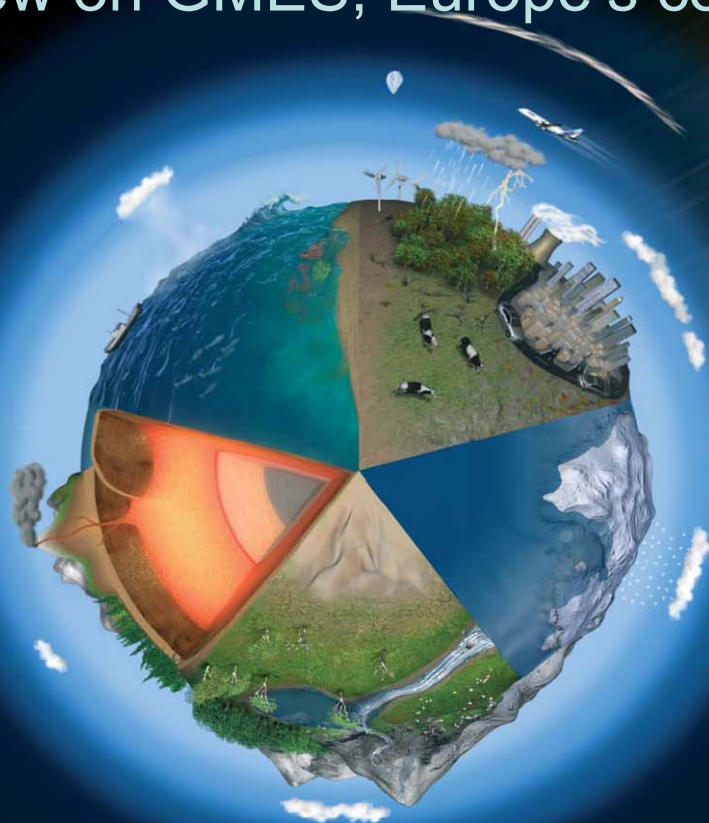


ESA's plans in Earth observation

with a particular view on GMES, Europe's contribution to GEO



Volker Liebig

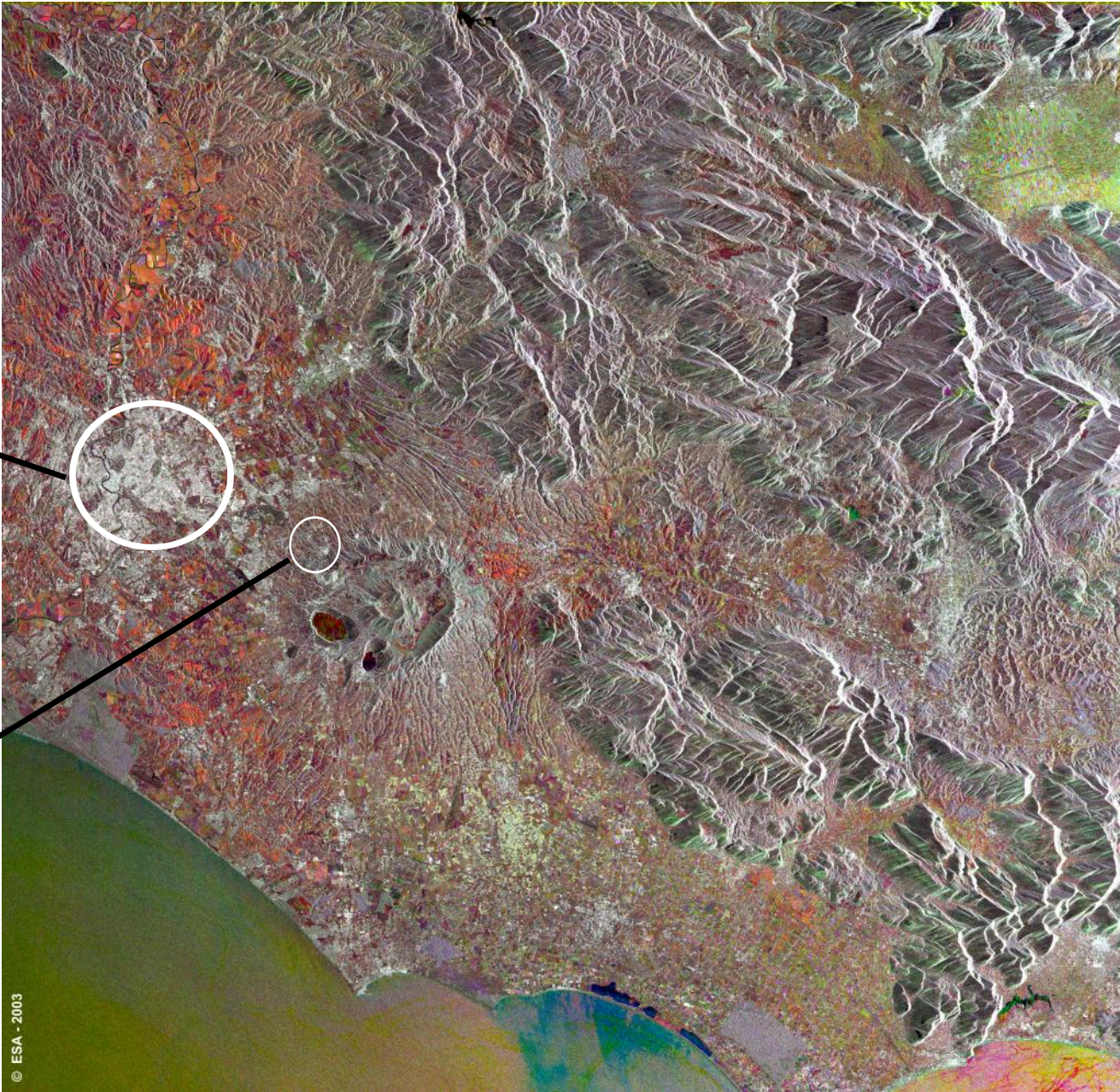
European Space Agency

Director, Earth Observation Programmes

