



MINISTÉRIO DA CIÊNCIA E TECNOLOGIA  
**INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS**

# INPE plan 2020: an overview as of May 2009

**João Vianeí Soares**

**Earth Observations branch**

**National Institute for Space Research  
(INPE)**

**Brazil**

**One world, one dream...**



**Free Earth Observation data for all!**



# A vision for the future

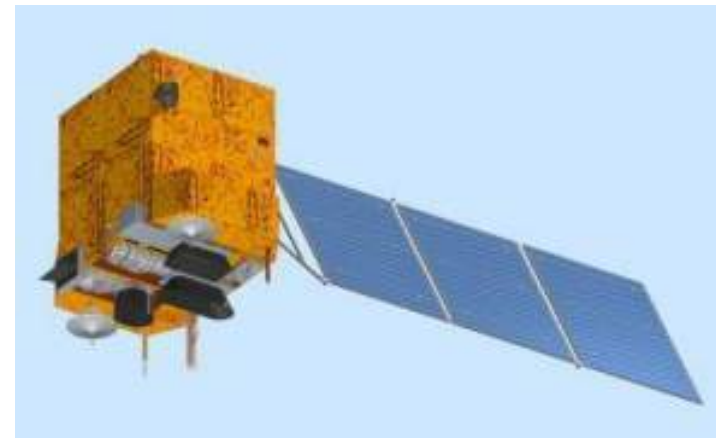
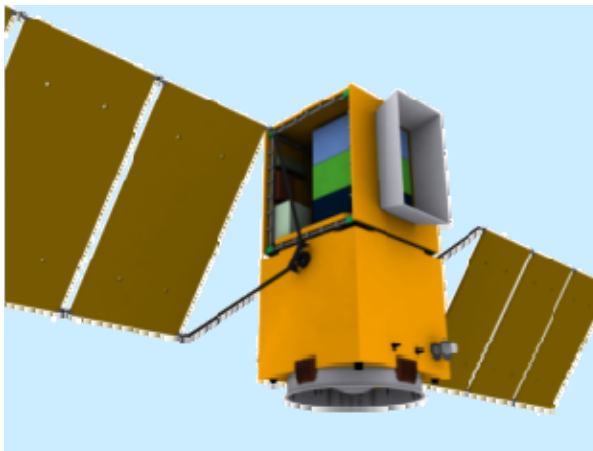
A constellation of satellites will provide free global land imaging for all countries on Earth (CEOS)



CBERS is a member of the CEOS land imaging constellation

# INPE's space technology agenda

“Global EO” – Brazil as global player in earth observation

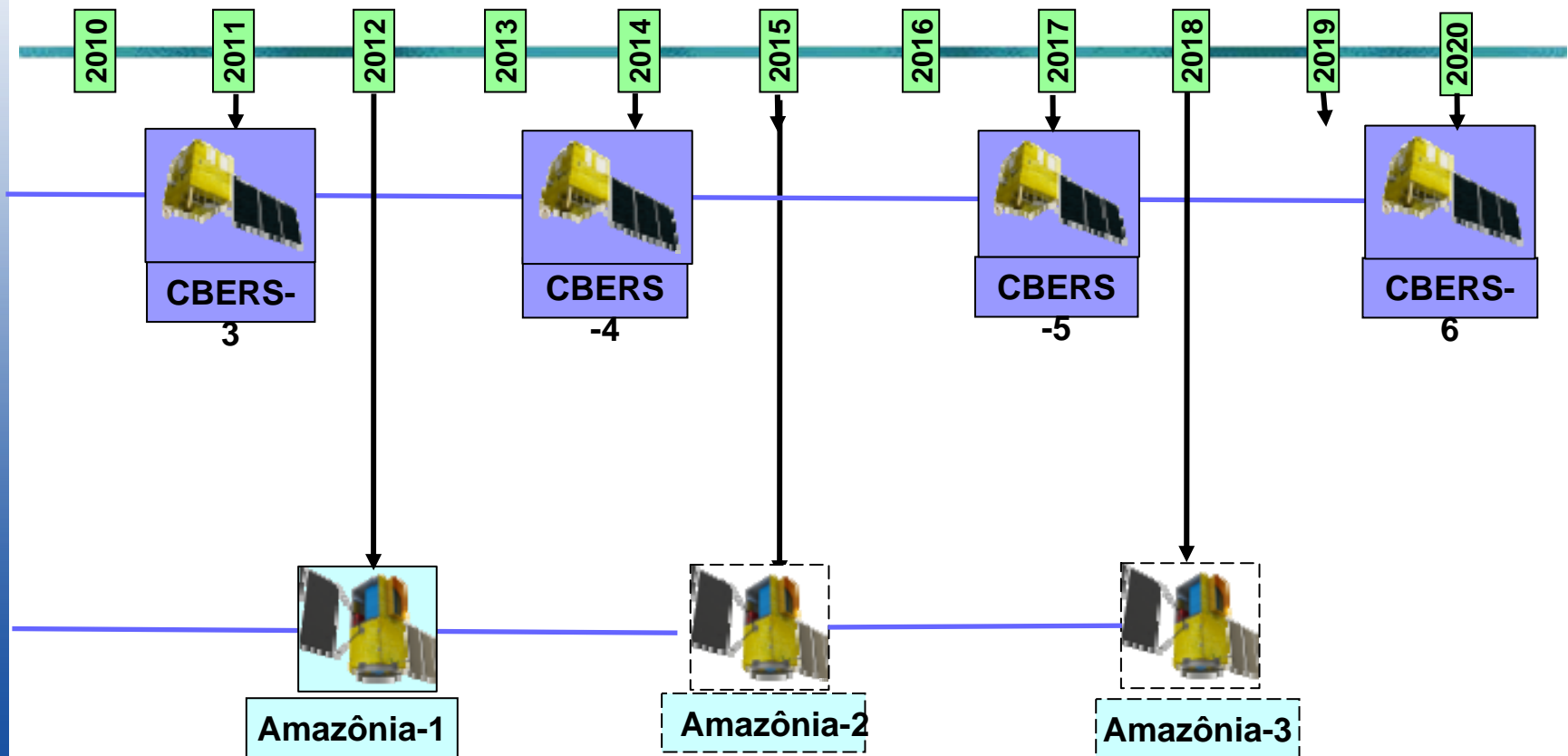




# INPE's Remote Sensing Satellites: 2010-2020

CBERS: China Brazil Earth Resources  
Satellite

Amazônia-1: 100% Brazilian







# CBERS:satellites for the public



***CBERS-2B Launch (19 September 2007)***



# What is a public good



## Non-rival

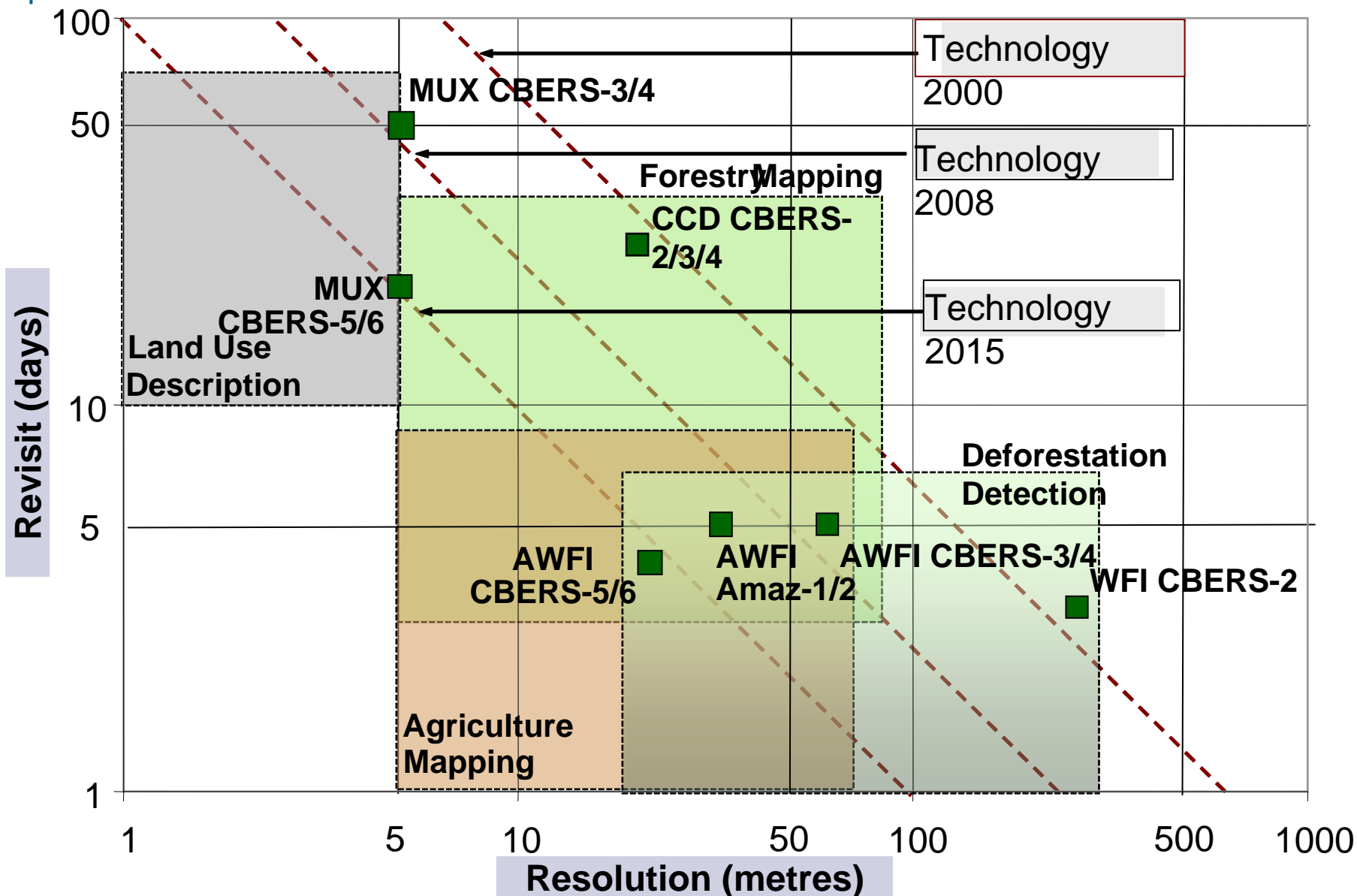
*...[goods] which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good... (Samuelson)*

## Non-excludable

*it is impossible to exclude any individuals from consuming the good*



# Satellites for Forestry and Agriculture







# CBERS platform



	<b>CBERS 1, 2, 2B</b>	<b>CBERS 3, 4</b>
Mass	1450 kg	1980 kg
Electrical Power	1100 W	2300 W
Payload Bit Rate	166 Mbps	303 Mbps
Lifetime	2 years	3 years



