



Introduction to the ESA Earth Observation Programme.

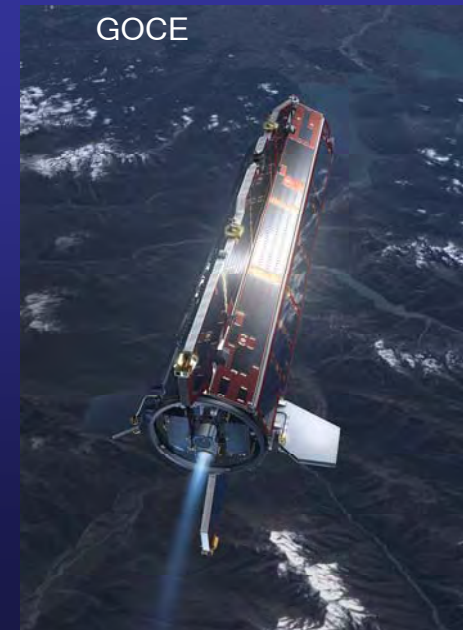
Projects and tools for Education



ENVISAT

Francesco Sarti

ESA/ESRIN



GOCE



The European Space Agency



The idea of an independent European space agency dates back to the early 1960 s.

ESA was formed in 1975, replacing the satellite and launcher organisations ESRO and ELDO.

Today ESA has 18 Member States



The purpose of ESA



An inter-governmental organisation (18 member states) with a mission to provide and promote – for exclusively peaceful purposes – the exploitation of:

Space science, research & technology

Space applications



ESA programmes



All Member States participate in activities related to space science and in a common set of programmes (mandatory programmes).

In addition, members chose the level of participation in optional programmes:

Human spaceflight and Exploration

Microgravity research

Earth observation

Telecommunications

Satellite navigation

Launcher development.



Space Science

For over 30 years ESA's space science projects have shown the scientific benefits of multi-nation cooperation.

Space environment of the Earth

Solar-terrestrial interaction

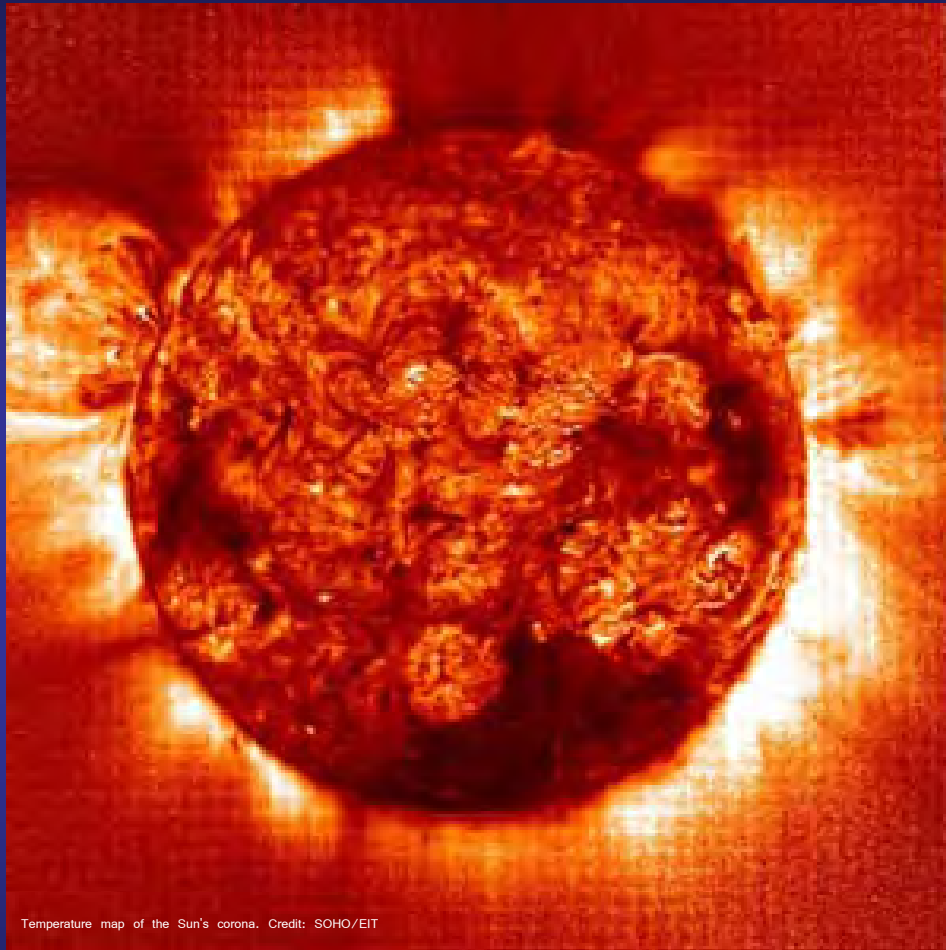
Interplanetary medium

Moon, planets and other objects

Stars and the universe

Fundamental Physics.



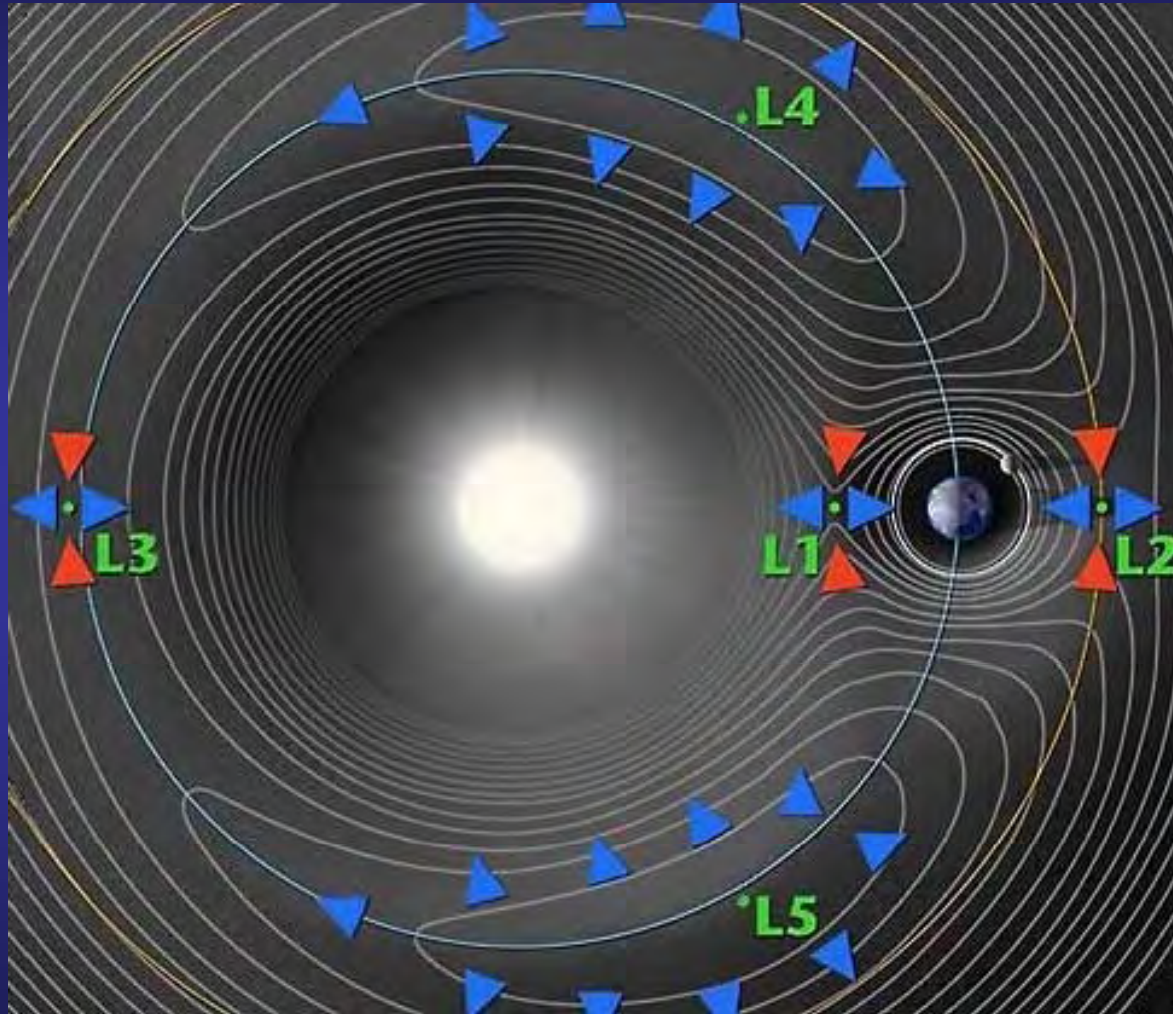


Soho

SOHO is in a [Halo-Orbit](#) with a radius of 600.000 km Radius around Lagrange-Point L1 (distance 1,5 Millions Km from Earth)



Satellites



A contour plot of the effective [potential](#) of a two-body system (the [Sun](#) and [Earth](#) here) due to gravity and the [centrifugal force](#) as viewed from the [rotating frame of reference](#) in which Sun and Earth remain stationary. Objects revolving with the same [orbital period](#) as the Earth will begin to move according to the [contour lines](#) showing [equipotential](#) surfaces. The arrows indicate the gradients of increasing potential around the five Lagrange points — toward or away from them, but at the points themselves these forces are balanced.



Earth Observation

*The quest for
information about the
Earth*

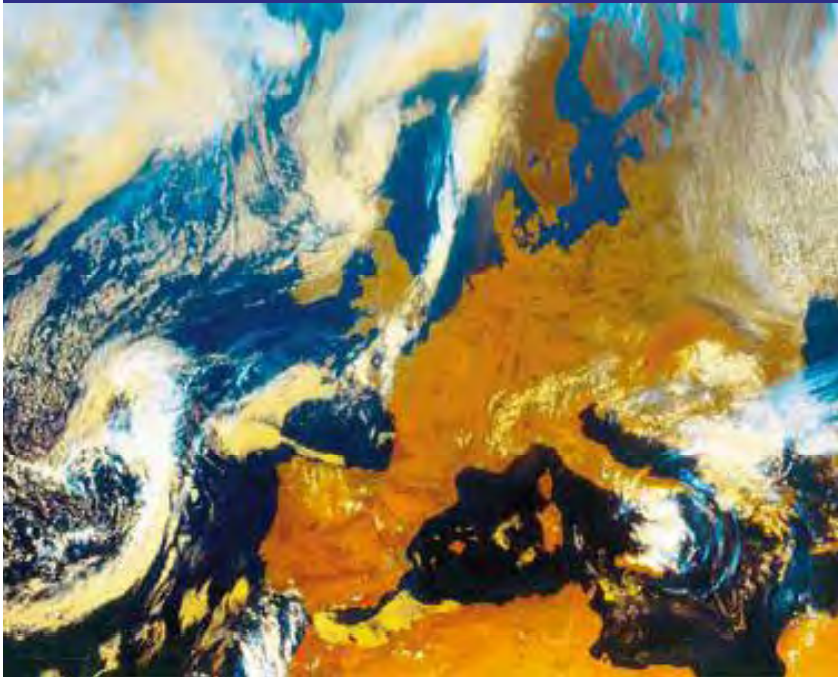


ESA has developed the Meteosat and MSG series of weather satellites, METOP, the environmental and climate research and monitoring satellites ERS-1 & 2 and Envisat, and recently launched its first Earth Explorer, respectively for:

- Meteorology
- Environmental & climate monitoring
- Earth resource management & other applications
- Better understand the earth



Europe's first weather satellites



The first Meteosat was launched in 1977.

Five more followed and the seventh was launched in 1997.

- Placed in geostationary orbit
- Take pictures of the Earth every 30 min
- Distribute meteorology data

Since 2002: MSG (Meteosat Second Generation): series of 4 geostationary (enhanced) meteorological satellites

Since 2006: METOP (series of Meteorological Operational Polar Orbiting Satellites)

Eumetsat owns and exploits these satellites



*Cooperation with
Eumetsat*



ESA is cooperating with Eumetsat, the European Organization for the Exploitation of Meteorological Satellites on the development of two series of meteorological satellites:

- MSG (Meteosat Second Generation): series of 4 geostationary meteorological satellites (enhanced performances with respect to Meteosat). First launch: 2002
- METOP (Meteorological Operational Polar Orbiting Satellites): a European series of polar orbiting spacecraft embarking a very comprehensive series of meteorological payload.

- Development of the meteorological programmes:

1977

MOP



- 1 observation mission:
- MVIRI: 3 channels
 - Spinning** satellite

2002

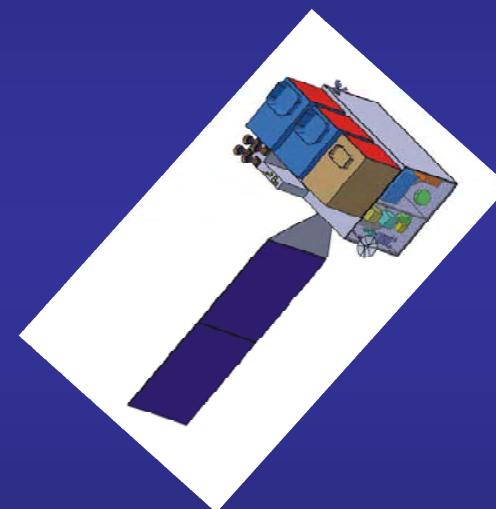
MSG



- 2 observation missions:
- SEVIRI: 12 channels
 - GERB
 - **Spinning** satellite

2015

MTG



5 observation missions:

- HRFI: 5 channels
- FDHSI: 22 channels
- Lightning Imager
- Infra-Red Sounder

3-axis stabilised satellite



*A radar view of the Earth:
ERS, ENVISAT*



The ERS (European Remote Sensing) satellites use radar instruments to survey the Earth's surface day & night and in all weather conditions.

- ERS-1, launched in 1991 ended its mission in March 2000.
- A second ERS satellite (ERS-2) was launched in 1995, with an additional instrument for ozone monitoring. A constant flow of data from ERS-2 provides information on status and changes of:
 - Ocean currents, sea surface and ocean winds
 - Polar ice caps & ice movement
 - Atmospheric ozone.



*ENVISAT:
focusing on the environment.*



ENVISAT is the largest and most ambitious Earth observation satellite ever built.

8 ton spacecraft launched in 2002 by an Ariane-5 into polar orbit at an altitude of 800 km. Payload consisting of 10 instruments to monitor the earth system and providing:

- a smooth transition from the measurements taken by ERS-1 and ERS-2 (radar in particular)
- new data on marine biology and atmospheric chemistry.

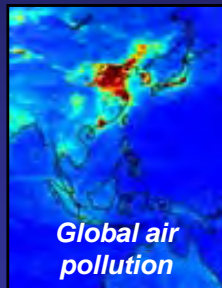
Along with ERS-2, it provides a continuous supply of services to scientists and operational users over almost 20 years in the field of:

- Crop inventories and forest management
- Tropical deforestation
- Biodiversity
- Natural disasters / damage assessment (flooding, forest fires, earthquakes, volcanic eruptions, etc.)
- Generation of digital terrain models
- Ozone layer / monitoring of ozone layer depletion and green house effect.

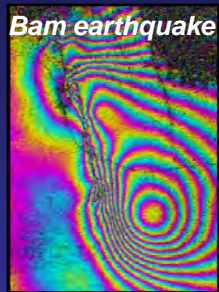


ENVISAT mission: 7 years !

