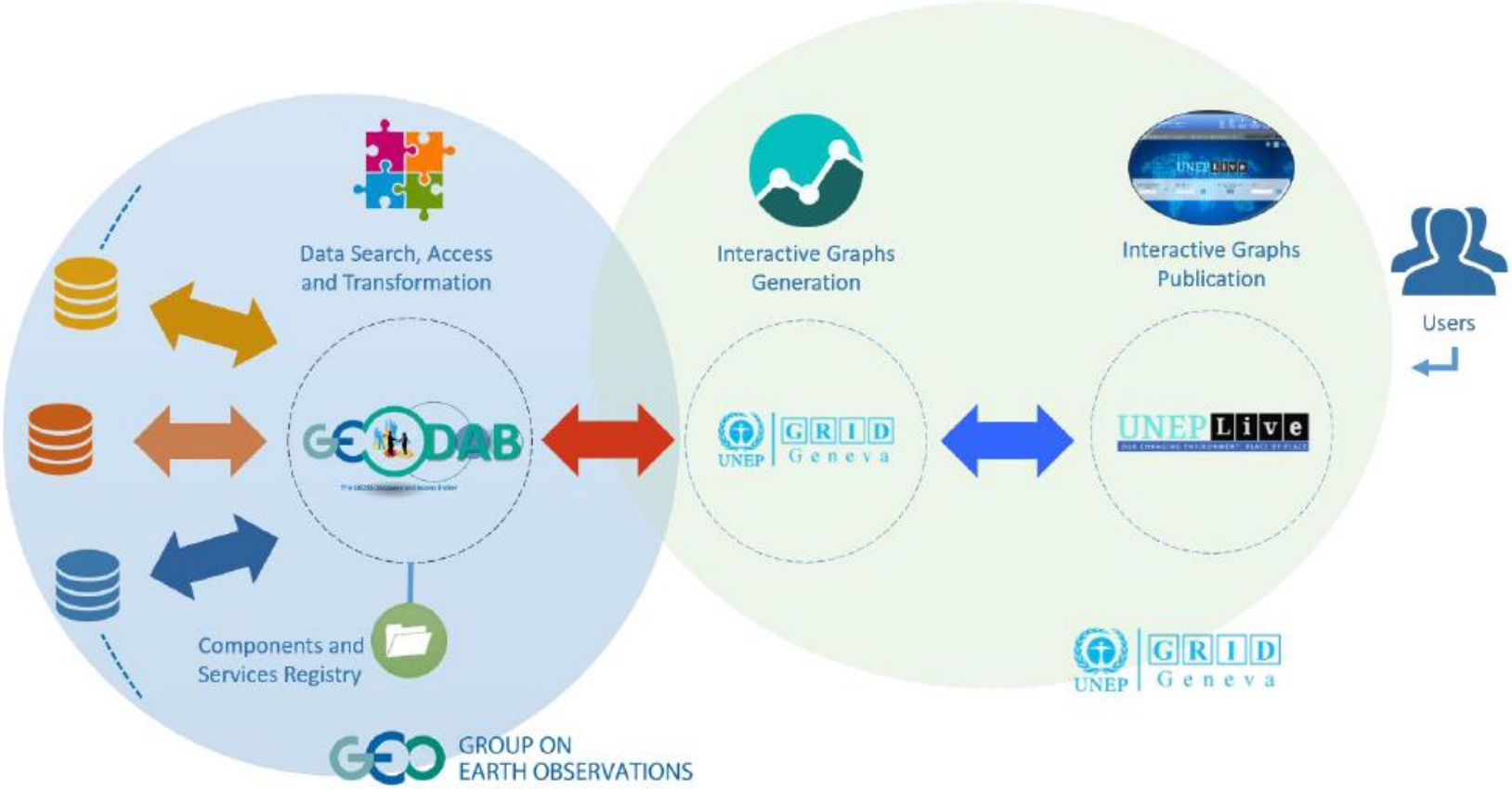
Global Climate Observing System



- GCOS constitutes the climate-observing component of GEOSS
- Identifies user requirements, gaps and provides guidelines

