MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

INPE plan 2020: an overview as of May 2009

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Earth Observations branch

National Institute for Space Research (INPE)

Brazil

One world, one dream...

Free Earth Observation data for all!

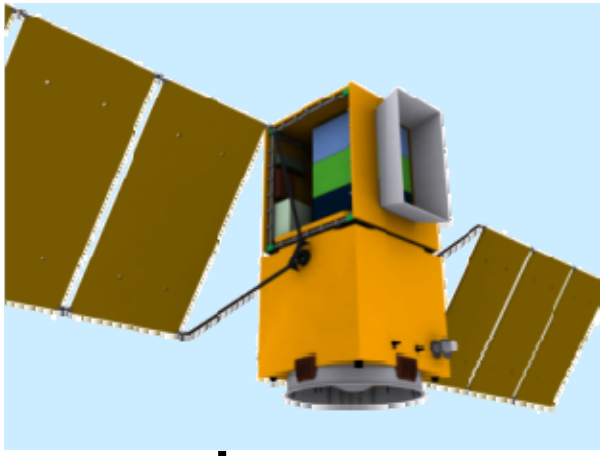
A vision for the future

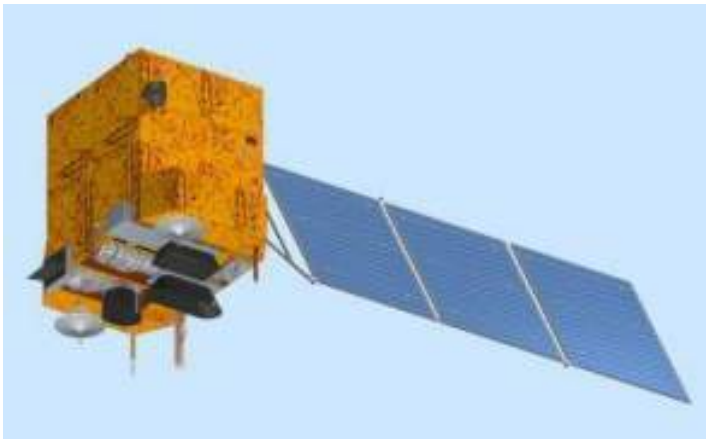
A constellation of satellites will provide free global land imaging for all countries on Earth (CEOS)