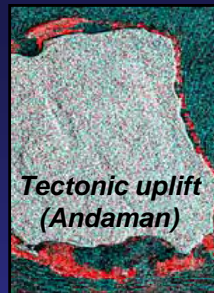
First images



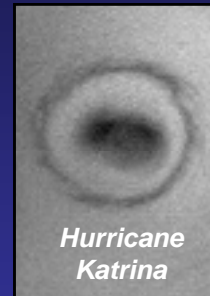
Global air pollution



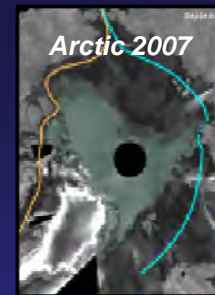
Bam earthquake



Tectonic uplift (Andaman)



Hurricane Katrina



Arctic 2007

~2000 scientific projects

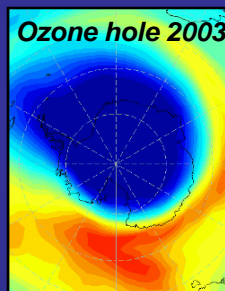
+ several GMES pre-operational projects



Launch



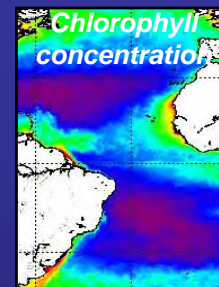
Prestige tanker oil slick



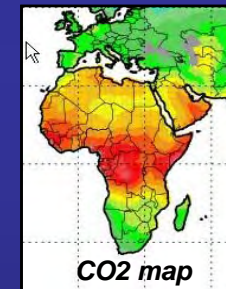
Ozone hole 2003



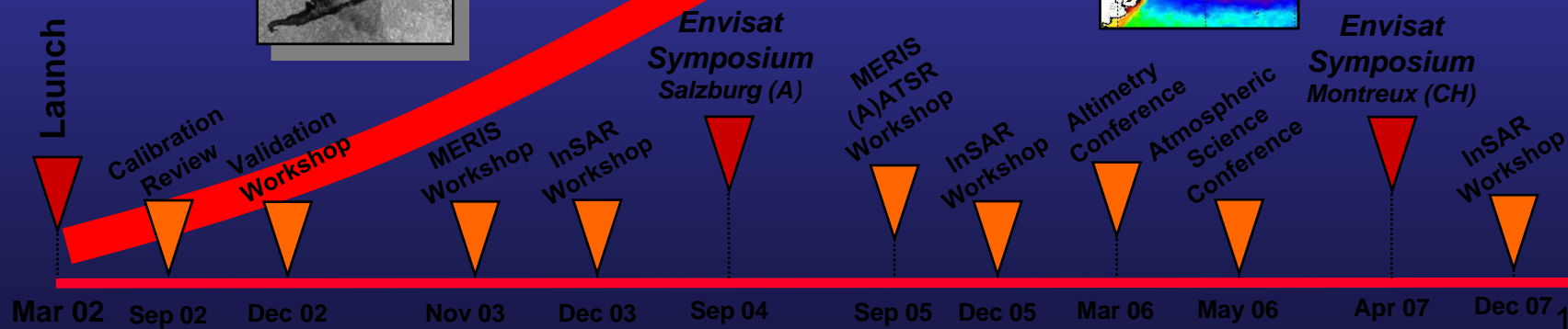
B-15A iceberg

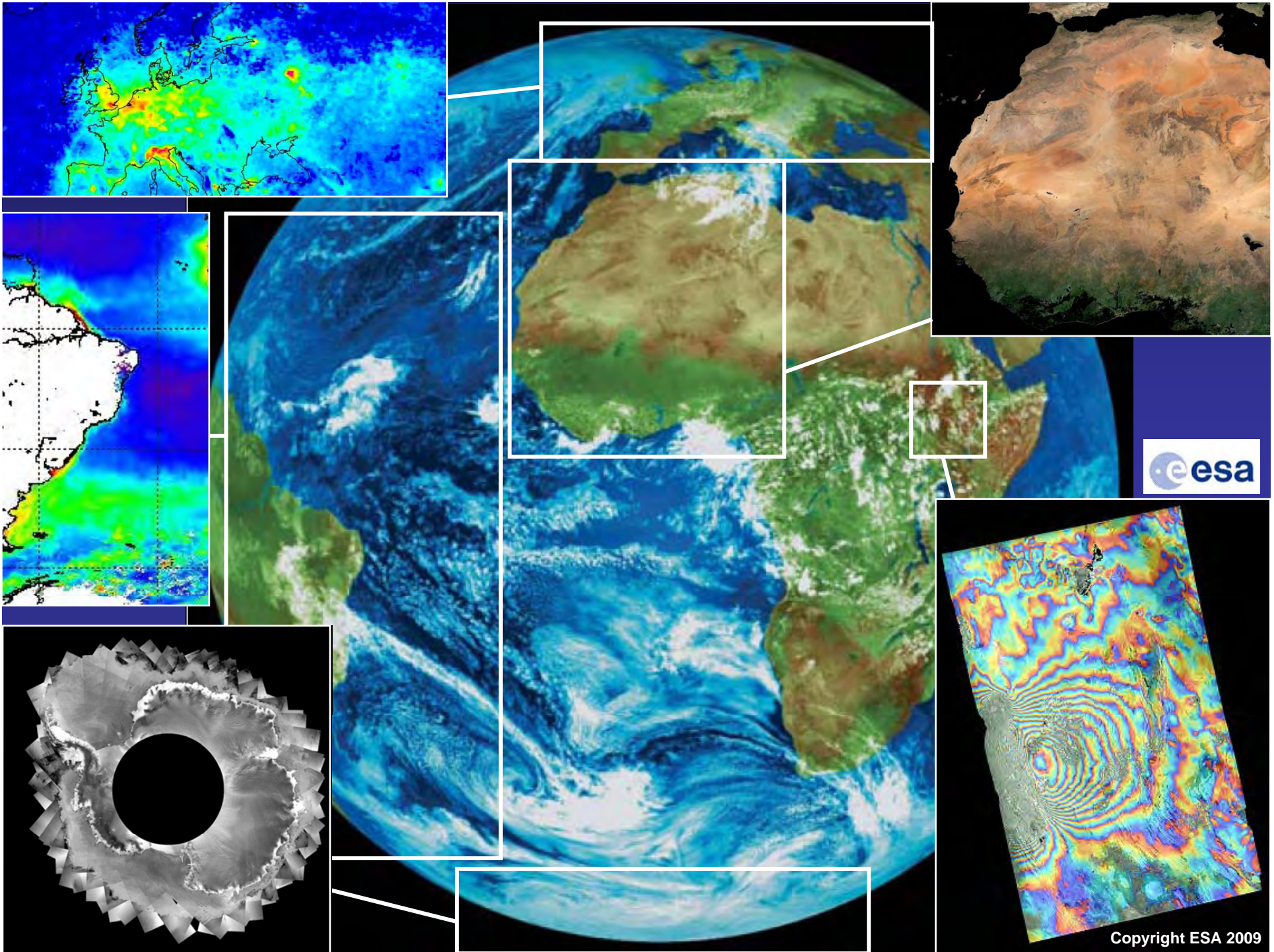


Chlorophyll concentration



CO2 map

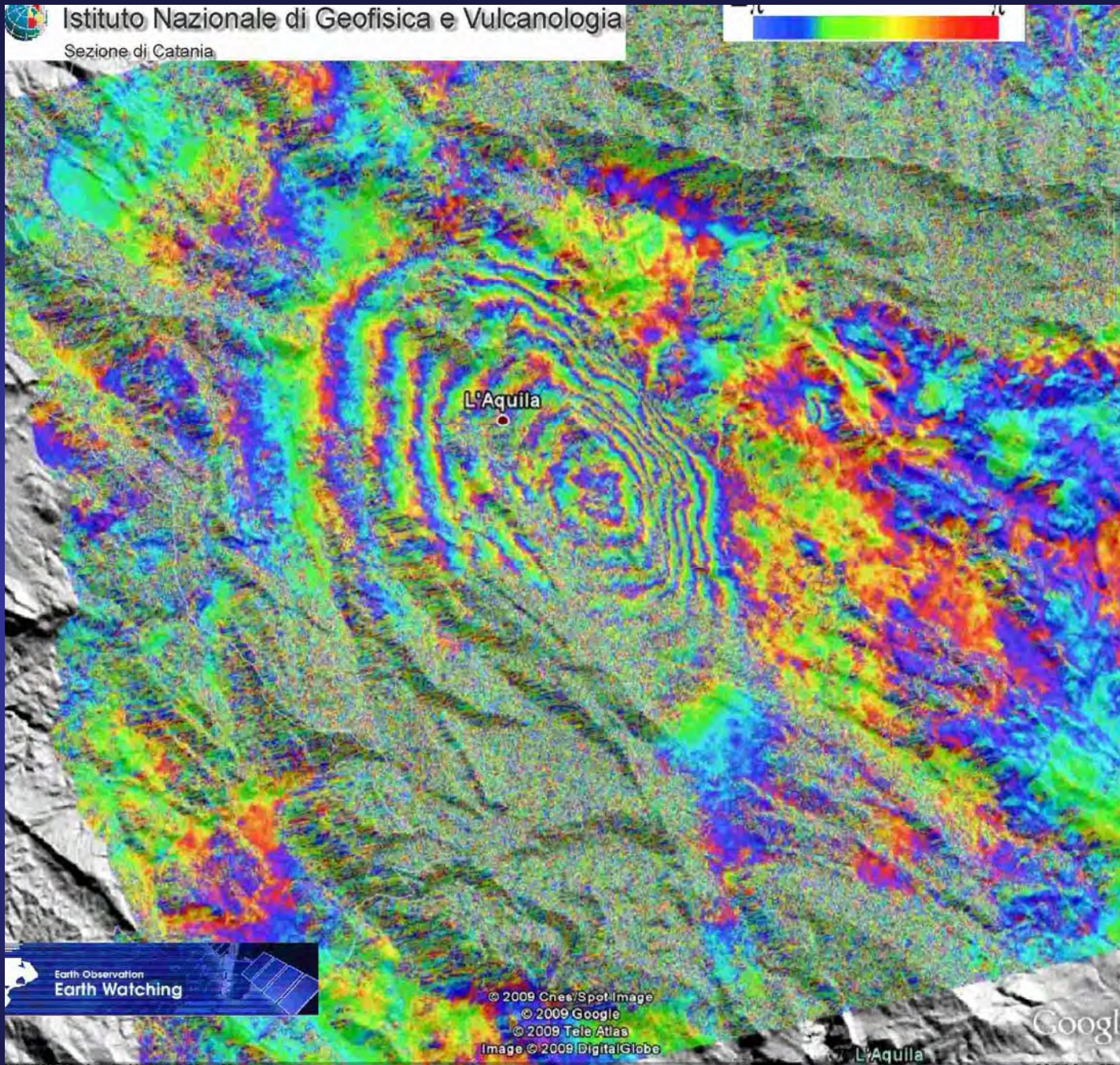






Istituto Nazionale di Geofisica e Vulcanologia

Sezione di Catania

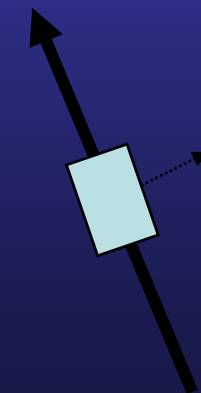


A sad recent application :

Abruzzo earthquake deformation field mapping with radar interferometry

(April 2009)

ENVISAR ASAR ascending geometry





Istituto Nazionale di Geofisica e Vulcanologia
Sezione di Catania

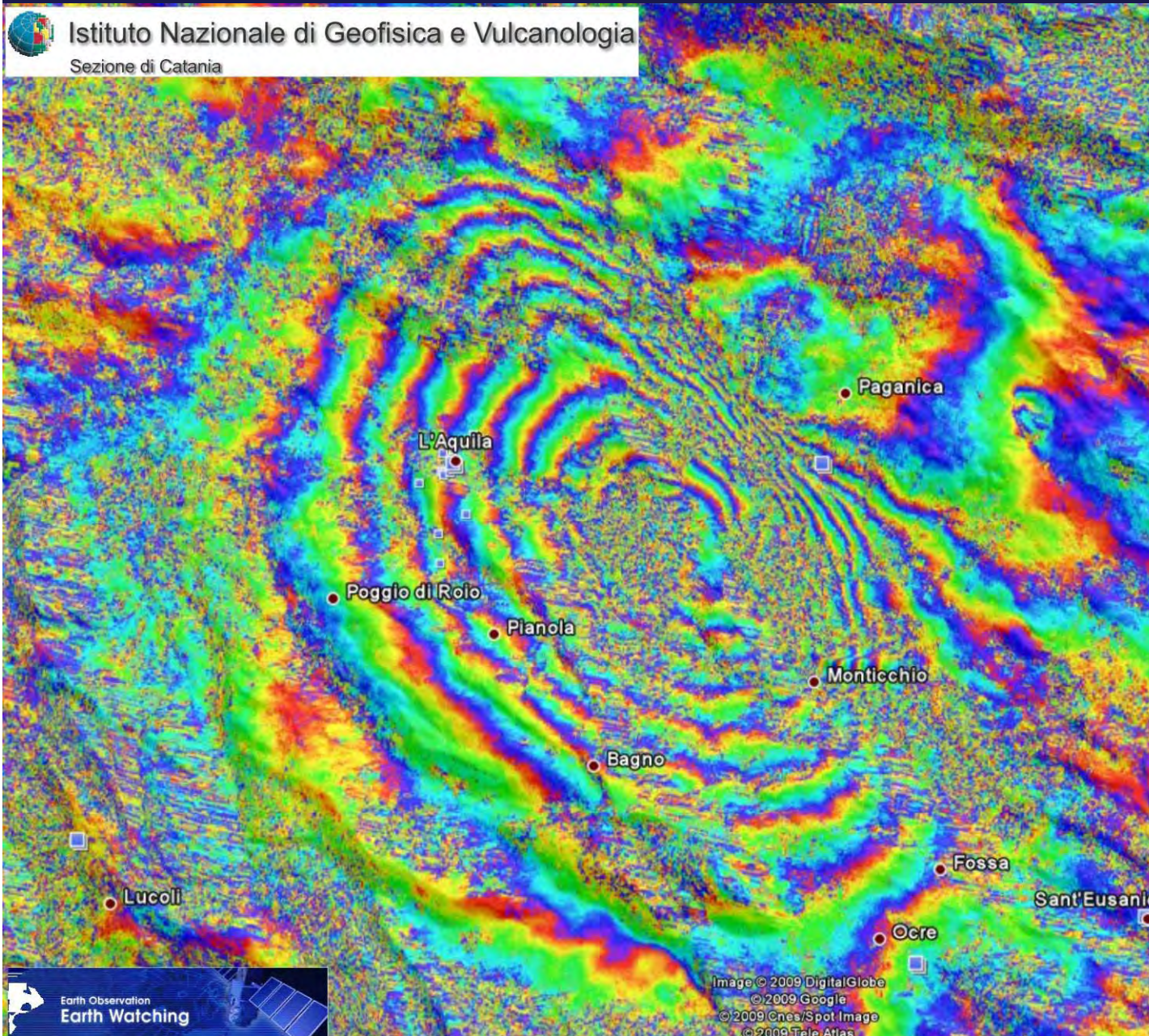


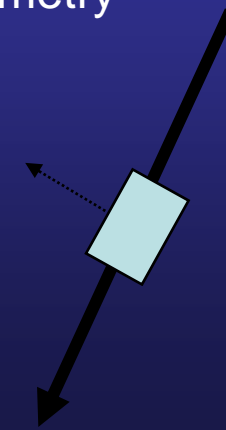
Image © 2009 DigitalGlobe
© 2009 Google
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© 2009 Tele Atlas

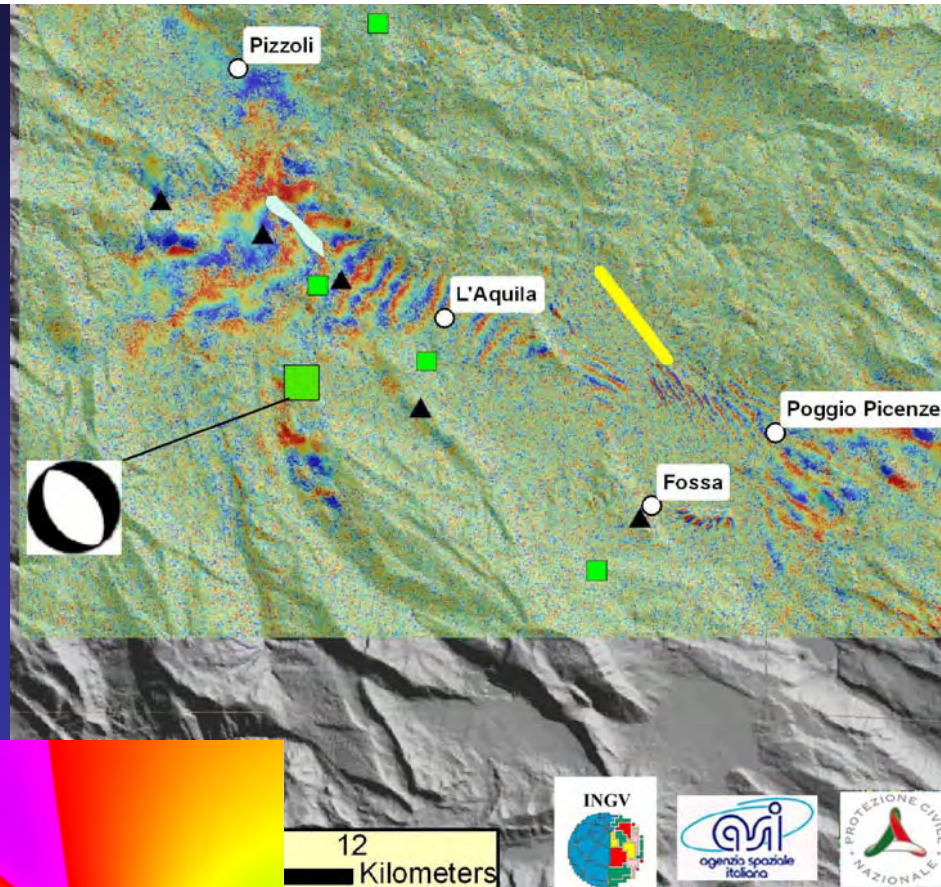
A sad recent application :

