Remote sensing data availability and access for natural disasters: ESA Data Availability

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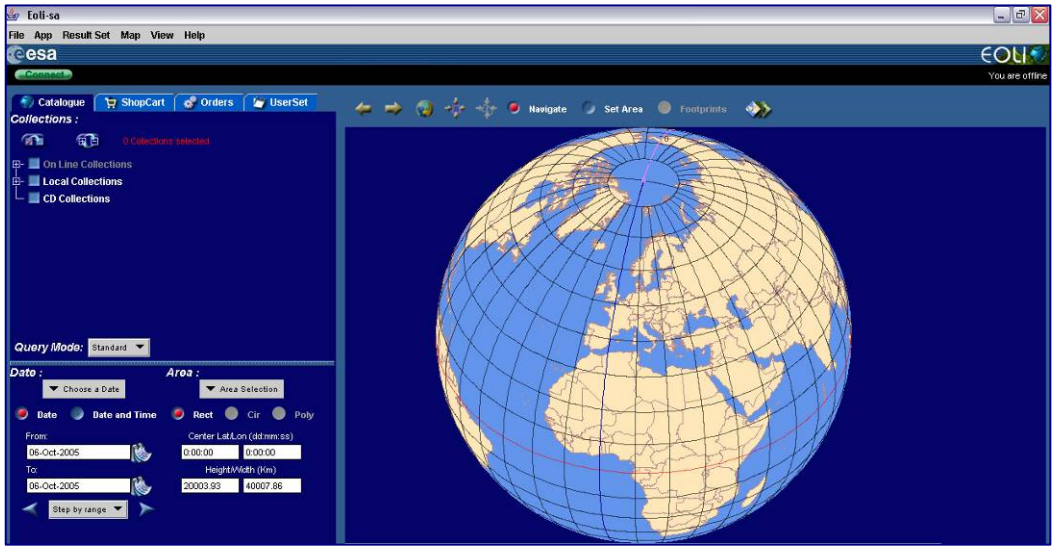
How to get data provided from ESA, in general: EOLI server

More Information at http://earth.esa.int/

Browsing & Ordering data

EOLI is the Earthnet OnLine Interactive catalogue. It is the ESA client for the Earth Observation (EO), multi-mission, catalogue and ordering services.



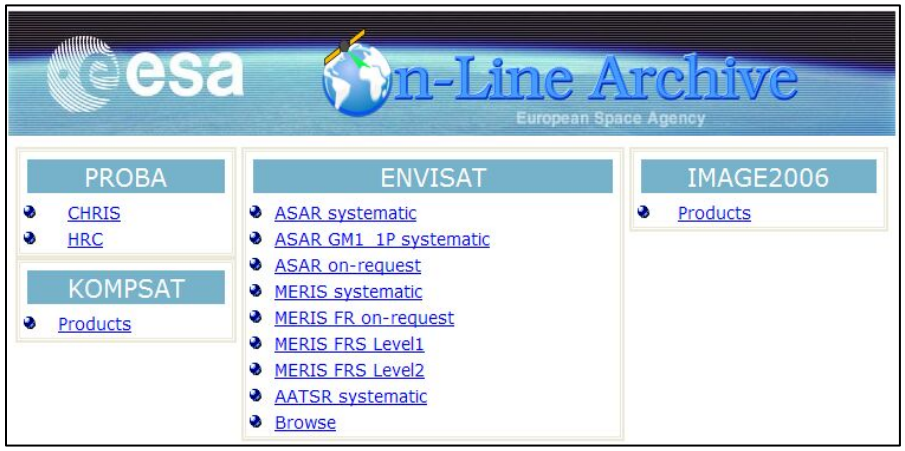
The EOLI – Stand Alone (SA) Client provides access to the online ESA catalogues of EO products, allowing the visualisation of quick-looks and online ordering.

http://earth.esa.int/EOLi/EOLi.html

Accessing online data [1]

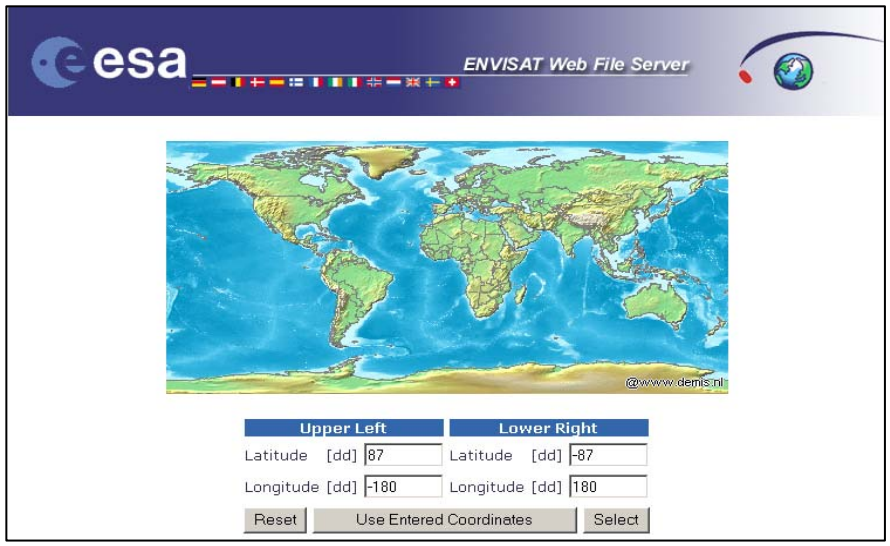
Rolling archives:

The multi-mission On-line Archive (Rolling Archive) consists of servers available at the three ESA acquisition stations of Kiruna, ESRIN and Matera. Access is given to ERS, ENVISAT and TPM data

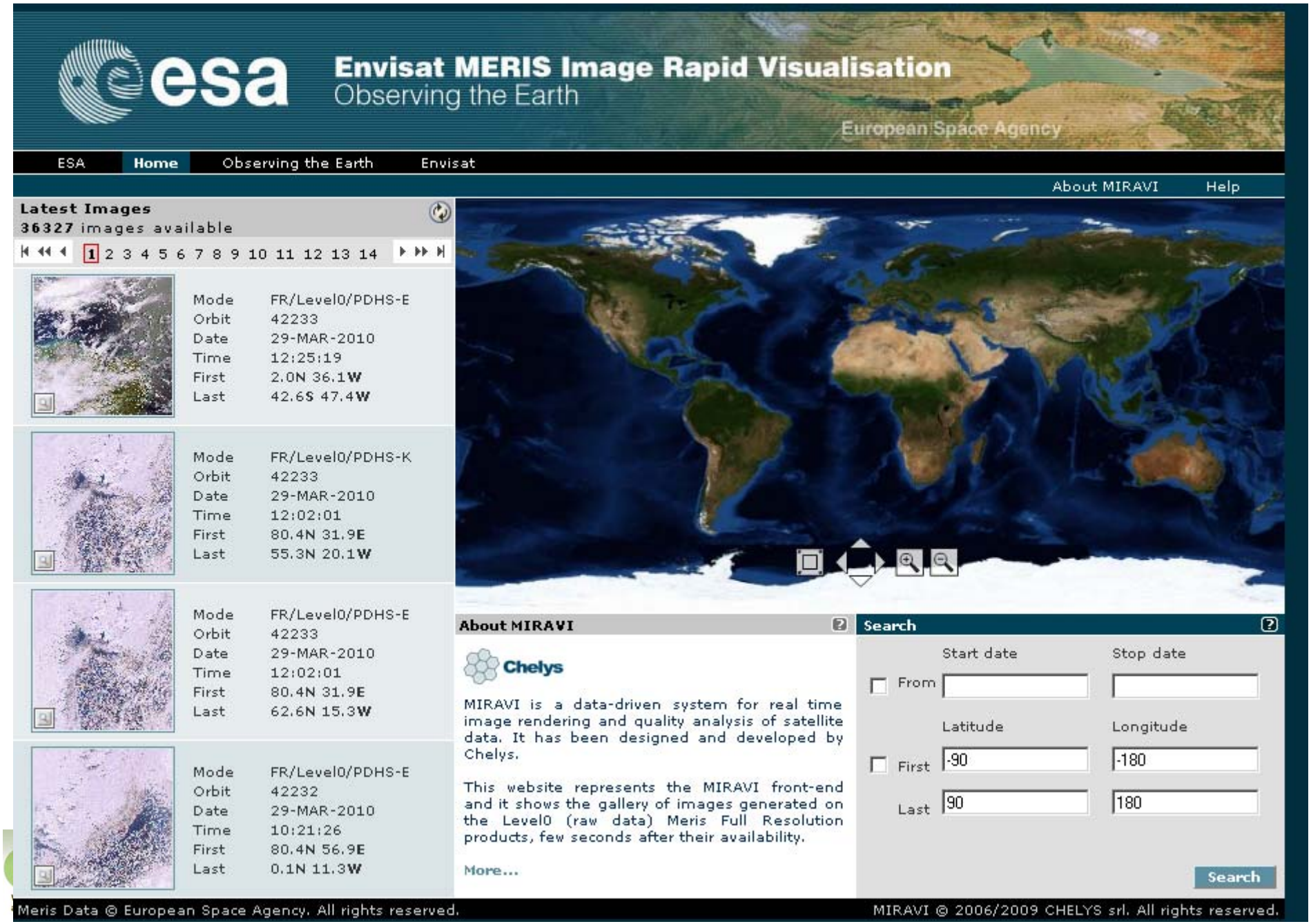


Envisat Web File Server (EWFS):

It allows users to download a subset of ASAR, MERIS or AATSR data available online covering only a selected geographic region

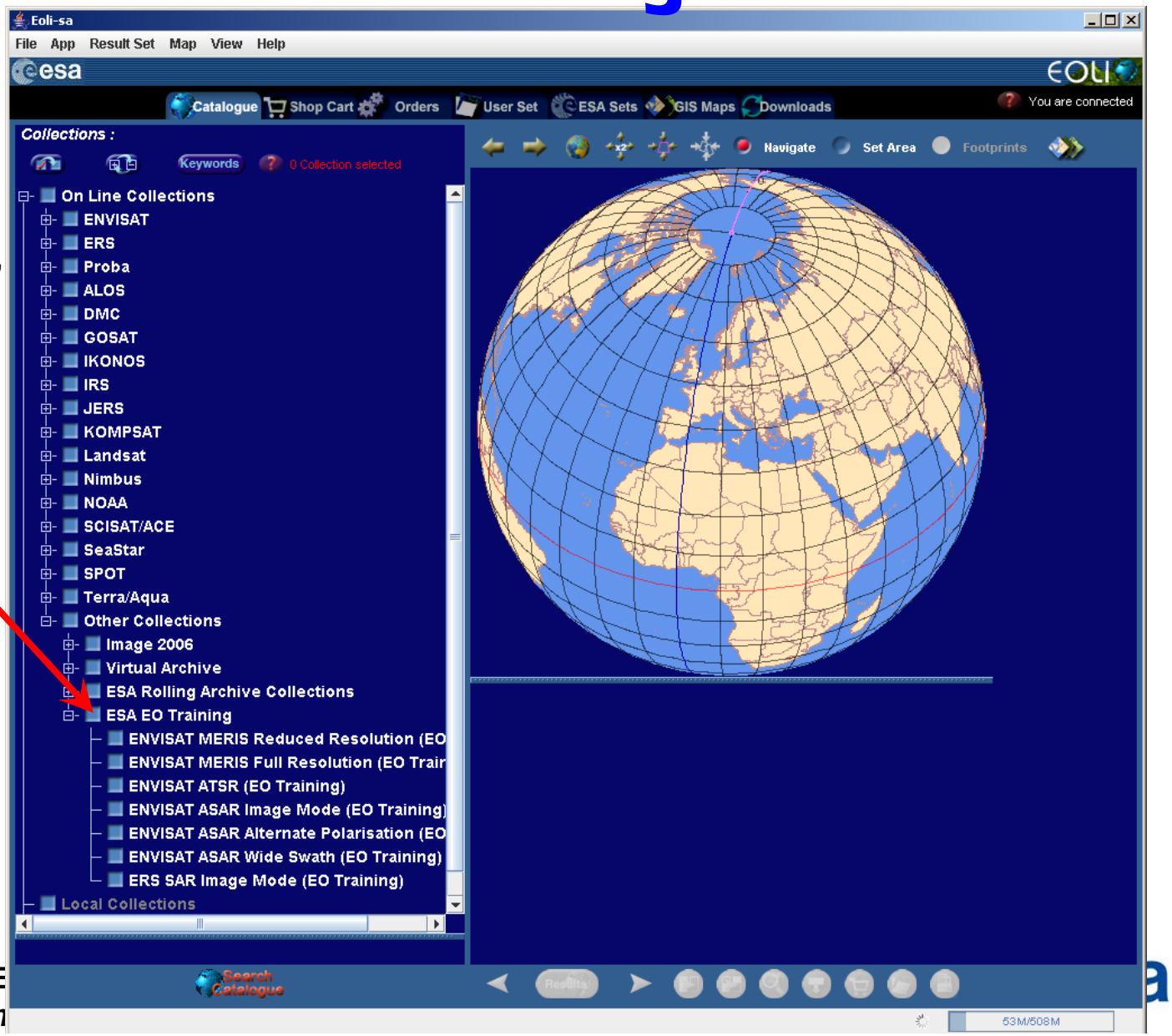


Accessing online data [2]



ESA EO Training Data Collections on EOLI-SA Catalogue

In “On Line Collections” list, select “Other Collections / ESA EO Training”



- No need to login!
- Can download immediately!

