

# **EO DATA APPLICATIONS IN CENTRAL AND SOUTH AMERICA**

**Examples of environmental applications of Earth  
Observation data, methods and techniques**

**Ana B. Ruescas  
ESA/ESRIN**

- **ESA EO missions review**
- **The Diversity Project**
- **The Jaguar Project**
- **EOPI**
- **International Charter Space and major Disasters**
- **ESA Initiative on Climate Change**
- **Remote Sensing Principles**
- **Eduspace and LEOWorks 3.0**

# ESA EO missions review

**Meteosat** – ESA has been dedicated to observing Earth from space ever since the launch of its first meteorological mission (1977).

**ERS-1 (1991) and ERS-2 (1995)** – providing a wealth of invaluable data about Earth, its climate and changing environment.

**Envisat** – the largest satellite ever built to monitor the environment, it provides continuous observation of Earth's surface, atmosphere, oceans and ice caps (2002).





Part of ESA's 'Living Planet' Programme, these missions address critical and specific issues raised by the science community, while demonstrating the latest observing techniques. The first two were launched in 2009:

**GOCE** – studying Earth's gravity field

**SMOS** – studying Earth's water cycle

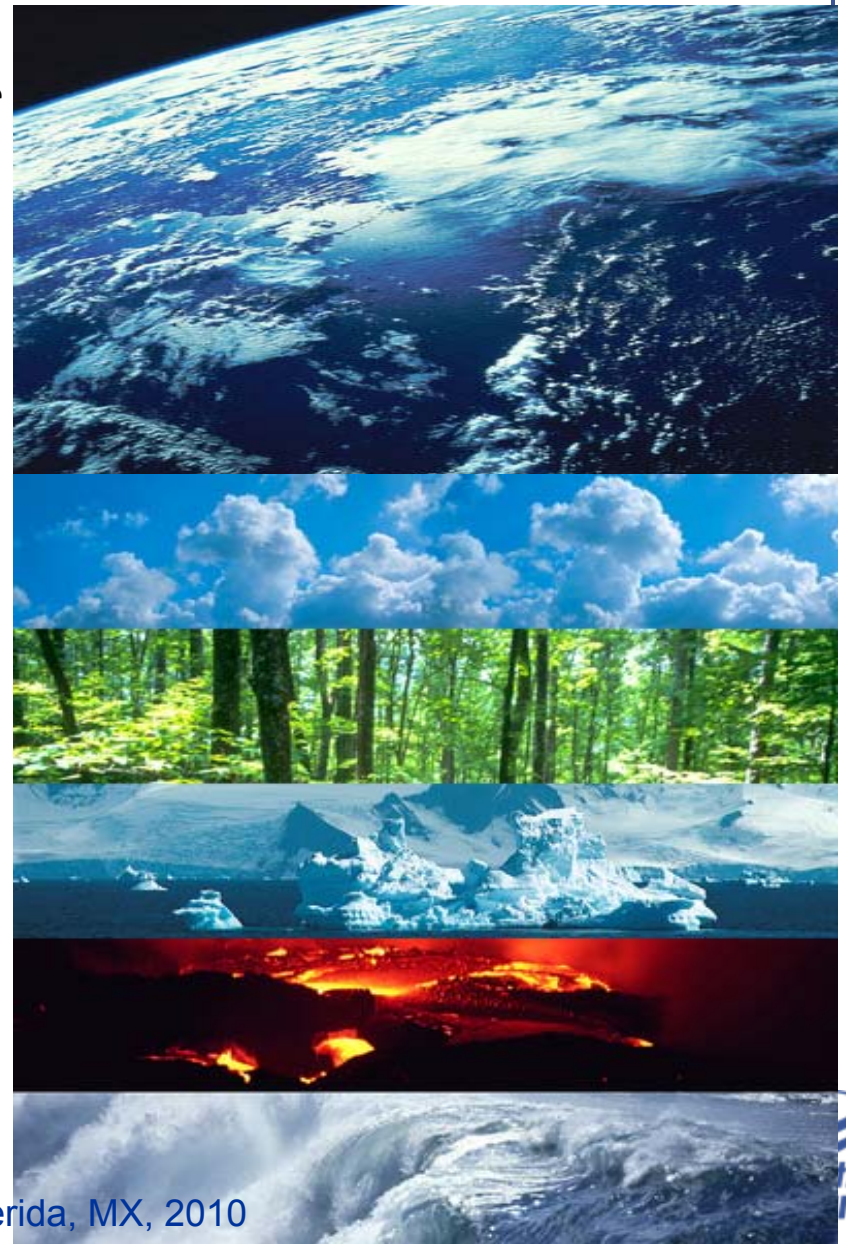
The next missions are:

**CryoSat-2** – studying Earth's ice cover

**ADM-Aeolus** – studying the atmosphere

**Swarm** – three satellites to study Earth's magnetic field

**EarthCARE** – an ESA/JAXA mission to study Earth's clouds, aerosols and radiation



**'Living Planet'** also includes the next generation of missions dedicated to weather and climate.

**Meteosat Third Generation** – taking over from Meteosat 11 in 2015, the last of four Meteosat Second Generation (MSG) satellites. MSG is a joint project between ESA and Eumetsat following the success of the first-generation Meteosat satellites.

**MetOp** – a series of three satellites to monitor climate and improve weather forecasting, the space segment of Eumetsat's Polar System (EPS).

**MetOp-A** – Europe's first polar-orbiting satellite dedicated to operational meteorology (2006).





# OBSERVING OUR PLANET FOR A SAFER WORLD

A joint ESA/European Commission initiative, **Global Monitoring for the Environment and Security (GMES)** is the response to Europe's need for geo-spatial information services. It will provide autonomous and independent access to information for policy-makers, particularly for environment and security issues.

ESA is implementing the space component: developing the **Sentinel** satellite series, its ground segment and coordinating data access.

ESA is also starting a **Climate Change Initiative**, for storage and production of essential climate data.



# Diversity Project



# Diversity project

In 1992, at the "Earth Summit", the **Convention on Biological Diversity**, the first global agreement on the conservation and sustainable use of biological diversity was signed.

Since then more than 187 countries have ratified the agreement.

The Convention has three main goals:

- *The conservation of biodiversity,*
- *Sustainable use of the components of biodiversity, and*
- *Sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way*

**DIVERSITY** addresses the first two targets;





- In 2003, UNESCO and ESA signed “**The Open Partnership**”.

- Under this agreement ESA and UNESCO collaborates to explore the potential of Earth Observation technology to support the implementation of the WHC and to conserve WH sites worldwide.

“Biosphere reserves are sites recognized under UNESCO's Man and the Biosphere Programme which innovate and demonstrate approaches to conservation and sustainable development. There are 482 sites worldwide in 102 countries.

Biosphere reserves have three inter-connected functions:

- **Conservation:** landscapes, ecosystems, species and genetic variation
- **Development:** economic and human and culturally adapted
- **Logistic support:** research, monitoring, environmental education and training

Earth Observation is a key element for the identification, documentation, conservation, and monitoring of these UNESCO sites.

**Sustainable use at Biosphere reserves contributes to UNCCBD and the CBD 2010 goal.**



## **Short-term Objectives:**

- *Develop and Implement a number of dedicated information services based on EO-technology to support the implementation of the UNCBD in central America:*
  - *Regional monitoring system for the Mesoamerican Biological corridor;*
  - *Monitoring of coral-reef and water quality conditions;*
  - *Inventorying of mangroves;*
  - *Supporting wildlife migration studies: Tropical East Pacific Corridor;*
- *In addition a dedicated global index of dry-lands will be developed for the CBD;*

## **Long-term objectives:**

- *Prepare the basis for a potential larger project on Biodiversity to be launched after 2008.*
- *Contribute to establish a solid basis for the use of EO within the context of the UNCBD;*



## Biodiversity in Mesoamerica:

- 7 countries
- 0.51 % of earth surface
- 9 % of world's biological richness

<http://www.geoville.com/diversity/products/>

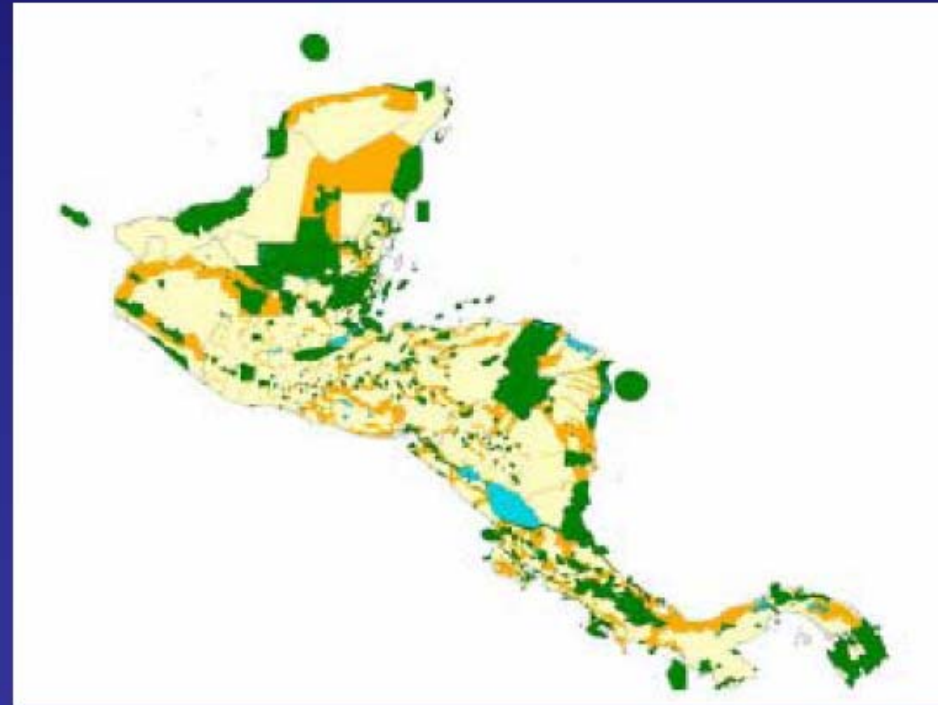
## Example: “Mesoamerican Biological Corridor”

- Multitude land cover and land use, ecoregions of different protection status
- Area: approx. 320.000 km²
- Composition in 2000:
  - 48.7% legally declared protected areas
  - 3.9% areas proposed for protection
  - 47.4% corridor zones connecting protected areas.

## Threats:

Urban/Industrial development, intensive agriculture

→ Annual loss of 2.1 % of forests is estimated





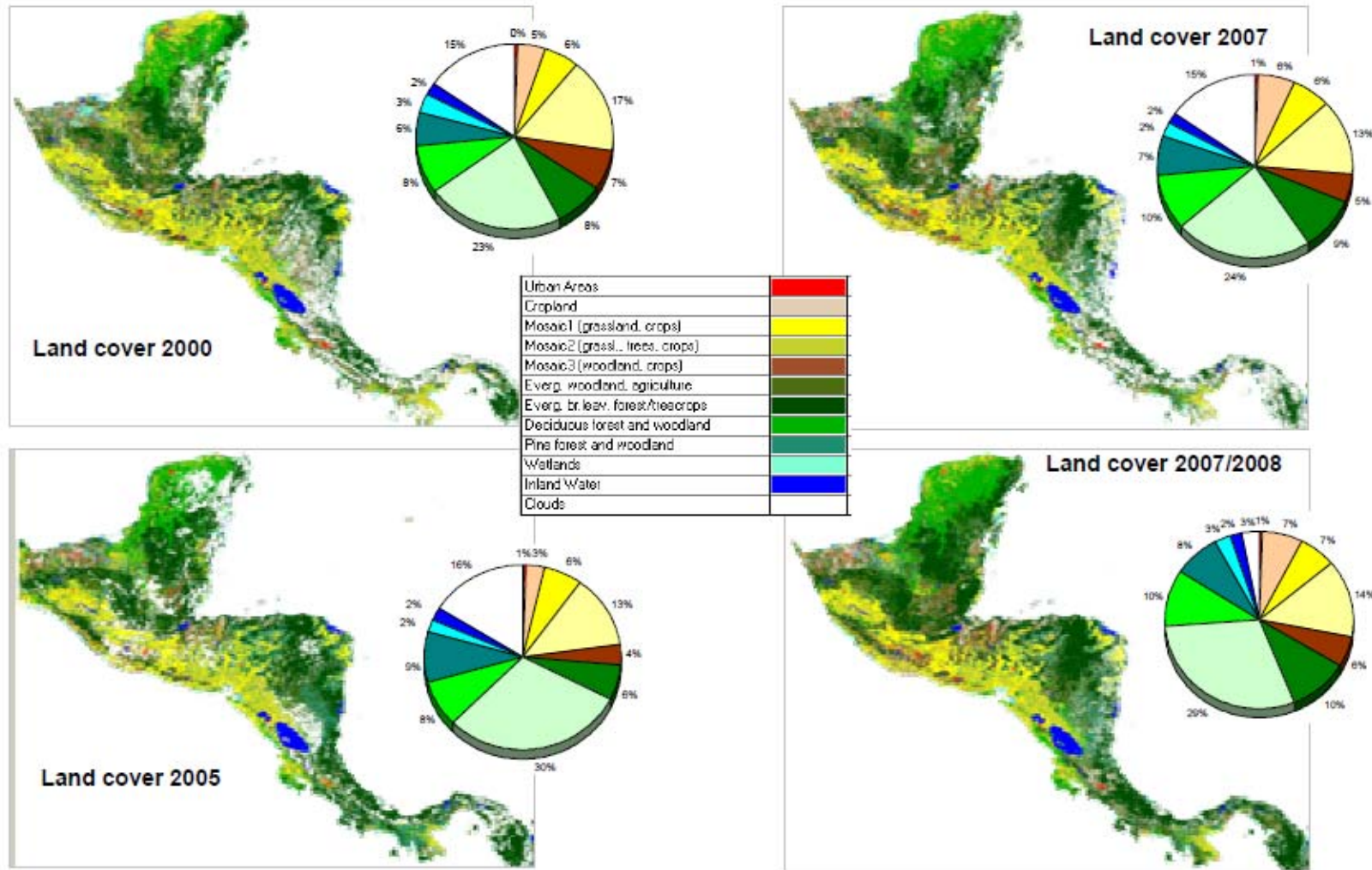
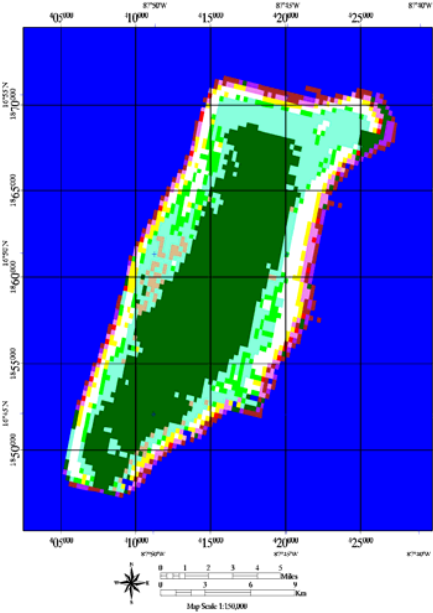
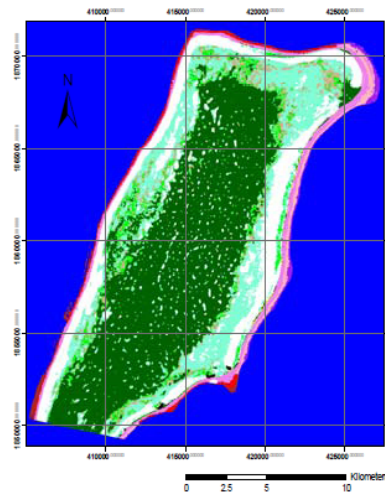
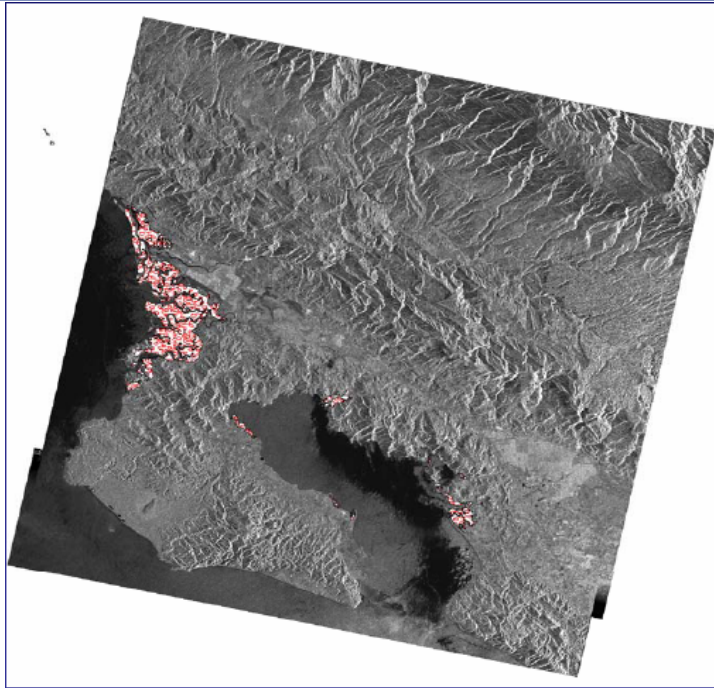
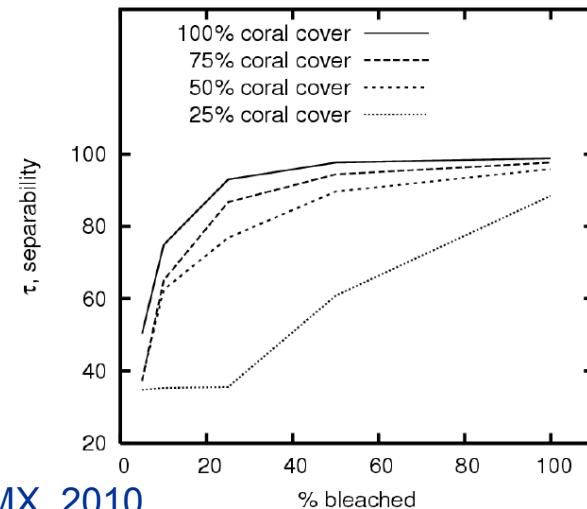
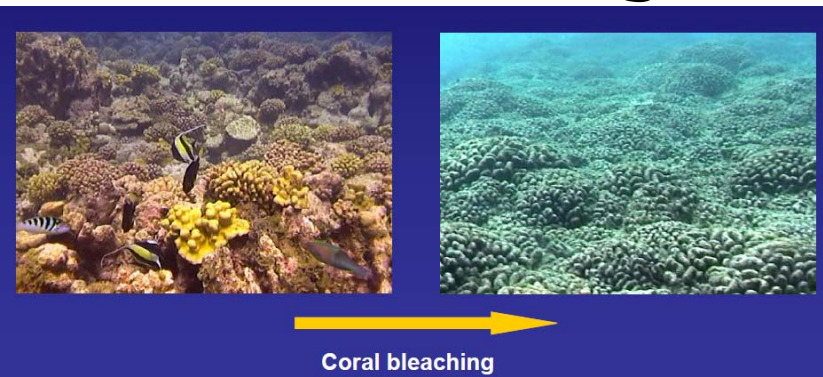