Abbruzzo earthquake deformation field mapping with radar interferometry

(April 2009)

ENVISAR ASAR descending geometry

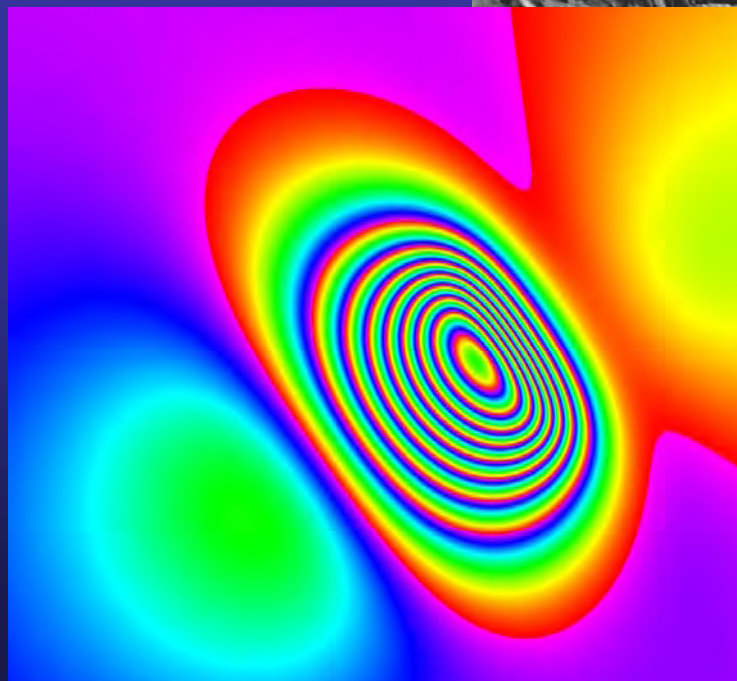




A sad recent application :

Abbruzzo earthquake deformation field mapping with radar interferometry

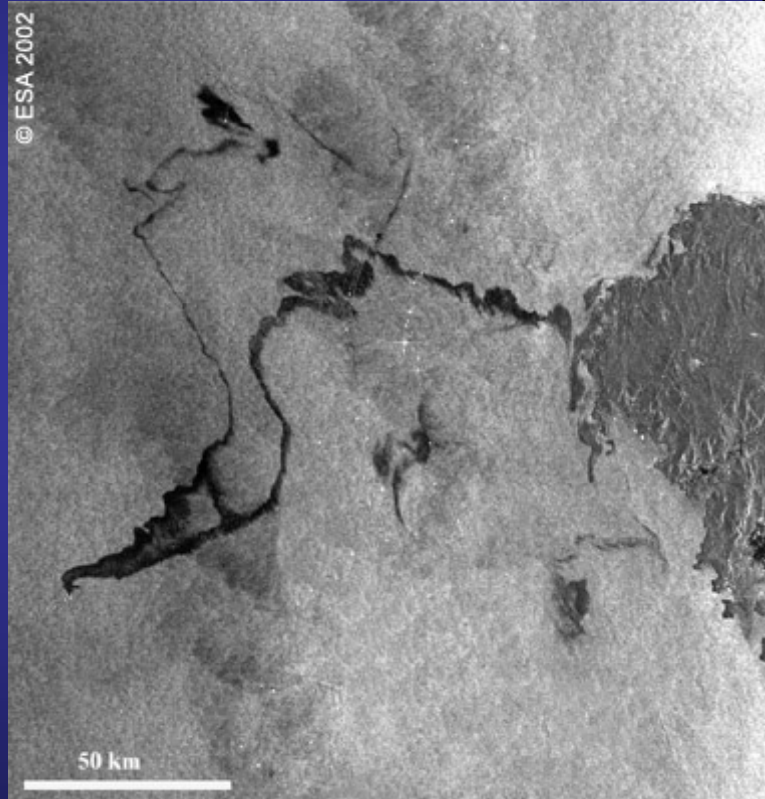
COSMO-SkyMed interferogram



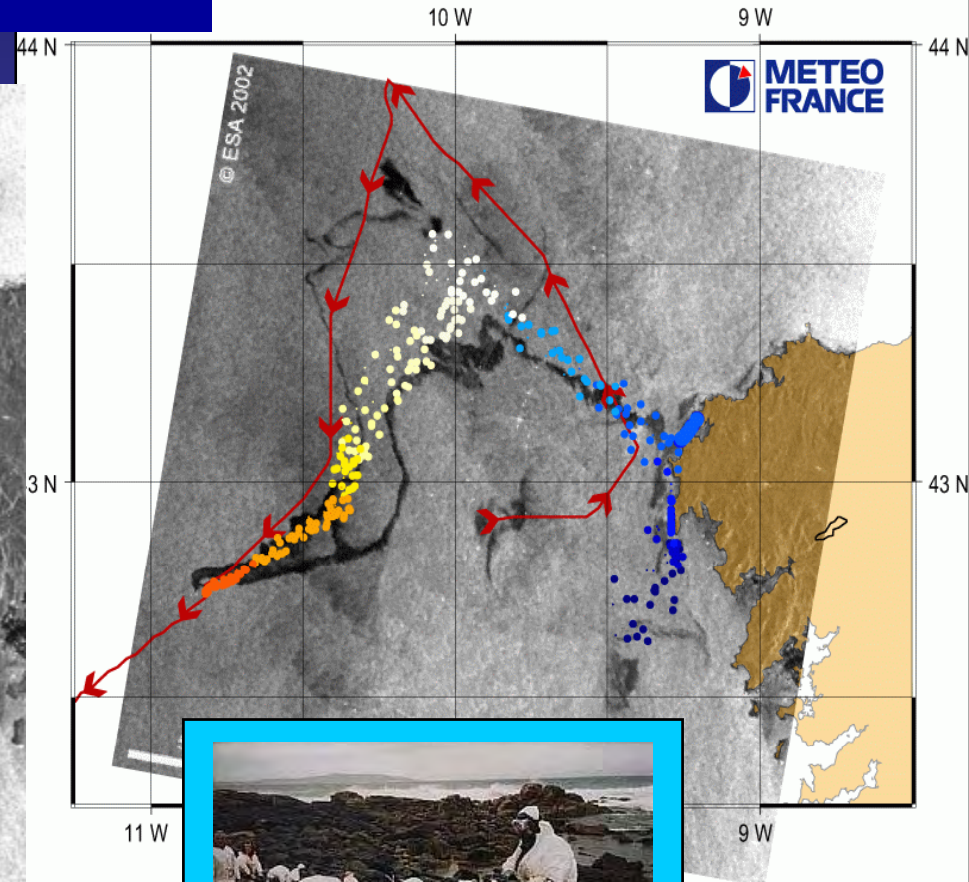
Model (P.Briole, ENS Paris)



Oil slick of "Prestige" tanker accident viewed by Envisat

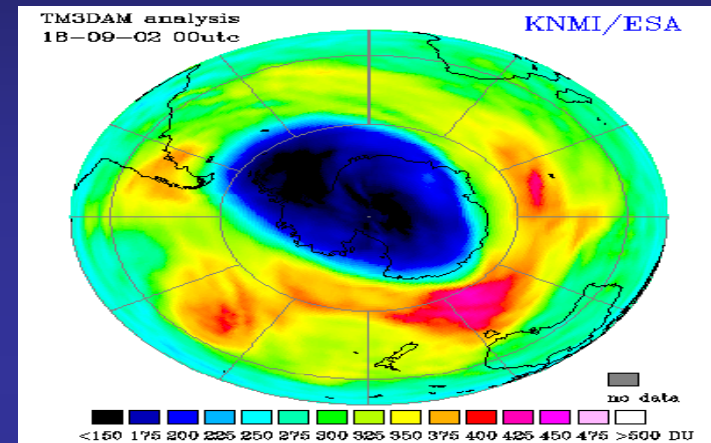


MOTHY
prévision pour le 17/11/2002 à 11 utc

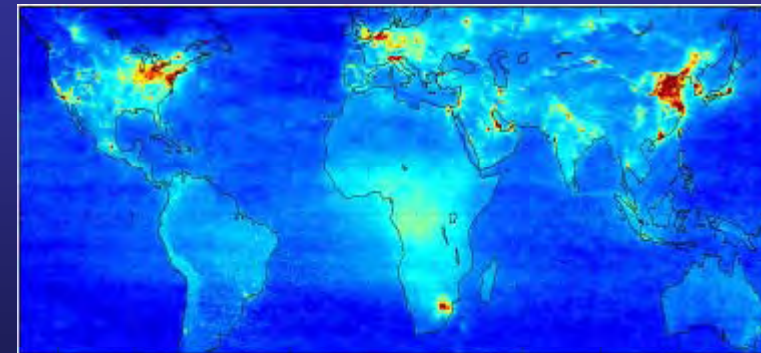


Major scientific results of ENVISAT and ERS

- **Climate change:** Global sea level rise of ~3mm/year and sea surface temperature increase of ~0.1 deg. C since 1992
- **Atmosphere:** Worldwide monitoring of air pollution, evidence of fast growing air pollution in China since 1995
- **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



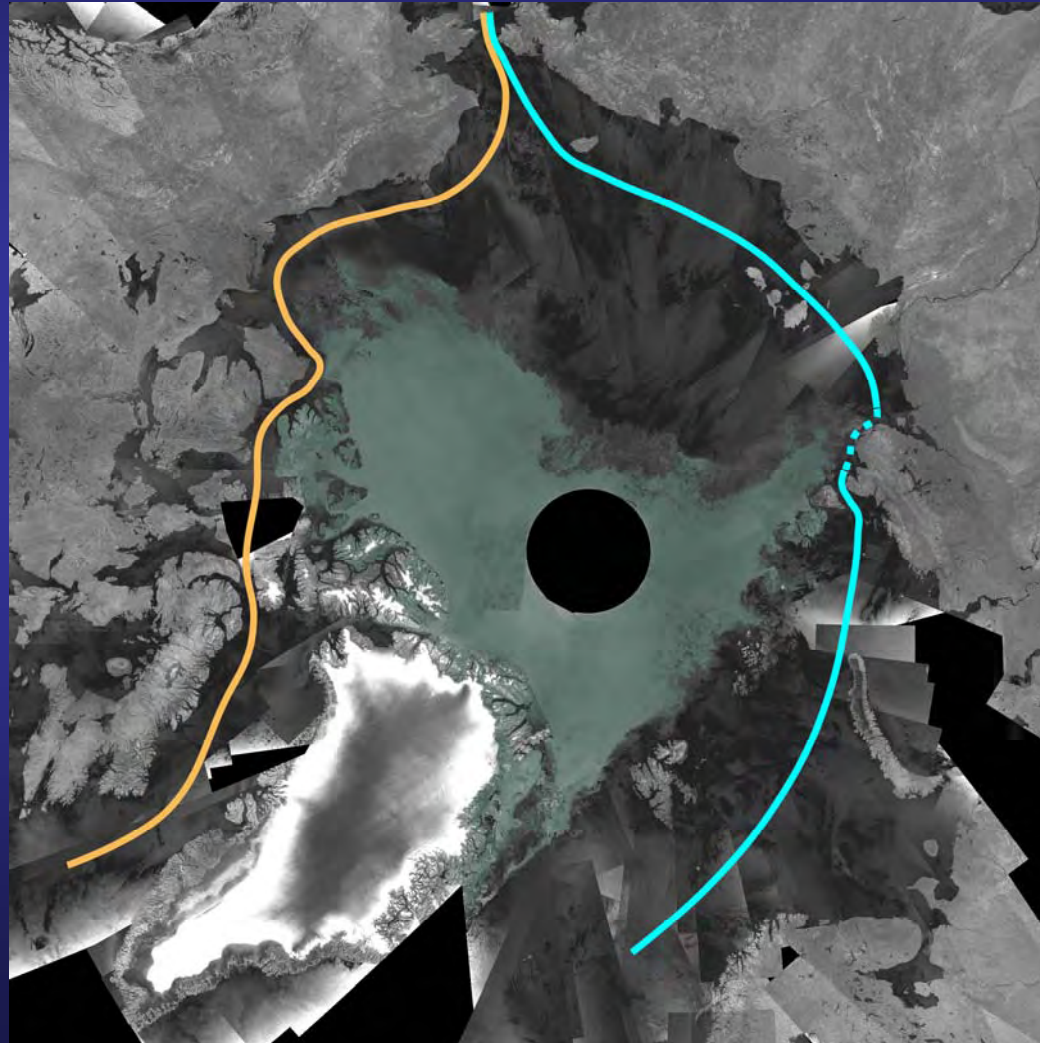
Ozone hole



NO₂ from SCIAMACHY
(Jan. 2003 - June 2004)

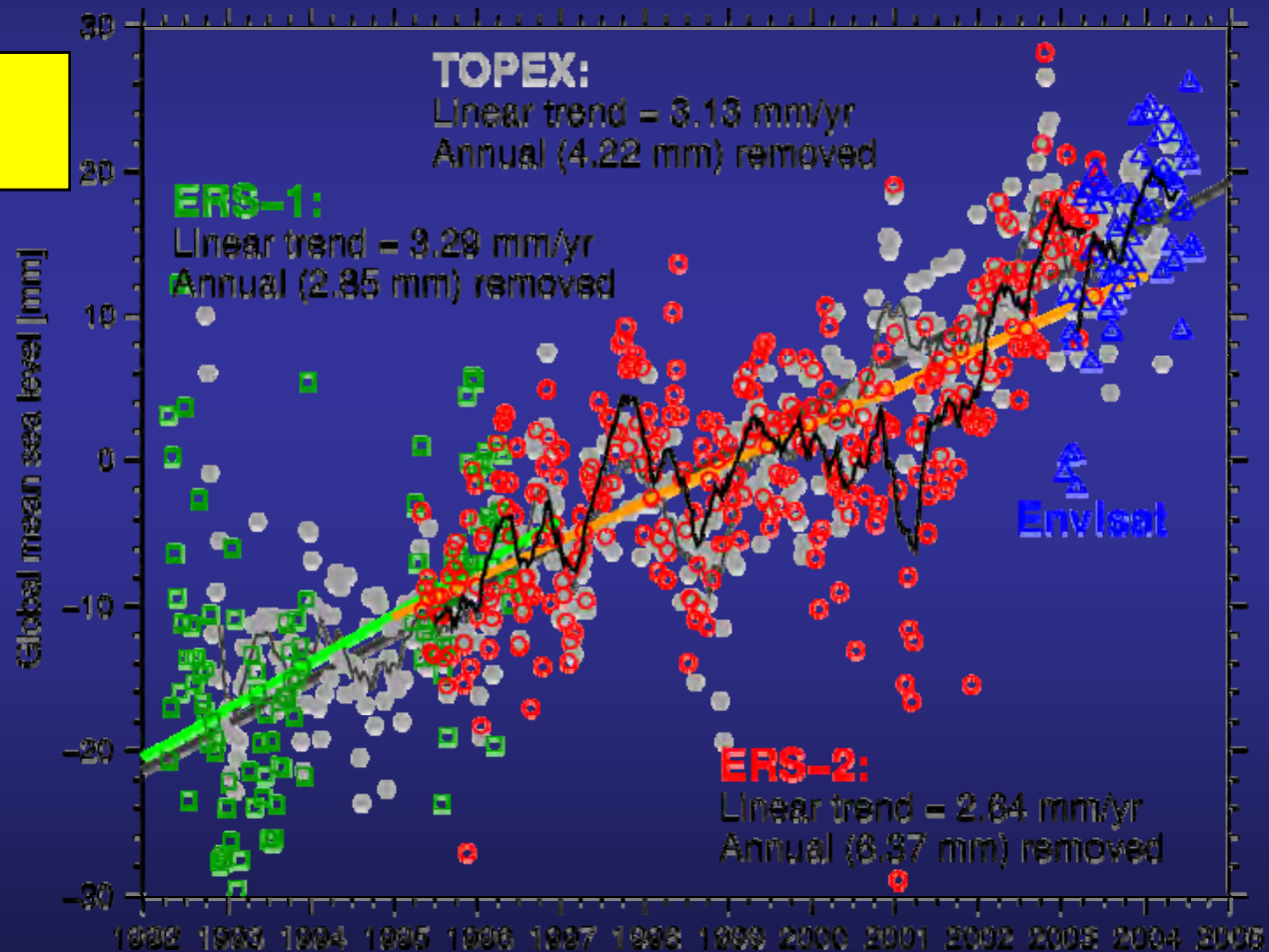
Lowest Arctic ice coverage (summer 2007)

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.



