

esa 3rd European Conference on Research Infrastructures
The status of ESA's GMES space component programme

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esa Katrina and Rita 2005
A hurricane's trace on Earth...

esa Rita 2005
... and seen from space

Envisat ASAR WSM
Sea surface swirling patterns

Windspeed derived from
Envisat ASAR

ERS 2 scatterometer
Wind speed & direction

esa **What is GMES ?**

European **independence** in critical data sources for environmental monitoring and security

and

the European **contribution** to the Global Earth Observing System of Systems (GEOS)

esa **GMES – Current status**

2001 EU Gothenburg Summit "by 2008... to develop a European capacity for Global Monitoring of Environment and Security"

- Initially, GMES investments focused on service developments
- 100 Meuro by ESA, 100 Meuro by EC, plus MS projects (funded by CNES, DLR etc.)
- 333 GMES operational user organisations across Europe

First budget for **space segment** by ESA in 2004 (40 M)

- GMES system architecture, Phase A of GMES space missions

EU declared GMES the next **flagship for Europe** in space, after Galileo

esa **GMES is delivering pilot operational services**

Coastal

Real-time Ocean

Ice Monitoring

Northern View

Risk fire & flood

Forest Monitoring

Soil & Water

Land Motion Risks

Urban Services

Humanitarian Aid

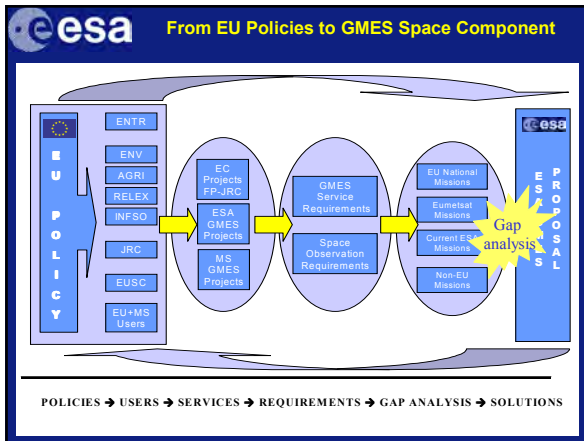
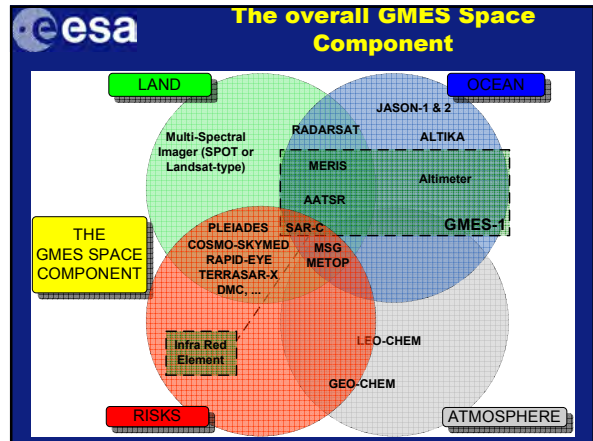
Food Security

Atmosphere

Some services already delivered

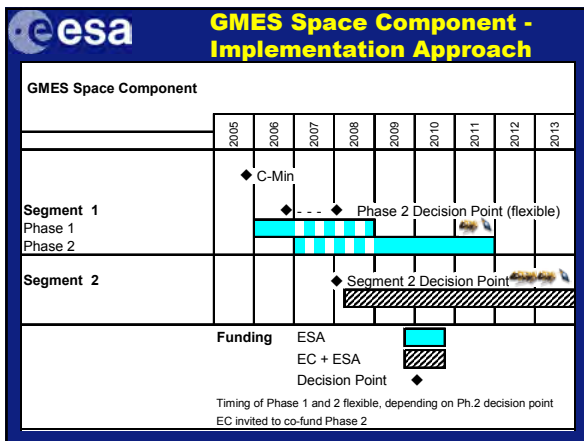
12 services out of 50+

• CoastWatch	Coastal indicator service	12 regional units
• ROSES	Algae bloom monitoring	60 regional basins
• ICEMON	Global ice type and ice drift	200 map-days
• Northern View	Sea ice monitoring	280 regions of interest
• Forest Monitoring	Input for national GHG reporting	3 nat. reports
• SAGE	Water Quality	4 river basins
• Urban Services	Urban land use	24 European cities
• GMFood Security	Large scale crop monitoring	250 districts/com.
• RISK-EOS	Burnt scar monitoring	17 admin. Areas
• TerraFirma	Ground displacement monitoring	16 European cities
• Promote	Urban Air Quality forecasts	2 European cities
• Respond	Crisis Mapping Products	Darfur, Tsunami & others



