LAPIS

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LABORATÓRIO DE ANÁLISE E PROCESSAMENTO DE IMAGENS DE SATÉLITES

SESSION 8 Topic: Landslides Management

Use of satellite precipitation products for landslide mapping: people and pixels in Brazil

Droughts, Floods and Landslides - Event Week 2014

"Droughts, Floods and Land Slides" from 1st to 5th December 2014.

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Outline

- Context and Objectives
- EUMETCast Service
- Case Study #1: Flood in Rio
- Case Study #2: Drought in NEB
- Summary and Questions

CONTEXT: Urgent questions

What is the current state of flood/drought in Brazil and what will be the future?

Trends

- **Do we observe more frequent or severe flood/drought?**

What will the future bring?

- **Shall we face more frequent, longer or severe drought?**

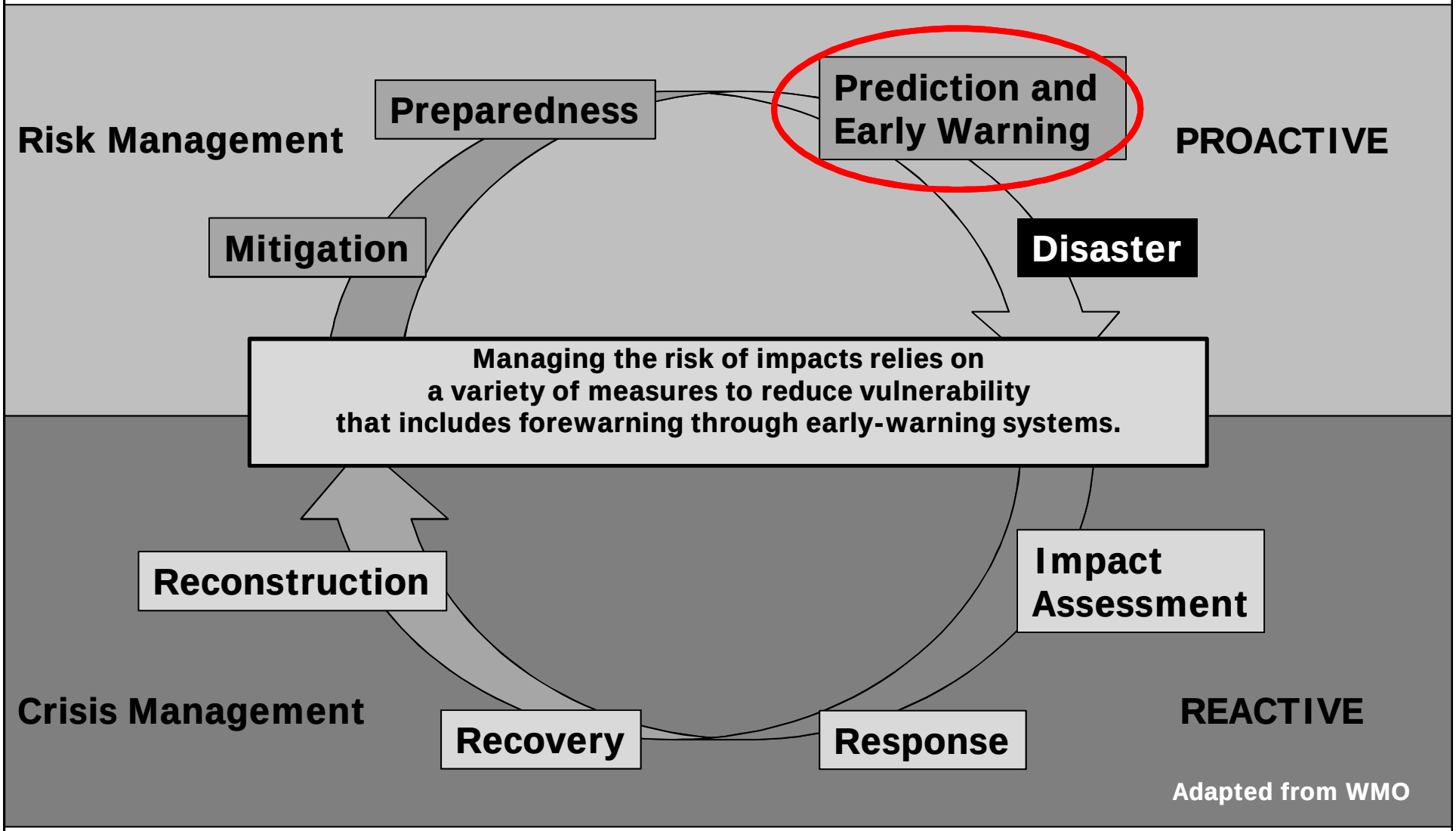
- **Which indicators?**
- **How to communicate to stakeholders, policy makers and general public ?**

Great advances in science, but still lots to understand: Uncertainties due to Models.

?

Key Input: GHG Emissions Assumptions: (e.g., in 2080-2100)
Technologies?
Energy Sources?
Deforestation rates?
Population? Uncertainties (IPCC Scenarios)

CONTEXT: How do we reduce the impacts of flood?



CONTEXT

RISK

Coping capacity

Structural Measures

Non-Structural Measures

Exposure

Land use

Urban/Rural Population

Vulnerability

Water use Efficiency

Groundwater Dependency

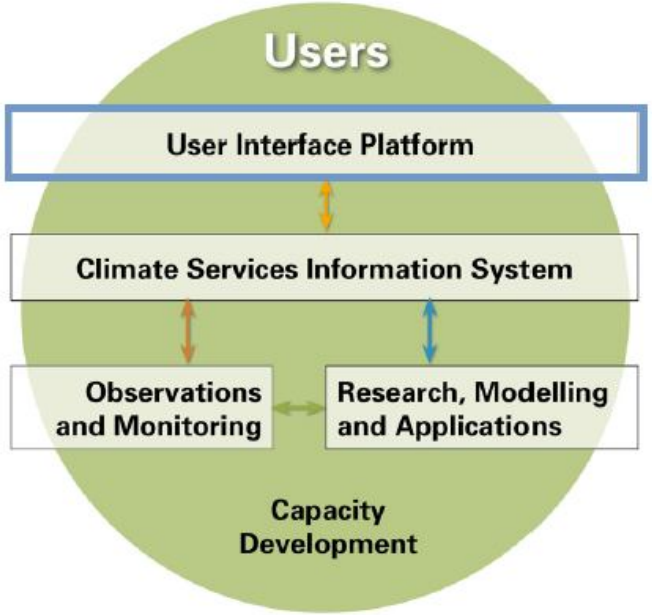
Socio/Economic

Hazard

Precipitation

Soil wetness

Temperature



Planning, Decision Making, Policy Making

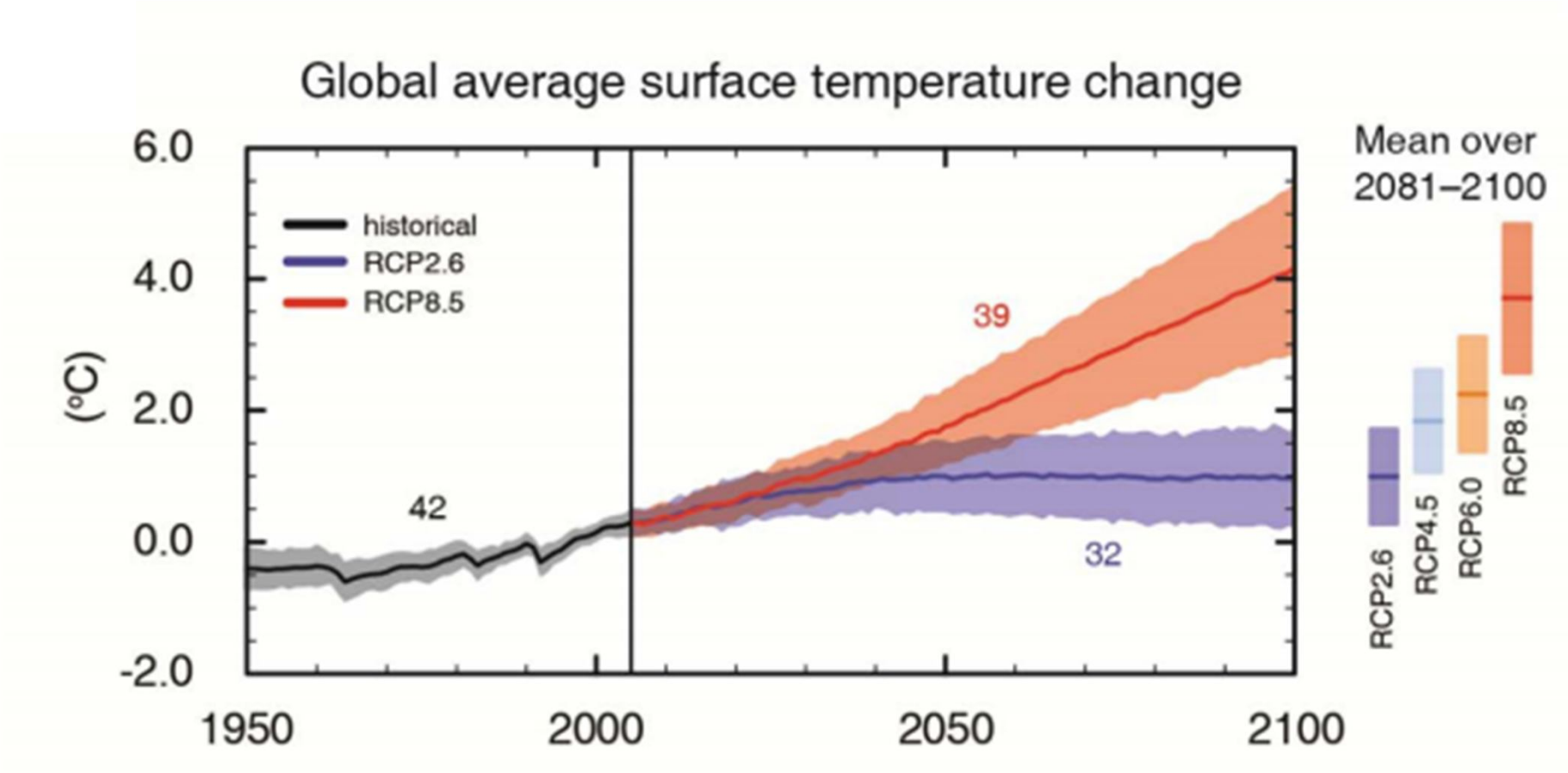
Adaptation to What?
What Can We Expect?

What Mitigation options are likely to succeed?

Information on Future Climate

CONTEXT

Expected Global Temperature For Different Possible Socioeconomic Scenarios (Reference: 1986 – 2005)



Source: IPCC, 2013 (Draft)

Uncertainty is huge!

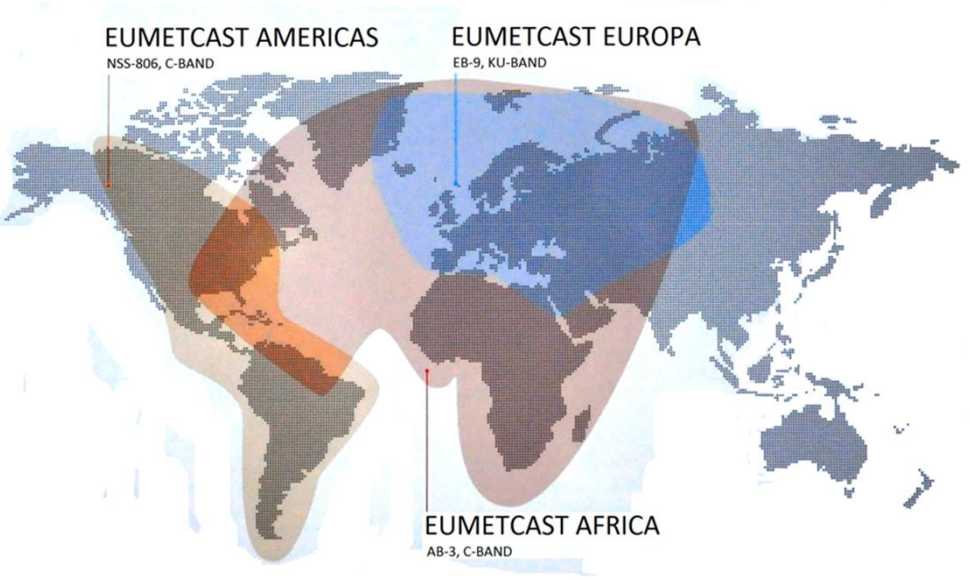
The Challenge and Our Goals

The challenge: How can early warning of physical flood/drought conditions be provided in regions with low data availability and low capacity?