Rome

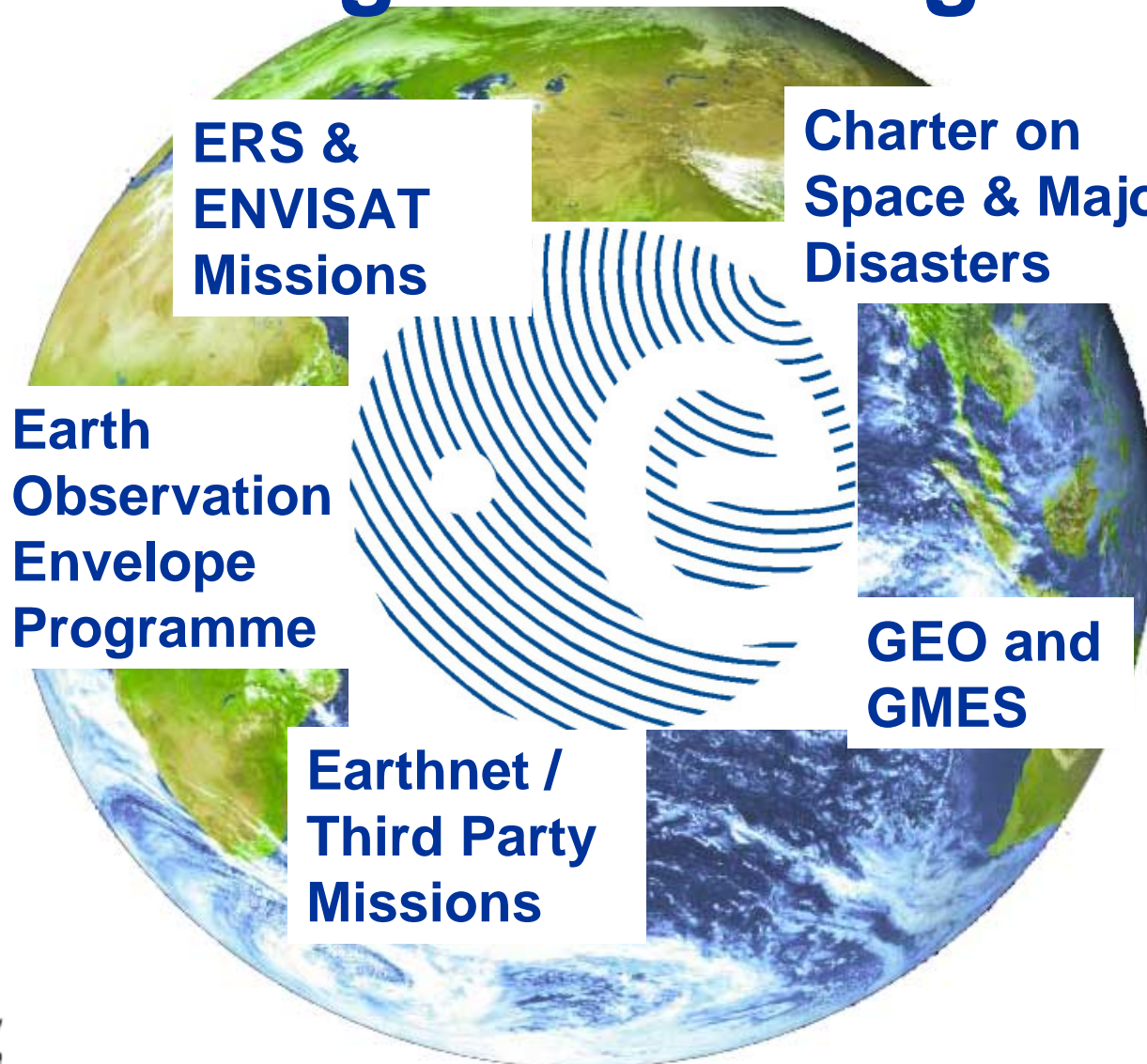


Frascati
&
ESRIN



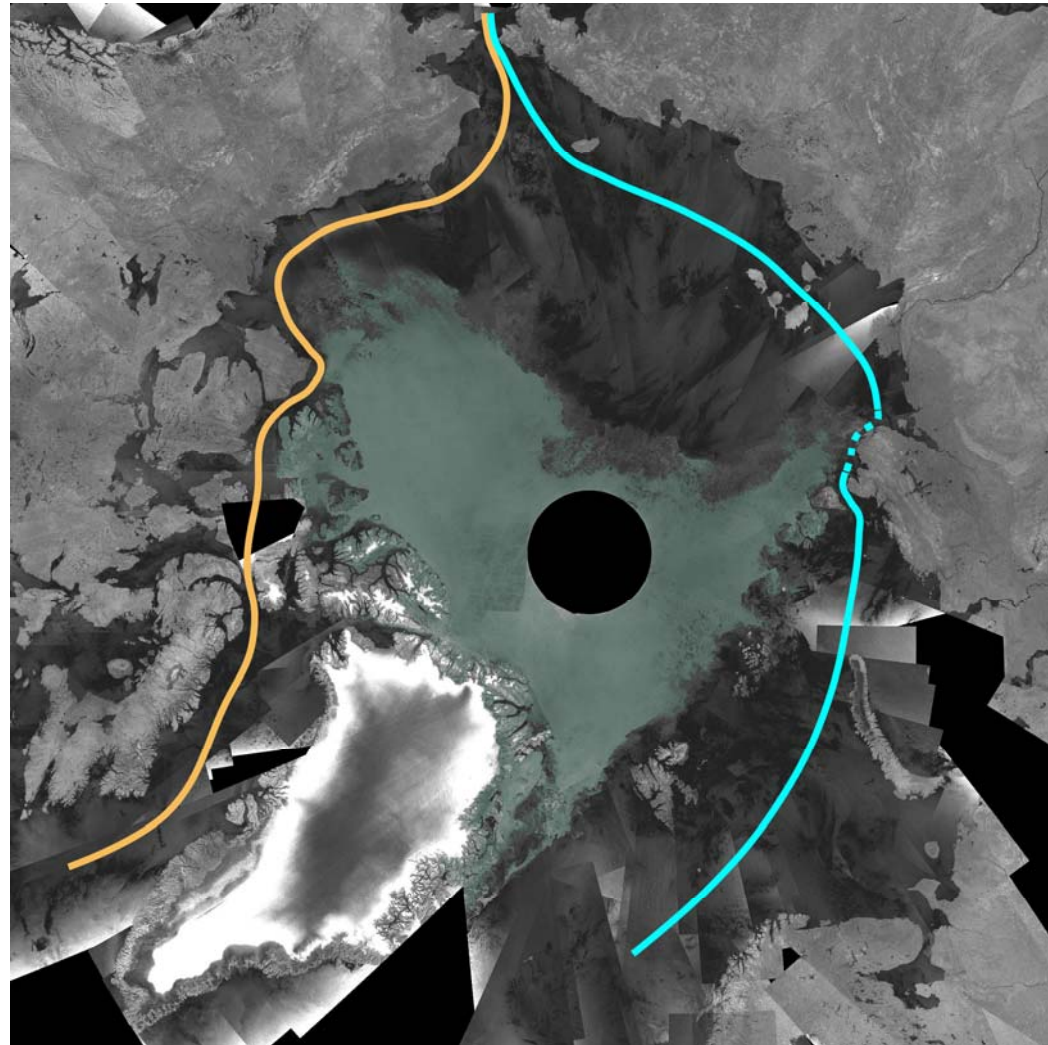
© ESA - 2003

The Living Planet Programme



Lowest Arctic ice coverage in history

Northwest Passage open (orange line) and