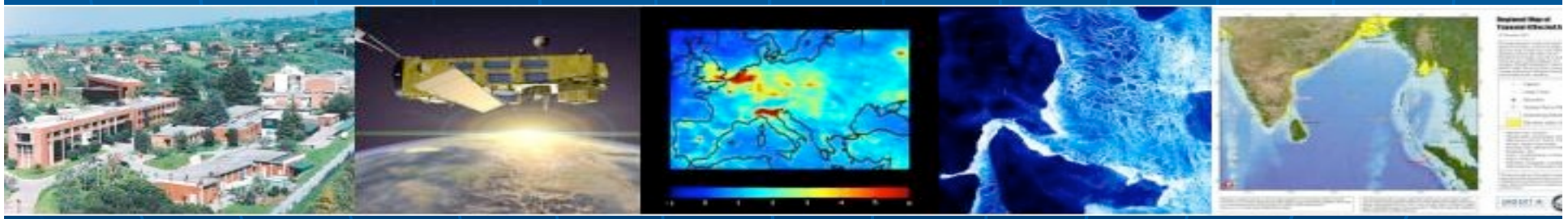
G8-UNESCO WORLD FORUM on
EDUCATION, RESEARCH and INNOVATION

Environment: Global challenges
-
The role of space



Giuseppe Morsillo
Head Director General's Policy Office

10 May 2007

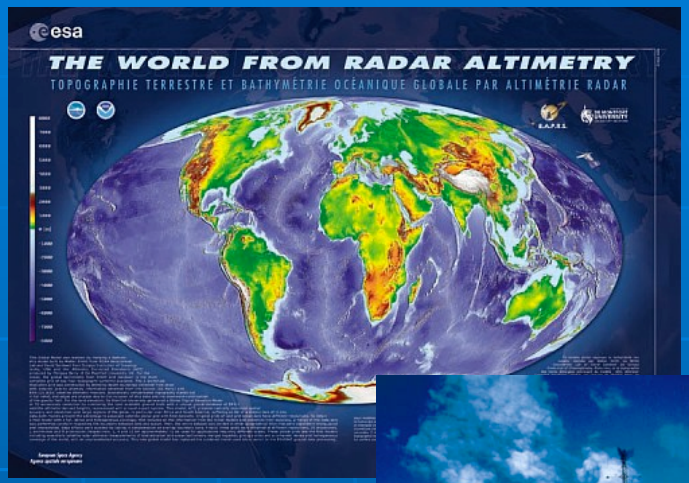
Overview

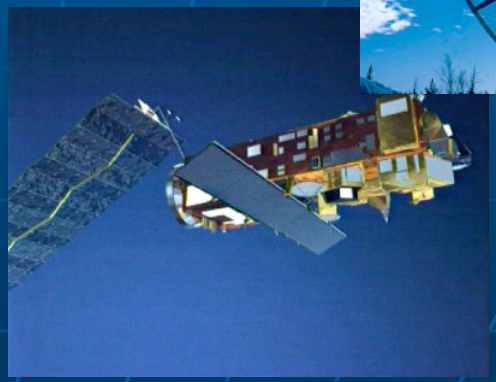
I – Space and the triangle of knowledge

- Space and Technological Innovation
- Space and Research
- Space and Education

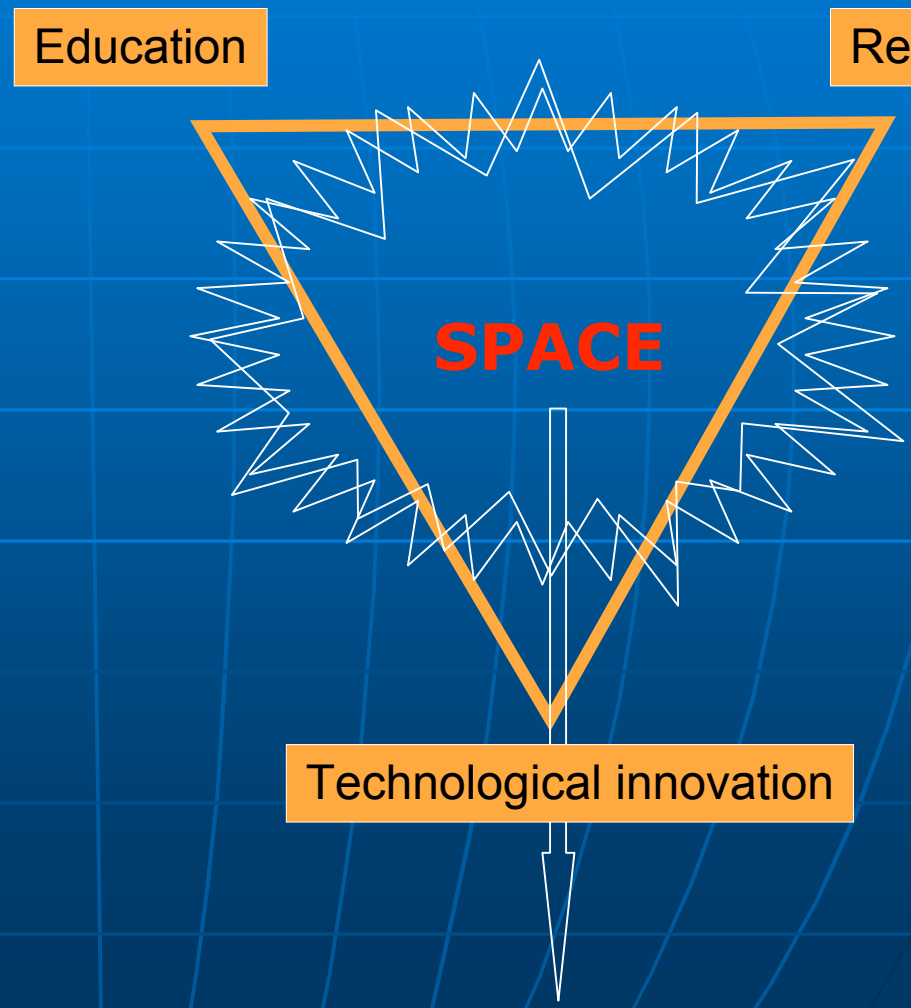
II – Space provides global responses to today's environmental challenges

- Cutting-edge S&T in support of environment and climate change
- Characteristics of space-based Earth observation
- Monitoring climate change from space
- UN inter-agency cooperation on the peaceful use of outer space
- The International Charter on Space & major disasters
- Europe's contribution to Earth Observation Applications
- Europe's contribution to Earth Science
- Towards increased integration and synergies



