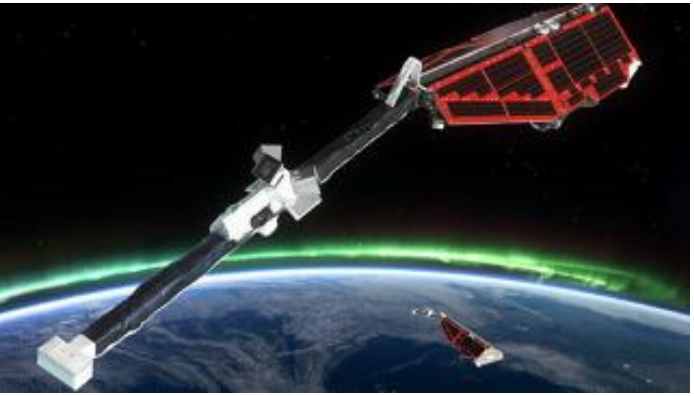
Maximizing the benefits of ESA's Earth Observation Programmes




Mark Doherty
European Space Agency

Presented by Stephen Ward, Symbios

Overview

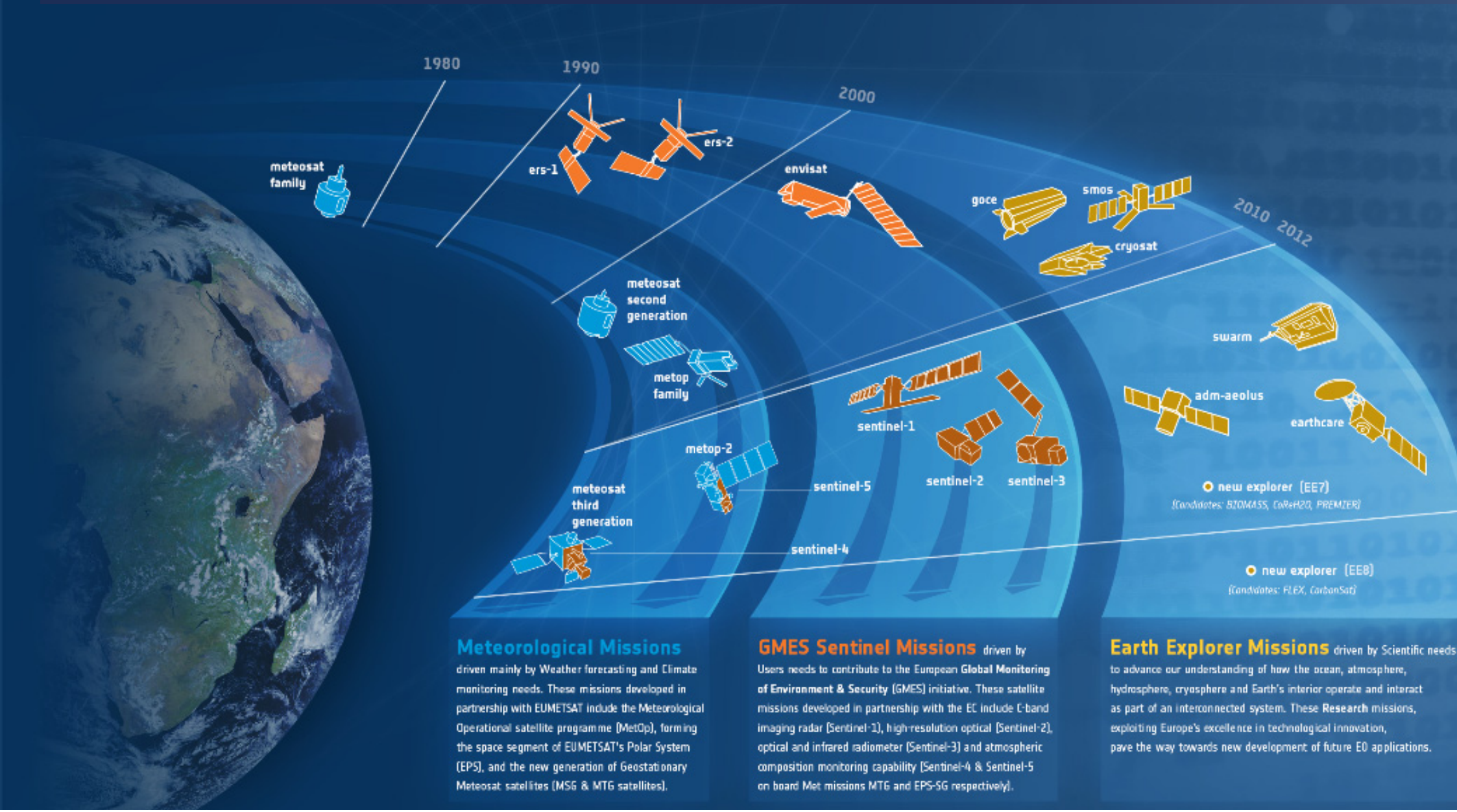
- **Working with the science community**
- **Engaging institutional users**
- **Working with Industry**
- **Achieving Sustainability**

Established Frameworks for International Cooperation on EO

- **ESA: 19 Member States**
- **ESA's Living Planet Programme**
  Science, Technology, Applications
- **ESA & EUMESAT: Operational Satellite Meteorology**
- **ESA & EU: GMES Space Component and Services**
- **CEOS: International Space Agencies**
- **GEO: Global Earth Observing System / Stakeholders**
- **GCOS: Global Climate Observing System / needs**

Global observations for Scientific understanding…

Expanding European Earth Observing Capability

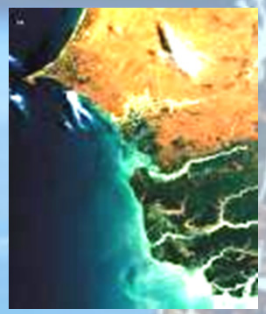


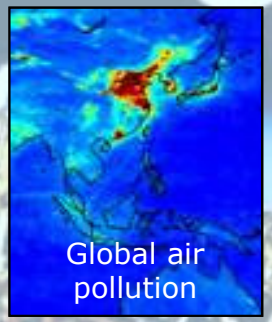
Meteorological Missions driven mainly by Weather forecasting and Climate monitoring needs. These missions developed in partnership with EUMETSAT include the Meteorological Operational satellite programme (MetOp), forming the space segment of EUMETSAT's Polar System (EPS), and the new generation of Geostationary Meteosat satellites (MSG & MTG satellites).