CBERS is a member of the CEOS land imaging constellation

INPE's space technology agenda

"Global EO" – Brazil as global player in earth observation





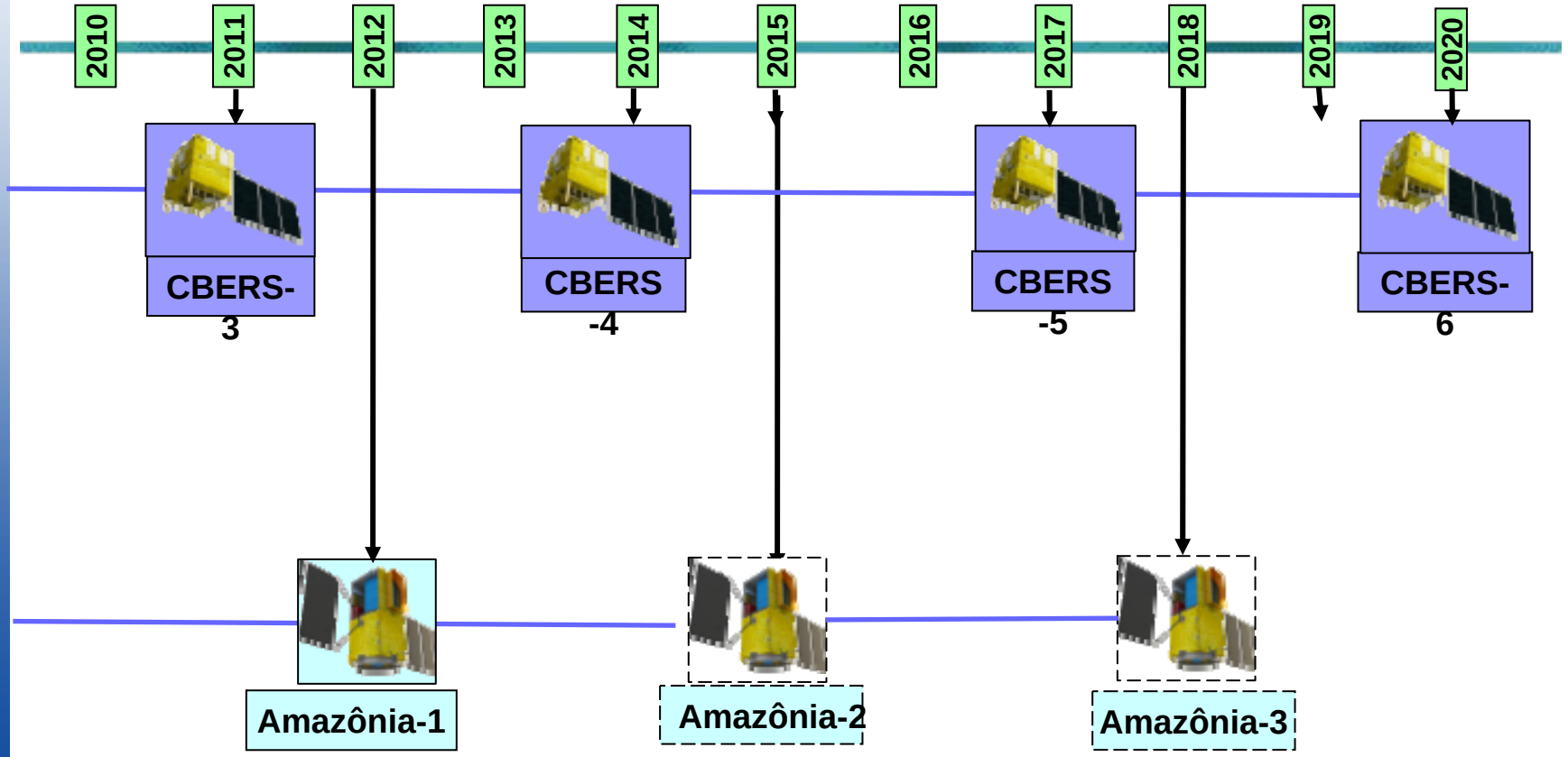
Bilateral agreements
(China, Argentina, UK,…)

Multilateral Agreements
(CEOS, key player for Brazil in GEO)