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CEOS WGE
in Latin Am

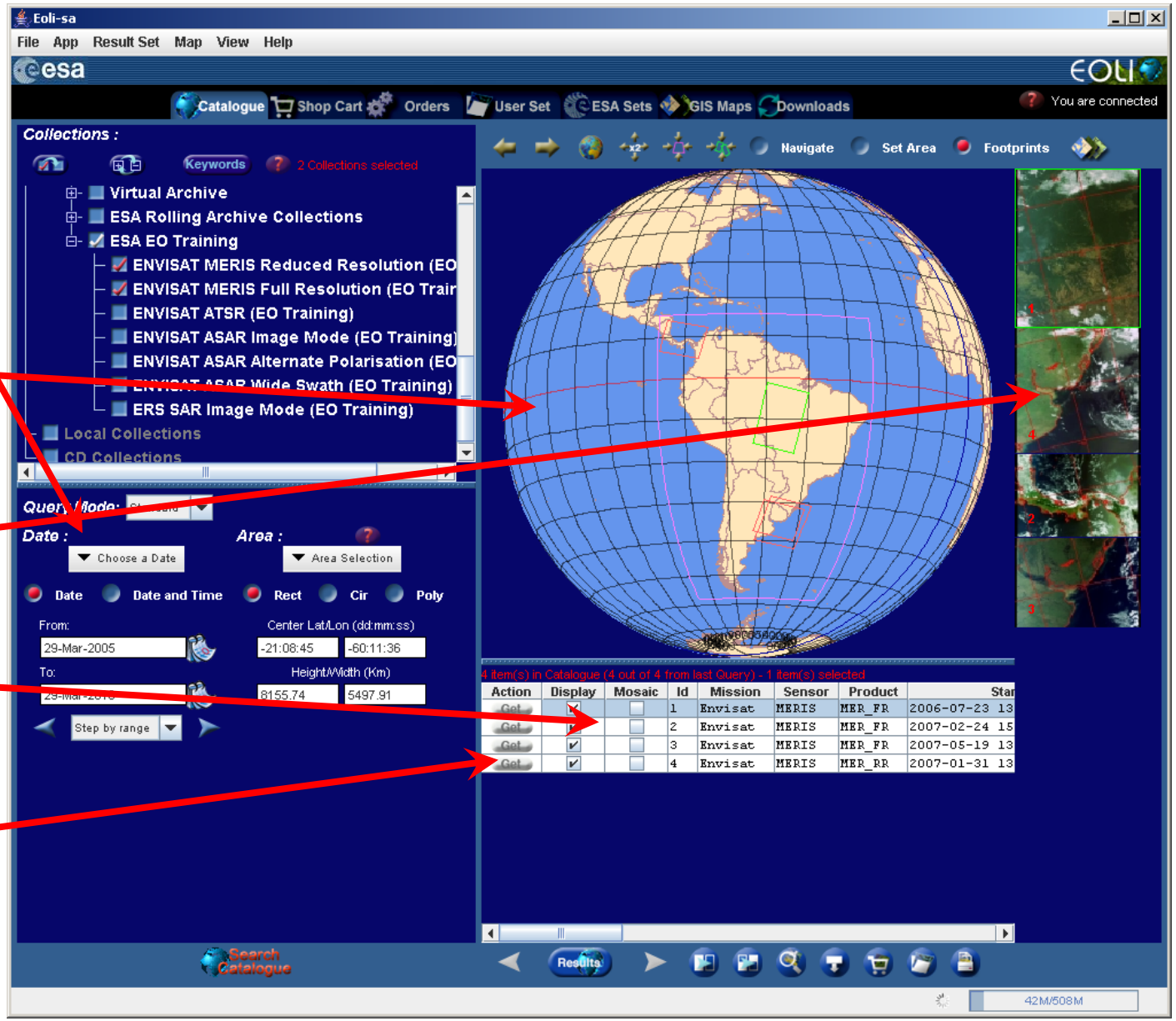
Specify search parameters.

Select geographic area on globe

View quicklooks

View details of products found

Click to download



ESA EO Data Access via the International Charter "Space and Major Disasters"

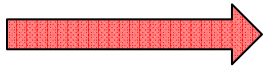
An International agreement (2000) among Space Agencies to support with space-based data and information relief efforts in the event of emergencies caused by **major disasters** (natural/man-made).

– a **virtual constellation of satellites**, coordinated to ensure immediate access to EO data to support disaster-response to organizations dealing with major disasters

– only focusing on **the immediate disaster-response** !!!
not the other phases of the 'disaster management cycle' (prevention, reconstruction, etc).

- **Multi-satellite data acquisition planning**
- **supply data at no cost (best effort)**

Respond to **Major Disasters**, primarily **fast onset events**, using satellite data useful for mapping damage of certain types of Hazard:



Types of hazard covered by the Charter :

- Earthquake
- Tsunami
- Floods
- Ocean storm (Hurricane, cyclone, typhoon)
- Landslides
- Volcanic eruption
- Fire
- Ice jam

- Oil Spill
- industrial accident

- **No epidemics or drought !!!**

Mechanisms for a user organization to submit requests for activating the International Charter

- ***Direct activation*:**

  The only bodies authorized to request the services of the Charter for a disaster occurring in their country or territory are the **Authorized Users**.

  AUs comprise a pre-defined list of **40+ user organizations (Civil Protection Authority (CPA), rescue body)** , corresponding to **36 countries** (the member states of the ten members of the International Charter).

- ***Activation via an AU for another country ('sponsor AU')*:**

  An **Authorized User** may request the Charter to assist a **disaster management user from another country** for relief actions in response to a major emergency.

  For example, activations requests from users in Latin American countries are often submitted via the Authorized User of Argentina.

- ***Activation via the UN for UN users*:**

  UN OOSA and UNITAR/UNOSAT may submit requests to the Charter. There is an agreement with UN OOSA (Vienna) and UNITAR/UNOSAT (Geneva) to provide support to UN agencies on behalf of users from the United Nations (UNDP, WFP, etc).

List of Charter Activations **in South and Central America:**

73 activations so far!

dis_type	countrg_name	Countrg with AU	Charter act_dat	Charter Requestor	Real Reques	Charter PM
Earthquake	El Salvador	0	2001-01-15	France		CNES
Industrial Accident	Ecuador	0	2001-01-26	Europe		CSA
Earthquake	El Salvador	0	2001-02-14	France		CNES
Vind Storm	Mexico	0	2002-10-06	France		ESA
Flood	Argentina	/	2003-04-30	Argentina		CONAE
Flood	Dominican Rep	0	2003-11-27	UNOOSA	Cross	UNOSAT
Flood	Bolivia	0	2004-01-26	Canada		CSA
Flood	Haiti	0	2004-05-26	UNOOSA	Cross	UNOSAT
Flood	Argentina	/	2004-07-02	Argentina		CONAE
Earthquake	Colombia	0	2004-08-26	Argentina		CONAE
Vind Storm	Grenada	0	2004-09-11	UNOOSA	UNOCHA/WFP/ Red Cross	CNES
Vild Fires	Bolivia	0	2004-09-16	Argentina		CONAE
Vind Storm	Haiti	0	2004-09-21	UNOOSA	UNDP	CNES
Flood	Colombia	0	2004-12-03	Argentina		CONAE
Flood	Guyana	0	2005-01-24			
Flood	Guyana	0	2005-02-01	UNOOSA	Ask Einar	NOAA
Flood	Venezuela	0	2005-02-11	Argentina		CONAE
Volcano	El Salvador	0	2005-10-05	Argentina		INA
Vind Storm	Guatemala	0	2005-10-05	Argentina/UNOCHA		INA
Vind Storm	Nicaragua	0	2005-10-05	Argentina		INA
Flood	Suriname	0	2006-05-10	UNOOSA	UNOCHA Emergency	ESA
Flood	Argentina	/	2006-07-27	Argentina		INA
Flood	Argentina	/	2007-01-17	Argentina		CONAE
Flood	Argentina	/	2007-01-19	Argentina		CONAE
Volcano	Colombia	0	2007-02-19	Argentina		CONAE
Flood	Bolivia	0	2007-02-23	Argentina		INA
Flood	Argentina	/	2007-03-30	Argentina		INA
Volcano	Colombia	0	2007-04-20	USA		USGS
Earthquake	Chile	0	2007-04-26	Argentina		ONEMI
Flood	Uruguay	0	2007-05-08	Argentina		SNE
Industrial Accident	Chile	0	2007-06-01	Argentina		ONEMI
Earthquake	Peru	0	2007-08-16	Argentina		INDECI
Vind Storm	Mexico	0	2007-08-21	USA		CATHALAC-SERVIR
Vild Fires	Paraguay	0	2007-08-27	Argentina		CONAE
Vind Storm	Nicaragua	0	2007-09-04	Argentina		CATHALAC
Vind Storm	Dominican Rep	0	2007-10-30	Canada		CATHALAC
Flood	Mexico	0	2007-11-02	Argentina		CATHALAC
Earthquake	Chile	0	2007-11-22	Argentina		ONEMI
Volcano	Ecuador	0	2008-01-22	Argentina		Istituto Geofisico, Ecuad
Flood	Bolivia	0	2008-01-25	UNOOSA	UN_HABITAT	INA
Flood	Ecuador	0	2008-02-26	UNOOSA	FAO	INA
Vild Fires	Chile	0	2008-03-06	Argentina		ONEMI
Vild Fires	Argentina	/	2008-04-17	Argentina		CONAE
Volcano	Chile	0	2008-05-02	Argentina		CONAE

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in Latin America", March 2010