# CBERS Orbit

SSO Polar, 778 km height,  $98^{\circ}$  inclination, 100 min period,

Equator crossing at 10h30 AM



Track distance of 107 km, revisit time of 26 days



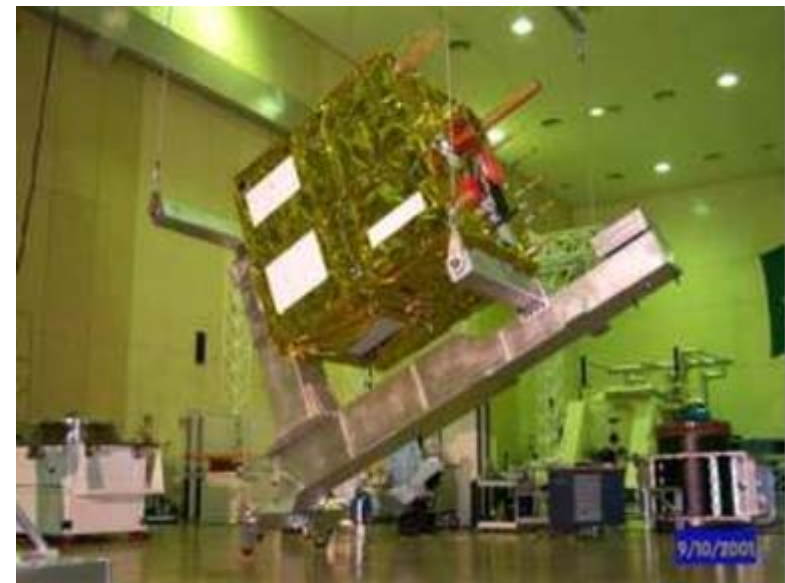
# CBERS-1, 2, 2B work share (70% China, 30% Braz

## Service Module

Structure	Brasil
Thermal Control	China
Attitude and Orbit Control	China
Power supply	Brasil
On-board computer	China
Telemetry	Brasil