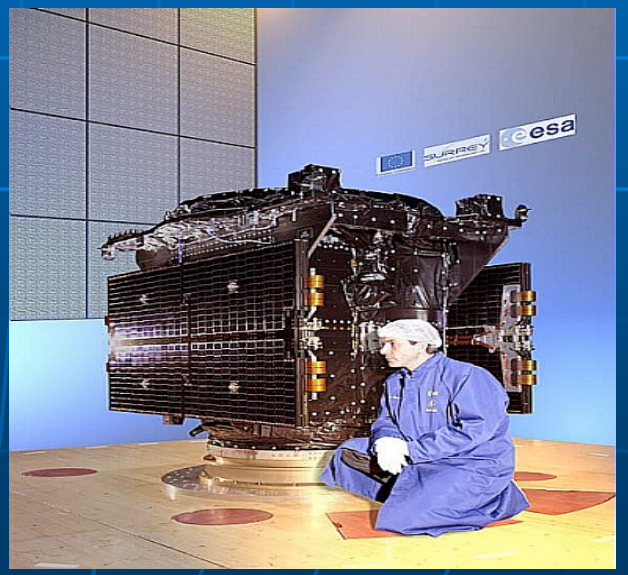


I - Space and the triangle of knowledge



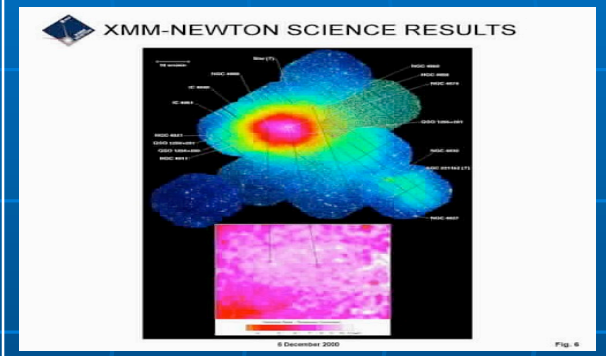
Space and Technological Innovation

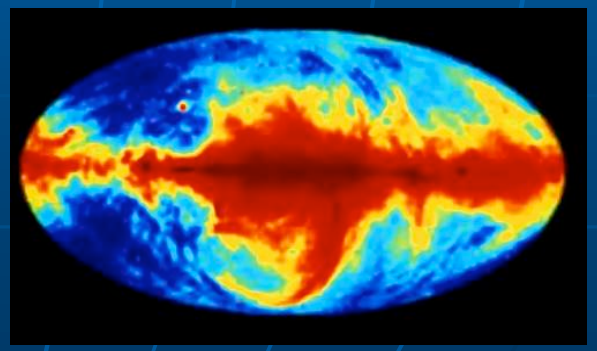
- Evocative of frontier and rupture technologies
- High risk involved requires upfront early public investment that leads to decisive spin-off (for environmental purposes e.g. cooling technology from space exploration, photovoltaic cells)
- Technological complexity and level of investment involved calls for international cooperation
- Value added multiplied when integration and synergies with non-space technologies



Space and Research

- Space-based science contributes to the knowledge-based society
- Space-based science is underlying technological development and subsequent applications
- Space-based science is predestined for international cooperation on a global level
- Synergies among space-based science
  - Science on space (Space Science)
  - Science in space (Microgravity)
  - Science from space (Earth Science)





Space and Education

- Education and investment in Science, Engineering and Technology (SET) careers are key to the knowledge-based society and understanding our planet
- Education programmes and creative learning environments developed around cutting-edge space projects inspire and motivate students
- The fascination for space widens the interest and understanding of science among the public

European Space Policy:

'The pursuit of world class science is crucial to expand the knowledge base; to develop new technologies and applications; and to attract young people into science and engineering.

ESA Convention:

'The purpose of the Agency shall be to provide for space research and technology and their space applications with a view to their being used for operational application systems […] and ensure the execution of basic activities such as education, documentation and studies of future projects and technological research.'

II – Space provides global responses to today's environmental challenges

Cutting-edge S&T in support of environment and climate change

'Knowledge based economies require innovative education systems and reliable transparent and non-discriminatory legal, regulatory and policy frameworks, supporting investment in knowledge research and development.' (G8 St Petersburg Declaration 2006)

'International cooperation in science and technology is indispensable to generate the talent and knowledge needed to find solution to fundamental global challenges.' (G8 St Petersburg Declaration 2006)

'Climate change demands an international response as scientific and technological progress and innovation improves the quality of climate prediction and weather forecasts and will enable more effectively adapted responses. (Stern Review)'

European Space Policy

Among the Strategic Objectives:

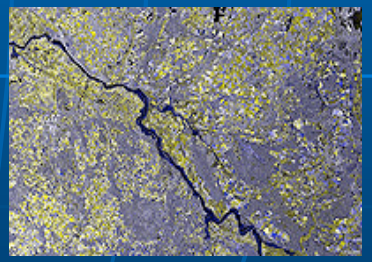
'To develop and exploit space applications serving Europe's public policy objectives and the need of European enterprises and citizens in the field of environment, develoment and global climate change'

Characteristics of space-based Earth observation

Coverage: Satellites cover the whole globe >>> study of large scale phenomena like oceans circulation, climate, deforestation and desertification as well as cost-effective monitoring of remote or dangerous areas.

Repitition and consistency: Satellites repeatedly view the same area over long periods of time and collect homogeneous data >>> monitor environmental change, impacts of human and natural processes. Long-term data series allow for trend identification.