Bojinski et al. 2014, BAMS

Use Case: UNEP and GEOSS Interoperability



- Visualization of several ECV datasets planned (in coordination with GCOS)
- Bridge the gap from data to information to support near-real-time environmental monitoring

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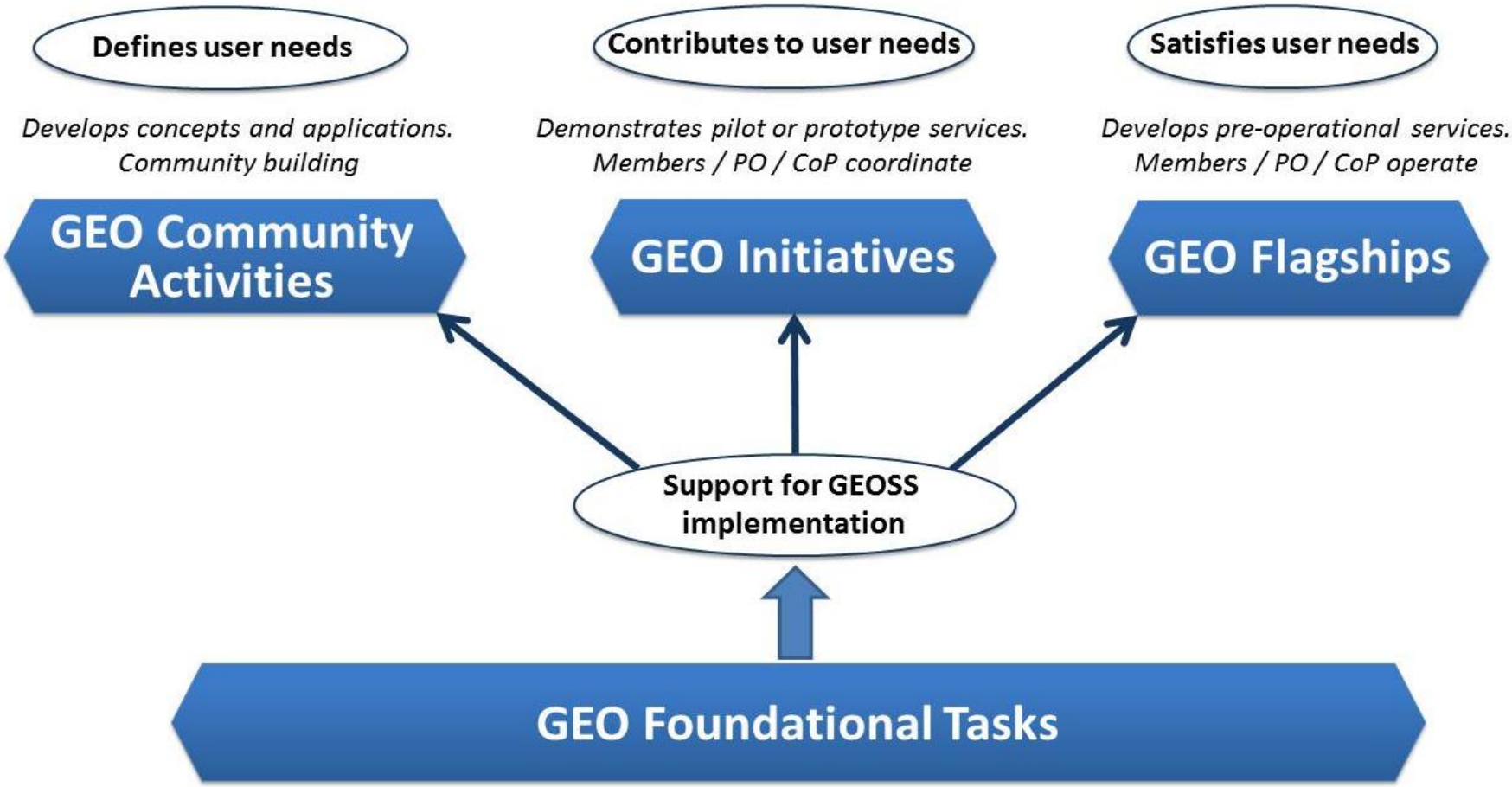
GEO Work Programme



Over-arching activities described in the GEO WP.
Initiated by GEO Secretariat.