Northeast passage only partially blocked (blue line). The dark grey colour represents the ice-free areas, while green represents areas with sea ice.



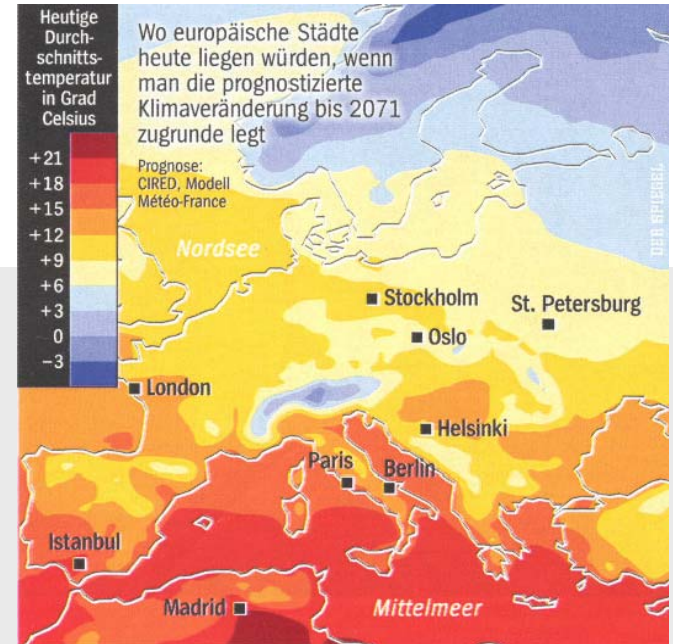
V.Liebig - GEO/GGOS Workshop - Frascati, 5 November 2007