(follows from previous slide)

dis_type	country_name	Country with AU	Charter act_dat	Charter Requestor	Real Reques	Charter PM
Flood	Chile	0	2008-05-23	Argentina		INA
Wind Storm	Jamaica	0	2008-08-29	USA		US Foreign Disaster Assistance
Wind Storm	Haiti	0	2008-08-30	USA		US Foreign Disaster Assistance
Wind Storm	Haiti	0	2008-09-05	France		US Foreign Disaster Assistance
Wind Storm	Haiti	0	2008-09-05	UNOOSA	WFP	US Foreign Disaster Assistance
Wind Storm	Haiti	0	2008-09-10	Germany		US Foreign Disaster Assistance
Wind Storm	Guadalupe	/	2008-10-15	France		CNES
Flood	Honduras	0	2008-10-27	UNOSAT	OCHA	ESA
Flood	Brazil	0	2008-11-27	Emergencias)		INPE
Flood	Colombia	0	2008-12-11	UNOOSA		INA
Earthquake	Costa Rica	0	2009-01-08	Argentina		Costa Rica University
Flood	Argentina	/	2009-02-10	Argentina		SEGEMAR
Volcano	Chile	0	2009-02-24	Argentina		CONAE
Flood	Peru	0	2009-03-26	Argentina		National Space Agency of Peru (CONIDA)
Volcano	Chile	0	2009-04-07	Emergencias)		CONAE
Wild Fires	Argentina	/	2009-08-30	Argentina		CONAE
Slides	Chile	0	2009-09-07	Argentina		
Volcano	Colombia	0	2009-10-23	Colombia Risk Management Direction –		INGEOMINAS
Wind Storm	El Salvador	0	2009-11-10	UNITAR/UNOSAT	OCHA	Cathalac
Wind Storm / Landslides	El Salvador	0	2009-11-10	USGS	Centro de	
Flood	British Virgin Islands	1	2009-11-16	UK Cabinet office		
Flood	Uruguay	0	2009-11-26	UNITAR/UNOSAT	UNDP	UNITAR/UNOSAT
Earthquake	Haiti	0	2010-01-13	UNOOSA	MINUSTAH	CNES
Earthquake	Haiti	0	2010-01-13	France		CNES
Earthquake	Haiti	0	2010-01-13	Canada		CNES
Earthquake	Haiti	0	2010-01-13	USGS		CNES
Flood	Bolivia	0	2010-01-26	SIFEM		Sistema Unico de Informacion
Flood	Peru	0	2010-01-28	SIFEM		CONIDA
Earthquake	Chile	0	2010-02-27	UNOOSA	WFP	ONEMI

Five Educational case studies developed by ESA on Remote Sensing for Disaster Management, based on real activations of the Charter "Space and Major Disasters":

- oil slick off the coast of Lebanon
- floods in Pakistan
- floods in China
- fires in Greece
- floods in Bolivia

Most Educational case studies developed by ESA on Remote Sensing use the ESA Toolboxes (satellite Image Processing, free and open source SW)

- Software 'Toolboxes' instigated by ESA contracts.
- Each Toolbox is a collection of software tools to help the remote sensing community to exploit ESA-TPM data.
- New generation to contain scientific tutorials prepared with Universities and practical case studies using real EO data.
- Offered to the user community free-of-charge

http://earth.esa.int/resources/softwaretools/

Basic ERS & Envisat (A)ATSR and MERIS Toolbox (BEAM)

Basic ERS & Envisat SAR Toolbox (BEST)

Basic ERS & Envisat Atmospheric Toolbox (BEAT)

Polarimetric SAR Data Processing and Educational Tool (POLSARPRO)

Basic Radar Altimeter Toolbox (BRAT)

Next ESA SAR Toolbox (NEST)

GOCE User Toolbox (GUT)

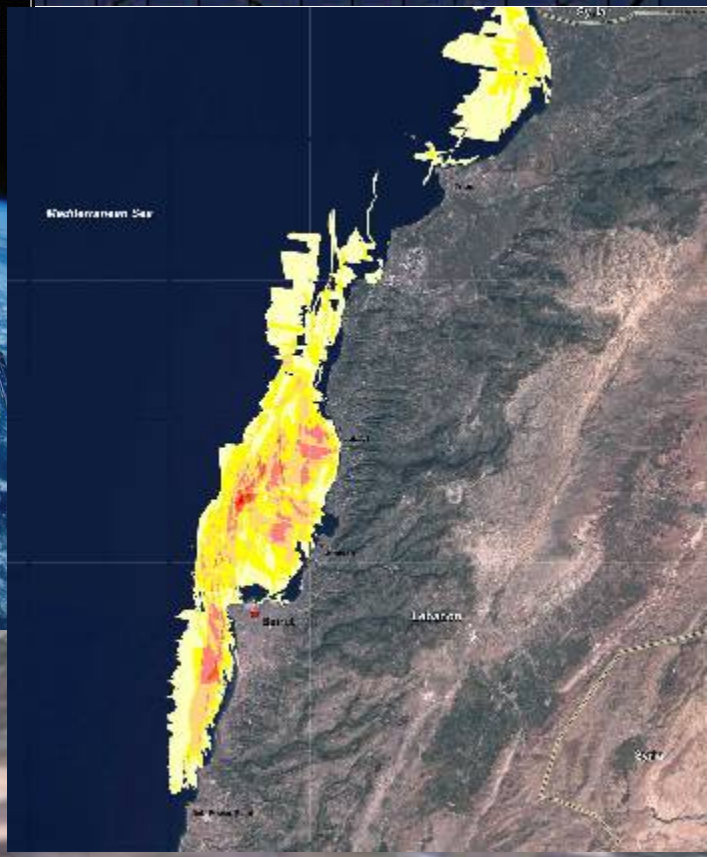
SMOS Toolbox

in planning

CEOS Working Group on Training and Education (WGEdu)

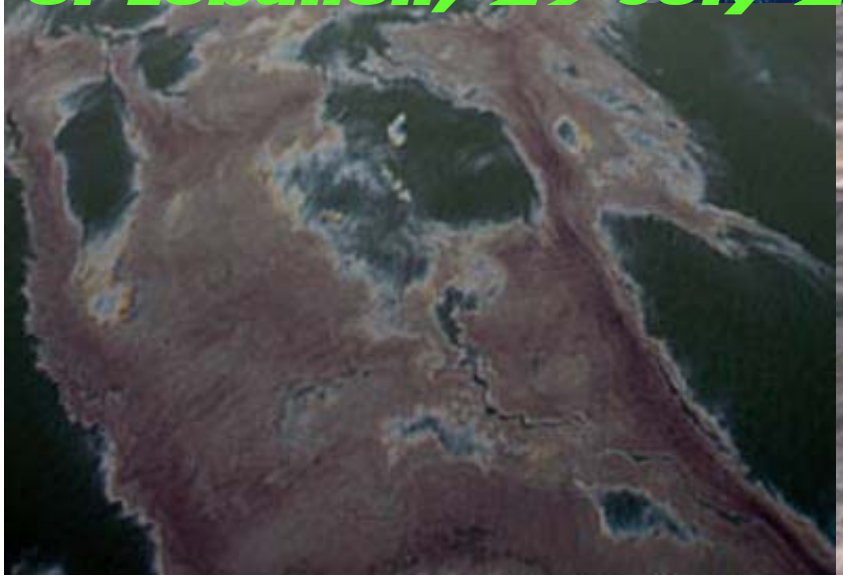
International Charter

Space and Major Disasters



Rapid Mapping of Oil Spills using SAR Data

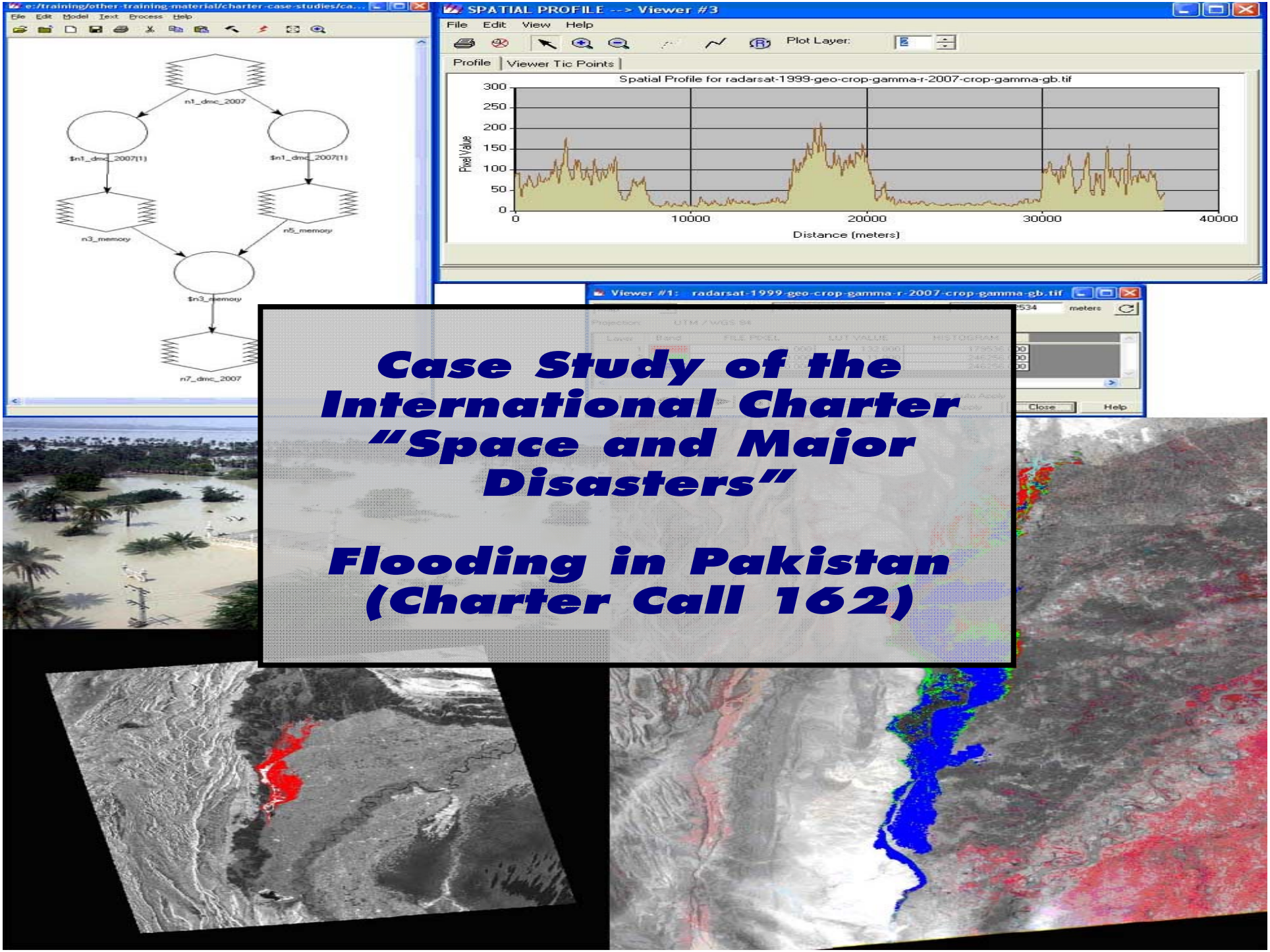
A Case Study based on the Charter Activation ID 126 to assess an Oil Spill off the coast of Lebanon, 29 July 2006



