Contribution of GMES for Monitoring Land Cover and Atmosphere
to support the implementation of the World submit on sustainable development

Authors: Josiane Masson, European Commission, DG ENTR, GMES Bureau, Chris Steenmans, European Environmental Agency
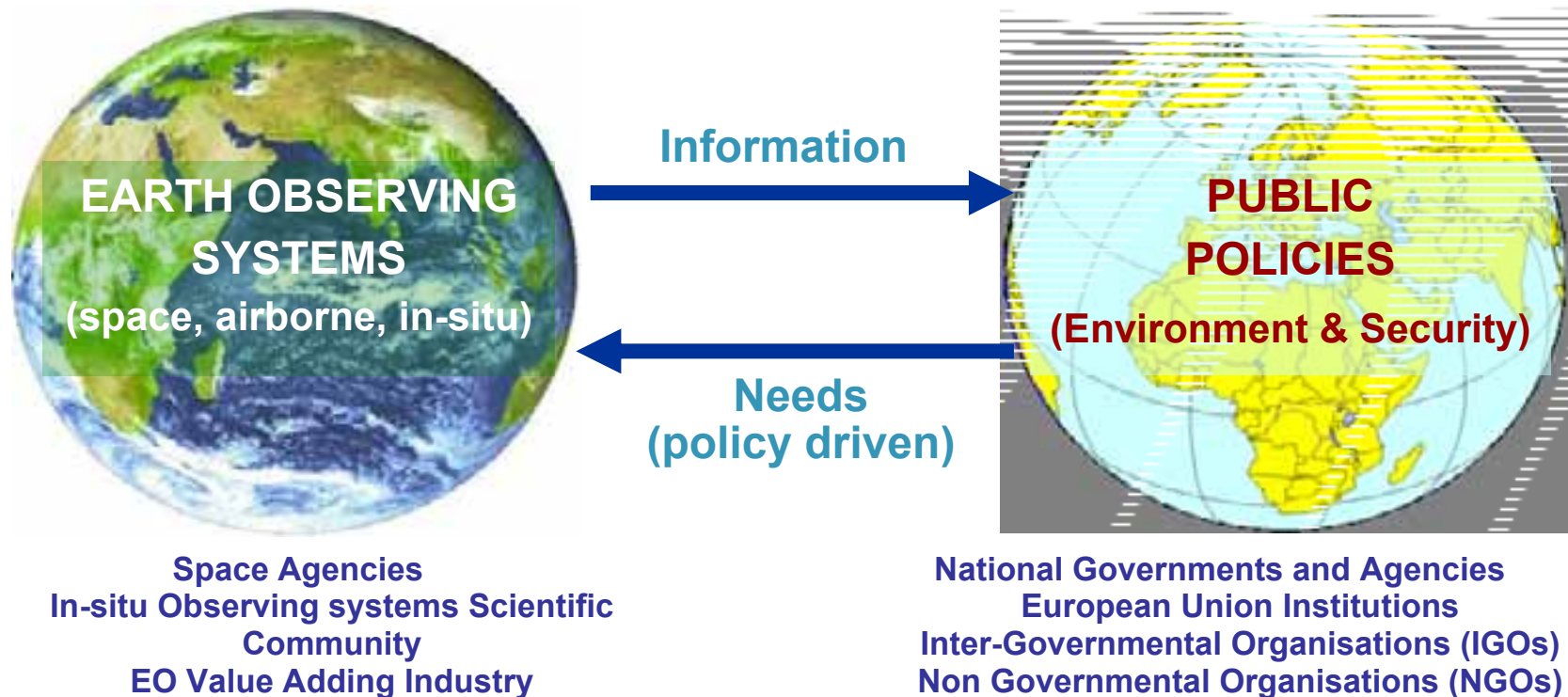
GMES: Autonomous capacity to generate & deliver Earth observation-derived information on environment & security: strategic for EU

- **Need for information in support of:**
  - European policies: environment & climate change, CAP, Maritime Policy, CFSP/ESDP...
  - EU international commitments: protocols and conventions (eg Kyoto, Montreal, CLRTAP..)
  - National or regional «adaptations» of these policies or commitments

GMES is a joint initiative of the European Commission and ESA. Its objective is to provide relevant information to policy-makers and other users, particularly in relation to environment and security

Information →

EARTH OBSERVING SYSTEMS

(space, airborne, in-situ)

PUBLIC POLICIES

(Environment & Security)

← **Needs (policy driven)**

**Space Agencies
In-situ Observing systems Scientific Community
EO Value Adding Industry**

**National Governments and Agencies
European Union Institutions
Inter-Governmental Organisations (IGOs)
Non Governmental Organisations (NGOs)**

- Global Environmental Change reinforces this need for Information
- Technological Progress is an asset to respond to the need
- Availability of relevant data
  - Lack of access
  - Lack of funding for technical infrastructure, lack of continuity
  - Spatial and temporal data gaps
  - Lack of data interoperability
  - Inadequate user involvement
  - …

