



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)

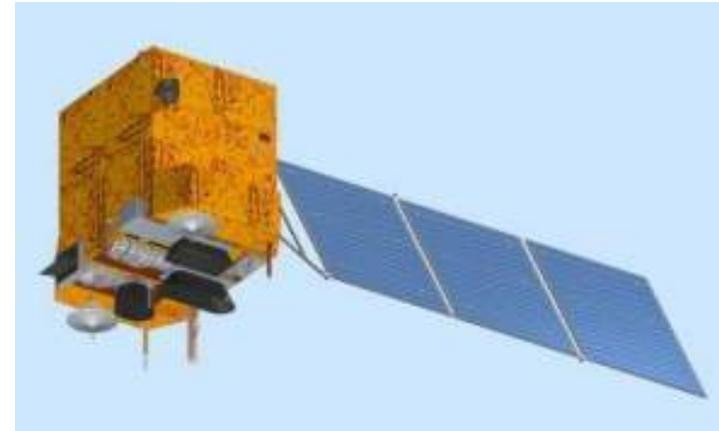
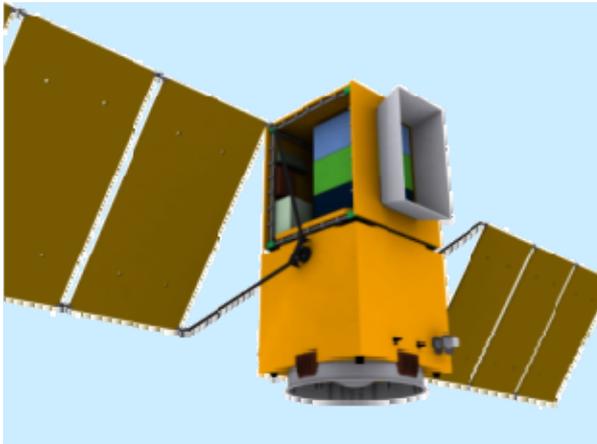


CBERS is a member of the CEOS land imaging constellation



INPE's space technology agenda

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

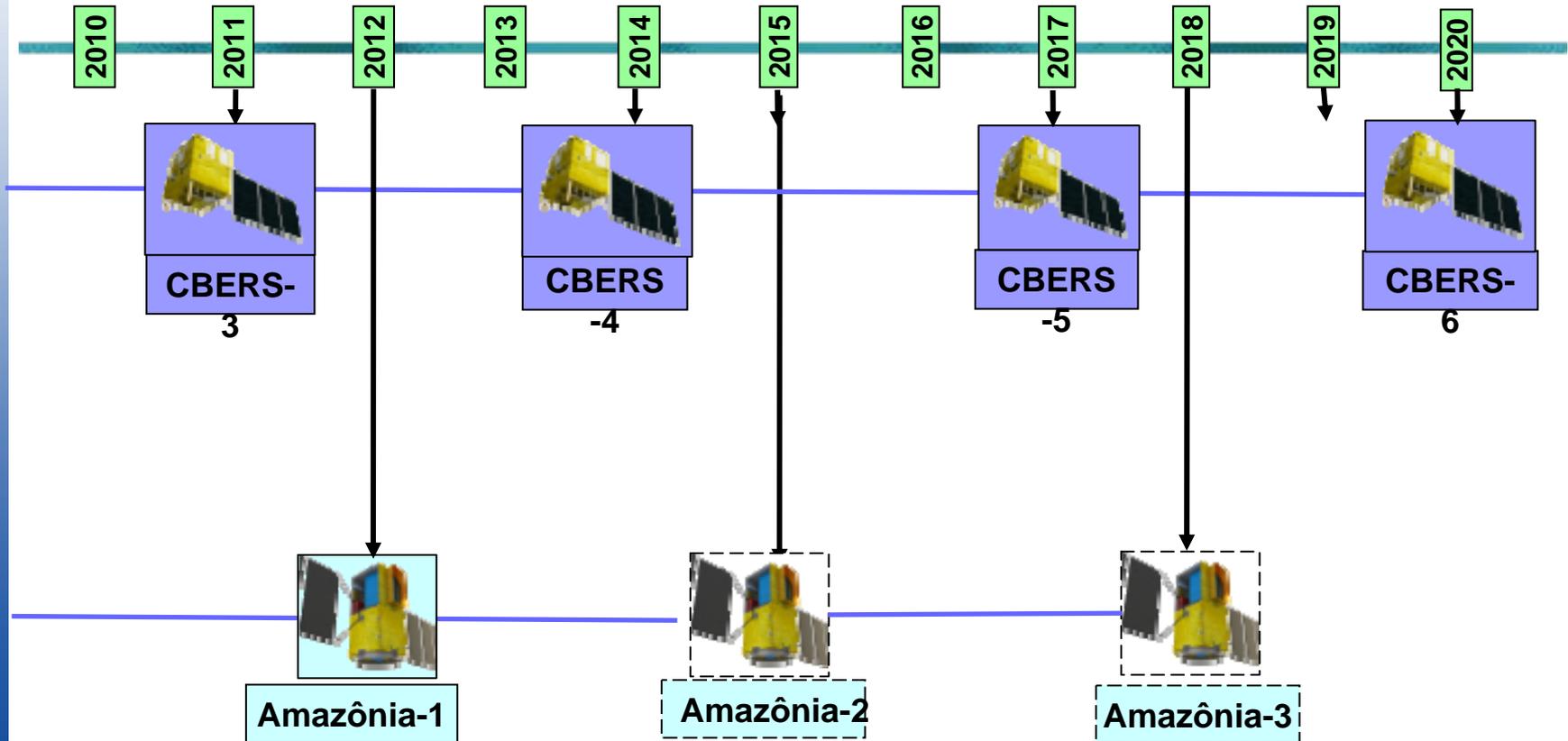




INPE's Remote Sensing Satellites: 2010-2020

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

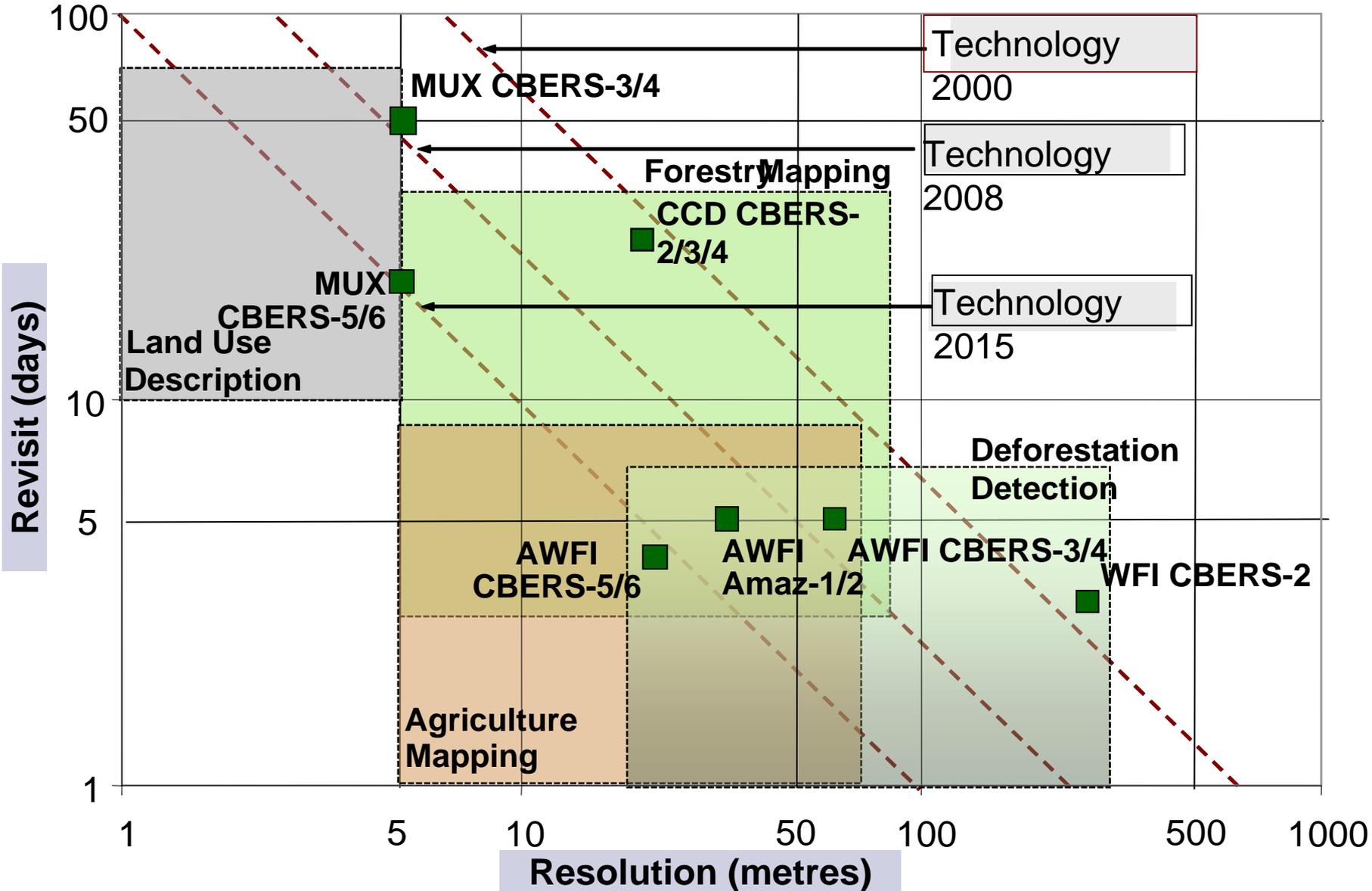
...[goods] which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good... (Samuelson)

Non-excludable

it is impossible to exclude any individuals from consuming the good



Satellites for Forestry and Agriculture





CBERS platform



	CBERS 1, 2, 2B	CBERS 3, 4
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° inclination, 100 min period,