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Climate in the GEO Work Programme

Community Activities

- Access to climate data in GEOSS
- Collaboration between GEO and GFCS
- Copernicus Climate Change Service (C3S) and Copernicus Atmospheric Monitoring Service (CAMS)
- Land Cover, Water Cycle, Floods, Droughts and others

GEO Initiatives/Flagships

- Global Carbon and GHG Analysis System
- Global Drought Information System
- Climate Change Impact Observation on Africa´s Coastal Zones
- Information Service for Cold Regions

GEOGLAM Global Agricultural Monitoring

GFOI Global Forest Observations Initiative

GEO BON

BLUE PLANET Oceans and Society

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The GEO Carbon Flagship: A timely initiative!

Article 7 Adaptation

7.7 Strengthening cooperation

(c) research, systematic observation

Article 14 Global stocktaking

1. …in a comprehensive and facilitative manner, considering mitigation, adaptation and the means of implementation and support, and in the light of equity and the best available science.

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Reporting

- to be transparent
- based on global stocktake
- shift from verfication to support for countries to improve reporting

Policy needs reliable GHG-related information

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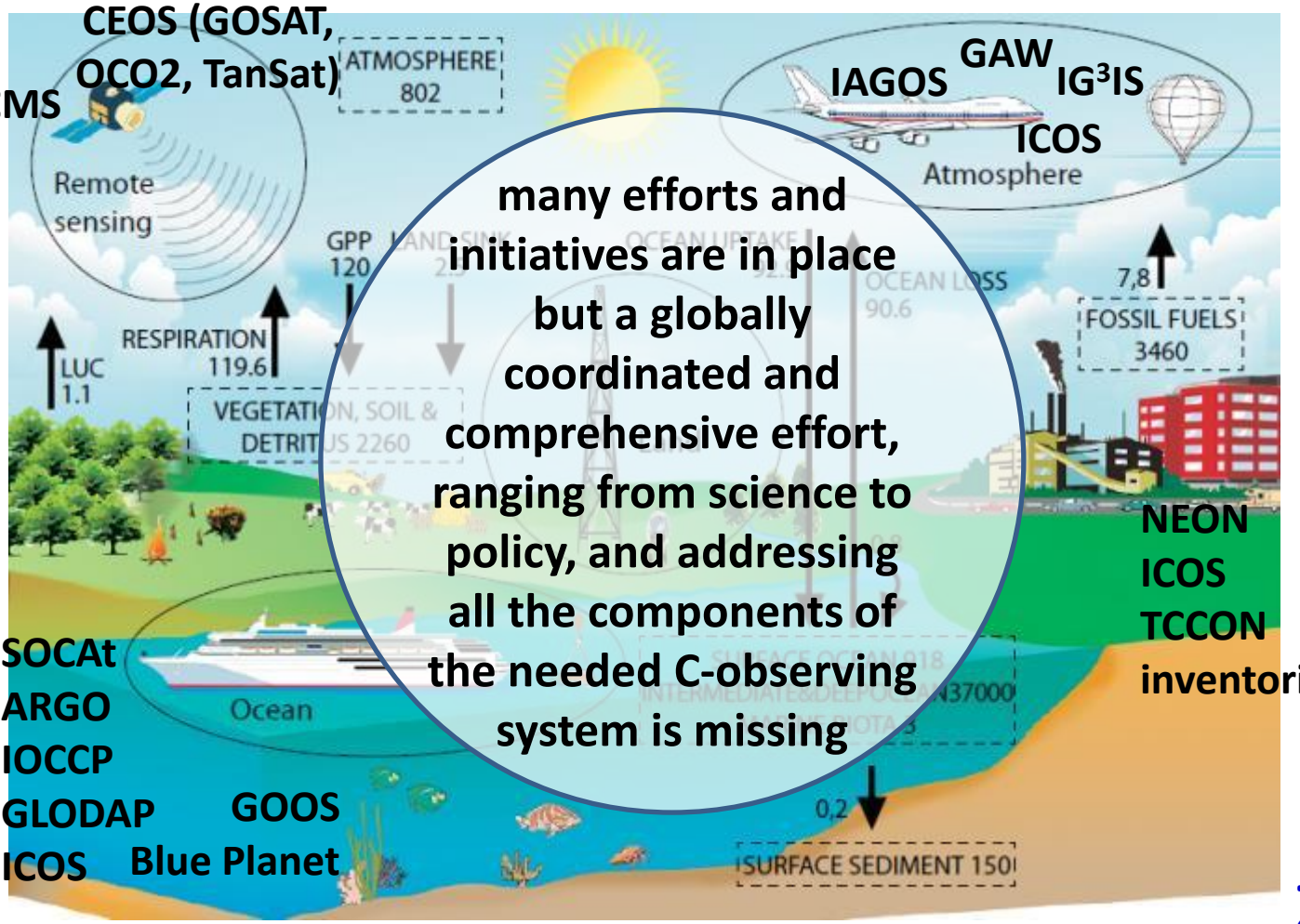
Monitoring the Global Carbon Cycle: a complex ensemble of different players, countries, systems, networks, datasets, methodologies, rules, standards, etc.