GMES is a user driven initiative

Various categories of users

- European institutions and agencies
- National and regional authorities
- Policy makers and support organisations
- International bodies in support of conventions
- European citizens and NGOs
- Downstream industry, especially SMEs

Integrated system approach

- Relevance of EU level taking into account subsidiarities
- Overall "information chain": from observation to information required by the users
- "System of systems": mutualisation & long term sustainability of capacities & resources
- Build on existing capacities in Member States
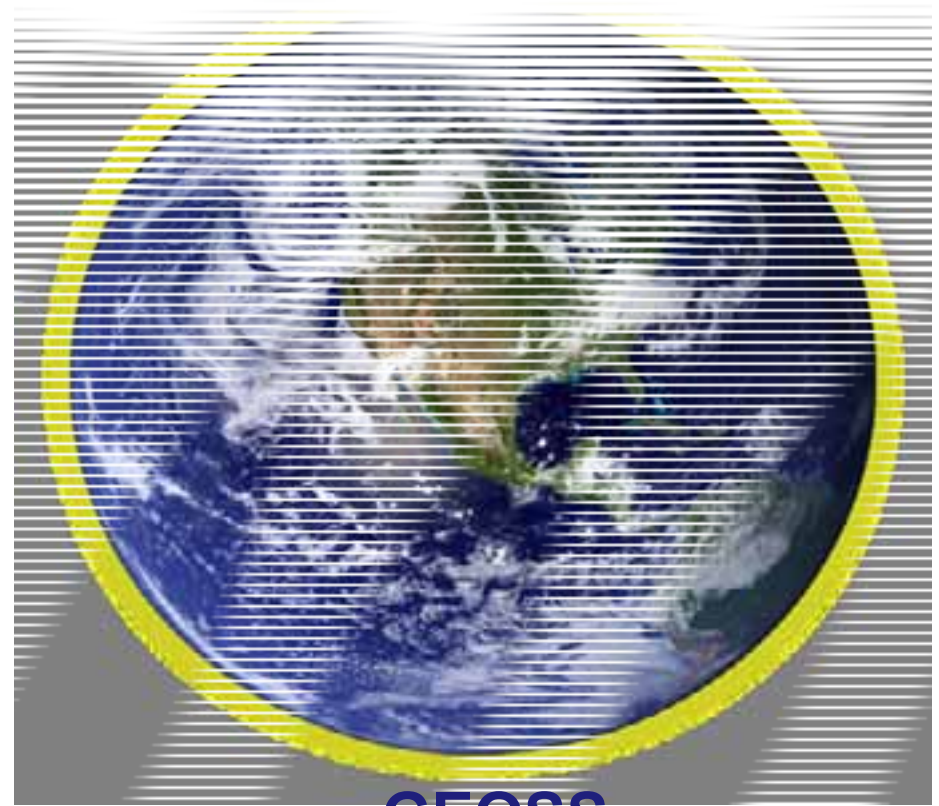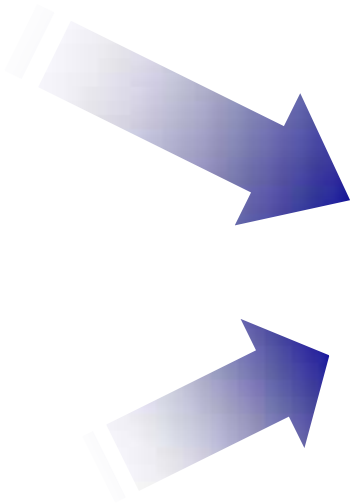- International cooperation through other initiatives (GEO/GEOSS, GCOS, UN conventions etc.)