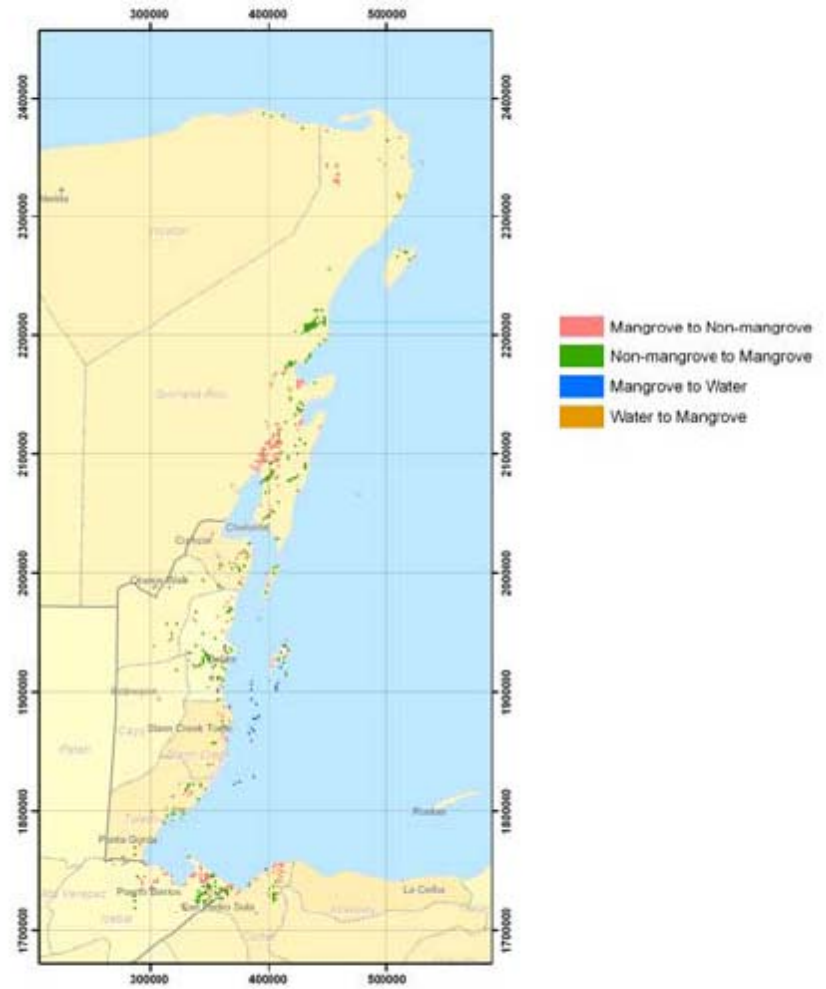
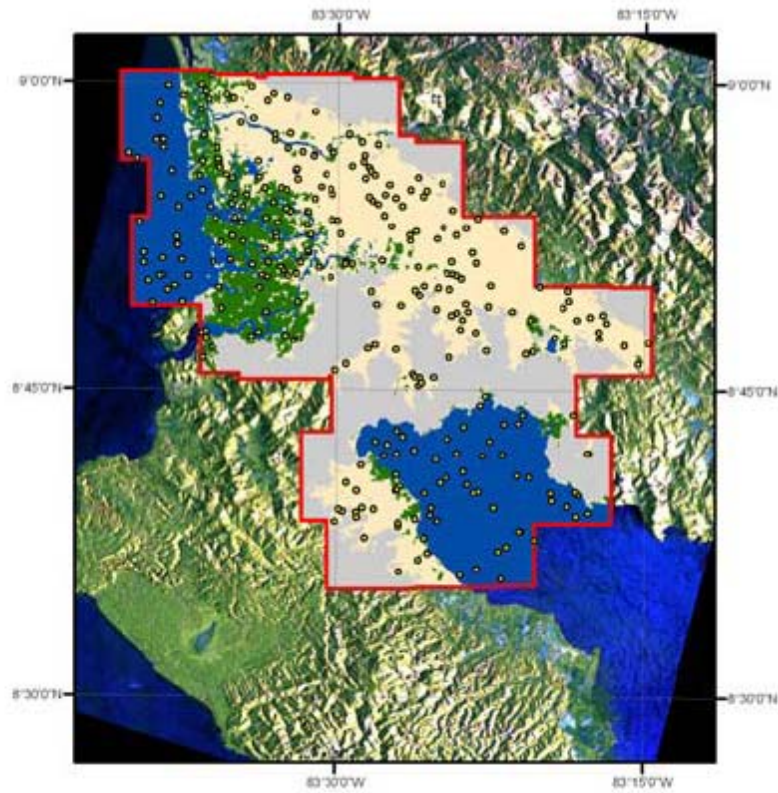
Figure 1: Regional land cover maps for the years between 2000 and 2007/2008 based on MERIS (MODIS)

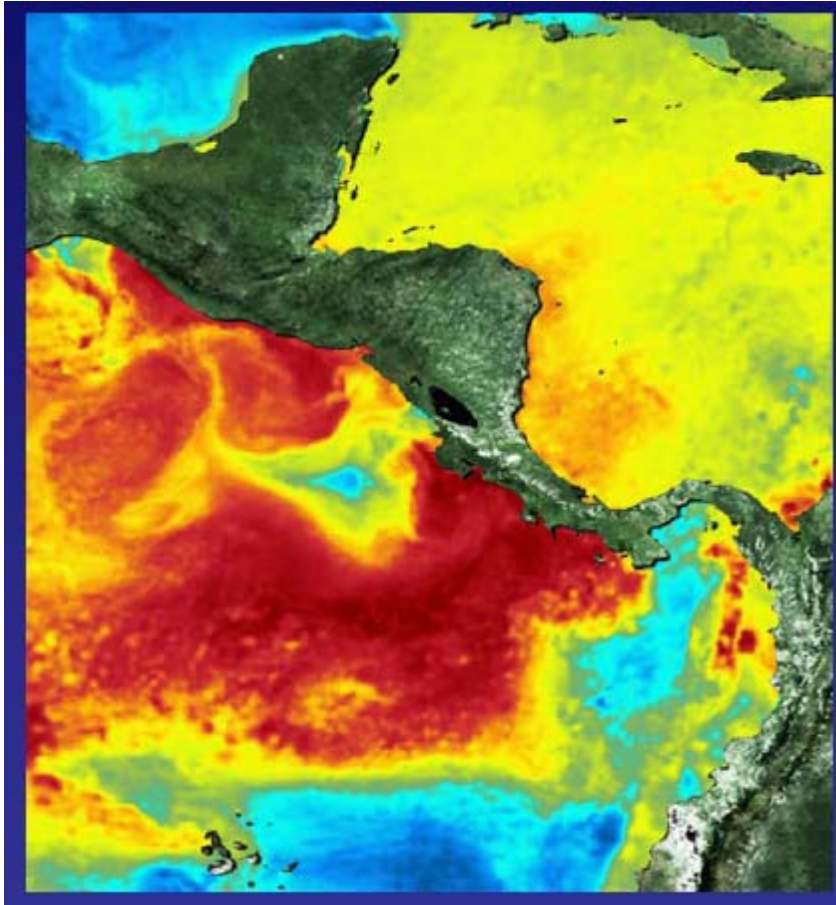


## Coral reef maps and surfaces of coral bleaching

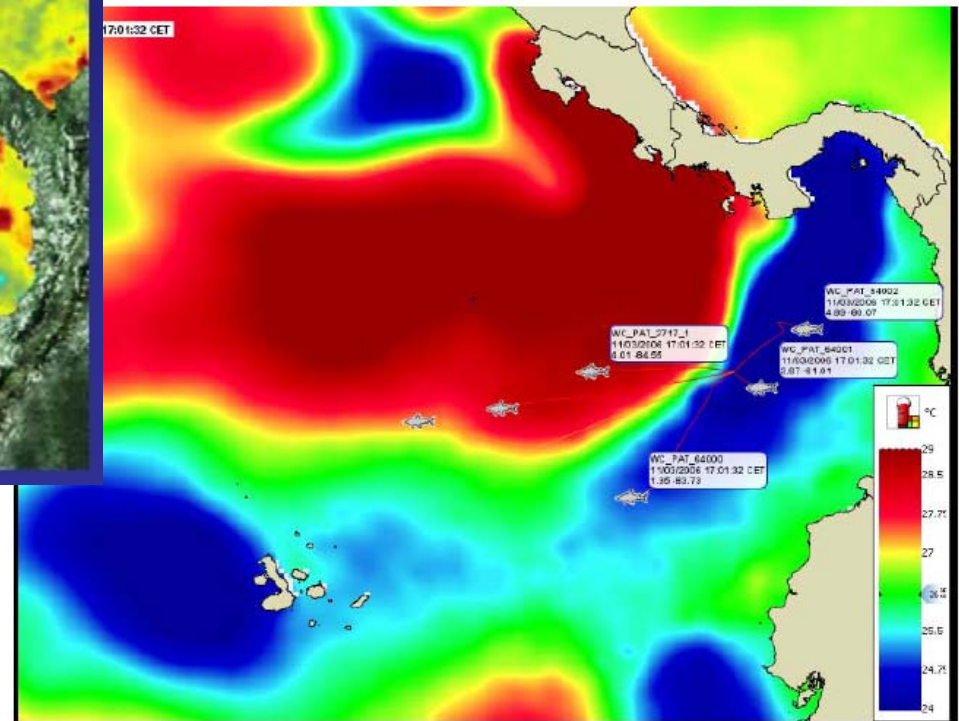






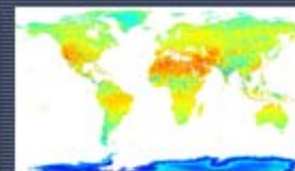
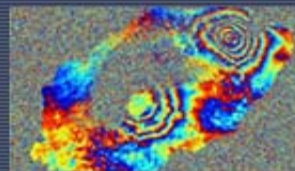


Shark's trajectories in the Tropical East Pacific Corridor (tracking data courtesy of Malpelo Foundation)





# Jaguar Project



The goal of the JAGUAR PLAN is to design an action plan for European Space Agency (ESA), in order to promote the international development of the European and Canadian EO market in Latin America and the Caribbean.

## Actions:

- **Market characterization:** collected information referred to the situation of the EO market in

Latin America and the Caribbean region

- The development of 4 miniprojects.
- INDRA will provide an Action Plan to ESA for the development of a Strategic Plan, focused on the expansion of the usage of European and Canadian EO products in Latin America and the Caribbean region, with an expected duration of five years.


Institutions



<http://www.planjaguar.info>

- **Miniproject 1. “Definition of the Lake Titicaca Territorial Observatory”.**
- **Miniproject 2. “Remote Sensing as an Instrument to Manage Risks and to Develop Agrarian Insurances in the Rural Sector”.**
- **Miniproject 3. “Cooperación Urban Services (CUbS): Viability analysis of remote sensing products for the urban management in LAC countries”.**
- **Miniproject 4. “Methodology for an Enviromental Audit for Oil & Gas Activity in Ecuador Using Earth Observation (EO) Data”.**

# Earth Observation Principal Investigators



**Earth Observation**  
Principal Investigator Portal  
European Space Agency

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[AOs](#)
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02-Mar-2010 UT

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Password:  
 **GO >>**

**New request**  


Category-1


Registration


ESA EO Campaigns


G-POD


Third Party Missions

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[Related links](#)
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**Haiti earthquake: ESA dataset package freely available**  
ESA makes freely available to the scientific community a dataset of SAR products (Envisat and ERS) acquired before and after the massive earthquake which struck Haiti and devastated the capital ...  
[Read more](#)

[Visit The Archive](#)

**Training & News**  


**ESA "Earth Observation" Summer School (2-13 Aug 2010, ESA ESRIN - Frascati, Italy) 02/2010**  
[Read more](#)

[Visit The Archive](#)

**Results**  


**Stress transfer analysis in the Lazufre volcanic area, central Andes using DInSAR time series**  
Stress field changes in volcanic areas have often been hypothesized to be responsible for sudden, unexpected eruptions at volcanoes that are close to a critical state. However, the importance of ...  
[Read more](#)


**InSAR WS and IM to analyse the Lazufre volcanic system**  
An interferometric analysis of Envisat data acquired in Wide Swath Mode (WSM) and Image Mode (IM) from ascending and descending geometry, respectively, has been used to monitor and assess active ...  
[Read more](#)

**PI events**  
[Workshops and Symposia](#)
[Trainings & News](#)
**PI Toolboxes ...**
**Other Resources**  
[Missions](#)
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# Principal Investigator Portal

- **Users who would like to submit scientific proposals for the use of ESA EO missions data**
- **PIs of any accepted project willing to present their findings to ESA**
- **Representatives of the ESA Member States, who can get up-to-date information on the on-going EO projects, their status and their achievements**
- **Scientists working in connected fields who can find projects with related objectives and establish contact with other PIs**
- **Students, who can find up to date information and contacts to leading R&D groups all over the world**
- **Industry who can get a broad overview of state-of-the art projects in many EO application domains**
- **The Aerospace industry, who can see the results obtained with systems and technologies they develop**
- **Members of the broader user community who want to understand how EO could help in meeting their information needs**
- **ESA staff involved in past, present and future Earth Observation missions**



## Search

Use thematic and geographic criteria to search results and published papers reported from PIs

### Application Domain

[Unselect](#) / [Select all](#)

- ☒ Atmosphere
- ☒ Calibration/Validation
- ☒ Coastal Zones

### Instruments

- ☒ Altimeter
- ☒ SAR
- ☒ Optical / IR
- ☒ Other

### Date Selection

From:

To:



... and draw an area on map

**Rectangle Zoom**



... or search "global" results

**Search global**

Choose zoom level



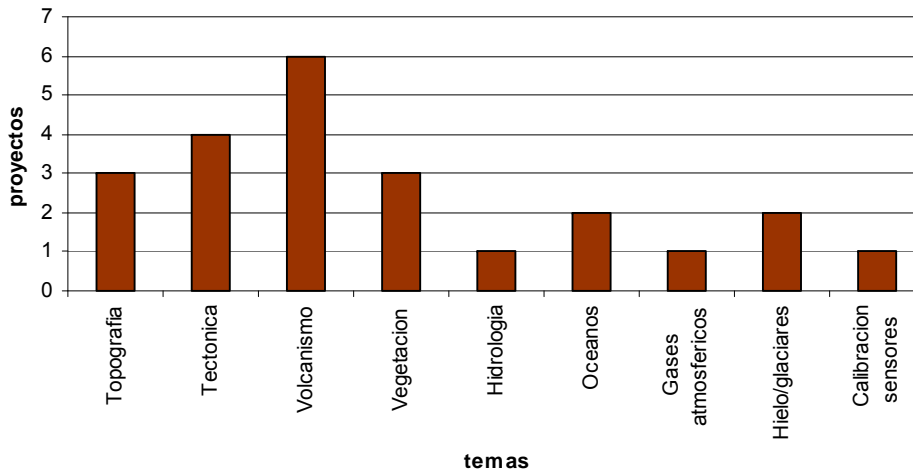
Satellite

ID	Title	Pi	Report Types
215	SUBSIDENCE MAPPING WITH ENVISAT ASAR	Tazio Strozzi	
413	ENVISAT ASAR FOR REGIONAL VOLCANO EARLY WARNING	Nicki Stevens	
431	OPERATIONAL DEMONSTRATION OF COASTWATCH COASTAL OCEANOGRAPHIC AND HYDROLOGIC APPLICATIONS OF ENVISAT	William	

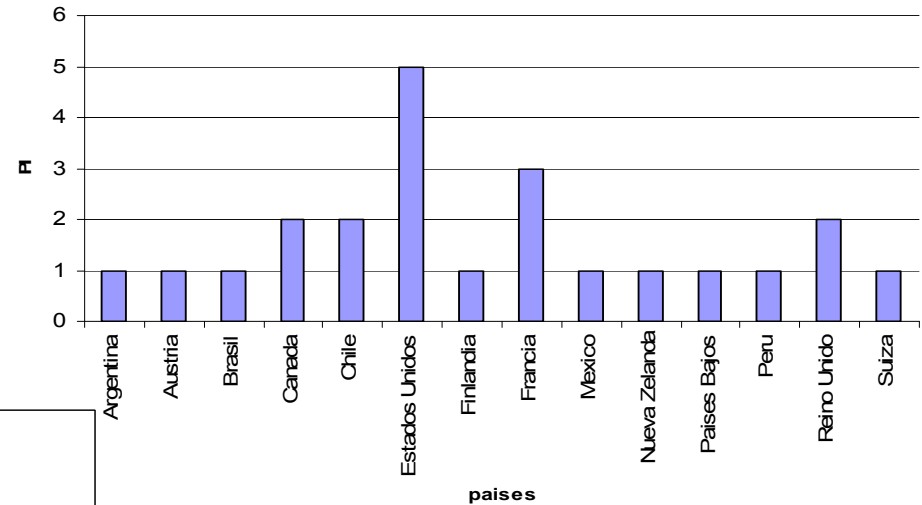


- 23 proyectos científicos aprobados sobre América Latina, 2 de ellos ya cerrados.
- Investigadores principales de 14 países.
- 9 temáticas diversas.