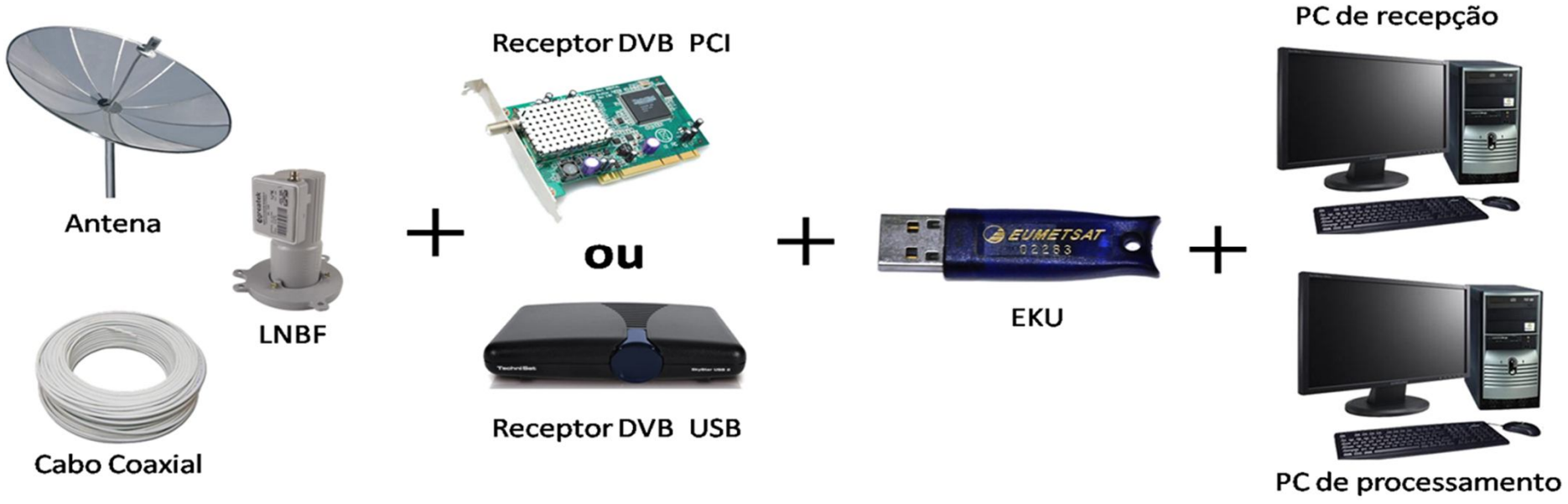
The goal: To develop a flexible framework for providing historic records, real-time monitoring.

SAGEO: Sharing EO products using EUMETCast service

The use of Meteosat to quantitatively observe the Earth's atmosphere for research and operations has made steady, and in some cases spectacular progress over the last five decades. Several professors and their graduates from the Brazilian's universities have utilized Meteosat. I will describe personal experiences involved in SAGEO's group and how under and grad studies contributed to these experiences.

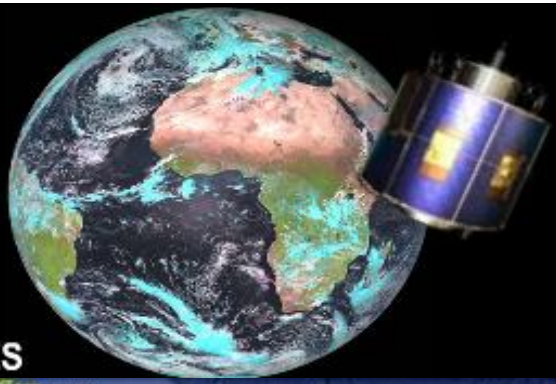


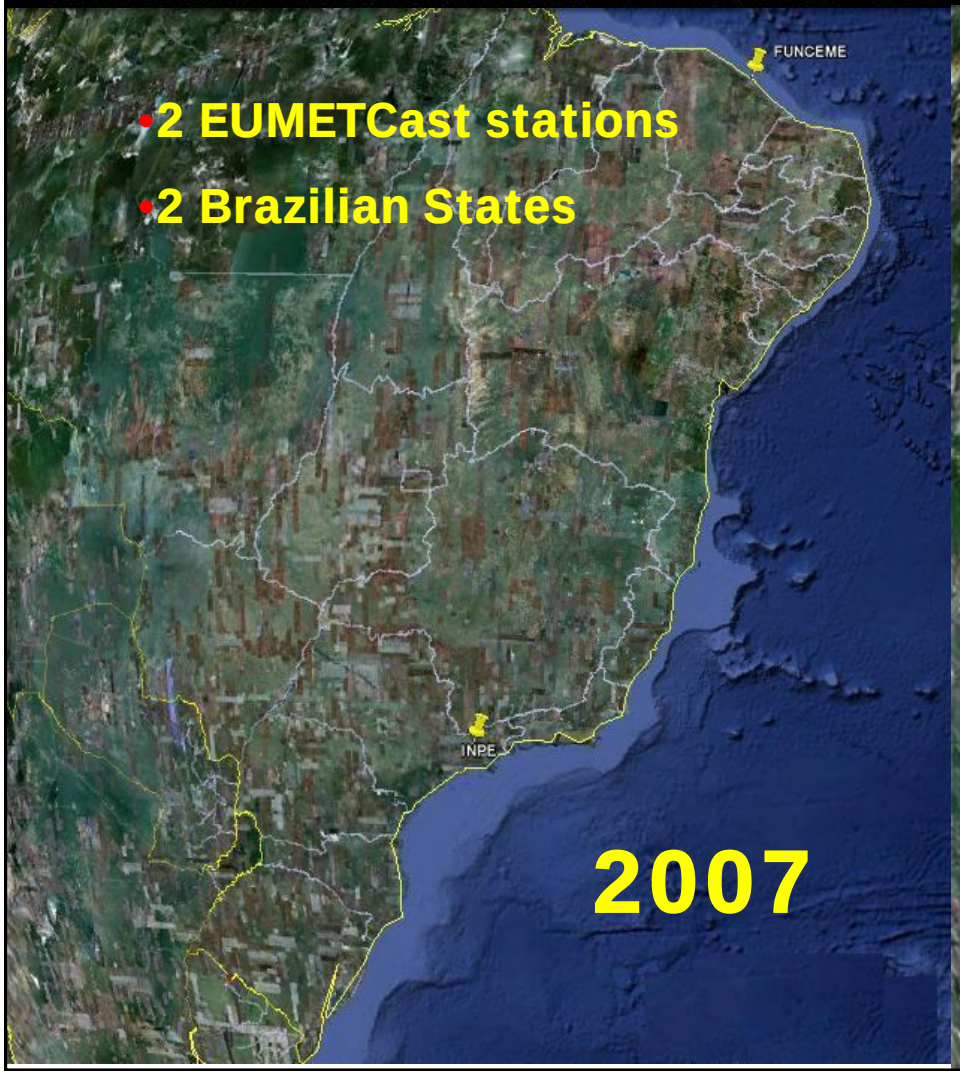
SAGEO: Setting up receiving stations

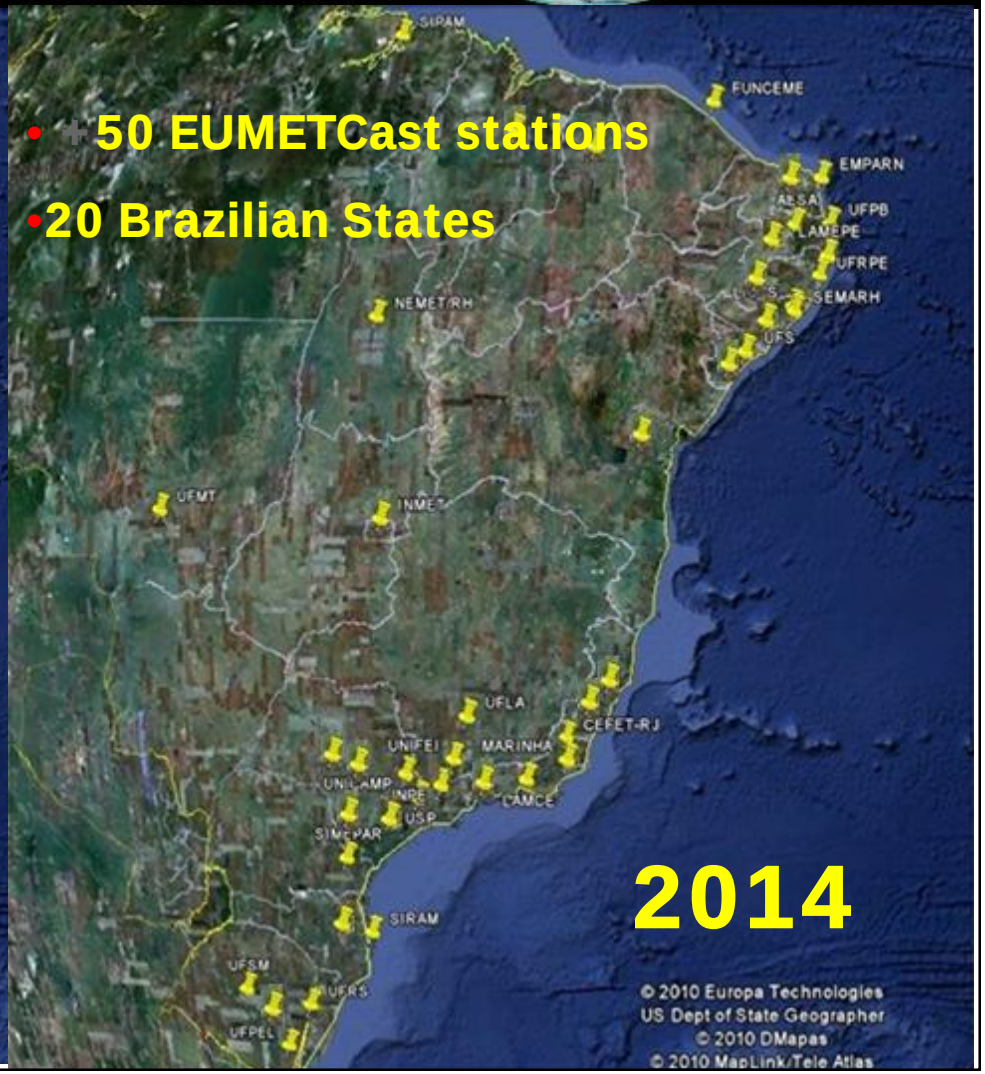


SAGEO grupo

LABORATÓRIO DE ANÁLISE E PROCESSAMENTO DE IMAGENS DE SATÉLITES







South American Group EUMETCast Opertaors (SAGEO): 4 core activities

Sharing cross-cutting Earth Observation products

Setting up receiver and hub infrastructure

Capacity building: supporting & training user communities

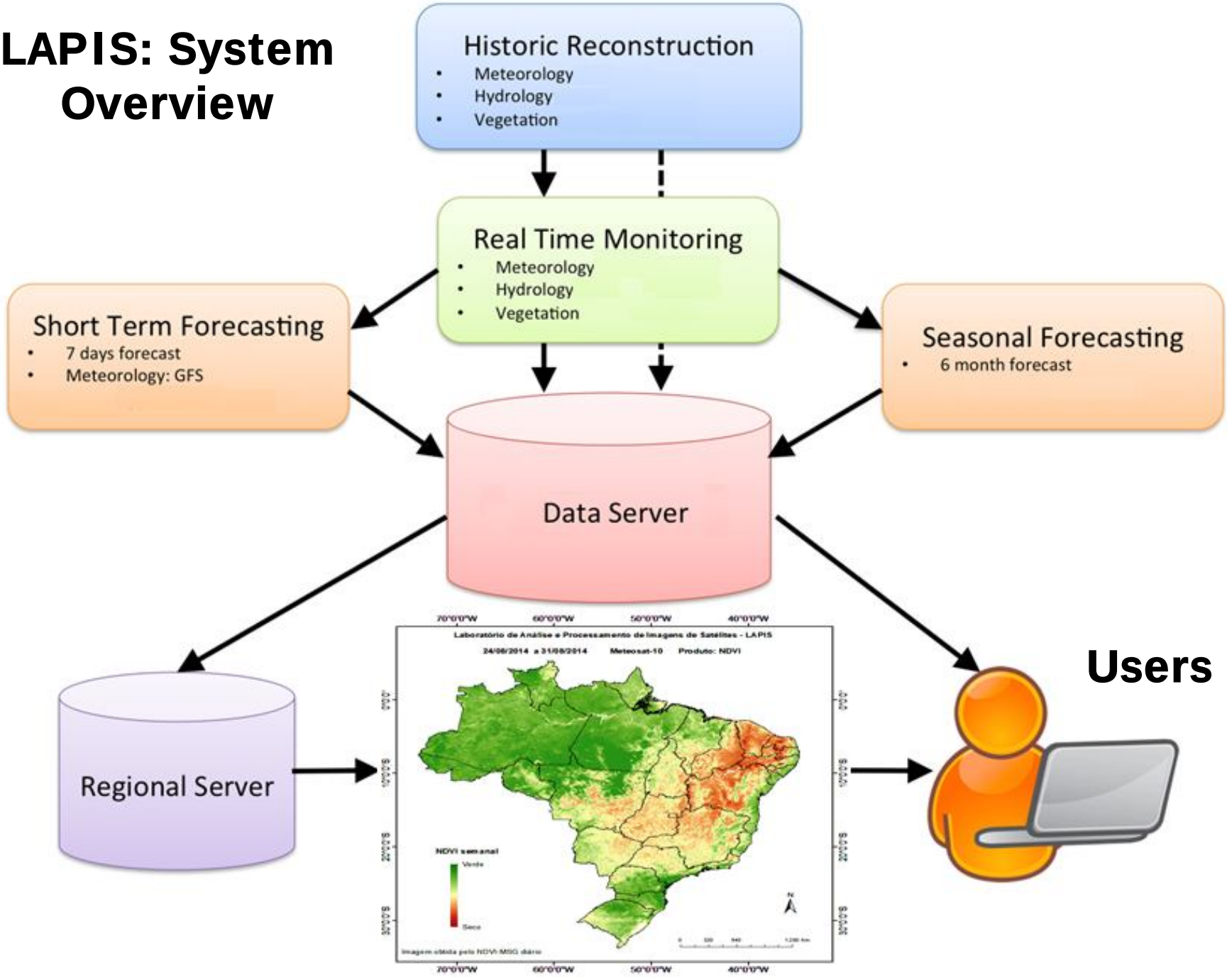
Building on capacity: Making everyday use of EUMETCast

The ultimate goal of EUMETcast is to embed the provided products into every day research, environmental monitoring, planning and decision making processes

Monitoring drought
Crop modeling (Brazil)
Severe weather monitoring

Key message: data dissemination, training and free software are all nice.