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

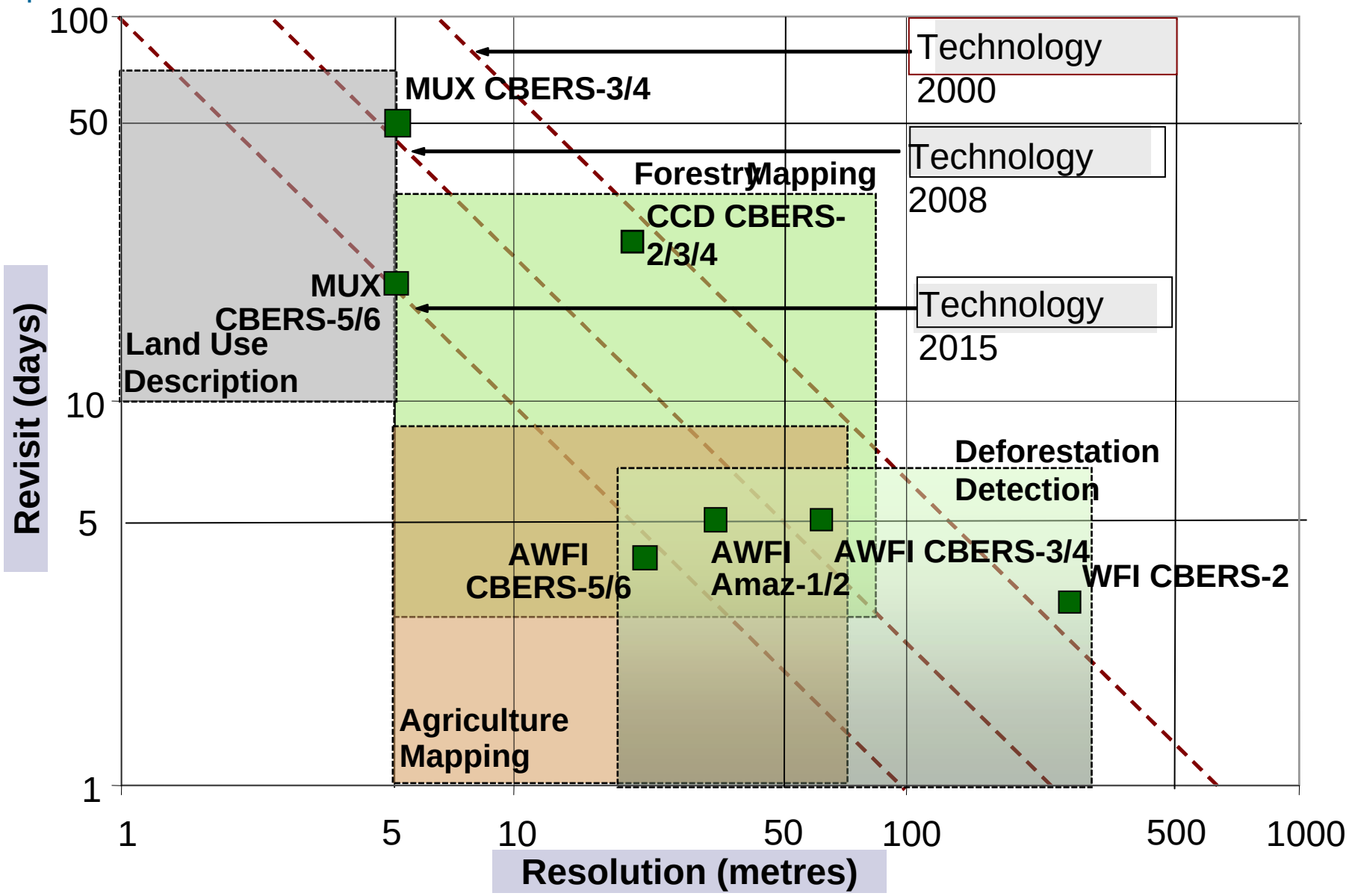
Non-rival

...*[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

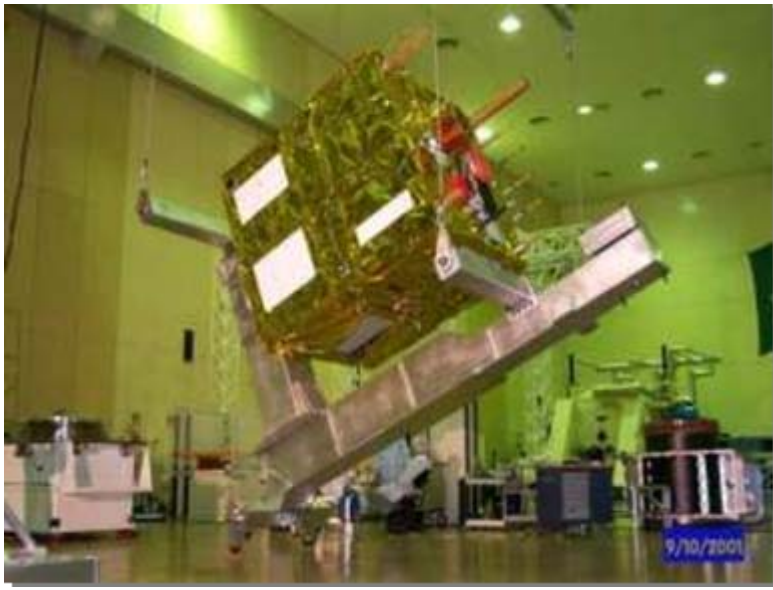
SSO Polar, 778 km height, 98^0 inclination, 100 min period,