Equator crossing at 10h30 AM



Track distance of 107 km, revisit time of 26 days



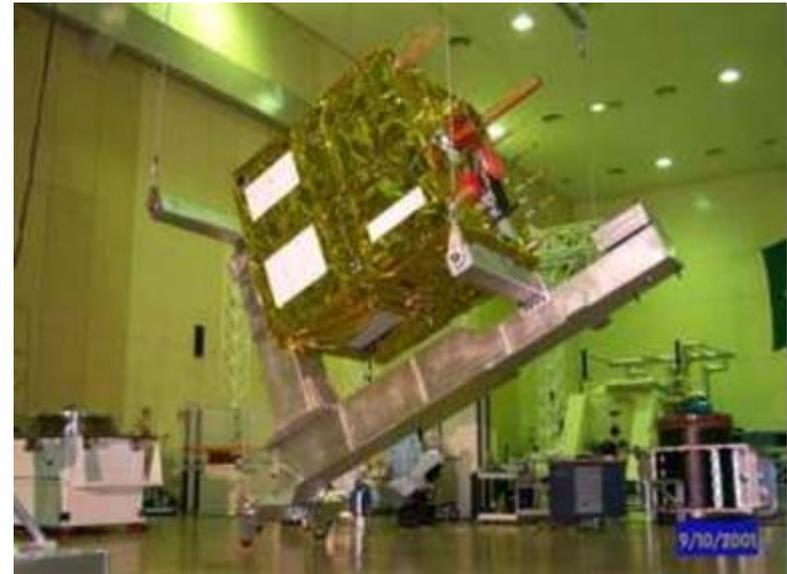
CBERS-1, 2, 2B work share (70% China, 30% Braz

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)





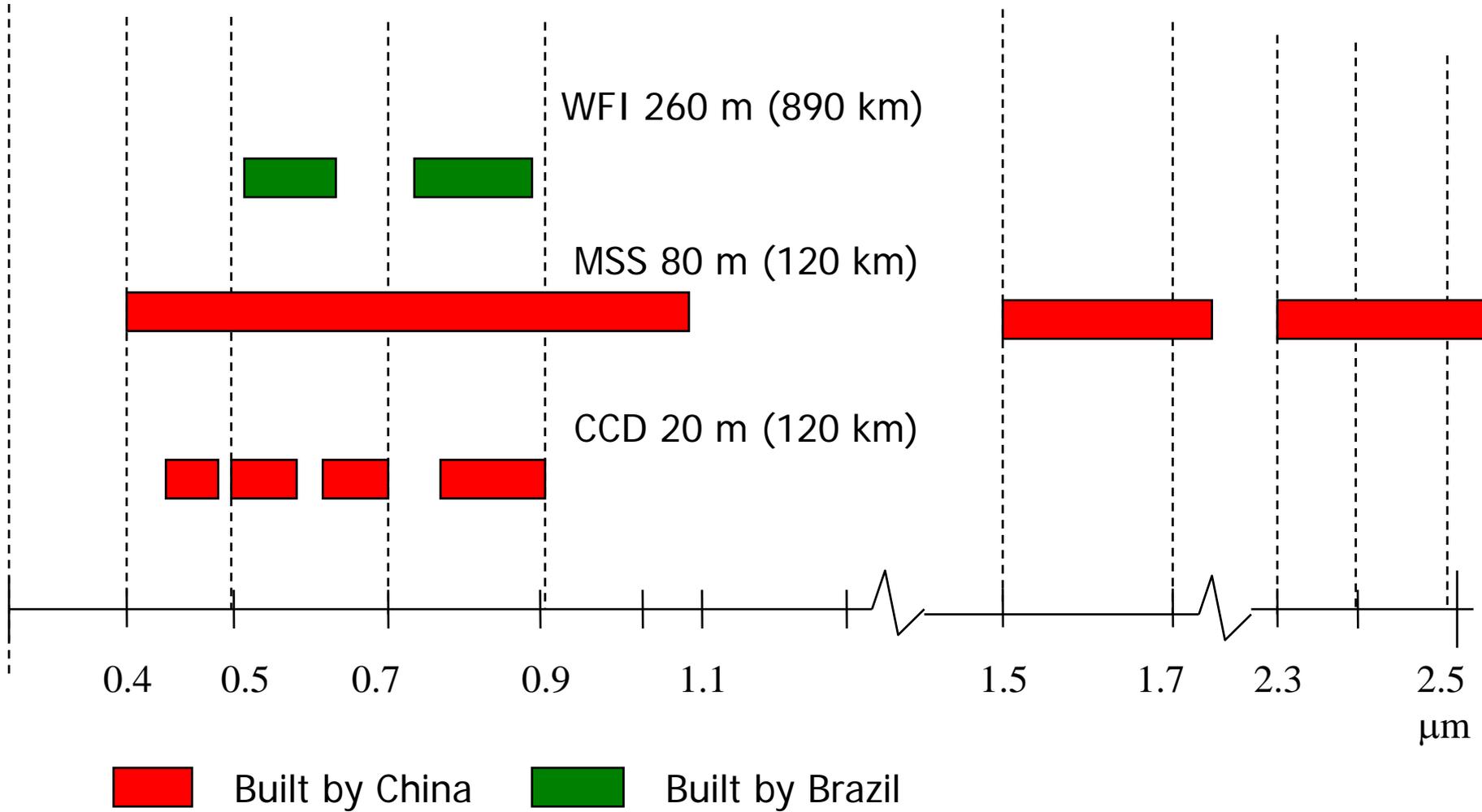
CBERS-2



CBERS-2 Launch (21 October 2003)