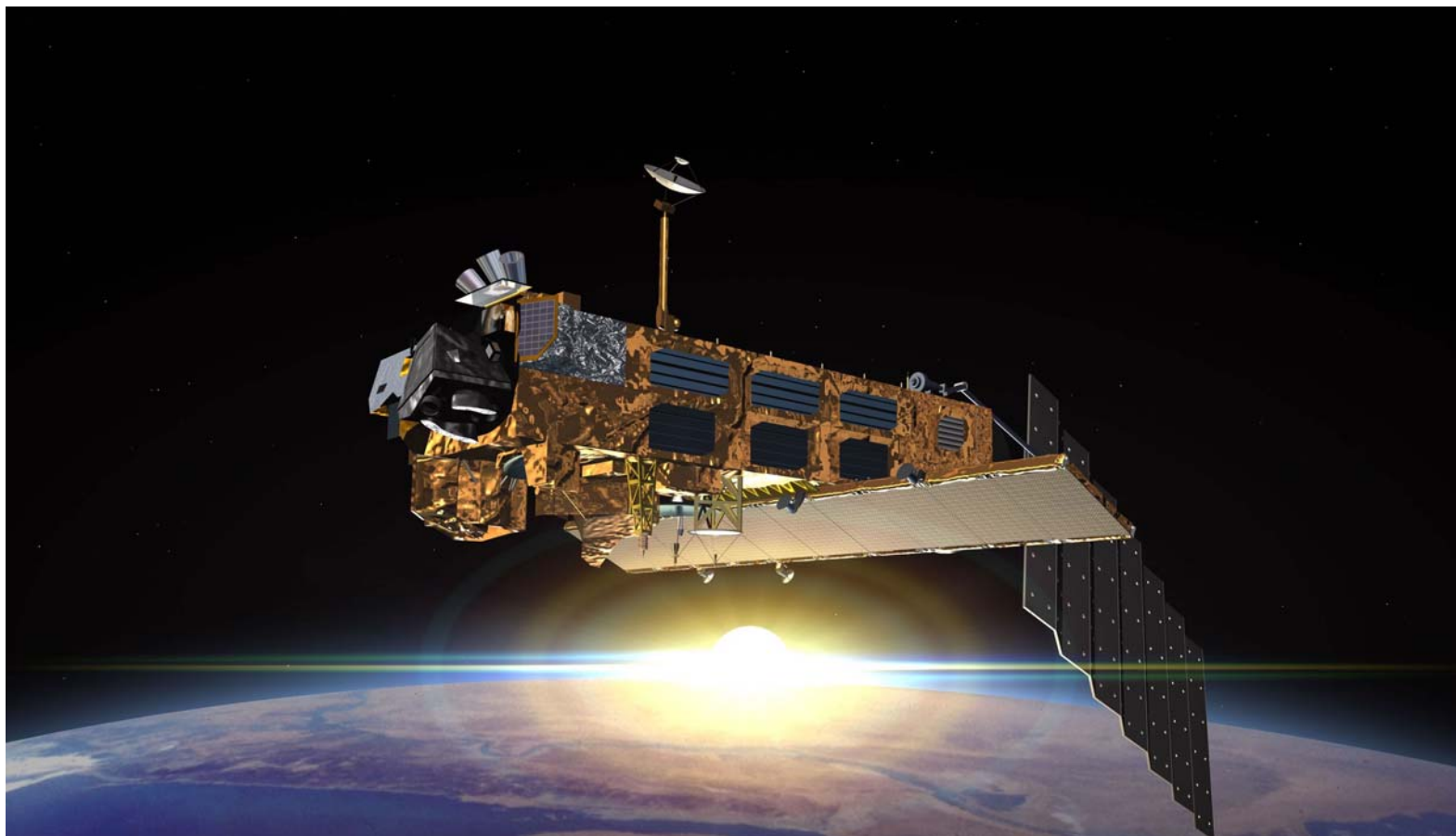
The IPCC Report 2007

Space-based EO contributes significantly to global change monitoring

Model: Global temperature increase between + 2.4 and 6.4 degrees until 2100

- **Arctic:** ice-free as of 2nd half of the century
- **Permafrost:** up to 90% melting until 2100, freeing high amounts of Methane gas
- **Precipitation:** decrease in arid regions and increase in wet areas
- **Storms and surges:** less in number but significantly stronger in intensity
- **Gulf Stream:** significantly weakened
- **Sea level rise:** up to 48cm until 2100 due to thermal expansion of water only





- **Envisat celebrated 5th year in space on 28 February, fulfilling its expected lifetime**
- **280 GB of data products generated per day, 78 types of data products available**

