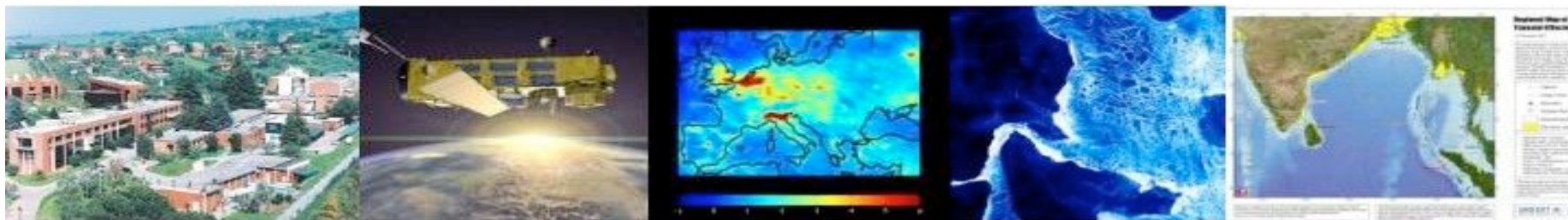


The Earth Observation Programme of the European Space Agency



Susanne Mecklenburg

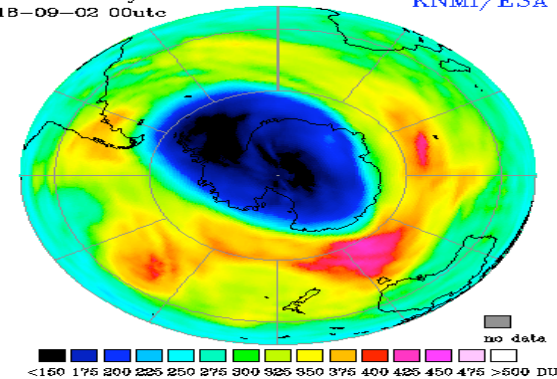
**SMOS Mission Manager
29 October 2007, ESRIN**

Major scientific results

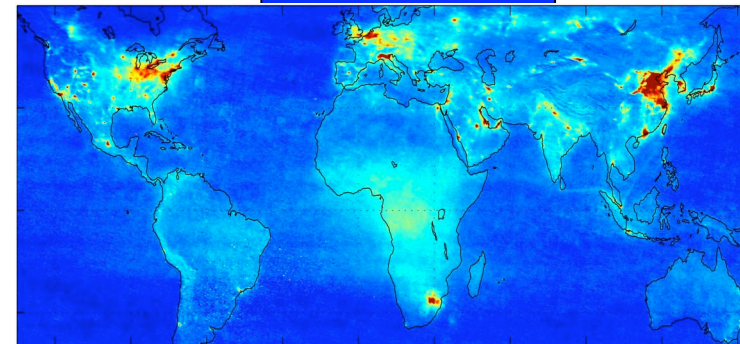
- **Climate change:** Global sea level rise of ~3mm/year and sea surface temperature increase of ~0.1 deg. C since 1992 (Envisat + ERS).
- **Atmosphere:** Worldwide monitoring of air pollution, with evidence of fast growing air pollution in China since 1995 (Envisat + ERS-2).
- **Polar areas:** Daily monitoring of sea ice motion and observation of Antarctica ice-shelves collapse.
- **Oceanography:** Quantification of global chlorophyll concentration, an index of the oceanic phytoplankton biomass.
- **Tectonics:** Identification of the blind tectonic fault at the origin of the Bam earthquake in December 2003.

TM3DAM analysis
18-09-02 00utc

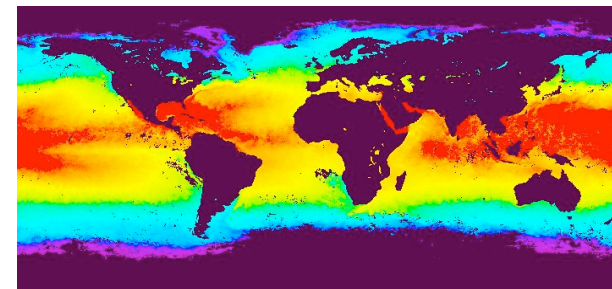
KNMI/ESA



Ozone hole

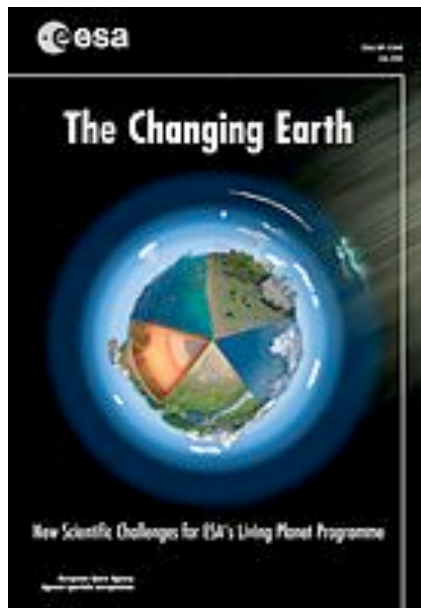


NO₂ / SCIAMACHY (Jan. 2003 - June 2004)