CEOS (GOSAT, OCO2, TanSat)

NASA CMS

IAGOS

GAW

IG³IS

ICOS

GCOS

GCP

many efforts and initiatives are in place but a globally coordinated and comprehensive effort, ranging from science to policy, and addressing all the components of the needed C-observing system is missing

NEON

ICOS

TCCON

inventories

SOCAt

ARGO

IOCCP

GLODAP

ICOS

GOOS

Blue Planet

… and many OTHERS!

Source: GEOCARBON project

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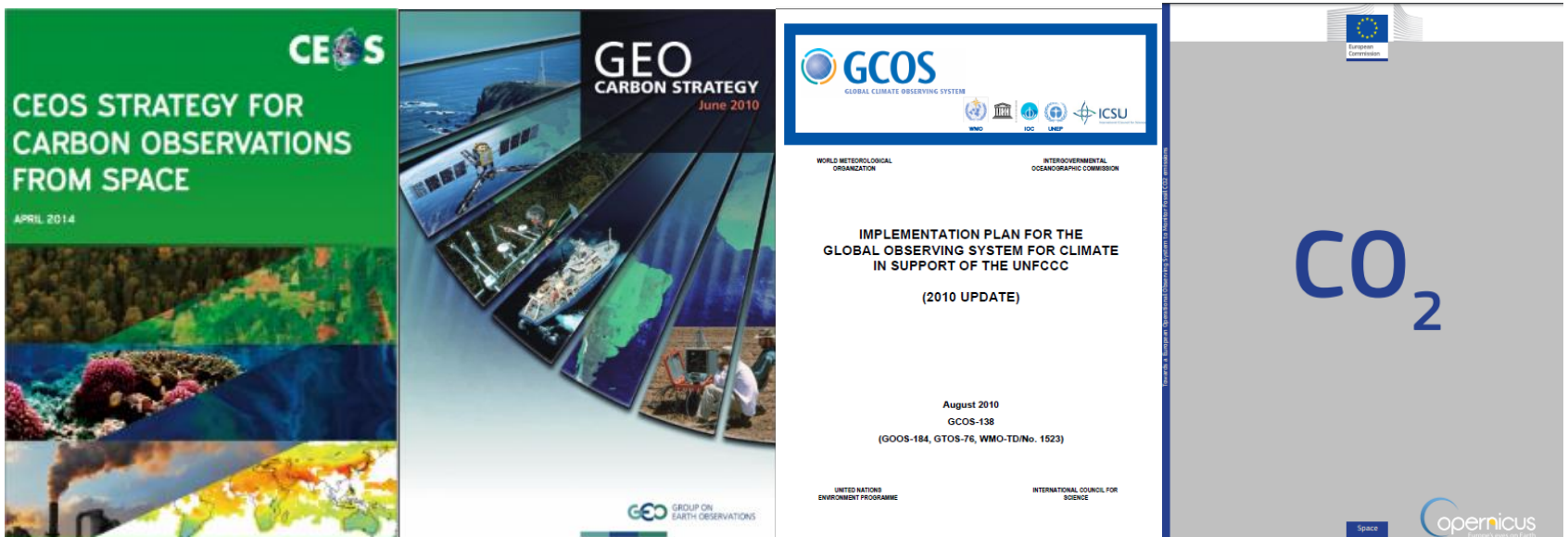
The difference – What the C-Flagship will not be/do

- It will not be a self-standing entity in competition with others!
- It will neither rewrite new strategies nor duplicate existing efforts.