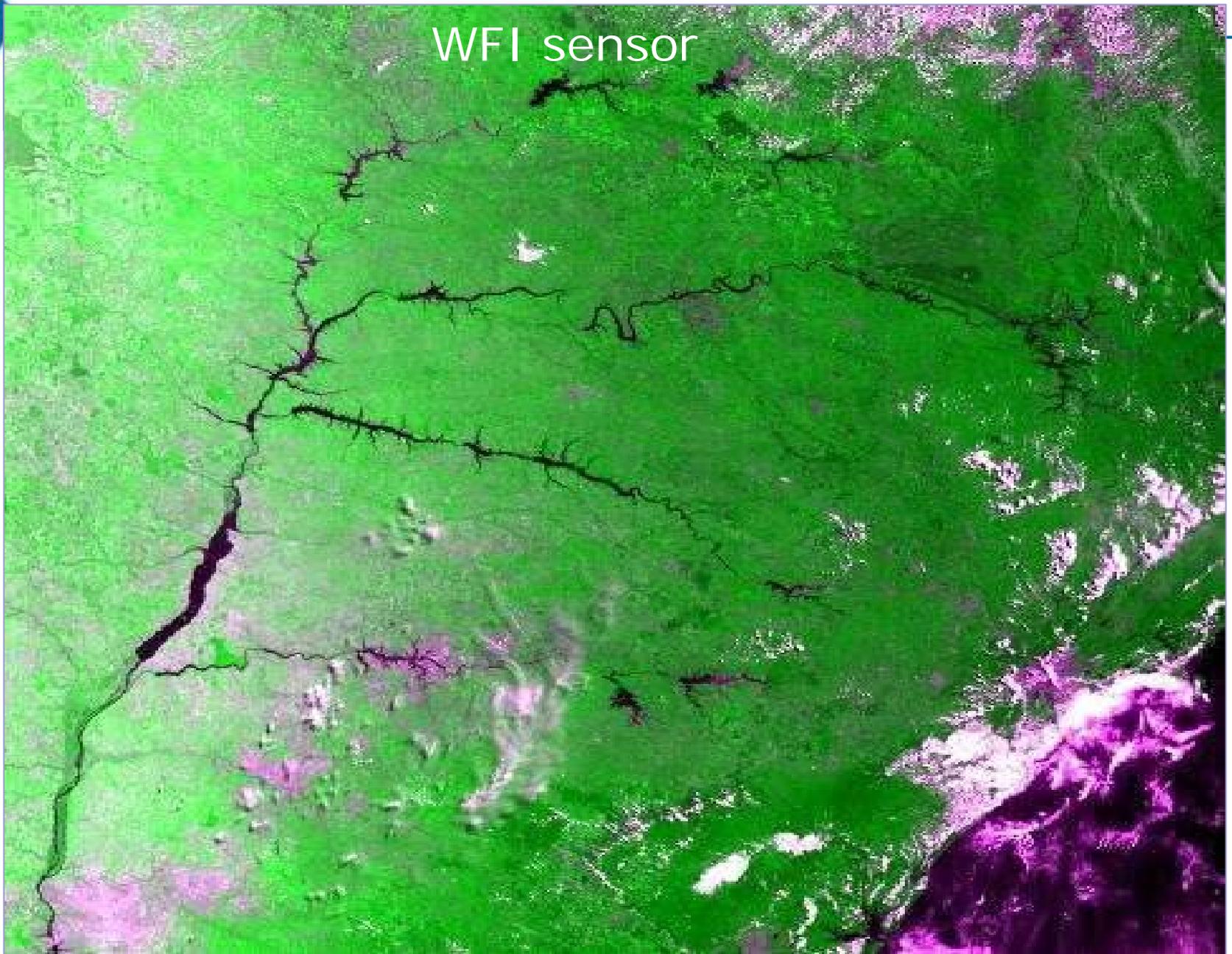


CBERS 1,2 Sensor Configuration





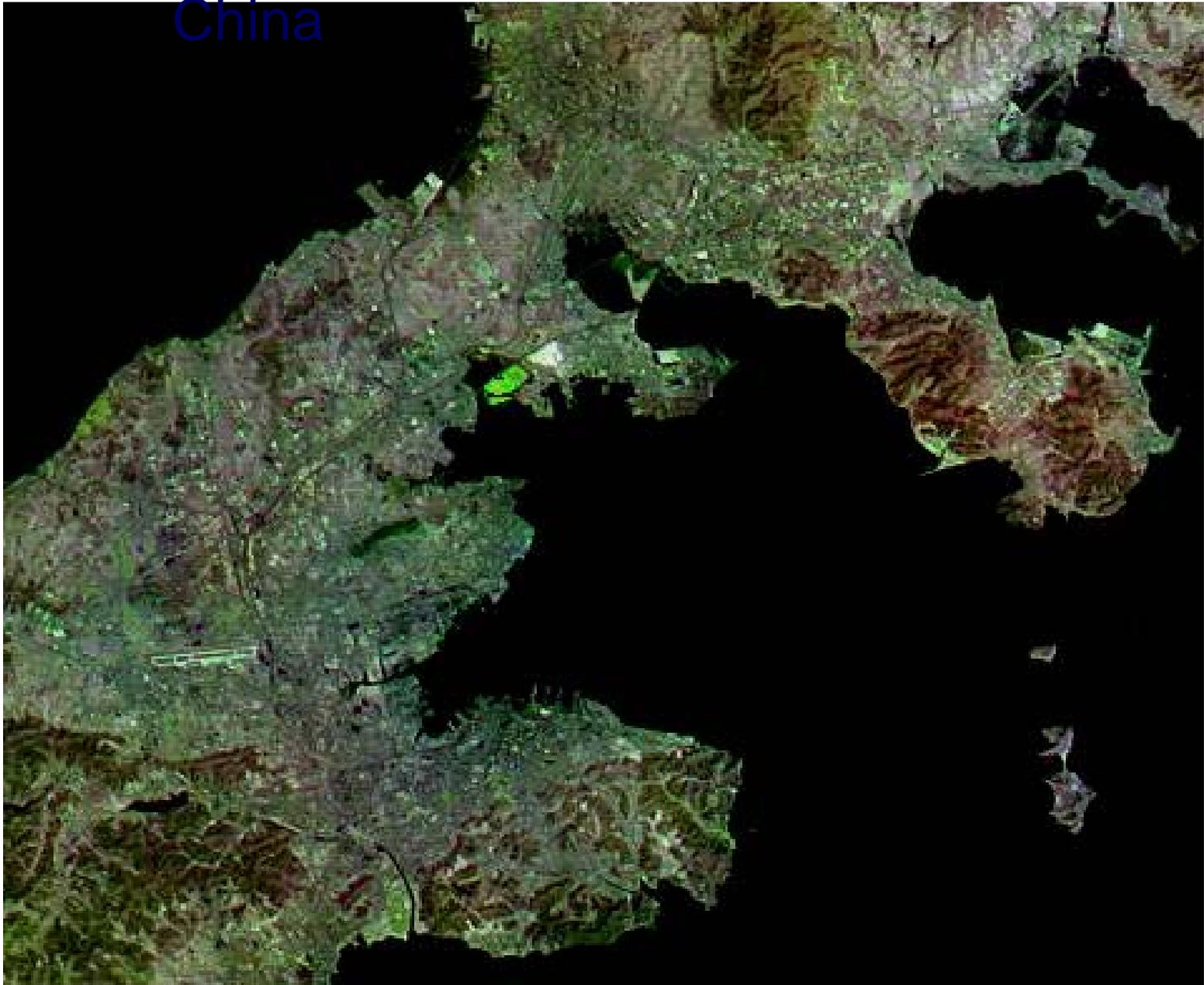
WFI sensor



CBERS2-WFI – 157/124, 18/01/2004, São

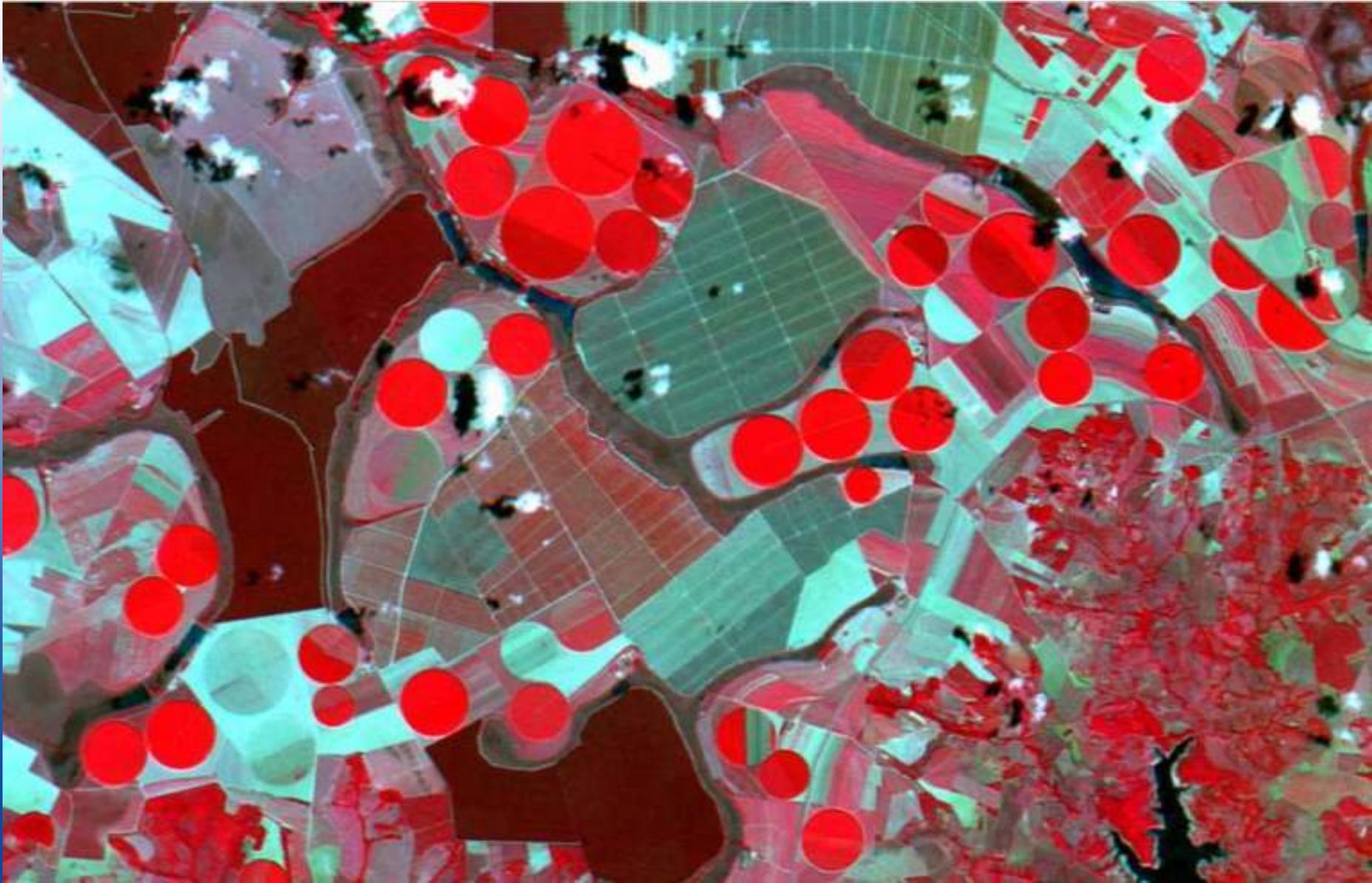


CBERS-1 IRMSS DaLian Bay , China



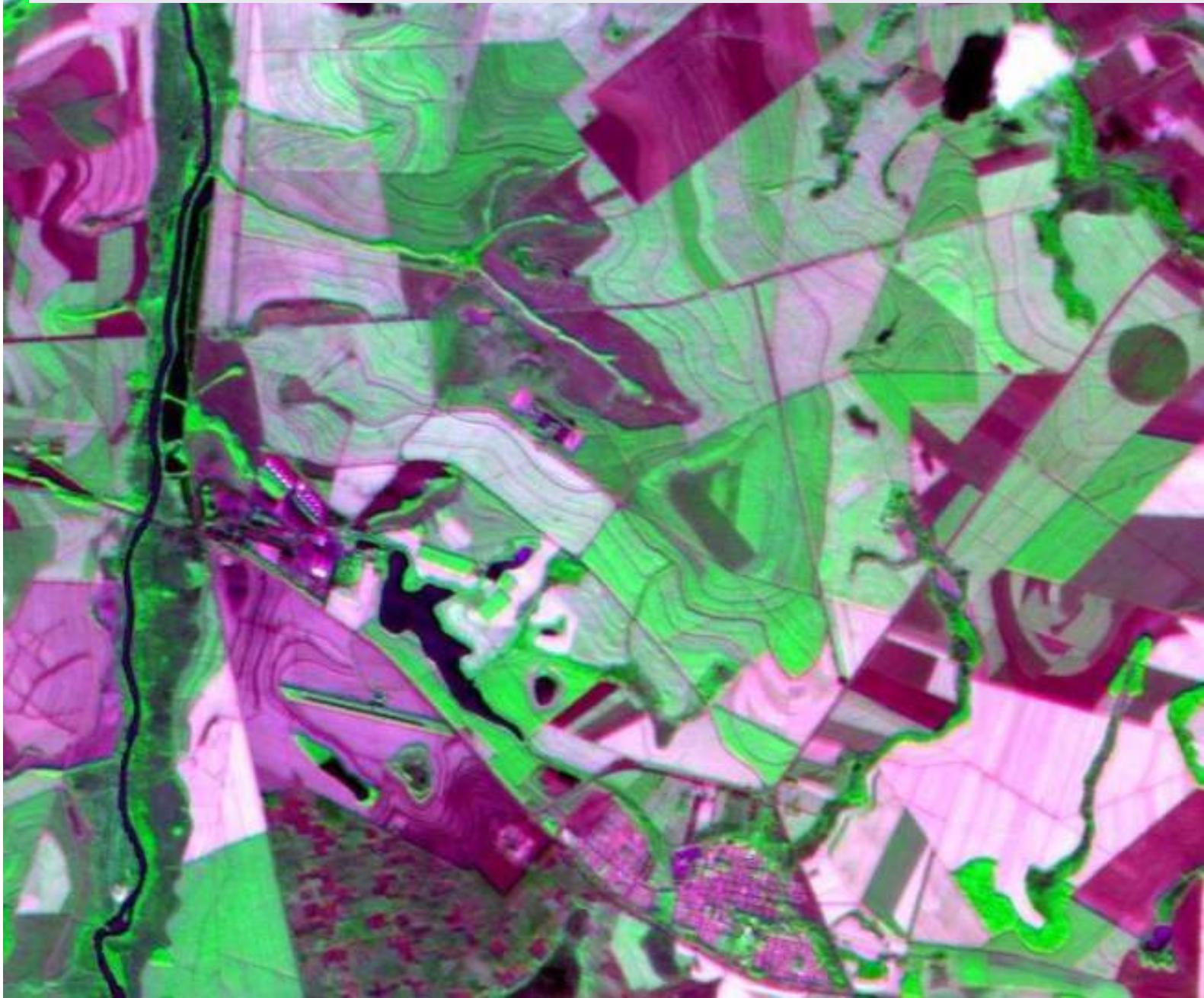


CBERS-2 CCD, Minas Gerais, Brazil





CBERS-2 CCD, Pradópolis, Brazil, Nov-2006

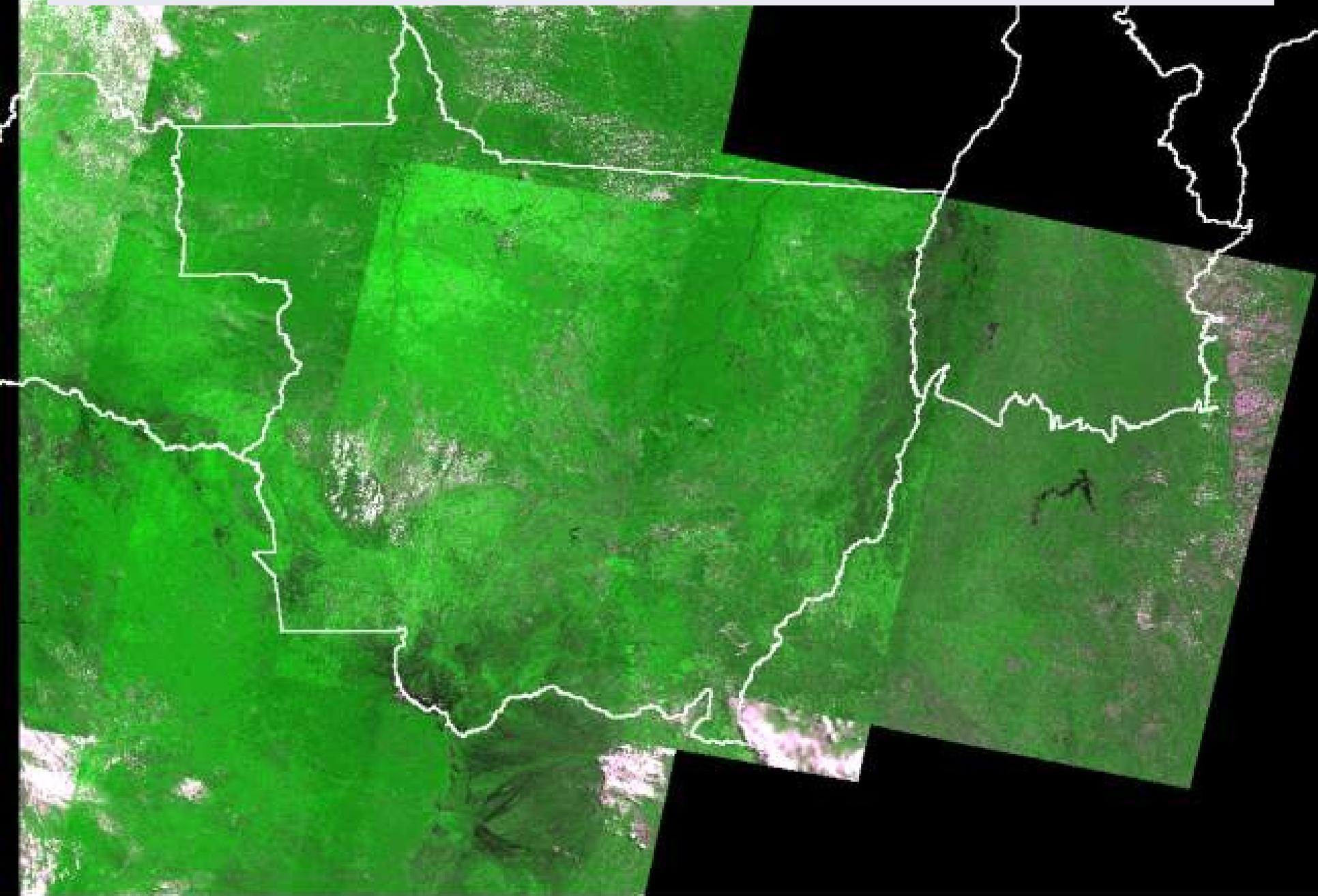




CBERS-2 CCD, Macapá, Brazil