## Payload Module

CCD	China
IRMSS	China
WFI	Brasil
Data Transmission	China
Data collection	Brasil







# CBERS-2 being put into Long March-4B





# CBERS-2 prepared for launch (2003)







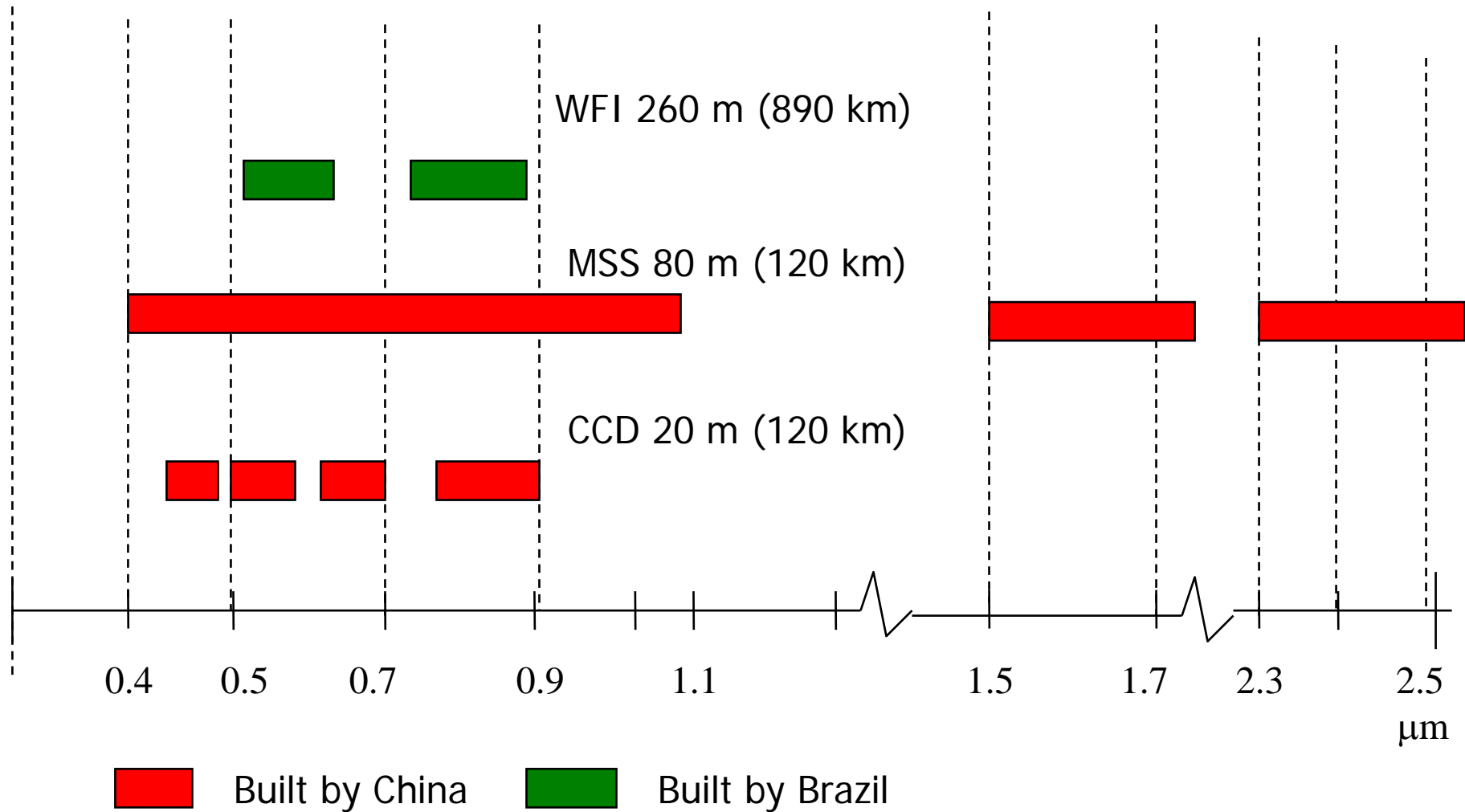
# CBERS-2



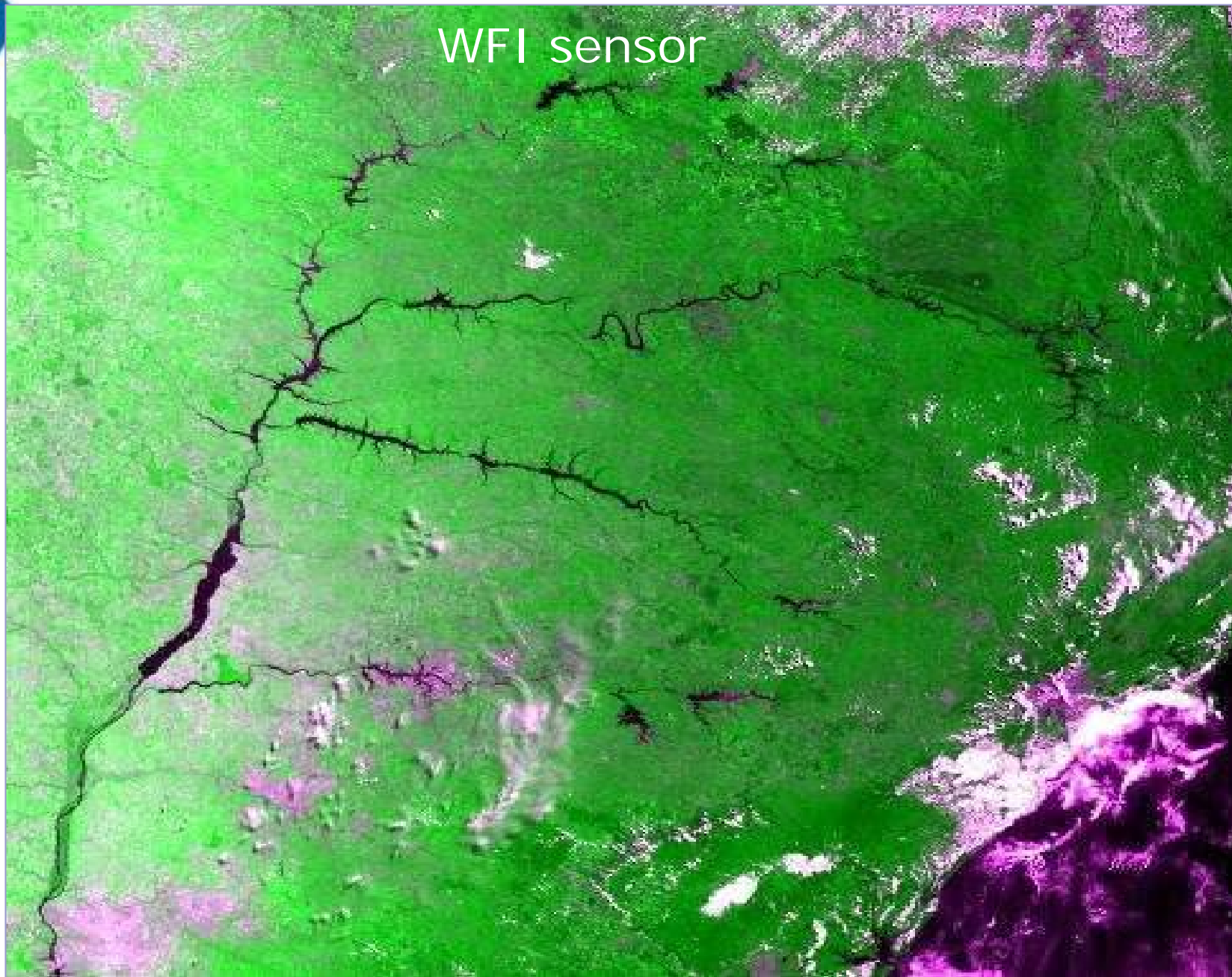
**CBERS-2 Launch (21 October 2003)**



# CBERS 1,2 Sensor Configuration



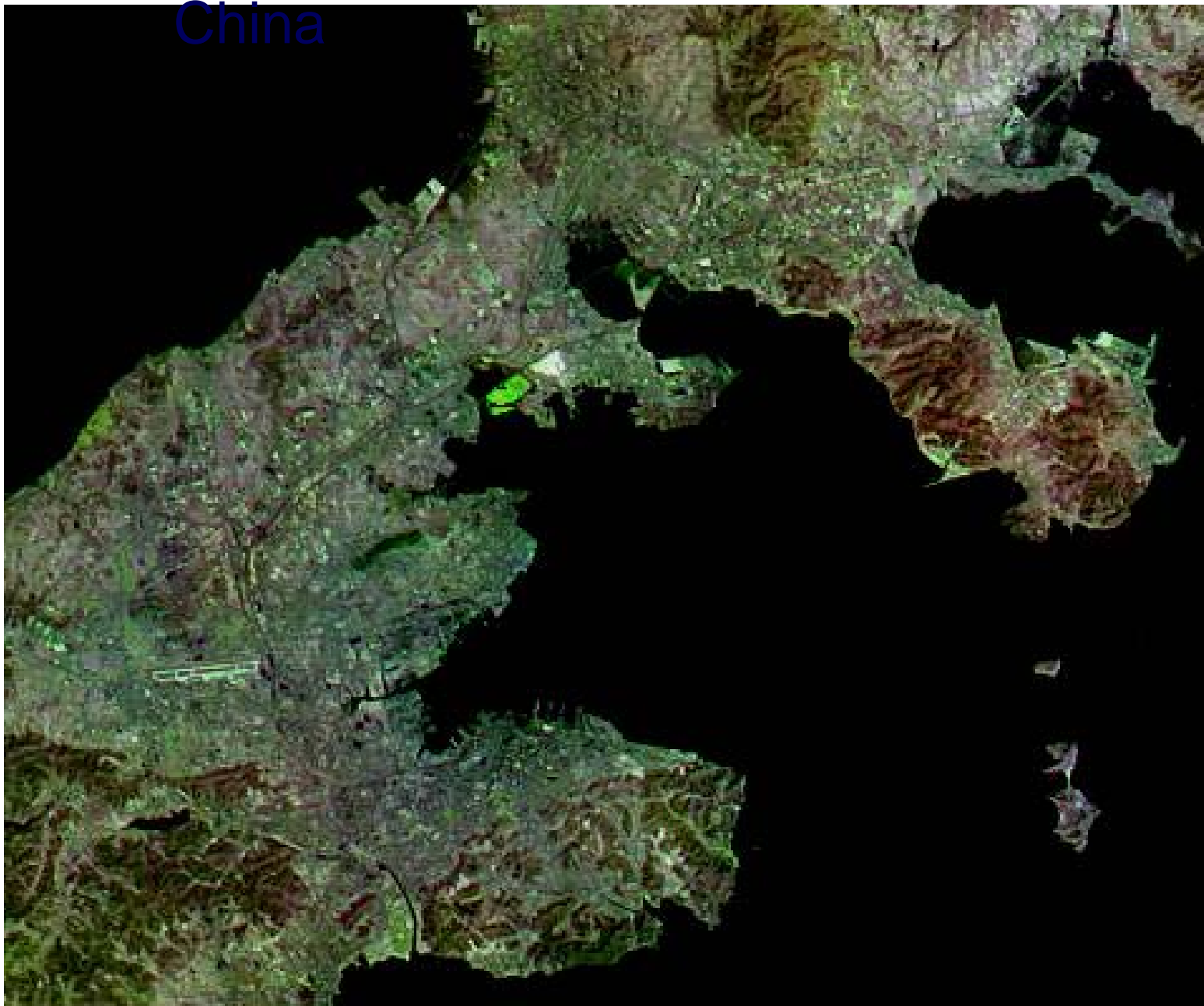
WFI sensor



CBERS2-WFI – 157/124, 18/01/2004, São



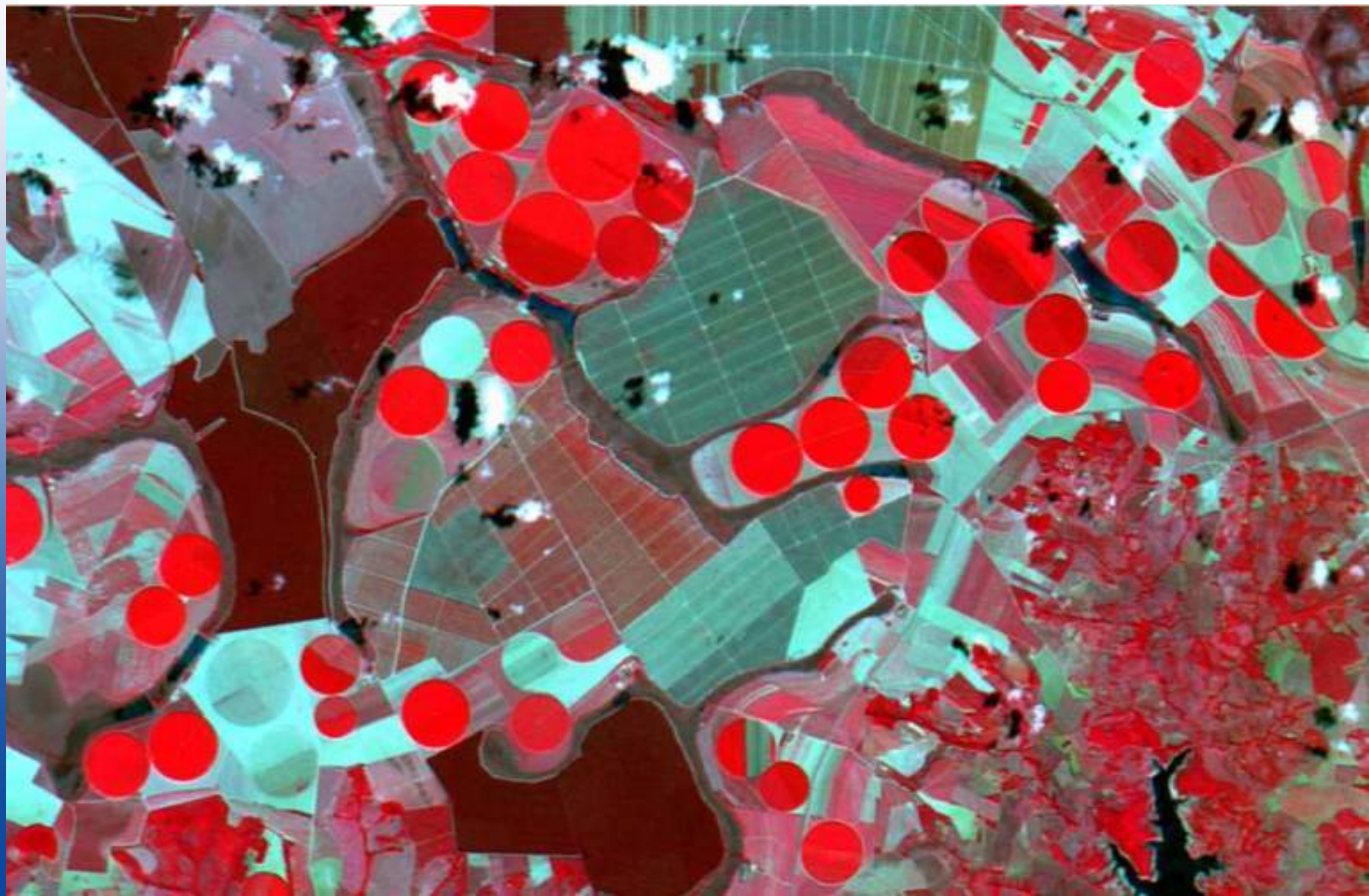
# CBERS-1 IRMSS DaLian Bay , China







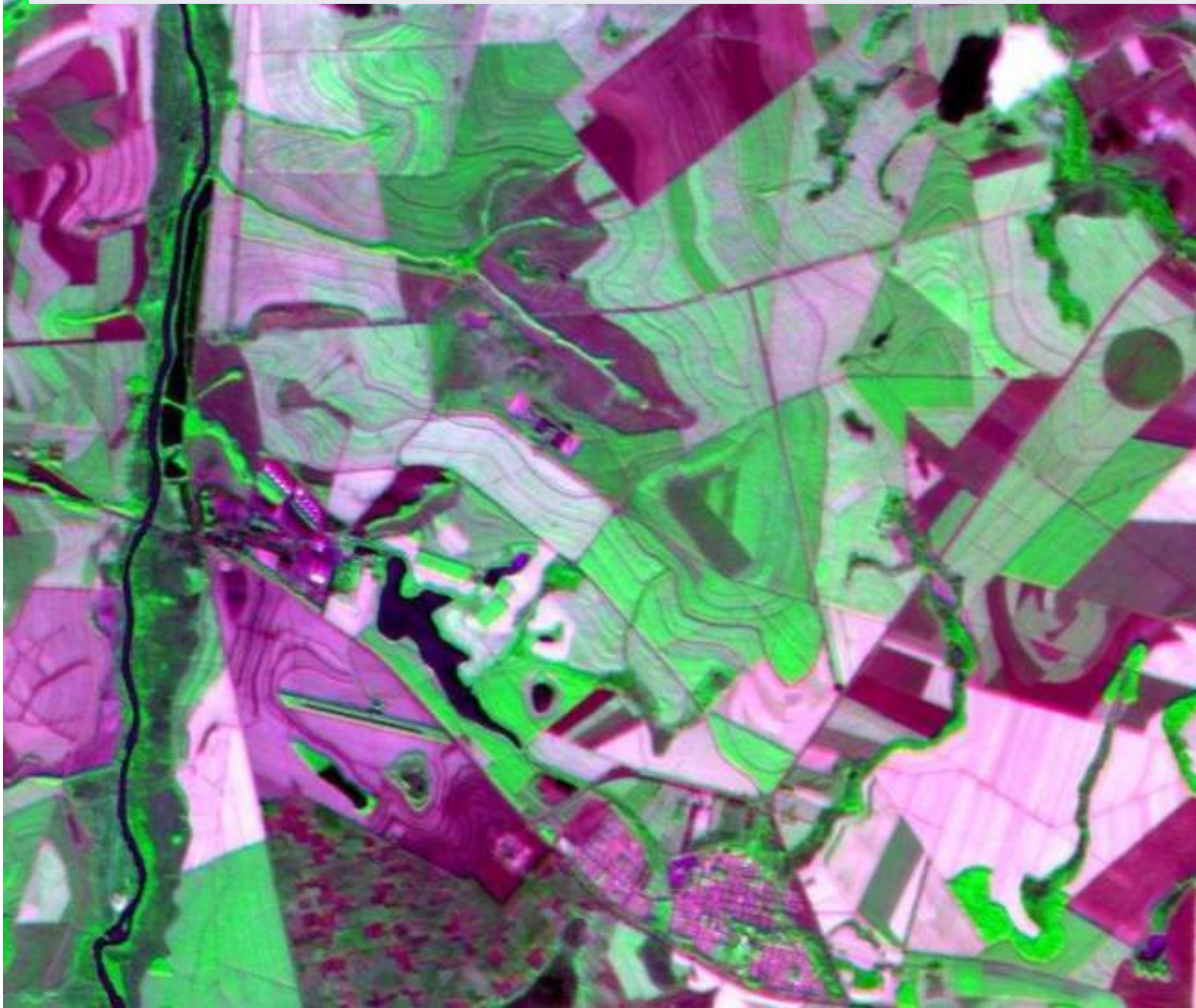
# CBERS-2 CCD, Minas Gerais, Brazil







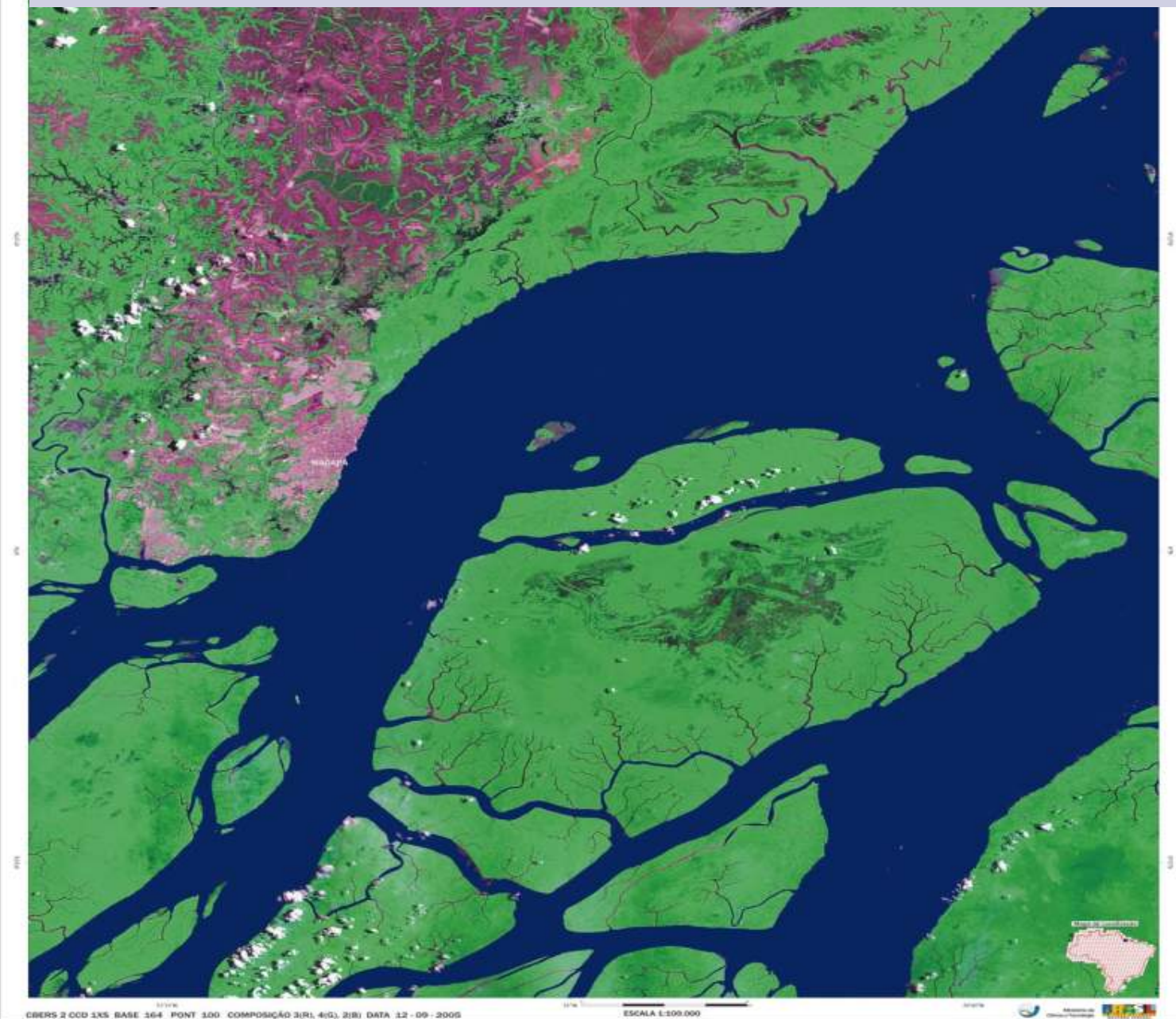