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



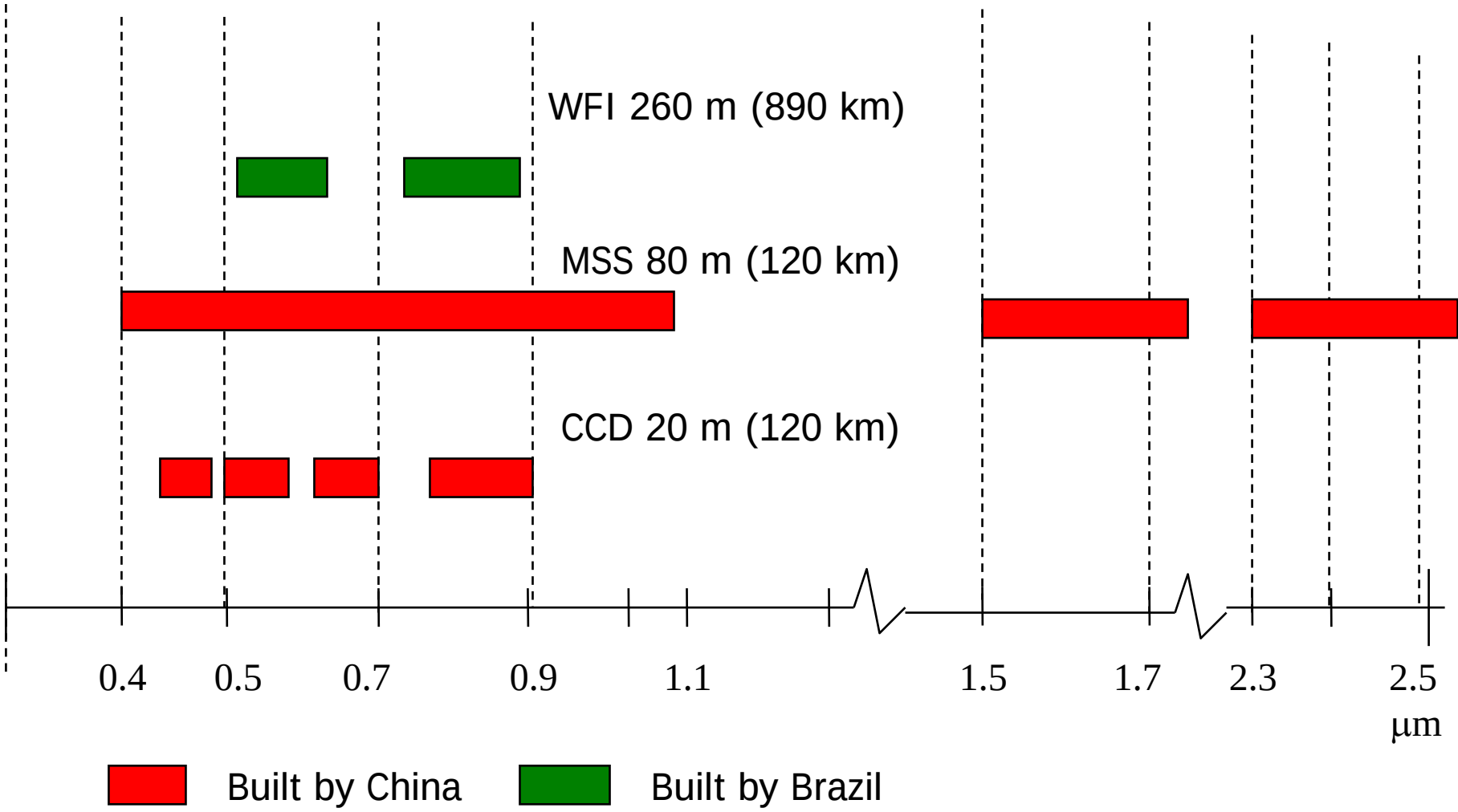
CBERS-2 being put into Long March-4B

CBERS-2 prepared for launch (2003)