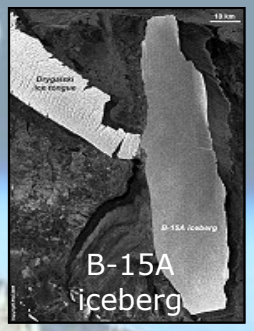
GMES Sentinel Missions driven by Users needs to contribute to the European **Global Monitoring of Environment & Security** (GMES) initiative. These satellite missions developed in partnership with the EC include C-band imaging radar (Sentinel-1), high-resolution optical (Sentinel-2), optical and infrared radiometer (Sentinel-3) and atmospheric composition monitoring capability (Sentinel-4 & Sentinel-5 on board Met missions MTG and EPS-SG respectively).

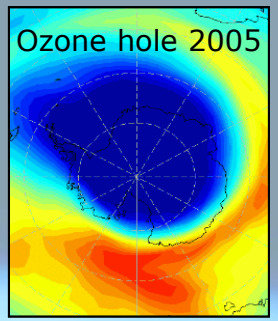
Earth Explorer Missions driven by Scientific needs to advance our understanding of how the ocean, atmosphere, hydrosphere, cryosphere and Earth's interior operate and interact as part of an interconnected system. These **Research** missions, exploiting Europe's excellence in technological innovation, pave the way towards new development of future EO applications.

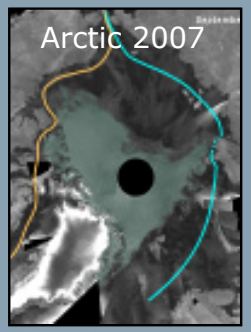
Innovation in Earth Science & EO Applications

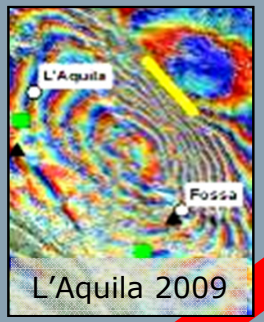


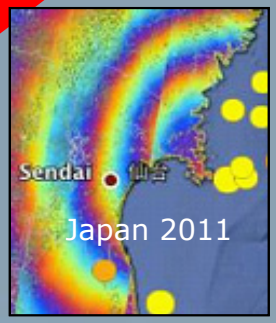


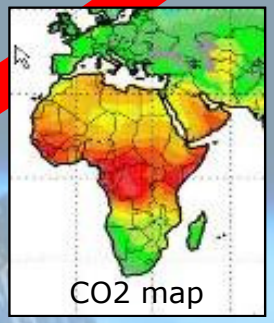


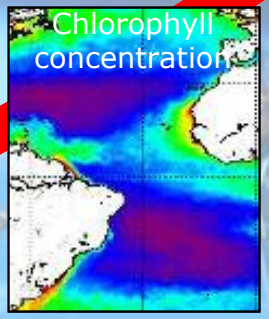


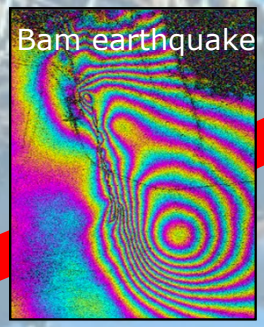












4000+ scientific projects and many operational users

Envisat Symposium Salzburg (A)

Envisat Symposium Montreux (CH)

Living Planet Symposium Bergen (N)

Mar 02 | **Sep 04** | **Apr 07** | **Jun 10** | **July 12**

and many workshops dedicated to specific Envisat user communities

Earth Explorer Missions

- Preparing the Future

esa

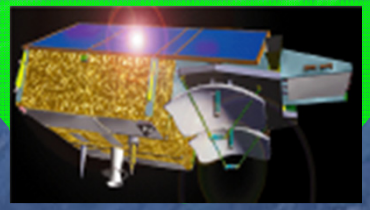
GOCE
17 March 2009

SMOS
2 Nov. 2009

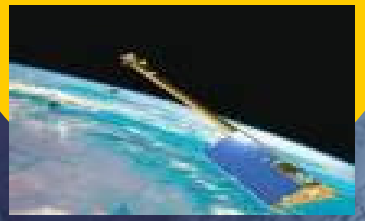
7th EE

8th EE

Cryosat
8 April 2010

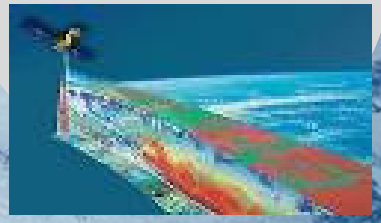


SWARM
November 2012



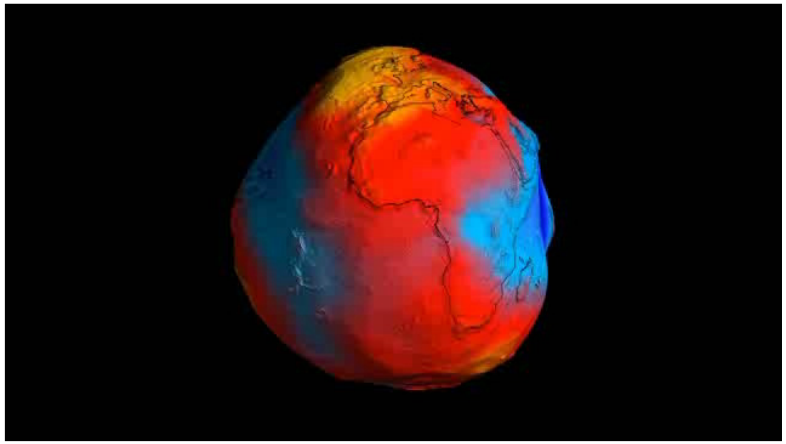
ADM
AEOLUS

EARTH
CARE



Maximising Scientific return of Research Missions => e.g. GOCE

- All GOCE **mission requirements met** in full by end 2012
  - *Gravity anomalies < 1 mGal*
  - *Geoid accuracy: ~2-3 cm @100 km res*



- GOCE could map gravity signals **significantly beyond original goal** of spherical harmonic degree 200 (100km)

- From late 2012 until depletion of Xenon gas **GOCE will fly 20km lower (235km) to increase spatial resolution of gravity model to 80km**

Source: ESA

Developing and validating the Applications with users

Working with Institutional Users
=> Data User Element

User Groups: National & sub-national public authorities,
European institutions, International organizations, NGOs