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GMES

U.S. IEOS

**GEOSS**
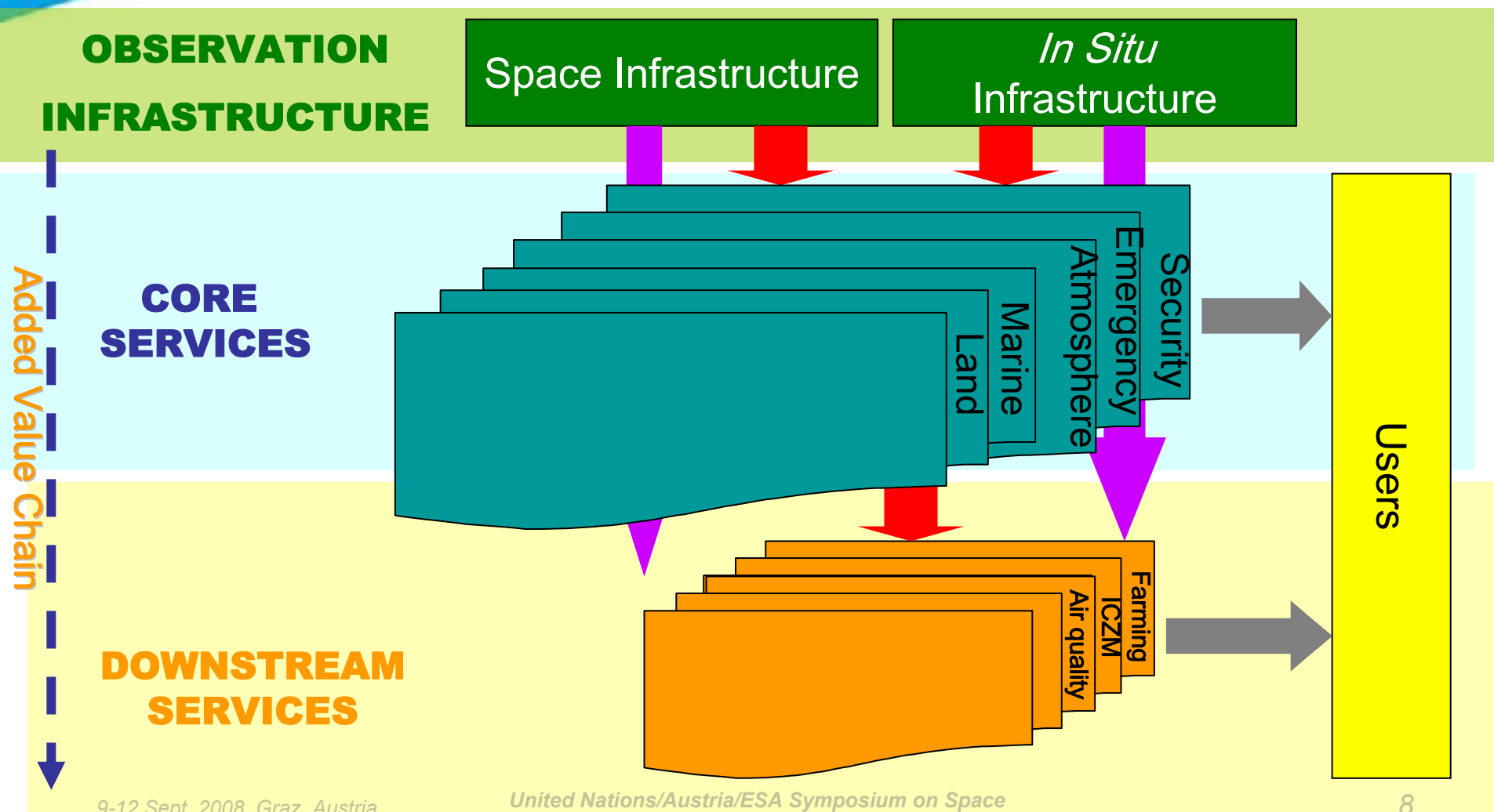
Observation Infrastructure

- **In-situ** observation infrastructure: co-ordinated at National level

  – air-, sea- and ground-based systems and instruments (e.g. airborne, balloons, floats, ship-borne, measuring stations, seismographs, etc)

- **Space** infrastructure component for GMES: different missions co-ordinated at European level

  – Dedicated GMES missions: the ESA Sentinels

 – Contributing missions: EU National, EUMETSAT and third parties

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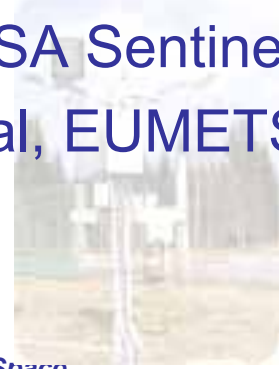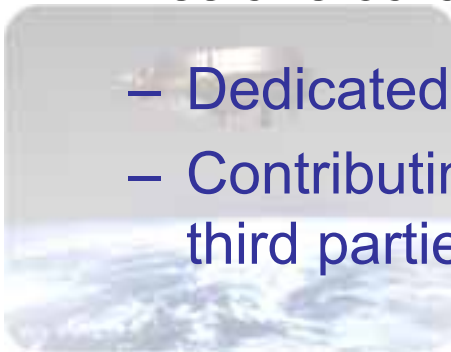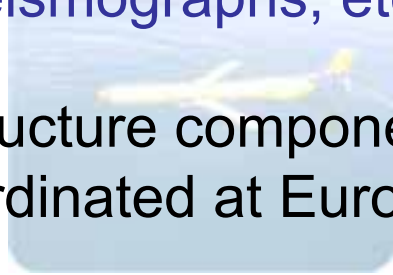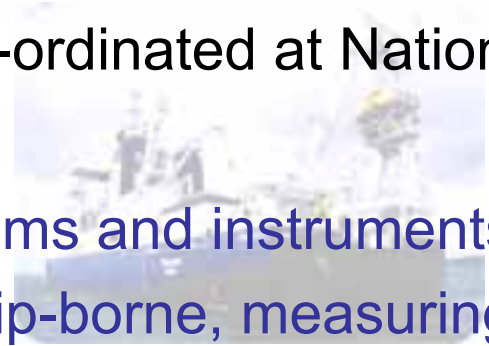
GMES Services