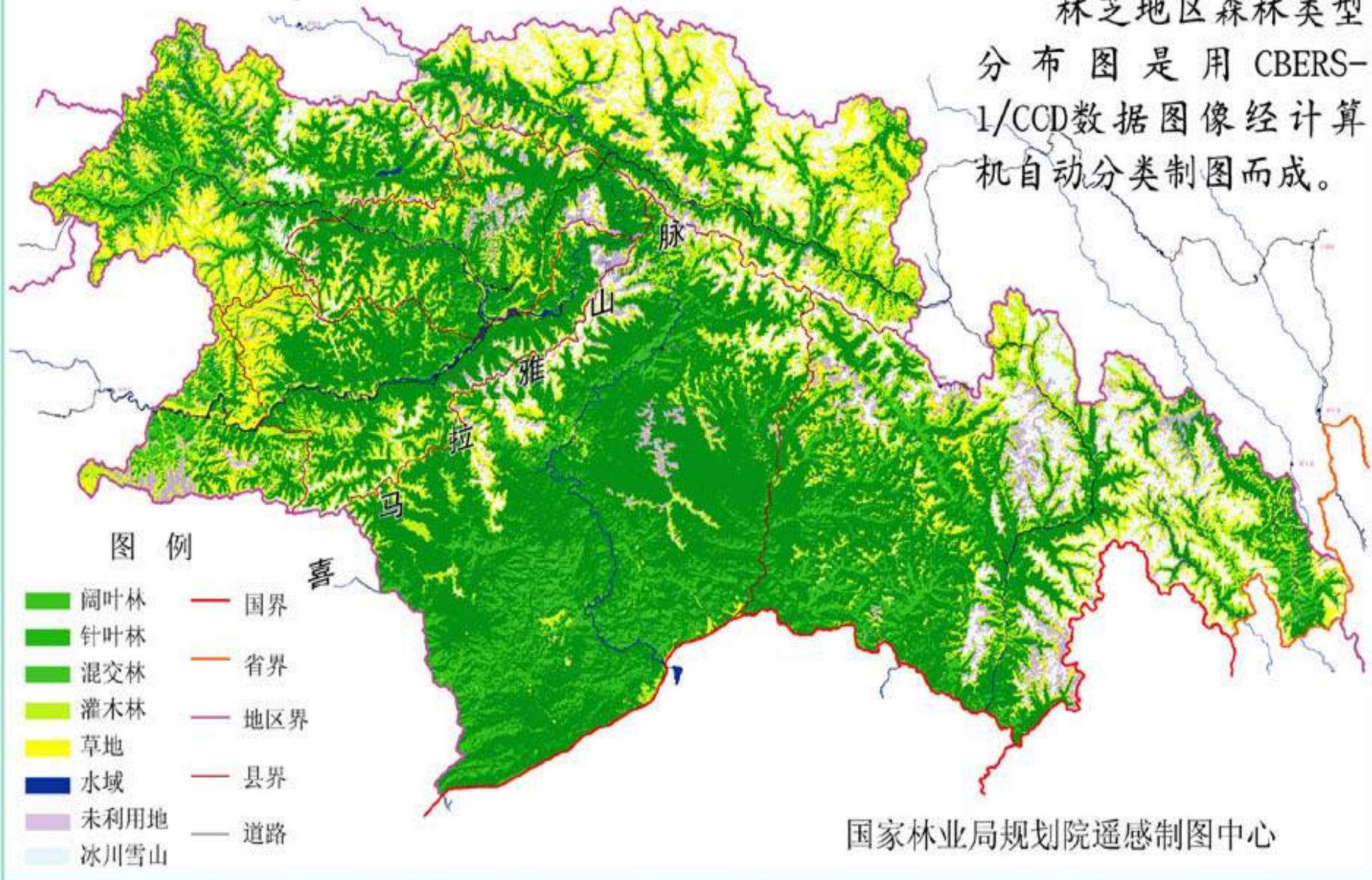


CBERS-2 WFI mosaic of Mato Grosso state, 2003



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。



国家林业局规划院遥感制图中心



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



Assembly of CBERS-2B Cameras

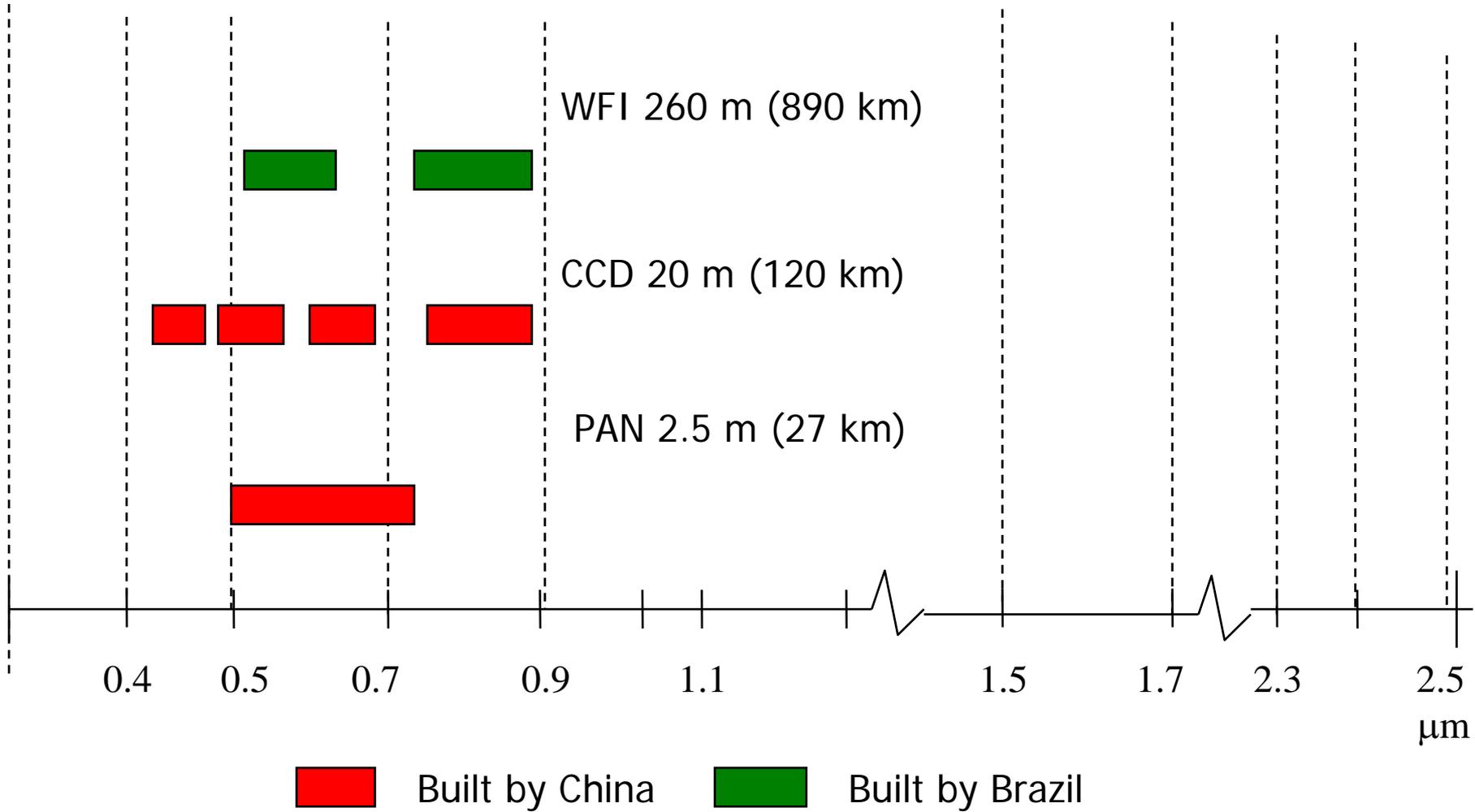


CBERS-2B Sensor Configuration

Sensor	Bands (μm)	Swath (km)	Resolution (m)
PAN	0.51-0.73	27	2.5
CCD	0.45-0.52	120	20
	0.52-0.59	120	20
	0.63-0.69	120	20