User requirements consolidation

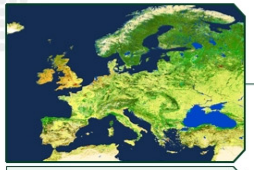
Ground truthing
In-situ data access

Products validation

Service assestment

EO data

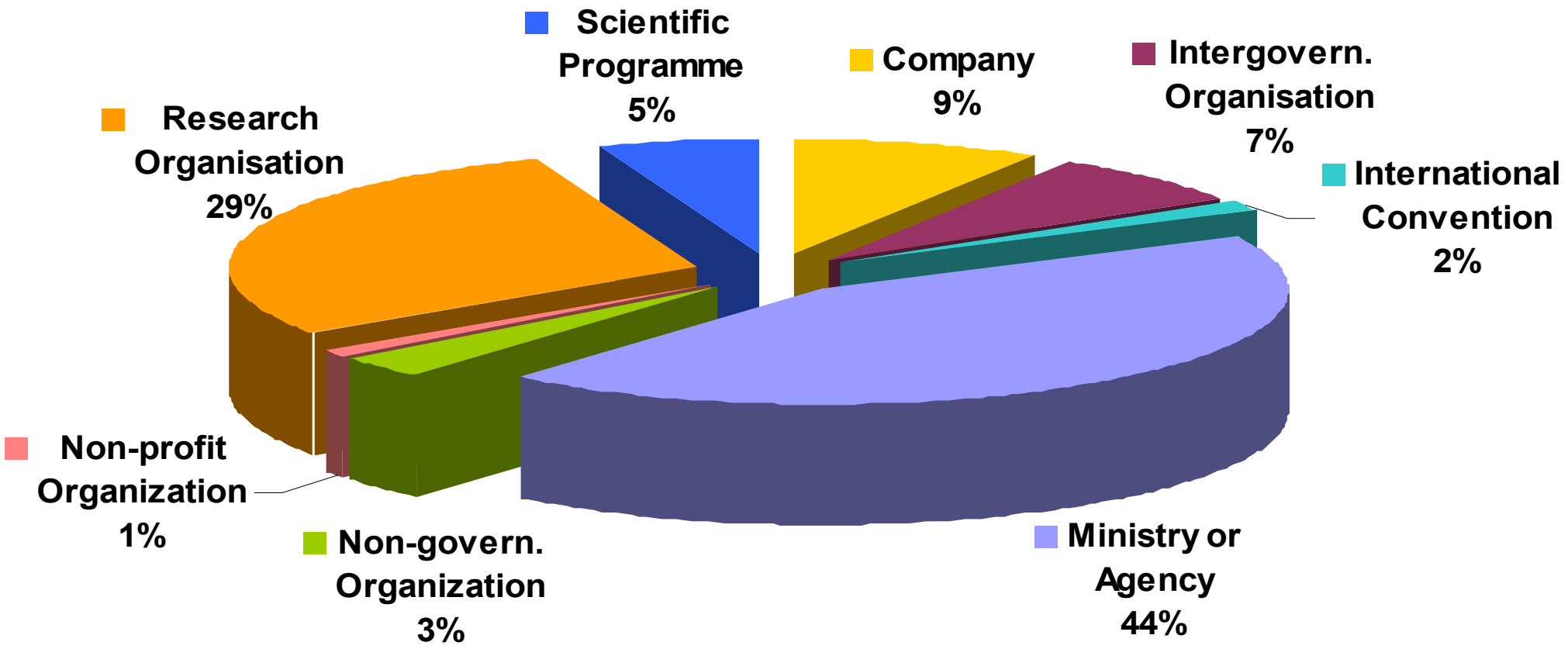
Service Development



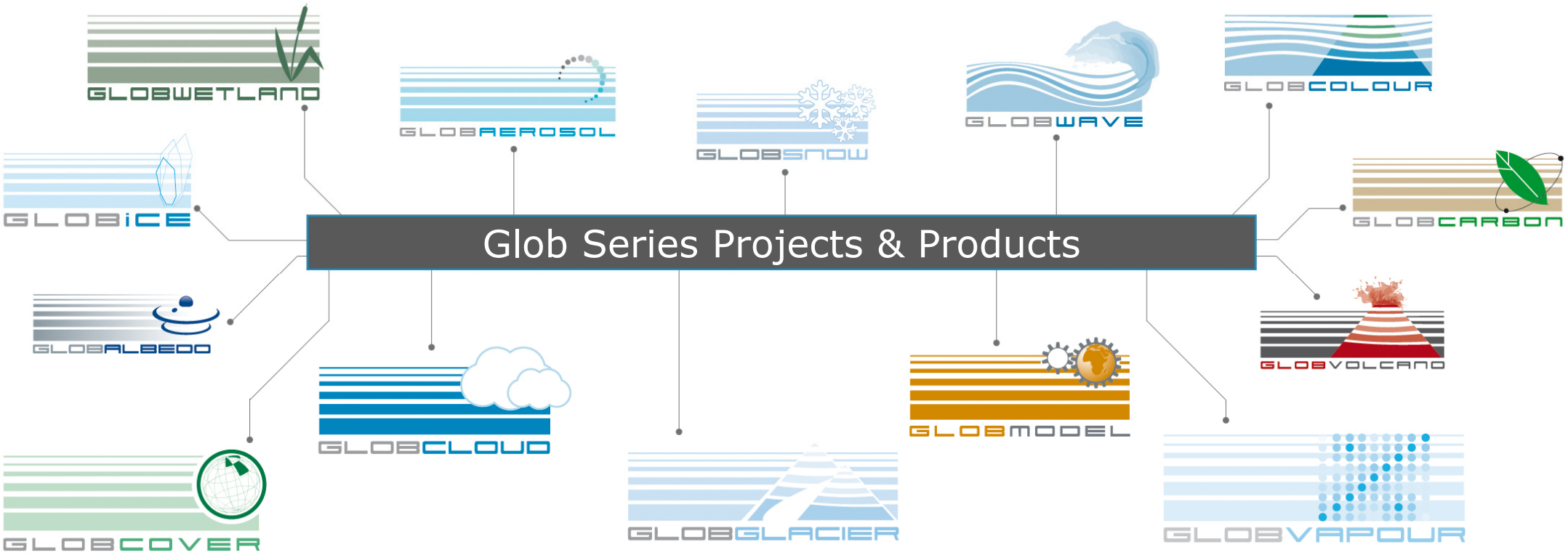
Products

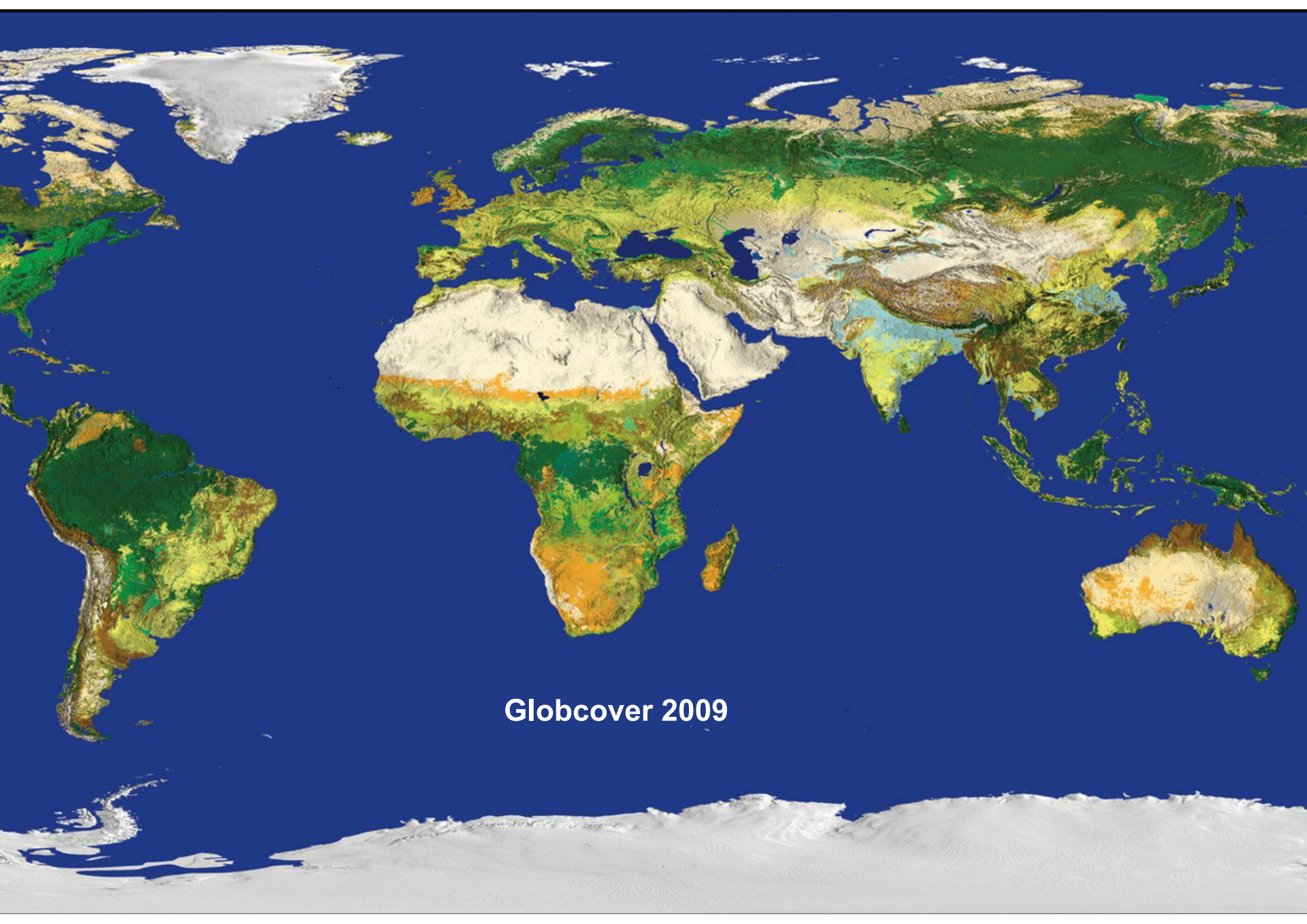
Service Demonstration

Engaging institutional end-users