LAPIS: System Overview



Case Study 1: Flood in Rio de Janeiro

The critical events occurring in Rio de Janeiro State, specially the most recent ones, in Abril 2010 and January 2011 and their consequences.

The concern by the authorities and the media with the information about the return period of the catastrophic events just occurred and the often lack of hydrological information to assist them.

Data from 1900 a 2011 (EM-DAT: The OFDA/CRED International Disaster Database) show that annual floods are the main natural disaster in Brazil, in number of reported killed or affected people and economic damage costs

Brazil
52 events - average of 55 killed people and losses of US$ 80 million per event or 26 killed people and losses of US$ 37.7 million per year.

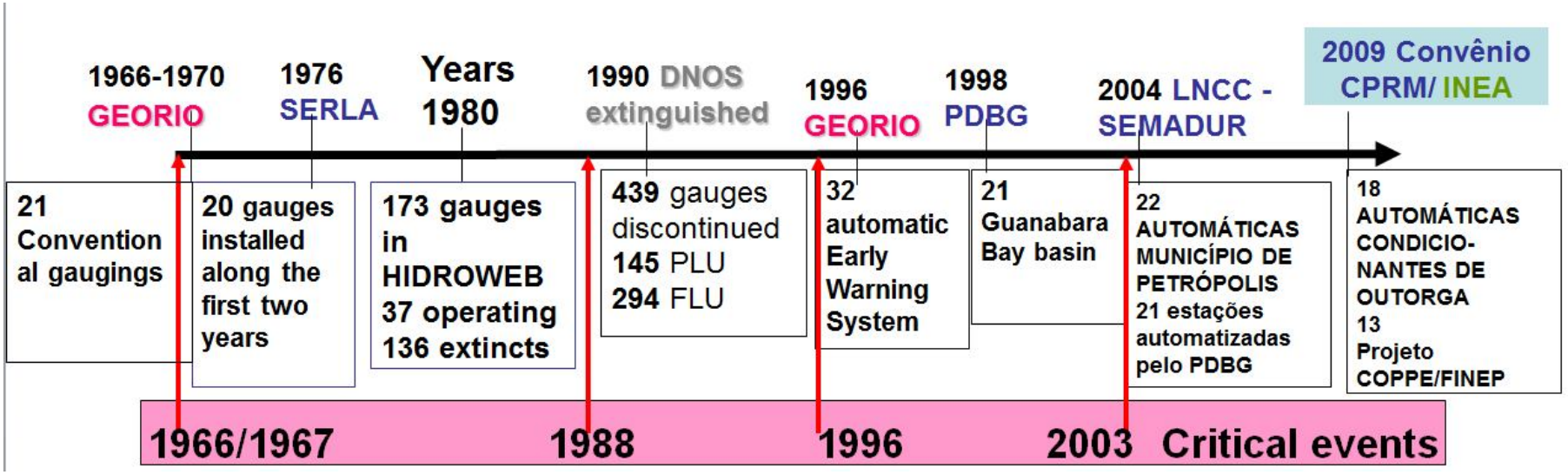
World
2,049 events - average of 2,159 killed people and losses of US$ 166 million per event or 39,849 killed people and losses of US$ 3 billion per year.

Brasil

RIO...

CIDADE SUBMERSA
A Lagoa Rodrigo de Freitas subiu quase 1,5 metro acima do nível normal e a água invadiu pistas e calçadas: uma semana de caos

Time line of the evolution of hydrometeorological monitoring network in Rio de Janeiro State



•1981 to 1990, hundreds of gauging stations were discontinued along the state.

•The implementation of the Alerta Rio (Rio's Early Warning System) – after recommendation of the "Seminário Prevenção e Controle dos Efeitos dos Temporais do Rio de Janeiro", held on 28th February 1996.

- 32 automatic gaging stations were installed in Rio de Janeiro city.

Major disasters occurred in Rio de Janeiro

Year	Date	Occurence	máx 24 h (mm)	Gaging station	Consequences and spots	Killed	Homeless dislodged
1711	Septembre						
1811	10 to 17/02	catastrophe/ flods and flash floods			Lanslides, many victims Morro do Castelo, enxurrada descia dos morros que cercavam a cidade, enormes prejuízos materiais e de vidas humanas, desabamento de muitas casas. Ficou conhecido como "Águas do Monte". O Príncipe Regente encomendou estudo sobre as suas causas.	many	many
1851		Begining of monitoring		Main Climatological station			
1883	26 to 28/04	30% do total annual	239		Great impacts all over the city		
1966	11/01 (ou 2/01)	11% of total annual in 24 hours and 45% in 48hours	237 ou 245		One of the major catastrophes -Petrópolis	250 9	50.000 105
1967	20/01				General flood and colapse of transportation system e energy supply, a house and two buildings failed between Belisário Távora and Gal. Glicério streets	> 100 (200)	thousands
	Fevereiro		160				
	24/10	Heavy storm			Lanslides in Morro do Pavãozinho	13	

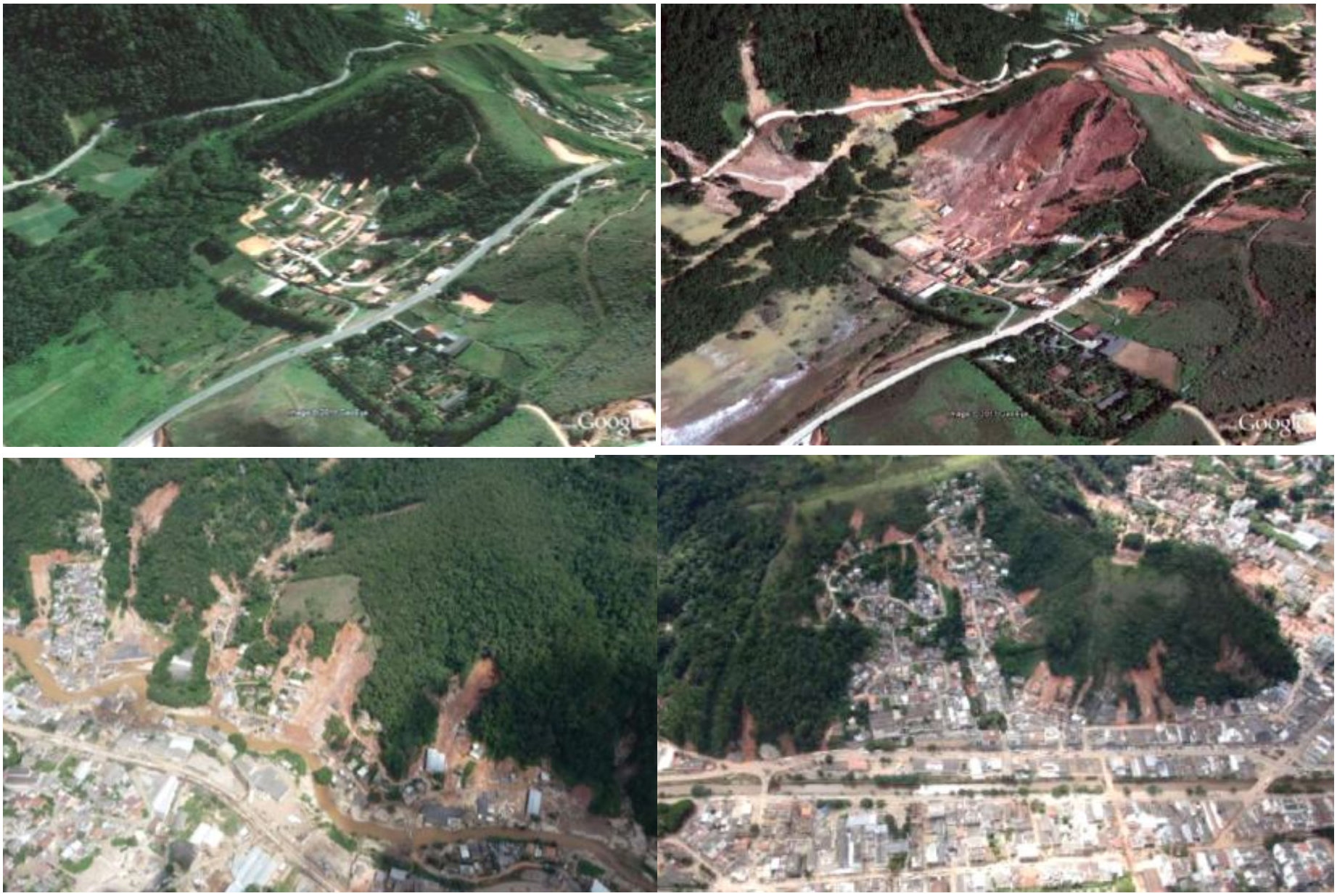
Major disasters occurred in Rio de Janeiro

Year	Period	Occurence	máx 24 h (mm)	Gaging station	Consequences and affected spots	killed	Homeless Dislodged
1988	3/02	10% do total anual			Landslides Morro Dona Marta, encostas desmatadas e solo mal consolidado deslizaram com grande violência, destruição e morte	6	300
	5/02				Flash floods and landslides in Petrópolis, Teresópolis e Baixada Fluminense	200	4.000
	19 a 22/02	384mm	192 ou 230		Debris flow with great violence, a hospital, houses and buildings failed, streets under water	82 (289)	milhares (18.560)
1996	13/02	200mm em 8horas	200	South hillslope of Maciço da Tijuca	South and West Zones, specially Jacarepaguá 38 landslides, tragical consequences, comparable to "Águas do Monte", 1966, 1967 e 1988	59	1.500
			55	Vertente N Maciço da Tijuca	Landslides		
2003	Fevereiro				General flood. Municípios da região serrana, Sul e Norte Fluminense	36	823/ 870
2009	1 de Janeiro			Angra dos Reis	Landslide a hotel in Ilha Grande and a whole	52	
2010	5 a 7 de Abril	A storm	304	Rocinha	Rio de Janeiro, Niterói; São Gonçalo; Nilópolis,Magé, Petrópolis e Paracambi.	256	12.500
2011	12/01		231	Nova Friburgo	Areal, Bom Jardim, Nova Friburgo, Petrópolis, Santa Maria Madalena, São José do Vale do Rio Preto, São Sebastião do Alto, Sapucaia, Sumidouro, Teresópolis, Trajano de Moraes e Três Rios	914	8.789

Teresópolis, flash flood and landslides – 6.727 made homeless, 388 killed by the disaster (Defesa Civil-RJ, 2011)

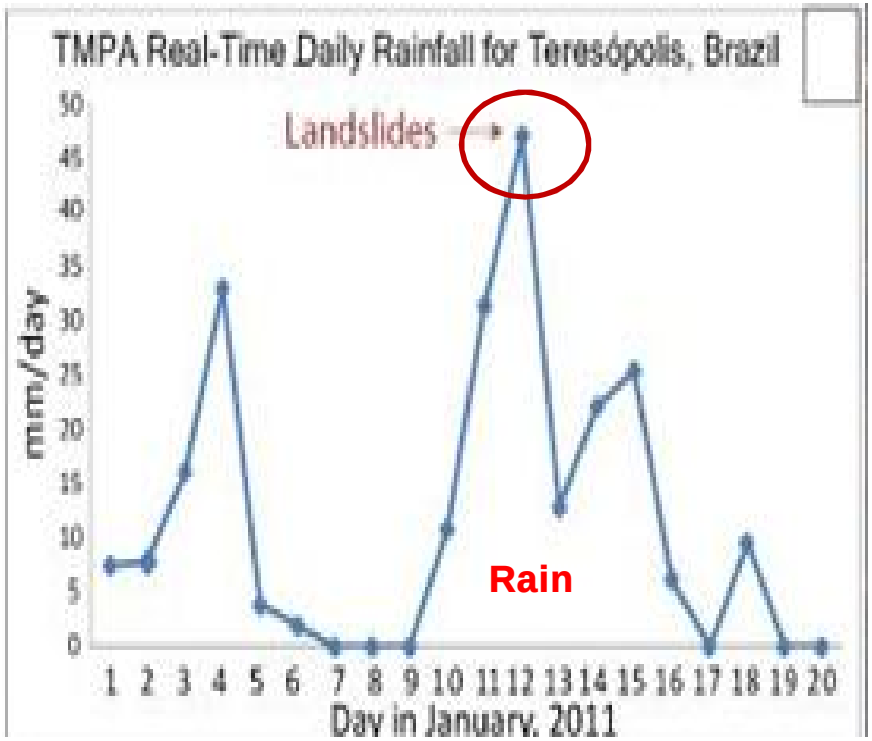
Source: MMA, Secretaria de Biodiversidade e Florestas, 26-01- 2011