Three Service areas based on **Earth systems**:

- Land Monitoring: initially European land cover & urban spots, extension to Global Land and thematic services
- Marine Monitoring: sea state & ecosystem characteristics over global ocean & European regional seas
- Atmospheric Monitoring: atmospheric composition for air quality (European) and climate forcing (global), ozone monitoring (global) and solar energies

Further, **horizontal components**:

- Emergency Response: initially rapid mapping (reference maps within 6 hours over crisis area, damage assessment maps available within 24 hours & daily updated, further evolution to other components of the Emergency cycle
- Security: "Interior" security, Land border security, maritime surveillance, external security (expected)
- Climate Change
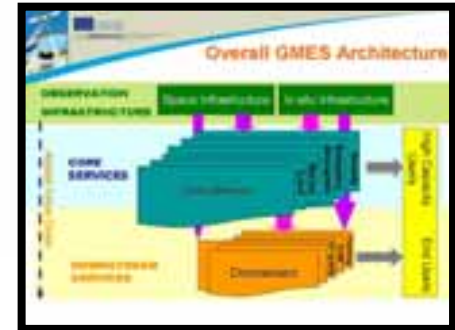
- **Core services**
  - Pan-European, multi-purpose information service capacity
  - Linked to EU information needs (EU policies and international commitments) or to decisions to share capacities at EU level
  - Sustained public funding (EU & Member States)

- **Downstream services**
  - Tailored for specific applications at local, regional, national, European levels (public good or private use)
  - Use core services as one of the inputs
  - EU not directly driving the service and not responsible for service requirements
  - EU should encourage / support the implementation of this service layer, e.g. through R&D funding
  - EU not involved in Downstream Service governance & operational funding

Land Monitoring Core Service

Land Monitoring Service

- **LMCS addresses a wide range of resources and policies at EU and international level (e.g. soils, water, agriculture, forestry, biodiversity, transport etc.)**

- **Very diverse user communities with various requirements**

- **Common key requirements: improve data access and reference data**

- **Will offer a portfolio of data and products with different levels of elaboration (from pre-processed images to elaborated information)**

- **Multipurpose products**
  - pre-processed space data (eg orthorectified images, image mosaic, cloud mask, daily/weekly image composites…)
  - basic reference data access improvement and European products
  - Bio-geophysical parameters to support GCOS-GTOS/ECVs
  - **A set of Land Use/Land Cover and Land Cover Change products**
    - at various scales (Global land cover, EU continental land cover, national or covering areas of interest)
    - and various time resolution: dynamic products (daily, weekly, monthly, or seasonally), periodic products (every 1-5 years)
    - various layers: generic land cover or thematic LU/LC&LCC (forest, agriculture…)