=> 400+ Institutions

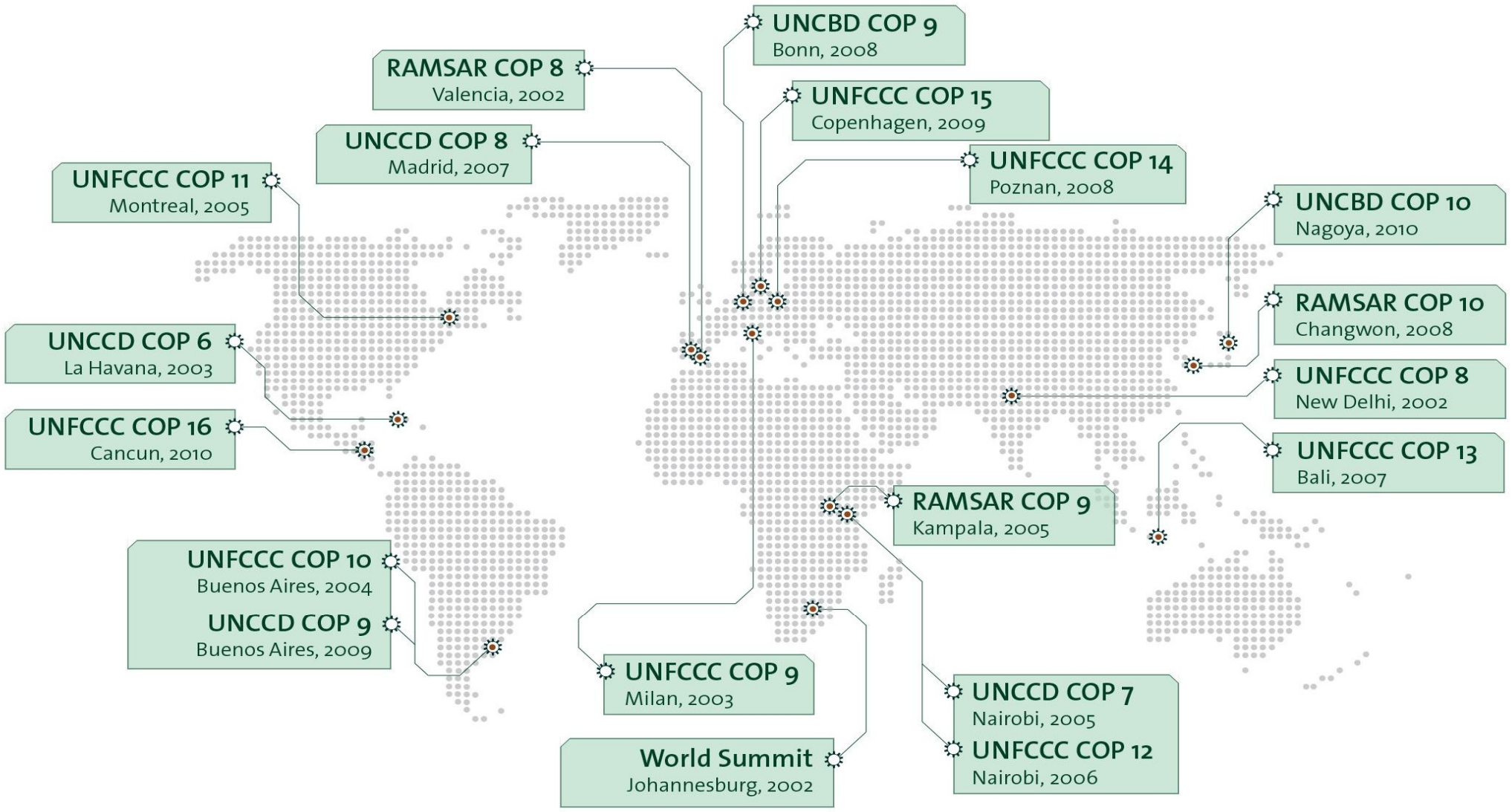


Serving the Global Change Community




Globcover 2009

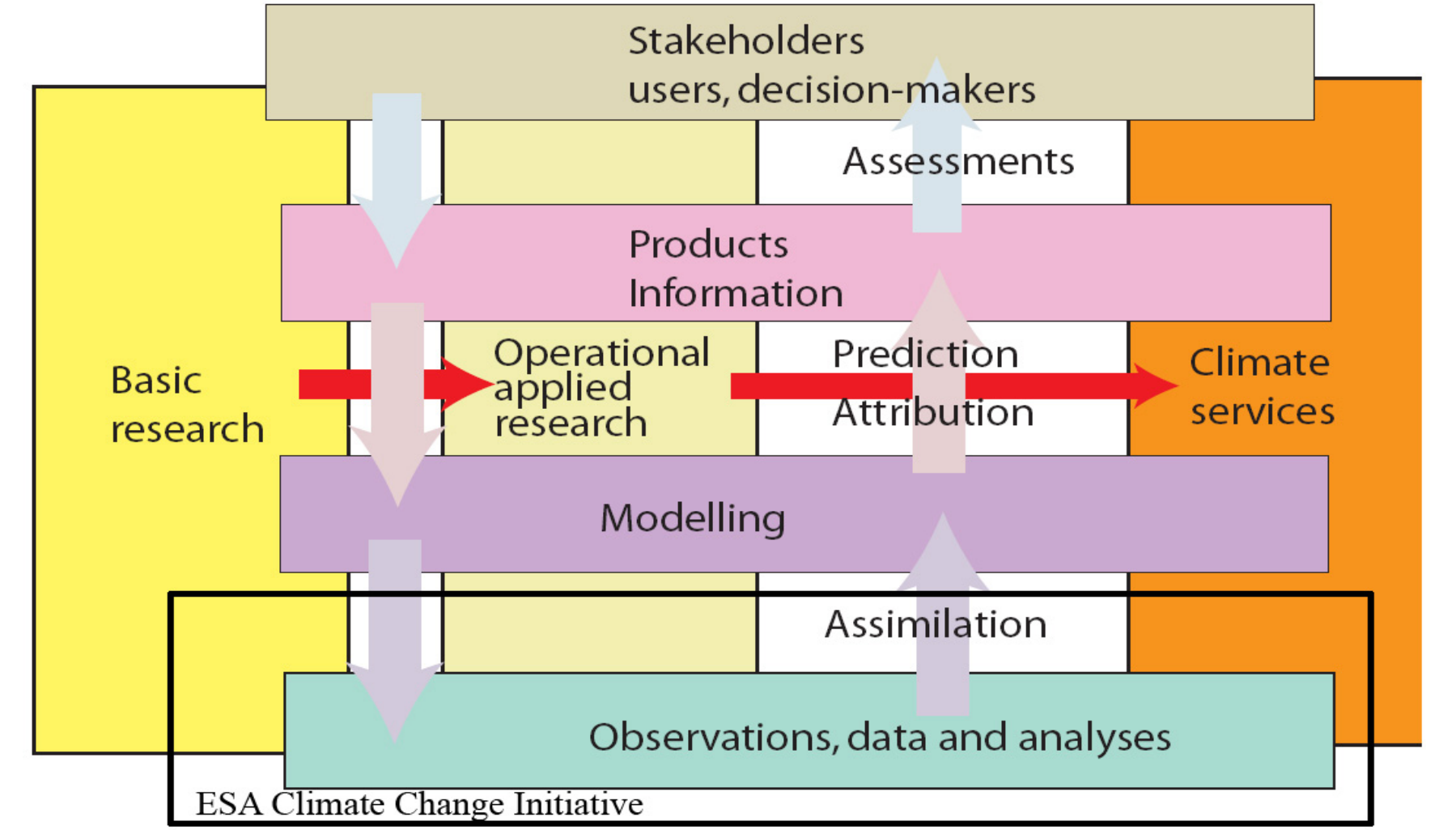
supporting multi-lateral environmental agreements



Contributing to GCOS
=> ESA Climate Change Initiative (CCI)

- Cloud Properties
- GHGs
- Ozone
- Aerosol properties
- Sea Surface Temperature
- Sea Level