# CBERS-2 CCD, Pradópolis, Brazil, Nov 200



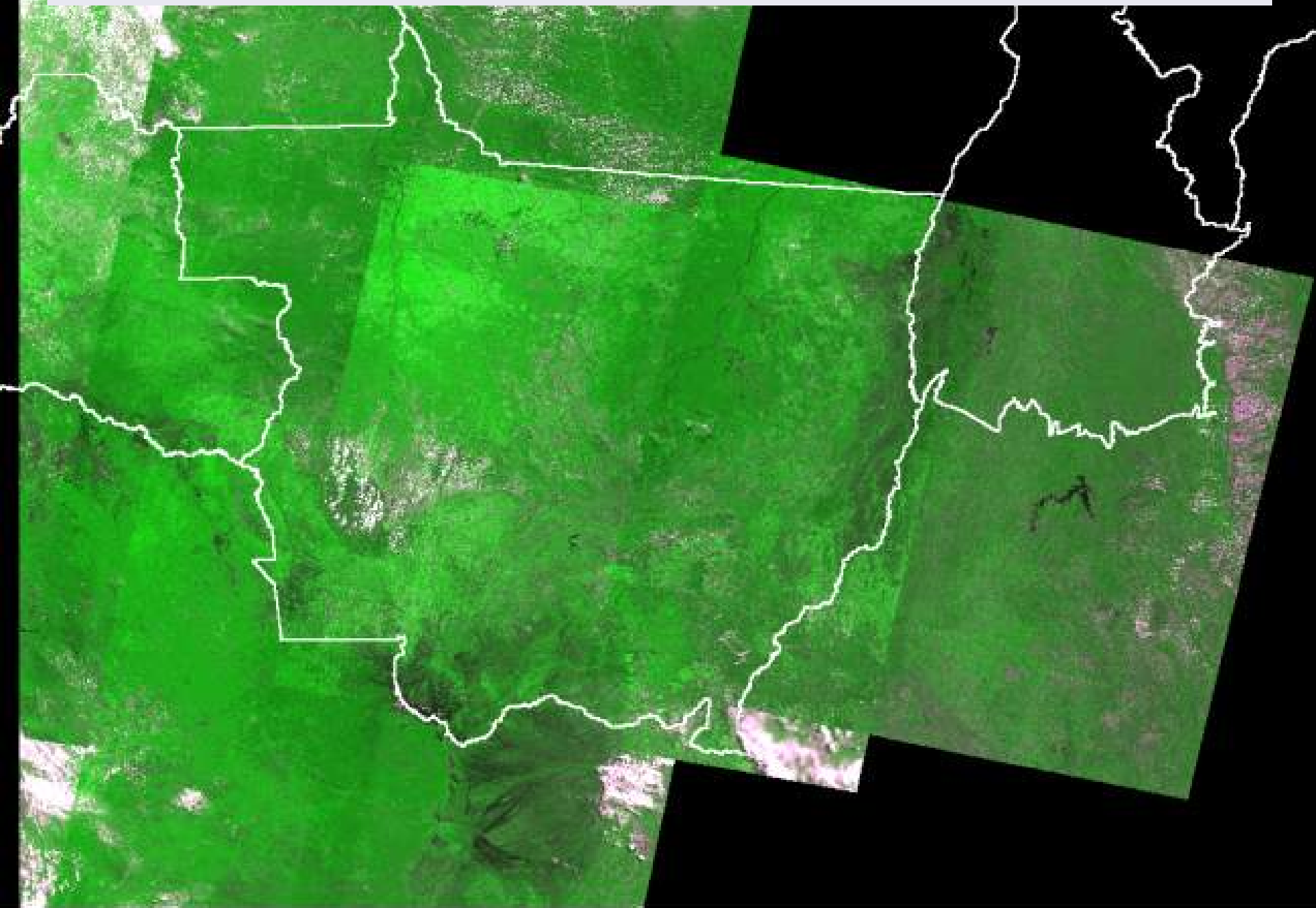




# CBERS-2 CCD, Macapá, Brazil



# CBERS-2 WFI mosaic of Mato Grosso state, 2





# Forest type map based on CBERS-1 CCD data (LinZhi area)

林芝地区森林类型  
分布图是用 CBERS-  
1/CCD数据图像经计算  
机自动分类制图而成。







# Integration of CBERS-2B in INPE (2006-2007)



**Assembly of CBERS-2B Cameras**



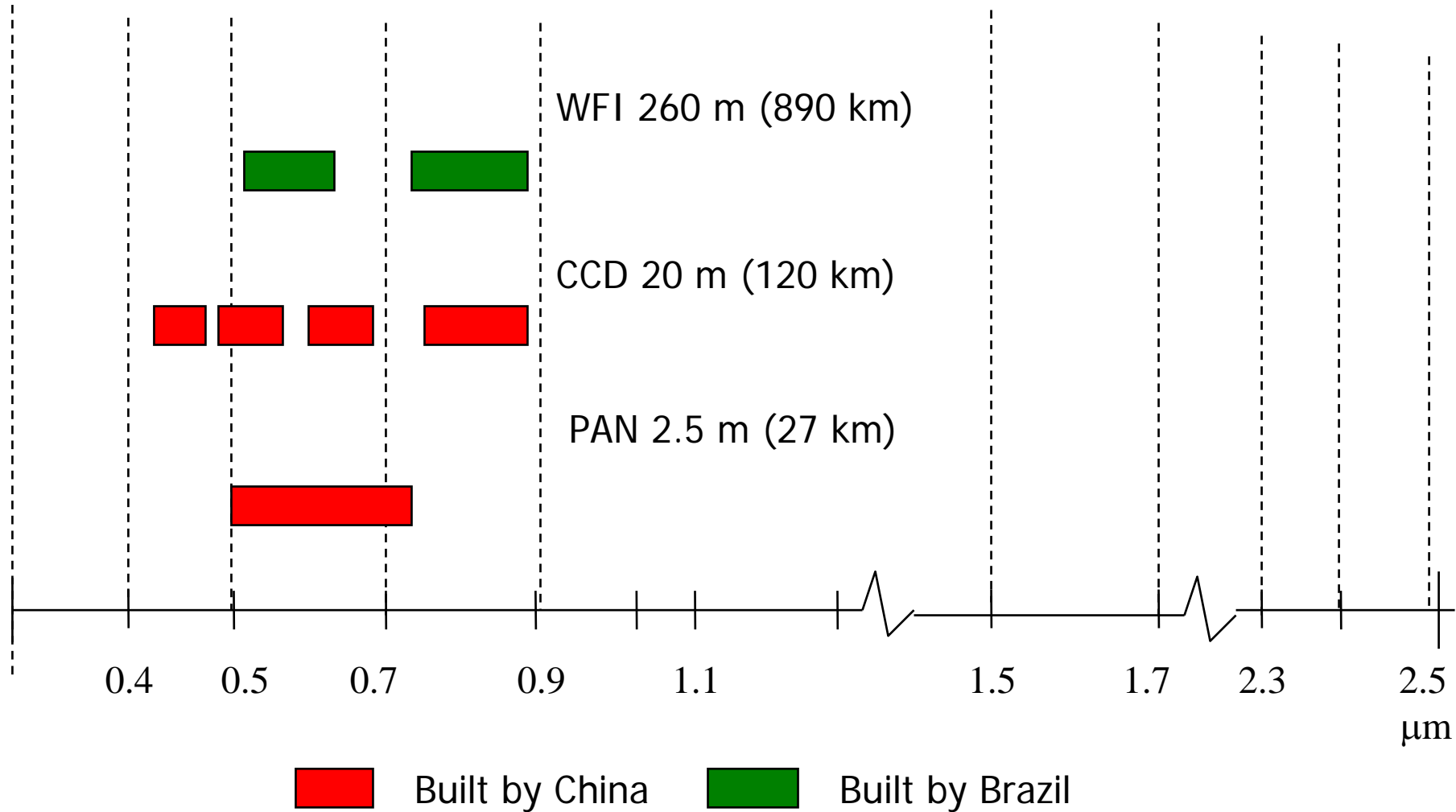


# CBERS-2B Sensor Configuration

Sensor	Bands ( $\mu\text{m}$ )	Swath (km)	Resolution (m)
PAN	<b>0.51-0.73</b>	27	2.5
CCD	<b>0.45-0.52</b>	120	20
	<b>0.52–0.59</b>	120	20
	<b>0.63–0.69</b>	120	20
	<b>0.77–0.89</b>	120	20
	<b>0.51-0.73</b>	120	20
WFI	<b>0.63–0.69</b>	890	260
	<b>0.77–0.89</b>	890	260