Objectives:

- Maintain Europe at leading edge of sciences
- Increase use of Earth Observation in formulation, implementation and monitoring of public policies and in the provision of public services
- Foster the development of commercial services using Earth Observation



European Space Agency
Agence spatiale européenne

Implementation:

EARTH EXPLORER SATELLITES for science and technology demonstration

EARTH WATCH SATELLITES for long-term operational monitoring

SERVICES and APPLICATIONS demonstration + int'l agreements (e.g. Charter on Space and Major Disasters)

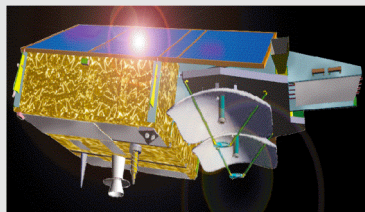
Earth Explorers – Opportunity Missions

- **Add-on missions with specific targets:** *Instrument provision to other programmes, small / micro satellite research missions, technology demonstration (incl. new observing techniques)*

CRYOSAT-2

Ice elevation and ice thickness measurements

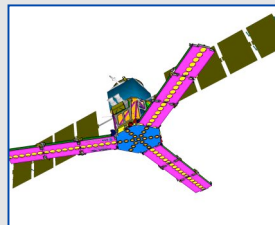
Launch: 2009



SMOS

Soil moisture and ocean salinity measurements

Launch: autumn 2008



SWARM

Earth magnetic field & Earth core dynamics meas.

Launch: 2010



Earth Explorers – Core Missions

- **ESA-led missions to cover the primary research objectives of the Explorer's program:** *Earth interior, physical climate, geosphere & biosphere, atmosphere & marine environment*

GOCE

Earth gravity field
and Geoid
measurements

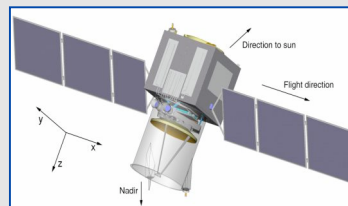
Launch: spring 2008



ADM-Aeolus

Windspeed
vectors
measurements

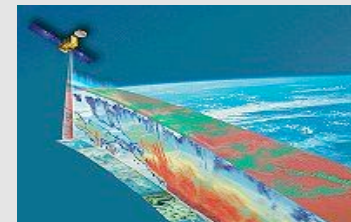
Launch: 2009



EarthCARE

Clouds, Aerosols
& radiation
measurements

Launch: 2012+

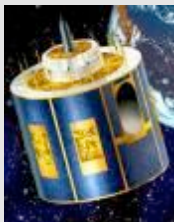


Earth Watch Missions

- Missions for long-term operational Earth monitoring
- Cooperation with **Eumetsat: Meteosat and Metop**
- Mission concept studies: TerraSAR-L, Fuegosat