- Sea Ice
- Ocean Colour
- Glaciers and ice caps
- Ice Sheets
- Land cover
- Fire disturbance
- Soil moisture

Enabling Climate Services



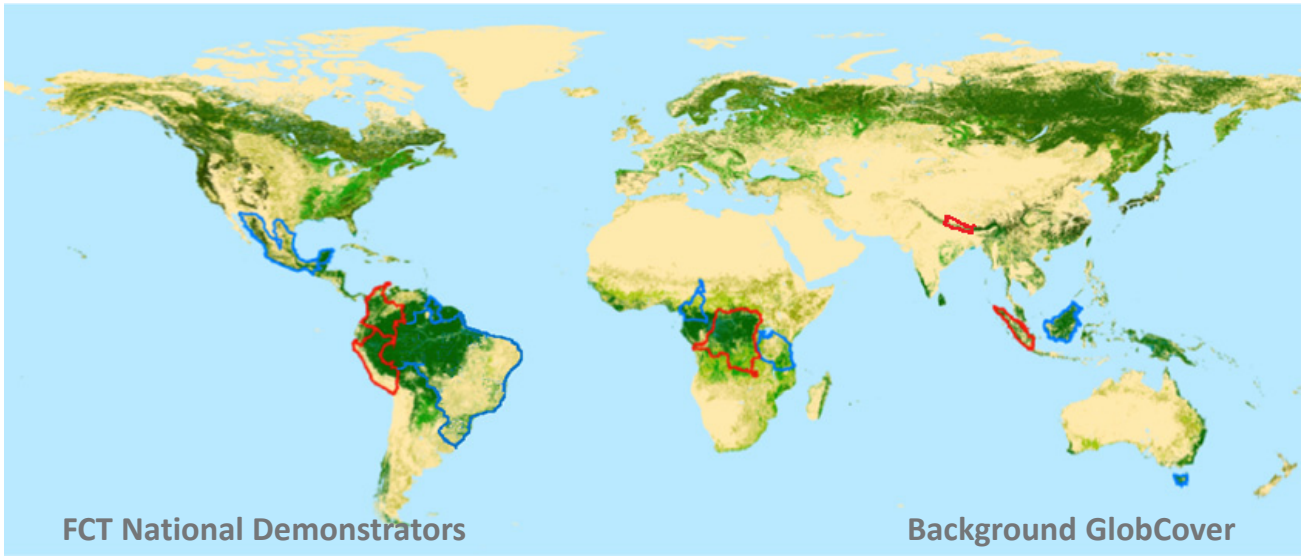
Data Access

Earth Explorers	ENVISAT/ERS	National Missions	GMES Sentinels	Meteo Missions (EUMETSAT)

Cooperating with GEO Stakeholders - Global Forest Observation Initiative

GFOI Objectives:

- to foster sustained availability of satellite and ground observation in support of national forest information systems
- to support countries in the use of observations for their national forest information systems



Co-leads:

- Australia (CSIRO, DCCEE)
- Norway (NSC)
- USA (USGS)
- FAO
- CEOS (ESA, NSC, USGS)

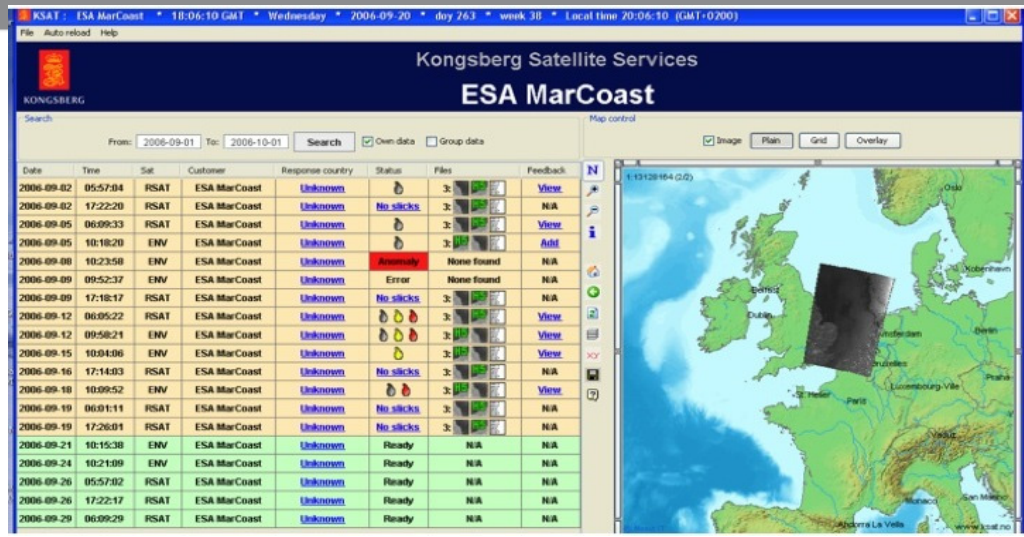
2008	Establishment of GEO FCT task
2009+	FCT demonstration based on NDs
2010	GFOI Concept plan
2011	GFOI Implementation plan
2012	GFOI Start-Up Phase
2013	Commencement of operations phase
2014+	Operations Phase

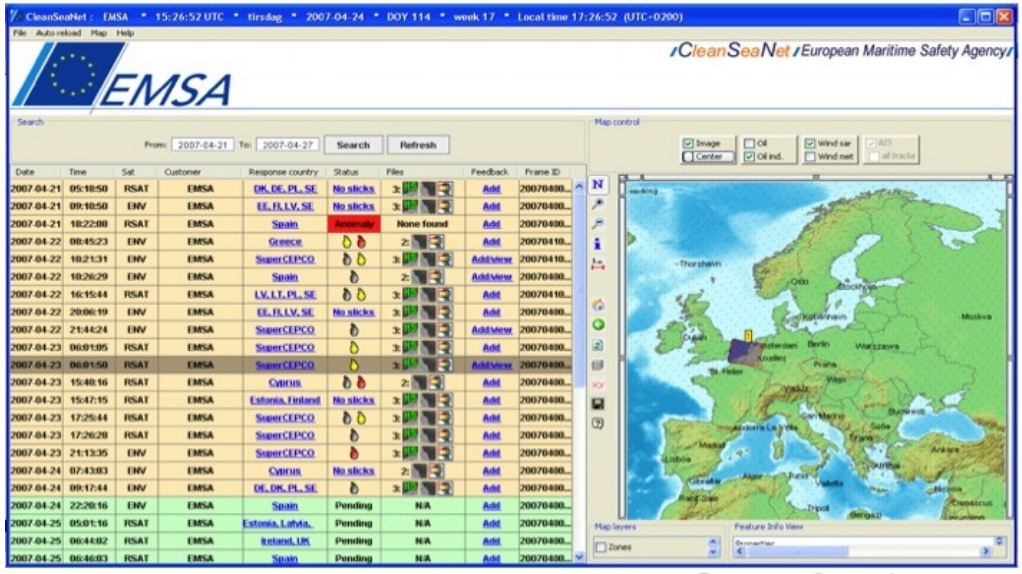
European Space Agency

www.geo-fct.org

Working with European Operational Authorities => European Maritime Safety Agency

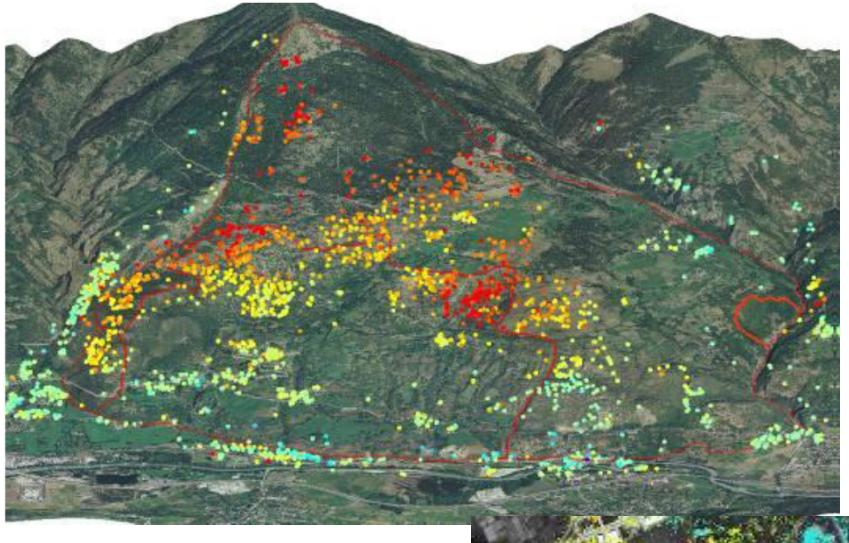
- Large number of national and EU funded R&D projects 1995 – 2002 demonstrated satellite capability to detect oil slicks
- Two key roles for ESA (2002–2010)
  - Aggregate critical mass of industrial service providers to ensure operational oil-spill detection capability for EU waters
  - Cooperate with national and European organizations to develop operational service framework:
    - Qualify service specifications and delivery capabilities
    - Support transfer to user Legal and financial framework
- Transfer to operational EMSA CleanSeaNet achieved in 2007