**Definition, development, launch and operations of EE missions
(platform, payload, ground segment)**



GOCE

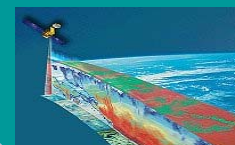


7th EE

SMOS



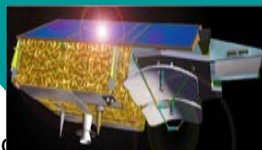
EARTH CARE



**ADM
AEOLUS**



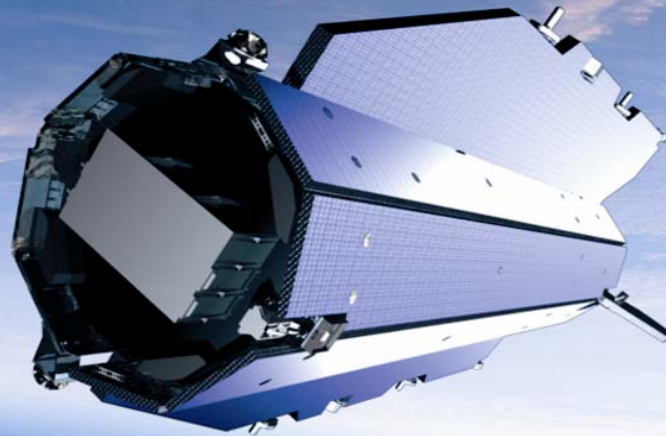
**CRYOSAT
2**



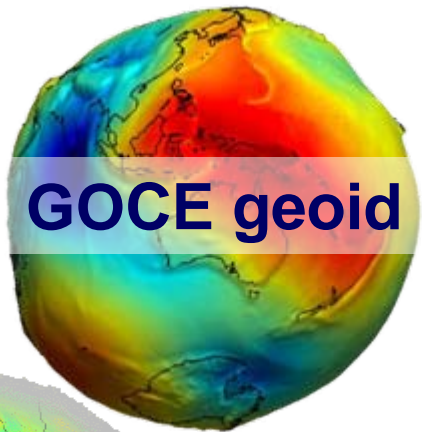
SWARM



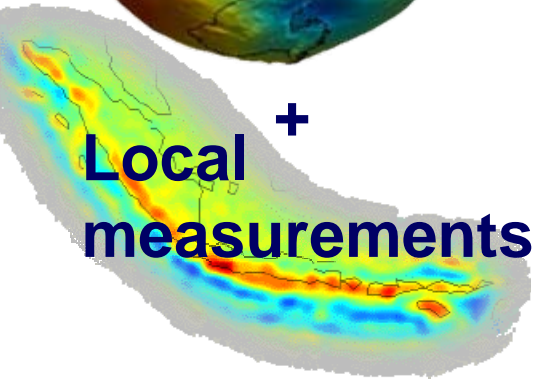
GOCE



The next ESA Earth Explorer to be launched
May 2008



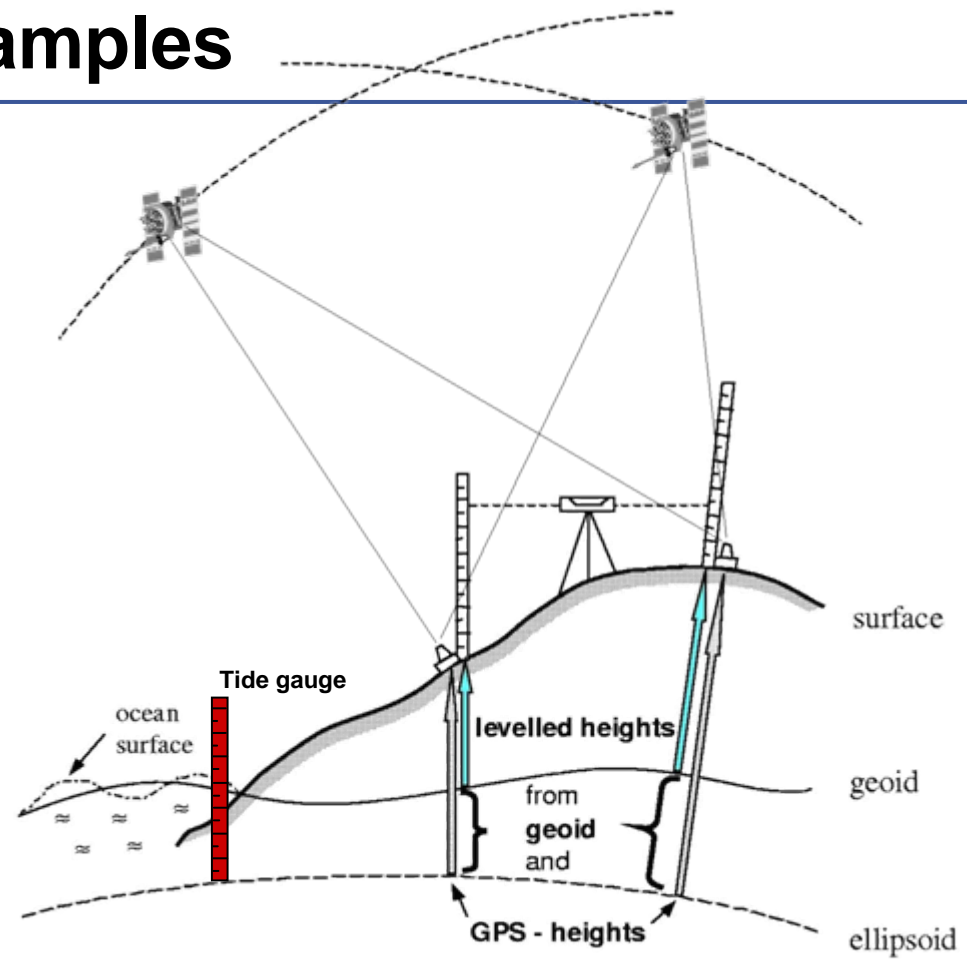
GOCE geoid



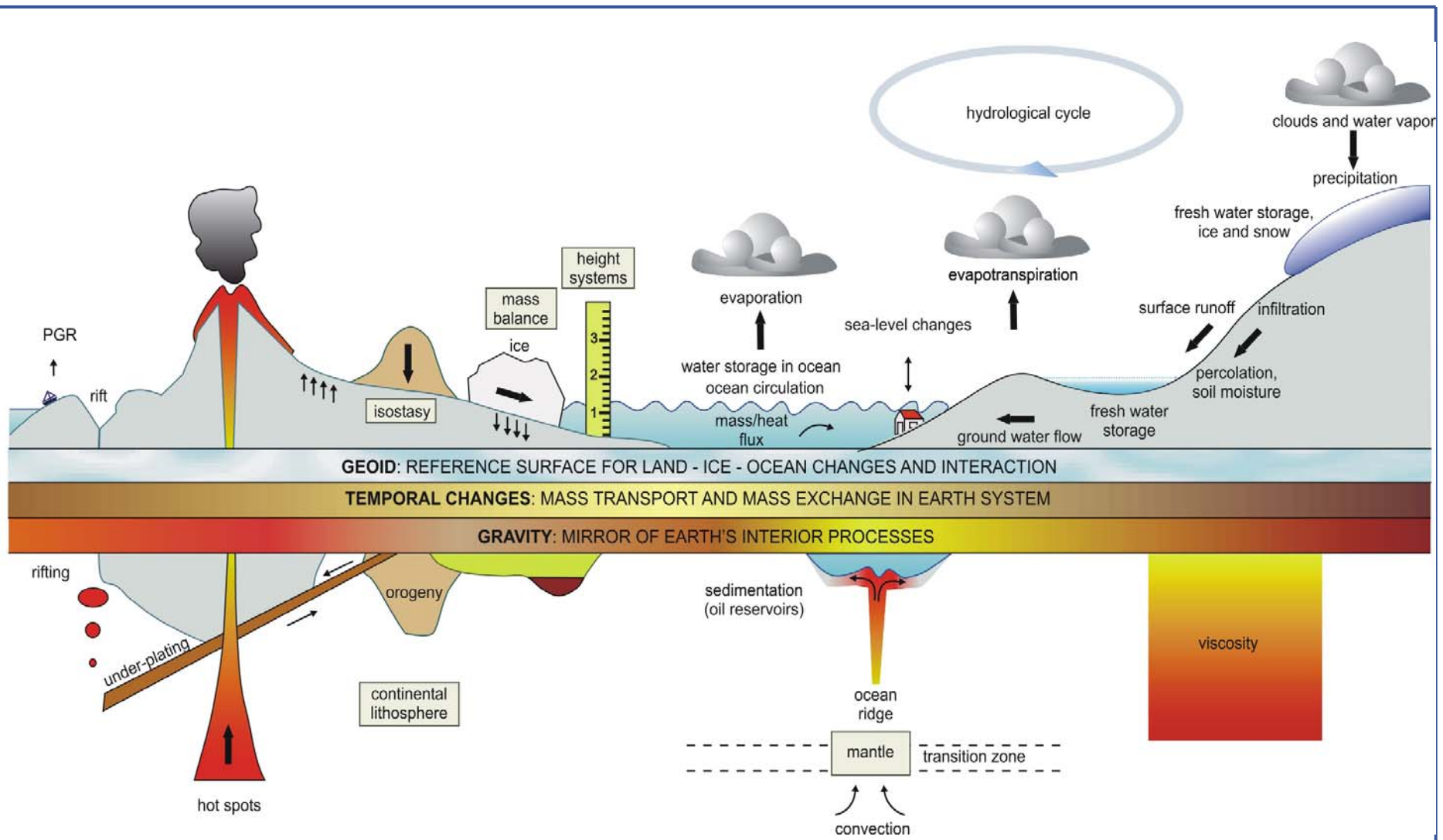
Local measurements

=

Detailed regional geoid



- ✓ Traditional levelling replaced by GPS height - geoid height
- ✓ Uniform height systems: link of tide gauges on global scale
- ✓ Improves understanding of sea level change processes



From: Ilk et al. 2005



From: Ilk et al. 2005

Geometry

IERS: Int. Earth Rotation & Reference Systems Service
IGS: Int. GNSS Service
IVS: Int. VLBI Service
ILRS: Int. Laser Ranging Service
IDS: Int. DORIS Service

Gravimetry

IGFS: Int. Gravity Field Service
BGI: Bureau Gravimetricque International
IGeS: Int. Geoid Service
ICET: Int. Center for Earth Tides
ICGEM: Int. Center for Global Earth Models

Ocean

PSMSL: Permanent Service for Mean Sea Level
IAS: Int. Altimetry Service (in preparation)

Std

BIPM: Bureau International des Poids et Mesures
IBS: IAG Bibliographic Service

Geometry

Examples of ESA's use of Services:

- ▶ Standards (reference gravity and frames etc.)
- ▶ Orbit determination: gravity & tide models
- ▶ For scientific analysis: tide gauge & altimetry
GPS networks & InSAR
GPS networks & METOP



Gravimetry

Examples of ESA's (future) contributions:

- ◀ support to IGS (Int. GNSS Service)
- ◀ Galileo programme
- ◀ Swarm: Earth Rotation related to Core/mantle processes
- ◀ GOCE gravity field and unified height system
- ◀ ERS, ENVISAT, CryoSat & Sentinel 3 satellite altimetry
- ◀ Harmonisation of precise orbits procedures for future missions
- ◀ Access to data archives and data reprocessing