TEMATICA PROYECTOS

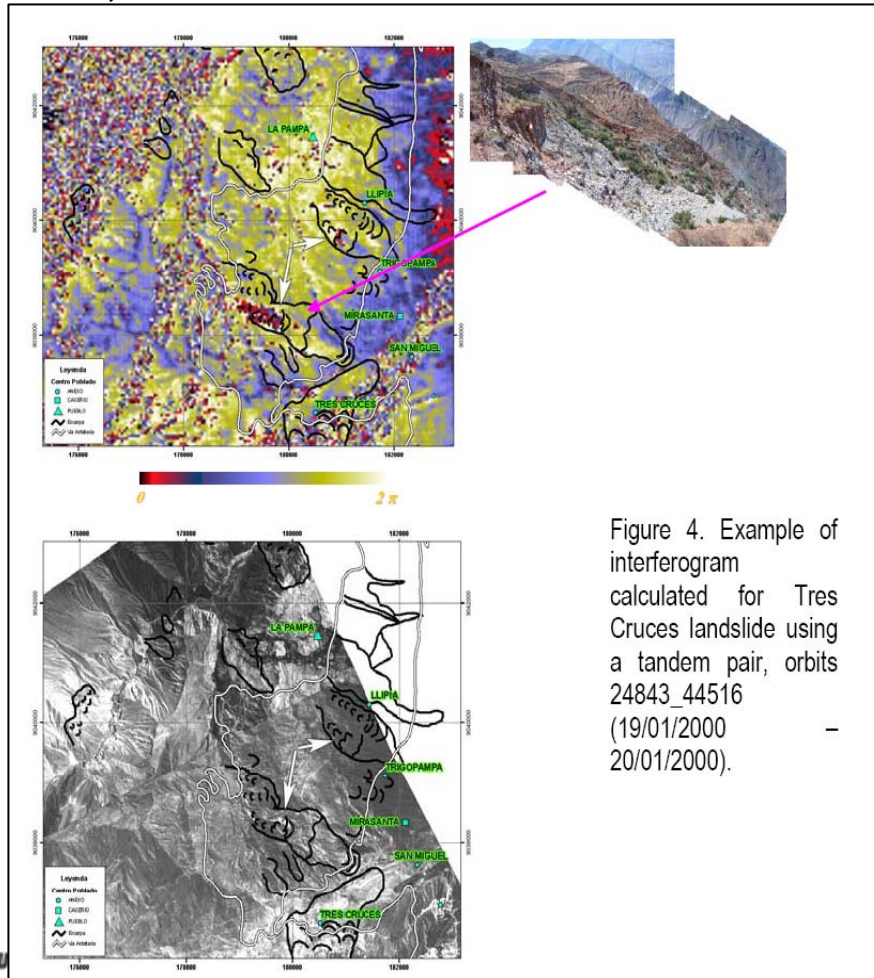


NUMERO EOPI AMERICA LATINA

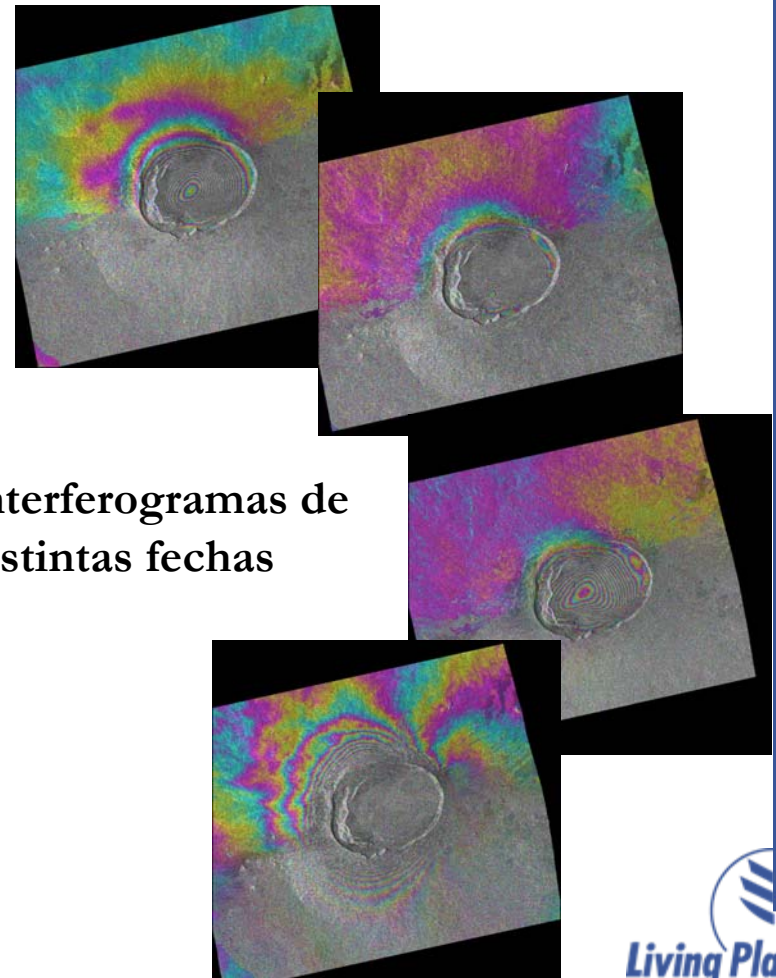


**SÓLO 7 INVESTIGADORES PRINCIPALES DE AMÉRICA LATINA**

Detecting ground deformation in landslides areas in Peru, by means of INSAR (PI: Miguel Vidal Valdiviezo, Perú)



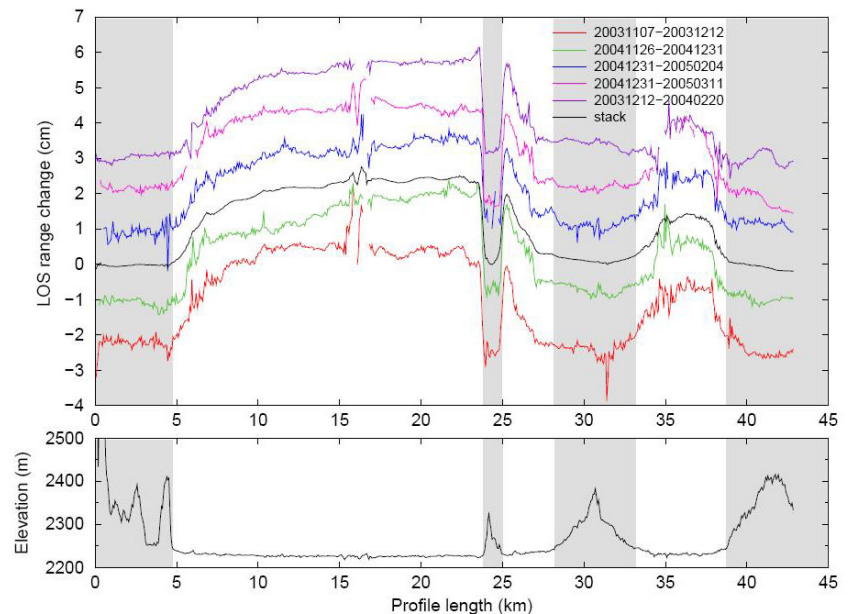
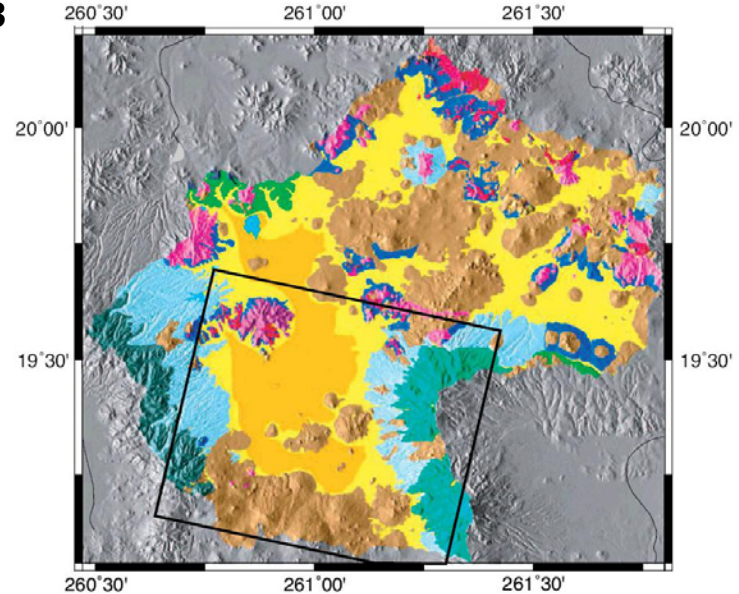
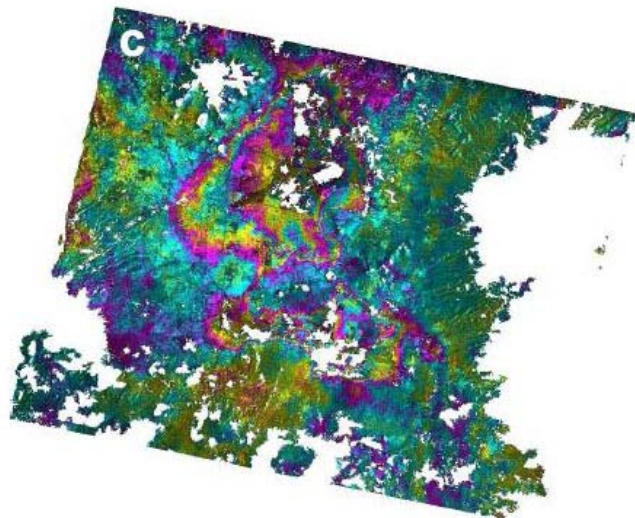
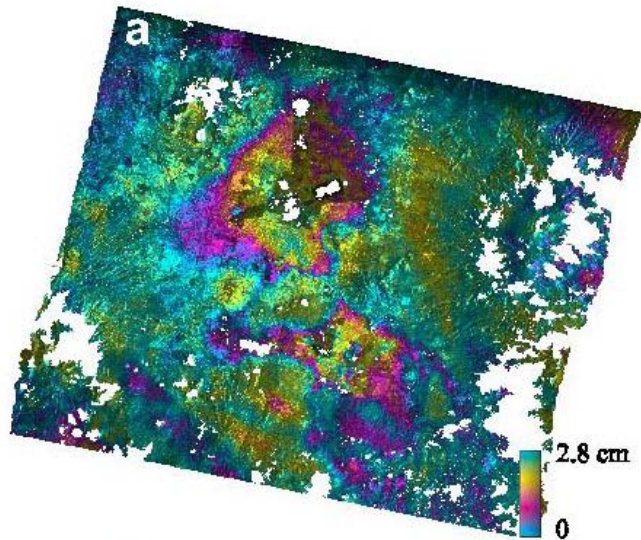
Surface deformation at Sierra Negra and Fernandina volcanoes, Galapagos (PI: William Chadwick, USA)



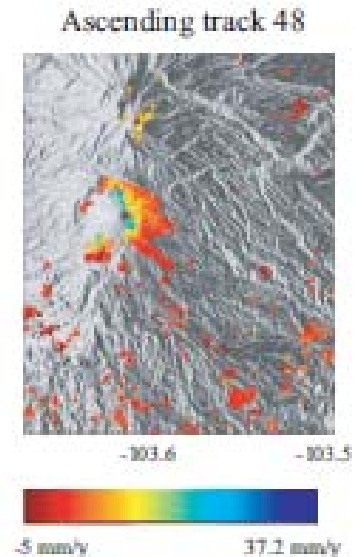
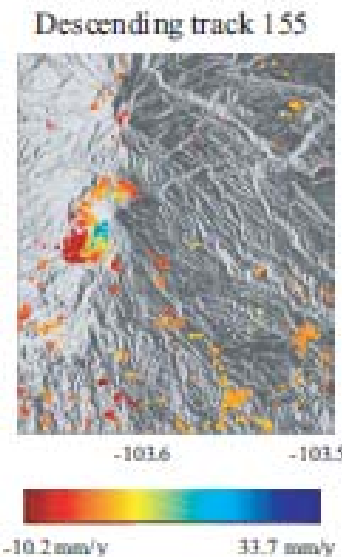
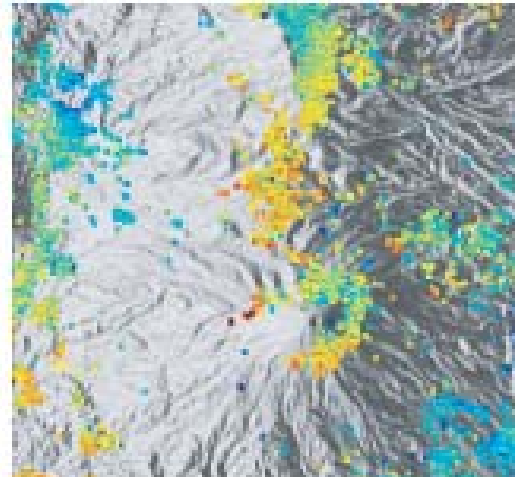
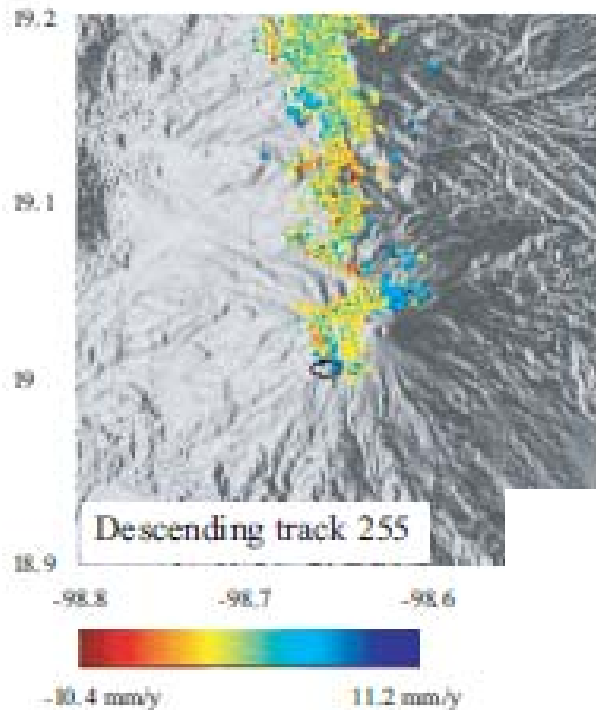
Interferogramas de distintas fechas



## Subsidencia en Mexico City - Lopez-Quiroz et al., 2008



## STUDY OF THE DEFORMATION FIELD OF TWO ACTIVE MEXICAN STRATOVOLCANOES (POPOCATEPETL AND COLIMA VOLCANO) BY TIME SERIES OF INSAR DATA (Pinel et al.)



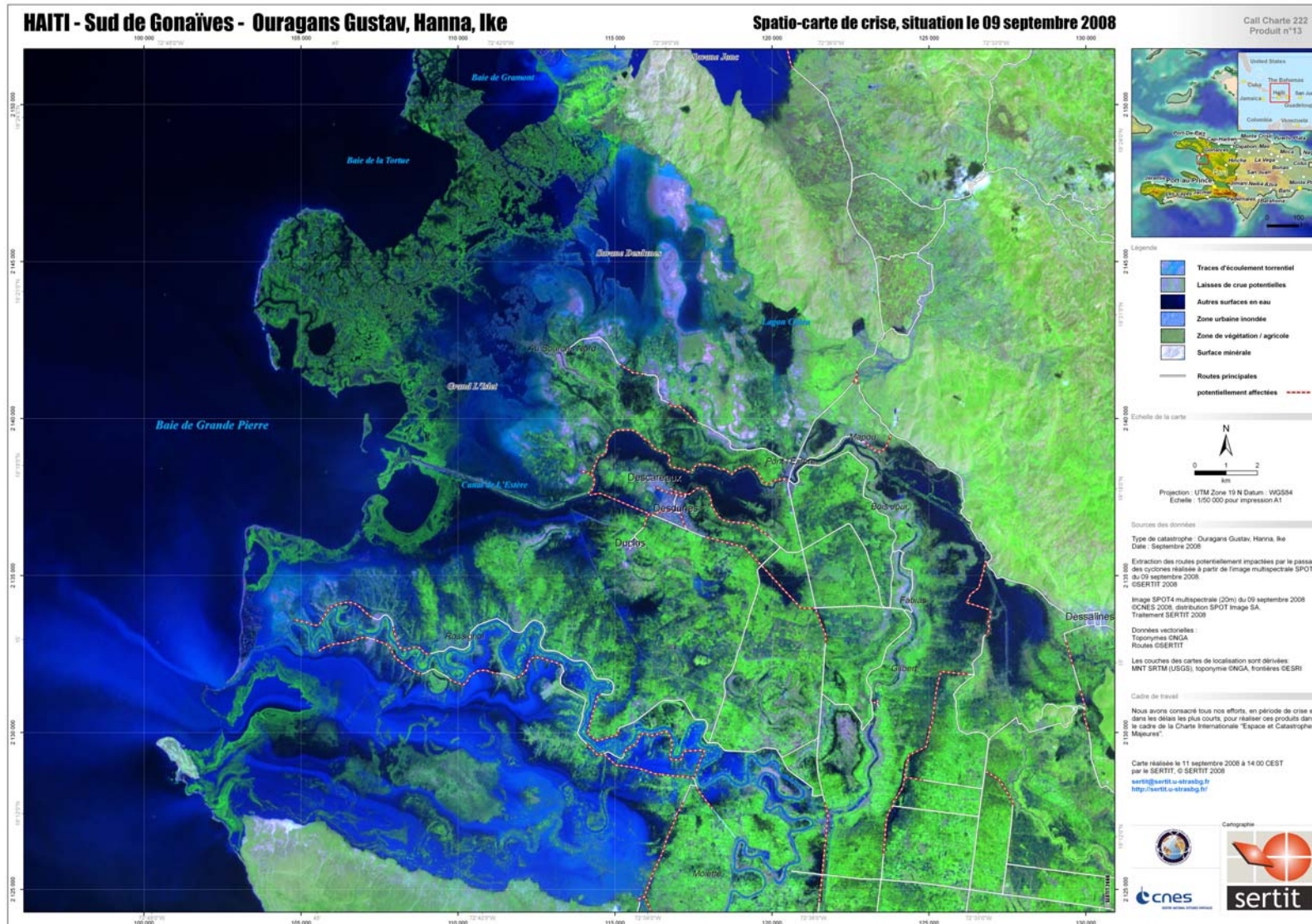
# **International Charter Space and Major Disasters**





The screenshot shows the homepage of the International Charter Space and Major Disasters website. The header features the ESA logo and the title 'INTERNATIONAL CHARTER SPACE AND MAJOR DISASTERS'. A navigation bar includes links for 'Contact Us', 'English', 'Español', 'Français', '日本語', and '中文'. The left sidebar contains a menu with links to 'Home', 'Charter Activations', 'Activations Map', 'Media Gallery', 'News', 'Press Releases', 'About the Charter', 'FAQ', 'Text of the Charter', 'Activating the Charter', 'Charter Members', 'Charter for Schools', 'Advanced Search', and 'Links'. The main content area is titled 'The International Charter' and describes the organization's mission. Below this, there are sections for 'Latest Charter Activation' (Earthquake and tsunami in Chile) and 'Recent Activations' (Earthquake and tsunami in Chile, Potential collapse of a tailing pit dam, Ukraine, Cyclone on Pacific Islands, Flood in Peru, Flood in Bolivia, and Activations Archive). The footer includes a copyright notice: 'Copyright © 2000 - 2009 | Last Update: 09 February 2010'.