Gap analysis leads to 7 types of instruments

- Sent-1: 10-30 m SAR for interferometry, ocean, ice, land applications
- Sent-2: 0.5-10 m SAR for detailed land mapping
- Sent-2: 0.5-10 m multispectral instruments for land mapping
- Sent-2: 0.5-10 m optical instrument for detailed land mapping
- Sent-3: 100-1000 m wide-swath thermal infrared instruments for sea surface and land temperature measurements
- Sent-3: 100-1000 m wide-swath multi-spectral instruments for ocean colour and global land monitoring
- Sent-4: radar altimeters for ocean current measurements at high inclination orbit
- Sent-4: radar altimeters for ocean current measurements at low inclination orbit
- Sent-4: radar scatterometers for sea surface wind speed and direction
- Sent-4: atmospheric chemistry instruments for trace gas composition, pollution and climate change monitoring (low and geo orbit)
- Sent-4: 100-500 m infrared instruments for fire monitoring



Implementation Approach (Space Component)

- **2005 ESA C-MIN (Segment 1)**
 - Development of GMES-1 mission (launch 2010/11); predevelopment of instruments; ground segment
 - ESA funded, EC 'invited' to contribute
- **2008 ESA C-MIN (Segment 2)**
 - Development of full GMES space component
 - Co-funded by EC and ESA
- **2010-2015**
 - Deployment of GMES missions; operational ground segment
- **2010+**
 - Long-term maintenance and operation

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But there is more than GMES for EO-based research issues...

- EO archiving issues
- EO provision of consolidated data sets
- EO multi-mission access

esa **EO data volumes are increasing...**

Development of ESA's EO Historical Data Archive between 1986-2004

Total Archive in Terabytes (Tb)

Year

Legend:

- AQUA Modis (April 03-today)
- ENVISAT LR (March 02-today)
- ENVISAT HR (March 02-today)
- TERRA Modis (June 01-today)
- NOAA AVHRR (Jan 81-today)
- NOAA SCATT (01-today) / PROBA (May 02-today)
- LANDSAT 7 ETM (April 99-Dec 03)
- SEASAT SeaWiFS (Apr 98-today)
- ERS-2 ASAR (Nov 95-today)
- ERS-1 ASAR (Nov 95-today)
- Nimbus 7 (Nov 78-May 86), SEASAT (Jun-Oct 78)
- LANDSAT 2-4 MSS (75-Dec 93)

This does not consider multiple copies, and high level products!

At present (2005) the total volume of archived data and products (from ESA acquired EO missions) is >> 500 TB/y

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- **Volume of data** to be archived are exponentially increasing
- At present, ESA **mandate** is to maintain archives for 10 years only after mission end of life
 - For a missions like ERS-1, this period is already over.
- ESA is proposing a coherent technical and managerial **strategy**
 - through Ground-segment coordination body with CNES, ASI, DLR, EUMETSAT...
 - coordination efforts started with some practical results
- The long-term **funding** strategy is to be found
 - Space agencies use the funds from other on-going programme to maintain these historical datasets
 - Such a scheme is no sustainable on the long-term

esa **PROBLEM AREA #2 : CONSOLIDATED DATA SETS**

Provision of reference consolidated data sets...

- Systematic and periodical global dataset generation
- Assimilation / integration processes (fill the gaps)
- Science user support and acceptance
- Technical issues: e.g. standards
- On-demand access to simple and complex products

Data Assimilation Research Centre

esa **Complexity of the Earth Science world**

Coupled and inter-disciplinary processes

Complex web of sensor

Complex data analysis

Optimal Trajectory

Field

time

First guess

Noisy observations

esa **PROBLEM AREA #3 : HARMONIZED MULTI-MISSION ACCESS**

- Wide distributed system environment:
 - multi-satellites
 - multi-facilities

A decentralized ground segment

Users want an easy (one-stop) multi-mission access to EO data!

- Large user community
 - multi-discipline
 - research, institutional, commercial and operational
 - Large international partnership

esa Large n° of facilities involved...

- Historical missions
 - SPOT 1/3
- Active missions
 - ERS-2 (HBR, LBR)
 - ENVISAT (HBR, LBR)
- Future missions
 - GOCE
 - ADM
 - SMOS
 - CRYOSAT
 - Earthcare
 - SWARM
 - ...
 - SENTINELS
 - ...
- Non ESA missions facilities
 - M...
 - Es...
 - I...
 - D...
 - M...
 - N...
 - Es...
 - T...
 - If...
- ESA missions facilities
 - UK-PAC
 - UK-PAF
 - I-PAC
 - I-PAF
 - D-PAC
 - D-PAF
 - E-PAC
 - CNES
 - IFREMER
 - LRAC
 - Esrin

• Archive facility coordination issues:
 –Data format, media, archive systems, migration plans ...

esa European coordinated approach

- The ESA strategy is based on principles defined in its 'Oxygen' strategy (**open and operational multi-mission access**)
- The coordination with EUMETSAT and National facilities started via the G/S Coordination Group
 - Common archive standards (SAFE)
 - Define common data model (OAIS) and operational procedures
 - Standardization of interfaces
- Some multi-mission tools like the EOPORTAL do already exist.
 - Operated by ESA since 2001, based on developments by JRC
 - Access to information, catalogue, ordering tools of more than 71 data providers + data processing centers, software providers, value added companies
- A strategy for the **long-term funding** remain however to be found.