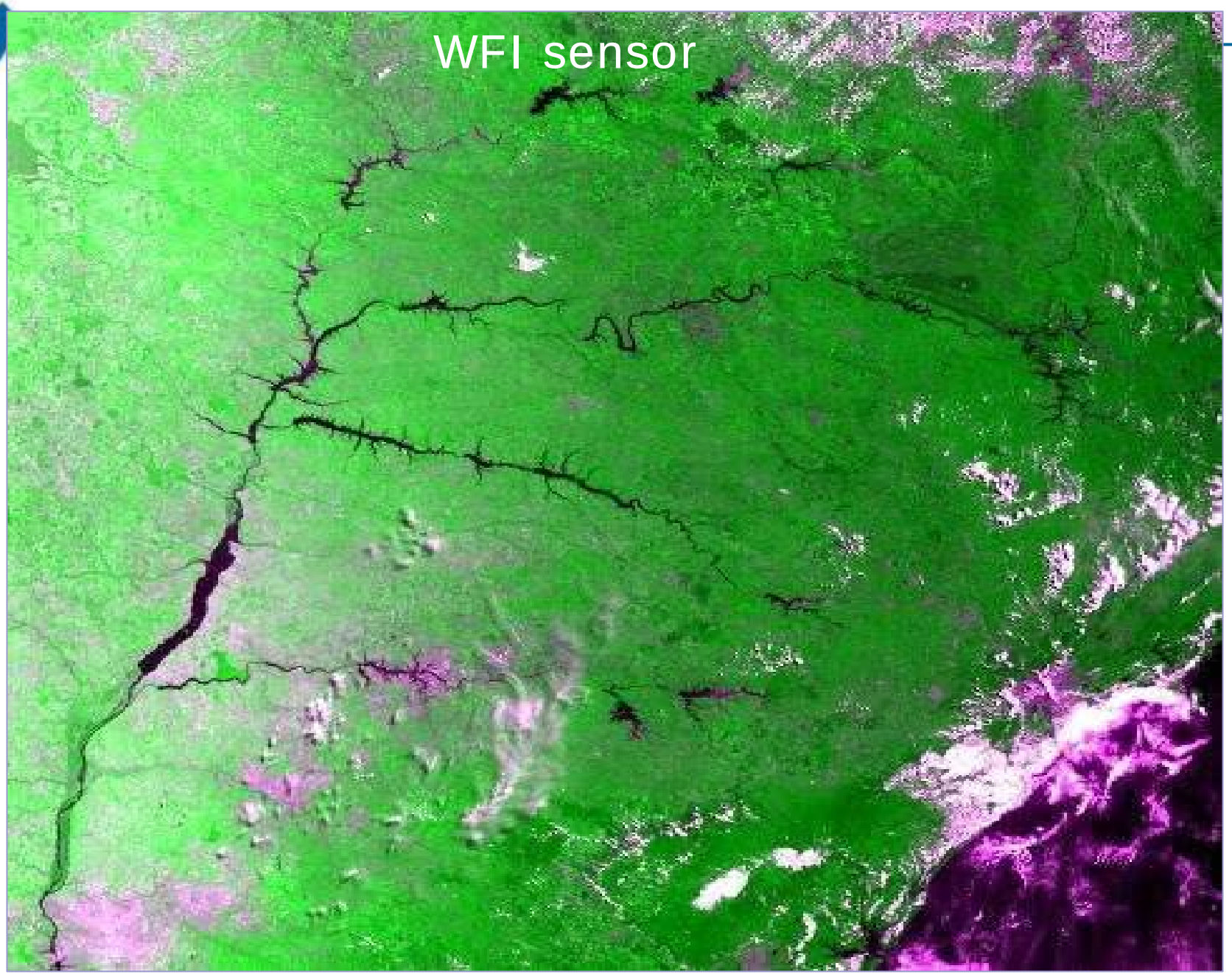
CBERS-2

CBERS-2 Launch (21 October 2003)