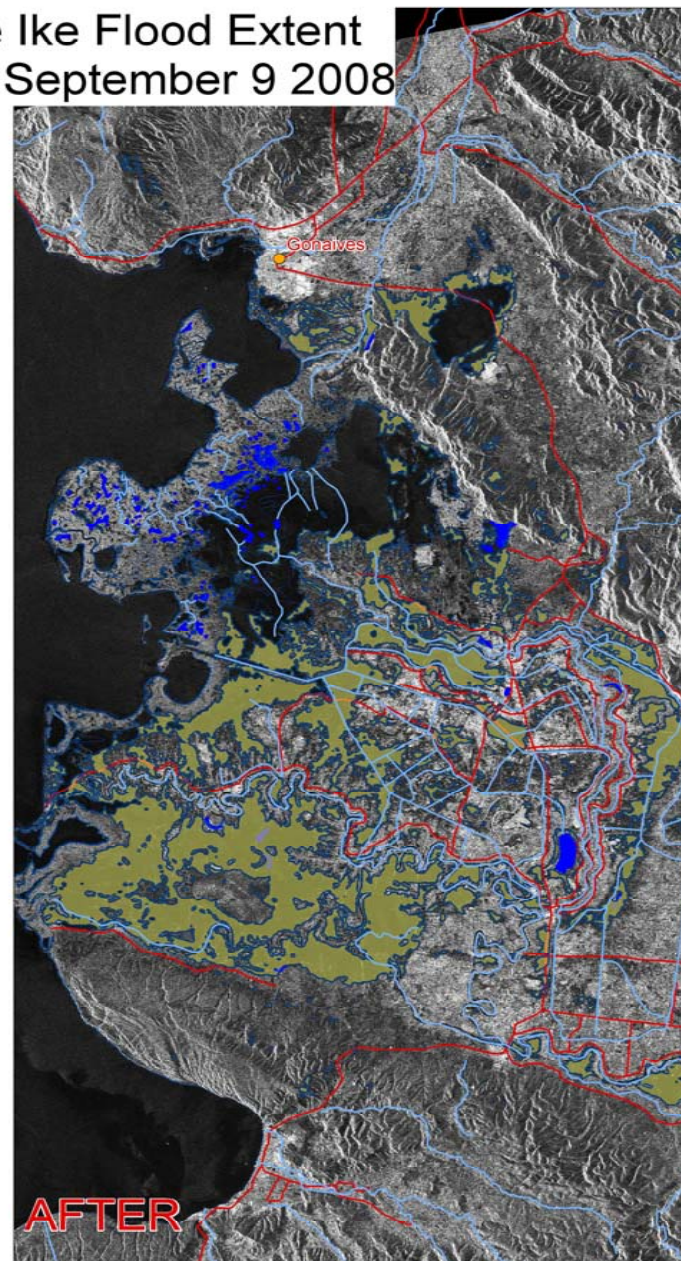
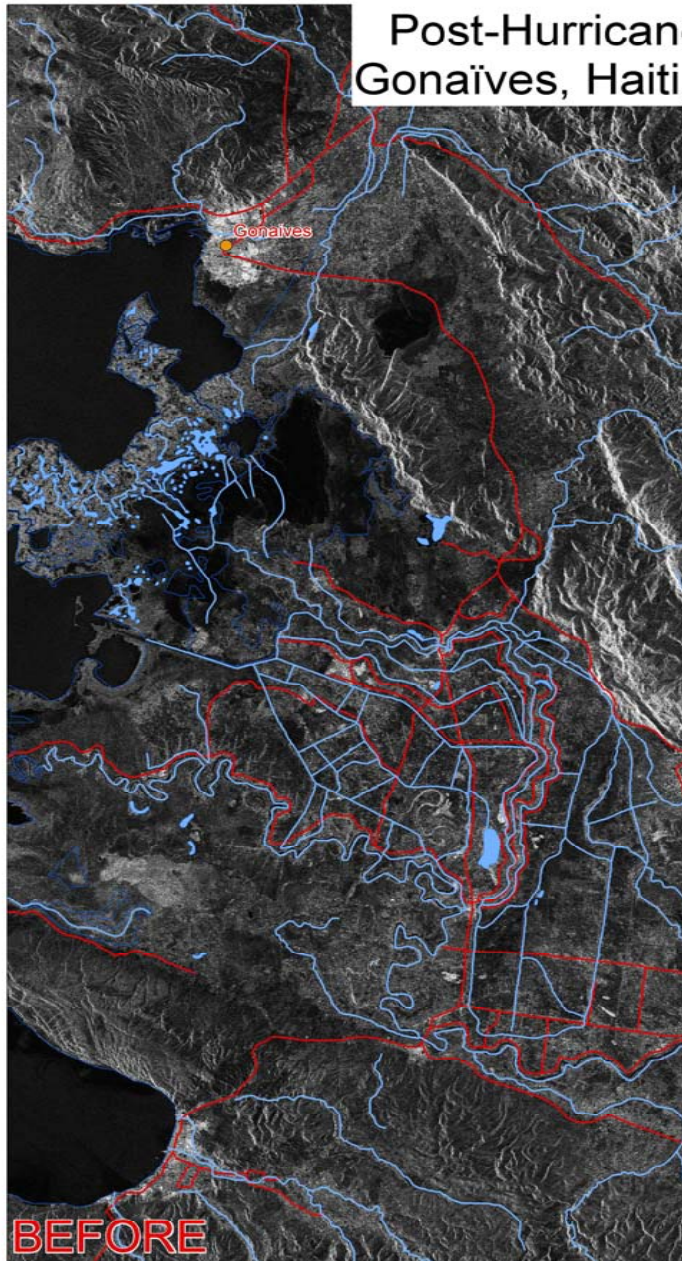
# CHARTER: Floods in Haiti, Hurricanes Gustav, Hanna & Ike





# CHARTER: Floods in Haiti, Hurricanes Gustav, Hanna & Ike

Post-Hurricane Ike Flood Extent  
Gonaïves, Haiti, September 9 2008



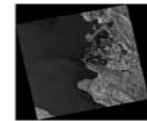
## Locational Diagrams



## Legend

- Rivers
- open water flooded extent
- Lakes
- Populated places
- Roads
- Coastline

## ALOS



## Interpretation

Severe flooding began in Haiti the end of August, 2008. This was the result of four major storms hitting the area in less than one month. In late August tropical storm Fay and Hurricane Gustav affected the Caribbean country. Hurricane Hanna hit the first week of September, and the Northern part of the country was affected by Hurricane Ike on September 7. This map shows the Gonaïves area affected by the flood on an ALOS. The emergency response team at the Canada Centre for Remote Sensing created flooded area and flooded vegetation products.

0 1 2 3 4 km

Map Scale 1:70 000

## Projection & Grid Information

Projection: UTM Zone 18 N  
Spheroid: WGS 1984  
Datum: WGS 1984

## Satellite Information

Satellite: ALOS  
Sensor: PALSAR  
Polarization: HH  
Off Nadir Angle: 30.8  
Pixel Spacing: 6.25 m  
Acquisition Date: September 9, 2008  
Georeferencing: Orthorectification

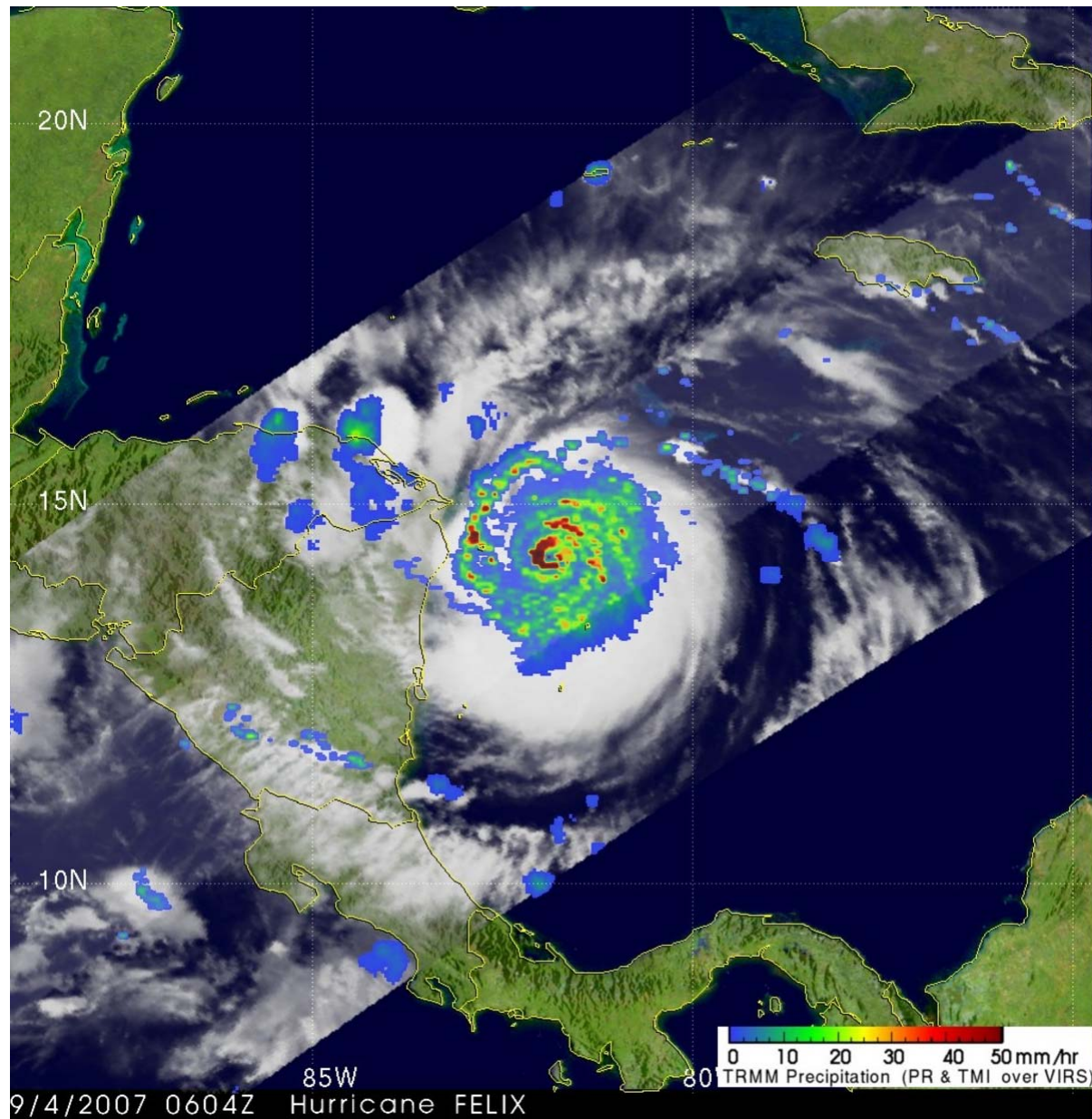
## Credits & Copyright

Open Water polygons derived from ALOS by the Canada Centre for Remote Sensing, Natural Resources Canada  
ALOS imagery © JAXA, 2008  
Coastline, river, lake, road vector data VMAP Level 1





# CHARTER: Hurricane Felix, Yucatan





## DFO Event # 2007-213 - Mexico - Tabasco - Rapid Response Inundation Map 1

ALOS PALSAR\* flood inundation limit November 8, 2007: ■

\* ALOS PALSAR data obtained by CATHALAC through the International Charter "Space and Major Disasters"

MODIS flood inundation limits

November 10, 2007: ■

Nov 6: ■ Nov 5: ■ Nov 3: ■

ALOS PALSAR scenes

November 8, 2007: □

MODIS cloud free area

November 10, 2007: □

GLIDE#: FL-2007-000200-MEX

SRTM SWBD reference water: ■

DCW Rivers: — Urban Areas: ■

Maximum Observed Inundation Limit

1999 - 2005: ■

Universal Transverse Mercator

UTM Zone 16 North

WGS 84 - Graticule: 2 degrees

Shaded Relief from SRTM data

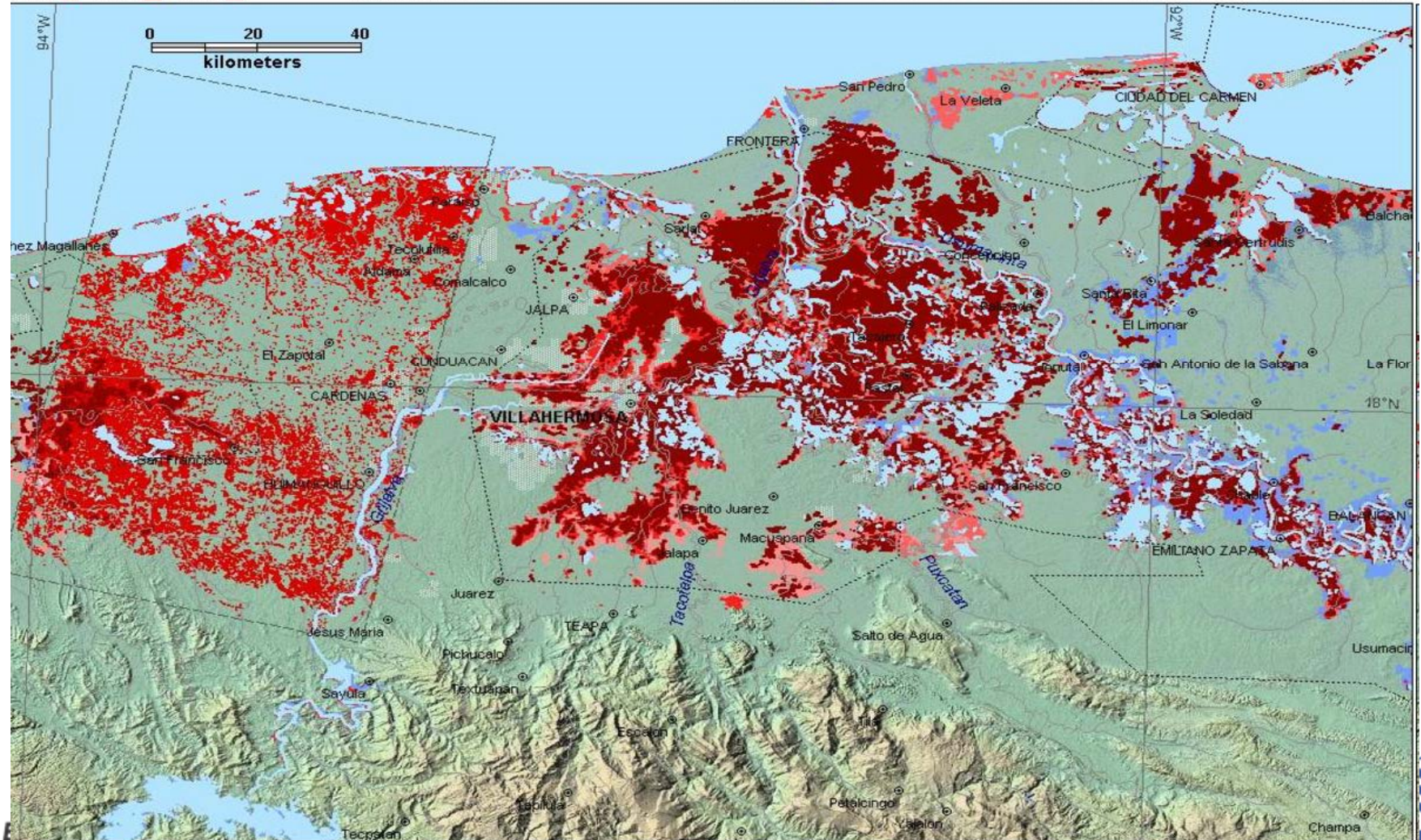
Copyright 2007

Dartmouth Flood Observatory

Dartmouth College

Hanover, NH 03755 USA

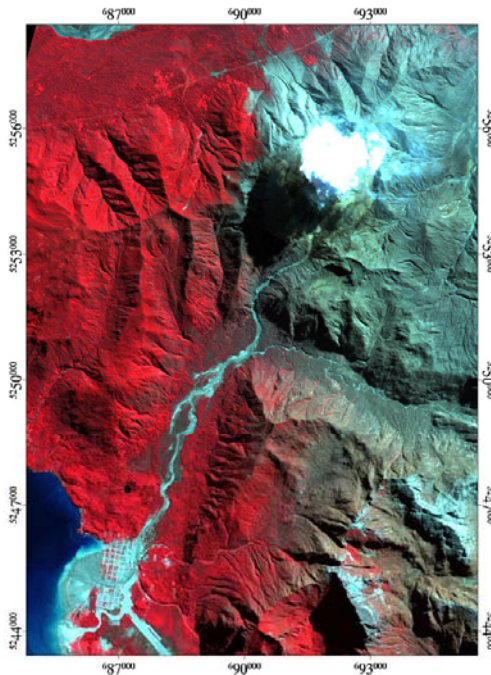
Elaine K Anderson, G. R. Brakenridge



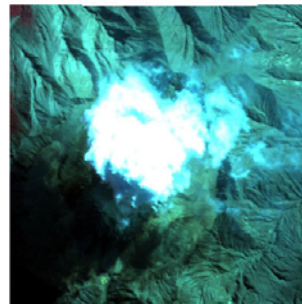


Volcán Chaiten, Ciudad y Alrededores el 8 de Marzo de 2009

ALOS - AVNIR-2, 10 m resolución, RGB: 432



Detalle del cráter (432)



Detalle de la ciudad (321)



Volcán Chaiten, Ciudad y Alrededores el 8 Marzo 2009

ALOS-AVNIR-2, 10 m, RGB: 4-3-2

Nivel de procesamiento: 2A (UTM, Zona 18)

Créditos: JAXA, 2009

Procesamiento: CONAE, 2009

Carta Internacional

'El Espacio y Las

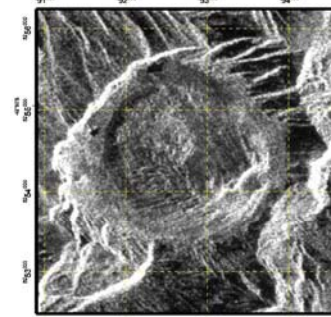
Grandes Catastrofes'

Charter Call # 246

Erupción Volcán Chaiten

## VOLCÁN CHAITÉN \_ CHILE \_ FEBRERO 2009

02 MAR 2008

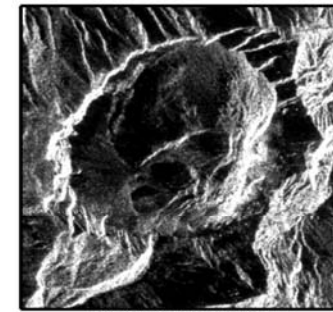


Producto:  
Composición por y por modo:  
Fuente: Imagen ALOS  
Sensor: PIV 10m, 6.5m  
Nivel de procesamiento: 2A  
Fecha: 02 MAR 2008 y 28 FEB 2009  
Código: Copyright JAXA, METI, 2009  
Procesamiento: JAXA y CONAE  
JAXA 2009

Carta Internacional  
El Espacio y Las  
Grandes Catastrofes  
Ch. Call # 246  
Volcán Chaiten 2009