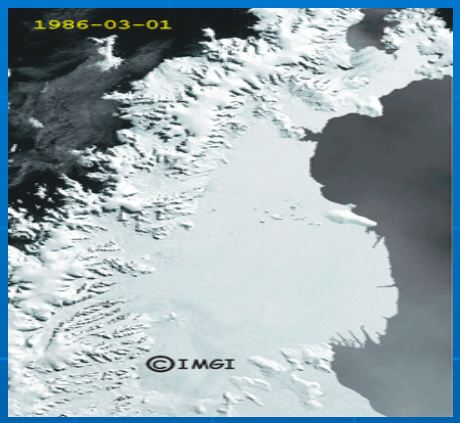
Speed and accuracy: Satellite can provide near real-time data in emergencies >>> damage assessment after natural disasters such as earthquakes, flooding, forest fires.



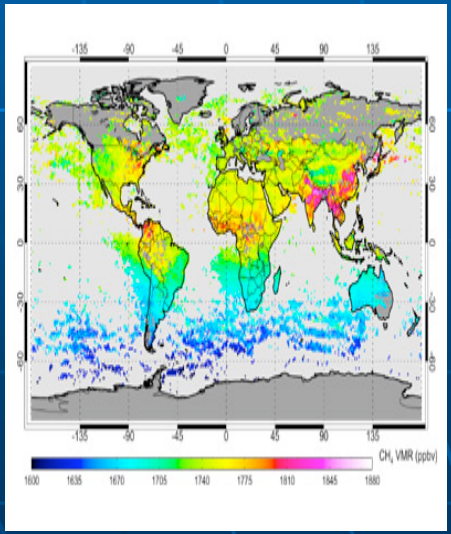
Return on investment: A satellite can be used for a large number of activities over a long period of time, thus offsetting the launch and operating costs by benefits provided. (SOURCE: UN Inter-Agency report)

Monitoring Climate Change from space

Collapse of the Larsen Ice Shelf (Envisat, courtesy Univ. Innsbruck)



Global Concentration of Methane (Envisat, courtesy KNMI)



Warming signs from space

Accelerated global warming and sea-level rise (ERS, Envisat, Sent-3)

* Faster rate of global sea-level rise (about 3.1mm/yr since 1993)
* Warming of the global ocean and lower atmosphere

Melting of ice and snow (ERS, Envisat, Cryosat, Sent-1, Sent-2)

* Shrinking of Arctic sea-ice cover (about 2.7%/dec. decline since '78)
* Breakup of Antarctic ice shelves
* Decrease in snow extent in both Hemispheres
* Retreat of Mountain glaciers

Understanding global change processes

Understanding Radiative Forcing

* Earth Radiation budget (MeteoSat, EarthCare)
* Monitoring of clouds and aerosols (EarthCare)

Quantifying the Carbon Cycle

* Monitoring Greenhouse Gases concentration (Envisat, Metop, Sent-4/5)
* Monitoring carbon stocks in vegetation & plankton (Envisat, ERS, Sent-2/3)

Validation and forcing of coupled climate models

Monitoring "tipping-point" of abrupt climate change

* Greenland icecap (Envisat, Cryosat, Sent-1)
* Ocean circulation (conveyor belt) (GOCE, SMOS)

UN inter-agency cooperation on the peaceful use of outer space

- Agriculture and land use
- Forests
- Water
- Weather and Climate
- Combating Marine Pollution
- World Heritage Sites monitoring
- Monitoring of endangered species
- Post-crisis recovery and development
- Education, Training, Capacity building
- Bridging the digital divide
- Refugees
- Health