International Charter

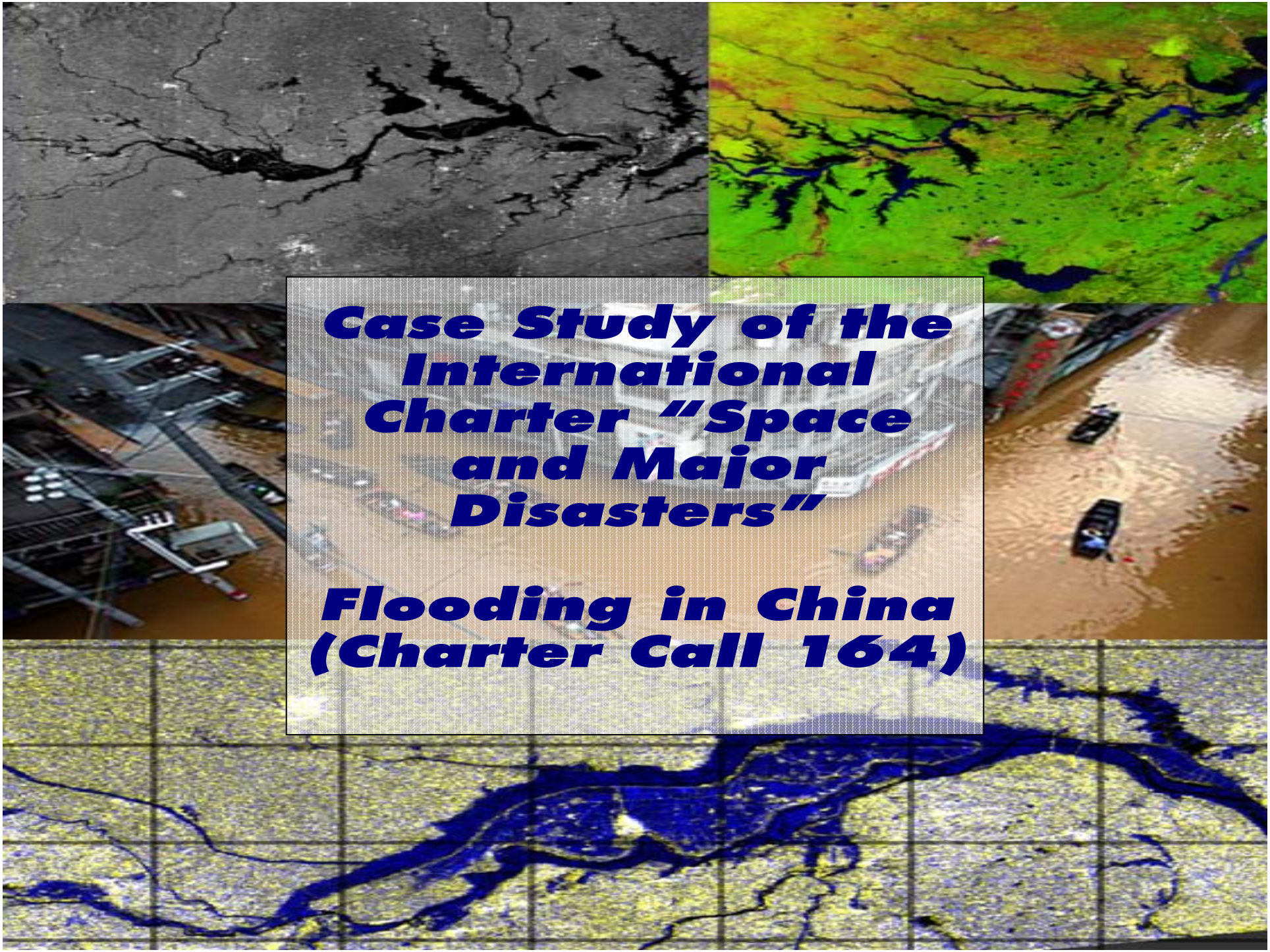
Space and Major Disasters

Rapid flood mapping using SAR data in Bolivia



Case Study of the International Charter "Space and Major Disasters"

Flooding in Pakistan (Charter Call 162)


Case Study of the International Charter "Space and Major Disasters"
Flooding in China (Charter Call 164)

Mapping of Greece Fires in August/September 2007.

A practical exercise using ENVI IDL.

G. Ottavianelli

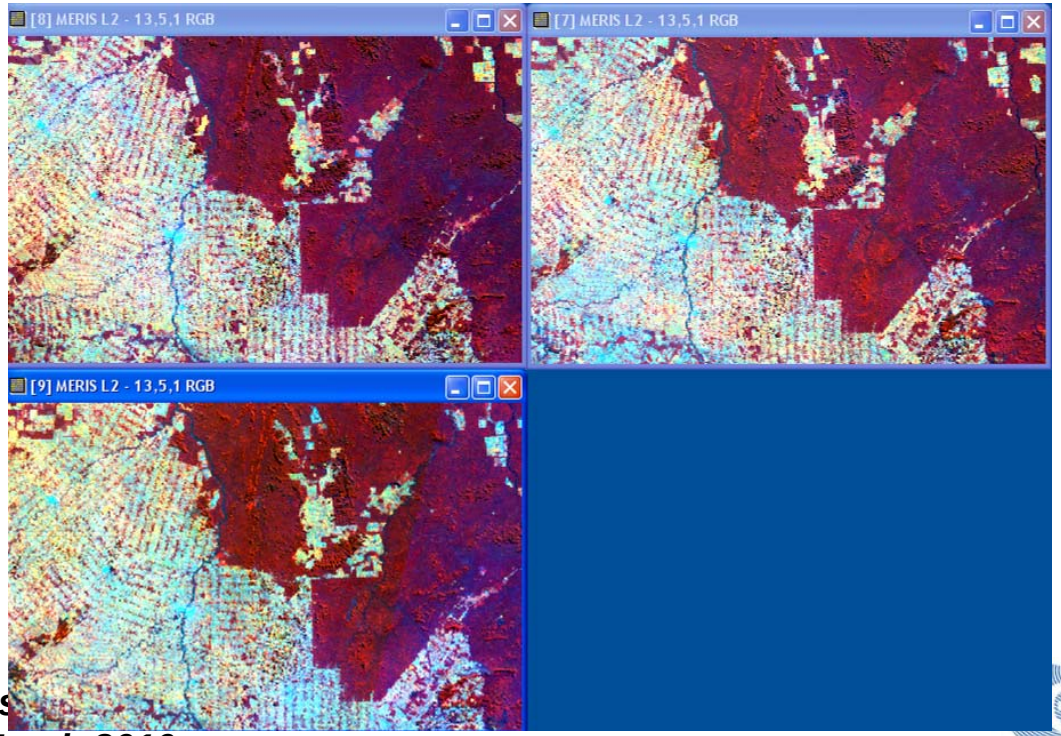
ESA EOP-GQ

Remark: ESA data for these five case studies can be retrieved via the EOLI server (ESA EO Training Data Collections)

Additional Educational Case Studies, useful for Disaster Management via Earth Observation

Rondonia deforestation using MERIS (or MODIS) comparing two different indices (ESA BEAM Toolbox)

- Area of Rondonia (Brazil)
- Calculate NDVI
- Compare with fAPAR by means of transects



NDVI

- The Normalized Difference Vegetation Index (NDVI) uses the characteristics of the spectral signature of vegetation in the red (low reflectance, high absorption) and near infrared reflectance (low absorption, high reflectance) bands of optical sensors to estimate the vegetation greenness.

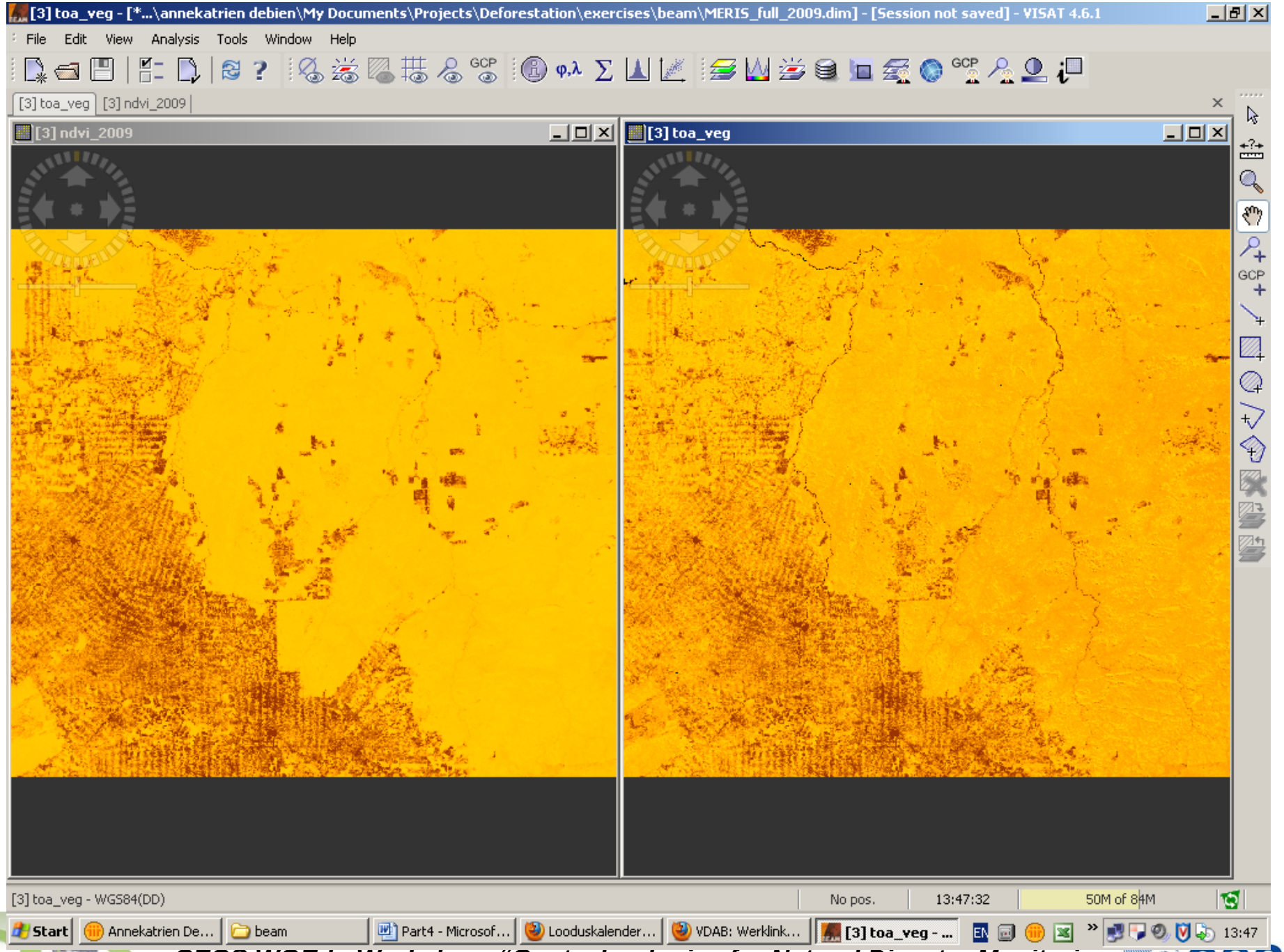
  NDVI = (NIR-red) / (NIR+red)

- For MERIS, the following bands are used:
  - Red = band 7 (665 nm)
  - NIR = band 13 (865 nm)

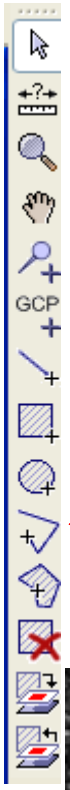
fAPAR

The Fraction of Absorbed Photosynthetically Active Radiation (fAPAR) is an indicator of the state and productivity of vegetation.

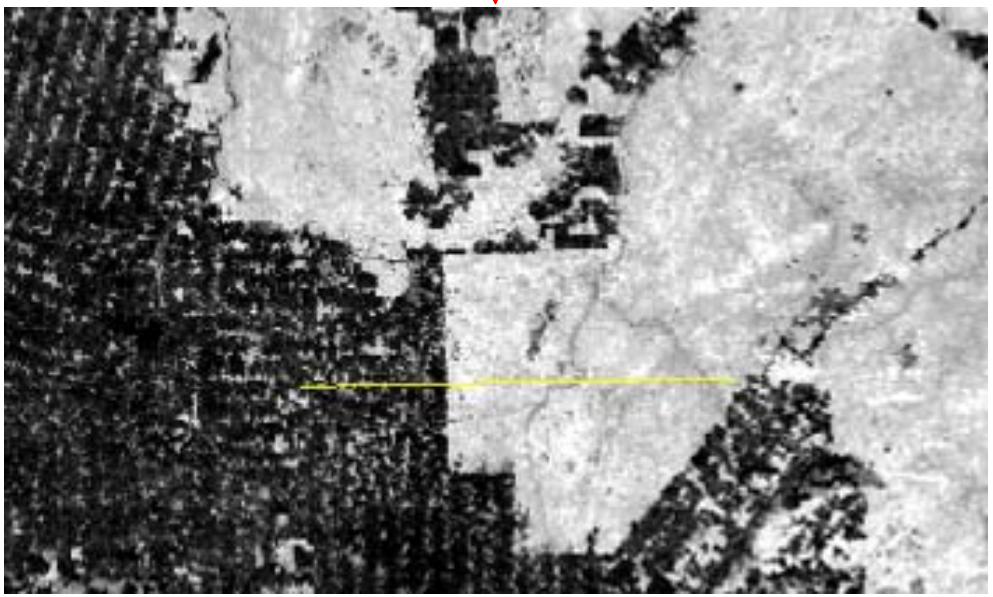
- fAPAR is directly related to carbon uptake (Olofsson and Eklundh, 2007), which is an important factor in global warming.
- The algorithm developed for MERIS is called **MGVI** (MERIS Global Vegetation Index), which is based on three spectral bands of MERIS: 442 nm, 681 nm and 865 nm, or the blue, red and near infrared band. There exists also one for MODIS.