CBERS 1,2 Sensor Configuration

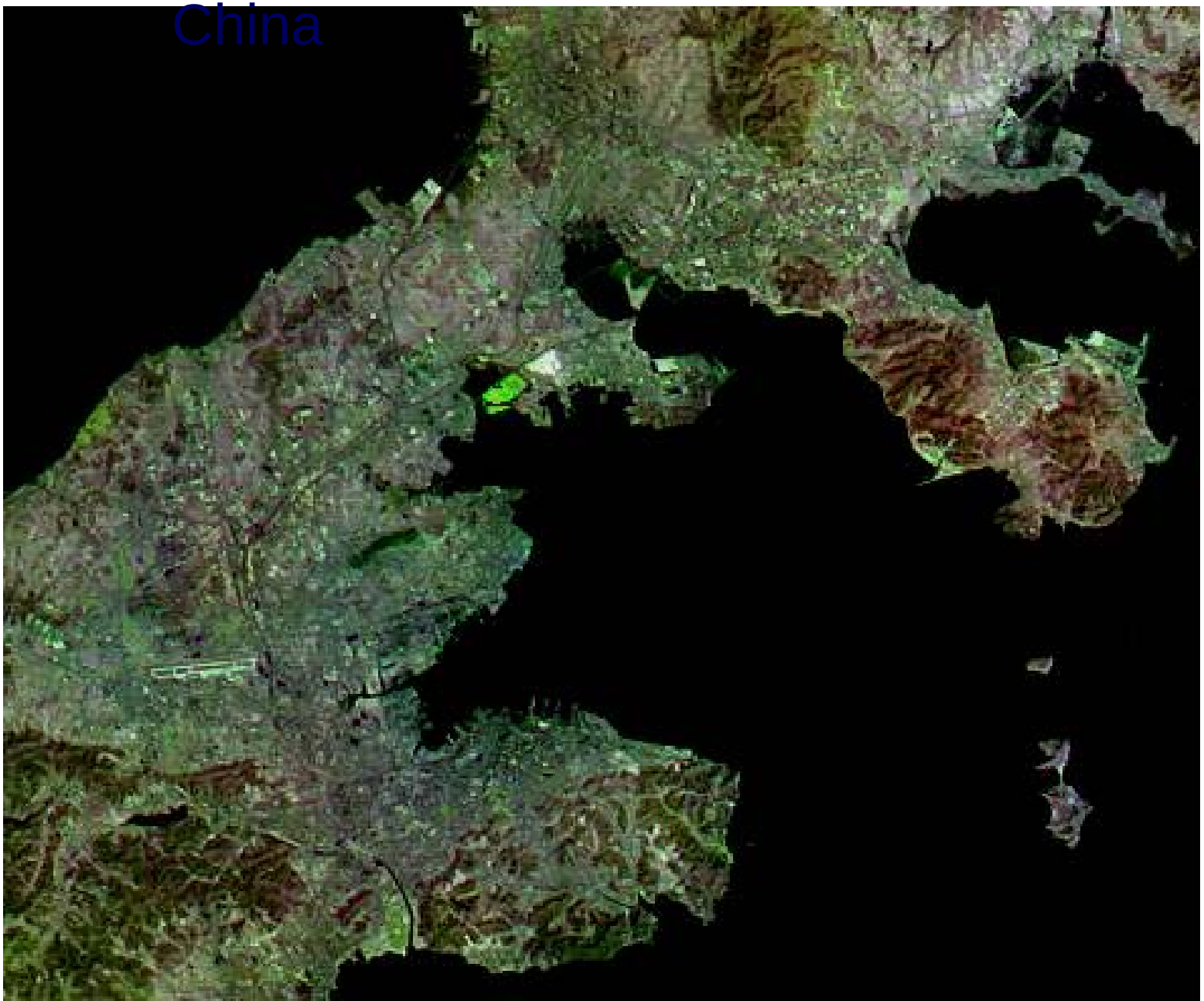


WFI sensor