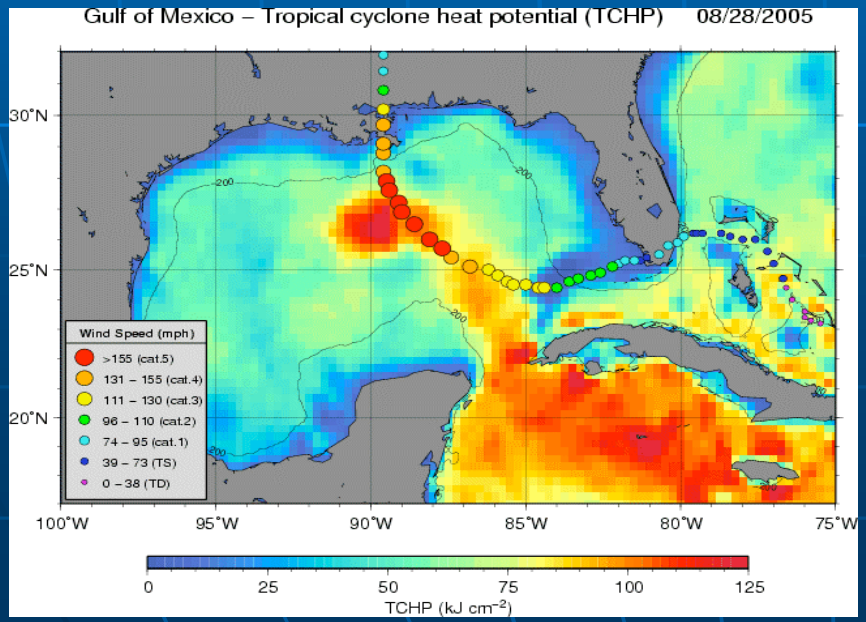
International Charter on Space & Major Disasters

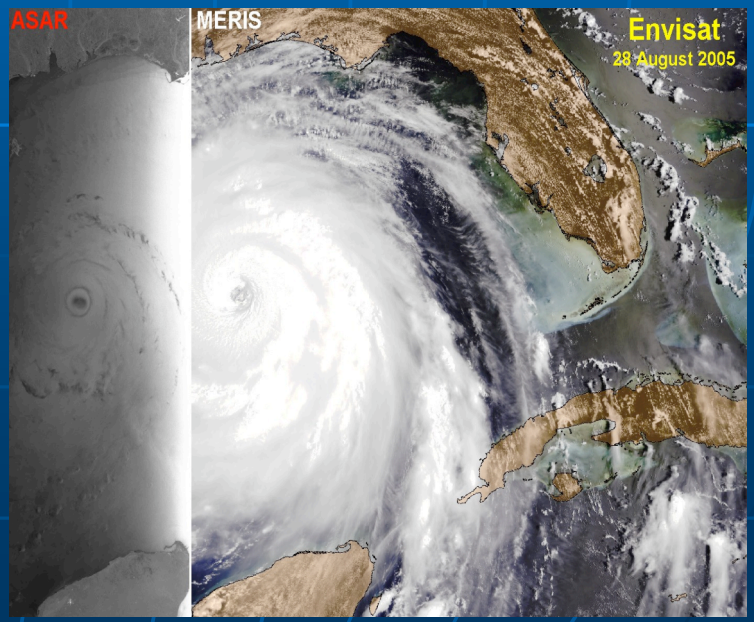
- An agreement between Space Agencies to use space assets in emergency situations so as to provide a single access point to space systems for emergency & rescue organisations in case of disasters.