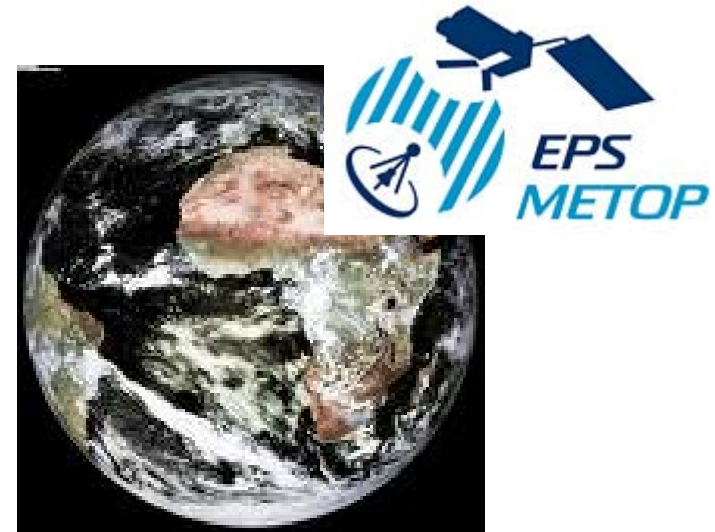
Ocean

Std



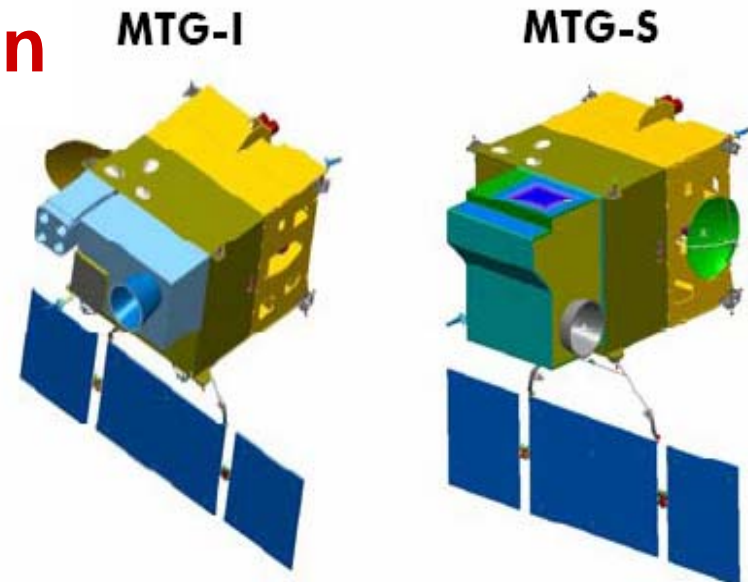
METOP-A

- Europe's first polar orbiting operational meteorological satellite system.
- Hand-over to EUMETSAT (May 2007), satellite operational



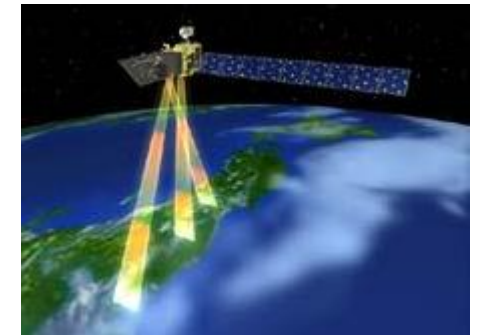
Meteosat Third Generation

- Phase A to be completed in 2008
- Decision for a twin satellite configuration



The Earthnet Programme

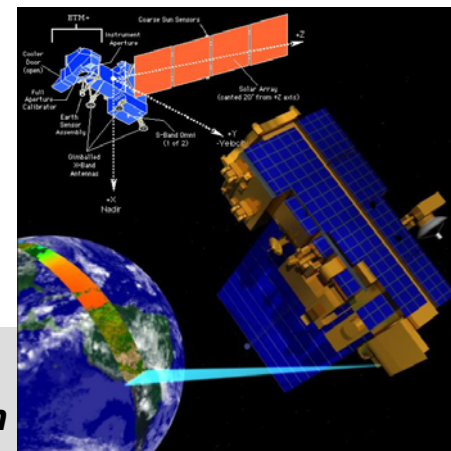
- Serving European users with non-ESA / non-European data
- Fostering European user communities and science competence
- Synergistic use and joint exploitation of ESA and Third Party data



The current ALOS mission

- Long-term commitment:

EARTHNET has been established almost 30 years ago!



The historical JERS-1 mission

The International Charter on Space and Major Disasters

- Initiated by CNES and ESA, joined by many space agencies
- **Unified system of space data acquisition & delivery in case of natural or human-made disasters**
- **Data delivery to civil protection agencies, emergency & rescue services; UN cooperating body since 2003**
- *Examples of Charter Activation:*

- | | |
|--|---|
| ▪ Bam Earthquake 2003 | ▪ Hurricane Katrina 2005 |
| ▪ Darfur Crisis 2004 | ▪ Cyclone Kyrill 2007 |
| ▪ Tsunami Catastrophe 2004/2005 | ▪ Fires in the Mediterranean region (Italy, Greece) 2007 |



Global Monitoring for Environment and Security (GMES)



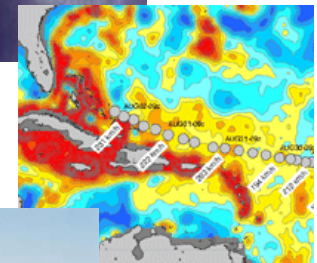
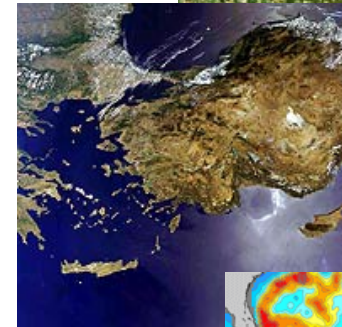
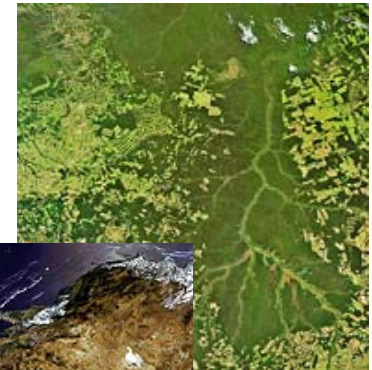
**European independence in data sources for
environment and security monitoring**