The ENVISAT altimeter provides continuity to the measurements initiated in the early 1990

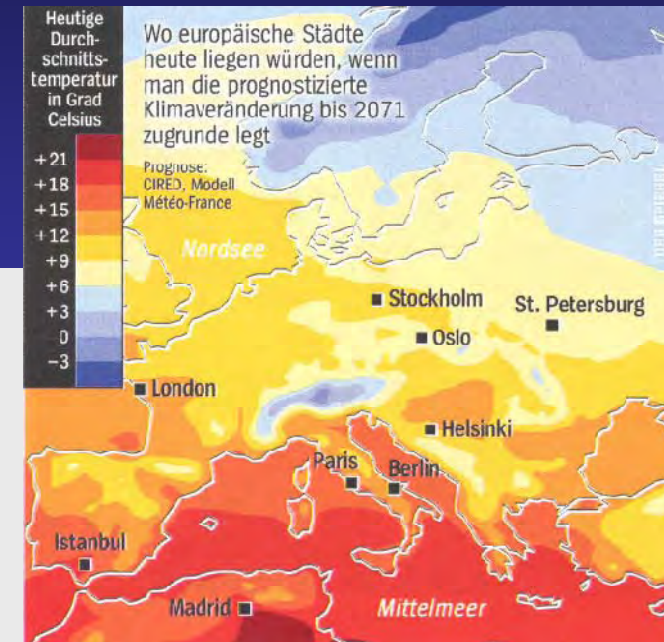
Sea level rise
Trend: +3 mm/yr



The IPCC Report 2007

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



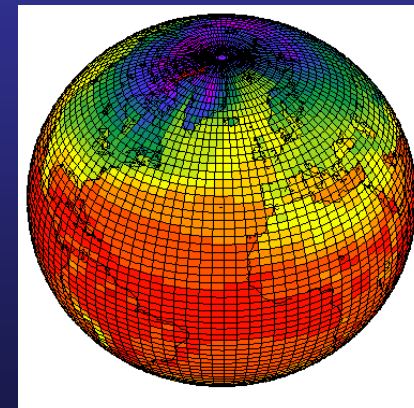
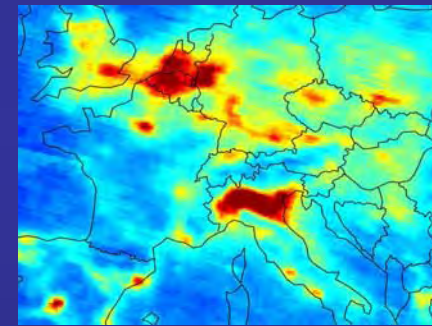
Space-based data contribute to global change monitoring

UNFCCC Conference 2007 Bali Action Plan

*“parties should describe the status of their programmes for contributing observations of the **essential climate variables** (ECVs) to the international community”*

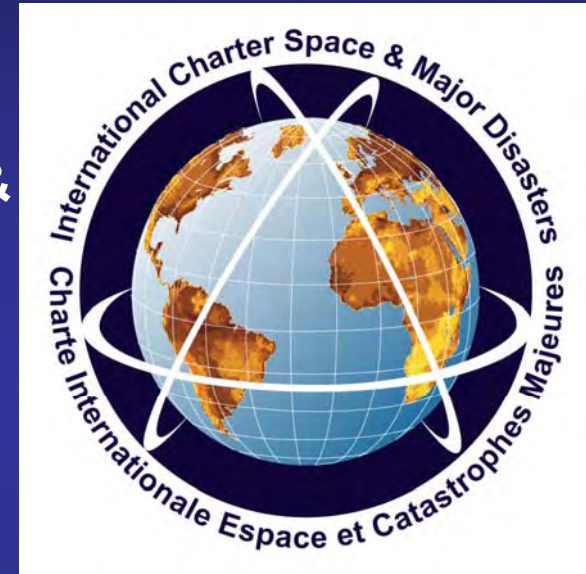


- Earth observation from space plays a vital role in this endeavour
- ESA through CEOS has committed to deliver global observations of ECV and associated products
- ESA has 30 years of archived data and will concentrate on those ECV which can be fed by ESA data



The International Charter on Space and Major Disasters

- Unified system of space data acquisition & delivery in case of natural or human-made disasters
- Data delivery to civil protection agencies, emergency & rescue services



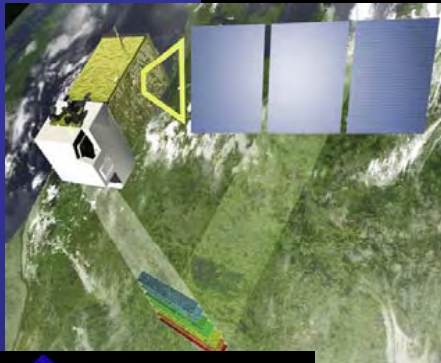
Examples of activations:

- **Bam Earthquake 2003**
- **Darfur Crisis 2004**
- **Tsunami Catastrophe 2004/2005**
- **Hurricane Katrina 2005**
- **Fires in the Mediterranean region (Italy, Greece) 2007**
- **Cyclone Nargis 2008**





*GMES Space Component:
space infrastructure in support of European
policy priorities.*



GMES (Global Monitoring for Environment and Security). Jointly led by ESA and the European Commission, it will be the European contribution to the Global Earth Observation System of Systems (GEOSS), for environment and security monitoring

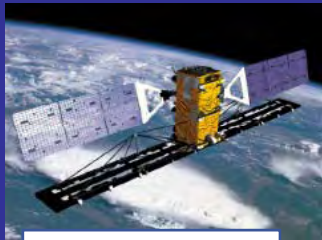
GMES space segment (after 2011):

- Sentinel-1: Imaging radar mission (all weather, day/night)
- Sentinel-2: Land monitoring mission (Superspectral imaging)
- Sentinel-3: Global ocean (and land) monitoring mission
- Sentinel-4,5: Atmospheric chemistry missions in GEO and LEO.

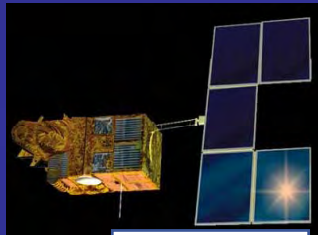
GMES ground segment:

- Provision of Earth observation data for GMES services
- Access to ESA, Eumetsat, national and third party missions.

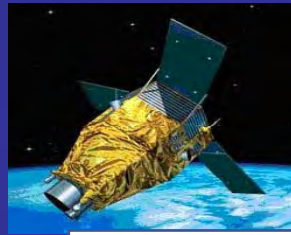
National, Eumetsat and Third Party Missions for GMES



Radarsat



SPOT



Pleiades



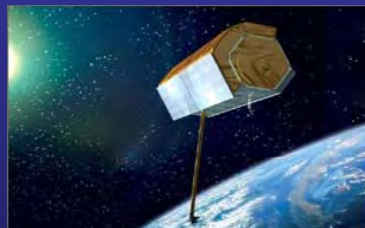
Jason-2



CosmoSkymed



TopSat



Terrasar-X



RapidEye



UK-DMC



METOP



2008-Aug-09 09:47:01 UTC

Lat : 0.0000
Lon : 0.0000
MLST : 09:47:01
SZA : 37.59 deg
Range : 13923 km
Altitude : 13923 km

Intersection Mode ON
Auto Steering ON

w32 Aug-2008 w33 Aug-2008 w34 Aug-2008 w35 Sep-2008 w36 Sep-2008
9-Aug-2008 09:47:10



SAVDIR - Swath Acquisition Viewer - © European Space Agency - Taitus Software

Heliosynchronous orbits, LEO

The Earth Explorer Missions

In order to better understand the Earth

Research oriented, focused on specific topics/techniques

GOCE



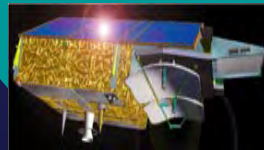
SMOS



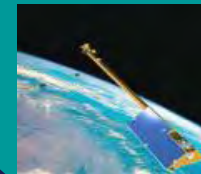
**ADM
AEOLUS**



**CRYOSAT
2**

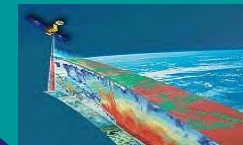


SWARM



7th EE

**EARTH
CARE**





The Earth Explorer Missions

GOCE: Gravity field and steady-state Ocean Circulation Explorer

GOCE_liftoff_36s.wmv



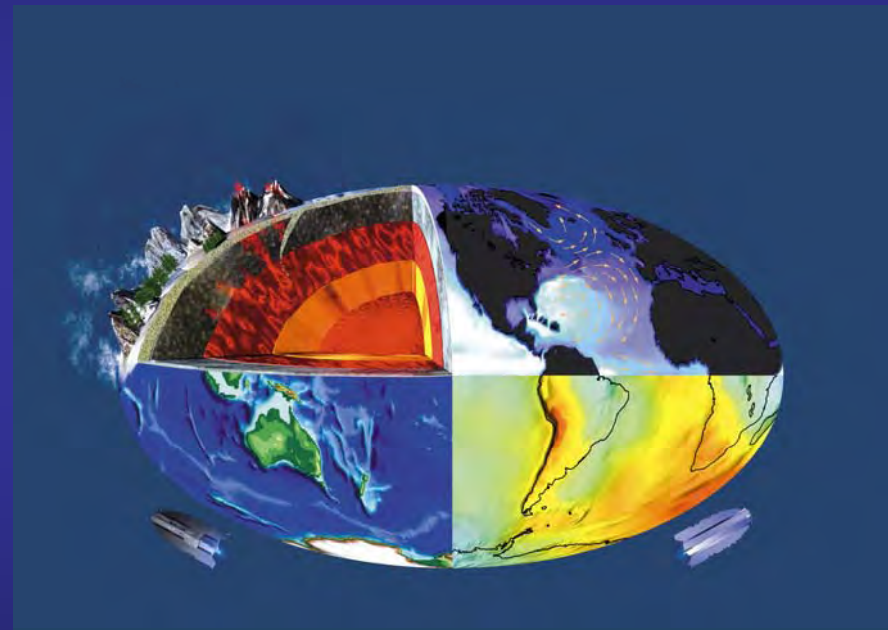
17 March 2009

15:21



The Earth Explorer Missions

GOCE: Gravity field and steady-state Ocean Circulation Explorer



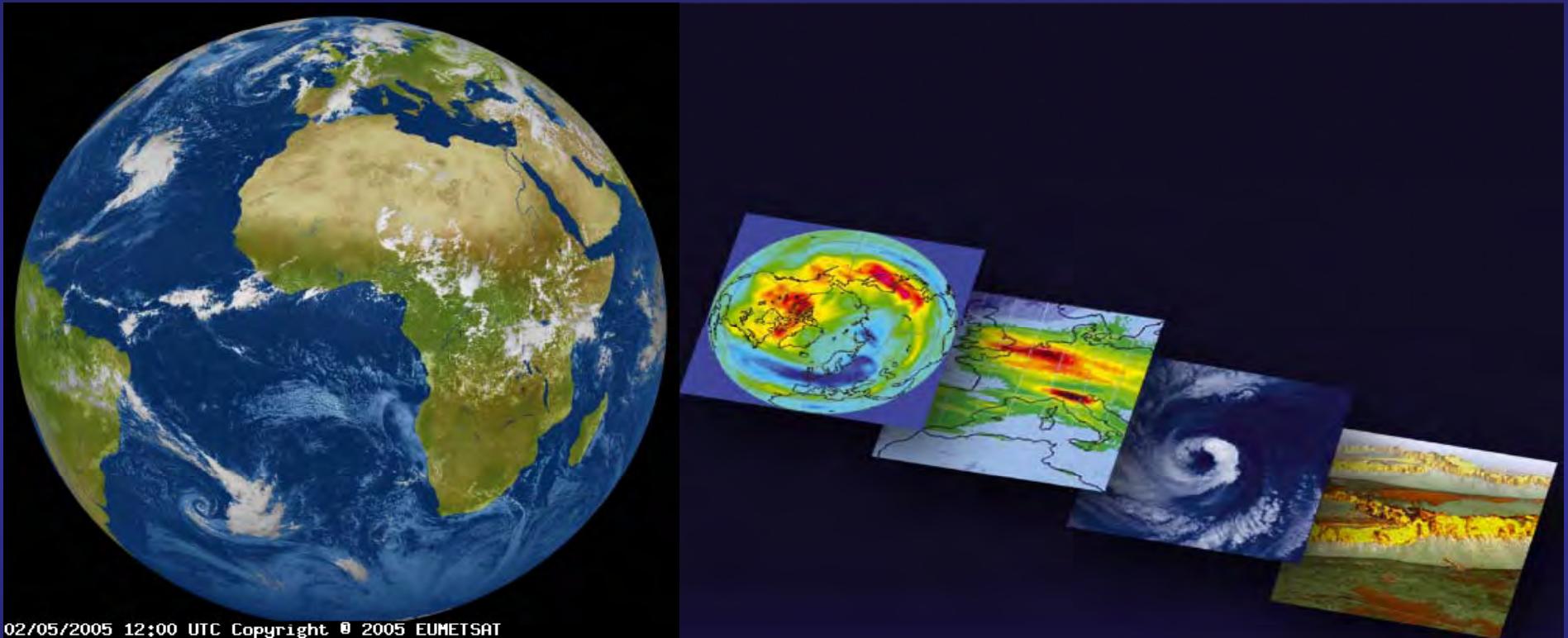
Applications :

Precise measurement of earth gravity field in order to better understand the earth interior and ocean circulation (geodynamics, oceanography, geodesy...)

**Earth Observation:
a tool for multidisciplinary
Education in secondary
schools**



Explaining to kids why “Earth Observation”?