Nova Friburgo, landslides – 789 made homeless, 429 killed by the disaster (Defesa Civil-RJ, 2011)



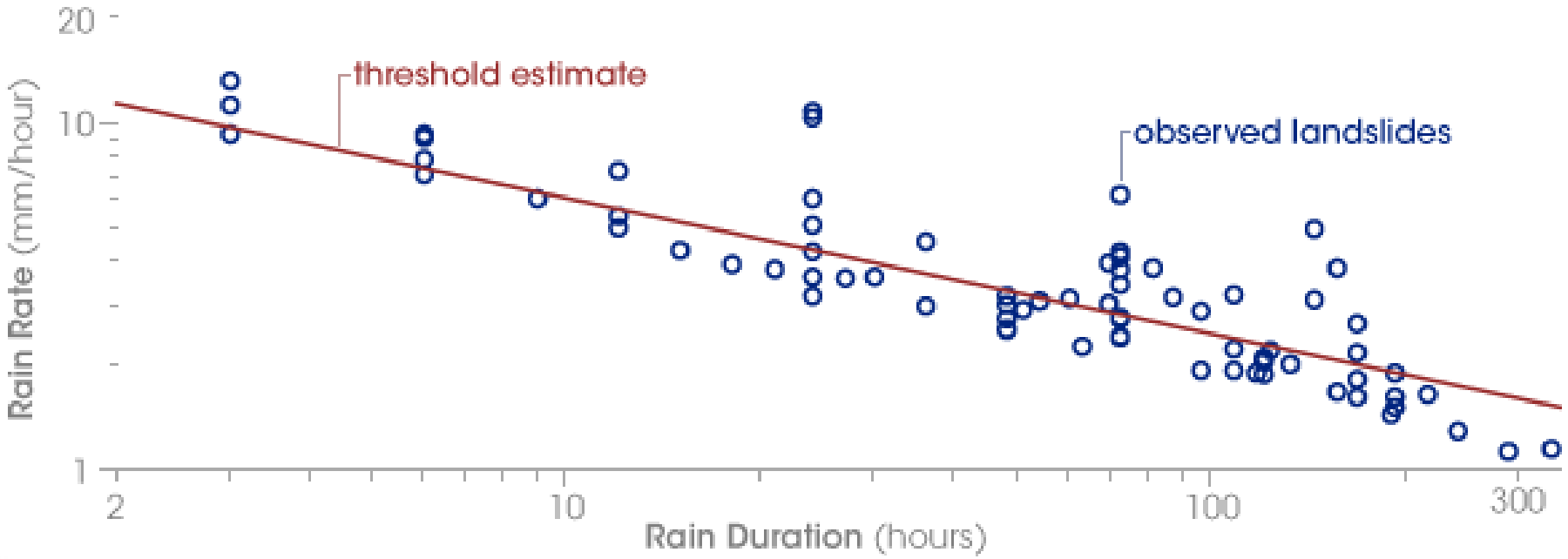
Source: MMA, Secretaria de Biodiversidade e Florestas, 26-01- 2011

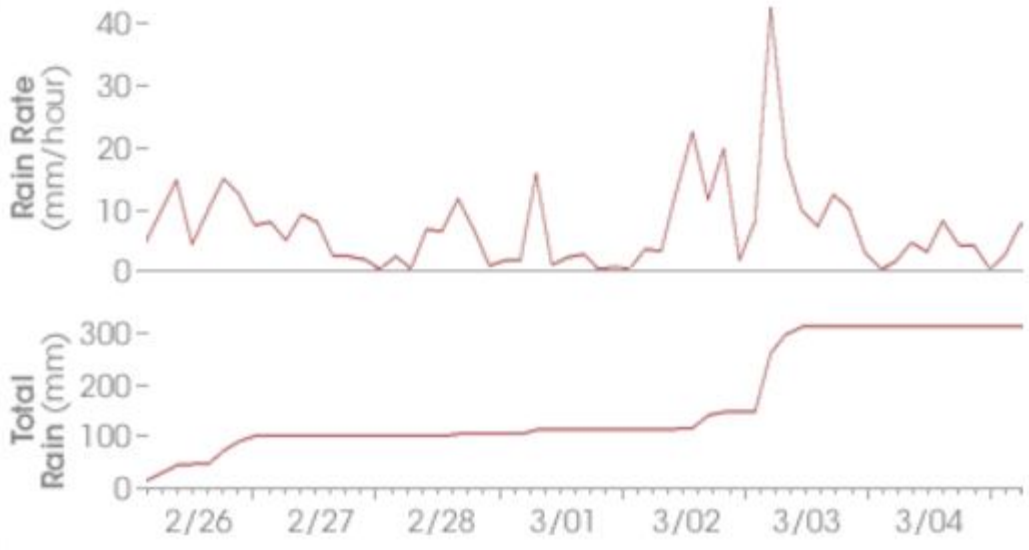

Jan 13, 2011

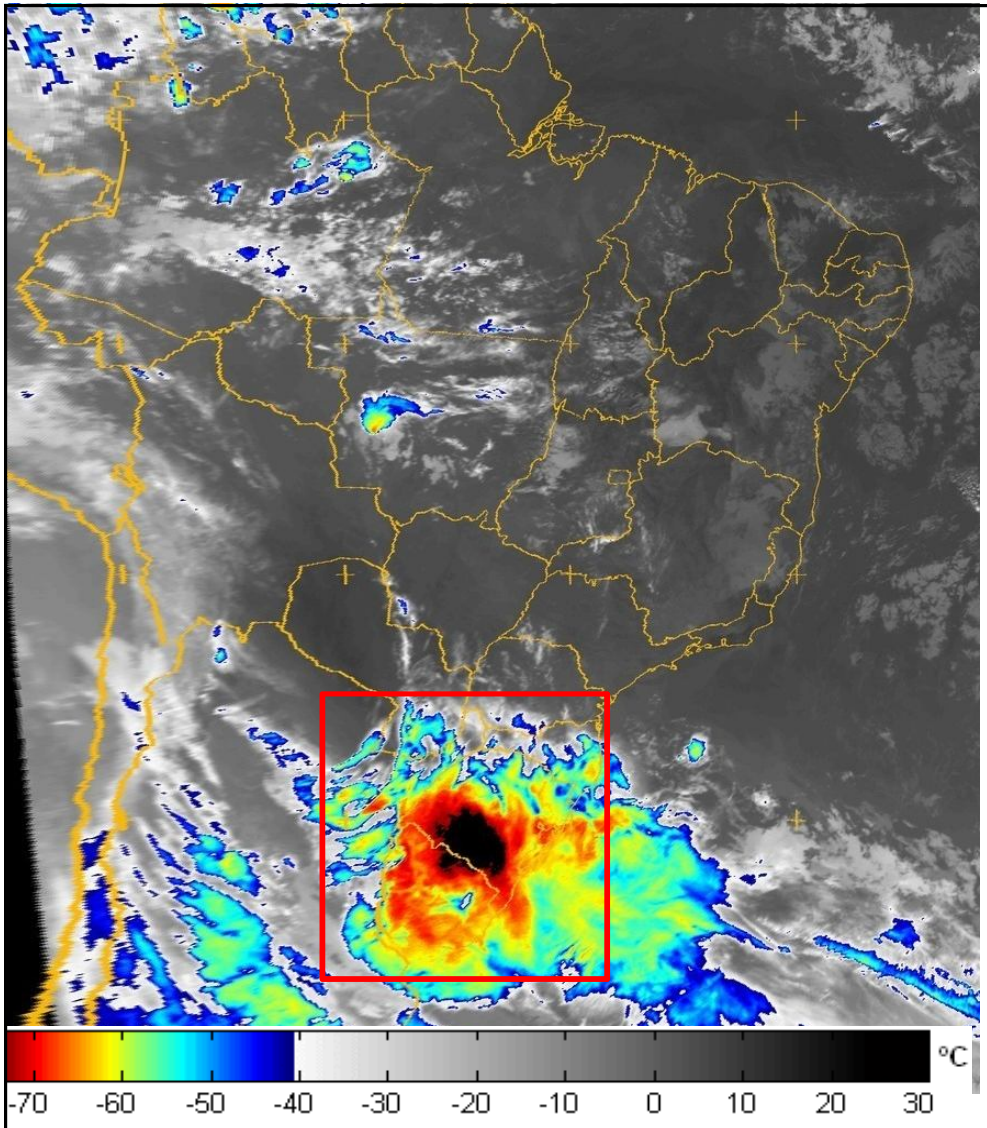

TMPA Real-Time Daily Rainfall for Teresópolis, Brazil
Landslides
Rain
mm/day
0
5
10
15
20
25
30
35
40
45
50
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Day in January, 2011

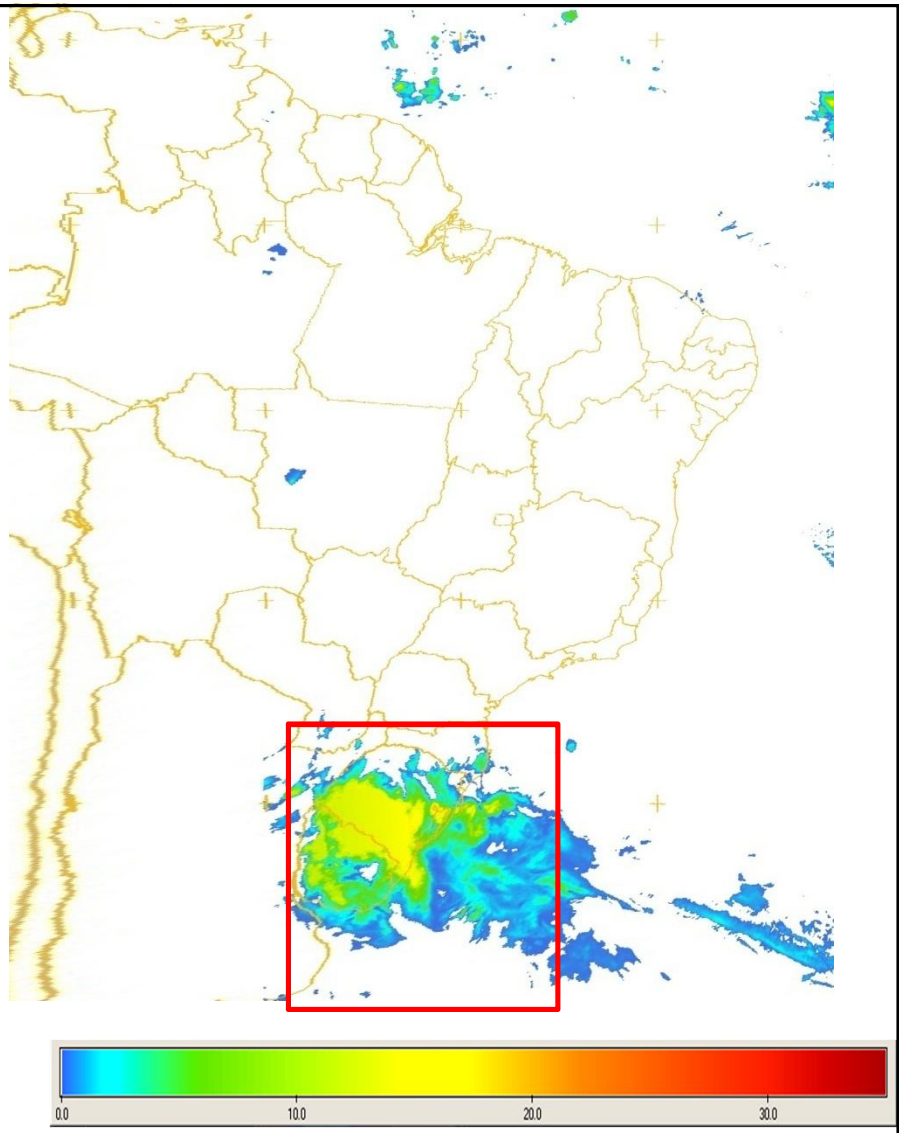

Satellite image by GeoEye

Extremely intense rainfall needed to trigger the slides.