# CBERS-2B Sensor Configuration



# CBERS-2B



**CBERS-2B Launch (19 September 2007)**

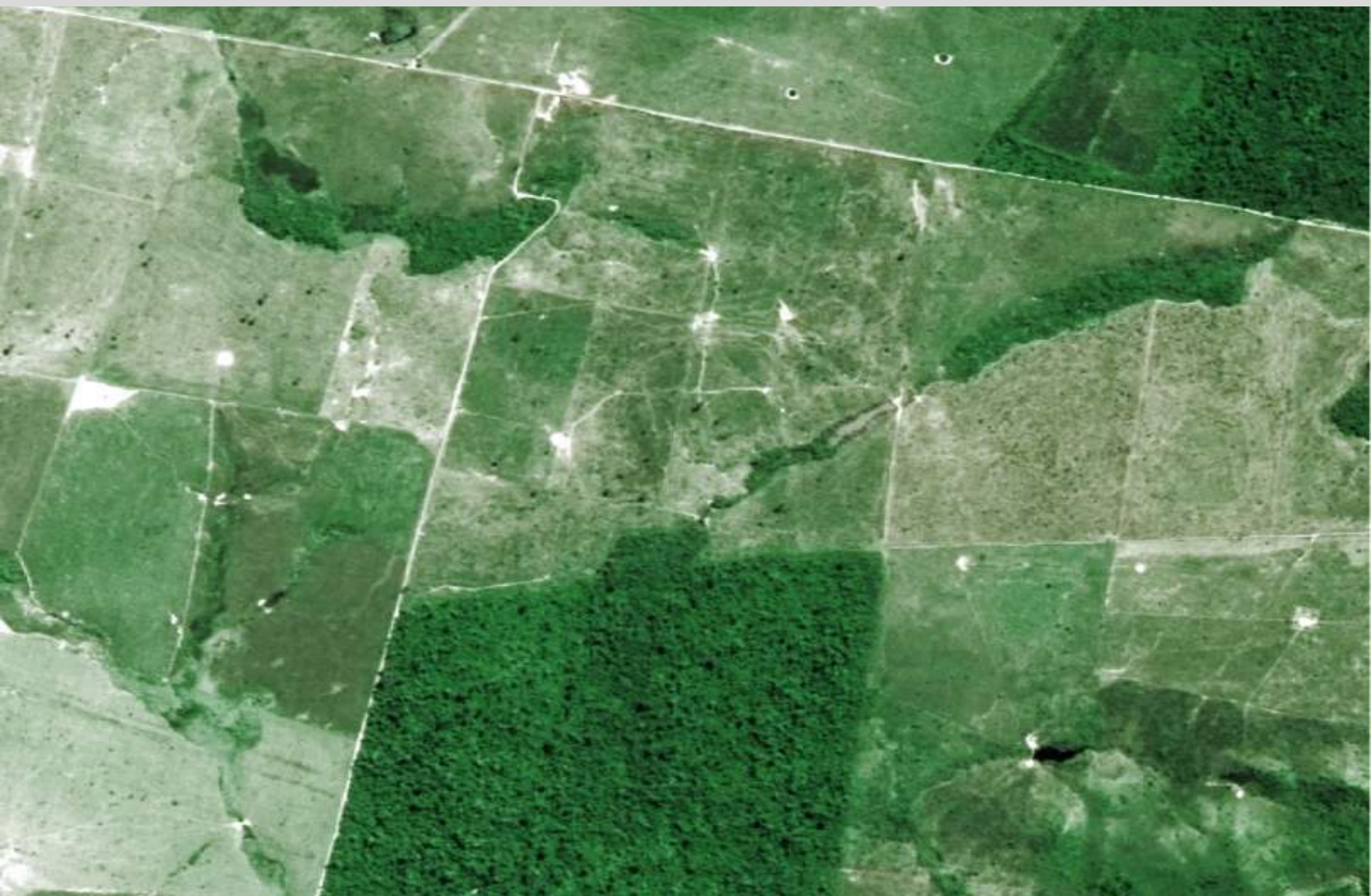


CBERS-2B HRC (PAN - 2,7 m) + CCD (multispectral, 20 m)  
Guarulhos Airport, Sao Paulo, March 2008



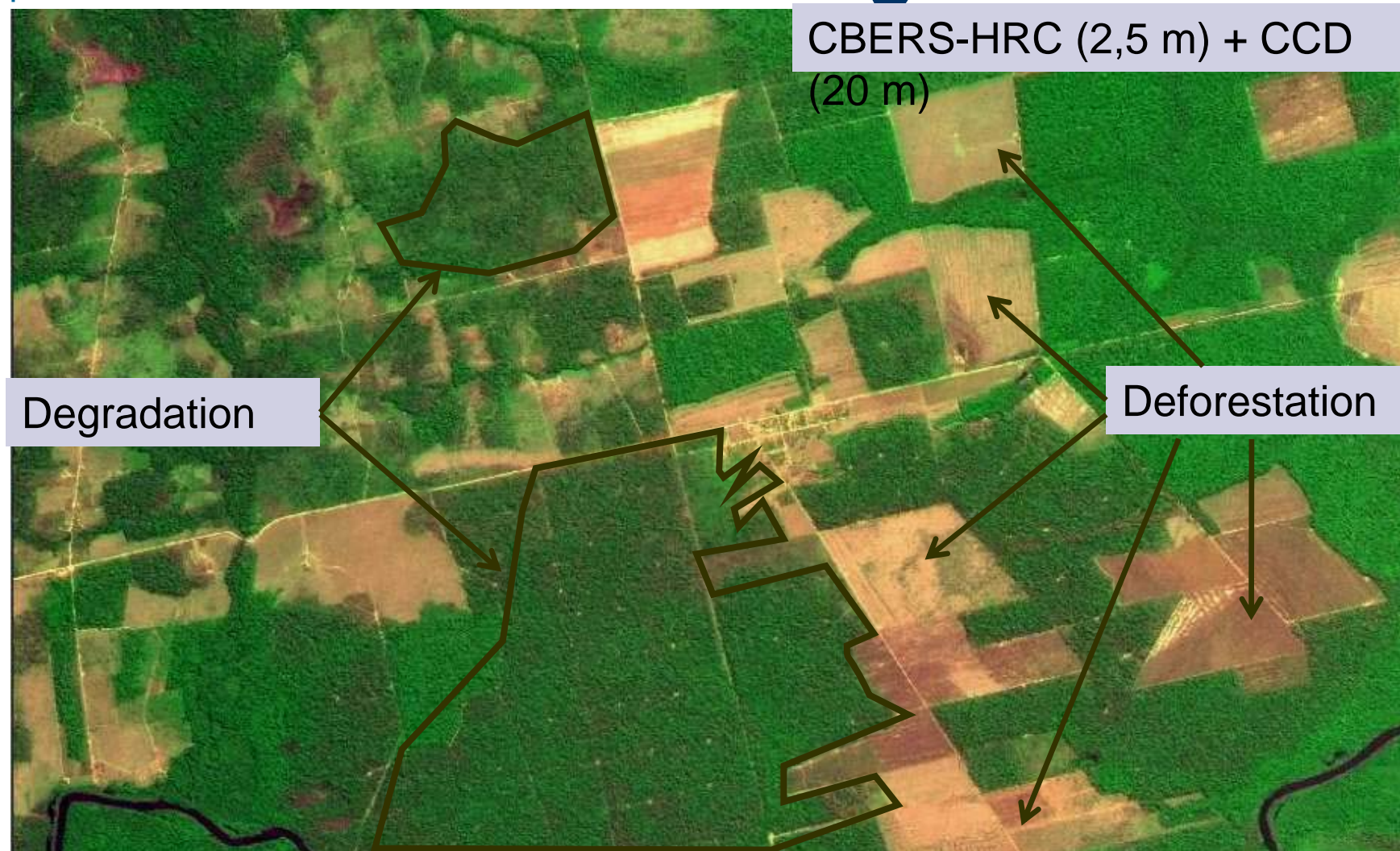


CBERS-2B HRC (PAN - 2,7 m) + CCD (multispectral, 20 m)  
São Felix do Xingu, Pará, June 2008





# CBERS-2B – Forest Degradation



CBERS-2B HRC allows better detection of forest degradation  
(region of Marcelandia, Mato Grosso, Brazil)