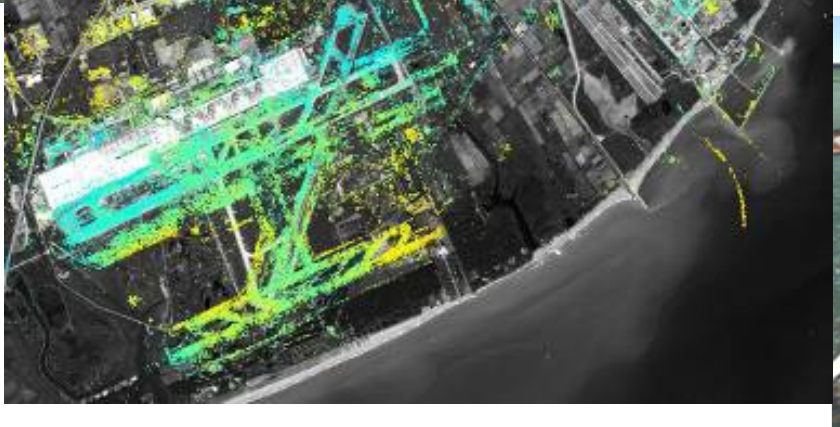




Working with Industry…

Fostering innovative industrial services:
=> Precision Land Motion Services





Industrial Sectors

Mining

Oil & Gas

Civil Engineering

Utility operators

Transport

Insurance

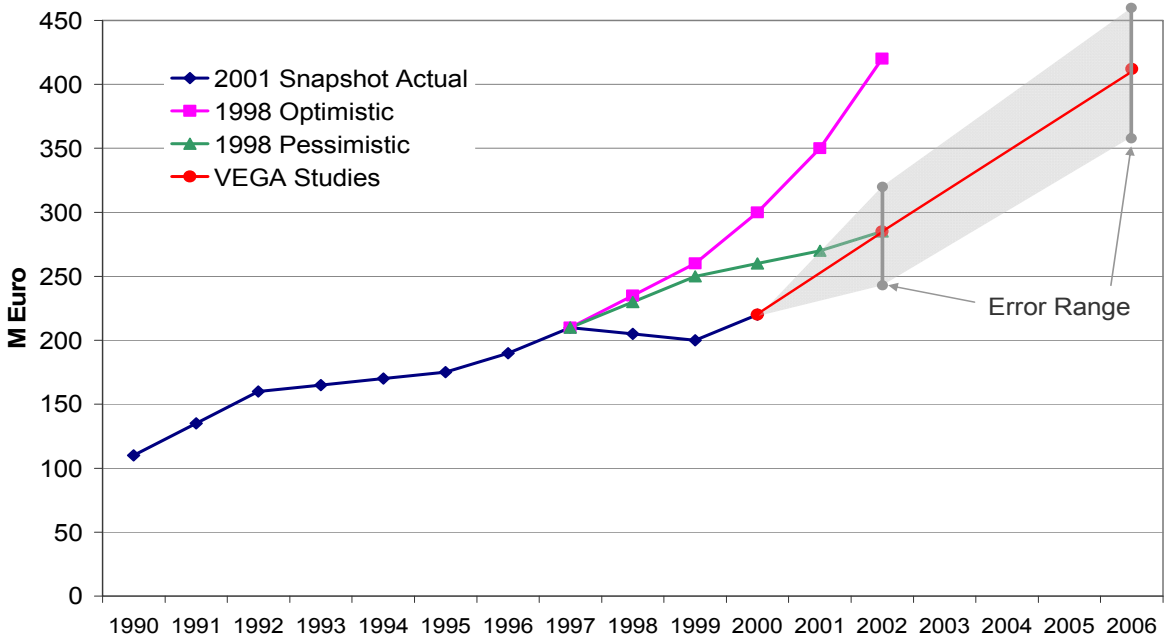
CO_2 Capture & Storage (emerging)

Long-Term ESA support (15+ years) from R&D to commercial exploitation!

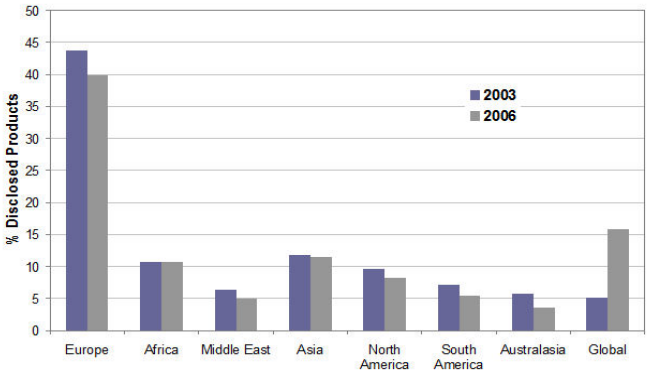
Working with European Value-Adding Industry

European EO Service industry:

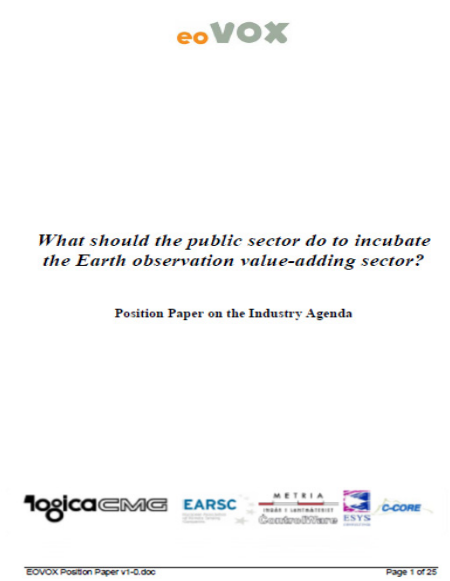
- Approx 3000 persons employed
- Assessed revenues 2006:
  - Services 306M€
  - Data 106M€
- Average growth approx 8% per annum
- Estimated revenues 2011: (total): 700M€

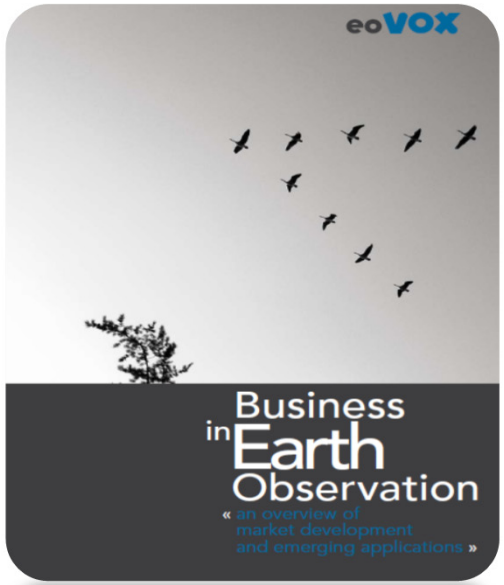


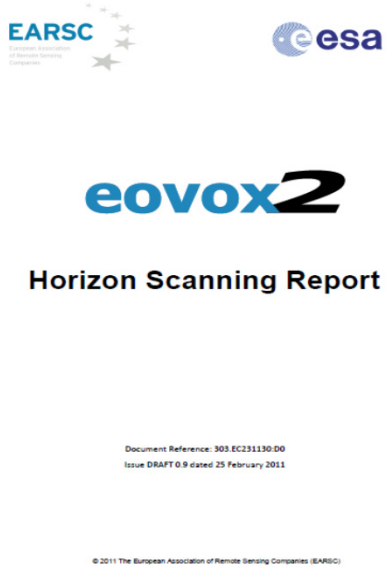
Sales breakdown (by geography)