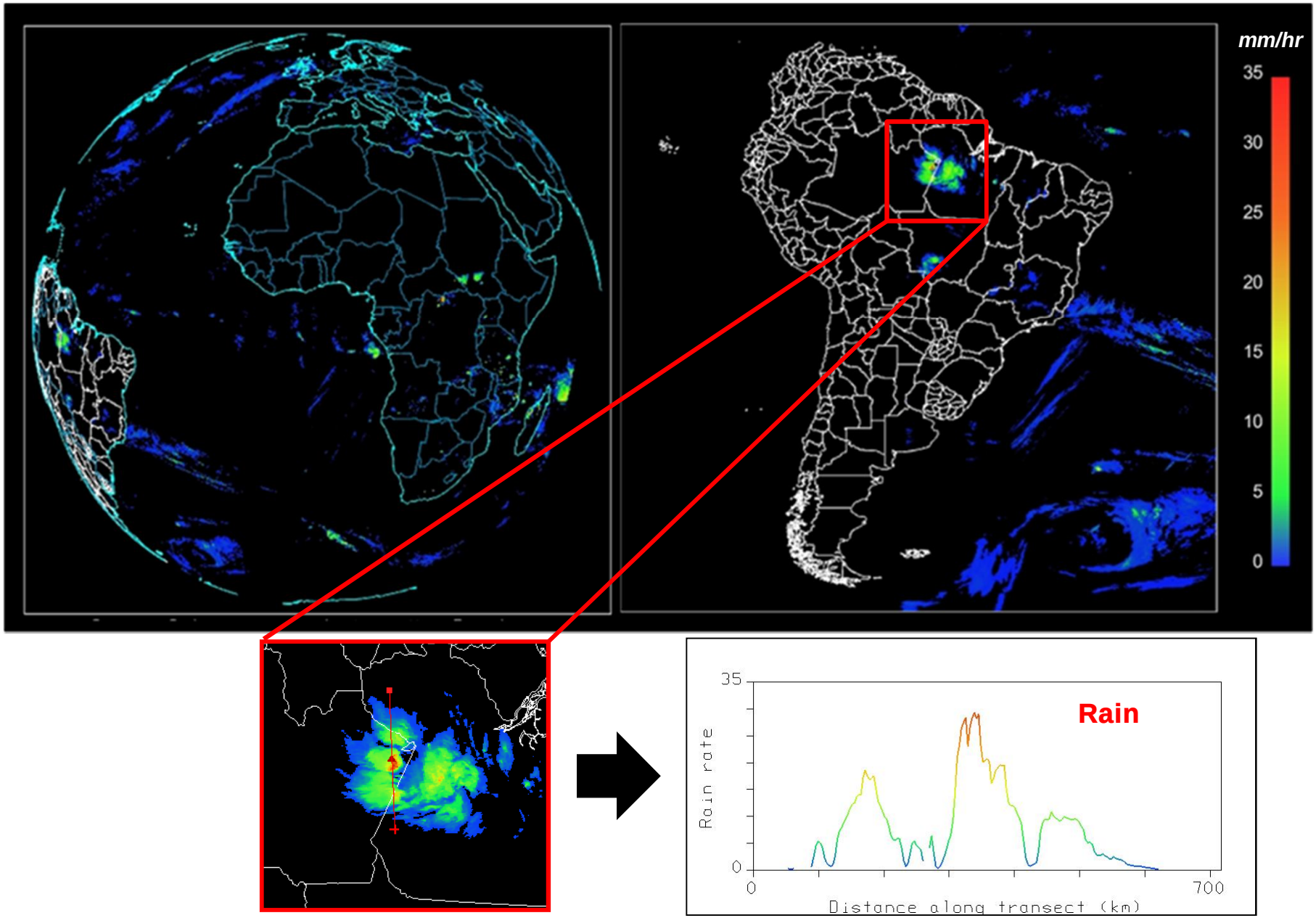


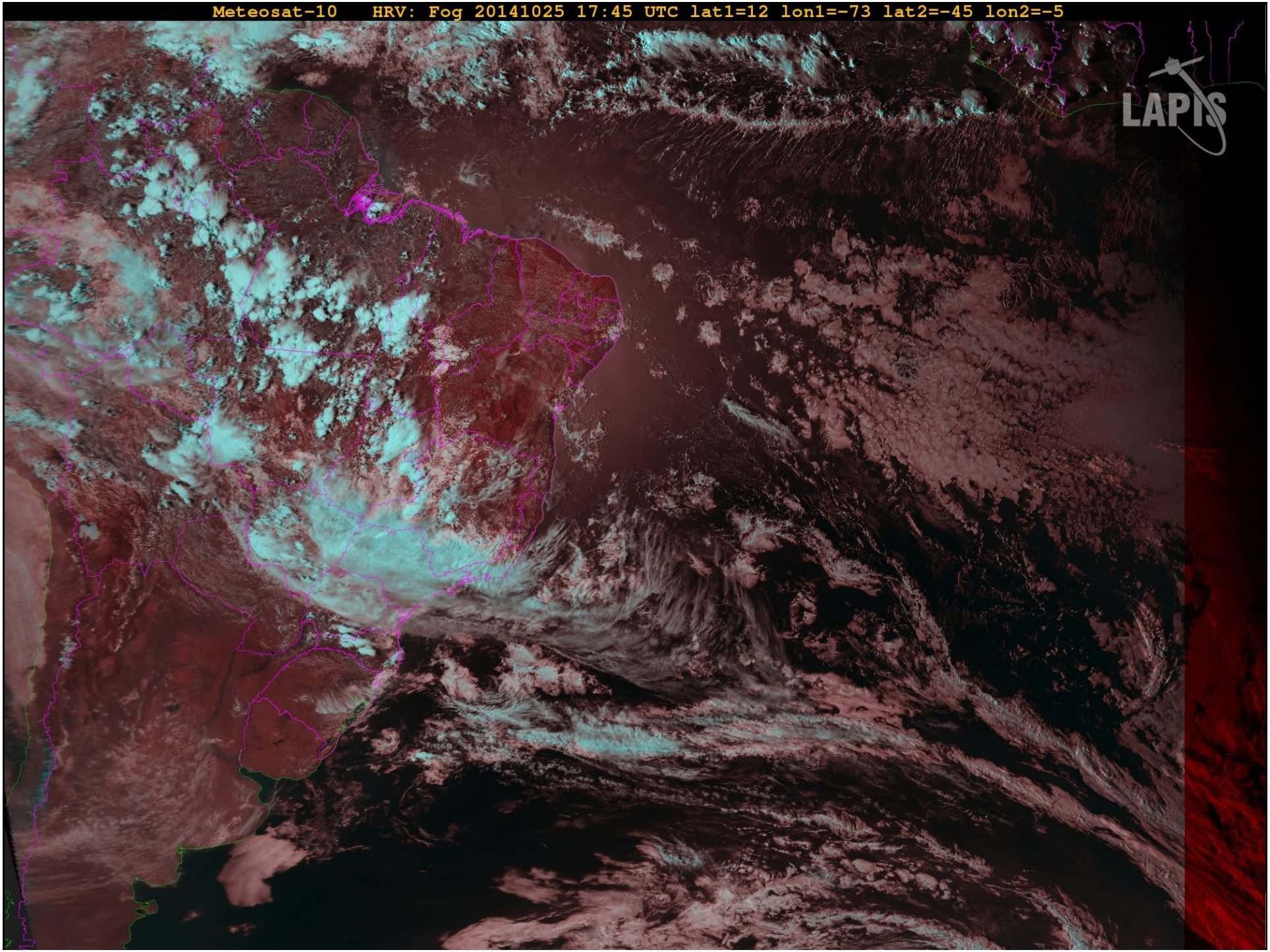


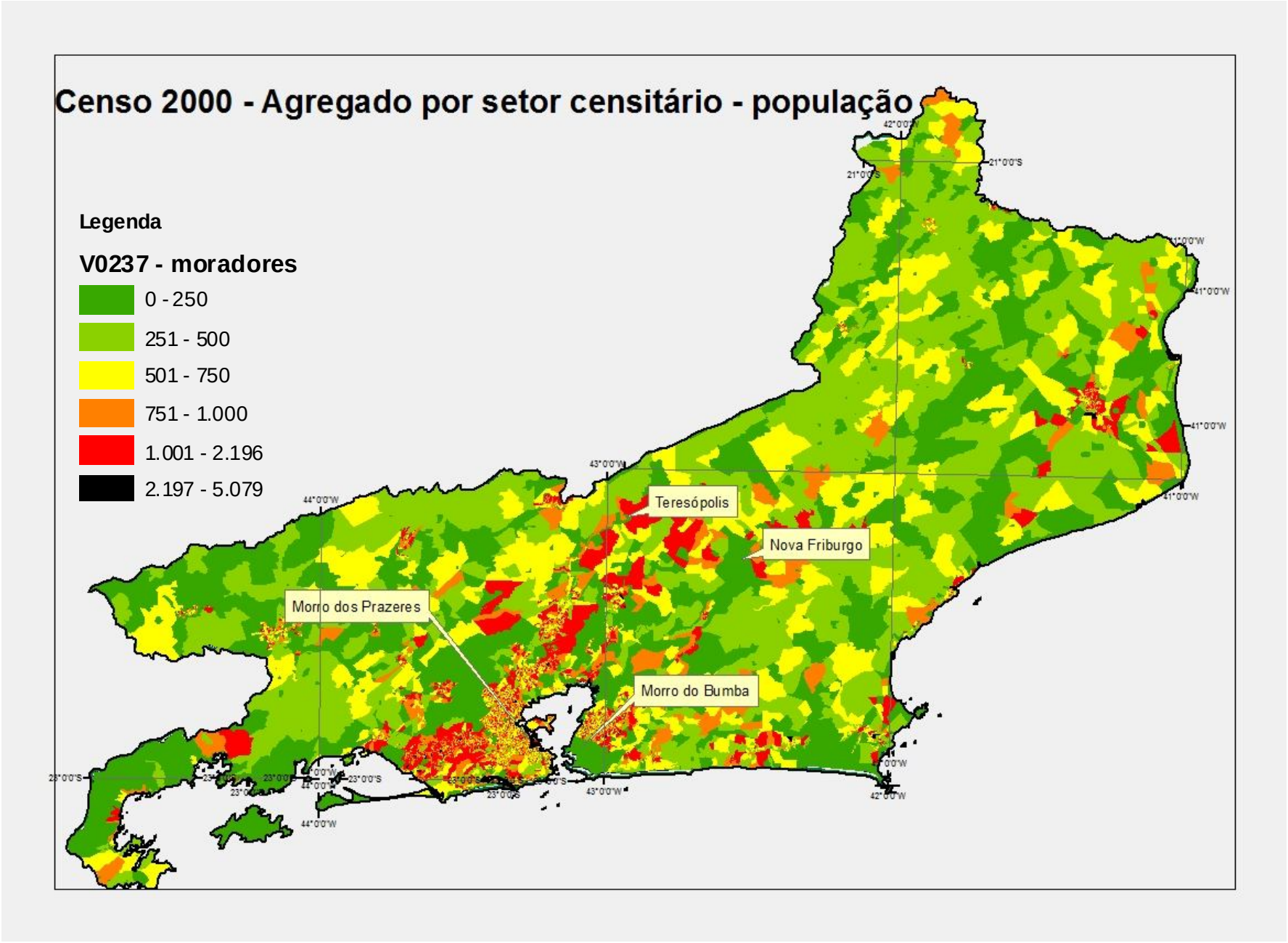
: MSG IR10.8

Product: MSG MPE Rainfall

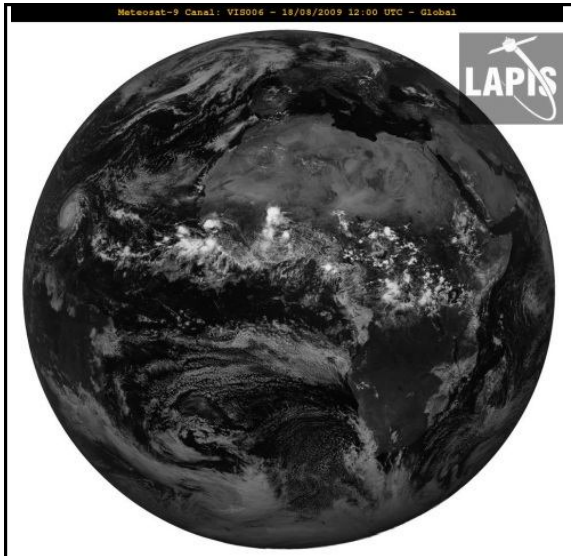
Imagem MPE

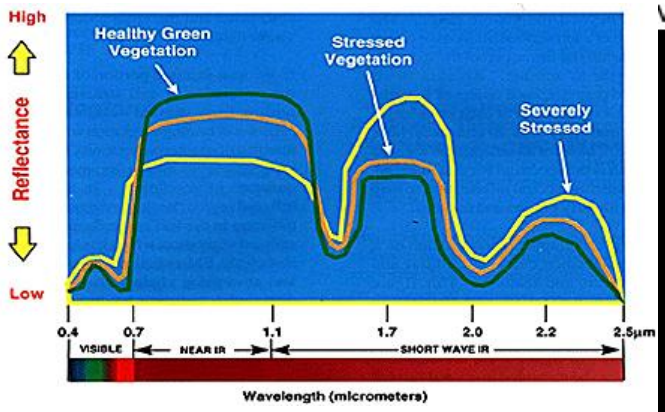

mm/hr
35
30
25
20
15
10
5
0
Rain
Rain rate
35
0
0
700
Distance along transect (km)