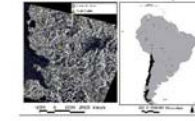


28 FEB 2009



VISTA DEL CRATER DEL VOLCÁN

Chile-Chaitén- Volcano - Posición Geográfica



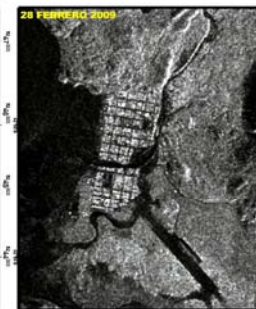
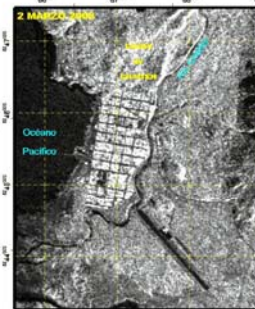
## SITUACIÓN PREVIA

- situación previa al evento de mayo 2008 -

## SITUACIÓN ACTUAL

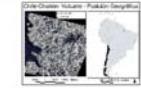
## LOCALIDAD DE CHAITÉN - CHILE - 2009

Comparación: Situación 02 MAR 2008 y 28 FEB 2009

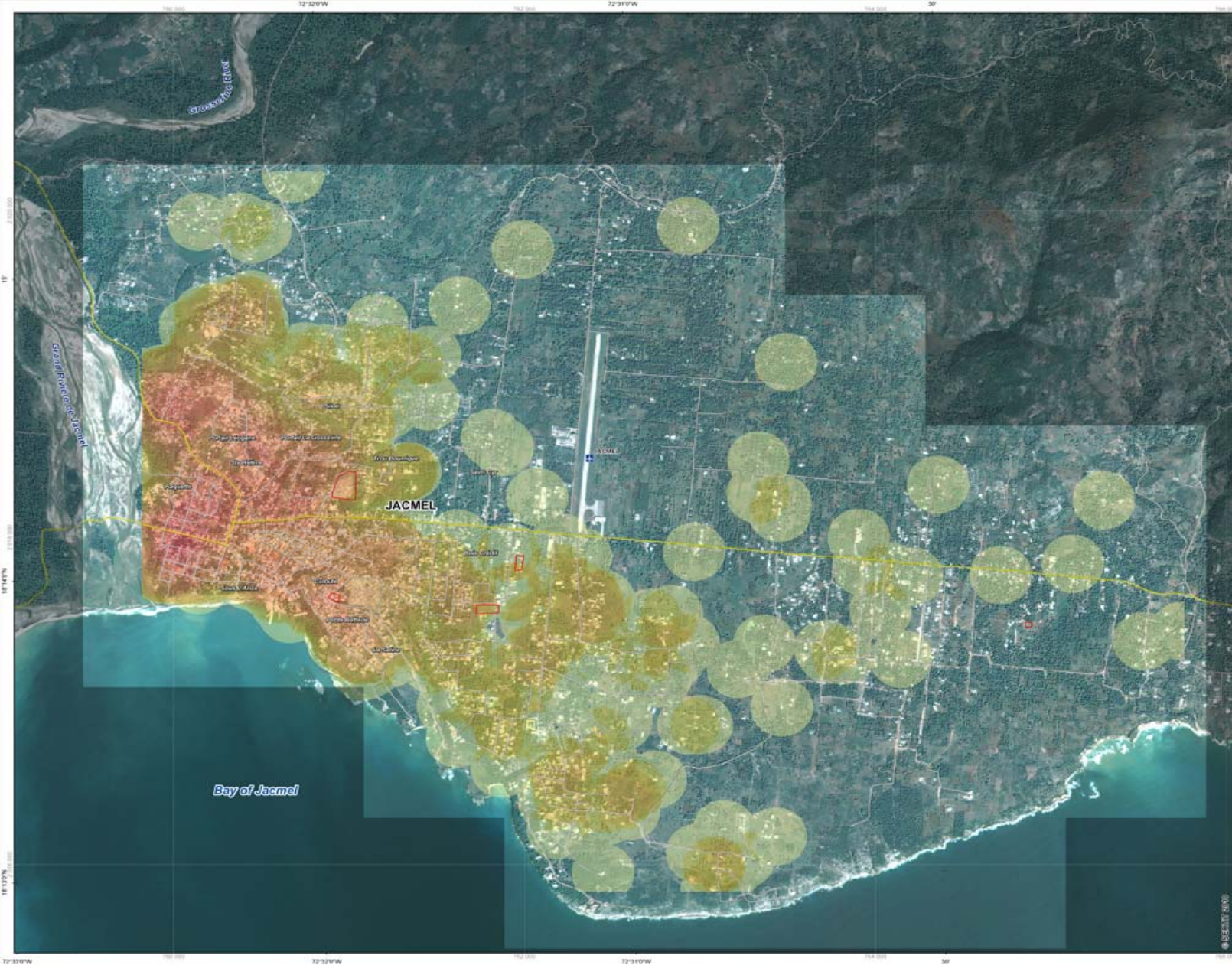


Producto:  
Composición por y por modo:  
Fuente: Imagen ALOS  
Sensor: PIV 10m, 6.5m  
Nivel de procesamiento: 2A  
Fecha: 02 MAR 2008 y 28 FEB 2009  
Código: Copyright JAXA, METI, 2009  
Procesamiento: JAXA y CONAE  
JAXA 2009

Al 28 de FEBRERO de 2009 se observa la desembocadura del río al océano Pacífico producida por la erupción en MAYO de 2008.







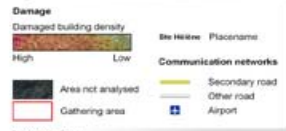
CHARTER G81 287 to 290 - SAFER Action No. 024  
Product No. 18

## HAITI Jacmel Damaged building density and gathering areas Situation the 15th of January 2010

### Location Diagrams



### Legend



### Interpretation

A strong earthquake of magnitude 7.0 hit Haiti on the 12th of January 2010 at 21h53 (GMT), 16h53 (local time). The epicentre was located 13 km to the South West of the capital Port-au-Prince causing heavy damage; many casualties are reported and feared. This map shows a density of damaged buildings and gathering areas as observed in DigitalGlobe imagery acquired the 15th of January 2010 in the city of Jacmel. The surface of the country circle is 0.1 square kilometer in a 21 km analysed area. The results of this mapping should be used with precaution. Exhaustivity is not guaranteed.

### Cartographic Information

0 500 1 000 N  
Local projection: UTM Zone 18 North, Datum: WGS 84  
Geographic projection: Lambert (Lambert), Datum: WGS 84  
Scale: 1:10 000 for A1 prints

### Data Sources

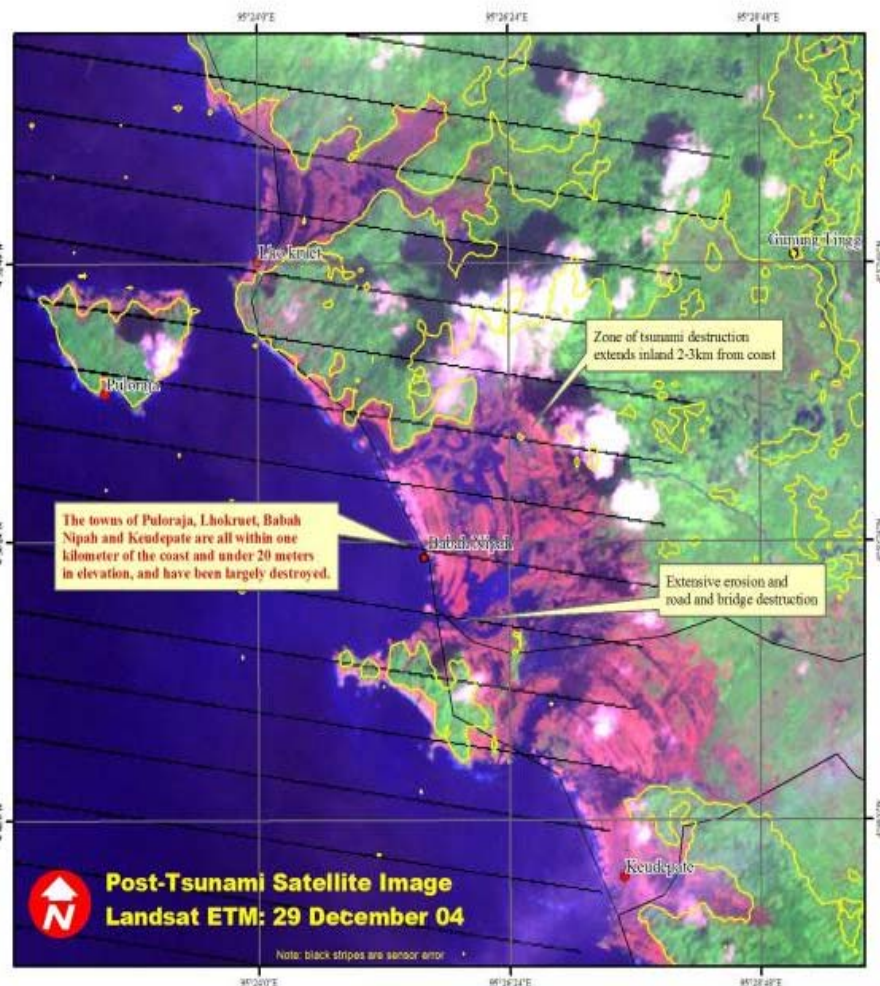
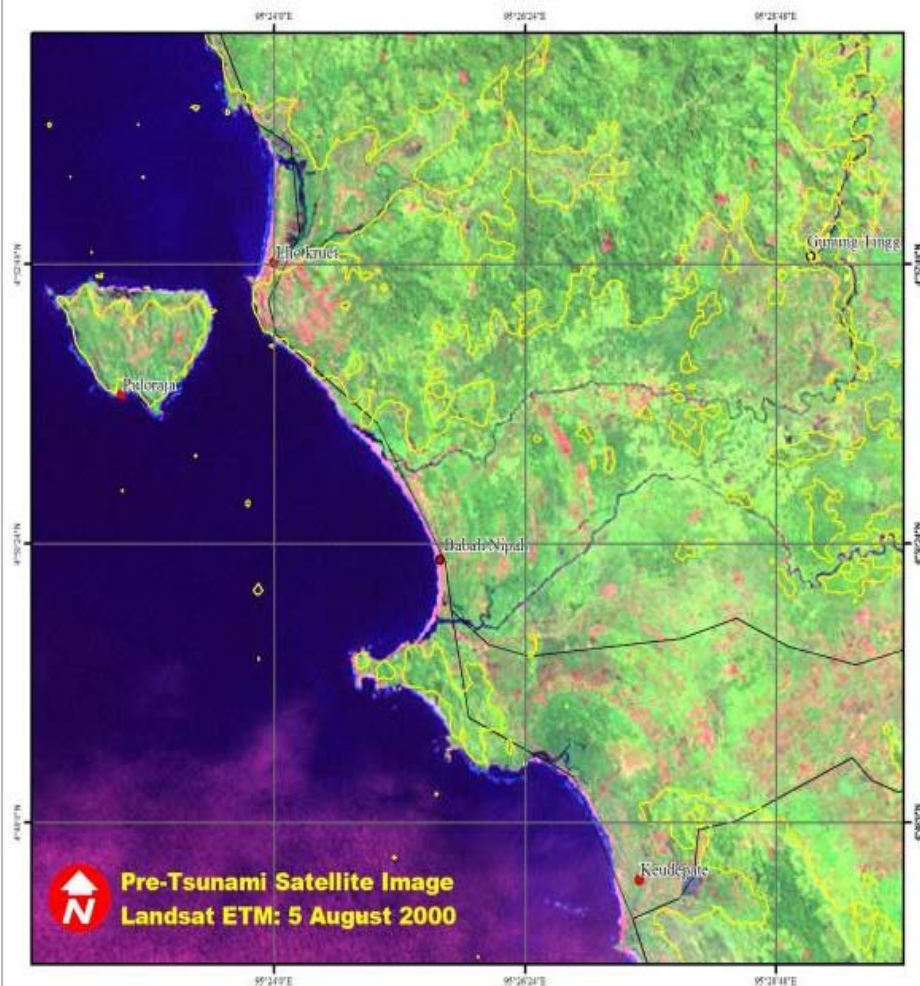
Damaged buildings density and gathering areas are derived from DigitalGlobe multispectral image (0.5 m) acquired the 15th of January 2010  
© SERTIT 2010  
Background imagery  
KOMPSAT 2 (1 m) acquired the 21st of January 2010  
© KARI 2010  
Roads are derived from SPOT 5 multispectral data (10 m) acquired the 3rd of July 2007  
© SERTIT 2010  
Other thematic layers & toponymy  
© SERTIT 2010, GIST, ESRI

### Framework

The products elaborated for this Rapid Mapping Activity are realized to the best of our ability, with in a very short time frame, during a crisis-response, optimising the material available. All geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials. No liability concerning the content or the use thereof is assumed by the producer.

Map produced the 22nd of January 2010 by SERTIT  
© SERTIT 2010  
[sertit@sertit.u-strasbg.fr](mailto:sertit@sertit.u-strasbg.fr)  
<http://sertit.u-strasbg.fr>





## Post-Tsunami Image along West Coast of Aceh Province

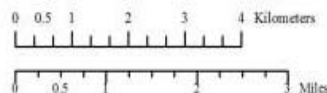
The International Charter on Space and Major Disasters aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorized users. Since 1 July 2003 the Charter is available to support the UN with satellite imagery. Please contact the UN Office for Outer Space Affairs for further information (oosa@unvienna.org).

This map was produced for the UNOSAT project headed by UNITAR and executed by UNOPS. UNOSAT is a UN-private consortium providing satellite imagery and related geographic information to UN humanitarian and development agencies, and their implementing partners. Please see [www.unosat.org](http://www.unosat.org) for additional information.

Disaster Type: Tsunami & Earthquake  
Disaster Date: 26 December 2004  
Data Source: USGS EROS, JPL, Global Insight  
Sensor: Landsat ETM (p131r057) 29 Dec. 2004 & 05 August 2000  
Resolution: 28m  
Bands: 7/4/2  
Elevation Data: SRTM (3 arc second)  
Resolution: 90m horizontal/16m vertical  
Scale: 1:77,000 for A3 Prints  
Datum: WGS-84  
Projection: UTM Zone 46N  
Map Produced: 1 January 2005

The depiction and use of boundaries, geographic names and related data shown here are not warranted to be error-free nor do they necessarily imply official endorsement or acceptance by the United Nations.

This map illustrates the extent of the tsunami destruction along the western coast of Sumatra. The dark red zone in the image from 29 Dec. 04 shows the tsunami reached inland up to 4km, inundating most coastal areas under 20 meters in elevation. The roads, bridges and villages in this zone have been devastated.



**UNOSAT**  
satellite imagery for all

- Town in 20m zone
- Town above 20m
- ✈ Airport
- Road
- +—+—+ Railroad
- 20 Meter Contour



# ESA Initiative on Climate Change

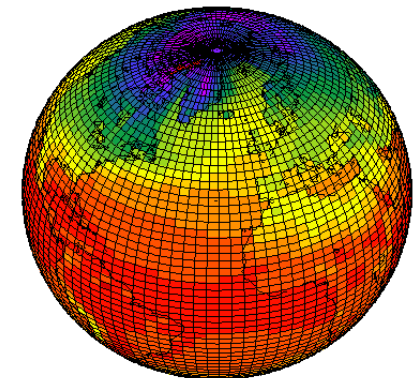
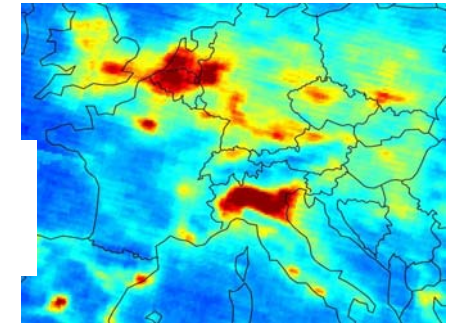
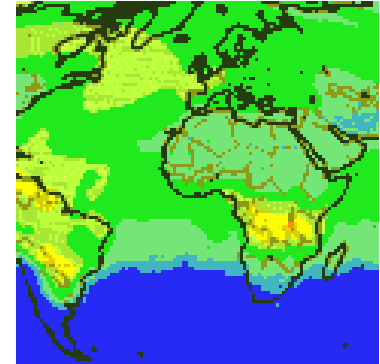
# ESA Iniciativa sobre el Cambio Climático

## ■ El fundamento de la iniciativa:

Para generar y distribuir sistemáticamente series a largo plazo de **“Variables climáticas esenciales” (ECV)** para cubrir las necesidades de la UNFCCC y el IPCC, basado en datos de archivo de la ESA

## ■ Output :

■ **ECV Records:** Cuantificar el estado del sistema climático para (a) avanzar en el conocimiento y (b) respaldar el trabajo de UNFCCC y el IPCC para la migración y adaptación al cambio climático



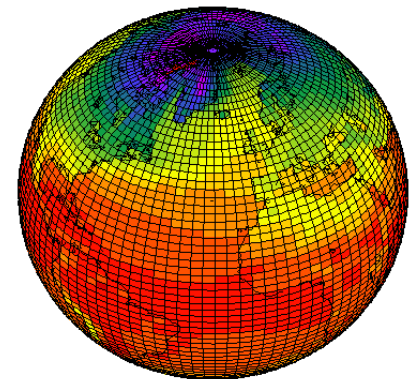
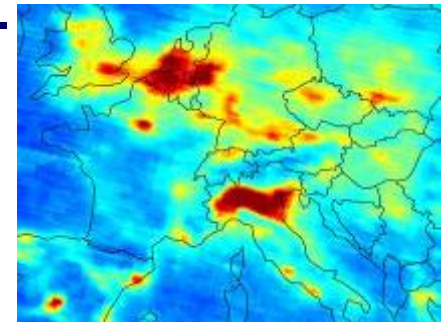