- **Thematic products** at European or Global level dedicated to specific usage e.g.: crop forecasts, early warning on food security, water models, environmental indicators, carbon fluxes, soil degradation and desertification models... **Still to be addressed**
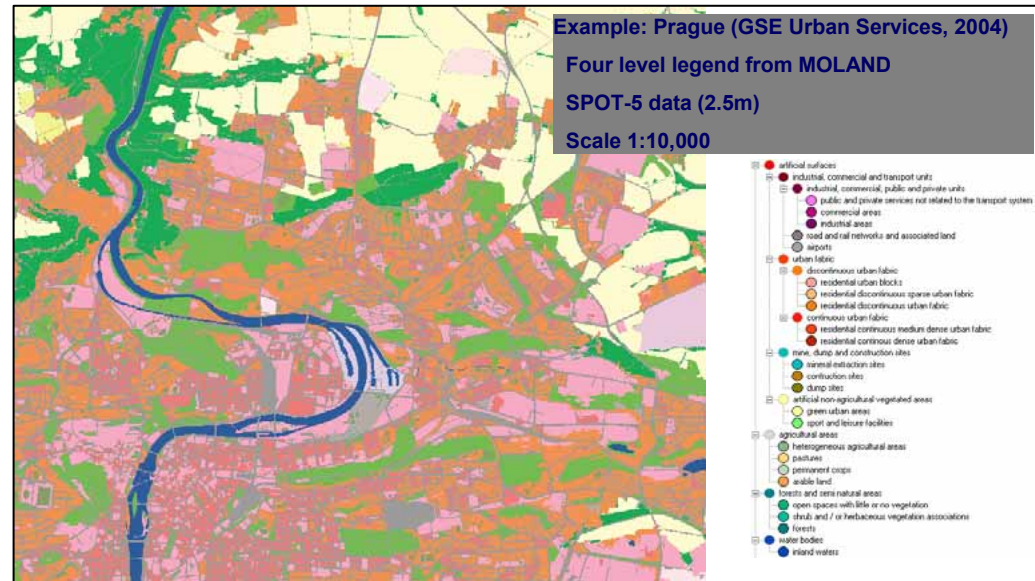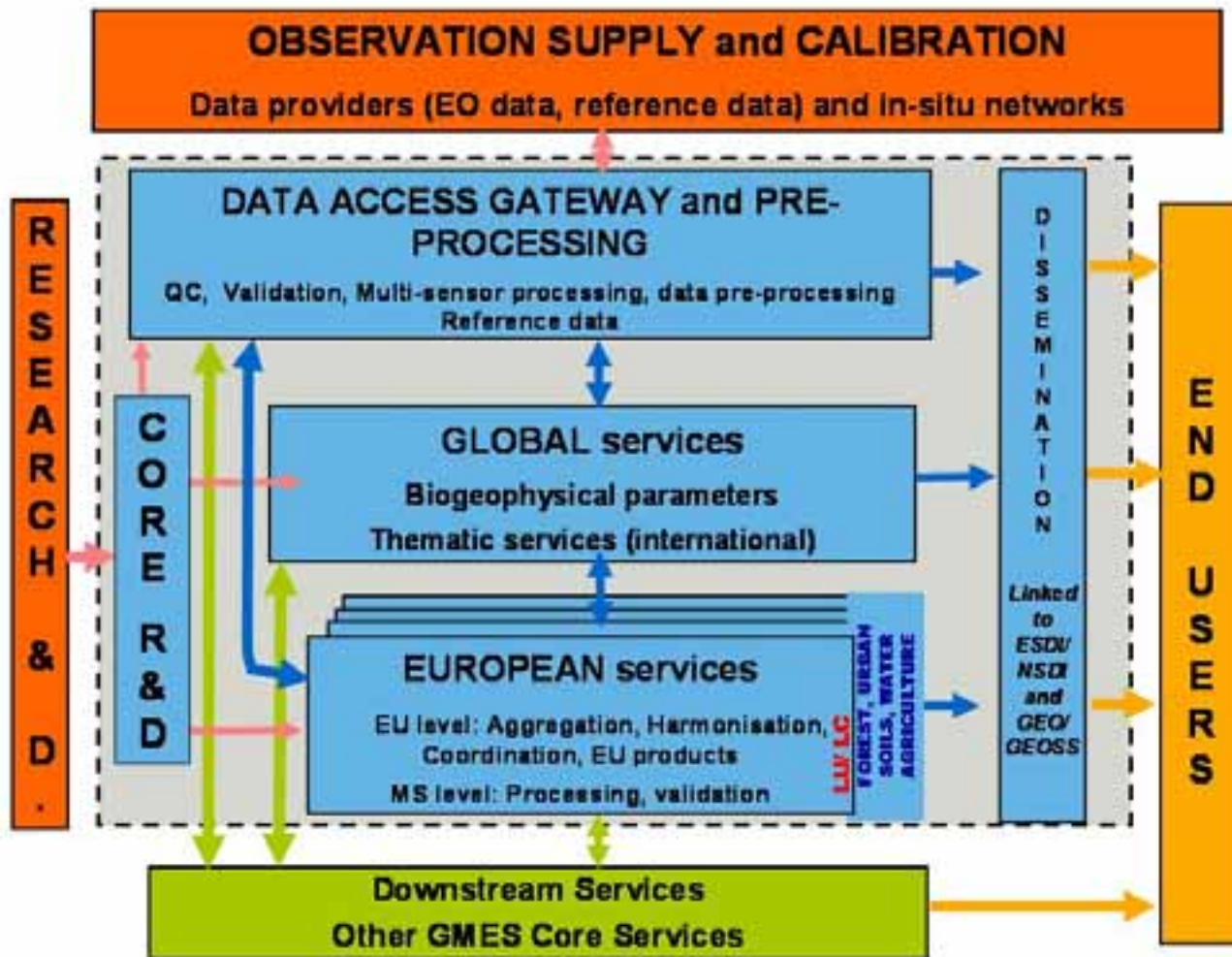
Starting with…

Main information over Europe

- 3-5 yearly updates of core land cover / land use data with minimum mapping units of 1-5 ha, improved on Corine basis

- Land cover / land use data of 500 functional urban areas ($\geq$100,000 inh.), minimum mapping units 0.1 ha

- Annual low resolution updates

Example: Prague (GSE Urban Services, 2004)
Four level legend from MOLAND
SPOT-5 data (2.5m)
Scale 1:10,000