02/05/2005 12:00 UTC Copyright © 2005 EUMETSAT

Answering mankind questions... where we are and how the earth system works

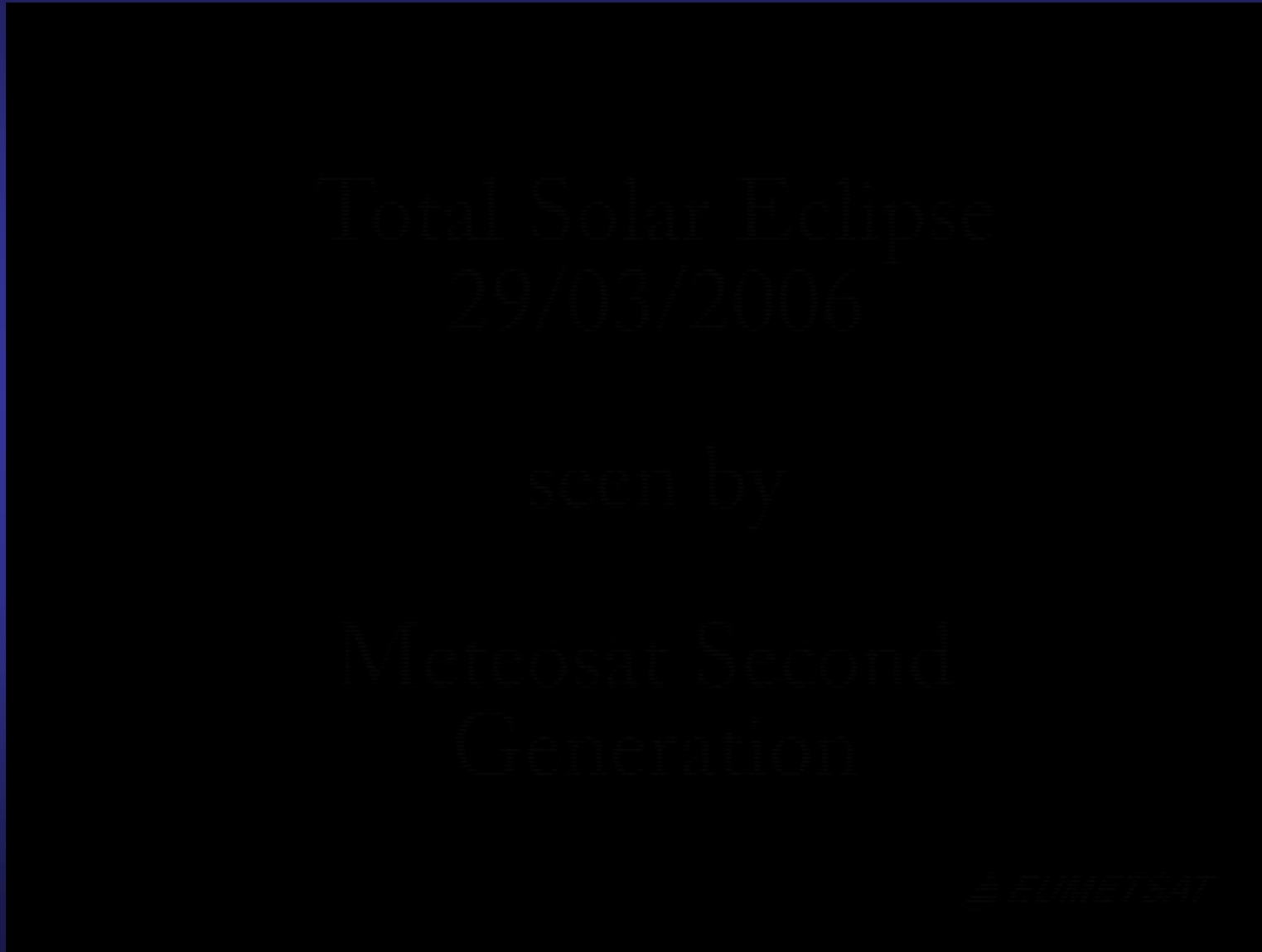
In order to better observe the earth (and not only), man always wished to fly, higher and higher

The moon, our natural satellite:



- distance 384.403 km
- radius 1.700 km, 1/4 of the earth's one
- Double planet earth-moon





The satellite “earth”

Historical references: heliocentric and geocentric system

- Galileo, Kepler, Copernicus
- universal gravitational law
- Keplerian orbits
- Orbital elements



References:

- Mars express, Rosetta, Ulysses, lunar missions
- Astronomic missions: Hubble, ISO, XMM



EarthMars.avi



geostationary satellites

- Meteosat, MSG
- 36.000 km from earth (6 earth radii)
- GEO Orbit



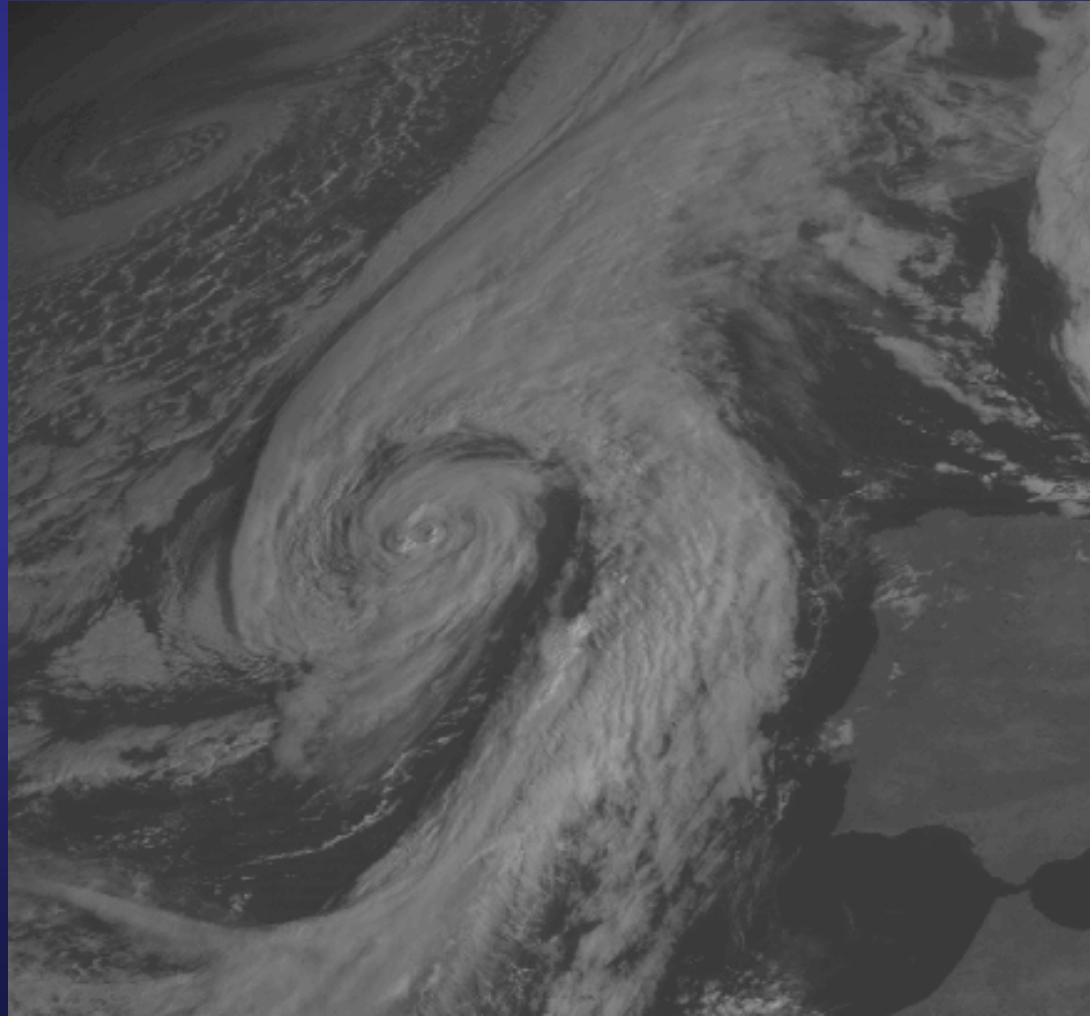
Applications: METEOROLOGY CLIMATOLOGY



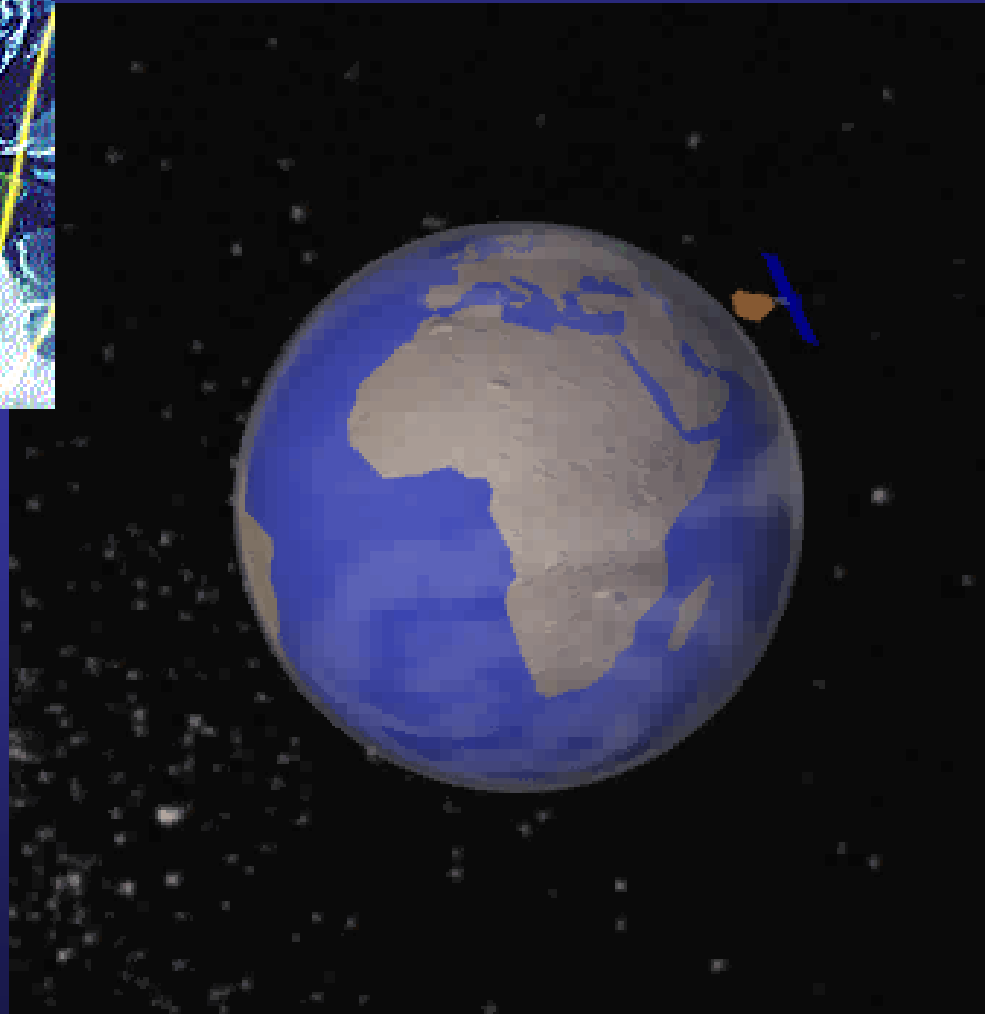
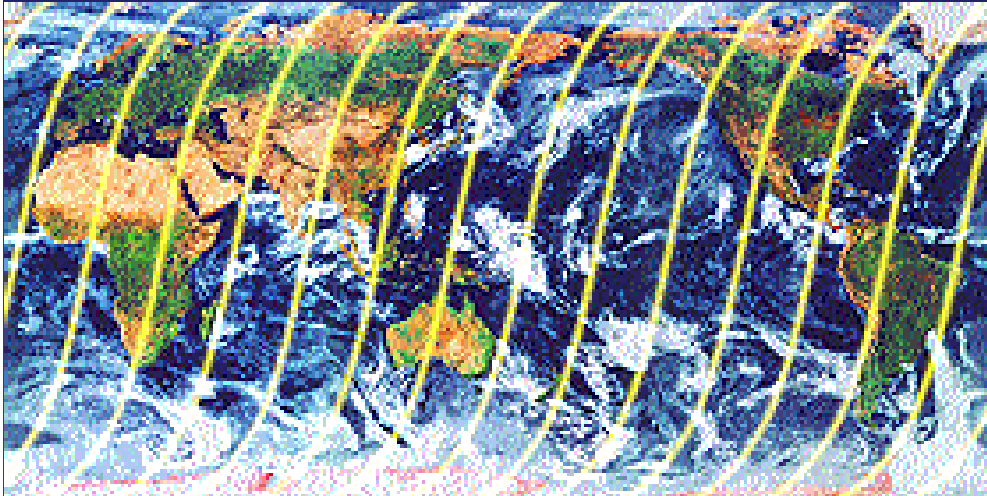
- Many images per day (MSG: one every 15 min)
- Low Space resolution, very large coverage



geostationary satellites



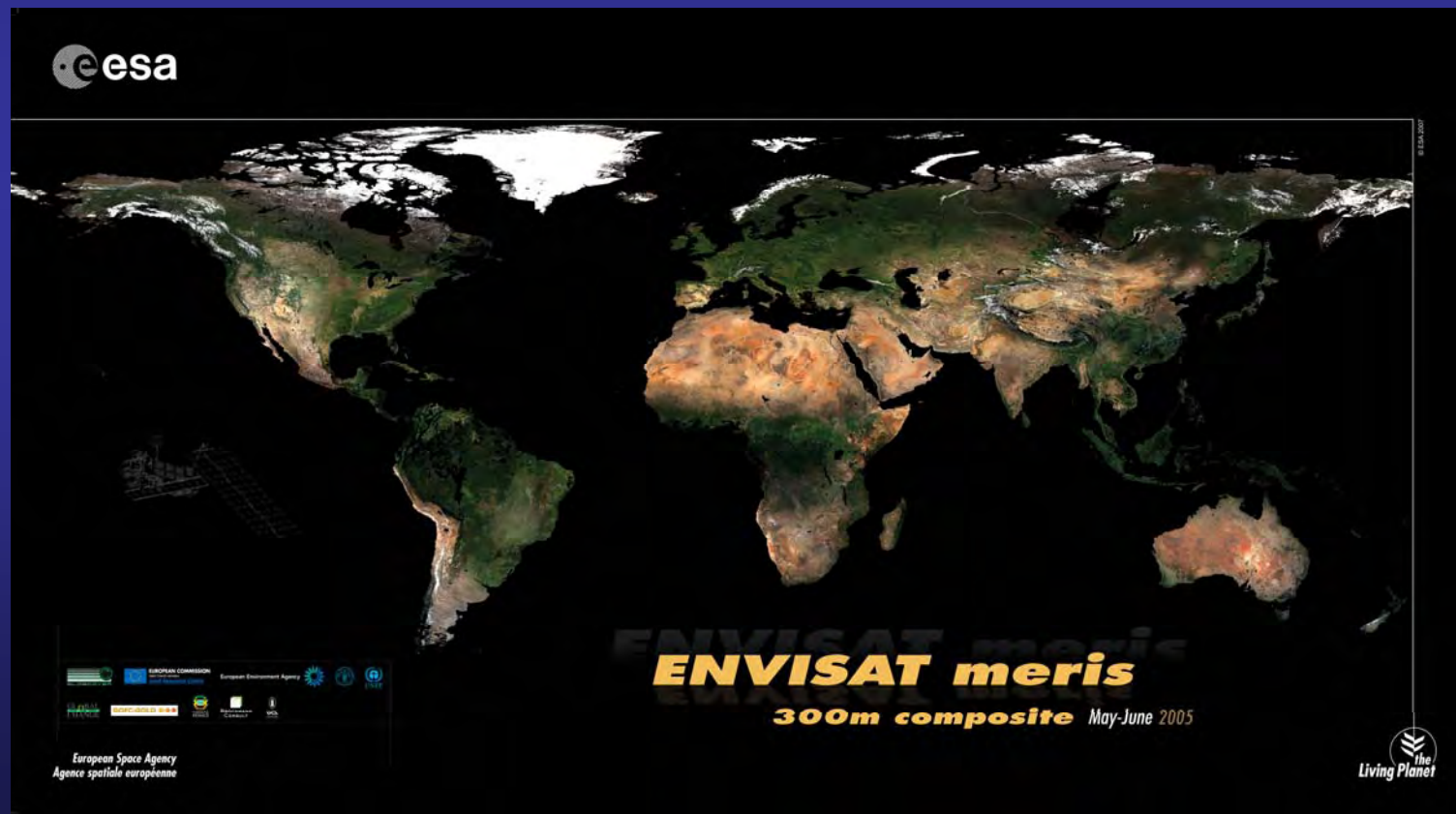
Polar Satellites



sat_polar.avi

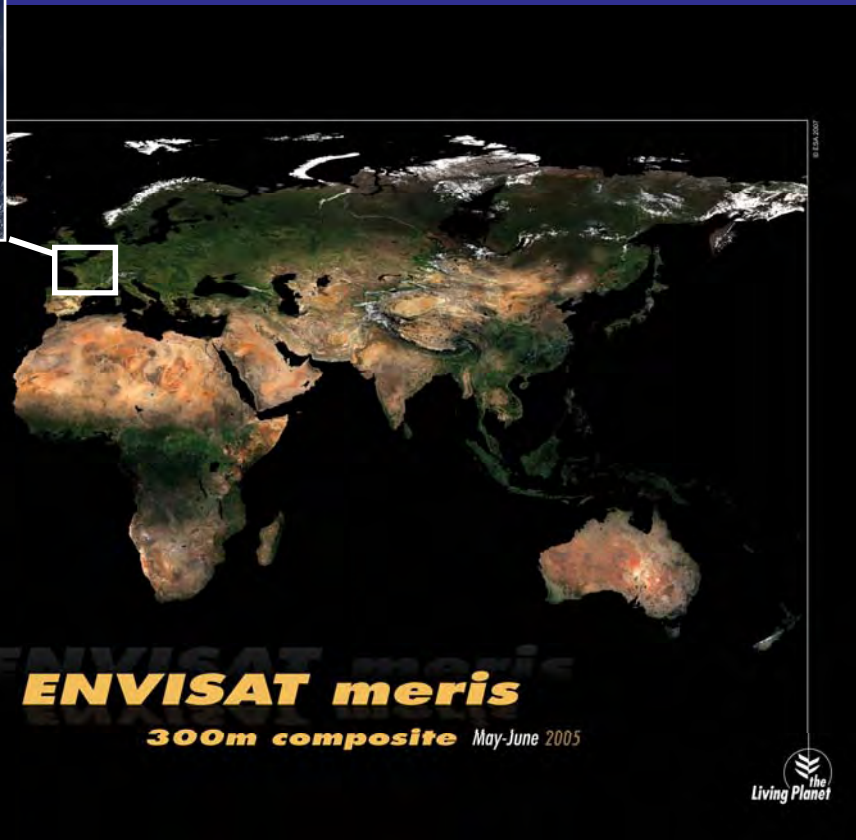


• LEO “Low earth orbits” 800 km height from the earth surface





- polar “LEO”
- high space resolution ... smaller coverage but with details



European Space Agency
Agence spatiale européenne

the
Living Planet



- polar “LEO”
- high space resolution ... smaller coverage but with details

Download recent ones from MIRAVI



ESA Earth Observation Education: available tools for schools

International Co-operation

<http://www.ceos.org/>

The CEOS strategy for Earth observation education and training is the creation of an effective coordination and partnership mechanism among CEOS agencies and institutions offering education and training.