UNFCCC Conference Dec 2007 **Bali Action Plan**

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

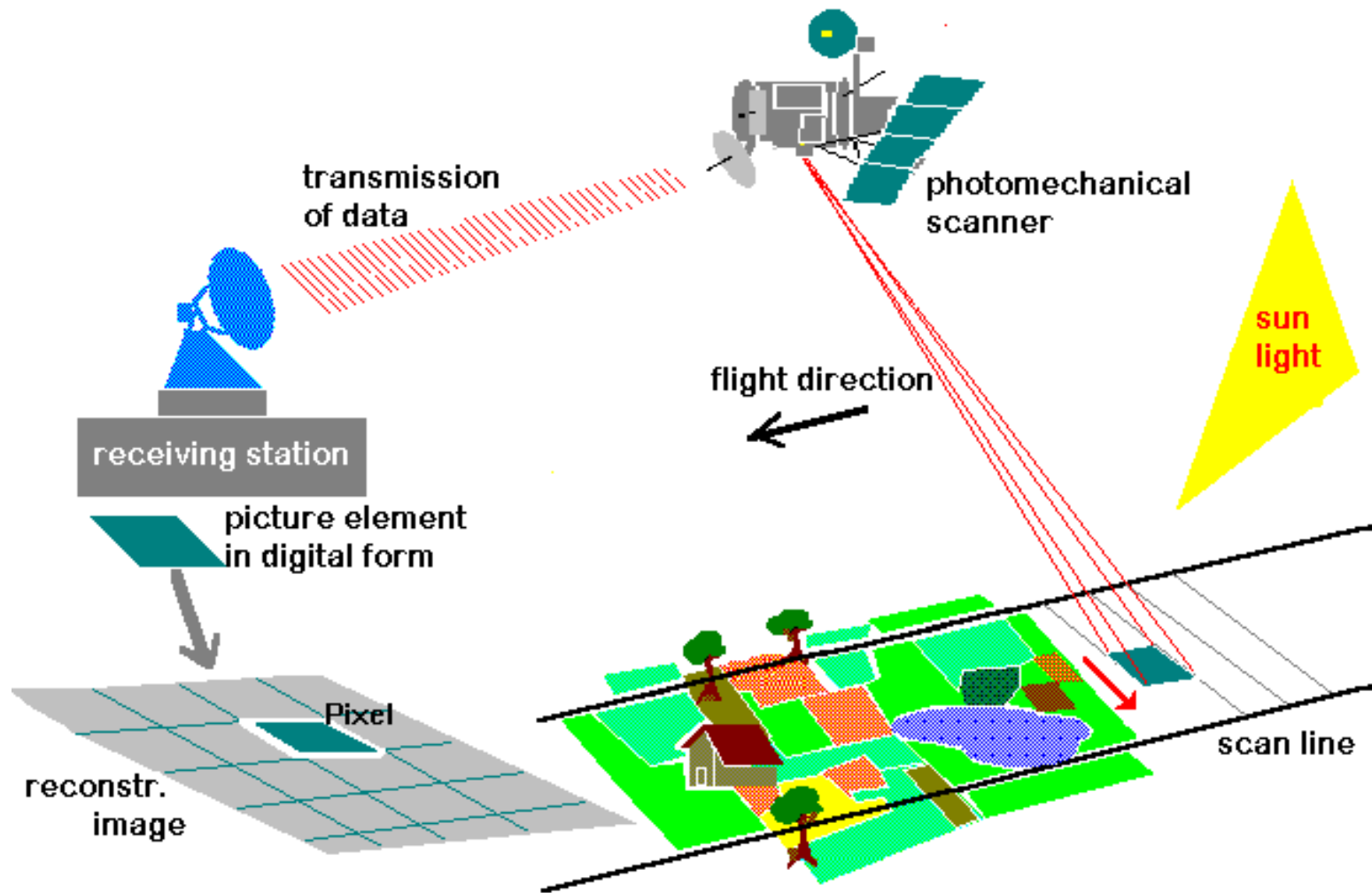


- EO from space plays a vital role,
- ESA to systematically generate and distribute long-term series of **“Essential Climate Variables”**
- Based on ESA archived EO data (30 years),
- Internationally agreed requirements
  - GCOS definition of ECV
  - CEOS response for required space observations
- To quantify the state of the Climate system to
  - Advance our knowledge of climate change,
  - Support work of UNFCCC and IPCC for climate change mitigation and adaptation
- 5 year program, ~ 300M€, decision C-MIN Nov 2008



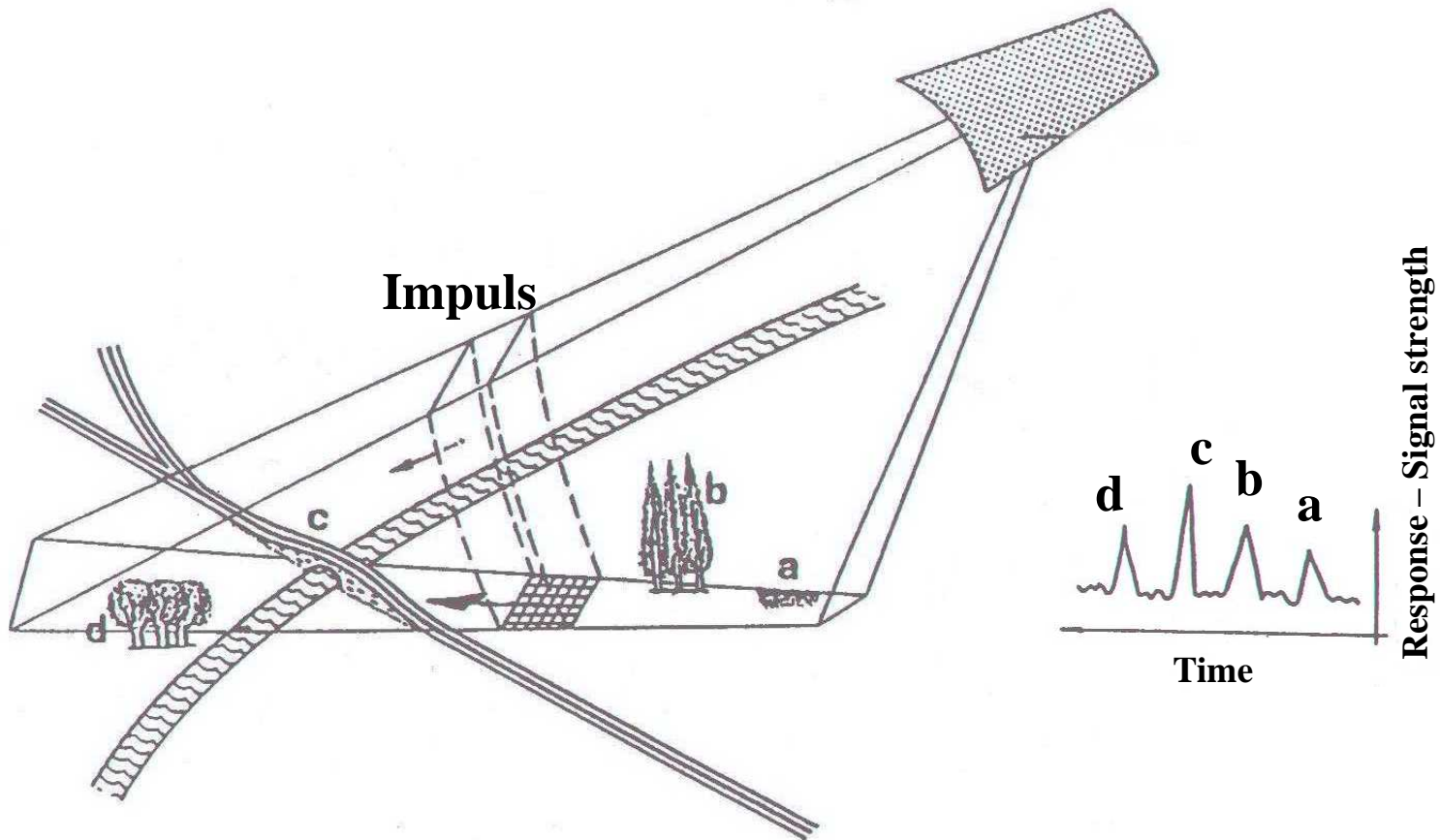
# Remote Sensing Principles

# Scanning and Image Reconstruction (visible/IR)



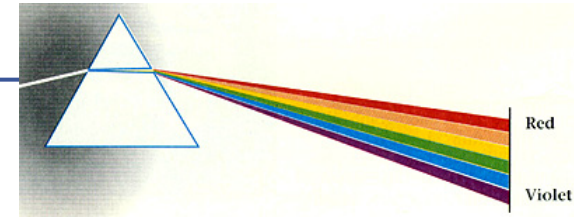
# Imaging Radar

**Radar Antenne:  
Transmitter/Receiver**



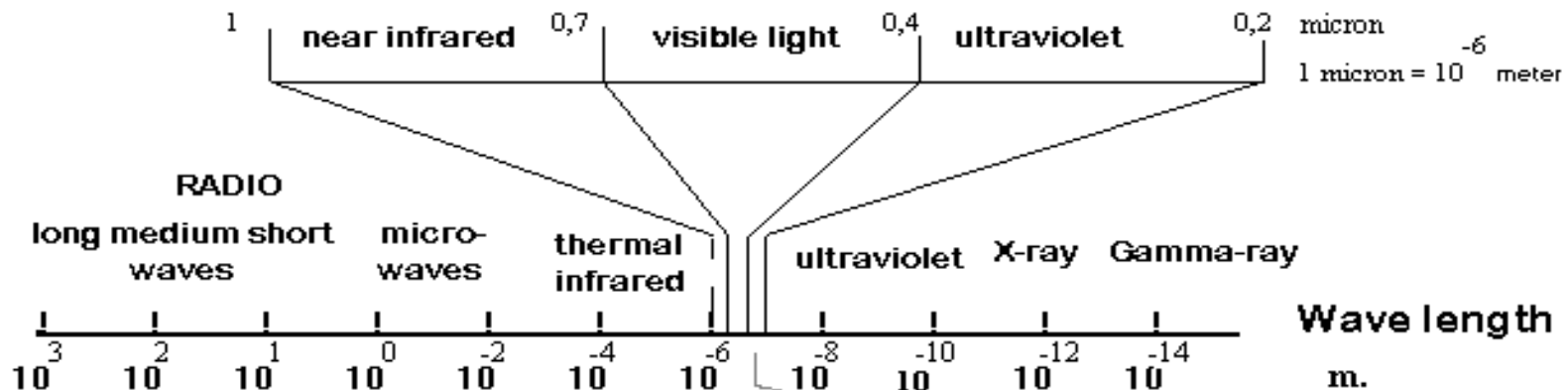


# The Electromagnetic Spectrum



■ red   
 ■ orange   
 ■ yellow   
 ■ green   
 ■ blue   
 ■ violet

white light

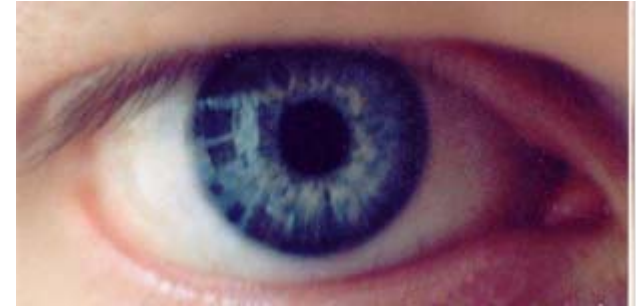


ERS1

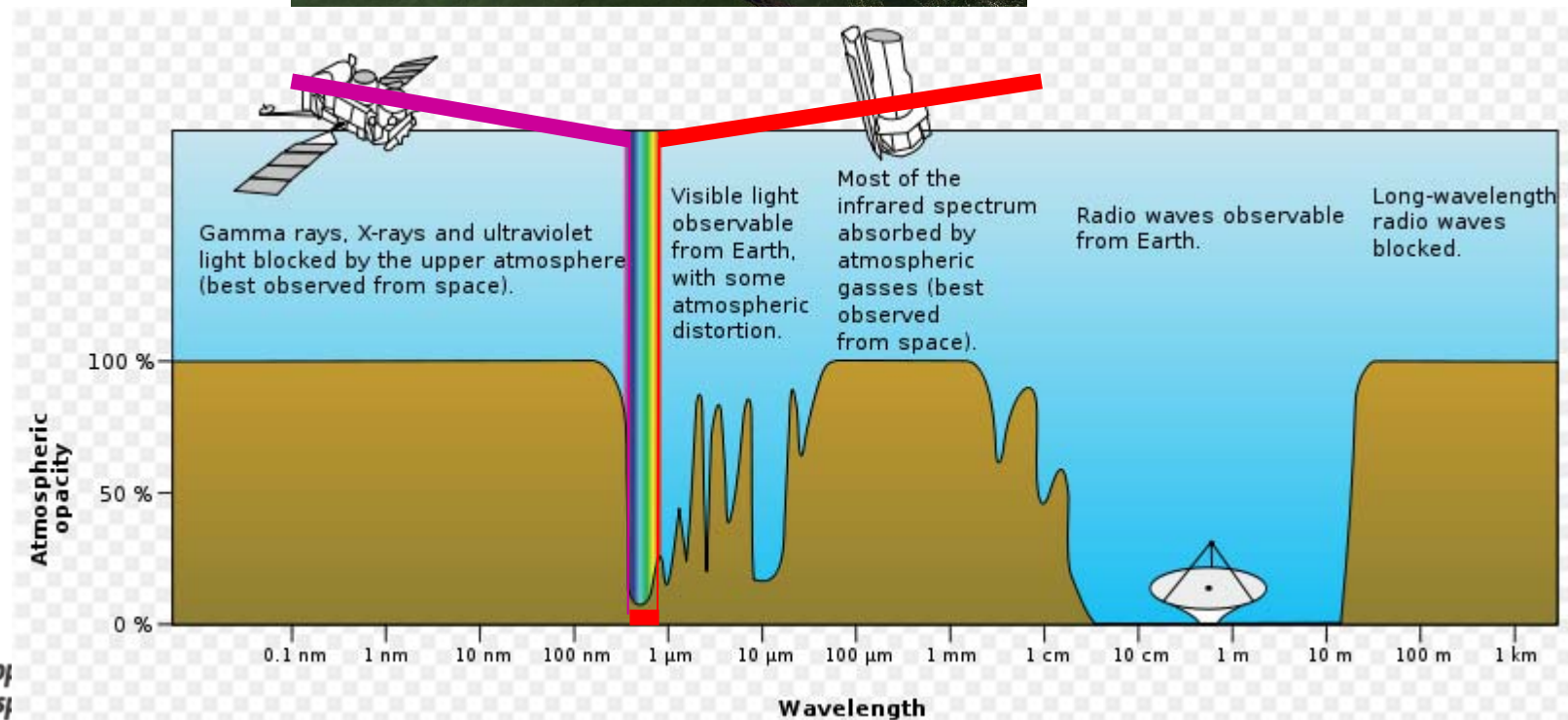
LANDSAT TM Bands

LANDSAT TM Bands

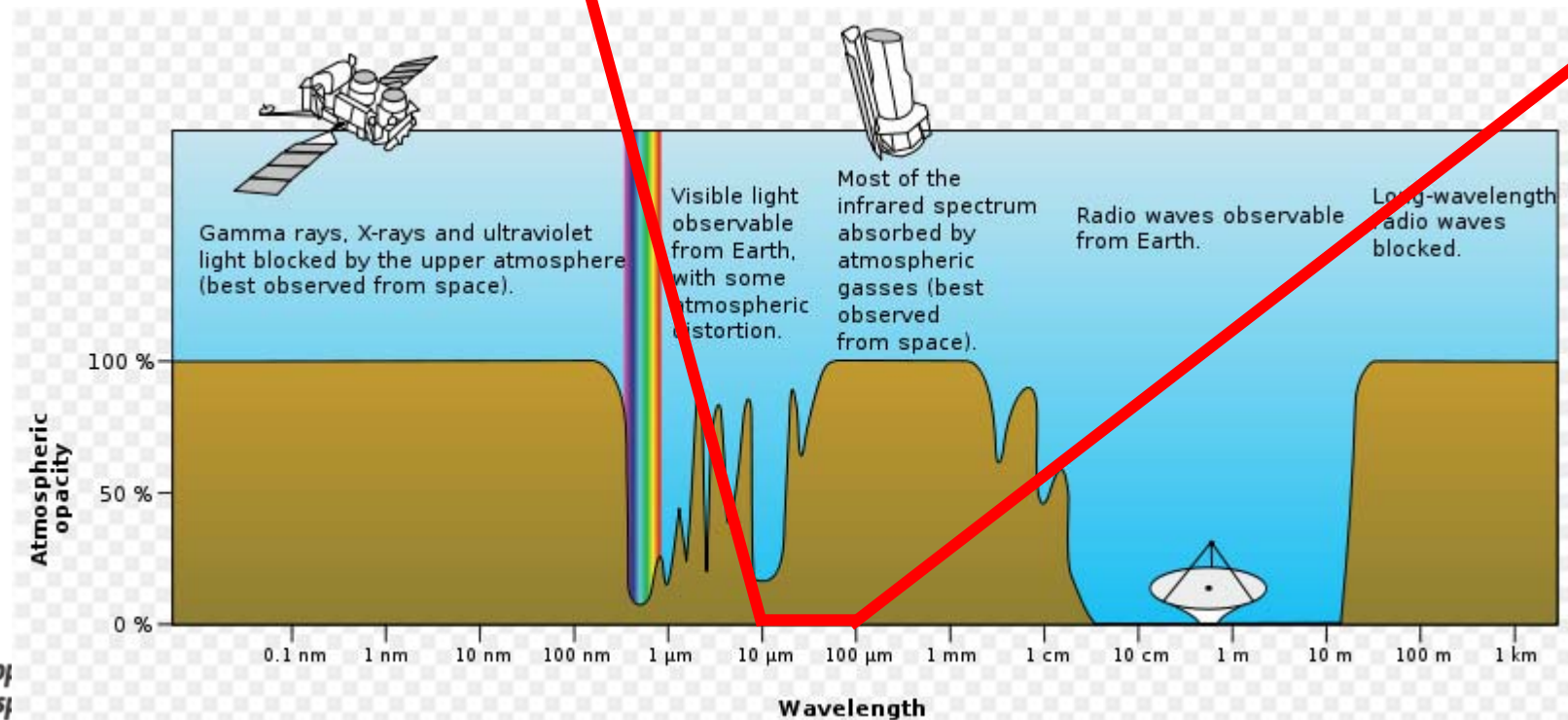
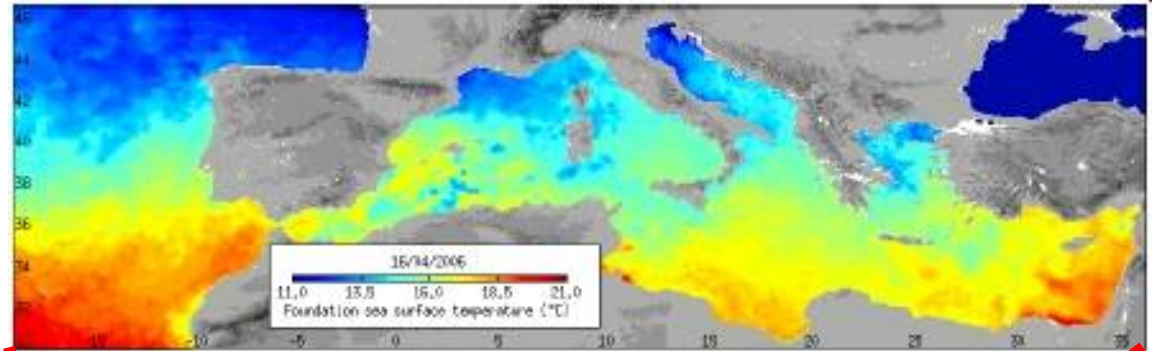
# El espectro electromagnético