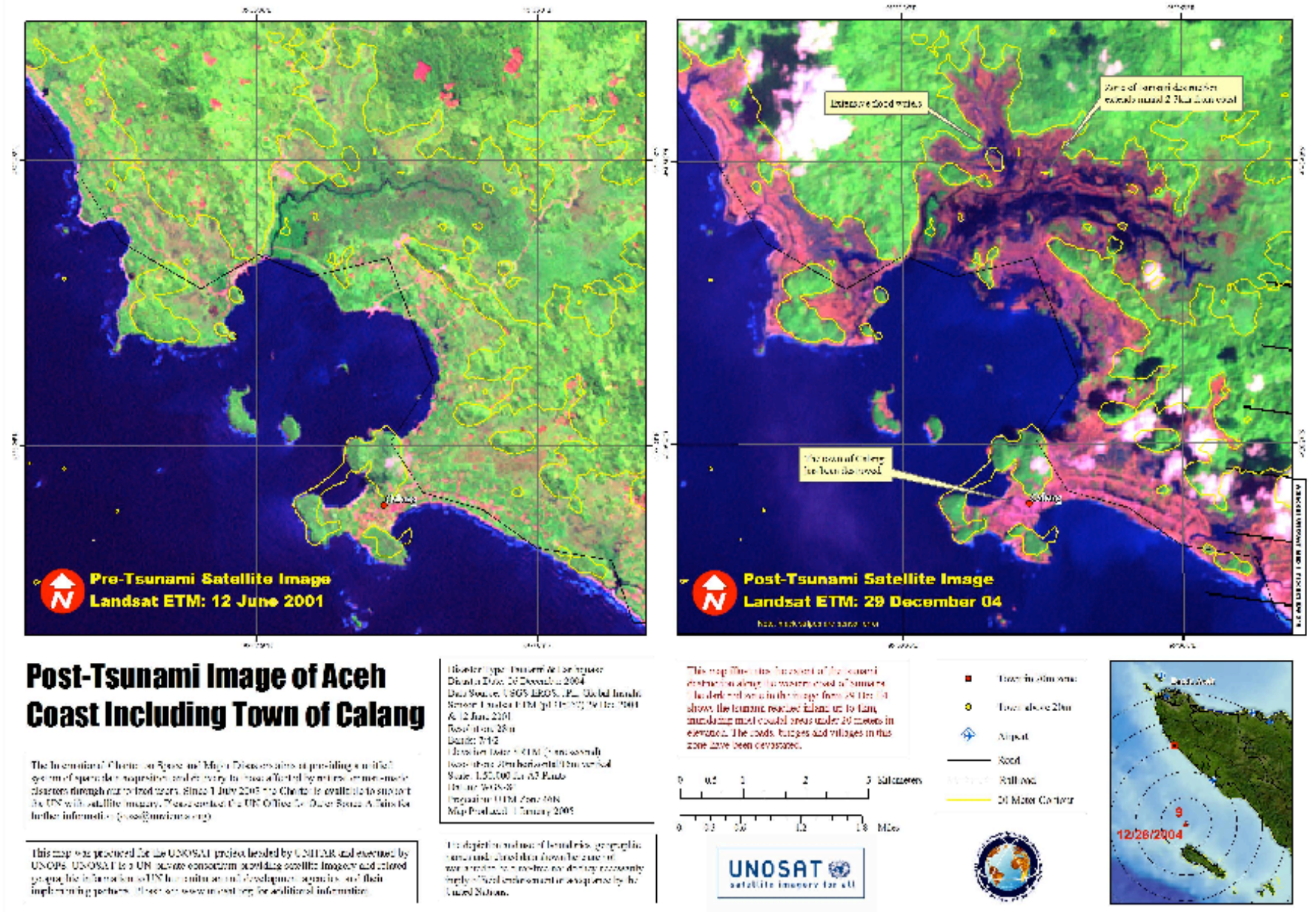
- Was originally signed by ESA and CNES on 20 June 2000

- Many major space agencies, among which ISRO (India), NOAA (USA) and JAXA (Japan), DMC (UK, Turkey, Algeria, Nigeria) joined since.

- Recent examples of Charter Activation: (Hurricane Katrina/2005; Kashmir Earthquake/2005; Tanker 'Ece' accident/2006)






Pre-Tsunami Satellite Image
Landsat ETM: 12 June 2001
Post-Tsunami Satellite Image
Landsat ETM: 29 December 04
Post-Tsunami Image of Aceh Coast Including Town of Calang
UNOSAT
satellite imagery for all
12/26/2004

Europe's contribution to Earth Observation Applications

Towards a Global Earth Observation System of systems (GEOSS)

- Group of Earth Observation (GEO) coordinating
- Data collection and integration at global level
- Several space and non-space stakeholders participating