[3] toa_veg - [*...\annekatrien debien\My Documents\Projects\Deforestation\exercises\beam\MERIS_full_2009.dim] - [Session not saved] - VISAT 4.6.1
File
Edit
View
Analysis
Tools
Window
Help
[3] toa_veg
[3] ndvi_2009
[3] ndvi_2009
[3] toa_veg
GCP
[3] toa_veg - WGS84(DD)
No pos.
13:47:32
50M of 84M
Start
Annekatrien De...
beam
Part4 - Microsof...
Looduskalender...
VDAB: Werklink...
[3] toa_veg - ...
13:47

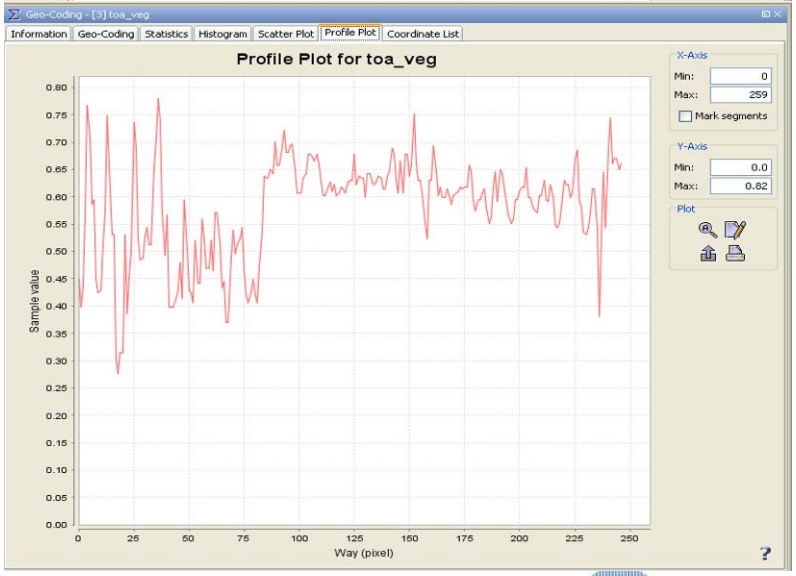
Transect profile plot



Draw a transect which covers both forested and deforested areas

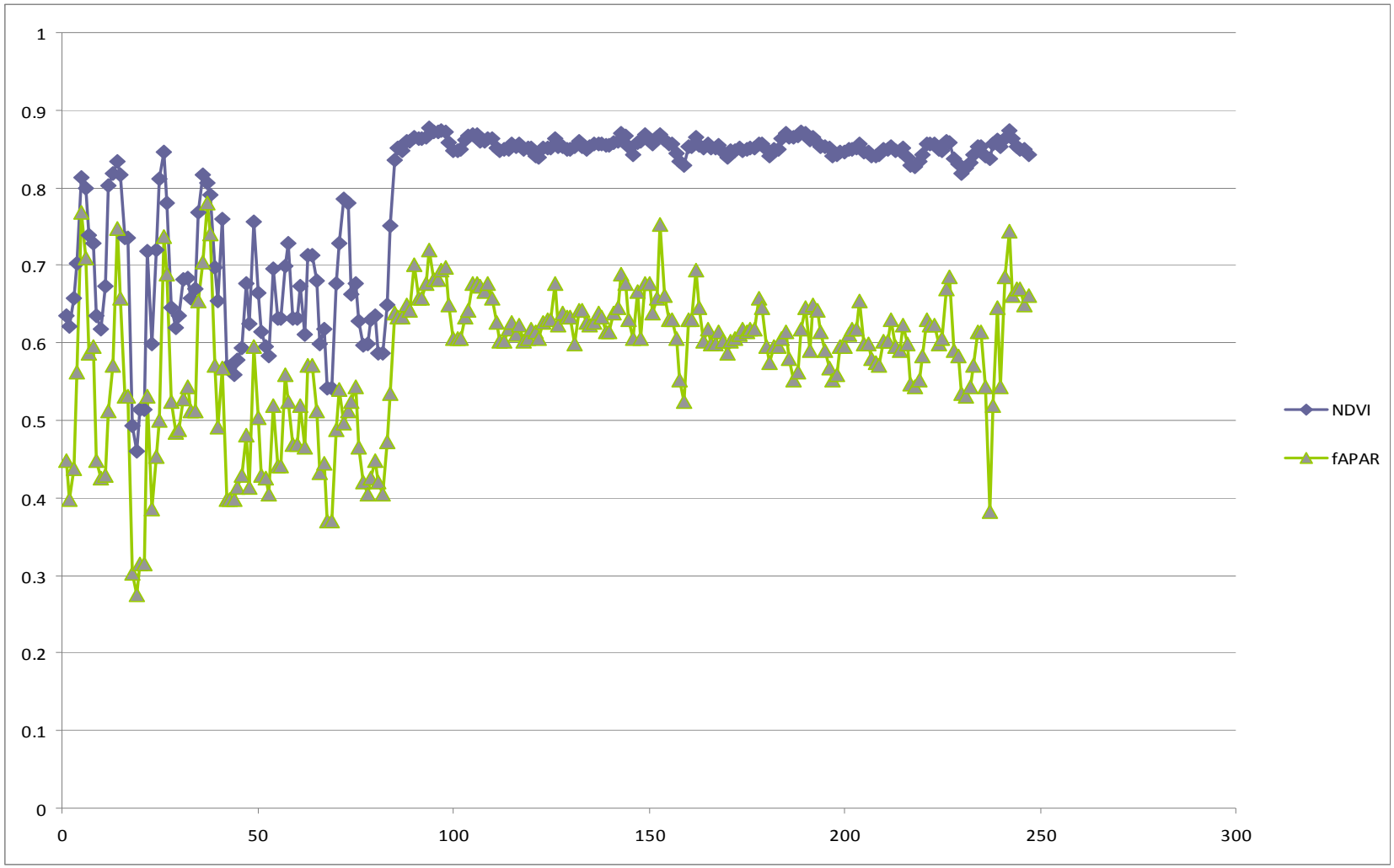


Transect Profile Plots for NDVI and fAPAR



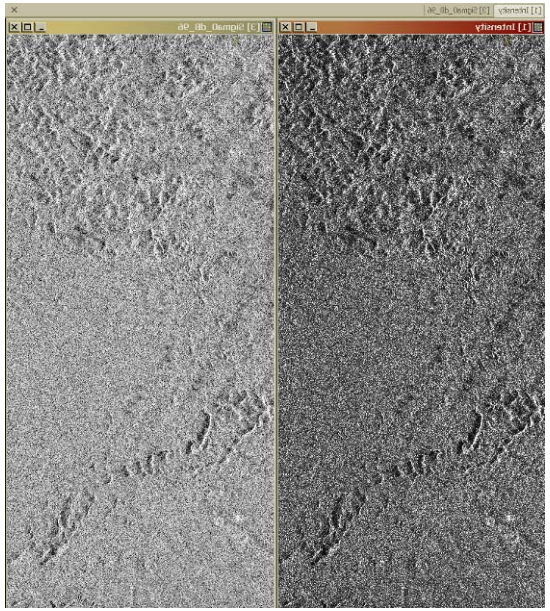
Comparison in Excel

Open the text file that contains the transect pixels in Excel



DECTECTING DEFORESTATION USING SAR DATA (ESA NEST Toolbox)

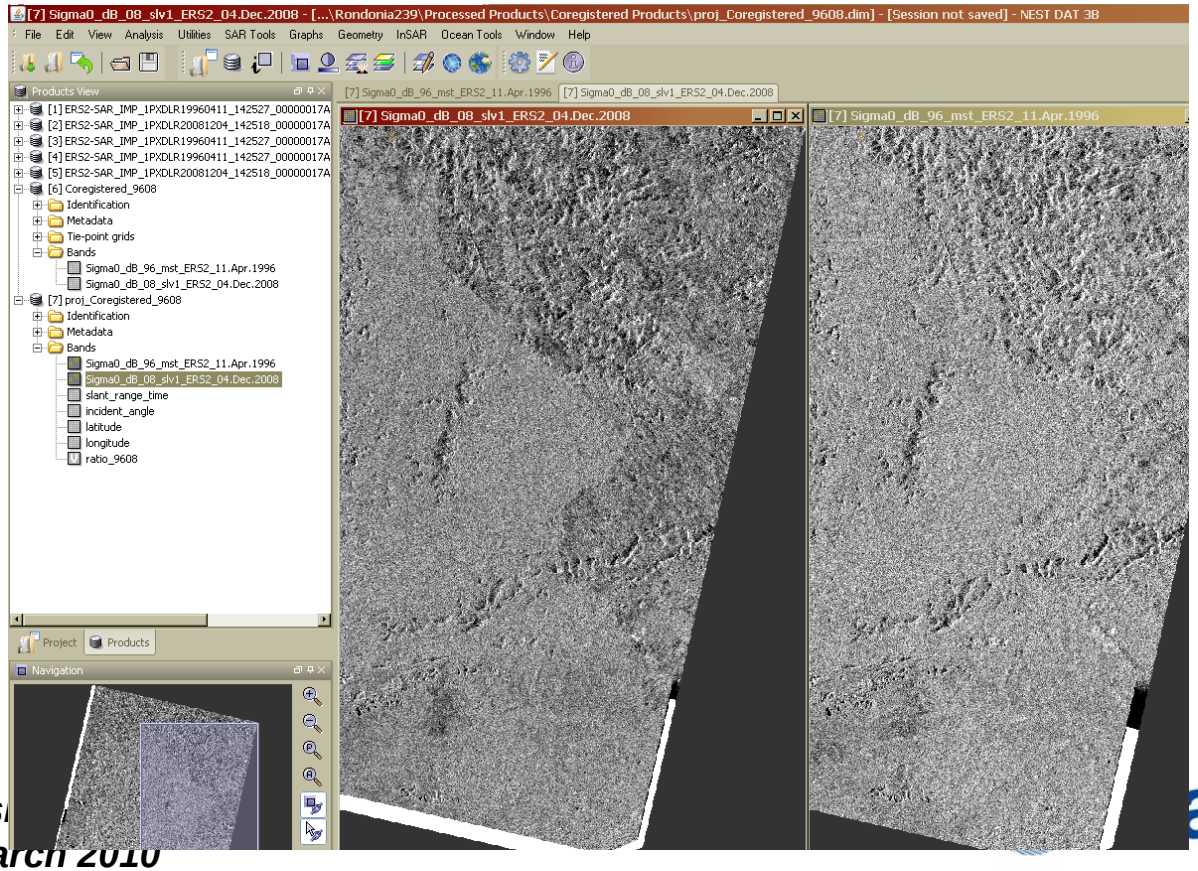
1. Calibrate data: convert to sigma values
SAR Tools/Radiometric Correction/Calibrate



2. Filter data: apply a FROST filter
SAR Tools/Speckle Filter/Single Product
(using the calibrated image)

3. Coregistration
SAR Tools/Speckle Filter/Single Product
(using the filtered image pair)

4. Calculate ratio between master/slave
Utilities/Band Arithmetic
(ratio=master/slave)



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CEOS WGEdu Works
in Latin America", March 2010