**VISIBLE**



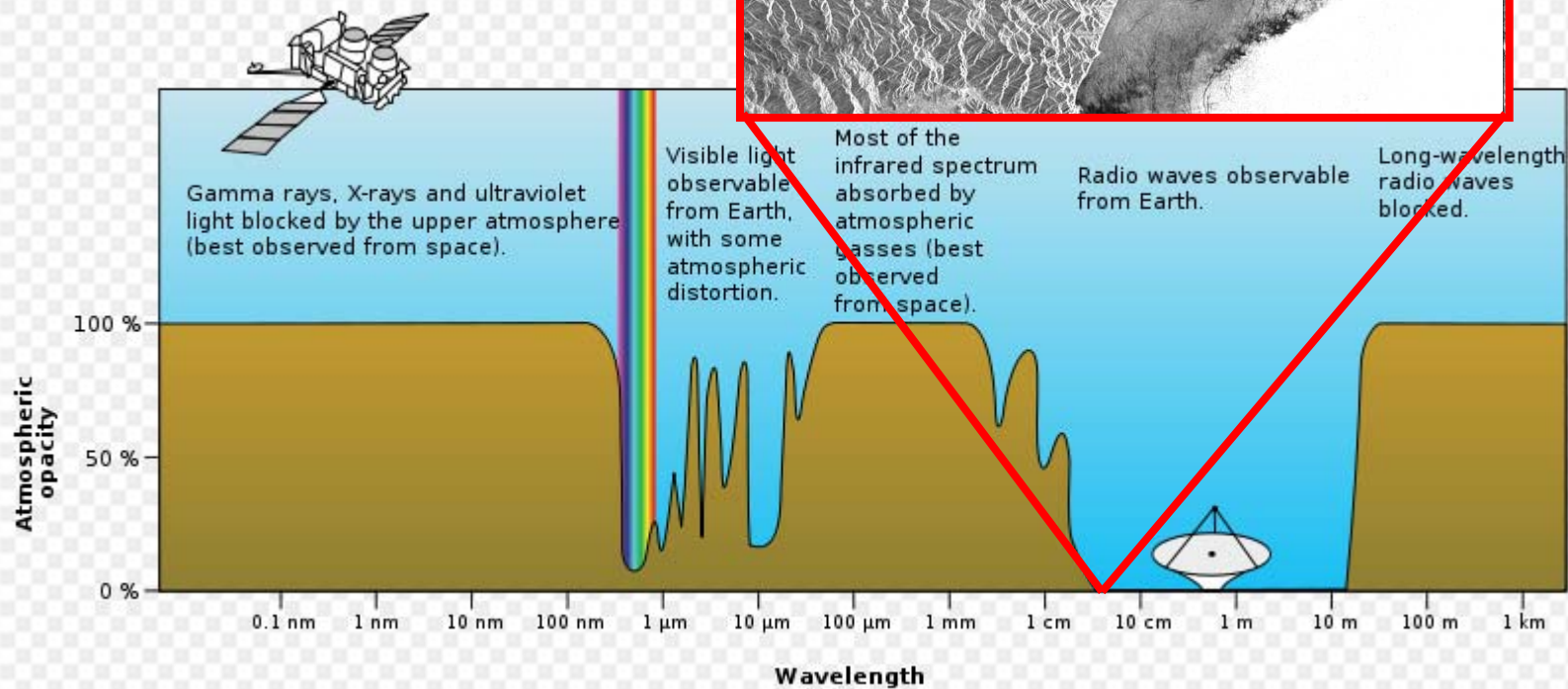
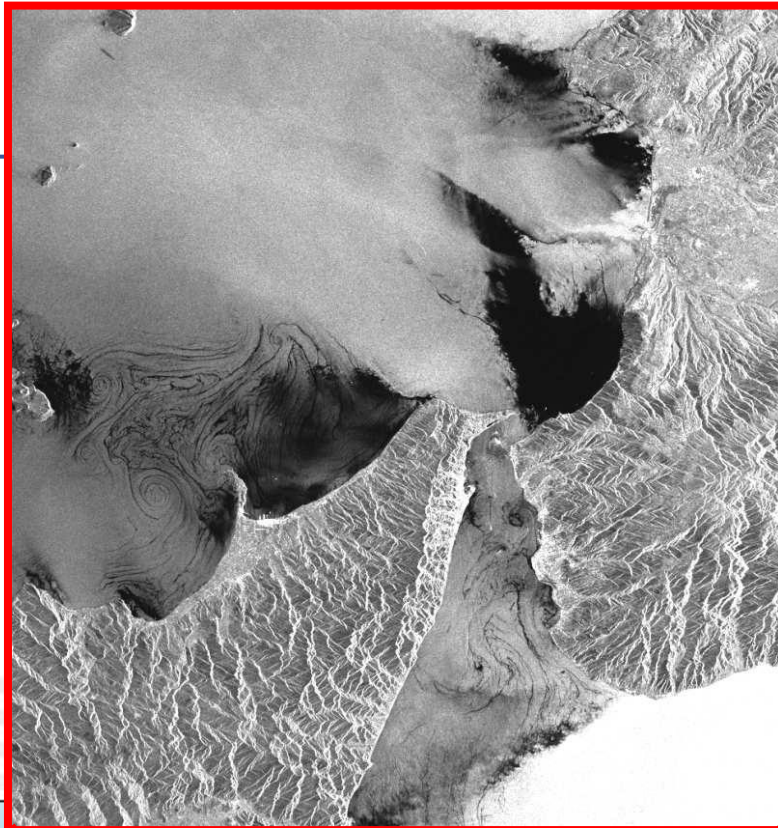
# Infrarrojo térmico



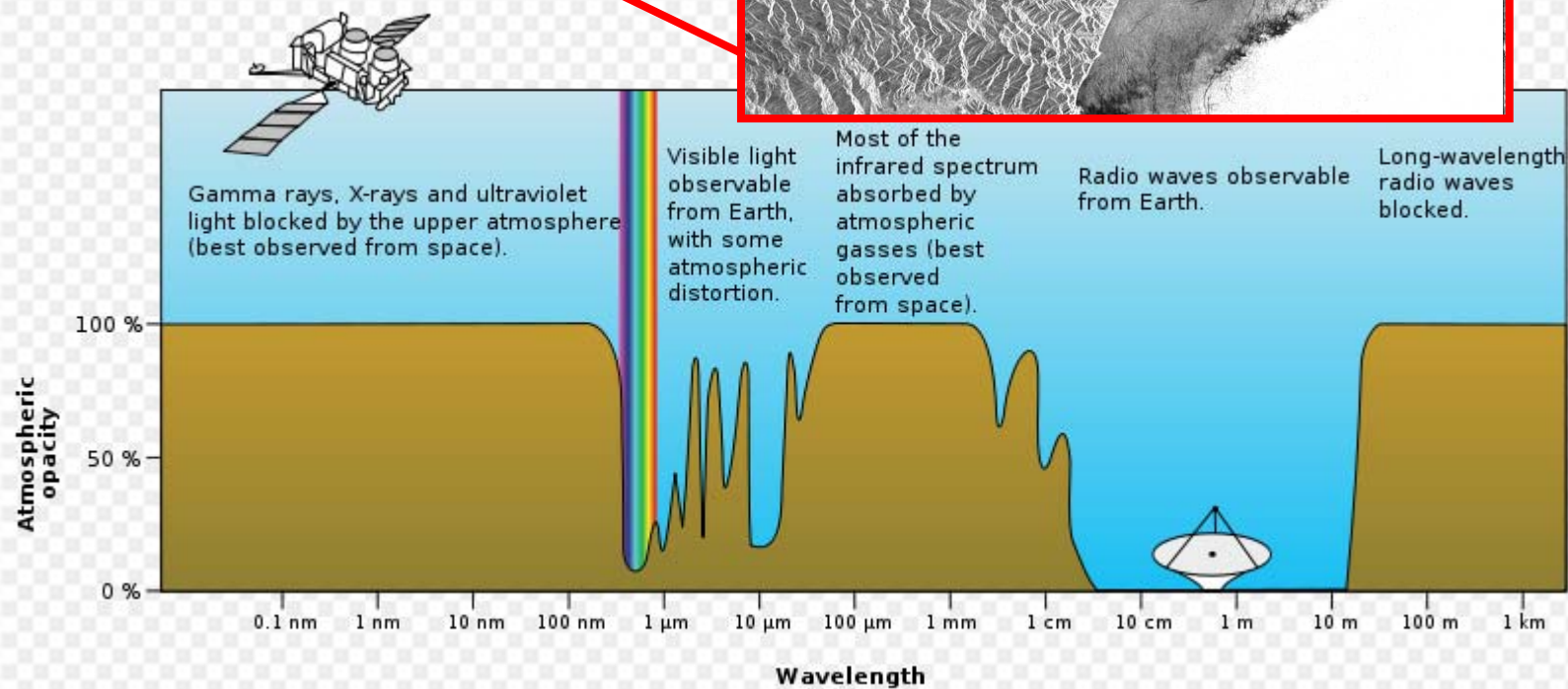
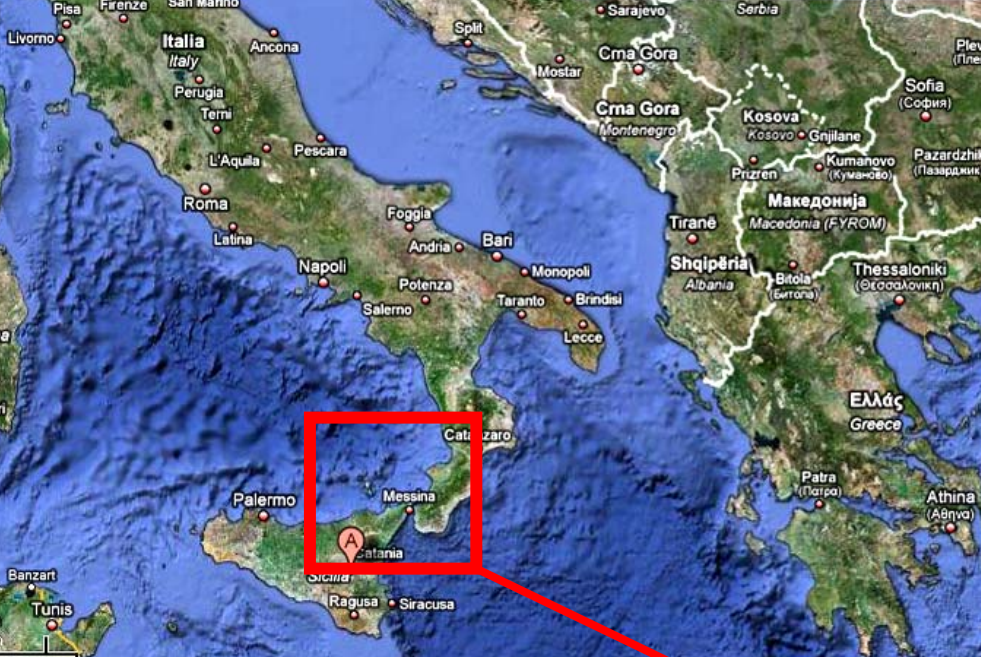




# RADAR







# Eduspace and LEOWorks 3.0

# History of Eduspace

- Eduspace initiative based on a 98 EURISY workshop on education

- Carried out under umbrella of EURISY by ESA and by some of its national and industrial Partners:



- Danish Ministry of Education, representing the final users (professors and teachers)



- Norwegian Space Centre (NSC), providing also the initial nucleus from the educational SAREPTA Web Site (which was co-sponsored by ESA PR a long time before)



- British National Space Centre (BNSC), contributing to the initial project proposal and towards funding



- Eurimage, providing access to Landsat imagery



- Geospace, Austria, providing access to their “The Alps from Space” high-resolution satellite database.

- Transferred in 2002 from EURISY to ESA

## OBJECTIVES



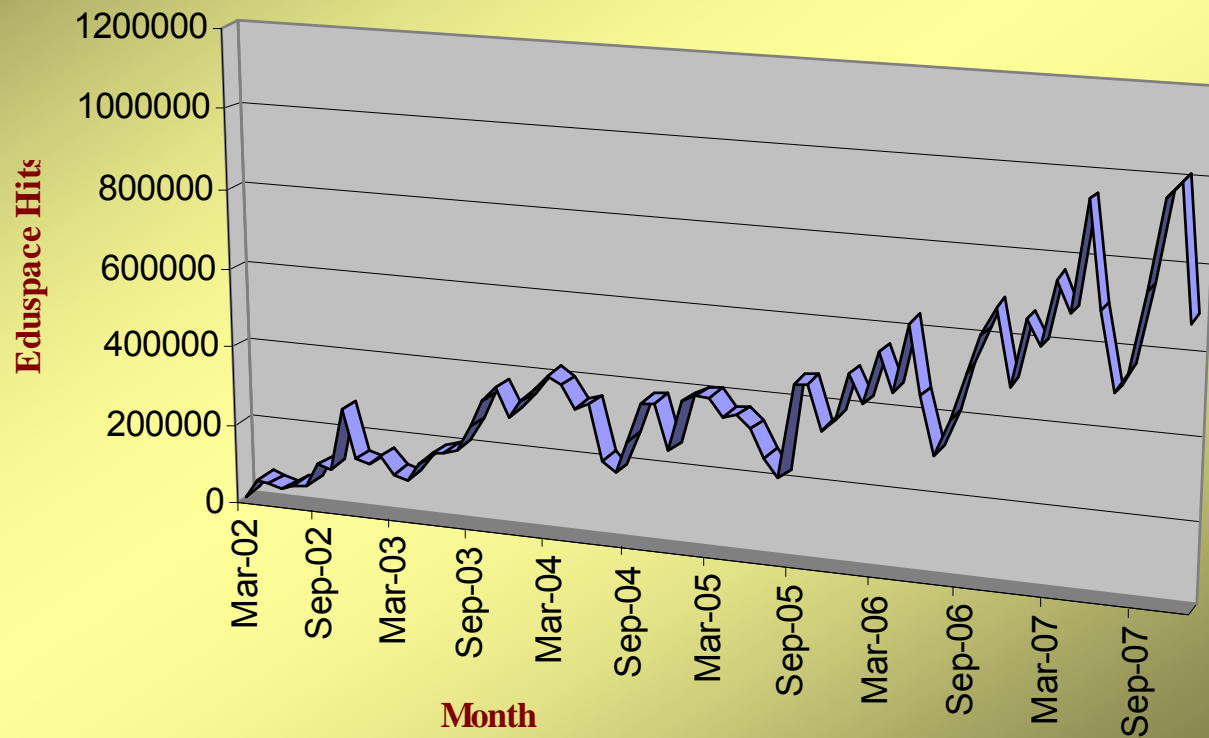
- To inspire teachers to incorporate Earth observation into their curricula
- To provide ready-made curricula projects
- To provide tools and Earth observation data for educational purposes
- To enable schools to take part in collaborative work in Earth observation through a network



- 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.esa.int/eduspace](http://www.esa.int/eduspace) is free



## *Eduspace Hits from March 2002 to December 2007*



**Low values correspond to school holidays**

ESA	Education	Inicio
Sobre Eduspace		
¿Qué es Eduspace?		►
¿Cuáles son las herramientas que ofrece?		►
Idiomas...		►
Elementos de la teledetección		
¿Qué es la teledetección?		►
Teledetección, a fondo		►
Historia de la observación terrestre		►
La cartografía y los datos de los satélites		►
Las órbitas de los satélites		►
Los satélites de recursos naturales		►
Satélites meteorológicos		►
Recursos...		►
Multimedia		
Image Gallery		►
Video Gallery		►
MIRAVI: Earth live		►
Services		
Búsqueda		
<input type="text"/>		<input type="button" value="GO"/>
<div> BOOKMARK    ...</div>		

[http://imagedb-srv.esrin.esa.int/Eduspace\\_Installer/install.htm](http://imagedb-srv.esrin.esa.int/Eduspace_Installer/install.htm)

<b>Recursos</b>
Eduspace image catalogue viewer
Install Image Catalogue Viewer
Instruction manual
Image processing software
Earth images gallery

Combine RGB

Select Red Band

RON1

Select Green Band

RON2

Select Blue Band

RON3

Output Type

Byte

OK

Cancel

Help

## Image processing software

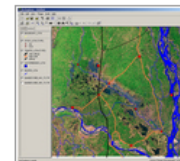
Eduspace provides students and teachers with the proper tools to manipulate images.

## LEOWorks

LEOWorks is a major component of this educational resource, which makes the actual processing of satellite imagery on school computers possible. LEOWorks is able to perform many advanced processing operations including image classification, geometric correction, and pan-sharpening. Many image filters are available, and GIS tools enable the displaying and drawing of vectors on images. LEOWorks is a didactical tool, and has very good help pages and an all-inclusive tutorial (see right of page). With the assistance of this help documentation, everyone is able to experiment with their own imagery to undertake their own processing. LEOWorks can process images in standard jpg, tiff, bmp, and png formats.

## ArcExplorer


is a freeware used to display and ers of Geographical Information (S). It includes a complete user as been made available by ESRI, ading providers of GIS software ations.



[Send this page to a friend](#)

<http://earth.eo.esa.int/satelliteimages/>





European Space Agency

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[Earth from Space](#)
[Environmental Issues](#)
[Envisat for Schools](#)

09-Mar-2010

Weather and climate...

Global Change

Introduction

Atmosphere...

Land

Glacier monitoring

Glacial retreat project

Himalayas

Kilimanjaro

Rondonia

Oceans...

Disaster monitoring

Introduction

Cyclones...

Earthquakes...

Floods...

Oil slicks...

Volcanoes...

Resources

Eduspace image catalogue viewer...

Image processing software

Earth images gallery

Multimedia

Image Gallery

Video Gallery


MIRAVI: Earth live

Services

Search

GO

BOOKMARK



Rondonia

Throughout the tropics, rain forests are being cut down. By different methods and for different reasons, people in tropical regions of the world are cutting down, burning, or otherwise damaging the forests. The process in which a forest is cut down, burned or damaged is called 'deforestation'.

This case study on Rondonia, Brazil, focuses on deforestation. It includes background material, exercises and a collection of external links. The exercises use computer tools that analyse satellite images.

This case study includes:

- a background section
- exercises

You can access them by clicking on the links on the right.