	0.77-0.89	120	20
	0.51-0.73	120	20
WFI	0.63-0.69	890	260
	0.77-0.89	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

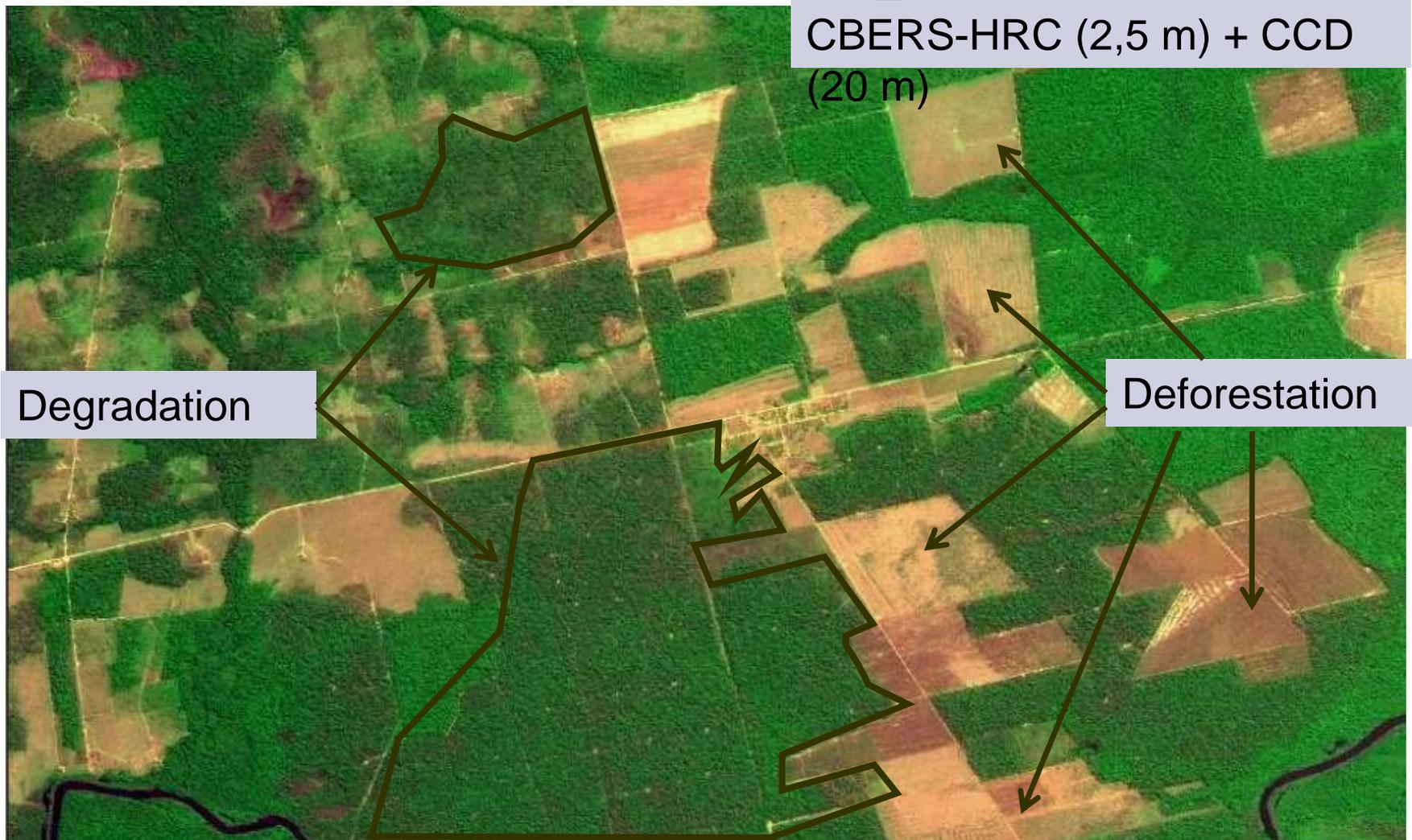


CBERS-2B HRC (PAN - 2,7 m) + CCD (multispectral, 20 m)
São Felix do Xingu, Pará, June 2008





CBERS-2B – Forest Degradation



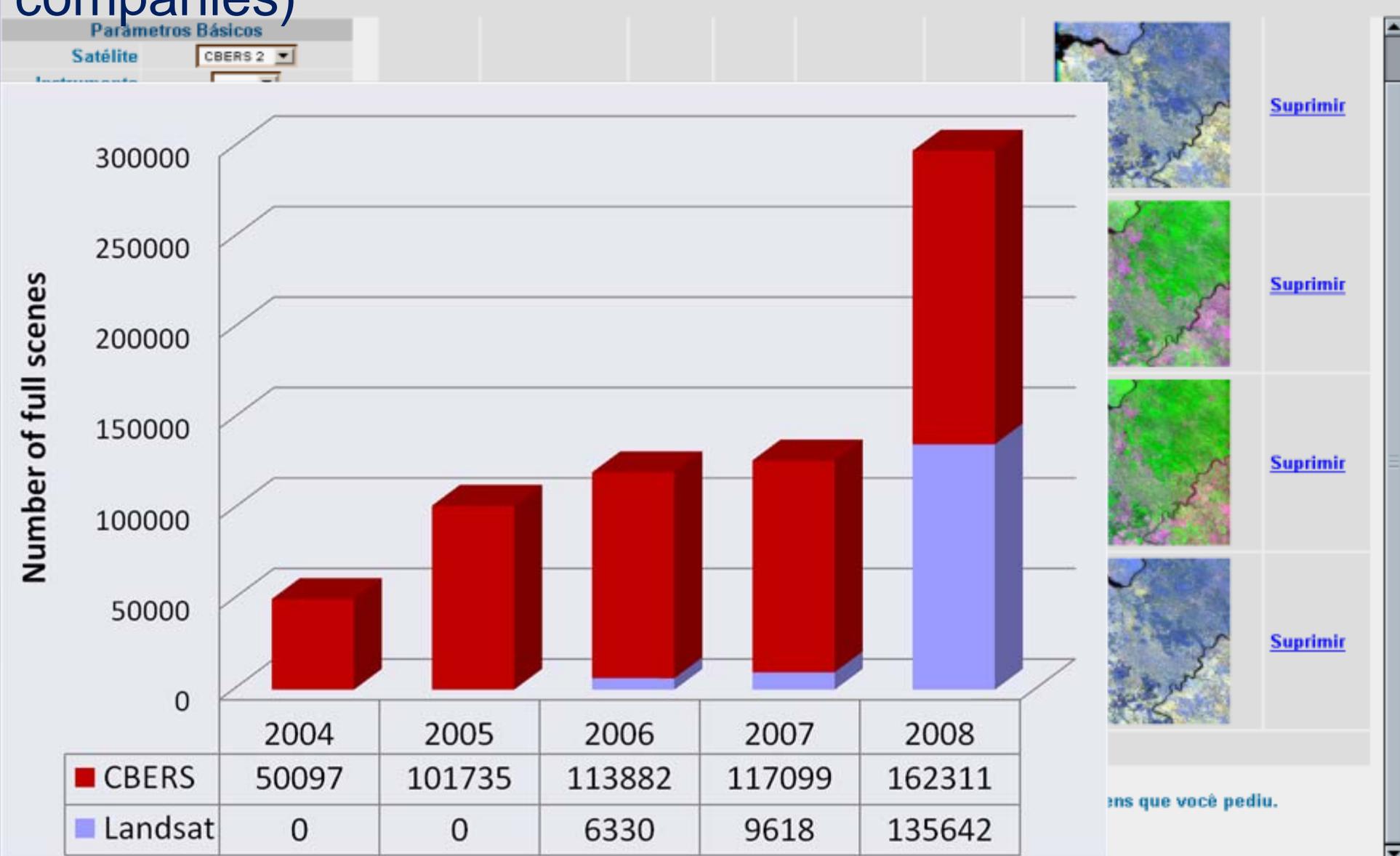
CBERS-2B HRC allows better detection of forest degradation (region of Marcelandia, Mato Grosso, Brazil)