What the C-Flagship will be/do

- The C-Flagship will build on existing initiatives, networks and infrastructures, and integrate them with the missing pieces to obtain a comprehensive globally coordinated GHG observation and analysis system



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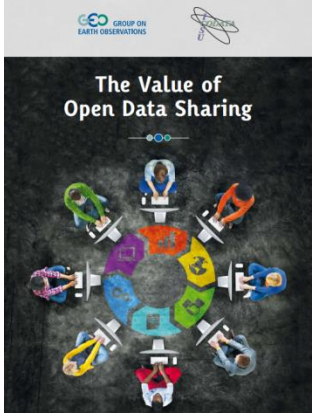
Challenges



- **Access to climate data**

  Broad, open data policies are needed for global monitoring and transparency

- **Interoperability**

  Data discoverability and access through federated systems

- **Downstream services**

  Applications and information are needed to make data useful for decision-makers

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GEO-XIII Plenary

7-10 November 2016, St. Petersburg
Russian Federation

http://www.earthobservations.org

Twitter: @geosec2025

Facebook: Group on Earth Observations

Additional slides

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THE GLOBAL GOALS
For Sustainable Development

Transforming Our World: The 2030 Plan for Global Action - Article 76: "We will promote transparent and accountable scaling-up of appropriate public-private cooperation to exploit the contribution to be made by a wide range of data, <u>including Earth observation and geo-spatial information</u>, while ensuring national ownership in supporting and tracking progress."

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Earth Observations and Geospatial Information

Support to SDGs

Direct measures of some Indicators and indirect support to others.

Contribute to progress on the Targets, which will show up in the Indicators.

SUSTAINABLE DEVELOPMENT GOALS

	Population distribution	Cities and infrastructure mapping	Elevation and topography	Land cover and use mapping	Oceanographic observations	Hydrological and water quality observations	Atmospheric and air quality monitoring	Biodiversity and ecosystem observations	Agricultural monitoring	Hazards, disasters and environmental impact monitoring
1 No poverty	■	■		■					■	
2 Zero hunger	■	■	■	■	■	■	■	■	■	■
3 Good health and well-being	■	■		■		■	■		■	■
4 Quality education	■	■								
5 Gender equality	■	■								
6 Clean water and sanitation	■	■	■	■	■	■	■	■	■	■
7 Affordable and clean energy	■	■	■	■	■	■	■	■		■
8 Decent work and economic growth	■	■	■	■					■	
9 Industry, innovation and infrastructure	■	■	■	■			■			■
10 Reduced inequalities	■	■								
11 Sustainable cities and communities	■	■	■	■			■	■	■	■
12 Responsible consumption and production	■	■	■	■				■		■
13 Climate action	■	■	■	■	■	■	■	■	■	■
14 Life below water	■	■	■	■	■	■	■	■	■	■
15 Life on land	■	■	■	■		■	■	■	■	■
16 Peace, justice and strong institutions	■	■		■						
17 Partnerships for the goals	■	■	■	■	■	■	■	■	■	■

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GEO and Climate Services

GFCS
GLOBAL FRAMEWORK FOR CLIMATE SERVICES

Copernicus
Europe's eyes on Earth

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GEO and the Climate Convention

Research and Systematic Observation
SystematicObservation.2015.1.InformationNote

Systematic Observation at the forty-third session of the Subsidiary Body for Scientific and Technological Advice

Note by the Chair of the SBSTA

12 November 2015

30. The SBSTA recognises the importance of:

- **GEO**, including its implementation plan for **GEOSS**;
- collaboration between **GEO and GCOS**; and of
- capacity building on systematic observation, inter alia, to enable developing countries to apply climate observations for impact assessment and preparation for adaptation.