Then extension

- **Addition of a global component**

- **Thematic services: agriculture, forest, soils, water resources**

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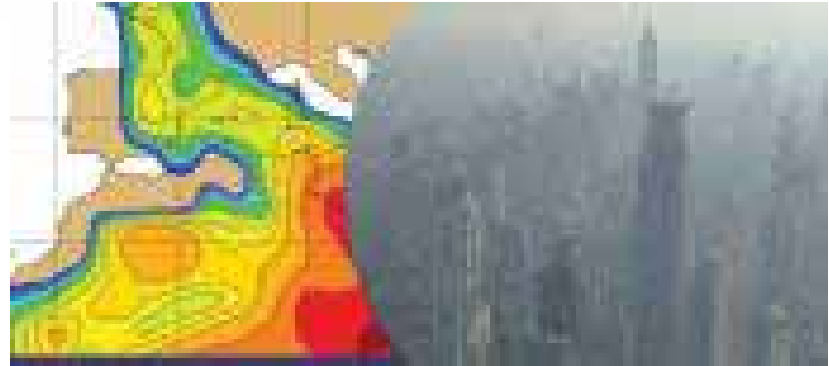Applications for Sustainable Development

Core Atmosphere Service

Atmosphere Service

Main information within & outside Europe

- **Air quality**
- **Climate forcing**
- **Stratospheric Ozone & UV**
- **Renewable energy support**

Pilot service starting later, but maturing quickly

- **User workshop in December 2006**
- **Implementation group set up in June 2007**
- **Strategic Implementation Plan due for mid-2008 (on track)**

- **Service preparation:**
    - **FP6 - GEMS about 10 M€**
    - **ESA GMES Service Element - PROMOTE about 5 M€**
    - **FP7 – MACC about 11 M€**

- **Will produce in real-time, operational, generic, multi-purpose data to monitor the composition of atmosphere at Global and European scale:**
    - provision of GCOS ECVs;
    - gridded information on atmospheric composition;
    - long-term databases in order to clearly establish trends;
    - ensuring effective and easy access to in-situ and satellite data, including in near real time (NRT);
    - forecasting and assessment capabilities for policy development, health and other applications;
    - reanalysis at regular intervals;
    - interface with other GMES CS, in particular for Climate Change

Address http://www.gse-promote.org/

PROMOTE
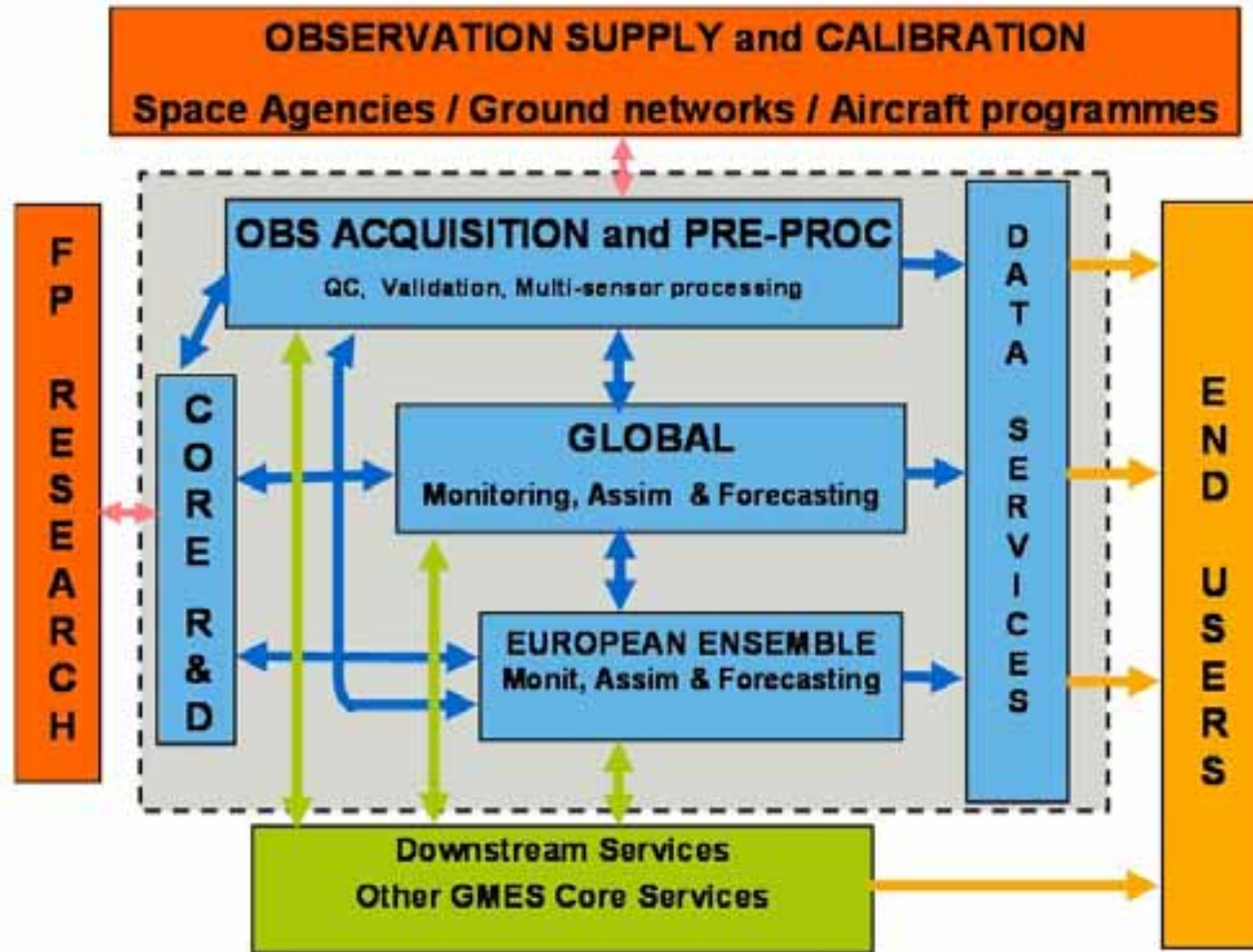
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Air Quality Ensemble
NO$_2$ Forecast, Surface Level