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



INPE 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: [] 02 [] 04

Click Look: Pequeno Grande

Município: [] Estado: []

Executar

Órbita: [] Ponto: []

Até: [] De: [] Até: []

Executar

Por Região

Norte: 10. []

Oeste: 90. [] Leste: 30. []

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 **it!** [Cadastro](#) [Log In](#) [Carrinho](#) [Ajuda](#)

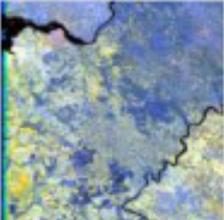
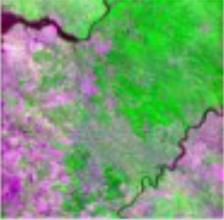
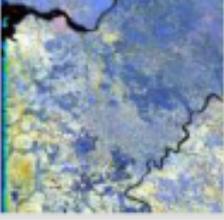
Parâmetros Básicos

Satélite:
Instrumento:
Intervalo de Tempo: Sazonal
De: /
Até: /
Cobertura de Nuvens Máxima
Q1: Q2:
Q3: Q4:
Quick Look: Pequeno Grande
Município: Estado:

Órbita: De Até Ponto: De Até

Por Região
Norte:
Oeste: Leste:
Sul:

Interface Gráfica
Lat: Lon:

CB2	IRM	162	131	2004-03-21		Suprimir
CB2	CCD	162	131	2004-03-21		Suprimir
CB2	CCD	162	131	2004-02-24		Suprimir
CB2	IRM	162	131	2004-02-24		Suprimir

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



FTP area for User

The screenshot shows a Netscape browser window displaying an FTP directory listing. The browser's address bar shows the URL `http://www.dpi.inpe.br/catalogo/tmp/epiphanio416/`. The directory listing includes a 'Parent Directory' and several files named 'CBERS 2 CCD1XS 20040...' and 'CBERS 2 IRM 20040225...'. A dialog box titled 'Downloading CBERS_2_CCD1XS_20040225_153_104_BAND3.tif.zip' is open, asking the user what to do with the file. The 'Save this file to disk' option is selected.

Index of /catalogo/tmp/epiphanio416

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
Parent Directory	25-Mar-2004 15:23	-	
CBERS 2 CCD1XS 20040...	18-Mar-2004 01:23	17.6M	
CBERS 2 CCD1XS 20040...	18-Mar-2004 01:23	15.0M	
CBERS 2 CCD1XS 20040...	18-Mar-2004 01:23	20.3M	
CBERS 2 IRM 20040225...	18-Mar-2004 01:30	1.5M	
CBERS 2 IRM 20040225...	18-Mar-2004 01:30	1.6M	
CBERS 2 IRM 20040225...	18-Mar-2004 01:30	1.5M	
CBERS 2 IRM 20040225...	18-Mar-2004 01:30	775k	

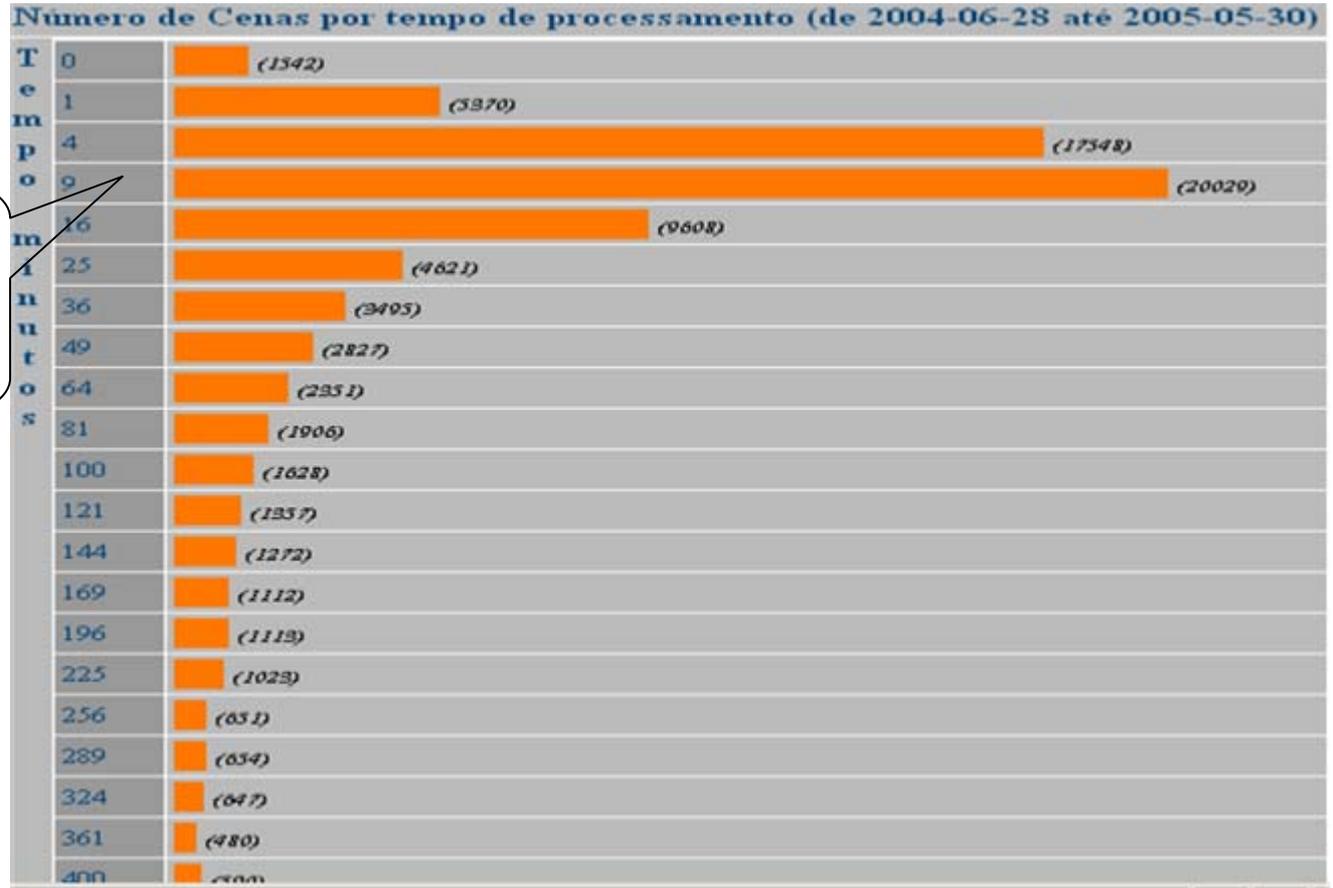
Apache/1.3.29 Server at www.dpi.inpe.br Port 80

Document: Done (0.751 secs)