<http://www.eohandbook.com/>



- CEOS Main
- CEOS Home
- Background
- Organization
- Membership
- Contacts
- Acronyms
- External Links and Docs

- CEOS Business
- Calendar
- Meetings
- Actions and Documentation
- Publications & Services

- Strategic Groups
- SIT - Strategic Implem. Team
- SEO - Sys. Engineering Office

- Working Groups
- WGCV - Calibration/Validation
- WGEdU - Education
- WGISS - Information Systems
- WGCV - Test Site
- WGEdU - Test Site
- WGISS - Test Site

- Constellations
- ACC-Atmos Composition
- LSI-Land Surface Imaging

Welcome to the CEOS Homepage

Established in 1984, the **Committee on Earth Observation Satellites (CEOS)** coordinates civil space-borne observations of the Earth. Participating agencies strive to enhance international coordination and data exchange and to optimize societal benefit. Currently 28 space agencies along with 20 other national and international organizations participate in CEOS planning and activities.

For more information about CEOS, how to add events to the CEOS calendar, how to access the CEOS Actions/Documentation, or to update web content, please contact:

Brian Killough, NASA SEO (Brian.D.Killough@nasa.gov) or **Kenneth McDonald**, NOAA SIT (Kenneth.McDonald@noaa.gov)



Recent News and Events

[CEOS Newsletter #32](#)
February 2009

[CEOS Flyer for GEO-5](#)
November 2008

[CEOS Brochure](#)
October 2008

CEOS SIT-23 Meeting



The 23rd CEOS SIT Meeting was held in Cocoa Beach, Florida, USA on March 3-5, 2009 at the Doubletree Hotel Cocoa Beach Oceanfront. Details regarding the meeting can be found at <http://www.ceos-sit23.com>



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THE EARTH OBSERVATION HANDBOOK

Climate Change Special Edition 2008




Beta online database

<http://wgedu.ceos.org> reference to courses, case studies, satellite data, links to education sites

The CEOS Working Group on Education and Training (WGEdu) links to a large database of free EO Educational material

http://www.acrors.ait.ac.th/ceos/home1_e.html


<http://wgedu.ceos.org> reference to courses, case studies, satellite data, links to education sites of various institutions through the internet




Working Group on Training and Education (WGEdu)

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[Overview](#) | [Strategy](#) | [Educational Resources](#) | [Events](#) | [Documents](#)




The CEOS strategy for Earth observation education and training is the creation of an effective coordination and partnership mechanism among CEOS agencies and institutions offering education and training. The CEOS Working Group on Education and Training (WGEdu) was established by the 13th CEOS Plenary in November 1999. Tasked to develop a plan for future CEOS activities in education and training particularly in developing countries, a coordination and partnership mechanism between CEOS agencies was established. The goal of the WGEdu is to facilitate activities that enhance international education and training in Earth observation techniques, data analysis interpretation, and applications.



Working Group on Training and Education (WGEdu)

[WGEdu Home](#) | [Contact Us](#) | [CEOS Site](#)

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Search - Educational Materials

Search for free Earth observation Educational Materials

Search by Keyword: (optional)
Keyword examples: Landsat, satellite, IRS, MOS, ERS, SPOT, J-ERS, CASI, SFSI, SWIR, RADARSAT

Type of Materials

- ALL
- Schools and Universities
- Geomatics Professional

Resource Type

- ALL
- Case Studies
- Reference Materials
- Tutorials
- Workshop Materials

Format

- ALL

International Co-operation with Africa:

TIGER Training Courses

(following the 2002 Johannesburg World Summit on Sustainable Development), focusing on the use of space technology for water resource management in Africa. Series of training courses on a variety of applications and techniques.

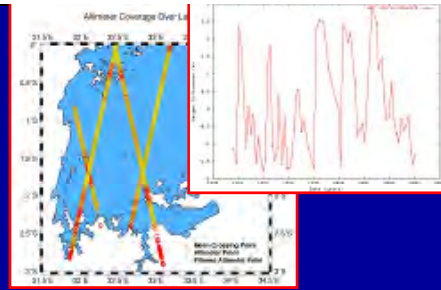


TIGER Initiative
Looking after water in Africa

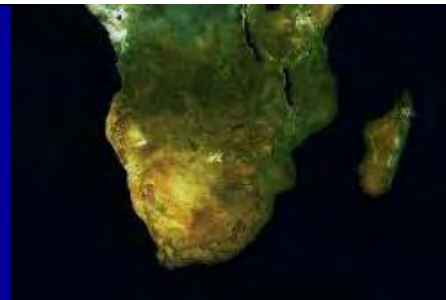




Wetlands Mapping



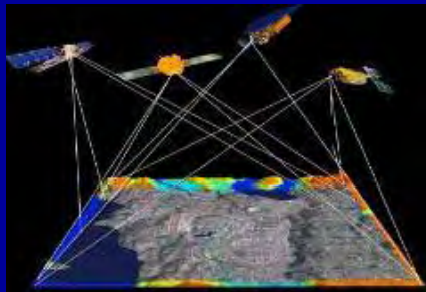
Rivers-Lakes-Water levels



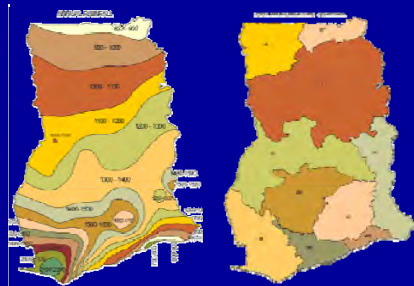
Soil Moisture-SADC



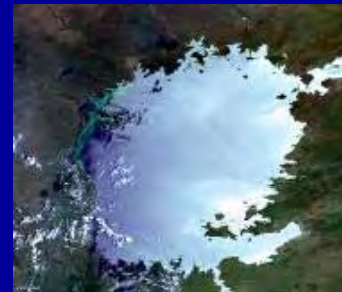
Nile Awareness Kit



Land and Topo. -Ghana.



Hydrogeo. Model-Ghana



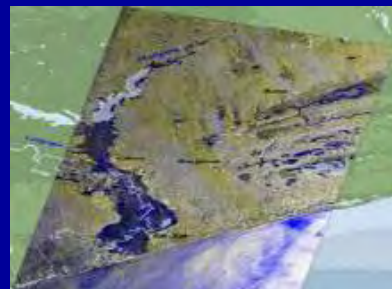
Lake Quality-Victoria



Lake Quality-Egypt



IS for IWRM-Morocco



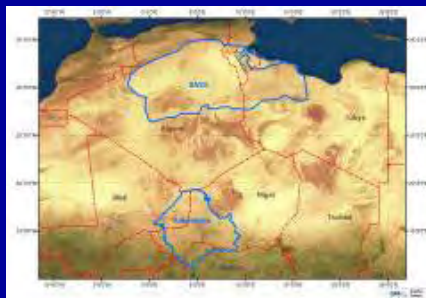
IS for IWRM- Mozambique



IS for IWRM-Zambia



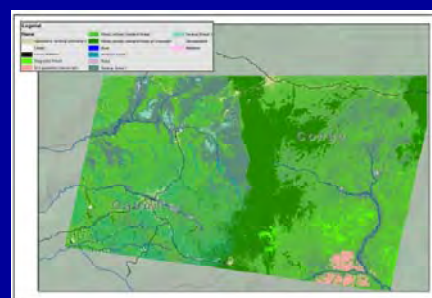
IS for WRM-Burkina Faso



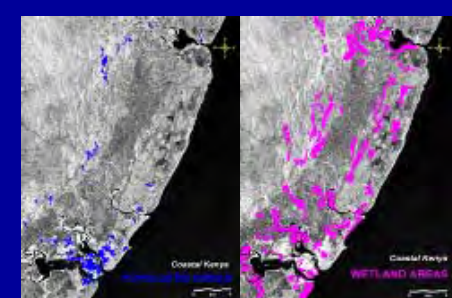
AQUIFER



Water & Ground str.-Niger



EPIDEMIO



Malaria-mapping

International Co-operation with China:

DRAGON Training Courses



esa European Space Agency

ESA-NRSCC Dragon Cooperation Programme

NRSCC National Remote Sensing Center of China

03-Oct-2007

Dragon Home

- Background
- Dragon Project Themes
- Dragon Partners Info
- Kick-off Symposium...
- 2005 Symposium...
- 2006 Symposium...
- 2007 Symposium...
- Related Links (NRSCC, ESA, Envisat)
- Dragon Coordinator
- Contacts
- Dragon Progress
- Meetings
- Dragon Documentation
- Photos...
- Training...
- Ocean 2007
- Atmosphere 2006
- Land 2005
- Ocean 2004
- Trainees at ESRIN 2005
- Trainees at ESRIN 2004
- Training material
- Communication material
- Dragon Results
- News
- Contact us

ESA-MOST DRAGON PROGRAMME

2nd ADVANCED TRAINING COURSE IN OCEAN REMOTE SENSING

15 to 20 October 2007
State Key Laboratory of Satellite Ocean Environment Dynamics,
Second Institute of Oceanography, State Oceanic Administration of China

INTRODUCTION

[In Chinese 中文](#)

Within the framework of the Dragon Programme, ESA and NRSCC are providing a series of advanced thematic training courses on remote sensing applications hosted by university and research institutions in P.R. China. The first of such courses was held in 2004 on ocean applications, a second course in 2005 on land applications and a third course was held in 2006 in atmospheric remote sensing.

In 2007 as part of this initiative, PhD students, post-doctoral and research scientists from P.R. China and other Asian countries interested in Ocean remote sensing applications are invited to attend a 6 day advanced training course in the subject. The objectives of this advanced Dragon training course are:

- To stimulate and support the exploitation of ESA EO and TPM remote sensing data for ocean applications
- Introduce available software tools and methods for the exploitation of ERS, Envisat, TPM and Explorer mission satellite data

The course will be hosted by the State Key Laboratory of Satellite Ocean Environment Dynamics, Second Institute of Oceanography, State Oceanic Administration, Hangzhou, P.R. China.



<http://earth.esa.int/dragon>



ESA Summer Schools on Data Assimilation at ESRIN (university and PhD level)

1st Summer School in 2002: Atmosphere

2nd Summer School in 2004: Ocean

3rd Summer School in 2006: Earth System Monitoring and Modelling

4th Summer School in 2008

All course material available on line!





ESA training courses in Europe on EO at MSc/PhD level: Land, Ocean, Atmospheric Applications (rotating)

The screenshot displays the ESA Earth Observation Principal Investigator Portal. The header includes the ESA logo and the text "Earth Observation Principal Investigator Portal" and "European Space Agency". The navigation bar contains links for "ESA", "EOPI Home", "Search", "Results", "News", "AOs", "Data Access", and "Login". The date "26-Mar-2009 UT" is shown in the top right corner.

The main content area is titled "Training & News" and features a list of training courses with associated images and "Read more" links:

- POLInSAR 2009 [ESRIN, Italy, 26-30 January 2009]** (06/2008) - Includes a satellite image of a forest.
- OceanObs'09 [Venice, Italy 21-25 September 2009]** (02/2009) - Includes an image of the ocean surface.
- Atmospheric Science Conference [Barcelona, Spain, 7-11 September 2009]** (02/2009) - Includes a satellite image of Earth's atmosphere.
- Advanced Training Course on Land Remote Sensing [Prague, Czech Rep., 28 June - 03 July 2009]** (06/2008) - Includes a satellite image of a landscape.
- 2nd MERIS/(A)ATSR User Workshop [ESRIN, Italy, 22-26 September 2008]** (06/2008) - Includes a satellite image of Earth's surface.

On the left side, there is a "New request" section with a list of categories and icons:

- TIGER 2
- CryoSat-2 AO
- Category-1
- Registration
- ESA EO Campaigns
- G-Pod
- Third Party Missions

At the bottom left, there is an "Information" section with links to "About this site", "ESA Data Policy", "FAQ", and "Related links".

<http://eopi.esa.int/esa/esa?cmd=round&startfrom=0>



Eduspace

ESA web-based EO Educational tool

The European Earth Observation Web Site for Secondary Schools

A banner graphic for the Eduspace website. It features a black background with a view of Earth from space, showing a satellite in orbit. The sun is visible in the upper left. The text 'eduspace' is written in white with a colorful arc above it. The main text reads 'Learning with Earth Observation', 'Europe from Space', 'Disaster Monitoring', and 'Global Change'. The ESA logo is in the bottom right corner of the banner.

eduspace Learning with Earth Observation
Europe from Space
Disaster Monitoring
Global Change

[[Dansk](#) | [Deutsch](#) | [Dutch](#) | [English](#) | [Español](#) | [Français](#) | [Italiano](#) | [Português](#)]

<http://www.eduspace.esa.int>



Eduspace

Target Groups



- **Secondary school teachers who want to incorporate EO into their curricula**
- **Secondary school students to extend on what they have learned in class**
- **University students pursuing related academic studies**
- **Access to website www.eduspace.esa.int is free**



Modules

Europe/Africa/Himalaya from Space; ENVISAT for schools;
Global Change; Disaster Monitoring

In preparation: Polar Module, World Heritage, Latin
America from space

A large **Image Data Bank** (complete European coverage with
Landsat and ERS-1&2 SAR, to be soon extended outside
Europe and enlarged to more sensors)