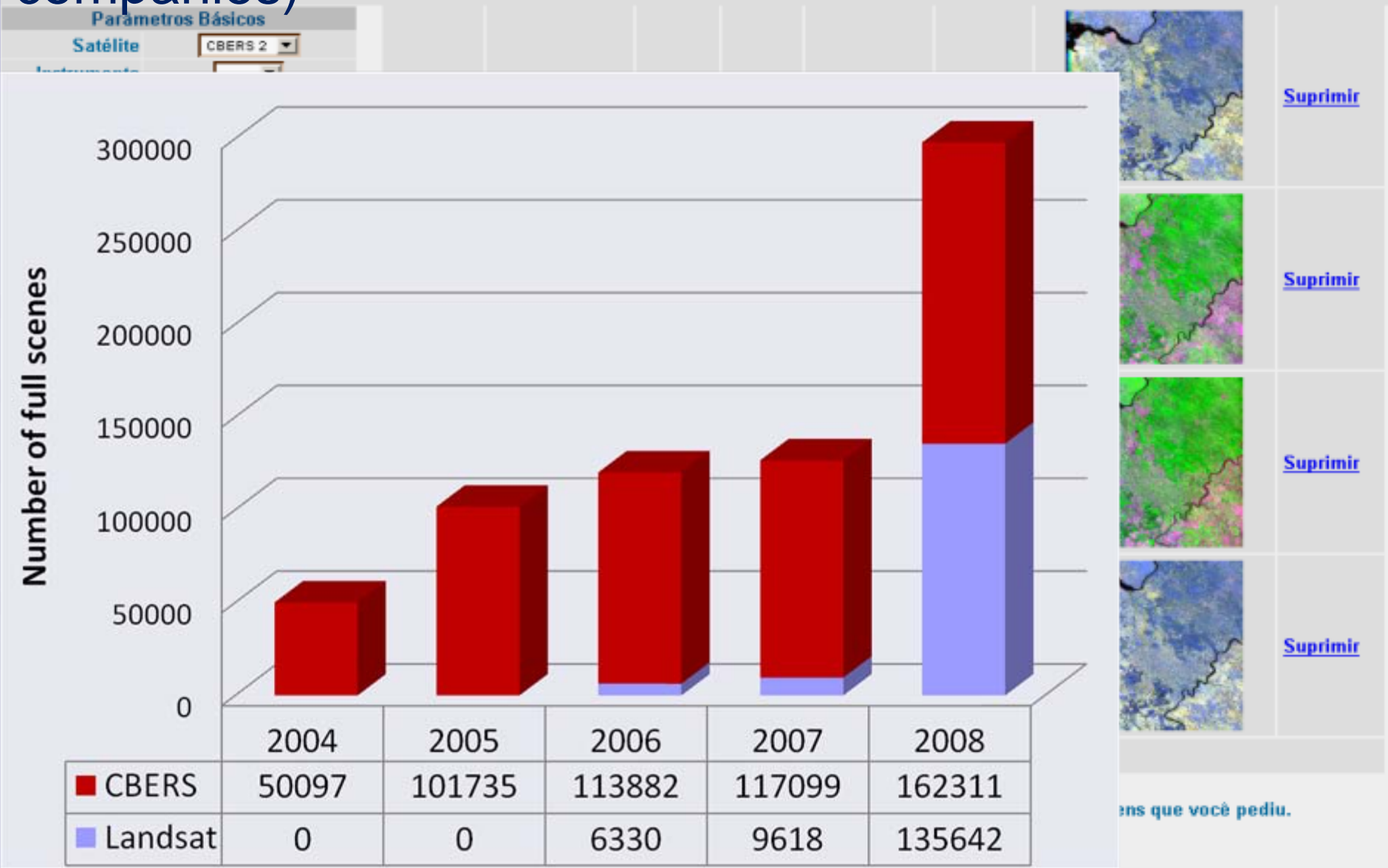




**CBERS-2B  
image of  
Beichuan  
County after  
earthquake on  
1 June 2008**



# Image Distribution: CBERS and LANDSAT (2004-2008) 16,000 User institutions (51% are private companies)





# CBERS Image Catalogue (Internet): access to all data

**INPE Catálogo de Imagens** [Cadastro](#) [Log In](#) [Carrinho](#) [Ajuda](#)

**Parâmetros Básicos**

Satélite: **CBERS 2**

Instrumento:

Intervalo de Tempo: ☐ Sazonal

De: **05 / 1999**

Até: **05 / 2004**

Cobertura de Nuvens Máxima: **Q2** **Q4**

Quick Look: ☒ Pequeno ☐ Grande

Município: **o paulo** Estado:

Executar

Órbita: **Até** **De** **Até**

Executar

Por Região: **Norte** **10.**












**Sul** **40.**

Executar

Interface Gráfica: **Lat** **28.021** **Lon** **-54.936**

Navegar

Página 1

CB2CCD 162/131-2004-04-16	CB2IRM 162/131-2004-04-16	CB2CCD 162/131-2004-03-21	CB2IRM 162/131-2004-03-21
			
CB2CCD 162/131-2004-02-24	CB2IRM 162/131-2004-02-24	CB2CCD 162/131-2004-01-29	CB2IRM 162/131-2004-01-29
			
CB2CCD 162/131-2004-01-03	CB2IRM 162/131-2004-01-03	CB2CCD 162/131-2003-11-12	
			



# CBERS Image Catalogue (Internet): go and get it!

Portugues **INPE** Catálogo de Imagens [Cadastro](#) [Log In](#) [Carrinho](#) [Ajuda](#)

**Parâmetros Básicos**

Satélite: CBERS 2  
Instrumento:   
Intervalo de Tempo: ☐ Sazonal  
De: 05 / 1999  
Até: 05 / 2004

**Cobertura de Nuvens Máxima**

Q1:   
Q2:   
Q3:   
Q4:

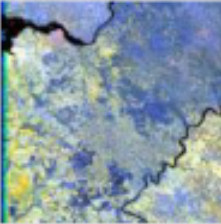
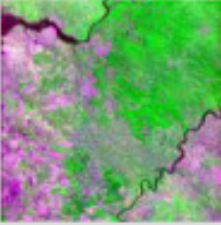


Quick Look: ☒ Pequeno ☐ Grande

Município:   
Estado:   
Executar

**Órbita** **Ponto**  
De:   
Até:   
De:   
Até:   
Executar

**Por Região**  
Norte: 10.   
Oeste: -90.   
Leste: -30.   
Sul: -40.   
Executar

**Interface Gráfica**  
Lat: -28.021   
Lon: -54.936   
Navegar

CB2	IRM	162	131	2004-03-21		<a href="#">Suprimir</a>
CB2	CCD	162	131	2004-03-21		<a href="#">Suprimir</a>
CB2	CCD	162	131	2004-02-24		<a href="#">Suprimir</a>
CB2	IRM	162	131	2004-02-24		<a href="#">Suprimir</a>

[Pedido](#)

Clique no botão Pedido e você receberá uma mensagem com os links para as imagens que você pediu.



# FTP area for User

Index of /catalogo/tmp/epiphanio416 - Netscape

File Edit View Go Bookmarks Tools Window Help

http://www.dpi.inpe.br/catalogo/tmp/epiphanio416/

Search

INPE Intranet - Lista de Ramais INPE Intranet - Lista de Ramais Index of /catalogo/tmp/epiphanio416

## Index of /catalogo/tmp/epiphanio416

Name	Last modified	Size	Description
<a href="#">Parent Directory</a>	25-Mar-2004 15:23	-	
<a href="#">CBERS 2 CCD1XS 20040...&gt;</a>	18-Mar-2004 01:23	17.6M	
<a href="#">CBERS 2 CCD1XS 20040...&gt;</a>	18-Mar-2004 01:23	15.0M	
<a href="#">CBERS 2 CCD1XS 20040...&gt;</a>	18-Mar-2004 01:23	20.3M	
<a href="#">CBERS 2 IRM 20040225...&gt;</a>	18-Mar-2004 01:30	1.5M	
<a href="#">CBERS 2 IRM 20040225...&gt;</a>	18-Mar-2004 01:30	1.6M	
<a href="#">CBERS 2 IRM 20040225...&gt;</a>	18-Mar-2004 01:30	1.5M	
<a href="#">CBERS 2 IRM 20040225...&gt;</a>	18-Mar-2004 01:30	775k	

Apache/1.3.29 Server at www.dpi.inpe.br Port 80

Downloading CBERS\_2\_CCD1XS\_20040225\_153\_104\_BAND3.tif.zip

You have chosen to download a file of type: "WinZip File" [application/zip] from  
http://www.dpi.inpe.br/catalogo/tmp/epiphanio416/

What should Netscape do with this file?

☐ Open using WinZip

☒ Save this file to disk

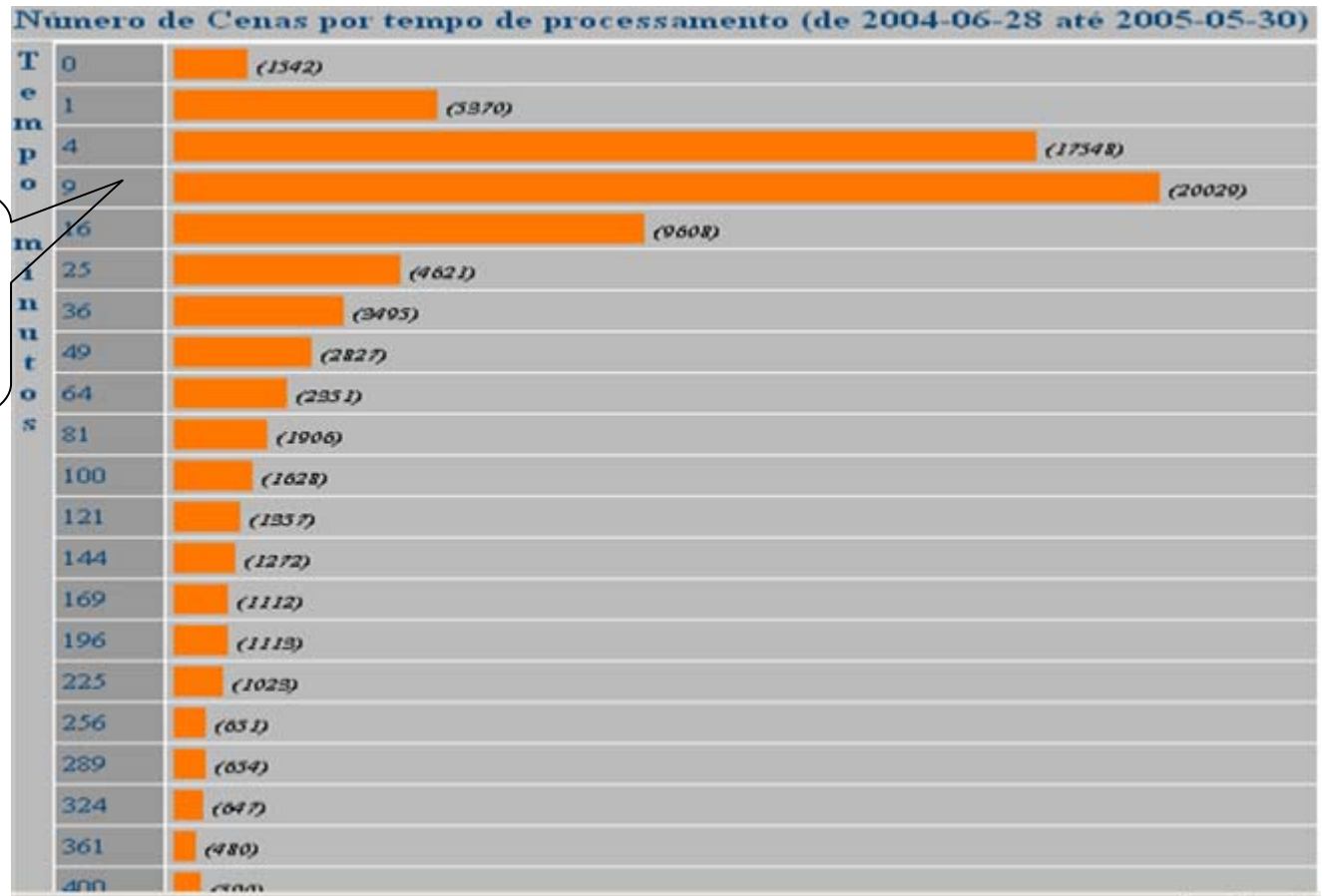
☒ Always ask before opening this type of file