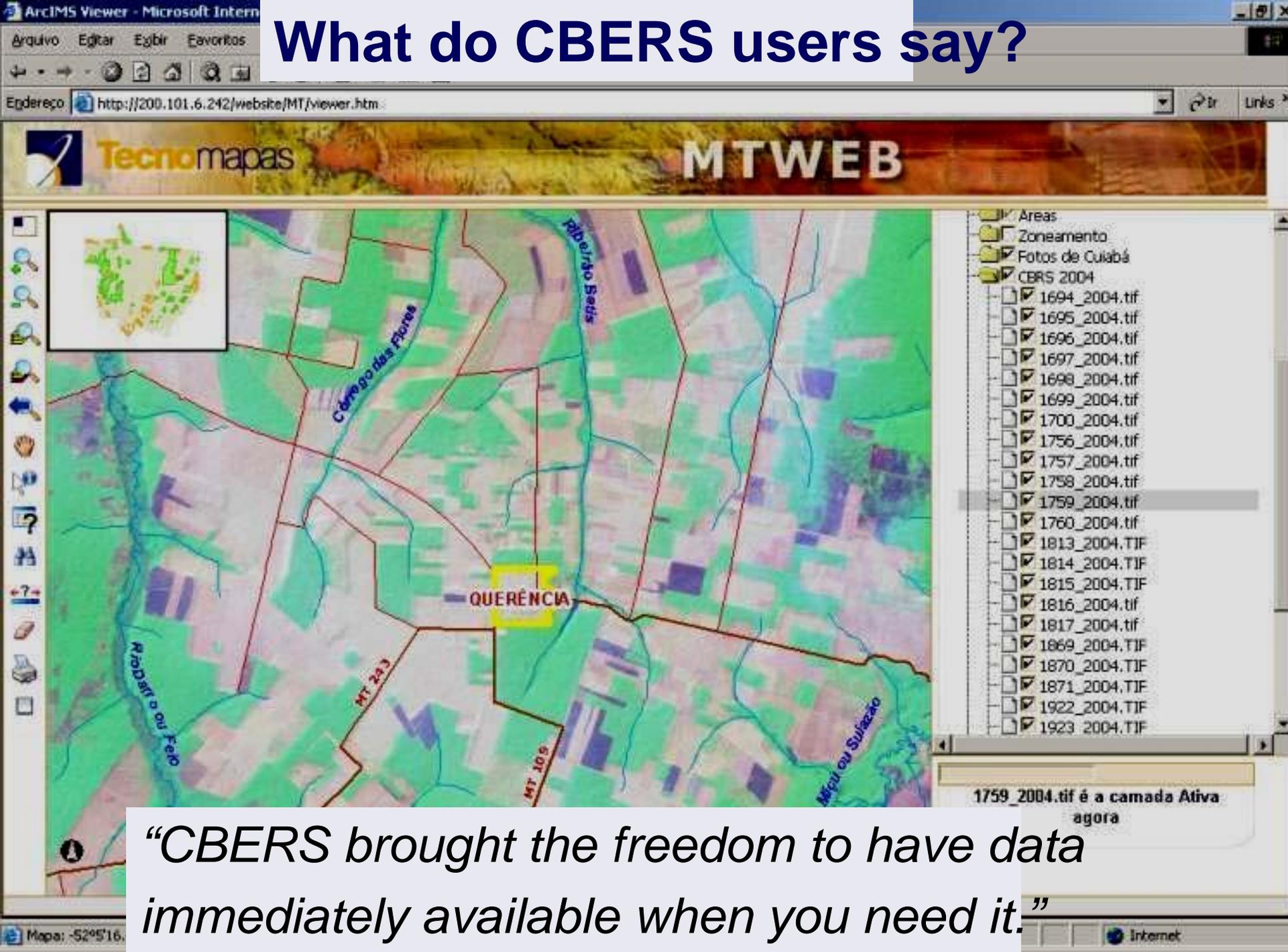


Time to respond to a user request

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

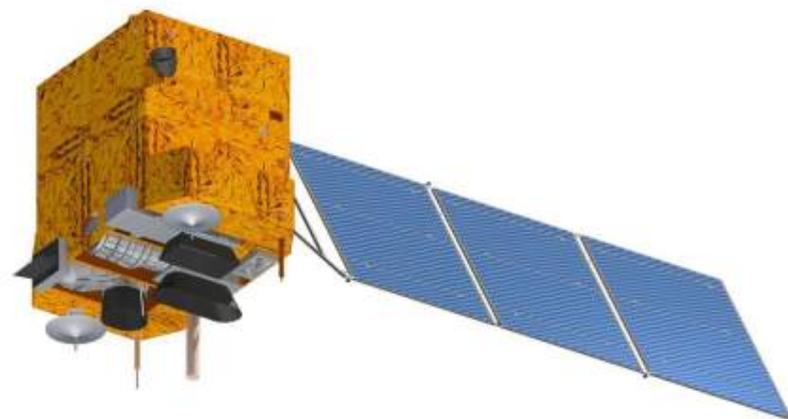
Planning new applications becomes easier

Creates jobs by reducing cost of data buys

Increases quality by adding data previously unavailable



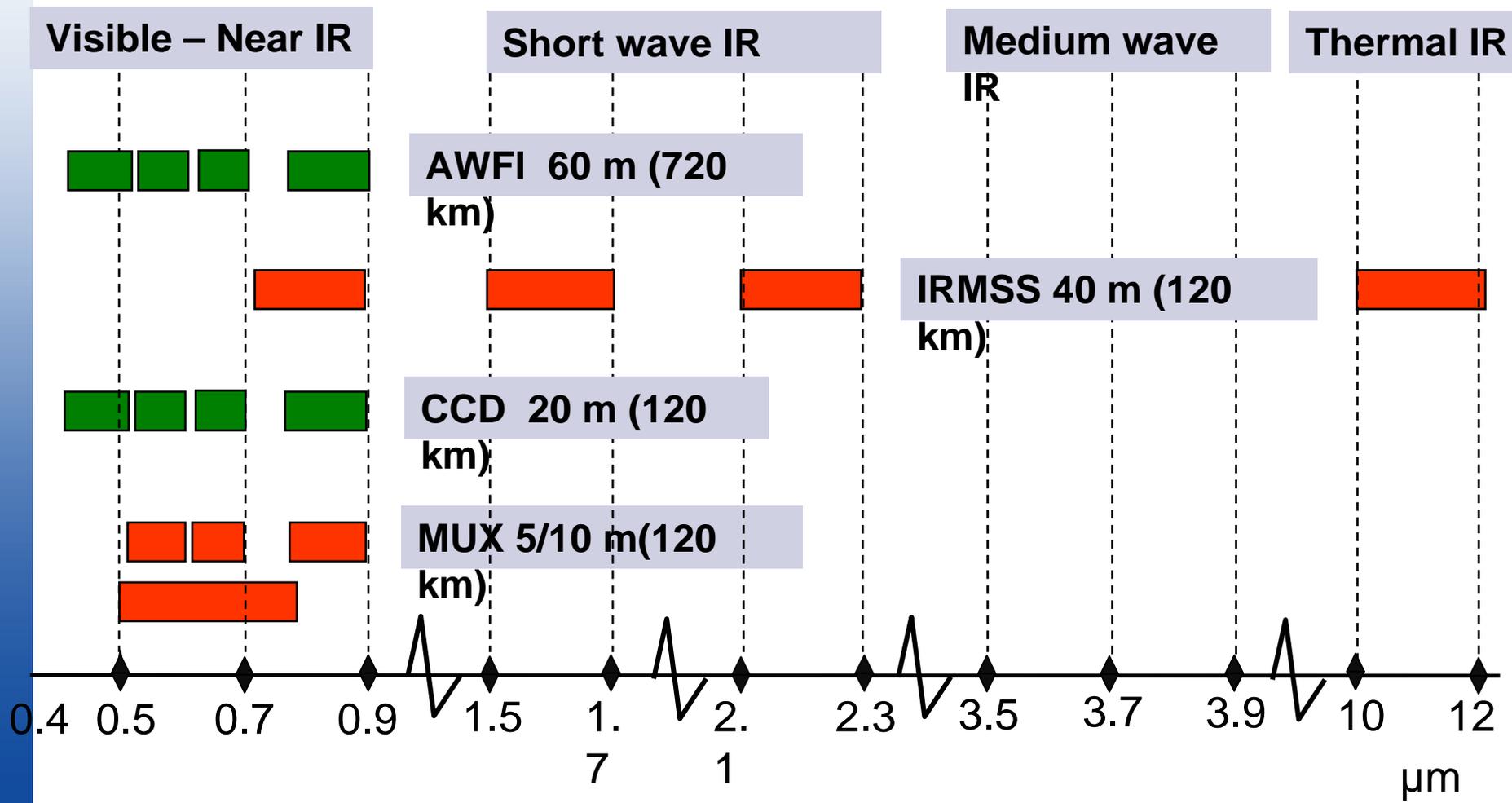
CBERS-3,4



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



CBERS 3 – 4 Sensors



Built by China



Built by Brazil



CBERS-3,4 Sensor Configuration: PANMUX, CCD

Sensor	Bands (μm)	Swath (km)	Resolution (m)
PAN	0.51 – 0.85	60	5
MUX	0.52 – 0.59	60	10
	0.63 – 0.69	60	10
	0.77 – 0.89	60	10
CCD	0.45 – 0.52	120	20
	0.52 – 0.59	120	20
	0.63 – 0.69	120	20
	0.77 – 0.89	120	20