SW and GIS

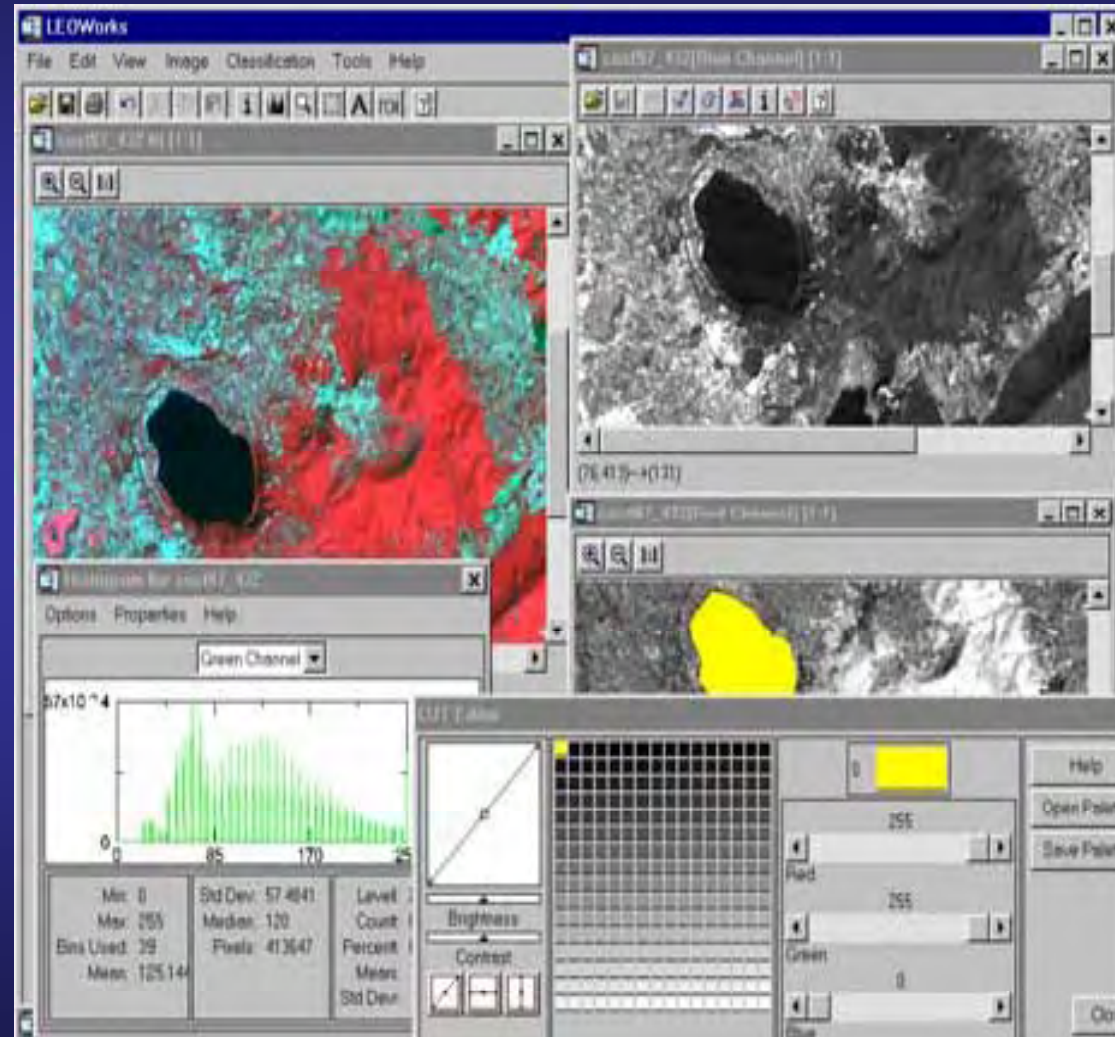
upgraded SW Leoworks v.3.2 (June 2008). Leoworks 4.0
(2010) will be an open-source, free and platform-
independent Image Processing optical-radar SW and
extended GIS for High Schools.



LEOWorks 3.0

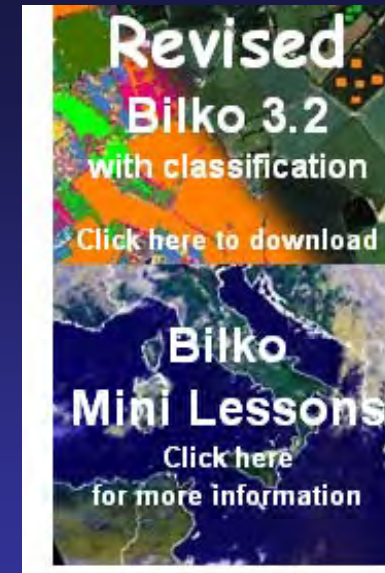
Image Processing Software (with GIS functionality)

- View images, histogram, pixel values, header info
- Crop, invert, stretch, layer stack, etc
- image arithmetic, filters
- Classification, PCA, geometric correction, pan sharpening
- GIS tools





The UNESCO BILKO Education Project Contribution by the European Space Agency

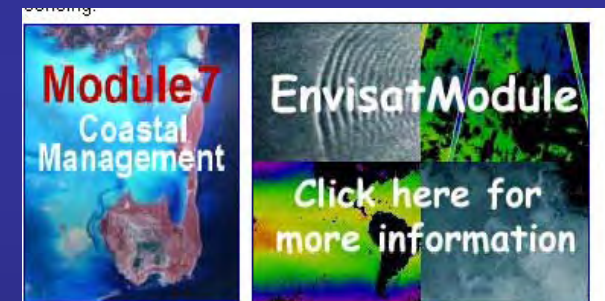


Envisat capabilities (Toolkit to enable use of
Envisat data products)

Observing the Ocean through Envisat

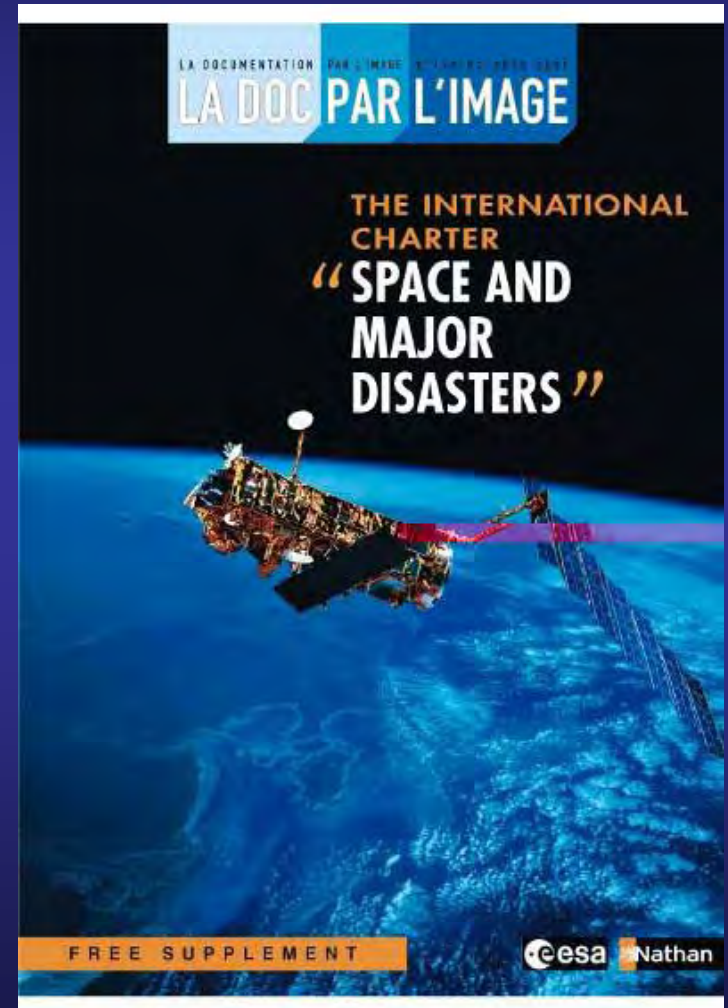
Land through Envisat Synthetic Aperture Radar

It can be downloaded for free from:
<http://www.noc.soton.ac.uk/bilko/>

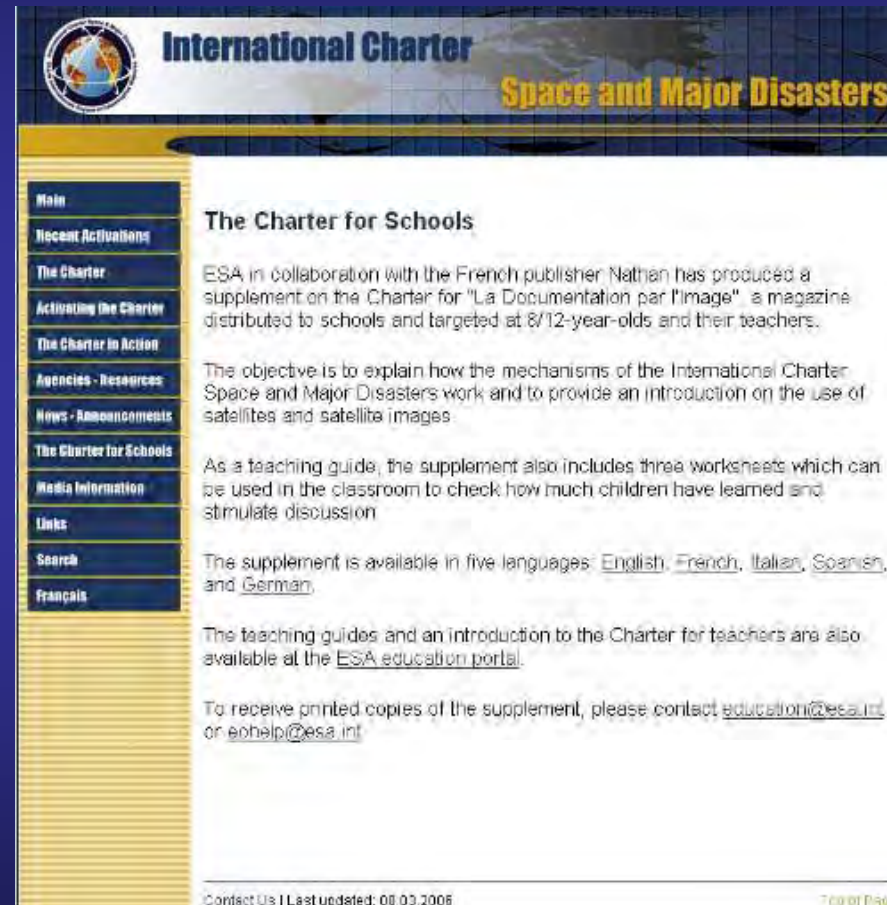


INTERNATIONAL CHARTER "SPACE AND MAJOR DISASTERS"

- target: primary/lower secondary level (8-12 years)
- objective: make the role of space facilities to manage natural and technological disasters more visible to youngsters
- product: a children supplement in 5 languages (En, Fr, It, Sp, Ger) downloadable in pdf from the Charter website
http://www.disasterscharter.org/ecoles_e.html
- includes 3 worksheets to be used in the classroom as exercises and to stimulate the discussion



INTERNATIONAL CHARTER ON SPACE AND MAJOR DISASTERS



The screenshot shows the website for the International Charter on Space and Major Disasters. The header features the ESA logo and the title "International Charter Space and Major Disasters". A navigation menu on the left includes links for Main, Recent Activities, The Charter, Activating the Charter, The Charter in Action, Agencies - Resources, News - Announcements, The Charter for Schools, Media Information, Links, Search, and Français. The main content area is titled "The Charter for Schools" and contains the following text:

The Charter for Schools

ESA in collaboration with the French publisher Nathan has produced a supplement on the Charter for "La Documentation par l'Image", a magazine distributed to schools and targeted at 8/12-year-olds and their teachers.

The objective is to explain how the mechanisms of the International Charter Space and Major Disasters work and to provide an introduction on the use of satellites and satellite images.

As a teaching guide, the supplement also includes three worksheets which can be used in the classroom to check how much children have learned and stimulate discussion.

The supplement is available in five languages: [English](#), [French](#), [Italian](#), [Spanish](#), and [German](#).

The teaching guides and an introduction to the Charter for teachers are also available at the [ESA education portal](#).

To receive printed copies of the supplement, please contact education@esa.int or ecbhelp@esa.int.

Contact Us | Last updated: 08.09.2006 7 of 10 Pages

Charter website



SCHOOL KIT (alias TEACHER's PACK)

- target: lower secondary level (11-14 years)
- objective: provide teachers with a working tool to introduce EO themes in schools.
- available in 4 languages (En, Fr, Sp, Ned). German translation is ongoing
- product: a folder containing 11 worksheets on EO themes related to teaching subjects such as geography, life and Earth sciences, physics. Each worksheet is composed of 3 colour pages recto-verso (trptych), plus an exercise sheet and a teacher information note

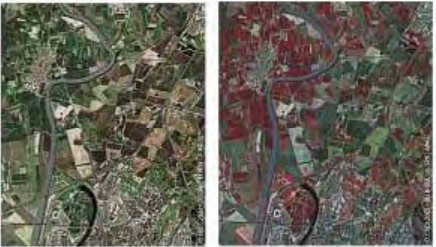
EUROPE CONTAINS MOST TRACTS OF AGRICULTURAL LAND



The great diversity of European soil and climate means that throughout the continent are good. Consequently, Europe has a rich variety of rural and agricultural landscapes, most of which are farmed. Farming has become a network activity, and across the continent it is the economic backbone of the continent. Agriculture is still a vital economic activity in many parts of Europe, and it has produced a rich diversity of rural landscapes. In some of Europe's most important agricultural areas, such as in the north of the continent.

From north to south.

When data is derived as a vegetation cover or required, it is often collected by satellite in the visible light which is used to detect vegetation cover. It is more than in the visible light, which requires the same amount of acquisition and analysis as the type of acquisition is more costly and more complex.



Agriculture in north of Europe (left) and south of Europe (right).

How do satellites work?



Urban expansion in Europe



Using satellites to analyse the characteristics of urban areas



Light and the signals reflected by the Earth's surface are different characteristics depending on the material. In building areas, concrete and asphalt surfaces will not send back the same signal as the surrounding vegetation. Likewise, roads will send back the same signal as asphalt or tarmac. Aerial data is a good example of how the satellite data is used to analyze urban areas. This knowledge is used to analyze urban areas. They are used to analyze urban areas. In a world where many cities are built on the same land, they often have the same characteristics. They can be used to analyze urban areas. They can be used to analyze urban areas. They can be used to analyze urban areas. They can be used to analyze urban areas.



Watching over the Earth

European Space Agency

6 - Europe - a developed continent

triptych (recto and verso)

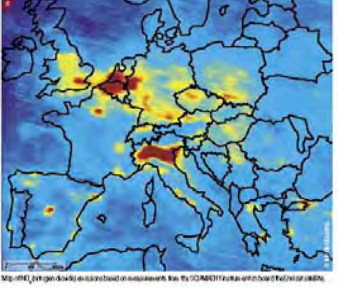
THE MAIN AREAS OF ECONOMIC ACTIVITY IN EUROPE

Europe can be divided into three main regions, classified according to their levels of activity and economic importance. There is the heart of Europe, which comprises the key cities and is home to much of the industrial and commercial activity. This region stretches from southern England to northern Italy. An intermediate zone and beyond is also dynamic and active, with modern agriculture and industrial activity. The extensive, rolling areas to the south and west are less populated.



Levels of development in the European Union vary considerably. The heart of Europe, its richest part, contains the greatest concentration of population and economic activity and forms a dense belt of cities and areas of communication. The other two zones, on the other hand, are less industrialized and less densely populated.

Satellite images, since they are able to observe an entire territory, reveal disparities between Europe's regions. These images, which cover any wide areas, do not show industrial activity directly but instead measure its indirect consequences. For example, through luminous flux and atmospheric pollution. Other satellite images, focusing on a more limited part of a given territory, make it possible to monitor changes to urban and industrial areas and can thus be used in town planning.



Economic activity has its drawbacks, notably that it generally causes high levels of pollution. By regularly measuring emissions of pollutants across the globe, satellites help to build up a map of atmospheric pollution. Now, however, that not all regions are affected to the same degree. In 2004, more than 15 billion tonnes of carbon dioxide (CO₂) were released into the atmosphere.

ROTTERDAM: EUROPE'S LARGEST PORT

Rotterdam at the mouth of the Rhine, whose port handles almost 300 million tonnes of goods every year is the largest port in Europe and the third largest in the world. Some of its port facilities, which are continuously expanding to respond to the growth in international maritime traffic, are built on platforms in the sea. The port authorities often use satellite images to assess them in their development.



In the picture to the left, areas of vegetation are shown in red. Plants reflect most of the energy they receive from the sun right in the infrared channel, an area in which satellite sensors are extremely sensitive. This image follows the convention of colouring them in red.