RGB composite

View/Open RGB Image View

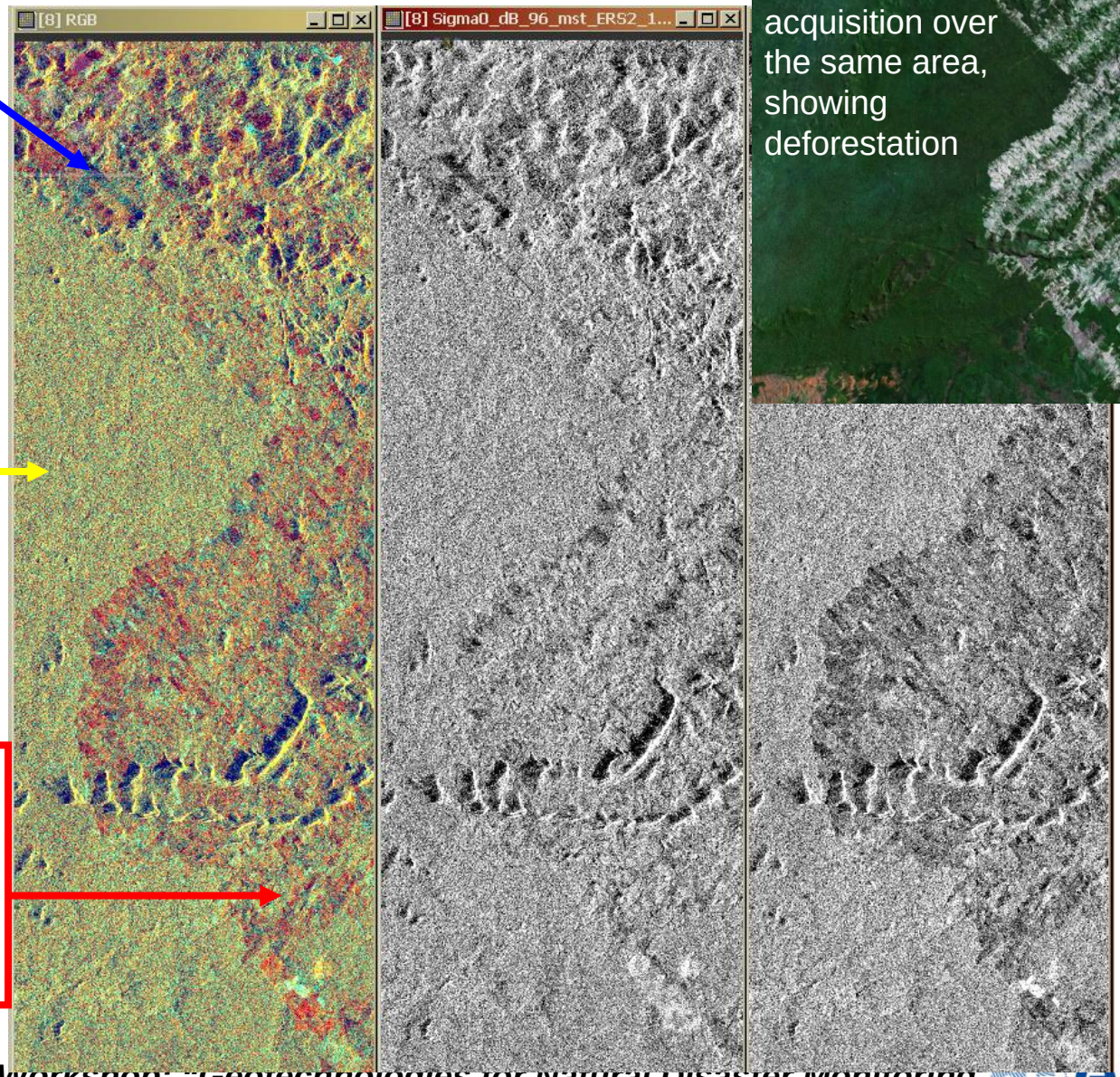
Bluish=positive change (reforestation)

dB > 1.0

Yellowish= no change

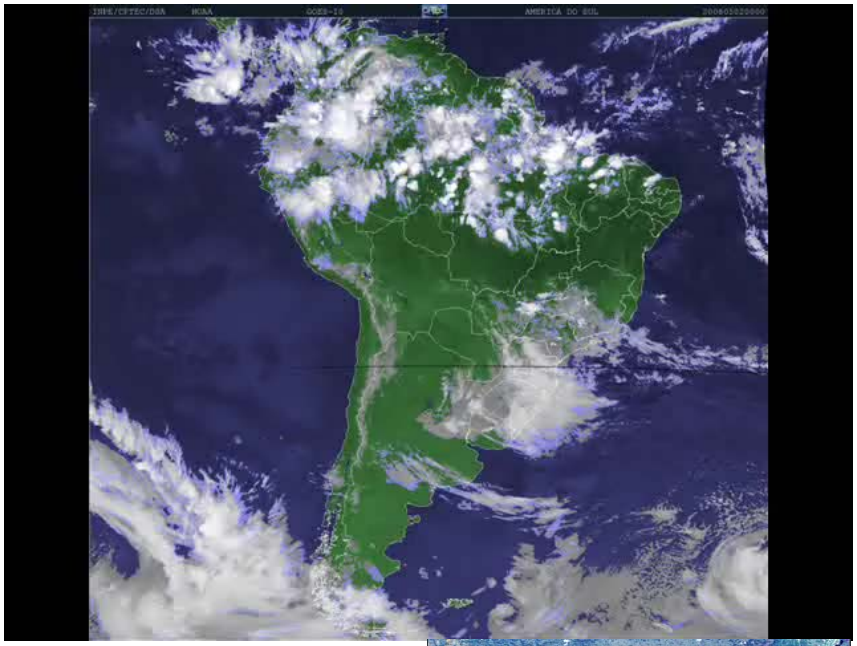
Reddish=negative change (deforestation)

dB < 0.5



Hurricane damage mapping in Brazil (Rio Grande do Sul) using MERIS

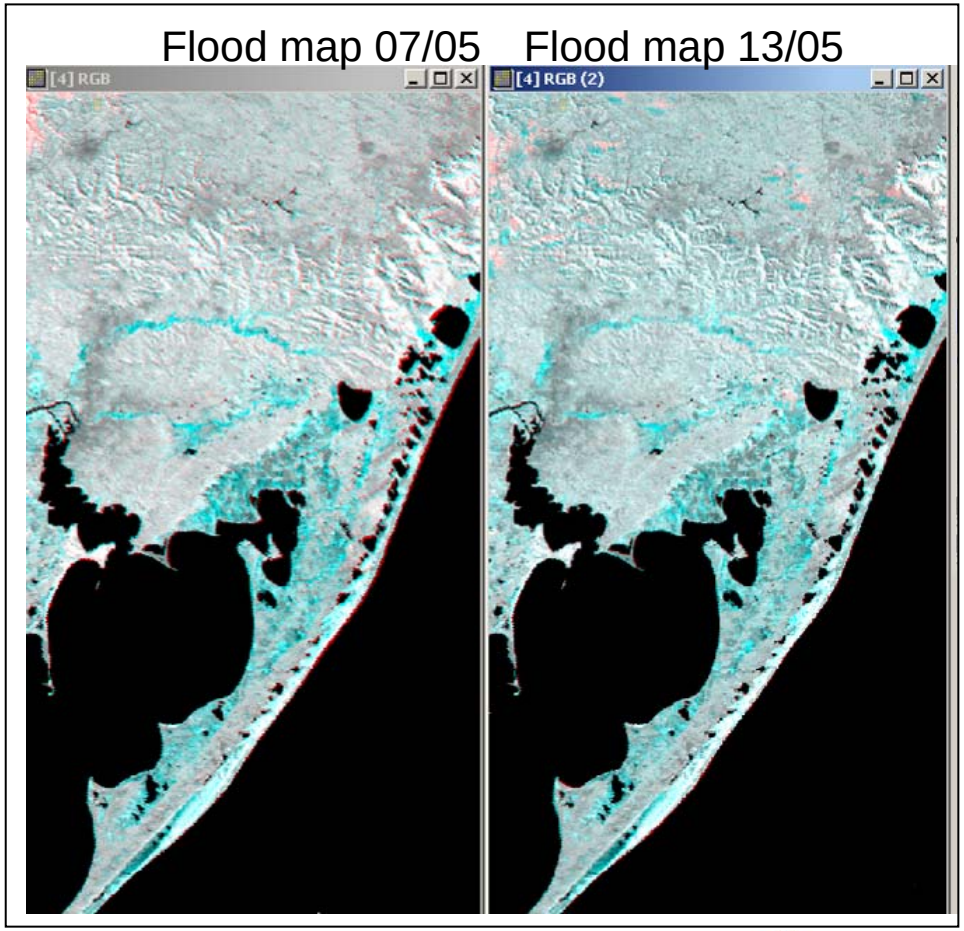
- Extratropical hurricane 2-4 May 2008
- Rio Grande do Sul and Santa Catarina
- Large floods
- Flood monitoring with MERIS data
  - 05/04/2008 (before)
  - 07/05/2008 (after)
  - 13/05/2008 (after)



Study area

- RGB based on blue bands of every image (best discrimination between water and land)
  - R=blue band post-event;
  - G and B= blue band pre-event

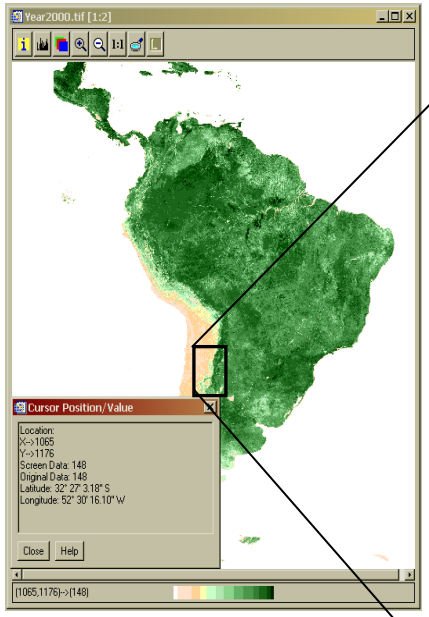
  → floods are visible in bright blue
- Calculation of flooded area by means of thresholds to discriminate the area on land before the event, and under water after the event

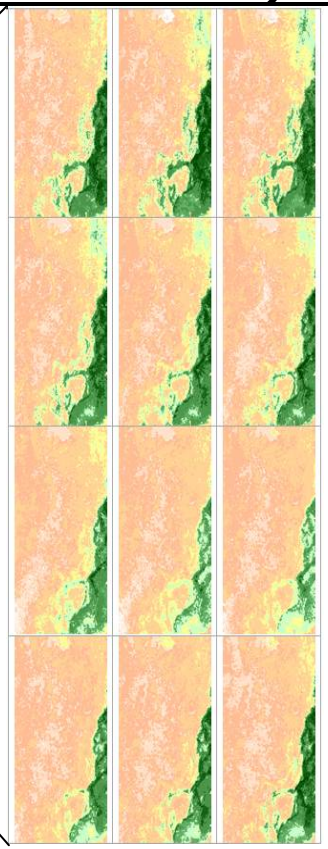


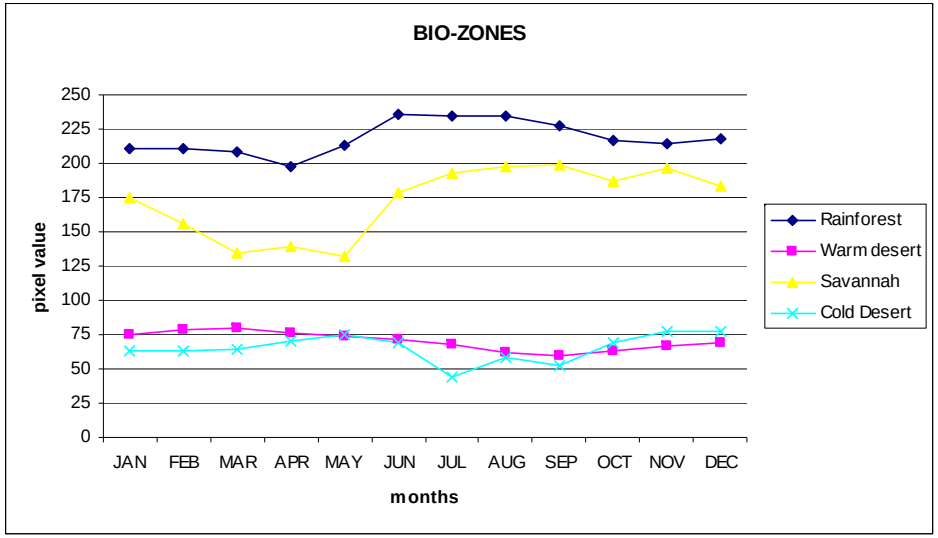
Additional Educational Case Studies, specific for Latin America (not Disaster Management-related)

NDVI VEGETATION MULTITEMPORAL DYNAMICS

i.e. Desert, NDVI evaluation





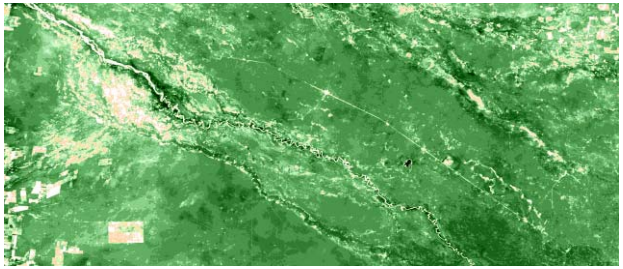


The main object of this exercise is to build a graphic like to compare the different behaviour of the vegetation through the year and by biogeographical zones.