Feb 09, 2008
Daily Maximum
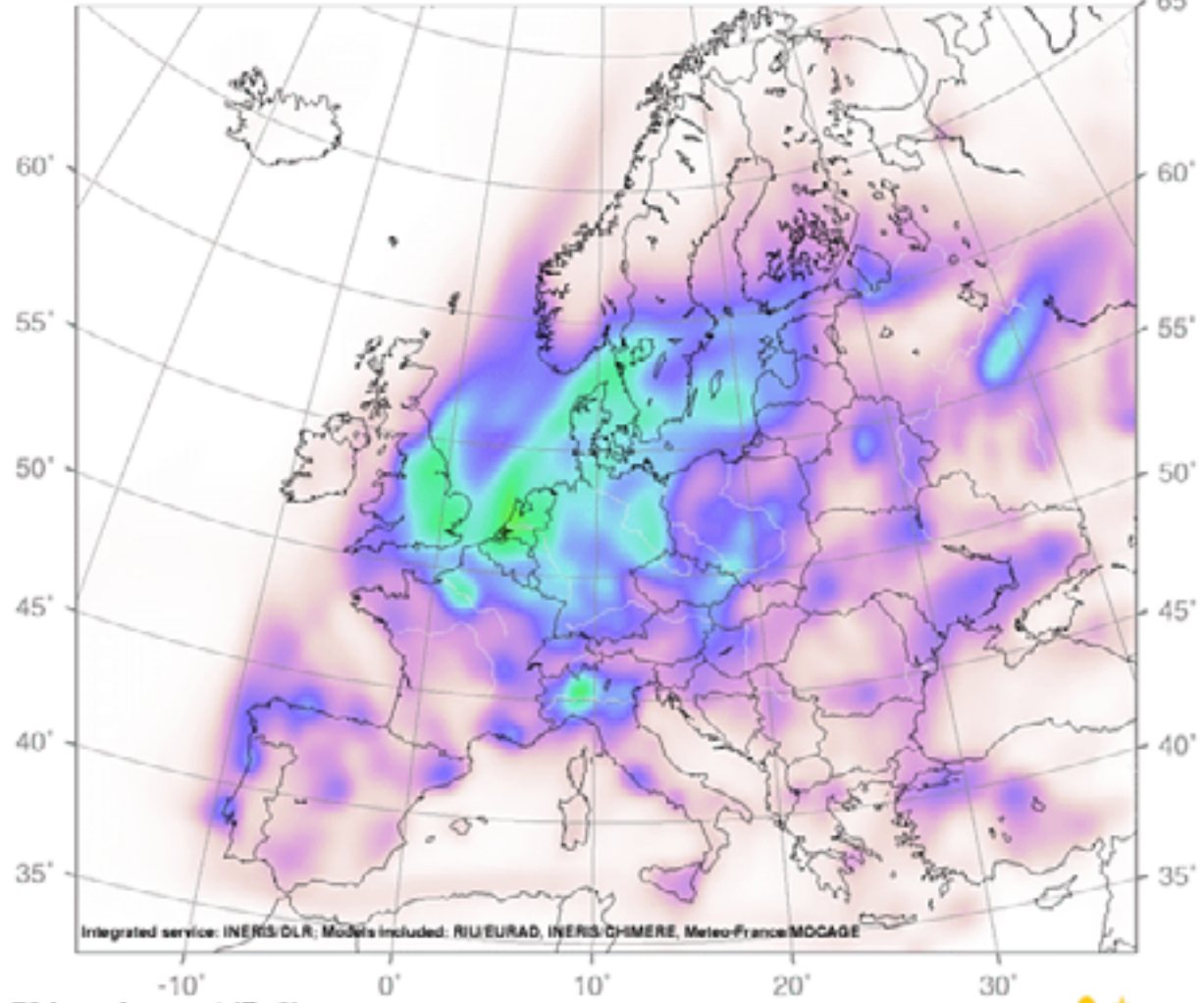
72 hour forecast (D+2)
issued on Feb 07, 2008
www.gse-promote.org