SCHOOL KIT

TOPICS

1. Earth observation satellites
2. The Earth viewed from space
3. Humans on Earth
4. Africa and environmental diversity
5. Asia and rice-growing
6. Europe: a developed continent
7. Living species and their environments
8. Water on Earth
9. Volcanoes: Mount Etna, a case study
10. Flood monitoring
11. Colours in satellite imagery



EARTH EXPLORER MISSIONS

- target: secondary level (15-18 years)
- product: CD-Rom in 2 languages (En, Fr)



CD-Rom



website



WINDOW ON THE WORLD

- target: teenagers
- products:
 - ✓ stand-alone terminal for exhibitions, museums and educational events
 - ✓ PC version on DVD, bilingual (En,Fr)
- similar to Google Earth (navigation and zooming in on the Earth), but with an important educational content



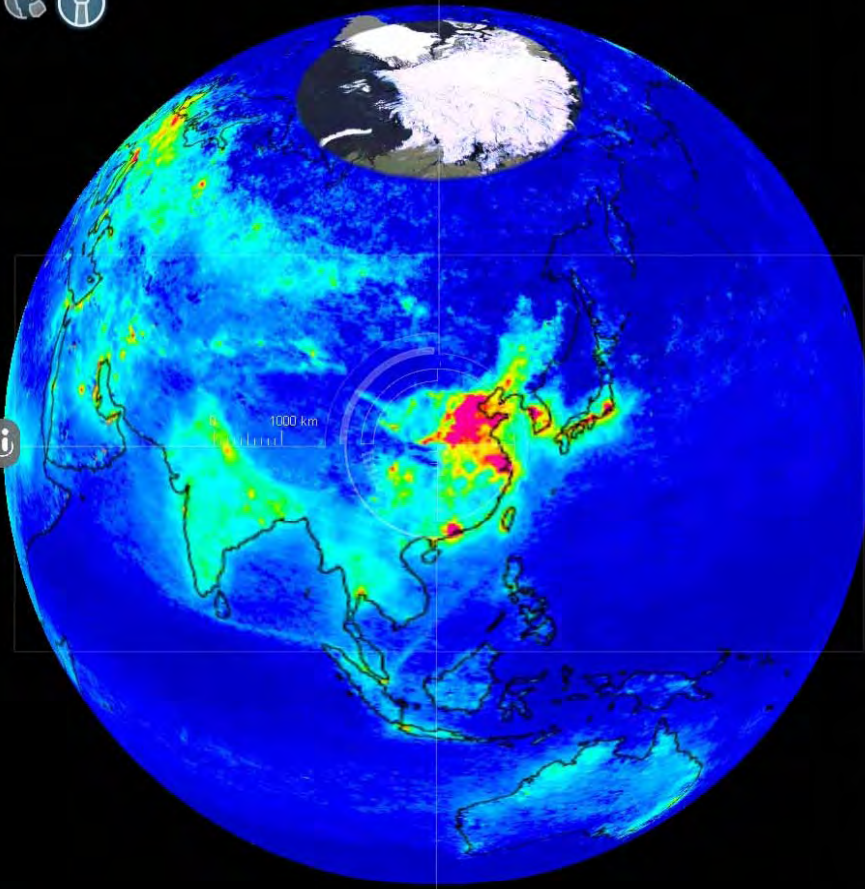

natural events



zooming in on Banda Aceh

WINDOW ON THE WORLD

THE ATMOSPHERE





Air pollution
The ENVISAT satellite measured the average quantity of nitrogen dioxide in the atmosphere in 2004. This gas, produced by oil and coal combustion, accumulates above the main industrial centres, living areas, and along the shipping routes travelled by cargoes.

THE EARTH
6 628 548 833
Inhabitants

SEEN FROM
41 000,0 km

NAVIGATION DATA
Planetary
troposphere
Gaseous pollution
Nitrogen dioxide

ENVISAT
Altitude : 800 km
Spectrometric instrument



atmosphere



ESA School Atlas

ESA School Atlas – Funded by ESA, produced by GEOSPACE

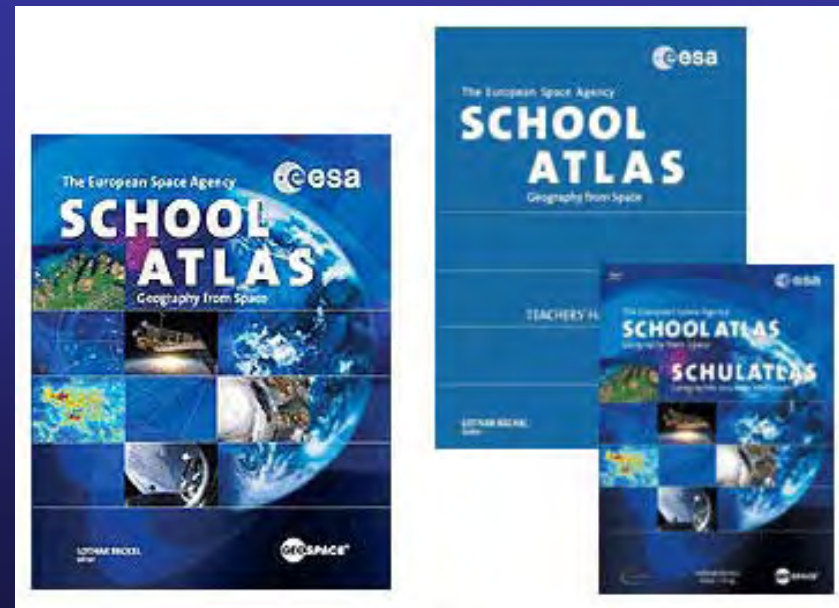
Targeting secondary schools and first university courses:

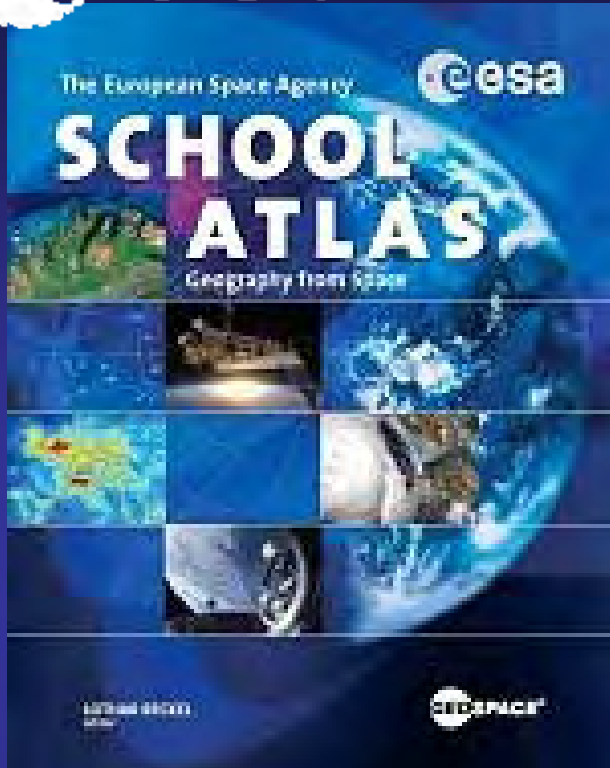
Realistic views of the Earth's surface, combined with thematic maps demonstrate the dynamic processes of our globe.

The atlas is accompanied by a Teachers' Handbook, a digital version on 2 DVD's and is also connected to Eduspace.

The Atlas is available in both English and German from the Geospace website at a special concessionary price for schools.

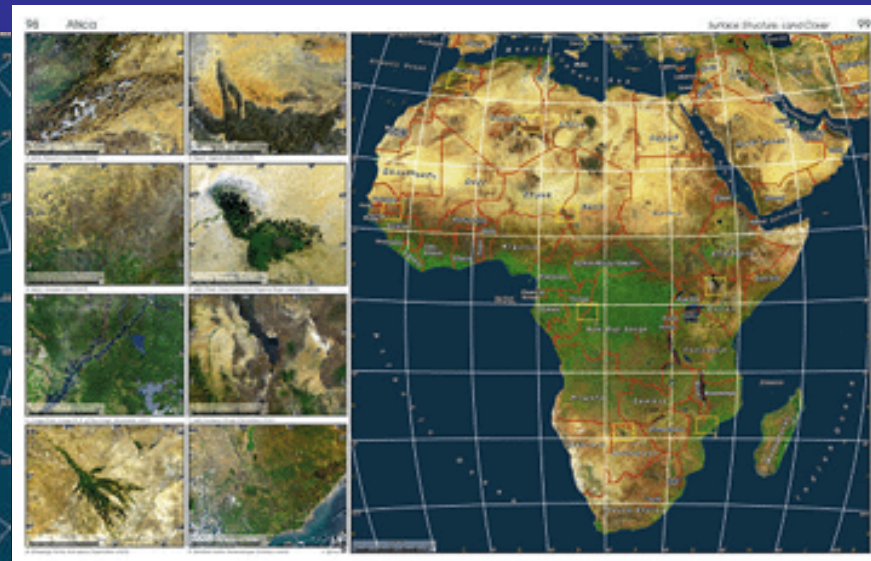
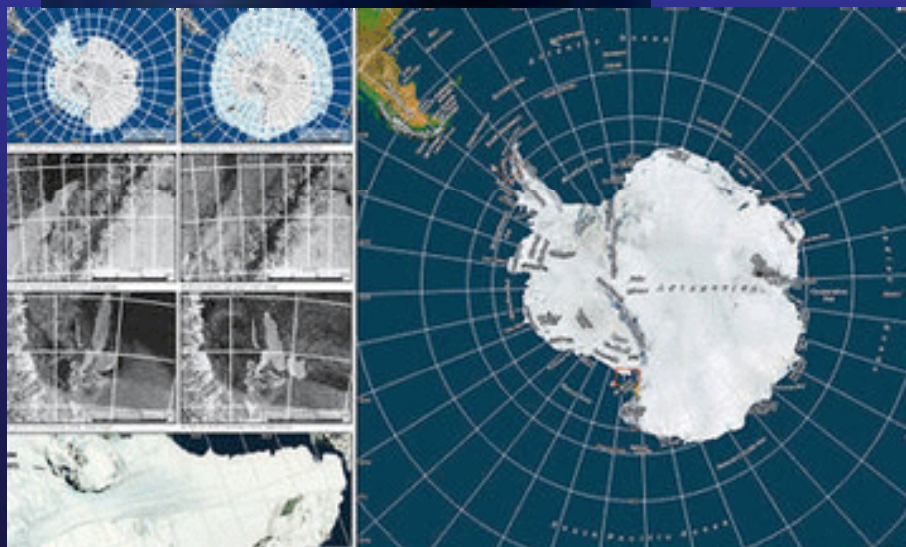
Order from: www.geospace.co.at





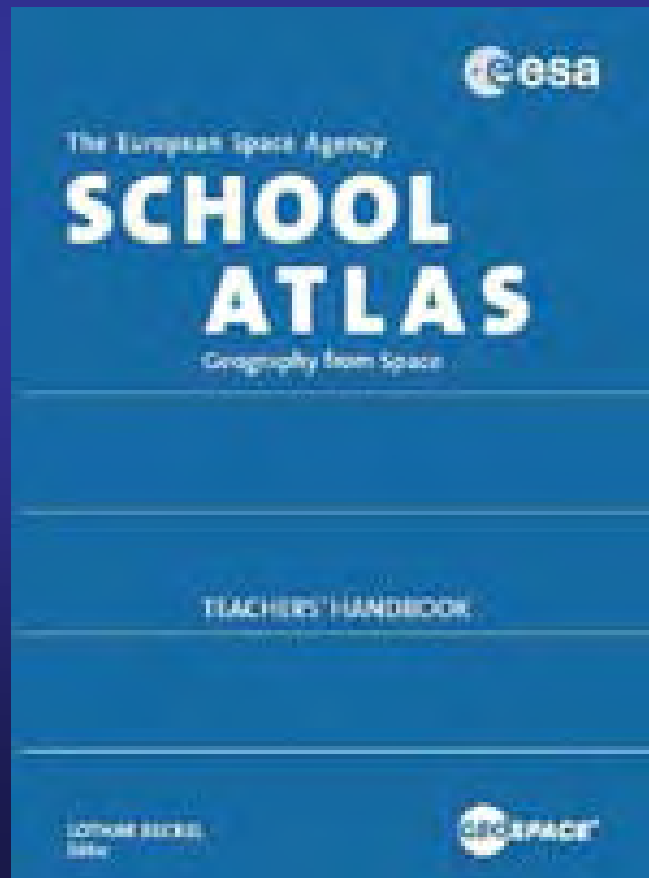
ESA School Atlas

- 1) Introduction to ESA (10 pages)
 - 2) Earth Observation (8 pages)
 - 3) Global Overview (20 pages)
 - 4) Continental Overview (82 pages)
 - 5) The Natural Sphere (60 pages)
 - 6) The Cultural Sphere (78 pages)
- Index (18 pages)





Annex to the **ESA School Atlas** - Teachers' Handbook



Provides an introduction to Earth Observation and a general description of each double page of the Atlas. For every image or thematic map, technical information on the data, as well as descriptions and interpretation aids are included.

The purpose of the Teachers' Handbook is to support teachers in the use of the Atlas in the classroom. There are numerous suggestions of questions and exercises – for many of them the LEOWorks software may also be used.



Annex to the **ESA School Atlas** - DVDs



The two DVD-ROMs contain the pages of the ESA School Atlas in reduced resolution (PDF format), **original bands of the satellite data, handbook content and exercises.** The images correspond with the maps in the atlas in the form of original data and thematic vector data. The software tools allow to process and evaluate the image data and thus to arrive at new maps.

The DVD's can be used in the classroom to accompany the learning process, where the students are studying the Atlas while the teacher, or a student, is demonstrating the images on a big screen.

Working with the exercises provided on the DVD-ROMs, a step-by-step approach to the methods and potential of satellite remote sensing, including cartographic design and interpretation, is possible.

PLANET EARTH, HEAVENS ABOVE!

- target: primary level (8-10 years)
- objective: present EO themes (e.g. atmosphere, water, Earth's ice cover) to children trying to amuse and interest them (game approach)
- product: CD-Rom in 7 languages (En, Fr, Du, De, It, Sp, Port)



The screenshot shows the ESA Education website interface. At the top, the ESA logo and 'Education' text are visible, along with the date '07-Jun-2006'. A navigation menu includes 'Home', 'High School', 'Higher Education', and 'Teachers'. The main content area features a CD-ROM cover for 'Planet Earth - Heavens Above!' with a cartoon penguin and the text 'Ciel, ma planète!'. To the right of the cover, the following details are provided:

- Planet Earth - heavens above!**
- Subject:** Physics & chemistry, biology, geography
- Level:** Primary
- Language:** Deutsch, English, Español, Français, Italiano, Nederlands, Português
- Type:** Support materials

The aim of this CD-ROM is to help 8-10-year-olds and their teachers discover the many ways in which satellite remote sensing can safeguard our environment.

Through the use of satellite images, animations, interactive quizzes, and background information it covers topics such as water, volcanoes, and atmospheric pollution.

The CD-ROM is available in Dutch, English, French, German, Italian, Portuguese, and Spanish. To receive a copy, please contact:

ESA Education Department
E-mail: education@esa.int

When making your request please give the name of your school, the full address and the language version you require.

Send this page to a friend



Projects with external partners : University of Heidelberg

Web-based EO Games for kids www.ph-heidelberg.de/esa





Projects with external partners :

Science Education via EO for High Schools (SEOS)

6th Framework Programme of EC

<http://www.seos-project.eu/home.html>



SCIENCE EDUCATION THROUGH EARTH OBSERVATION FOR HIGH SCHOOLS

Contact

- Home
- Project
- Modules
- Events
- Press
- Forum
- Search

Username

Password

Login

Welcome...

... to the homepage of the **Science Education through Earth Observation for High Schools** (SEOS) Project.

SEOS is an initiative for using remote sensing in science education curricula in high schools funded under the 6th Framework Programme of the European Commission (EC). The project is implemented by 11 different partners from several European countries in cooperation with the European Space Agency (ESA).

Based on current research results, 15 internet-based eLearning tutorials will be developed on selected topics in earth observation. The tutorials will be tested in co-operation with different European partner high schools.

The first draft tutorials are now available: Draft Modules

If you would like to be informed about the publication of new modules or if you want to provide feedback to the existing modules you may send an email to rainer.roeuter@uni-oldenburg.de.



Final Remarks

- EO education and capacity building is becoming increasingly more important in view of climate change, more frequent natural disasters (storms, flash floods, etc...), natural & cultural heritage degradation and need of preservation
- ESA and many other space agencies are taking this very seriously and aim to promote EO to an increasingly large, world wide audience
- All audiences including schools are targeted as decision makers and disaster managers of tomorrow are sitting in the classrooms today! EO and Space Education should be available for youngsters in schools, well before university level.....





USEFUL ADDRESSES

- education portal: *www.esa.int/education*
- eduspace: *www.eduspace.esa.int*
- to order EO material: *education@esa.int* or *eohelp@esa.int*