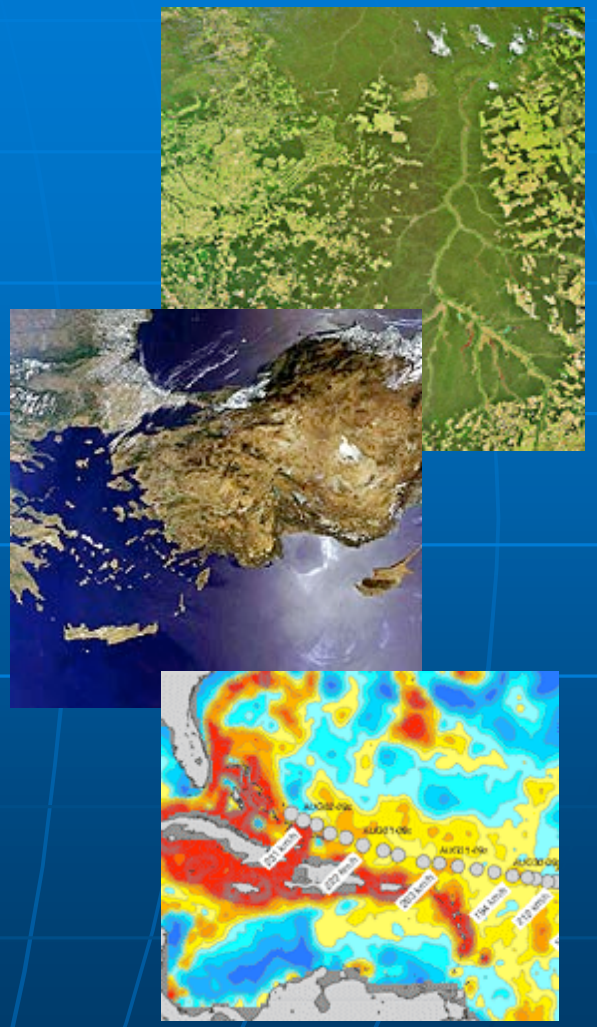
The 'Global Monitoring for Environment and Security (GMES)' - the European contribution to GEOSS

-Development of fast-track services to fill recent gaps (land, marine, emergency, *atmosphere, security)*

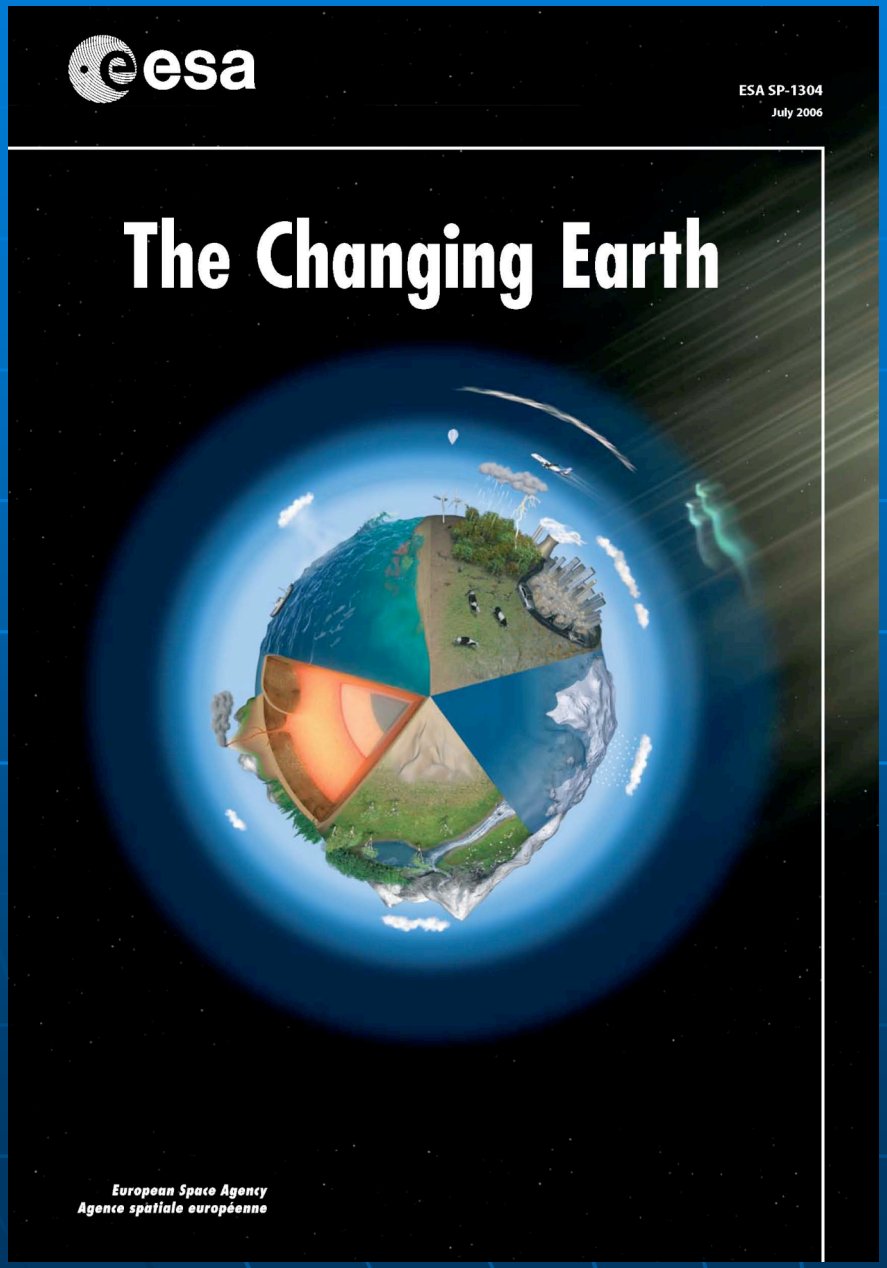
-Data policy and other regulatory aspects