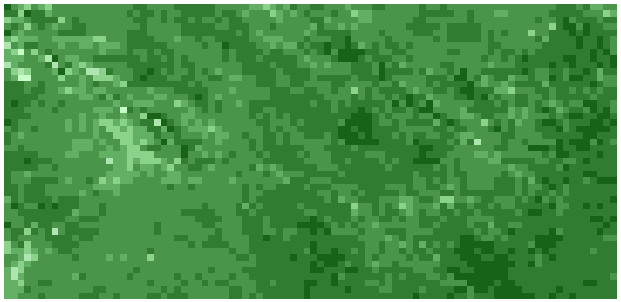
WARM DESERT	Maximum latitude	Minimum latitude	Maximum longitude	Minimum longitude
Geographical coordinates	30° S	20° S	70° W	65° W
Image coordinates	1121	897	673	785

Comparison of vegetation dynamics 2000-2006

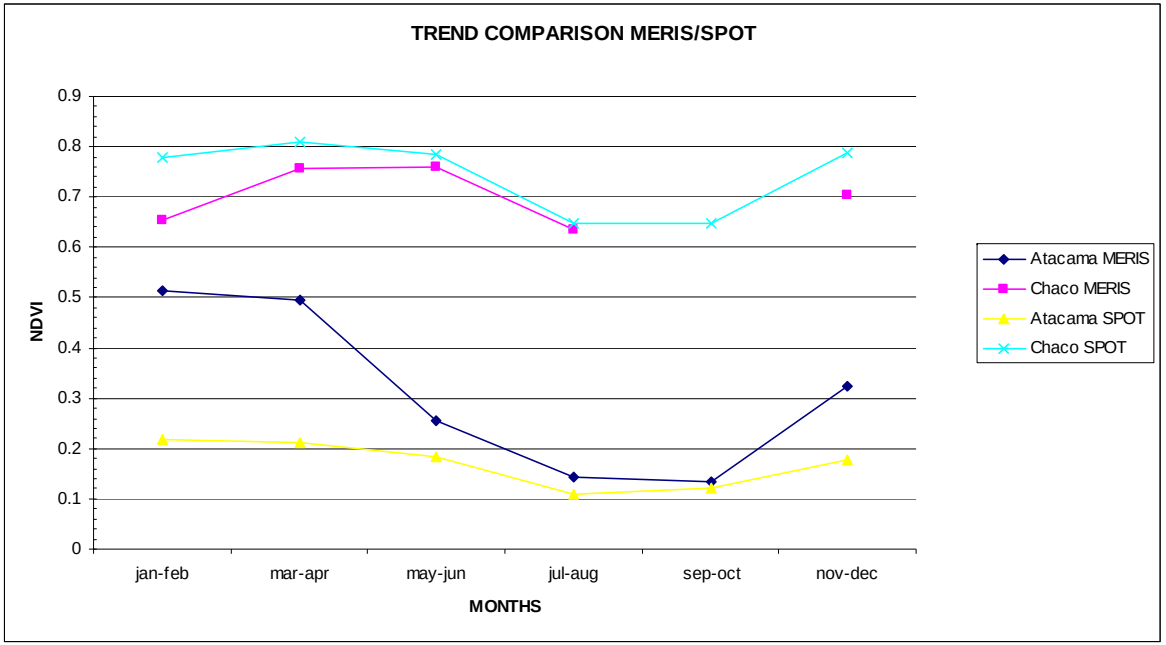
MERIS 2006



SPOT 2000



- Compare changes in NDVi from 2000 to 2006 by biogeographical zones following the previous process with full resolution images.
- We use "full resolution" imagery.
- We analyze the effect of the different spatial resolution.



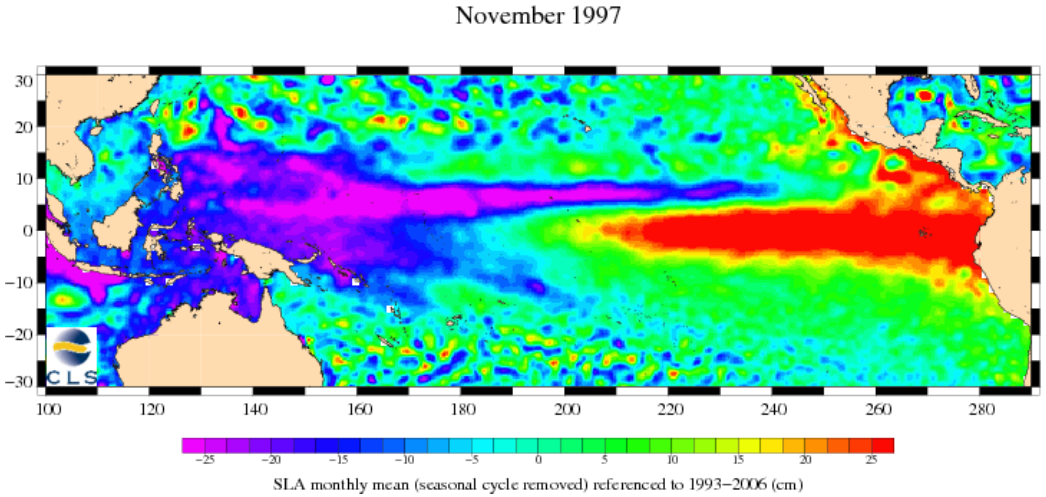
MERIS GLOBCOVER

- Spatial resolution 300m.
- 6 bimonthly images.

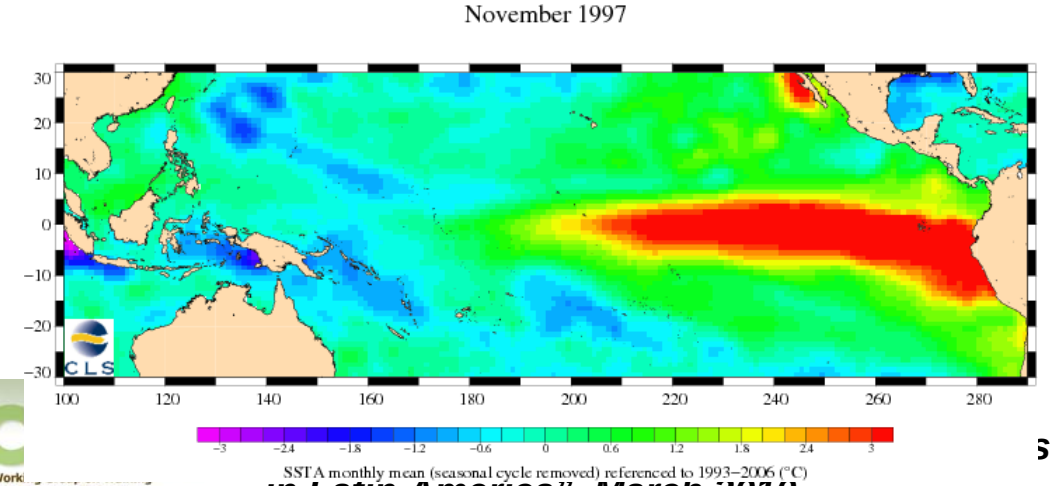
EL NIÑO/LA NIÑA
DETECTION USING DIFFERENT PARAMETERS

ENSO definition using:

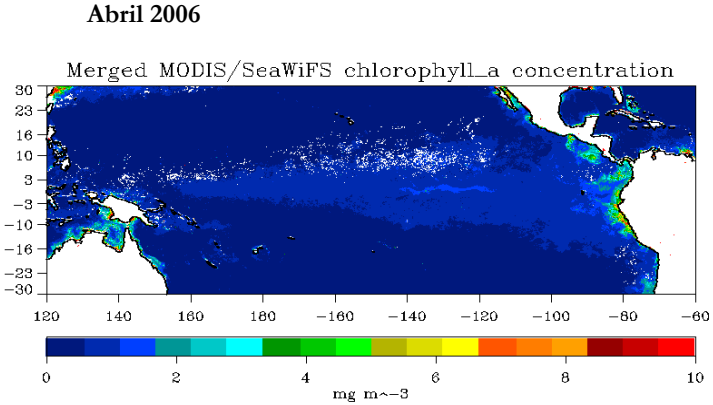
Sea Surface Level (Altimetry)

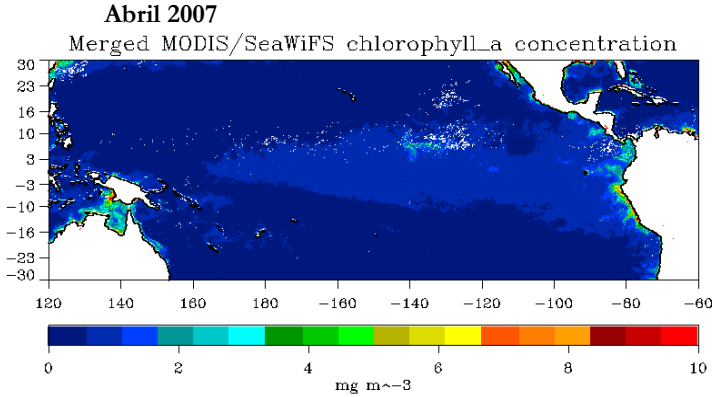


Sea Surface temperature



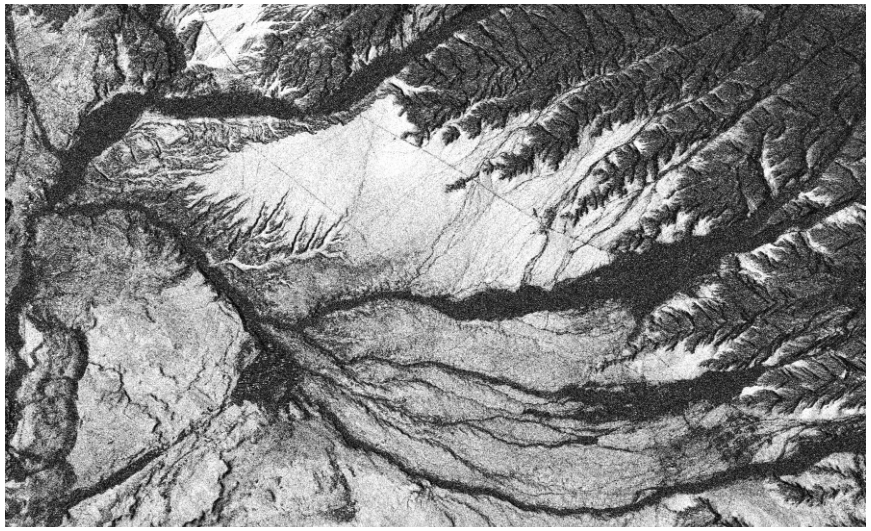
La Niña effects on chlorophyll_a production:





Change detection in Nasca Lines using interferometry coherence (1997-2004)

Coherencia 1997-1999, baseline 82m

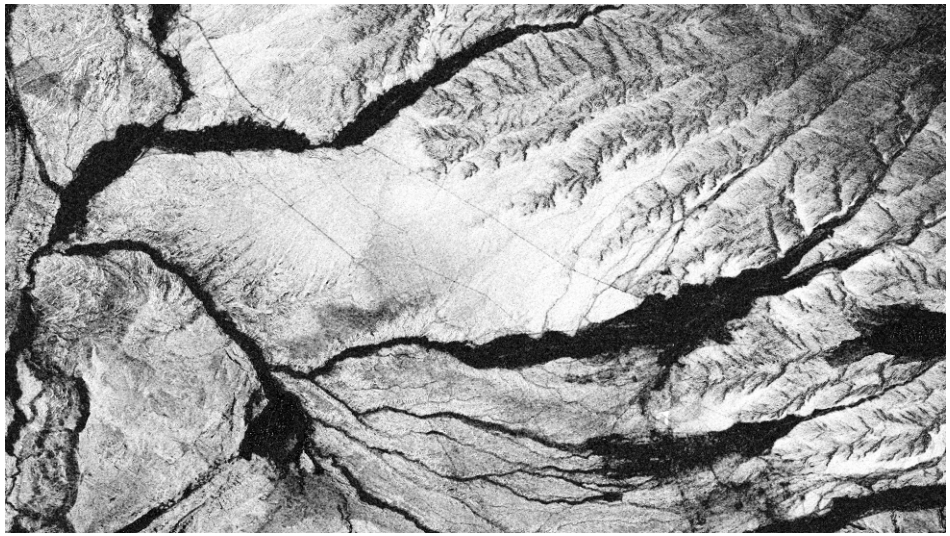


CHANGE DETECTION BY INTERFEROMETRIC COHERENCE IN NASCA LINES, PERU(1997-2004)

Ana B. Ruescas*, J. Manuel Delgado*, Fabiano Costantini**, and Francesco Sarti*

*ESA-ESRIN, Via Galileo Galilei, 00044 Frascati(RM), Italy
**Serco, Via Galileo Galilei, 00044, Frascati (RM), Italy

Coherencia 2003-2004, baseline 72m



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More Information at http://eopi.esa.int/

ESA EO Data Policy

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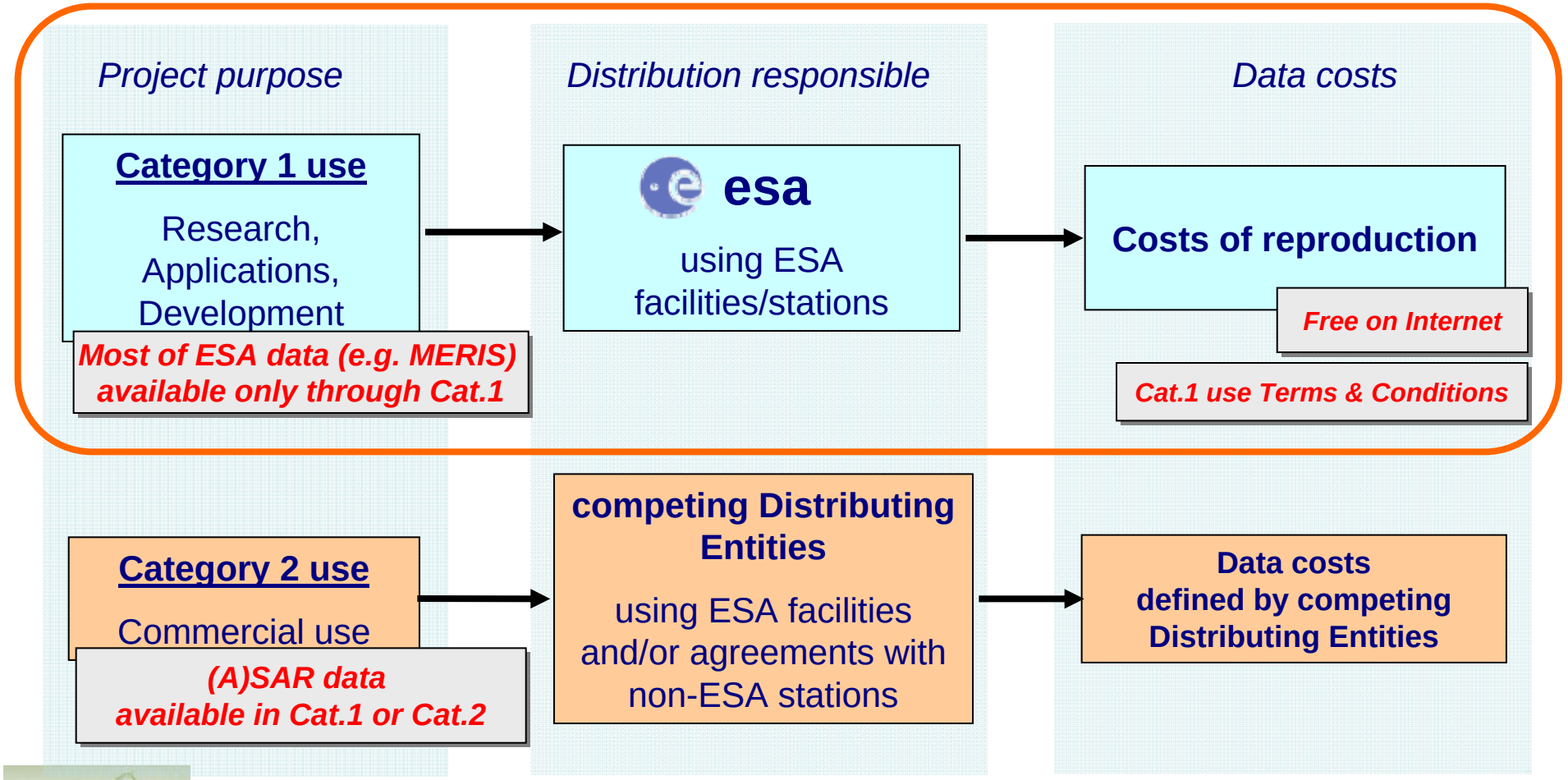
- to stimulate a balanced development of Science, Public Utility and Commercial Applications, consistent with the mission objectives,
- to maximize the beneficial use of data from ESA EO satellites.



Category 1 use: Terms & Conditions

Pre-condition for access to Category-1 data. Main points:

- to use the data provided for Category 1 use only **within the project team** (i.e. PI and co-PIs) and **only for the purpose** described in the project proposal
  → i.e. no data redistribution outside the Cat.1 use project team

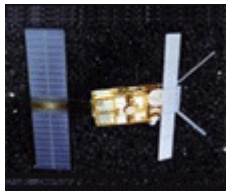
- to widely **publish** the project results in **scientific publications** or presentations
  → with data citation: ***"[mission or instrument] Data provided by European Space Agency"*** *(to facilitate web retrieval of publications, and subsequent ESA reporting on mission/instrument achievements)*

Each PI shall sign the Category 1 use Terms & Conditions (http://eopi.esa.int/files/terms)

Types of Category-1 Access

Products systematically available on the Internet

Fast Registration, any time, free of charge (Internet access)



Products available on specific request

Full Proposal, any time, reproduction cost

Products offered within an Announcement of Opportunity

Full Proposal fitting set objectives, time restrictions, normally free of charge

Products available via a Registration

Mission	Sensor	Product	Internet: Archived or Reprocessed	Internet: NRT and Recent	DDS Europe: NRT
ENVISAT	ASAR	ASA_WSM_1P		last 14 days	
		ASA_IMM_1P		last 14 days	
		ASA_APM_1P		last 14 days	
		ASA_GM1_1P		last 7 days	
		ASA_WVS_1P	Full mission	last 7 days	
		ASA_WWW_2P	Full mission	last 7 days	
	MERIS	MER_RR__1P	Full mission	last 7 days	NRT
		MER_RR__2P	Full mission	last 7 days	NRT
		MER_RRC_2P	included in MER_RR_2P	last 7 days	NRT
		MER_RRV_2P	included in MER_RR_2P	last 7 days	NRT
		MER_LRC_2P	included in MER_RR_2P	last 7 days	
		MER_FRS_1P (European coverage)		last 14 days	NRT
		MER_FRS_2P (European coverage)		last 14 days	
		MER_FRS_1P (North America coverage)		last 14 days	
		MER_FRS_2P (North America coverage)		last 14 days	
	AATSR	ATS_TOA_1P	Full mission	last 7 days	NRT
		ATS_NR__2P		last 7 days	NRT
		ATS_AR__2P		last 7 days	NRT
		ATS_MET_2P		last 7 days	
		UPA-L2P-ATS_NR__2P	From Dec 2008 onwards	NRT	
	Altimeter	RA2_FGD_2P		last 7 days	
		RA2_IGD_2P	Full mission		
		RA2_GDR_2P	Full mission		
		RA2_WWV_2P	Full mission	last 7 days	
	Atm. Chemistry	SCI_NL__1P	Full mission	last 7 days	NRT
		SCI_OL__2P	Full mission		
		MIP_NL__1P	Full mission (with gaps)	Last 7 days	NRT
		MIP_NL__2P	2002-2004 (with gaps)		
		GOM_LIM_1P		last 7 days	
		GOM_TRA_1P		last 7 days	
		GOM_NL__2P	Full mission	last 7 days	
		GOM_RR__2P		last 7 days	
	DORIS	DOR_DOP_1P	Full mission		
		DOR_POR_AX	Full mission	last 3 months	
		DOR_VOR_AX	Full mission	last 3 months	
ERS	SAR	SAR.IMM		last 14 days	
		WSC.UWI	From 21/05/2003 onwards	NRT	
		SWM.UWA	From 16/11/2005 onwards	NRT	
	GOME	GOME. LVL13	Full mission		
		GOME. LVL21	Full mission		
	ALTIMETER	ALT.URA	From 16/11/2005 onwards	NRT	
	ATSR	AT1_TOA_1P and AT2_TOA_1P	Full mission		
		AT1_NR__2P and AT2_NR__2P			
		AT1_AR__2P and AT2_AR__2P			
	Orbit	ORB.PRC	Full mission		
		ORB.PRL	Full mission		
TPM	Chris, HRC (Proba)	PROBA.CHRIS.1A	All available data, including recent		
		PROBA.HRC.1A	All available data, including recent		
	TM (Landsat)	LANDSAT.TM.SCPRCC	European coverage		
	EOC (Kompsat-1)	KOMP.EOC.ECD	City dataset		
	FTS, MAESTRO (ACE-Scisat)	ACE_FTS_L2V1.0	Full mission		
		ACE_FTS_L2V2.2	Full mission		
		ACE_MAESTRO_L2V1.1	Full mission		
	MODIS (Terra/Aqua)	MODIS.NRT.Level1B (European coverage)	All available data, including recent		
	SeaWinds (QuikSCAT)	QSCATT.Level 2A	Full mission		
		QSCATT.Level 2B	Full mission		
	ODIN	OSIRIS level 1 and 2	All available data, including recent		
		SMR level 1 and 2	All available data, including recent		

- Complete list available at: http://eopi.esa.int/files/regproducts

The list currently includes:

- MERIS RR and AATSR worldwide
- MERIS FR data over Europe and North America
- All ASAR Medium resolution products
- Altimeter data
- Atmospheric sensors data
- Access to TPM collections (e.g. Landsat or MODIS in European coverage, Proba…)

Depending on product type, access can be provided to the last weeks of acquisitions or to the overall archives