Meteosat

Since '78, ESA
has developed 8
Meteosat
satellites



MSG-1 & 2
2002 & 2005

Metop

Europe's first polar
orbiting satellite for
op. meteorology

Launch: 2006



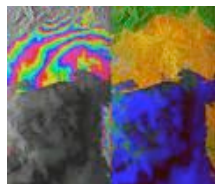
TerraSAR-L

Assessment of
L-band
capabilities

Fuegosat

Fire detection
and
fire monitoring

The GMES Sentinels



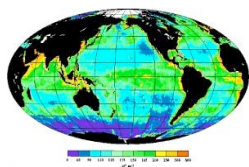
Sentinel 1 – SAR imaging

All weather, day/night applications, interferometry



Sentinel 2 – Superspectral imaging

Continuity of Landsat, SPOT & Vegetation-type data



Sentinel 3 – Ocean monitoring

Wide-swath ocean color and surface temperature sensors, altimeter



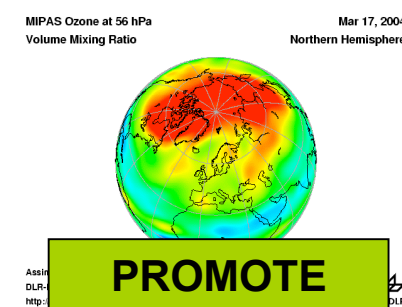
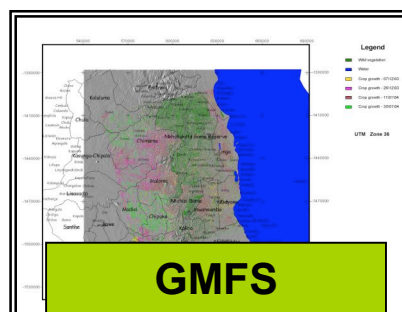
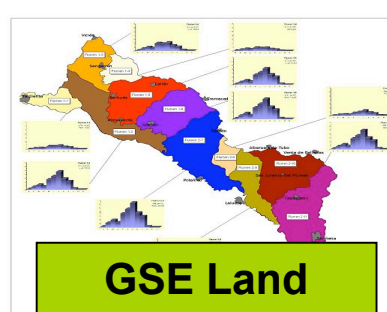
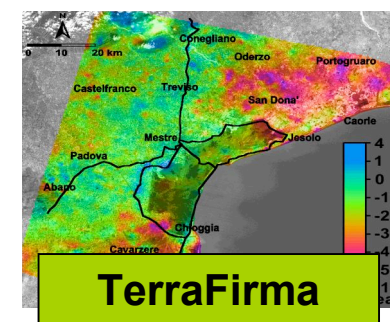
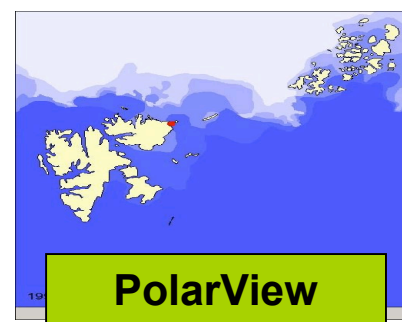
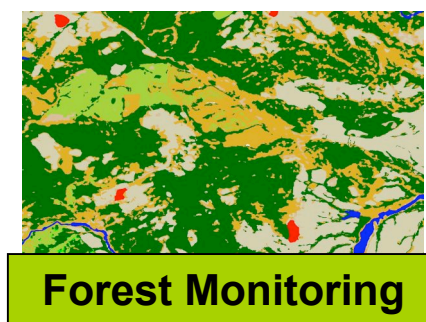
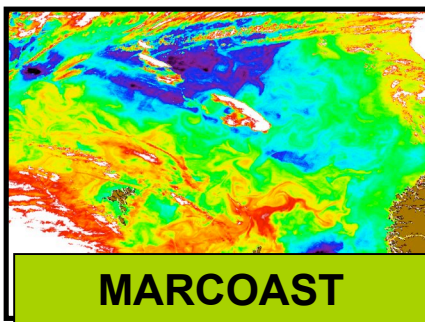
Sentinel 4 – Geostationary atmospheric

Atmospheric composition monitoring, trans-boundary pollution

Sentinel 5 – Low-orbit atmospheric

Atmospheric composition monitoring

Consolidated GSE Initial Services



**100 M€ by ESA
MS**

**Period 2003-
2008 (2009)**

**300+ user
organisations**

**EC has
invested
another 100 M€**

Multi Mission Ground Segment

Objectives and tasks:

- **Strategy, mission planning, interfaces and user services**
- **No single “ESA GS”:** interconnection of a multitude of GS facilities!
- Management and coordination by ESA
- Harmonization of infrastructure, improving data access, cost efficiency



Earthnet & Third Party Missions

- Missions operated by any legal body **other than ESA**
- for which ESA assumes some **formal responsibility** / contributes financially (*sharing of Ground Segment facilities or operations cost*)
- for which ESA assumes a **data distribution responsibility**, mainly towards European Scientific User Community

Historical	Long Operational	Approved 2004	Approved 2005	Approved 2006	Candidates 2007
JERS-1	NOAA	CBERS	HY series/ HJ const.	DMC Deimos	OMI (AURA)
Nimbus 7	Orbview-2	DMC	OCO	GOSAT	CosmoSkyMed
MOS-1/1B	QSCAT	IRS-P6	Cartosat-1/-2	Ikonos(-2)	Quickbird
IRS-P3	Aqua/Terra	KOMPSAT-2	Oceansat-2	J A S O N - 2 / (OSTM)	
Landsat MSS	SPOT	Radarsat-2	RISAT	Metop	
	Proba	SPOT-4	RAPIDEYE	ODIN	
	Landsat TM	Scisat	Monitor-E	Pleiades	
		Formosat-2	Resurs-DK	SAOCOM	
	ALOS		TerraSar-X		
			THEOS		

Data Exploitation

ESA Data User Element (DUE)

- Long-term relationship between user communities and EO
- Development of tailored demonstration products
- Based on proven research results



ESA Earth Observation Market Development (EOMD)

- Supports industry to develop EO services for market
- Fosters growth of European downstream industry (esp. SME)
- Involvement of key market players



ESA GMES Service Element (GSE)

The Charter in action: Earth Observation and disaster management

Examples



**Tsunami, SE Asia,
2004/05**



**Earthquake in Iran,
Feb. 2005**



**Floods in Eastern
Europe**



**Forest Fires in
Southern Europe**



**Hurricanes Rita &
Katrina, Sept. 05**



**Earthquake,
Pakistan / India,
Oct. 05**

SMOS

Observing Land Moisture and Salt in the Ocean

CAL VAL WORKSHOP

29-30-31 October 2007

ESA-ESRIN Frascati

Rome Italy