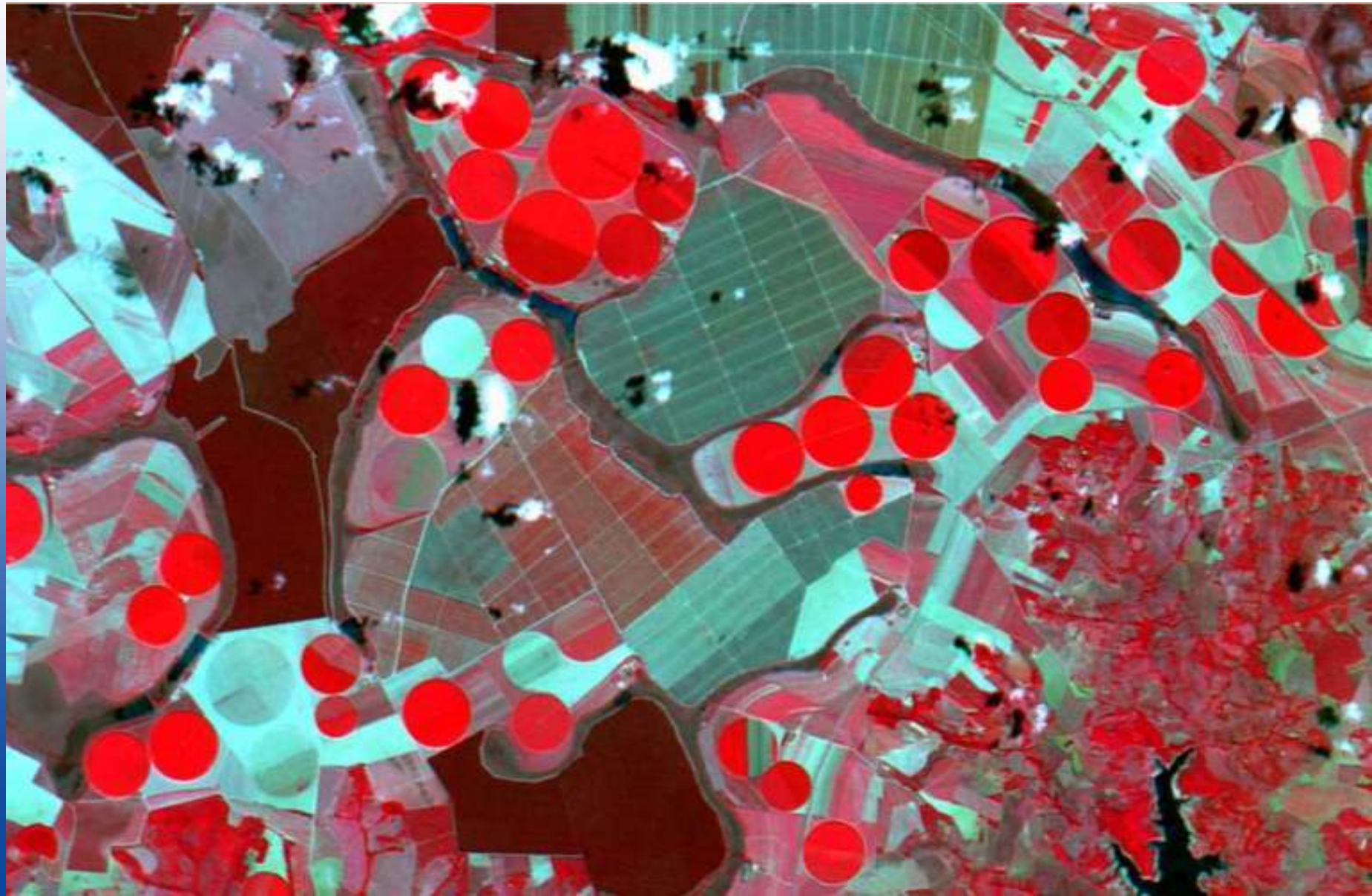


CBERS2-WFI – 157/124, 18/01/2004, São