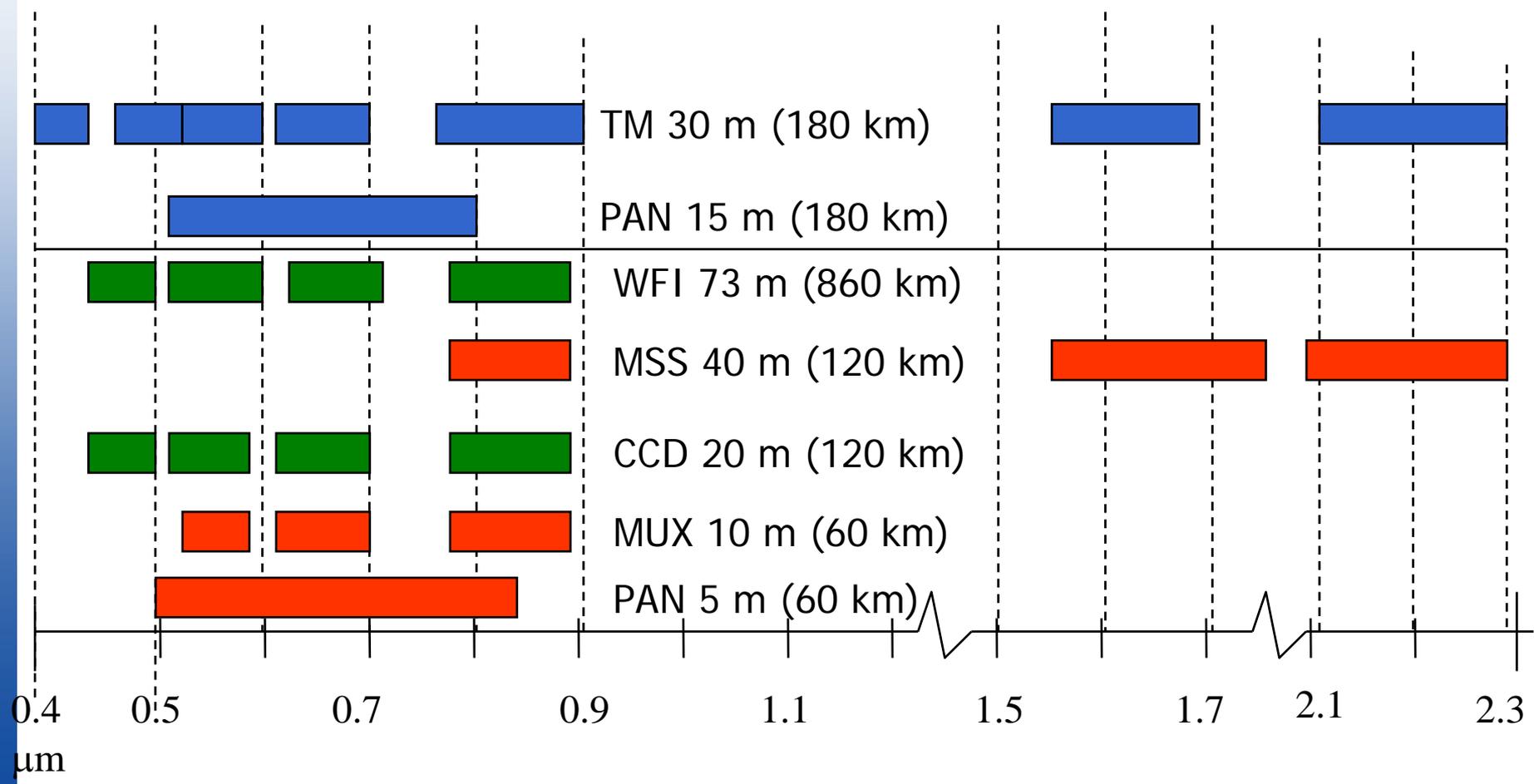


CBERS-3,4 Sensor Configuration: IRMSS, AWF

Sensor	Bands (μm)	Swath (km)	Resolution (m)
IRMSS	0.76 – 1.10	120	40
	1.55 – 1.75	120	40
	2.08 – 2.35	120	40
	10.4 – 12.5	120	80
AWFI (10 bits)	0.45 – 0.52	840	70
	0.52 – 0.59	840	70
	0.63 – 0.69	840	70
	0.77 – 0.89	840	70

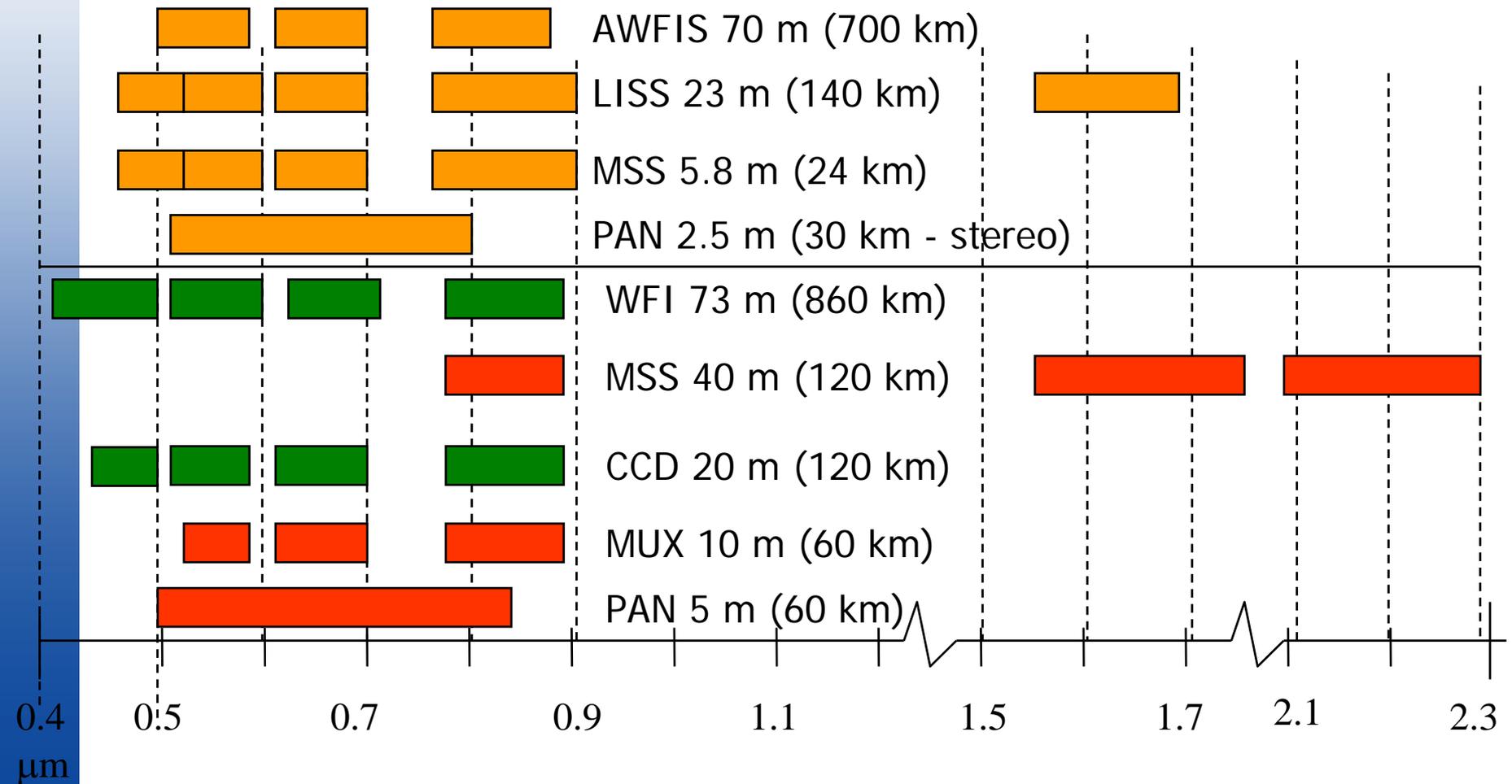


CBERS 3/4 x LANDSAT-7



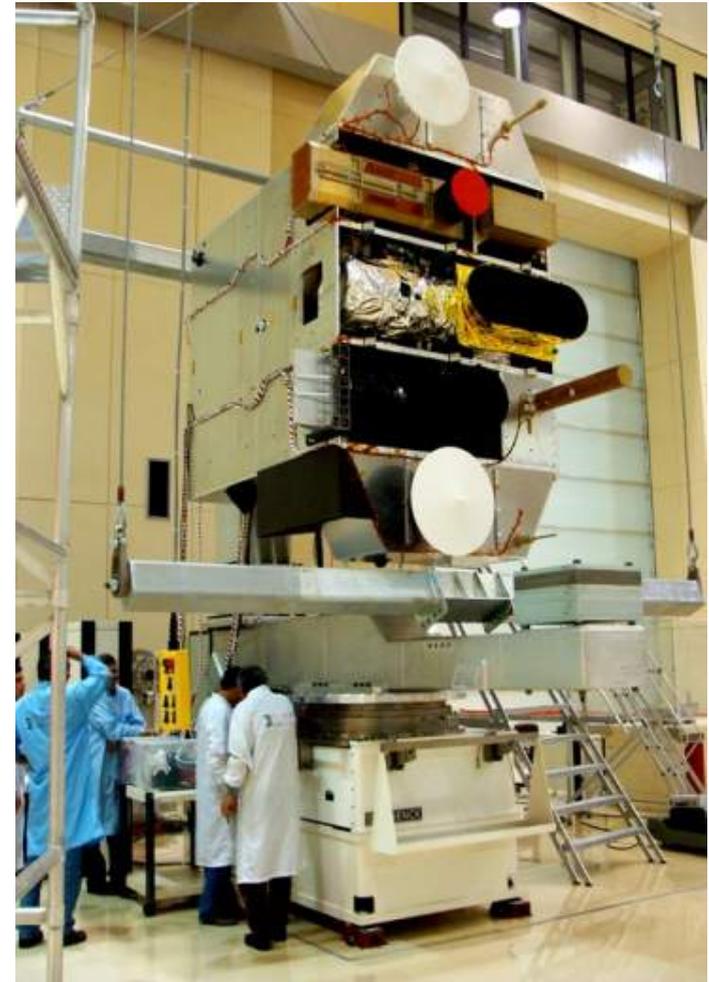


CBERS 3/4 x IRS-P6 e IRS-P5





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



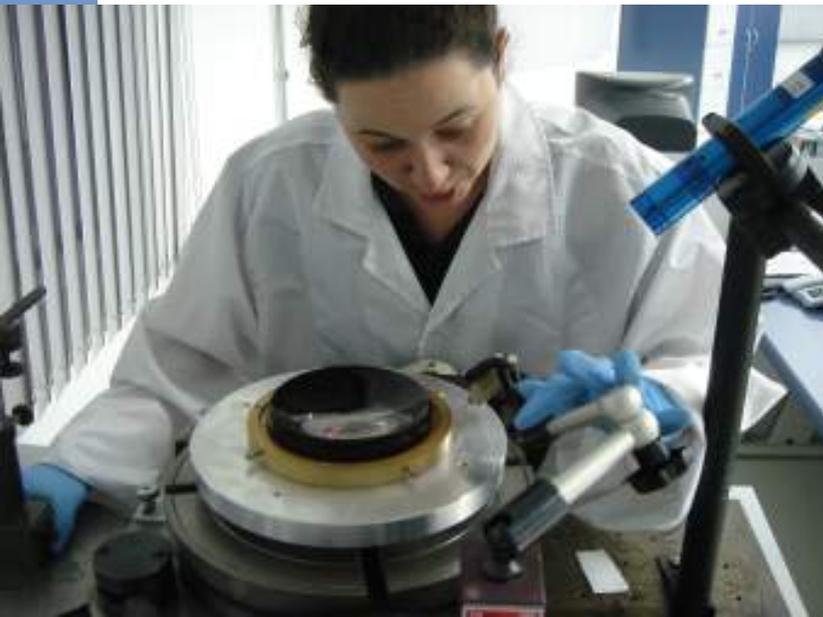
Contracts with Brazilian industry: R\$ 320 million



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°N and 30°S



Thank you!