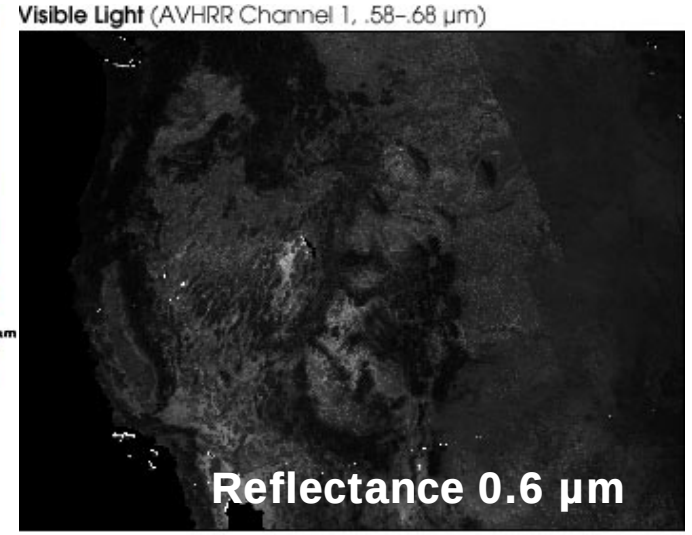

Meteosat-10 HRV: Fog 20141025 17:45 UTC lat1=12 lon1=-73 lat2=-45 lon2=-5
LAPIS



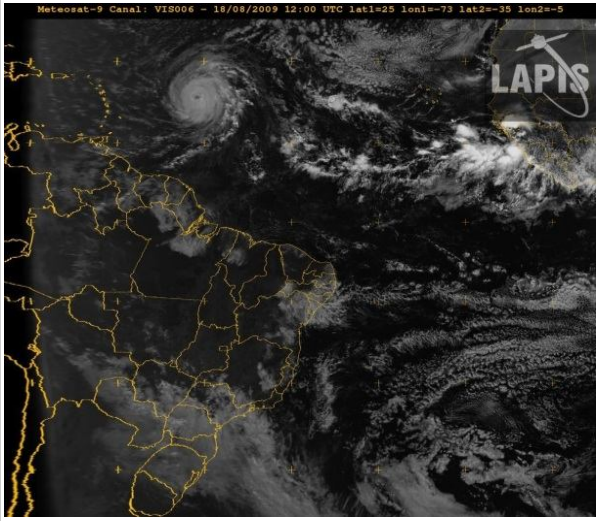
Aggregated data to the collecting unity of Census 2010 are not available yet. IBGE had promised its delivery in June and now it is postponed to November 2011.

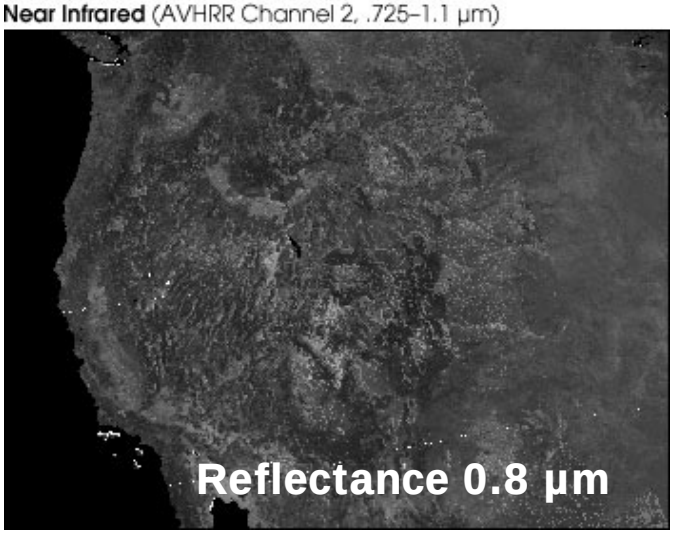


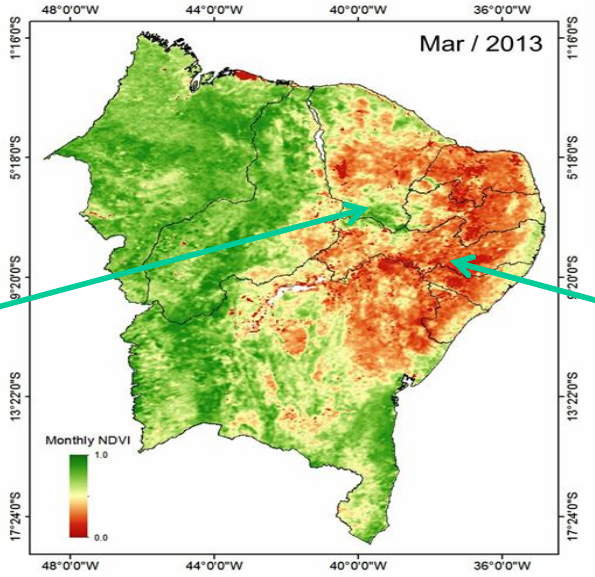


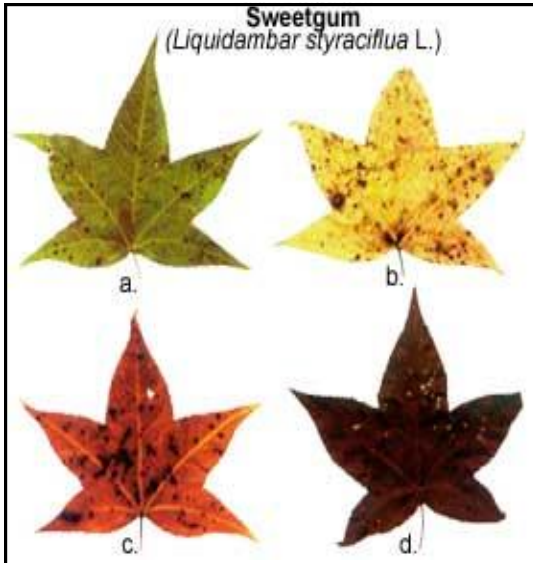


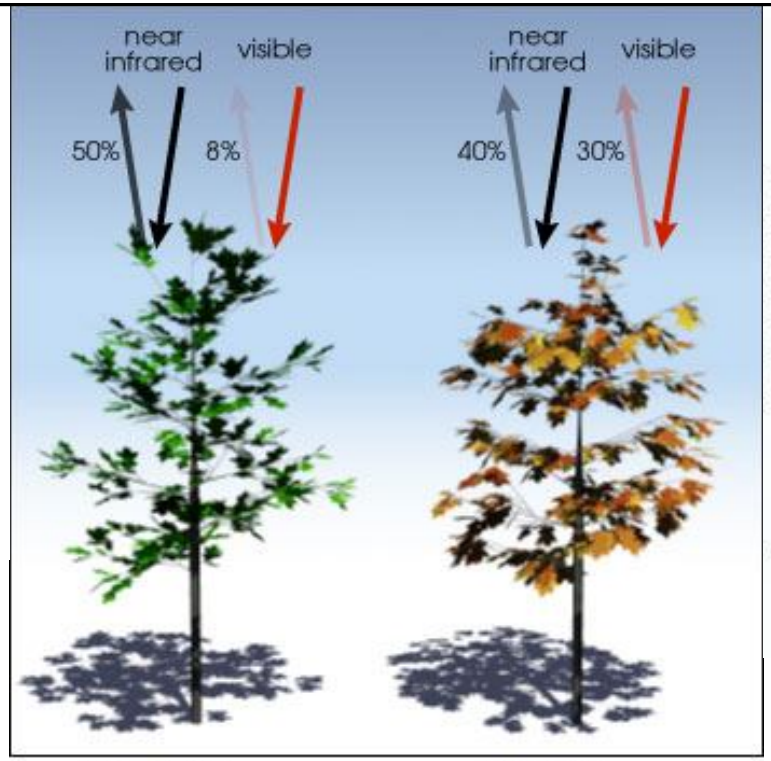
$$NDVI = \frac{R_{0.8} - R_{0.6}}{R_{0.8} + R_{0.6}}$$

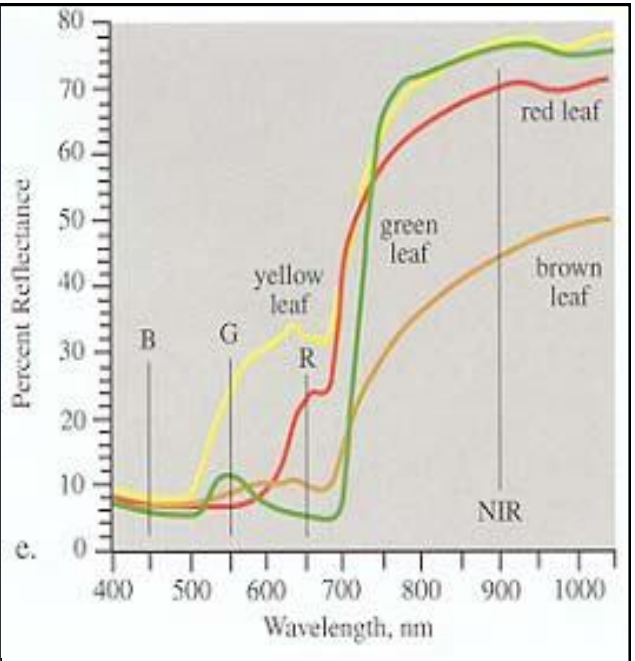












high NDVI

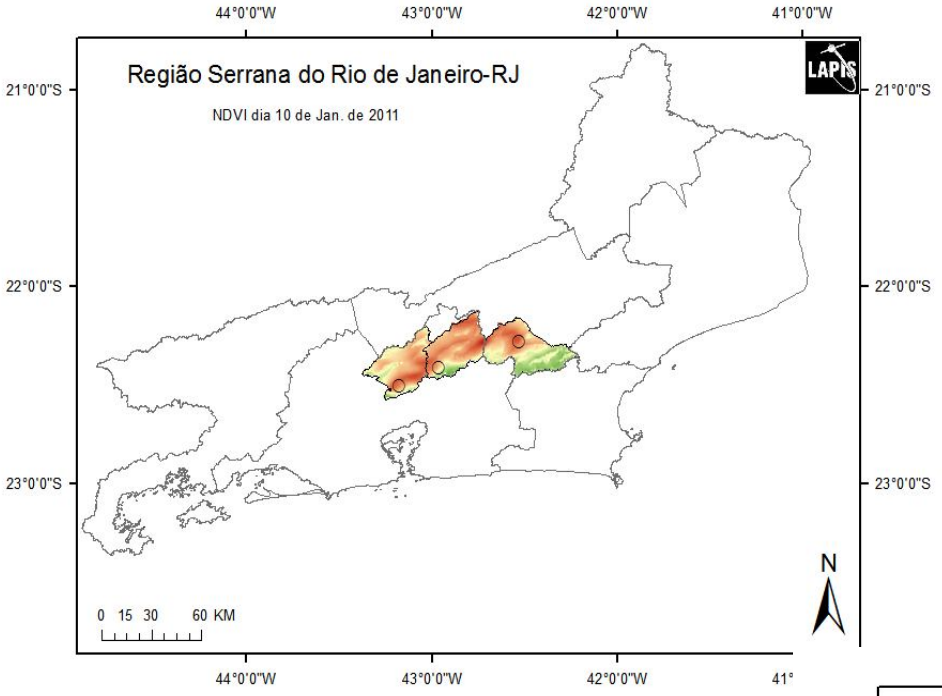
$$\frac{(0.50 - 0.08)}{(0.50 + 0.08)} = 0.72$$