09-Mar-2010

Rondonia

- Background
- Exercises
- NOAA images
- Landsat images
- Links
- Satellite images of environmental change
- INPE
- Global change
- Kilimanjaro National Park - UNESCO World Heritage List
- The Tropical Rain Forest Information Center
- The World Resources Institute
- Eduspace - Software
- LFOWorks
- Eduspace - Download
- Ron1-noaa-1234.zip (448 Kb)
- Ron1-LS-345.zip (815 Kb)
- Ron2-LS-345.zip (816 Kb)
- Ron3-LS-345.zip (638 Kb)
- Ron4-LS-345.zip (719 Kb)
- Ron5-LS-345.zip (720 Kb)
- Ron6-LS-345.zip (791 Kb)
- Ron7-LS-345.zip (593 Kb)


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Download Data



European Space Agency  
Agence spatiale européenne

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**Envisat MERIS Image Rapid Visualisation**  
 Observing the Earth  
 European Space Agency

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[Observing the Earth](#)
[Envisat](#)


[About MIRAVI](#)
[Help](#)

**Latest Images**  
 35820 images available

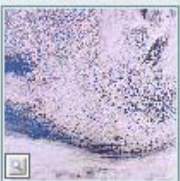
K << 1 2 3 4 5 6 7 8 9 10 11 12 13 14 >> H




Mode	FR/Level0/PDHS-K
Orbit	41933
Date	08-MAR-2010
Time	13:04:59
First	73.9N 15W
Last	62.7N 30.3W




Mode	FR/Level0/PDHS-E
Orbit	41932
Date	08-MAR-2010
Time	11:24:22
First	73.9N 10.2E
Last	28.5S 33.1W




Mode	FR/Level0/PDHS-K
Orbit	41932
Date	08-MAR-2010
Time	11:24:22
First	73.9N 10.2E
Last	50.4N 12.5W



Mode	FR/Level0/PDHS-E
Orbit	41931
Date	08-MAR-2010
Time	09:43:47
First	73.9N 35.3E
Last	1.9N 0.9W



**About MIRAVI**



MIRAVI is a data-driven system for real time image rendering and quality analysis of satellite data. It has been designed and developed by Chelys.

This website represents the MIRAVI front-end and it shows the gallery of images generated on the Level0 (raw data) Meris Full Resolution products, few seconds after their availability.

[More...](#)

**Search**

Start date	Stop date
<input type="checkbox"/> From <input type="text"/>	<input type="text"/>
Latitude	Longitude
<input type="checkbox"/> First <input type="text"/>	<input type="text"/>
Last <input type="text"/>	<input type="text"/>

Meris Data © European Space Agency. All rights reserved.

MIRAVI © 2006/2009 CHELYS srl. All rights reserved.

## About Eduspace

- What is Eduspace? ▶
- What tools does it offer? ▶

## Languages...

## Remote Sensing Principles

- What is remote sensing?
- Remote sensing in depth ▶
- History of Earth observation ▶
- Mapping and satellite data ▶
- Satellite orbits ▶
- Resource satellites ▶
- Weather satellites ▶



## What is remote sensing?

Remote sensing is a way of collecting and analysing data to get information about an object without the instrument used to collect the data being in direct contact with the object.

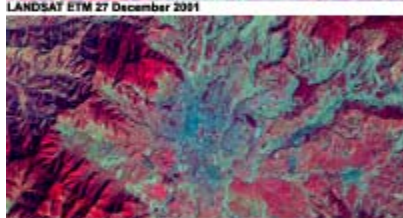
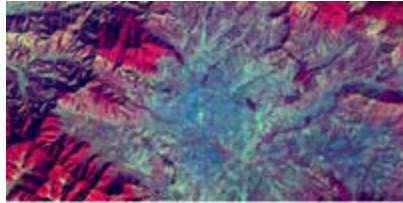
For example, if you take a photograph of your house, and on the picture you see that the house is composed of a roof, walls and windows, all of which

appear as different colours, then this is remote sensing.

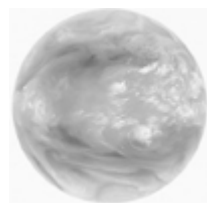
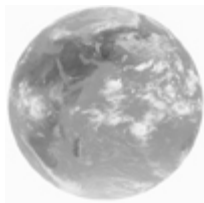
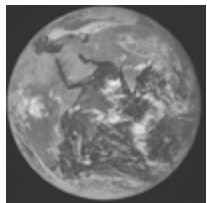
In remote sensing, three elements are essential. They are:

- 1 - a **platform** to hold the instrument
- 2 - a target **object** to be observed





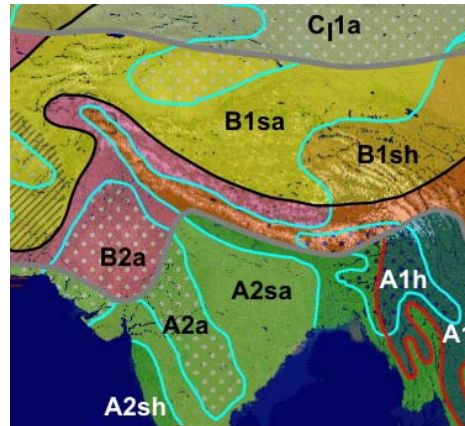
Instrument: LANDSAT  
ETM, TM, MSS



European Space Agency  
Agence spatiale européenne

**Case Study:** Kathmandu Now and Then optical case study  
→ Change detection of Kathmandu

**Resource:** Classification of  
Climate Zones

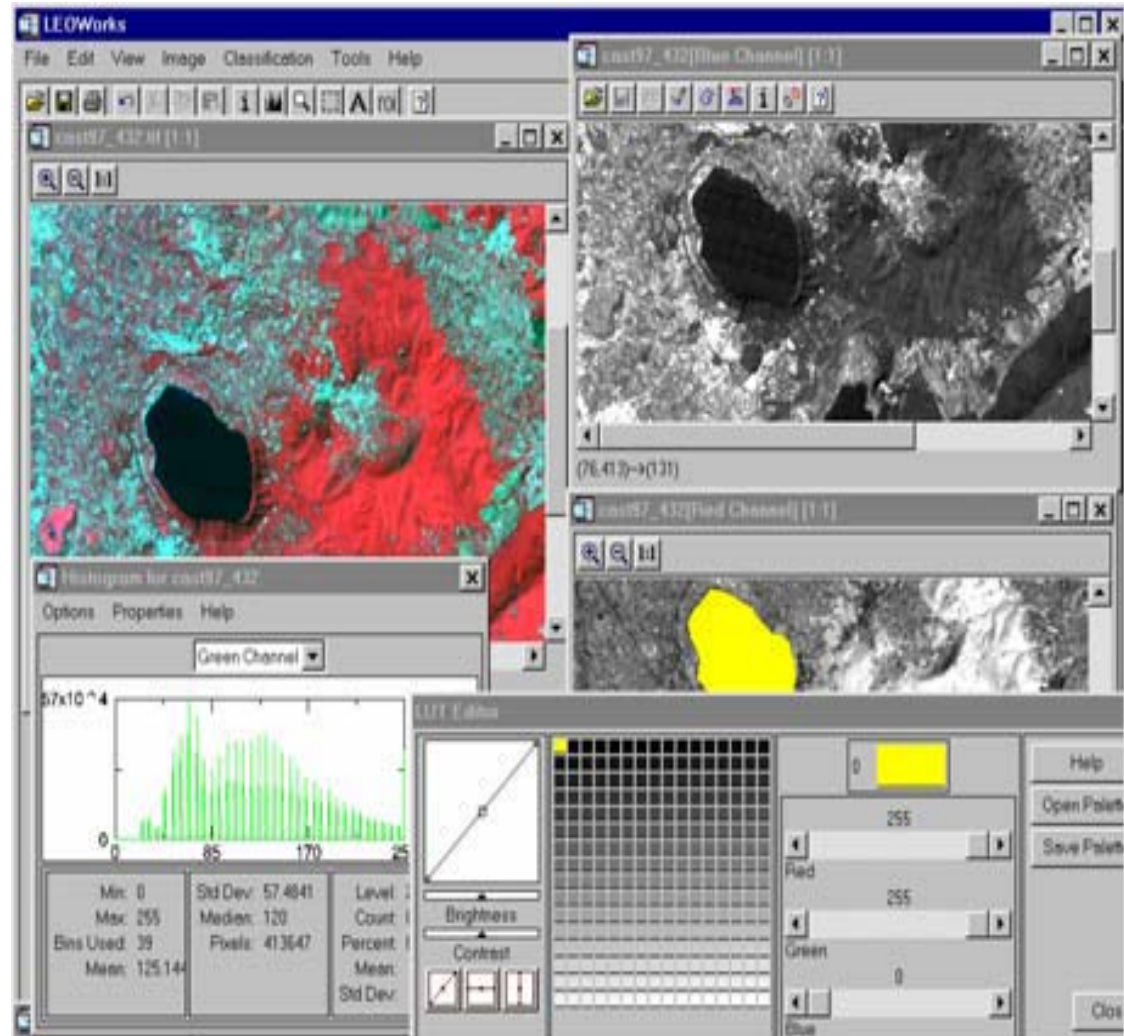


CLIMATE ZONES:	
<b>A</b>	tropical
<b>B</b>	subtropical
<b>C</b>	temperate (moderately warm = I and cold = II)
<b>D</b>	polar regions
SUBCLASSIFICATION OF THE TROPICS:	
<b>1</b>	cold tropical
<b>2</b>	warm tropical
SUBCLASSIFICATION OF OTHER CLASSES	
<b>1</b>	high-continental
<b>2</b>	continental
<b>3</b>	maritime
WATER HOUSEHOLD:	
<b>a</b>	arid (0-2 rainy months)
<b>sa</b>	semi-arid (3-5 rainy months)
<b>sh</b>	semi-humid (6-9 rainy months)
<b>h</b>	humid (10-12 rainy months).

**Project:** Analysis of Meteosat visible, infrared  
and water vapour channels

## *Image Processing Software (with GIS functionality)*

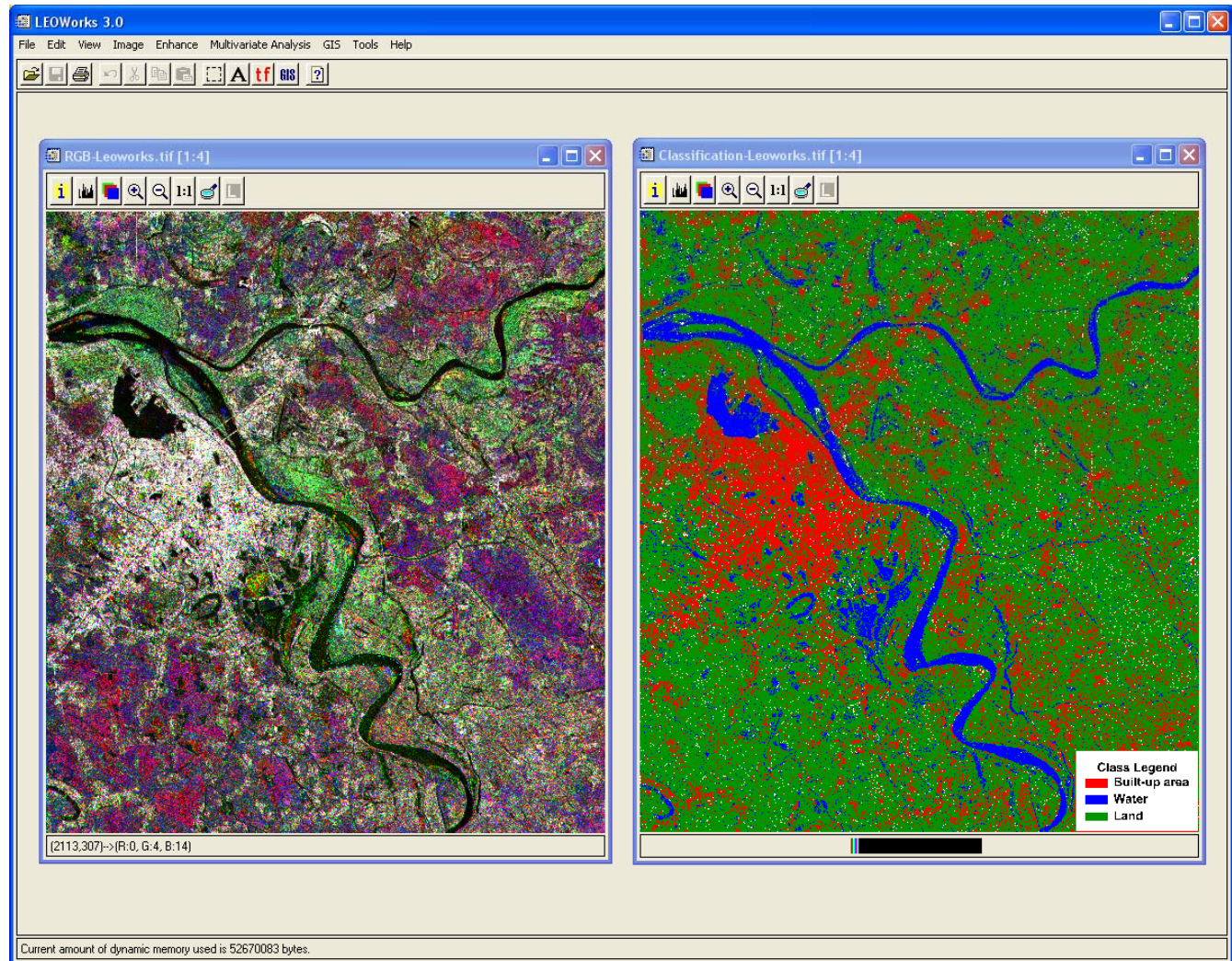
- View images, histogram, pixel values, header info
- Crop, invert, stretch, layer stack, etc
- Image arithmetic, filters
- Classification, PCA, geometric correction, pan sharpening
- GIS tools





## *Classification Example*

### Classification of Hanoi

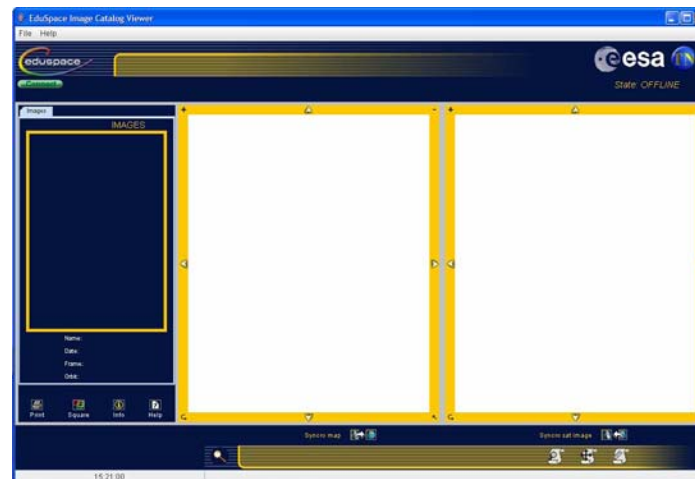




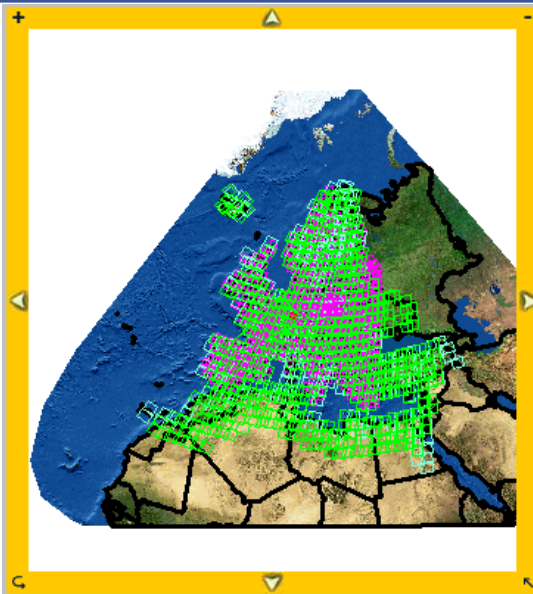
# Image Resources

## *Image Catalogue*

- The EduSpace Image Catalogue software is developed by Terranova in collaboration with ESA/ESRIN. It allows the user to perform multi – mission inventory searches on the main ESA – supported missions
- Eduspace Image Catalogue is an application composed principally by two main viewers, positioned in the centre of the application
  - The first shows satellite images from data-bank
  - The second shows a map of the area covered by EduSpace project
- Eduspace Image Catalogue application can be downloaded at page [http://imagedbk-srv.esrin.esa.int/Eduspace\\_Installer/install.htm](http://imagedbk-srv.esrin.esa.int/Eduspace_Installer/install.htm)



Eduspace Image Catalogue allows multi-mission inventory searches of the main ESA supported missions. Registered users can download selected sections of scenes of size 1000 x 1000 pixels



```

Readme.txt - Notepad
File Edit Format View Help
*****
SELECTED RECTANGLE :
*****
Geographical
x1-y1      : 12.44190-41.87175
x2-y2      : 12.56312-41.85370
x3-y3      : 12.57820-41.93416
x4-y4      : 12.45681-41.95223

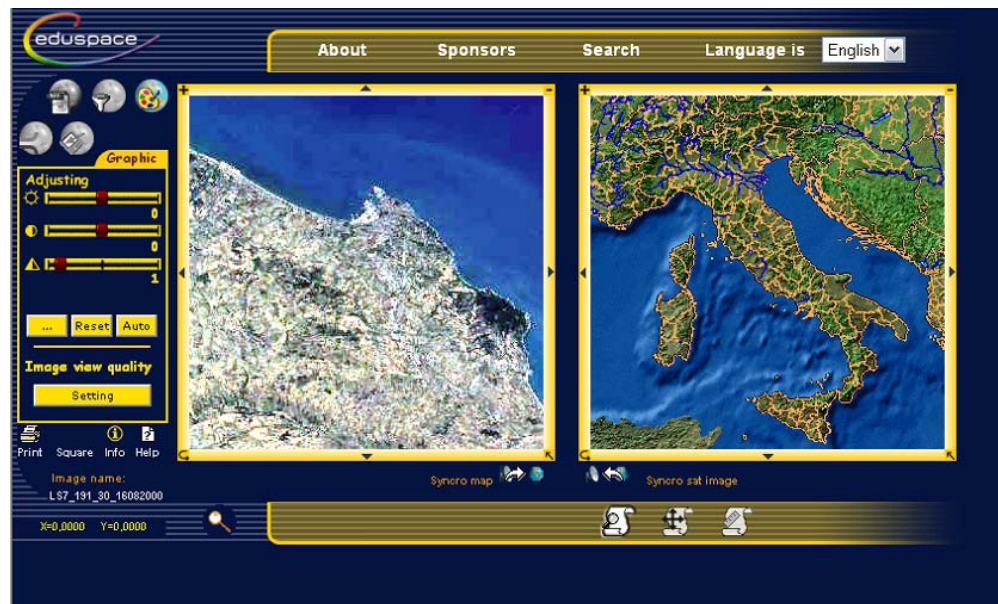
Metric (Lambert)
x1-y1      : 4788724.23187-4110666.11246
x2-y2      : 4798666.45887-4108336.66312
x3-y3      : 4800201.52522-4117183.30168
x4-y4      : 4790259.29822-4119512.75102

Area       : 87955288.73626

Download type : SameSizeSameExtents

B1 File     : LS7_191_31_16082000_B01
B1 OriginalPixelSize: 30.00000
B1 ResamplingFactor: 1.00000X
B1 OutputPixelSize : 30.00000

B2 File     : LS7_191_31_16082000_B02
B2 OriginalPixelSize: 30.00000
B2 ResamplingFactor: 1.00000X
    
```



For each downloaded image there is a read-me file containing image information