- Integration of space, airborne and in-situ assets

ESA GMES sentinels and national missions



Europe's contribution to Earth Science



- an updated science strategy for ESA's Earth Science Programme has been formulated under the guidance of the Earth Science Advisory Committee

- a wide consultation on the strategy with the scientific community was undertaken at a workshop in February 2006

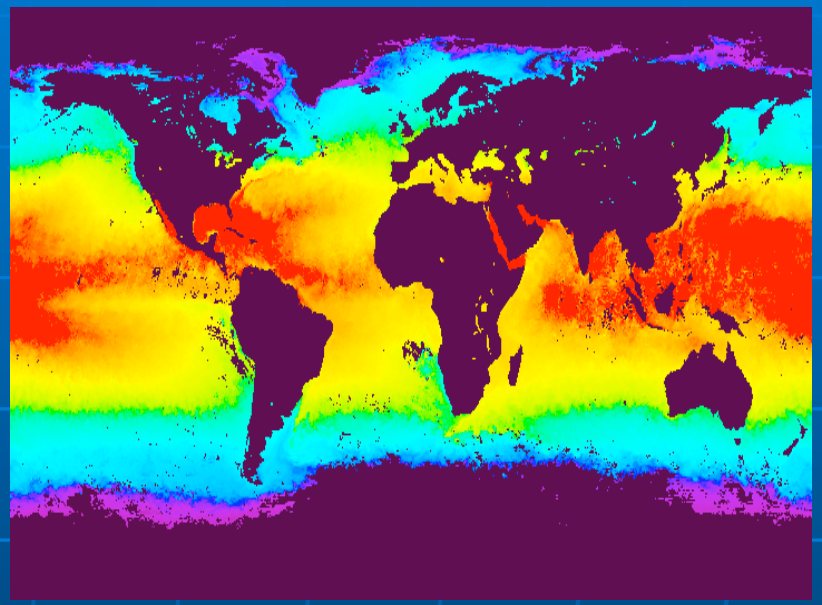
- the document addresses Earth science through the five topics oceans, atmosphere, cryosphere, land and solid Earth and identifies the challenges for each of these

- particular emphasis is put on the system approach, where links between different parts of the Earth System are considered

Towards increased integration and synergies

- Increased international cooperation efforts on the political level have to be backed by increased integration of Earth Observation assets and data providers, i.e. (space-borne, airborne, in-situ);

- Potential contribution of other space applications in the future, e.g. scientific use of Galileo:
Refraction of navigation signals in the Earth atmosphere allows for the measurement of e.g. humidity, temperature or density profile of the atmosphere.



The European Space Policy features:

- The development of integrated space systems

- Synergies between space and non-space technologies

- An open attitude towards international coooperation, in particular in support of EU external policies, sustainable development…

THANK YOU