Working with European Value Adding Industry







- Increased cooperation with European Industry Trade Association
- Horizon Scanning : Big Issues

  Climate Change, Sustainable development, Mobile technology, Standards, GMES IO framework, …
- Industry Position Papers

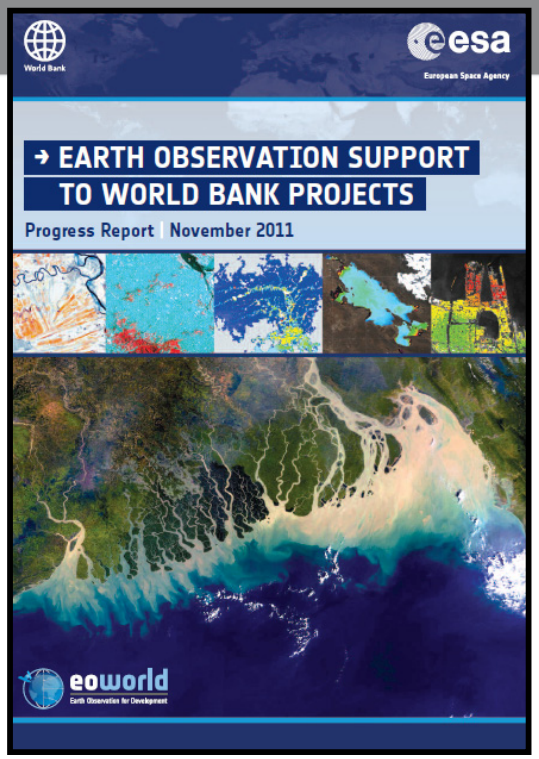
  (GMES operations, International Development, …..)

EARSC
European Association of Remote Sensing Companies

Working with the Private Sector: => Oil and Gas

- OGEO was initiated by ESA in 2010 in cooperation with the Oil and Gas sector
- OGEO has become the Earth Observation sub-committee of the International Association of Oil and Gas Producers (OGP)
- OGEO promotes the introduction of industrial guidelines for the use of EO data within the Oil and Gas industry

Working with Multi-lateral Funding Bodies
=> World Bank
=> opportunities for industry

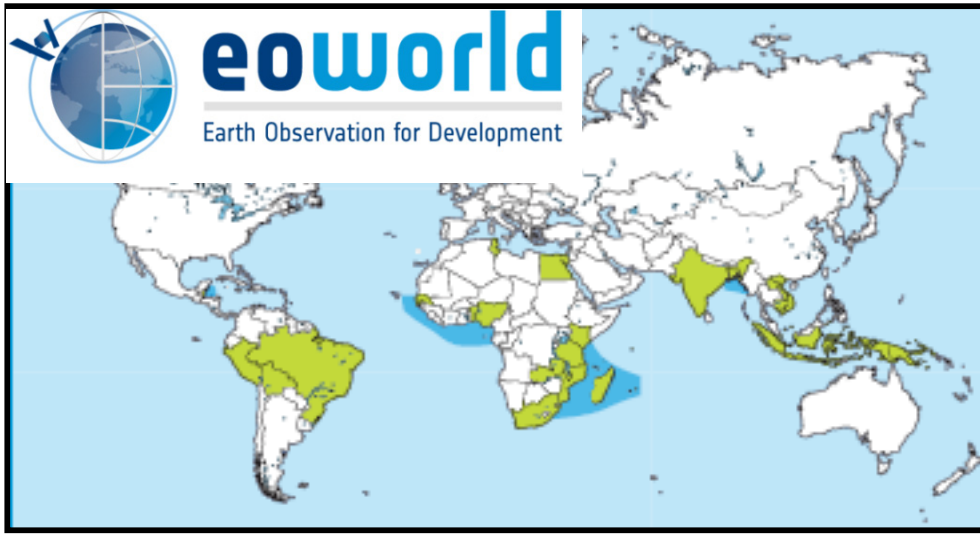


Background:

- World Bank Projects represent significant potential market for EO based information services
- Difficult for EO service industry to get directly involved with such organizations

Scope of ESA activity:

- Build links with teams within World Bank
- Set up well-defined demonstration activities linked to World Bank projects in cooperation with WB staff and in country partners
- *Services provided by Industry*
- Expand cooperation to additional priority activities identified in cooperation with WB
- Transfer services to WB funding



Current status

- 15 demonstration projects initiated so far
- Many already transferred to WB funding

Achieving Sustainability…

Building an Operational Observing Infrastructure => GMES

Sentinel 1 – SAR imaging
All weather, day/night applications, interferometry

2013 / 2015

Sentinel 2 – Multi-spectral imaging
Land applications: urban, forest, agriculture,..
Continuity of Landsat, SPOT

2014 / 2016

Sentinel 3 – Ocean and global land monitoring
Wide-swath ocean color, vegetation, sea/land surface temperature, altimetry

2014 / 2017

Sentinel 4 – Geostationary atmospheric
Atmospheric composition monitoring, trans-boundary pollution

2019

Sentinel 5 / 5P – Low-orbit atmospheric
Atmospheric composition monitoring
(S5 Precursor launch in 2015)

2015, 2020

Achieving Sustainabilty
=> Socio-Economic Benefits

"Over the 2006-2030 period… the benefits from all the GMES services in full use would equal 130 bn€ (2005 e.c.) or around 6.9 bn€ per year"

For 1 € spent by the European tax payer on GMES, a public return of 10 € can be expected

"Money where it matters – how the EU budget delivers value to you"

EC, MEMO/11/469, Brussels, 29 June 2011

"The Socio-Economic Benefits of GMES"

ESPI report 39, November 2011

Benefits are realized when data is used
=> Sentinel Data Policy Principles

- Sentinel data will be made available via a 'generic' online access mode → free of charge

- Anybody can access data; no difference is made between public, commercial and scientific use → open access

- *Progress on Sentinel data policy:*
- *The principles of full and open access with free of charge licenses is reflected in the draft EC regulation for a GMES data and information policy*
- *EC delegated act is expected to be finalised in the coming months*

Securing a sustainable future for European EO: the **GMES** programme

- Sustainability of the operational system is the single biggest challenge, for GMES and for EO in general

Space 2030

TACKLING SOCIETY'S CHALLENGES

- Build a sustainable space infrastructure
- Encourage public use
- Encourage industry initiatives

OECD

thank you