$$\frac{(0.4 - 0.30)}{(0.4 + 0.30)} = 0.14$$

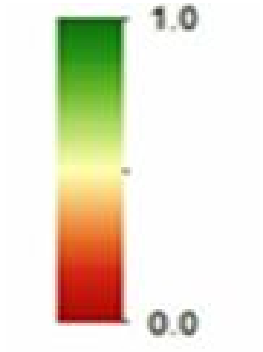
low NDVI

$$NDVI = \frac{\rho_{NIR} - \rho_R}{\rho_{NIR} + \rho_R}$$

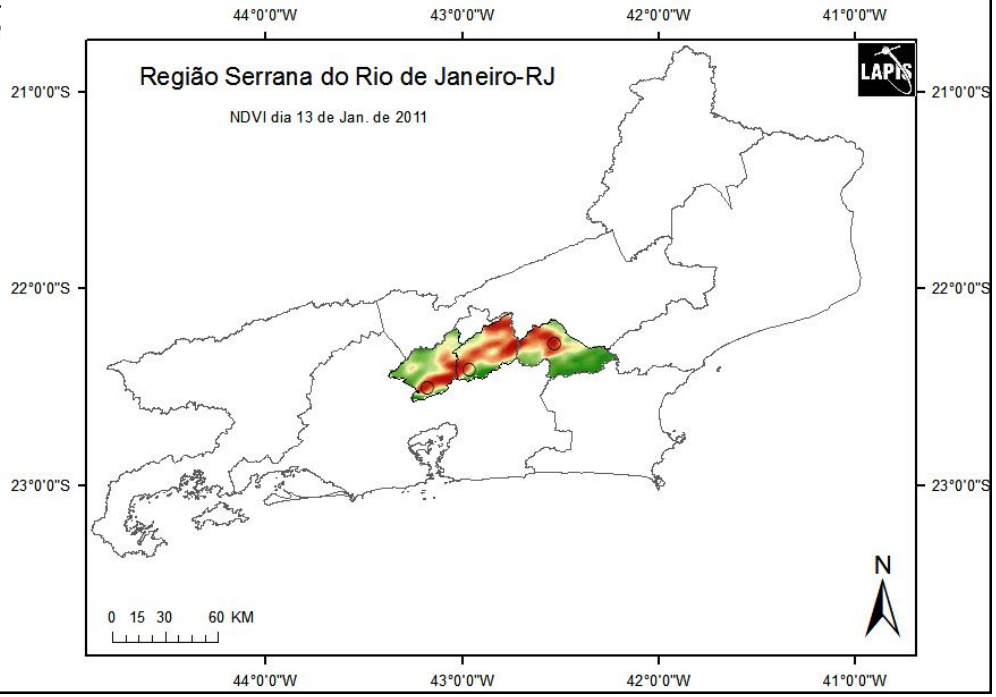
Pre- Event



Daily NDVI MSG SEVIRI



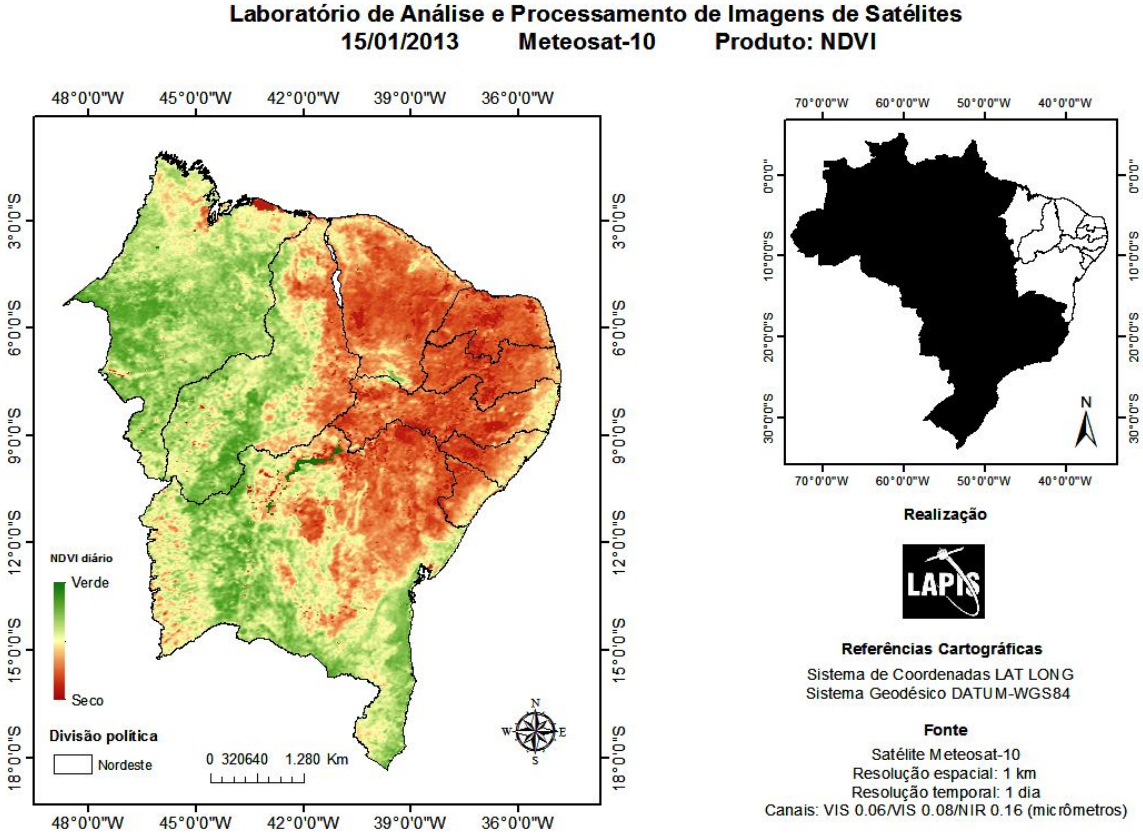
Post- Event



Landslide, Rio, Jan 11 2011

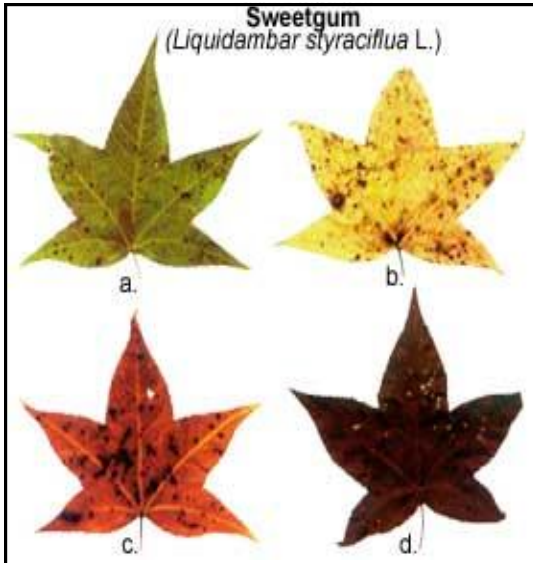
Development of Drought/Flood Monitoring at LAPIS (www.lapiset.com)

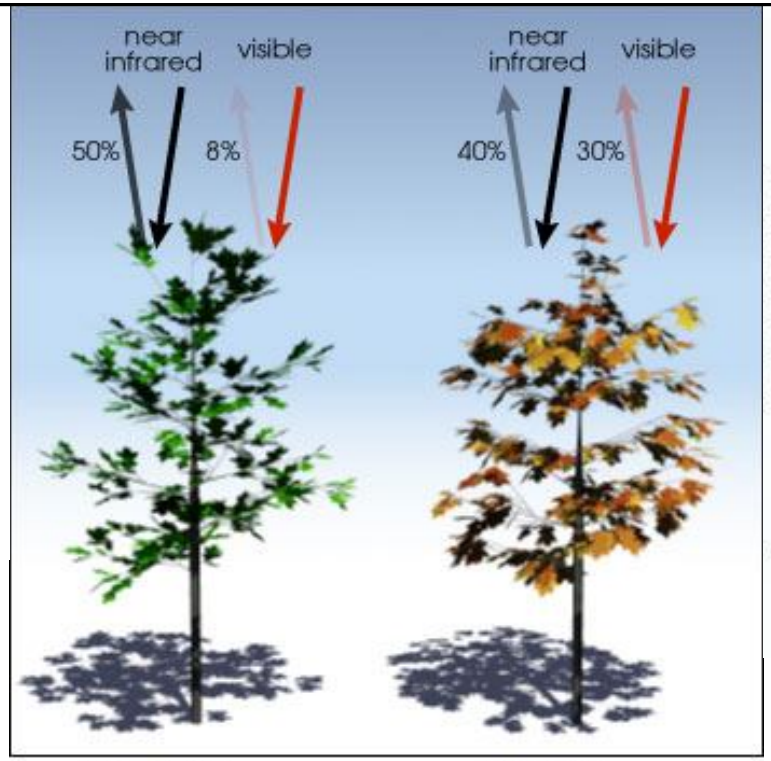
Northeast Brazil Drought Monitor - 2014

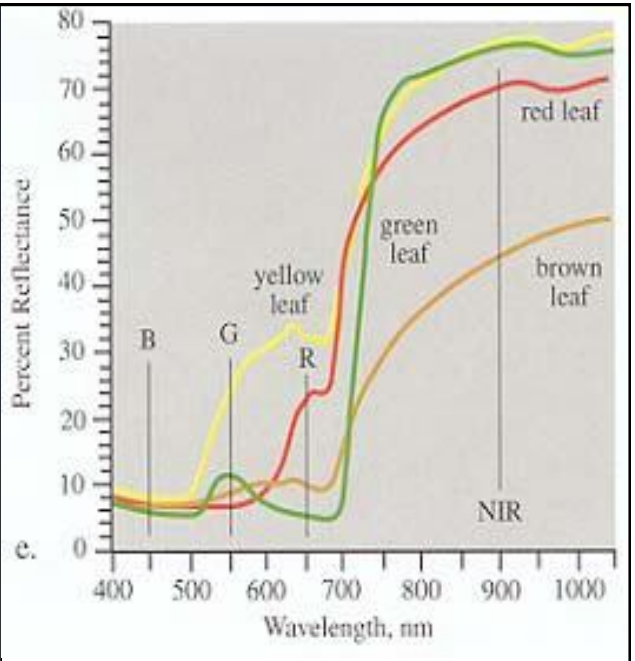


Drought Research Activities

- Historical analysis
- Mechanisms
- Risk analysis
- Drought/ Flood detection
- Future climate changes







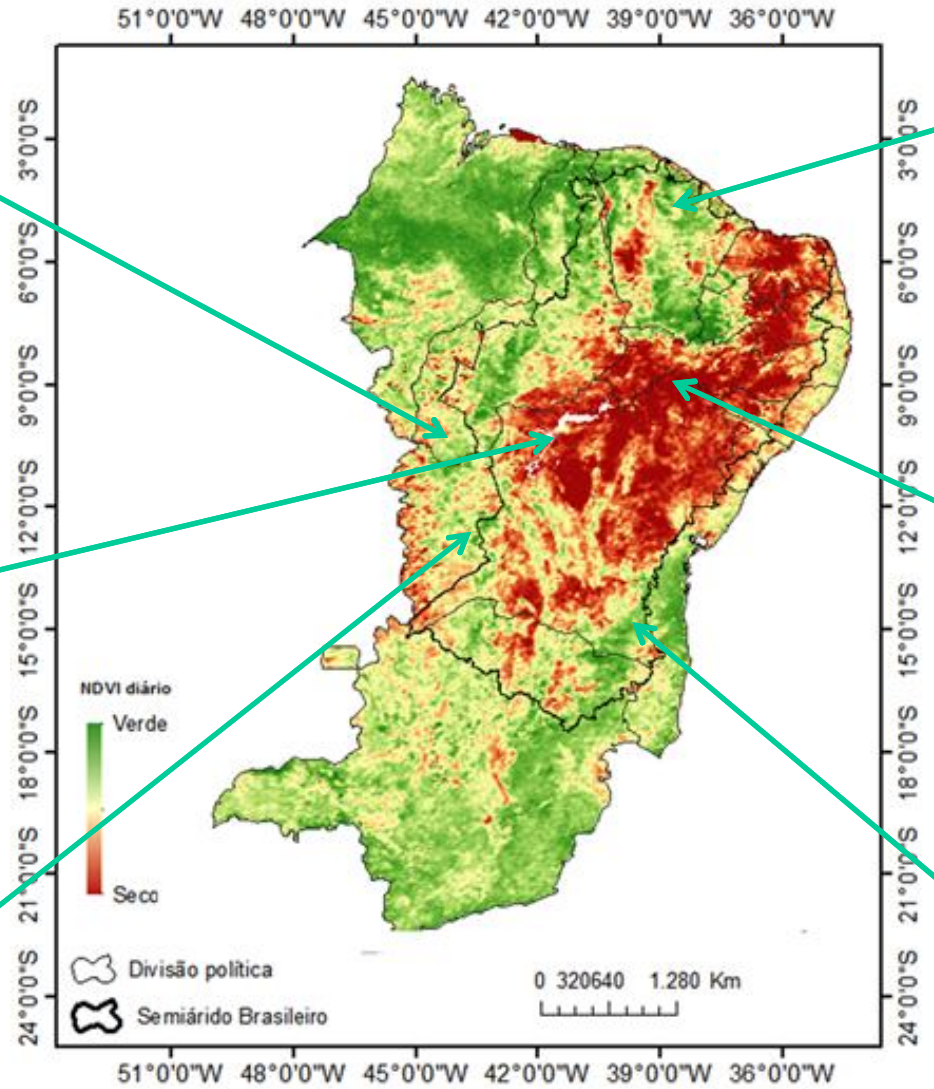
high NDVI

$$\frac{(0.50 - 0.08)}{(0.50 + 0.08)} = 0.72$$

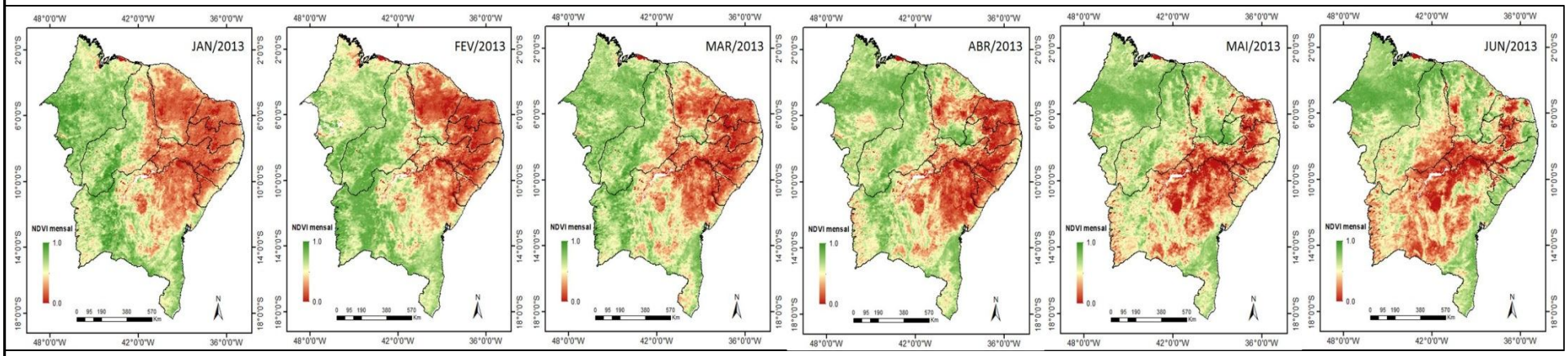
$$\frac{(0.4 - 0.30)}{(0.4 + 0.30)} = 0.14$$