NO$_2$ [µg/m^3]

0 5 10 25 50 75 100 150 200
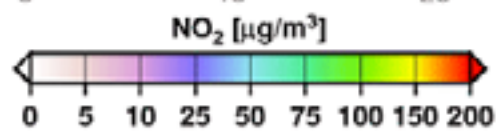
Climate Change and GMES

Address the topic horizontally in the Earth System components of Core Services (Marine, Land, Atmosphere)

- **Scope**
  - Generation of long time series of consistent observation datasets and reanalyses of past observational data → provide added value on essential climate variables identified by GCOS and drive the development of climate change (earth system) modelling to be performed by existing capacities outside of GMES
  - GMES supports interfacing geo-information into socio-economic models

- **FP7 Space call for 2009** includes specific topic on CC: extending Core Services for climate change monitoring

- Further funding in FP7 for CC research

Approach based on identifying user needs, rather than technology push

- User Workshops
- Implementation Groups: analysis of service scope & architecture, analysis of data needs, initial elements of governance
- Pre-operational validation from 2008 through R&D projects (FP7 until 2013)

- **Transition from R&D to operational programme -> Architecture & governance of services to be established**
  - **Governance plans**
    - GMES architecture components: space & *in situ* observation infrastructure, Core Services
    - Overall governance: resourcing and linkages between components
  - **Funding**
    - Consolidation of Member State contribution: *in situ* & space observation infrastructure, core service
    - EC contribution: transition from R&D to operational funding

GMES in FP7 funding
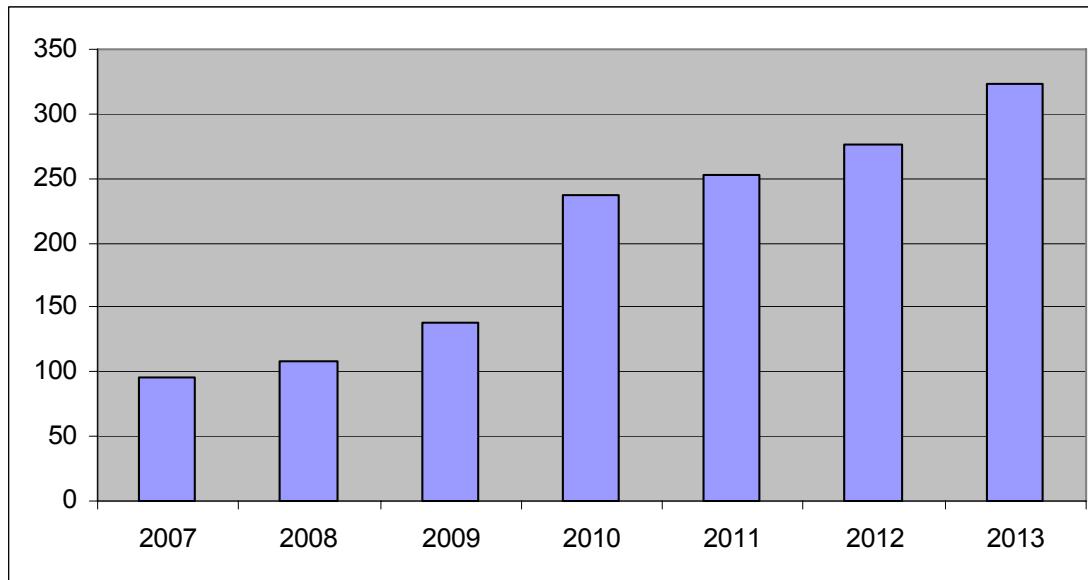
Draft Budget
Annual
Commitment
Profile 2007-2013
(subject to annual
adoption)

- FP7 Space theme is **€1.4 billion** altogether
- 85% for **GMES** ~ €1.2 billion including
    - dedicated space infrastructure ~€650m
    - information services ~€400m
    - data procurement ~€150m

Current EC and ESA projects (FP6 and GSE's) aiming at service delivery (will be over by 2008 or early 2009):

- FP6: Preview, Mersea, Geoland, GEMS, Limes

- GSE: Polarview , MarCoast , Forest Monitoring, Food Security, TerraFirma, Mariss, PROMOTE, Risk-EOS, Land service and Respond

Upcoming projects (*still not officially approved***)**

- FP7: SAFER, My Ocean, Geoland2, MACC, G-Mosaic

- (likely) extended GES's: PolarView, MarCoast, Forest Monitoring, Food Security, TerraFirma and Mariss

  – (activities carried out in Risk-EOS, Respond, Land service and PROMOTE will be integrated into above-mentioned FP7 projects)

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Thanks for attention!