The new **GEO Strategic Plan 2016-2025** establishes three Strategic Objectives – Advocate, Engage, Deliver – and emphasises climate change and its impacts as a cross-cutting area, and strengthens the societal benefit areas making them more focused on the needs of society to support processes under the UNFCCC, the UN Sendai Framework for Disaster Risk Reduction, the SDGs and other UN agencies

Climate Records

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PAGES PAST GLOBAL CHANGES

Proxies

ACRE Atmospheric Circulation Reconstructions over the Earth

Data Recovery, Digitizing, …

ECMWF

ERA-Interim

JRA-55

ERA CLIM2

AD 0 1000 2014

Reanalysis up to last 100 years

Sensing → Observations → Climate Record Creation

Satellite-based climate data records for ECVs

SCOPE•CM

CM SAF

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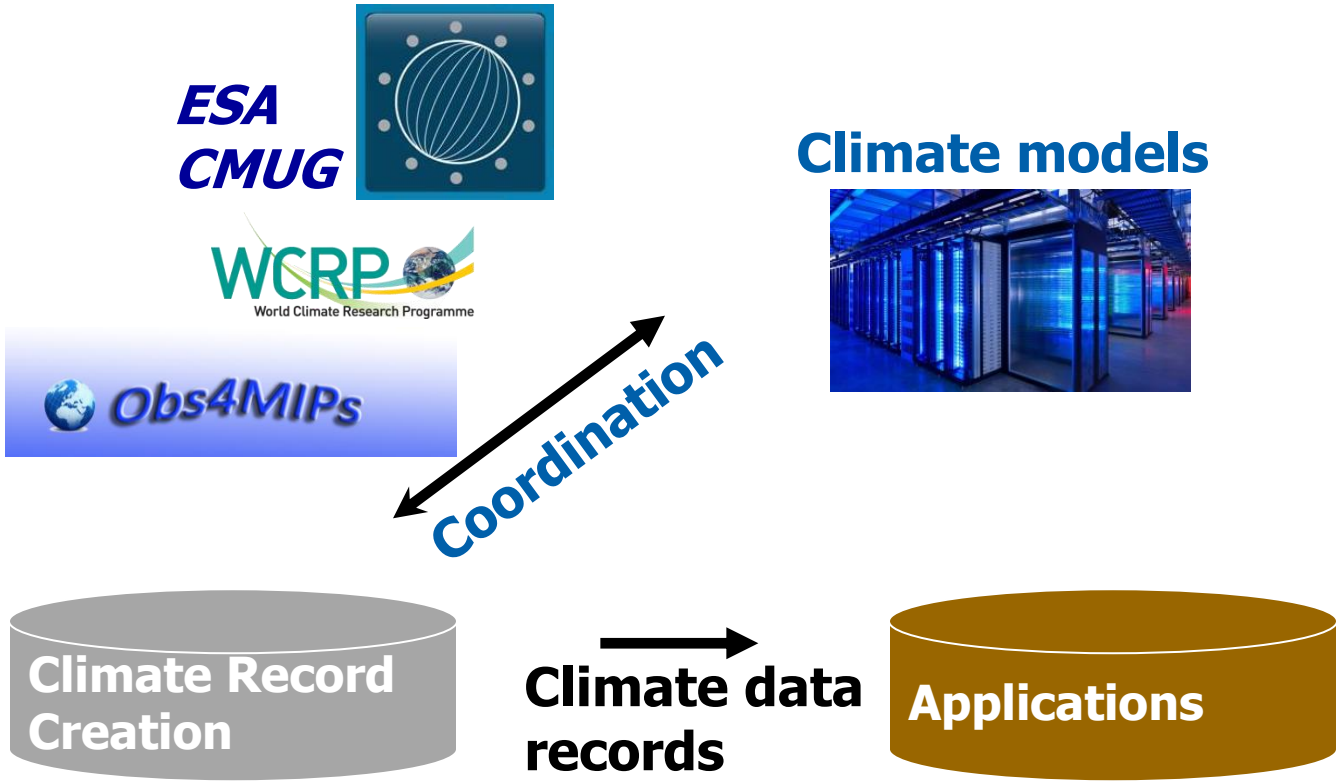
From climate data records to modeling



Recommended Action. Advance improved access to models and end-user applications, and in a form that be used in adaptation decisions