and

**The European contribution to the Global Earth
Observation System of Systems (GEOSS)**

The GMES Space Component Programme

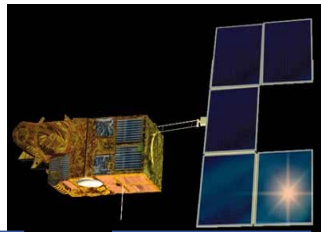
- **Development, launch and IOV of the Sentinels**
 - S1: SAR imaging (all weather, day/night)
 - S2: Superspectral imaging
 - S3: Ocean monitoring
 - S4 (on MTG) atmosphere (GEO)
 - S5 (on Post-EPS?) atmosphere (LEO)
- **Ground Segment & Coordination**
 - Access to EO data from ESA, EUMETSAT and Member States' missions for GMES services
 - Development of Sentinel Ground Segment



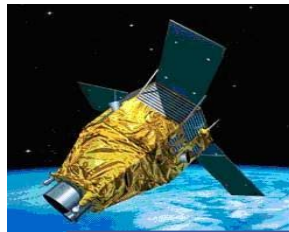
National, Eumetsat and Third Party Missions for GMES (excerpt)



CosmoSkymed



SPOT



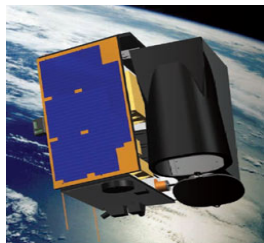
Pleiades



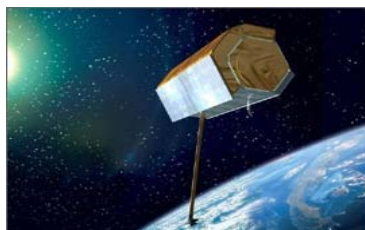
Jason-2



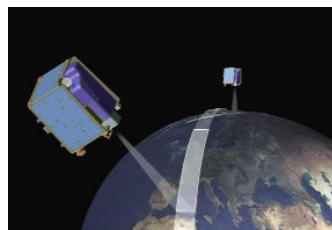
Radarsat



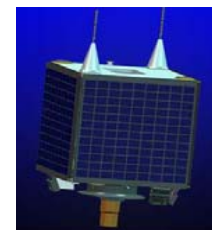
TopSat



Terrasar-X



Rapideye



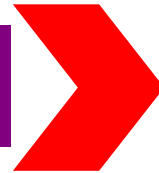
UK-DMC



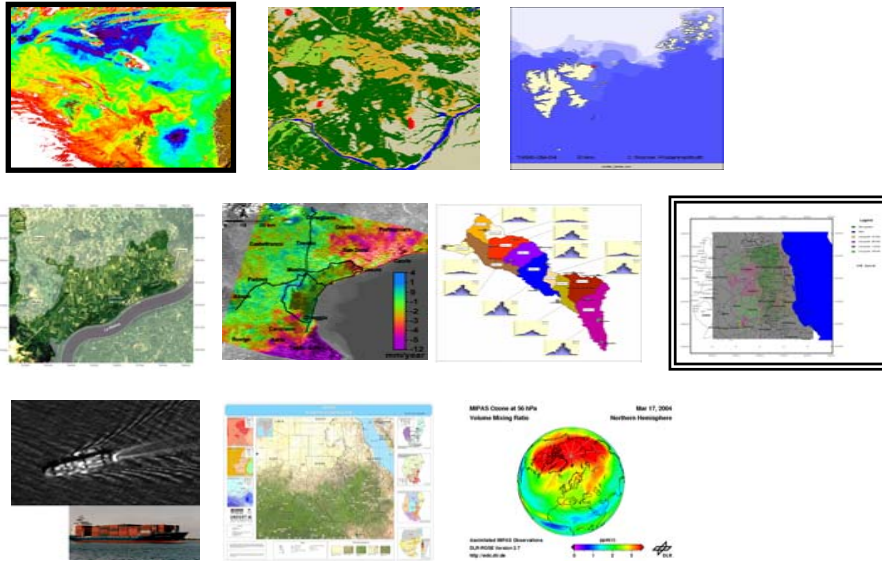
METOP



GMES Service Element



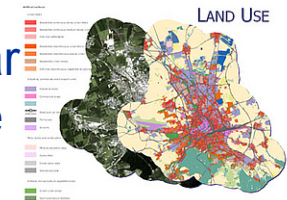
Fast Track Services



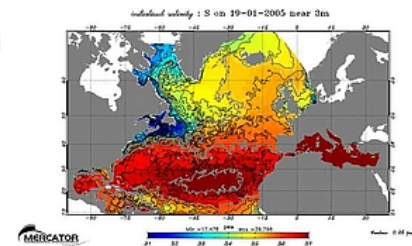
▪ **Emergency Respond Core Service** respond to crises and emergencies



▪ **Land Monitoring Core Service** regular independent satellite coverage of Europe



▪ **Marine Core Service** ocean forecasting, monitoring & reporting and applications on environment & safety



100 M€ by ESA MS

Period 2003-2008 (2009)

330+ user organisations

EC has invested another 100 M€

Availability – Reliability - Affordability

Further challenges of GMES

- **Funds for operational phase:**
 - *prototype satellites in orbit as from 2011/2012 onwards*
 - *recurrent satellites needed for fully operational system*
- **Governance structure**