Advanced... OK Cancel

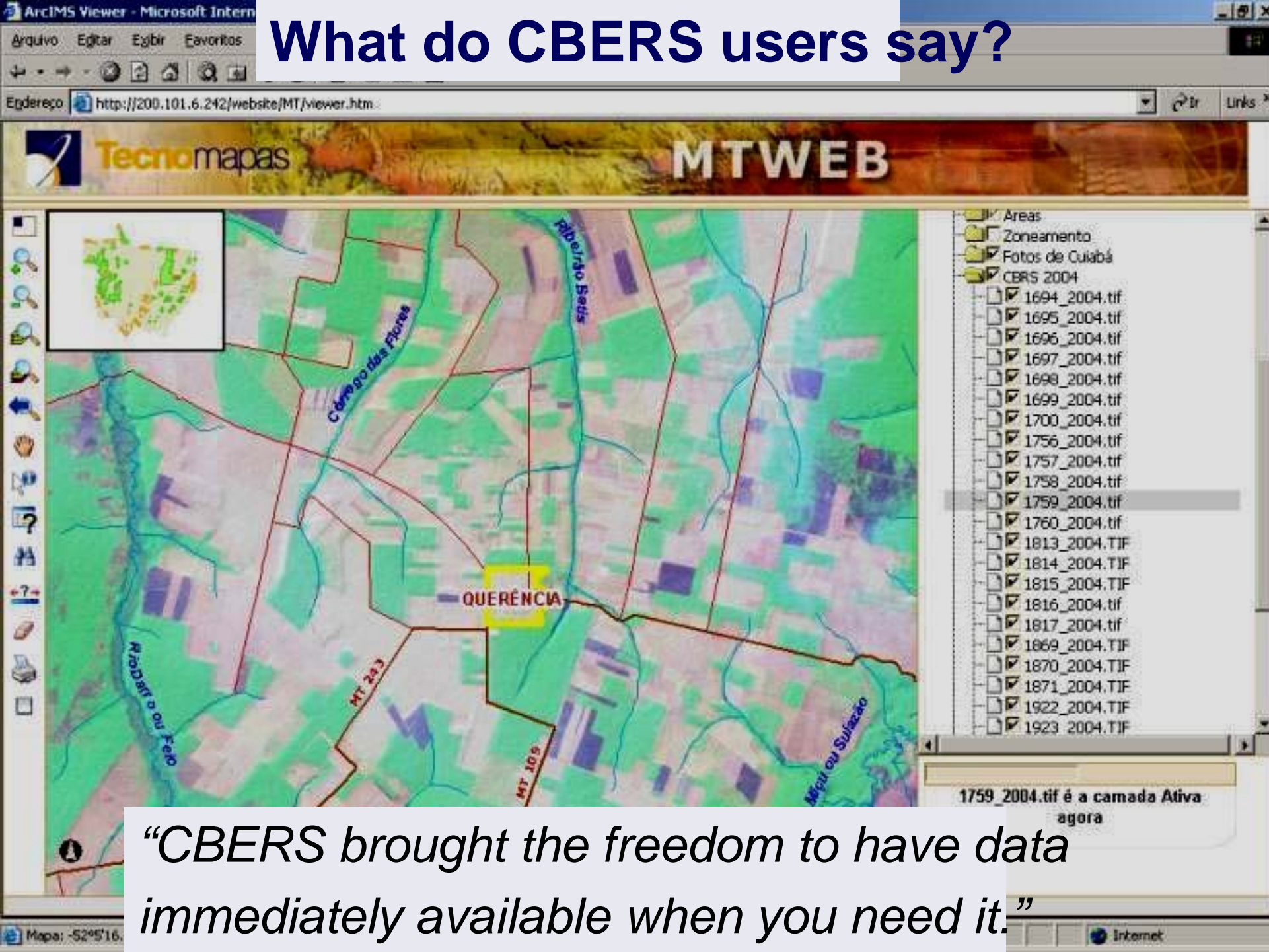


# Time to respond to a user request

Median time  
9 minutes



# What do CBERS users say?



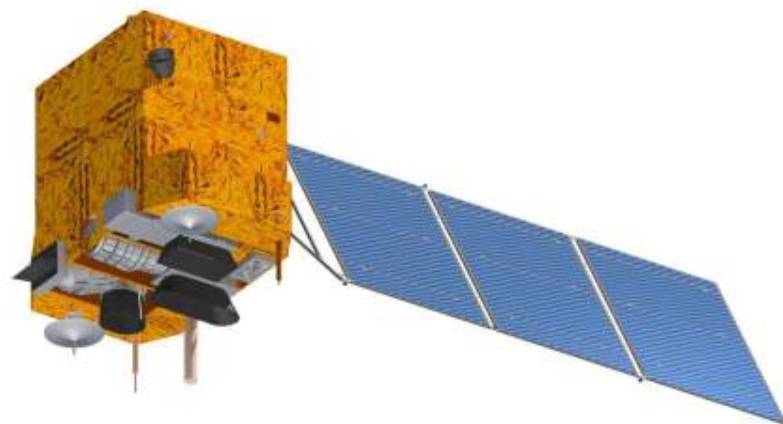
*“CBERS brought the freedom to have data immediately available when you need it.”*



# What do the private companies say about free CBERS data?

- Enables new business development
- Facilitates trial uses for new clients
- Planning new applications becomes easier
- Creates jobs by reducing cost of data buys
- Increases quality by adding data previously unavailable

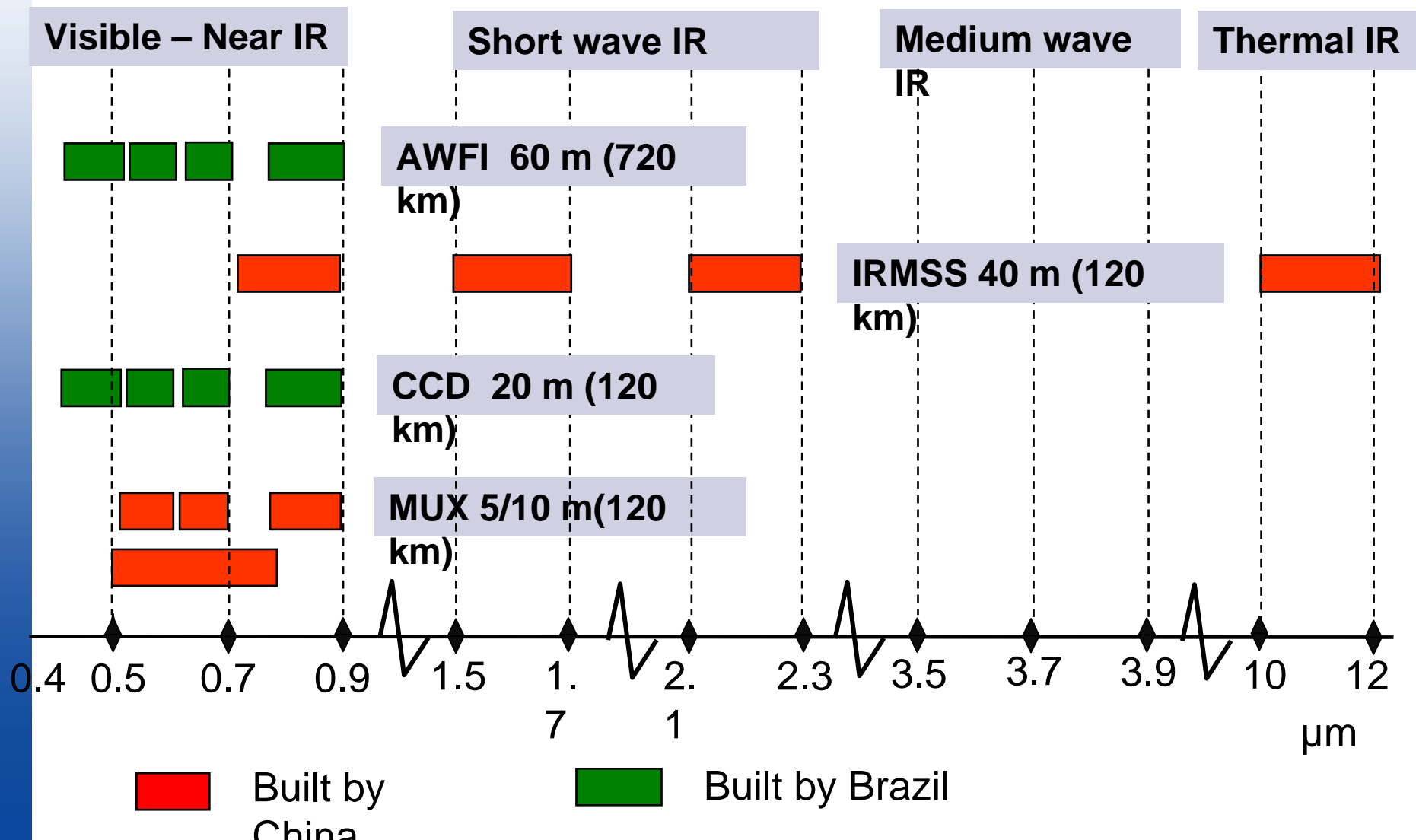
# CBERS-3,4



A new generation of CBERS satellite: better instruments, longer lifetime



# CBERS 3 – 4 Sensors







## CBERS-3,4 Sensor Configuration: PANMUX, CCD

Sensor	Bands ( $\mu\text{m}$ )	Swath (km)	Resolution (m)
PAN	<b>0.51 – 0.85</b>	60	5
MUX	<b>0.52 – 0.59</b>	60	10
	<b>0.63 – 0.69</b>	60	10
	<b>0.77 – 0.89</b>	60	10
CCD	<b>0.45 – 0.52</b>	120	20
	<b>0.52 – 0.59</b>	120	20
	<b>0.63 – 0.69</b>	120	20
	<b>0.77 – 0.89</b>	120	20