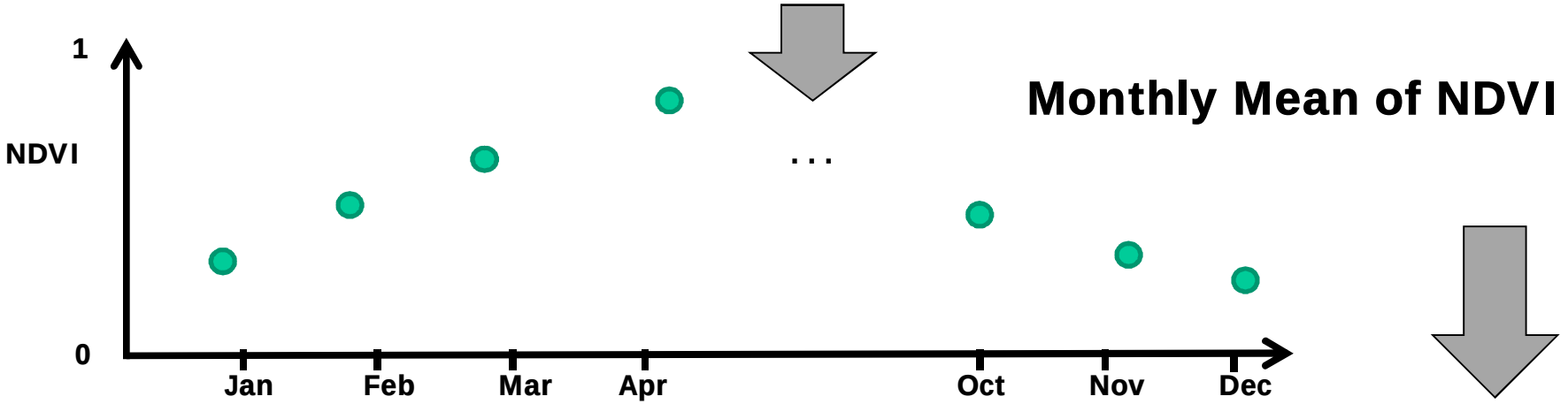
low NDVI

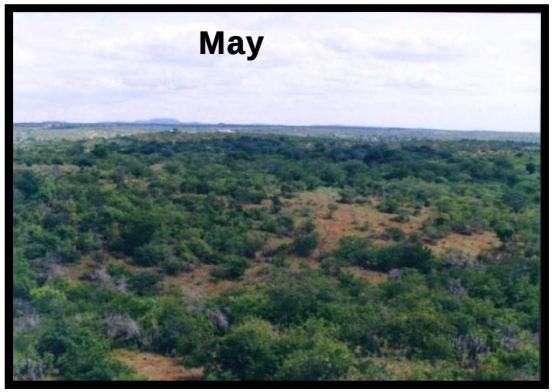
$$NDVI = \frac{\rho_{NIR} - \rho_R}{\rho_{NIR} + \rho_R}$$

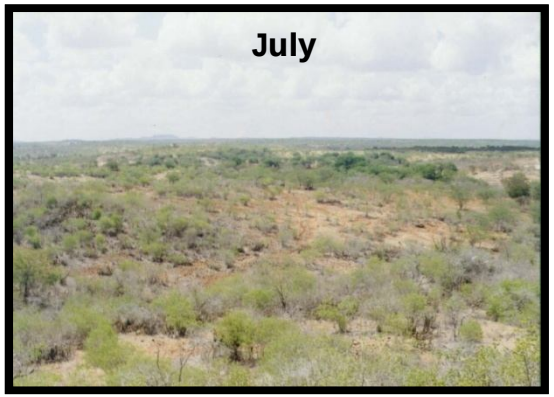


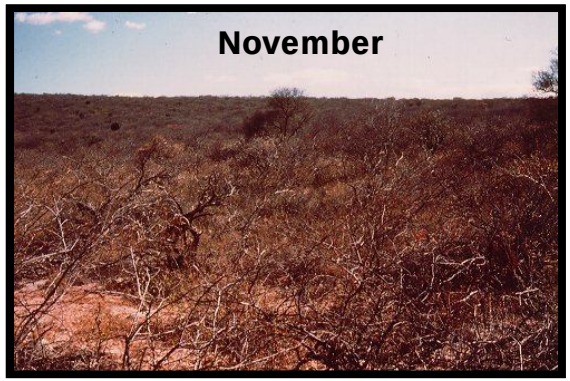
Case Study 2: Drought in Northeast Brazil



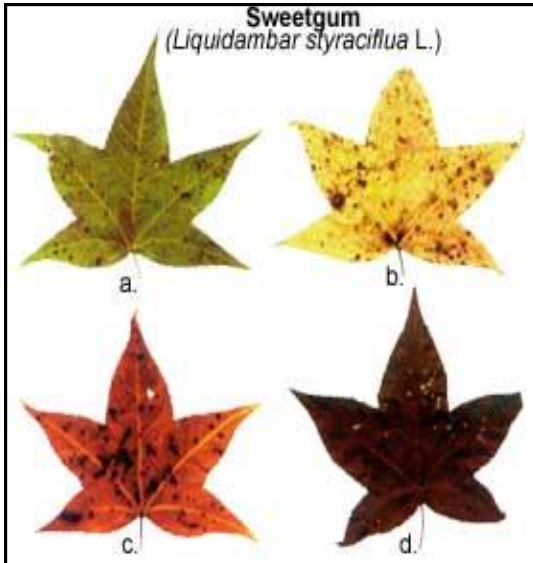


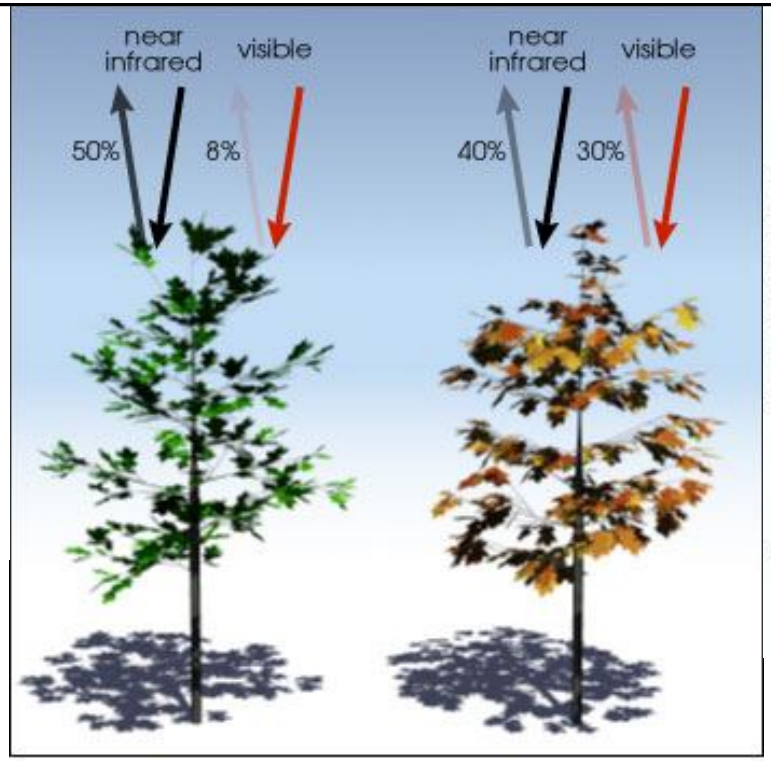


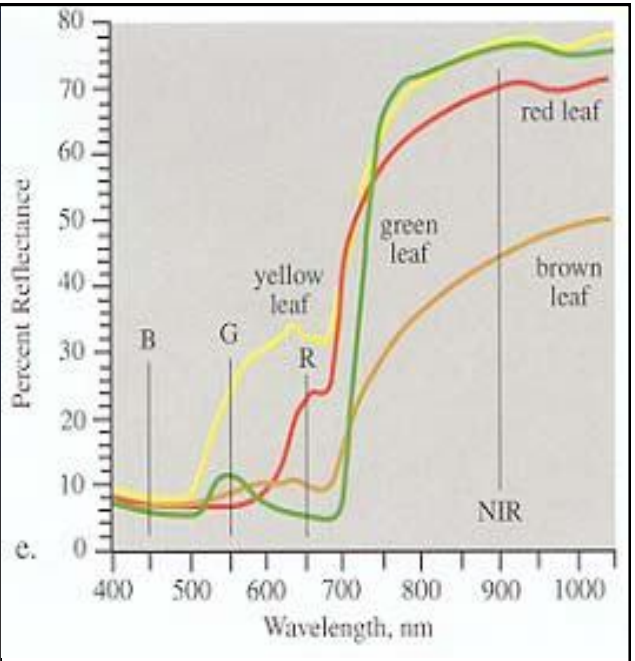




Seasonality of Bioma Caatinga – Northeast region of Brazil







high NDVI

$$\frac{(0.50 - 0.08)}{(0.50 + 0.08)} = 0.72$$

$$\frac{(0.4 - 0.30)}{(0.4 + 0.30)} = 0.14$$

low NDVI

$$NDVI = \frac{\rho_{NIR} - \rho_R}{\rho_{NIR} + \rho_R}$$

Summary

- **Latin American and Caribbean Flood and Drought Monitor developed as a framework for disseminating hydrological data and drought/flood monitoring/forecasting …**
- **… in support of research, assessment and decision making**
- **Initial evaluations indicate reasonable performance (global datasets, un-calibrated, very little local information/knowledge)**
- **Potential to improve estimates via data assimilation, calibration and knowledge exchange**
- **System is accessible at http://www.lapismet.com for data access.**

Questions

Q1) What types of drought/flood tools or research has your institution funded, and how has that helped achieve your priorities.

Q2) What do you think are the great gaps in your priorities that drought/flood "science and tools" could help close?

Q3) What strategies are there to enhance the drought/flood science - governance linkages?

Reply them to barbosa33@gmail.com

Thank you for your attention!
Obrigado por sua atenção!
Gracias por su atención!

LAPIS

LABORATÓRIO DE ANÁLISE E PROCESSAMENTO DE IMAGENS DE SATÉLITES

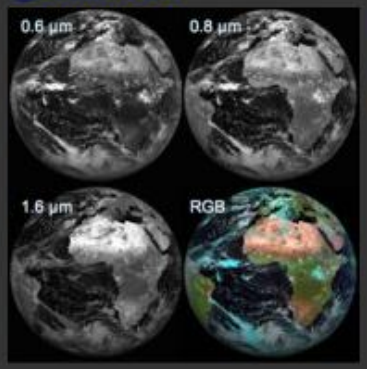
Objetivos Projetos Contatos

Menu Principal
- Home
- Equipe
- Pesquisas
- Publicações
- Softwares
- Contatos

Produtos
- Estação de Recepção

Links

EUMETSAT

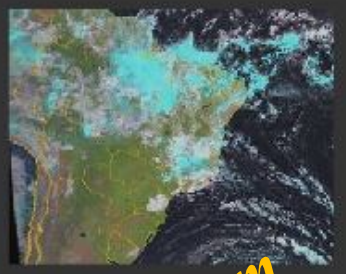


Lapis

Qui, 24 de Setembro de 2009 11:08

O **L**aboratório de **A**nálise e **P**rocessamento de **I**magens de **S**atélites (LAPIS) da Universidade Federal de Alagoas (UFAL) realiza atividades de pesquisa, assistência tecnológica e treinamento de recursos humanos para a recepção, processamento, interpretação e integração de imagens dos satélites da série METEOSAT. Para atender a essa demanda, em 2007 a UFAL instalou e operacionalizou a terceira estação de recepção de imagens do satélite METEOSAT Segunda Geração (MSG) do Brasil. Como atividades de pesquisa e transferência de conhecimento, a equipe do LAPIS elabora aplicativos para tratamento de imagens, disponibiliza produtos meteorológicos e ambientais derivados do MSG para setores operacionais e oferece treinamento na área. Desenvolvidas inteiramente com ferramentas open-source e freeware.

Eventos
- 2006
- 2007
- 2008
- 2009



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