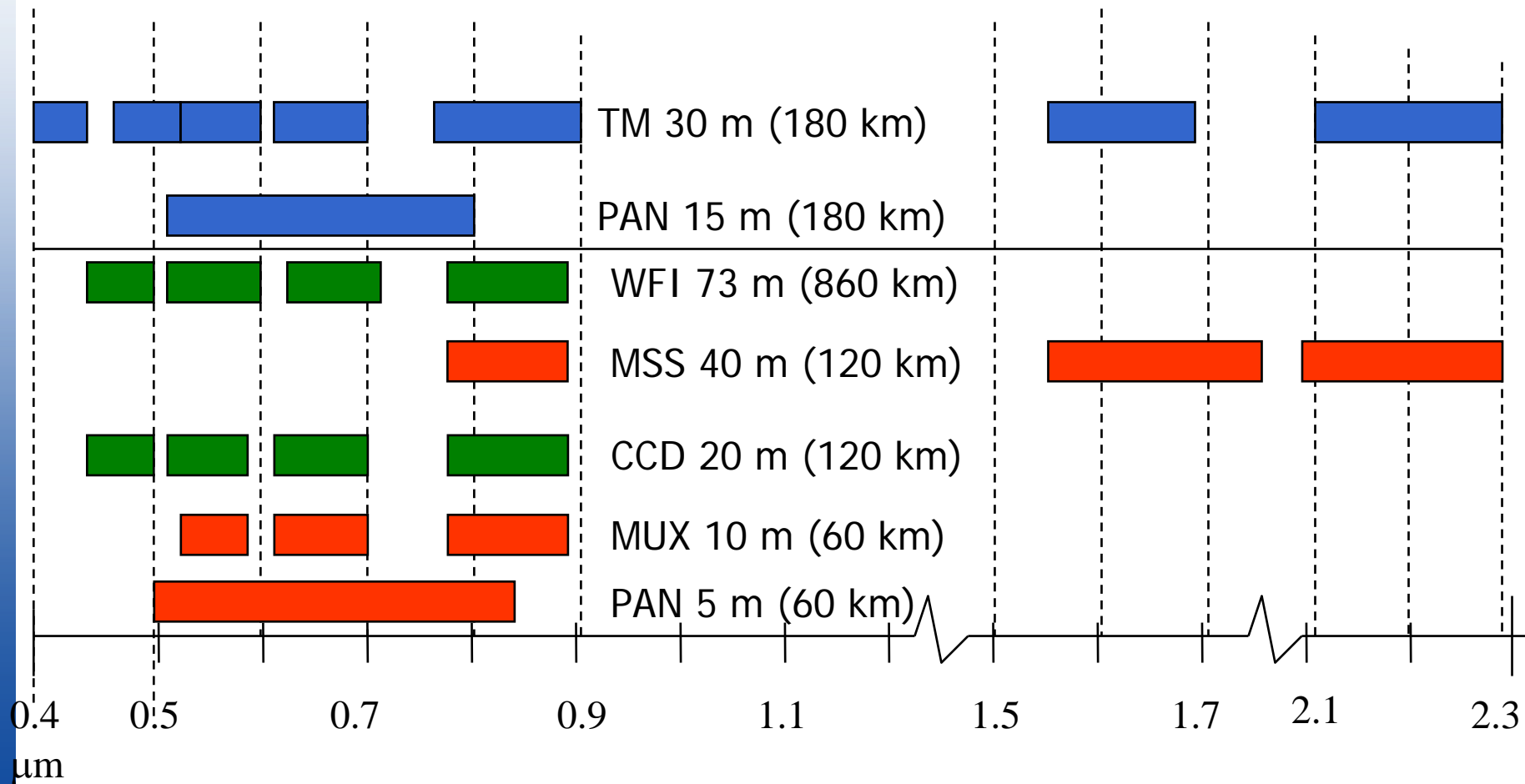


# CBERS-3,4 Sensor Configuration: IRMSS, AWFI

Sensor	Bands ( $\mu\text{m}$ )	Swath (km)	Resolution (m)
IRMSS	<b>0.76 – 1.10</b>	120	40
	<b>1.55 – 1.75</b>	120	40
	<b>2.08 – 2.35</b>	120	40
	<b>10.4 – 12.5</b>	120	80
AWFI (10 bits)	<b>0.45 – 0.52</b>	840	70
	<b>0.52 – 0.59</b>	840	70
	<b>0.63 – 0.69</b>	840	70
	<b>0.77 – 0.89</b>	840	70



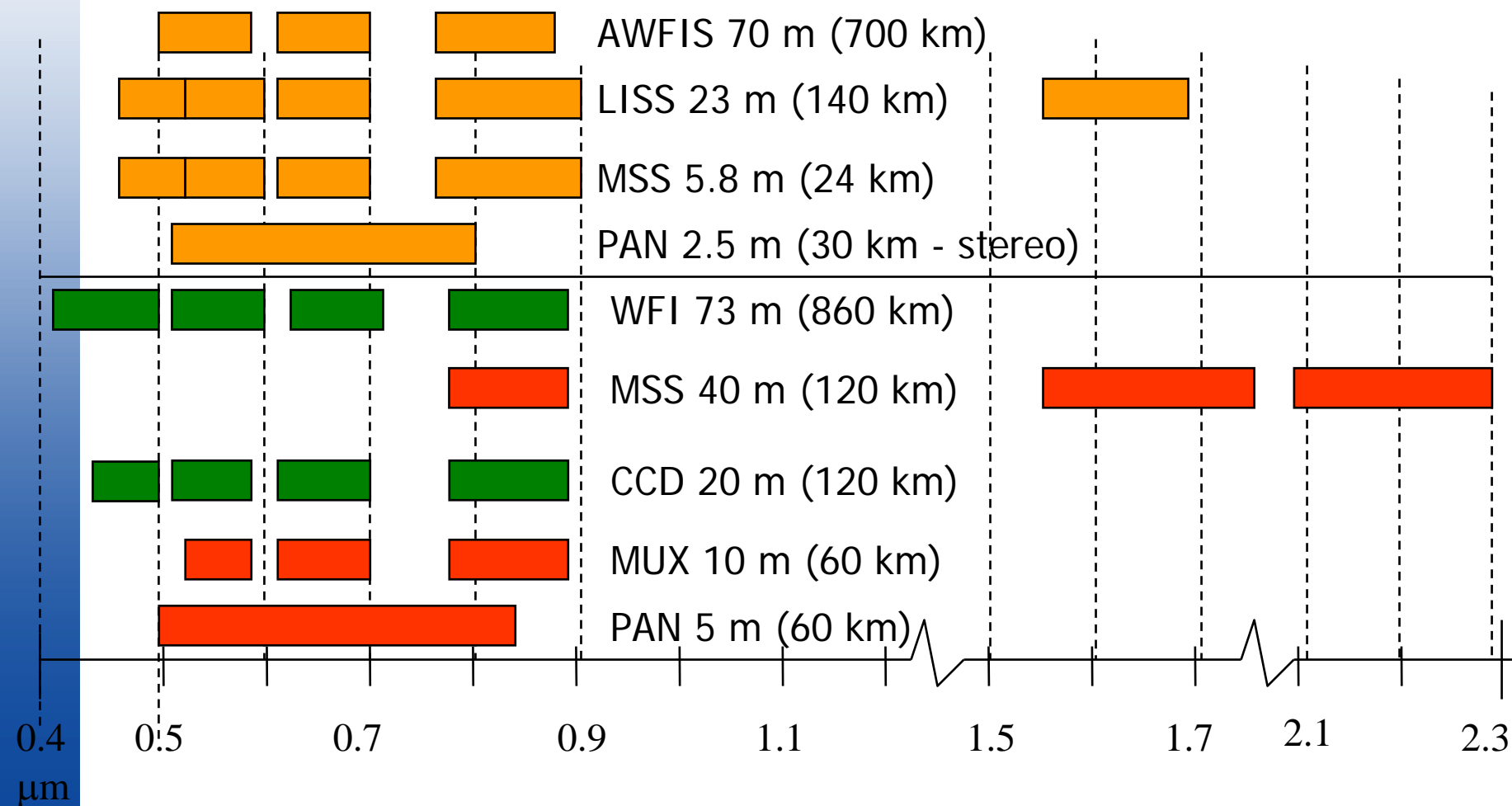
# CBERS 3/4 x LANDSAT-7







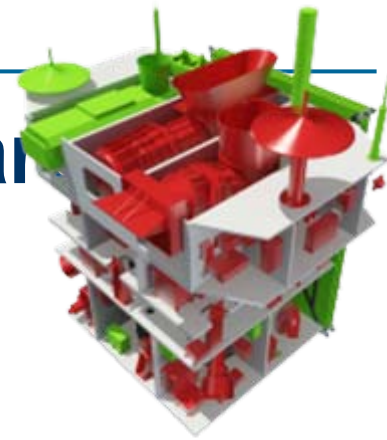
# CBERS 3/4 x IRS-P6 e IRS-P5





# CBERS-3 Structural Model Tests (2008-2009)





# CBERS-3,4 Subsystem Work Share

China	Brazil
TCS - Thermal Control	Structure
AOCS - Attitude Control *	EPSS - Electrical Power Supply **
OBDH - Onboard Data Handling *	TTCS – Service Telecommunications **
SCS - System Circuitry	MUX camera (20m)
PAN camera (5m)	WFI-2 camera (73m)
IRS camera (40m)	DDR – Data Recorder
SEM – Space Environment	DCS – Data Collecting
PIT – Data Transmitter	MWT – Data Transmitter





# CBERS-3, 4 industrial policy in Brazil



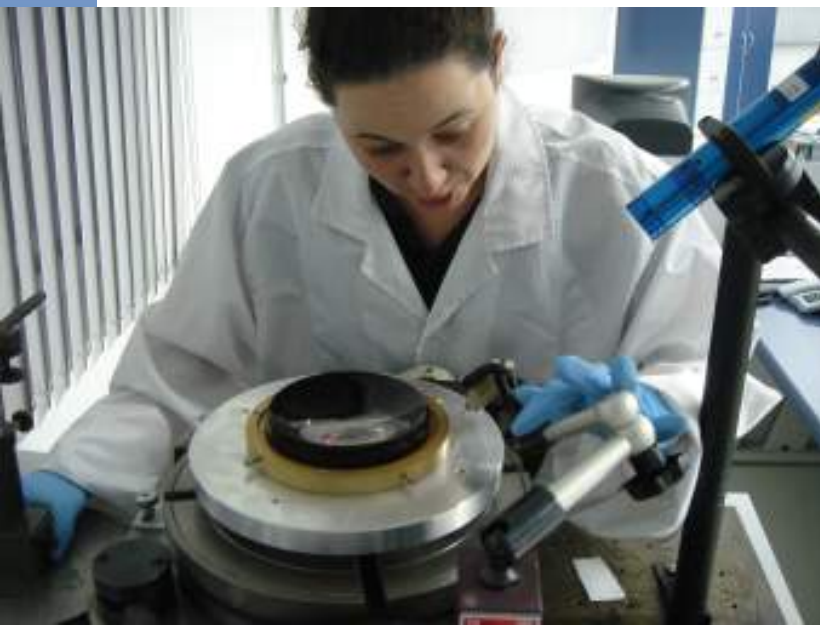
Contracts with Brazilian industry: R\$ 320 million



# MUX CCD Camera(CBERS-3, 4)



Optical, electrical, thermal and mechanical project done by OPTO (Brazilian industry)





# The future of CBERS



CBERS satellites will provide key information about global land change





# CBERS as a global satellite



CBERS ground stations will cover most of the Earth's land mass between  $30^{\circ}\text{N}$  and  $30^{\circ}\text{S}$



**Thank you!**