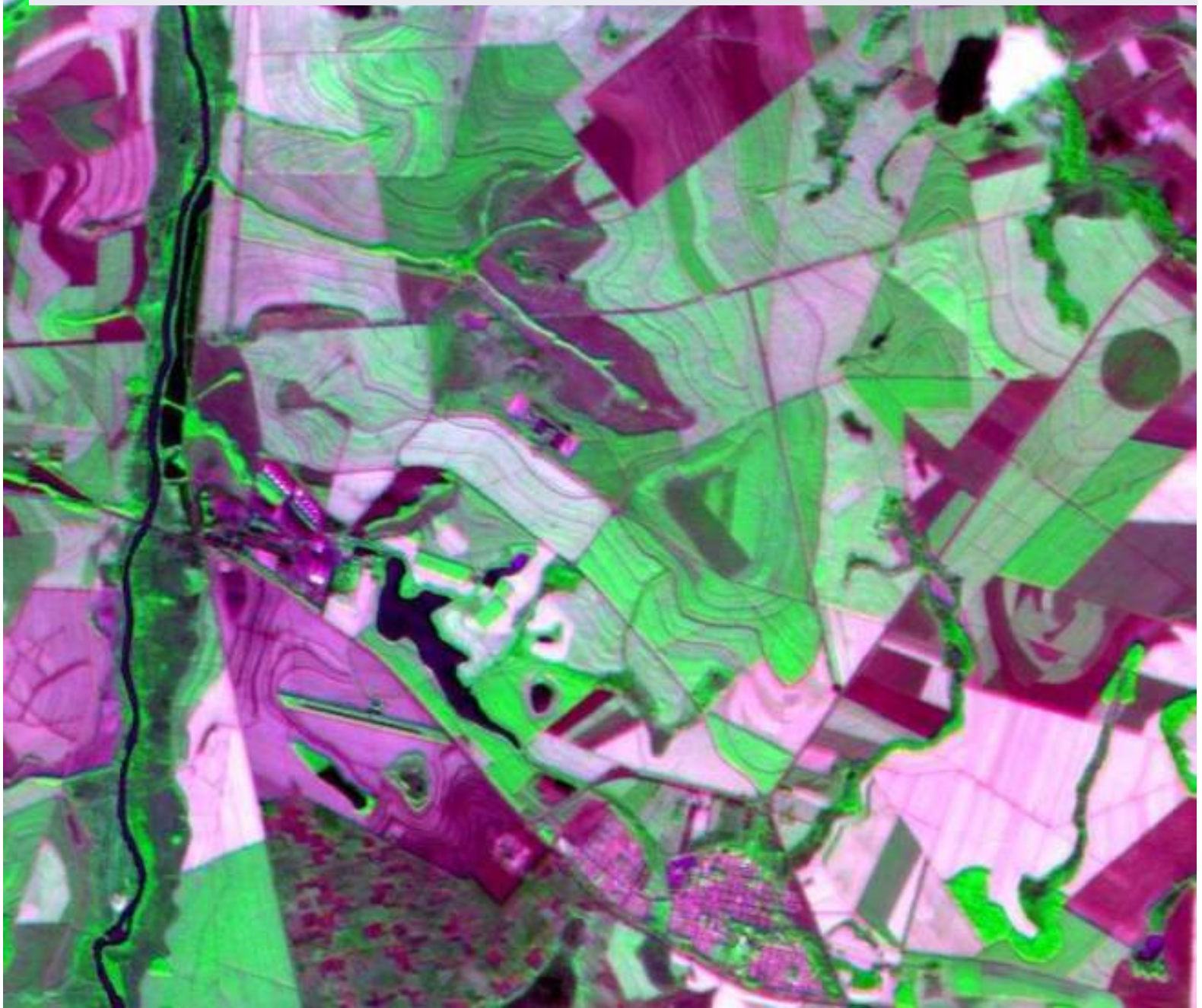
CBERS-1 IRMSS DaLian Bay , China



CBERS-2 CCD, Minas Gerais, Brazil

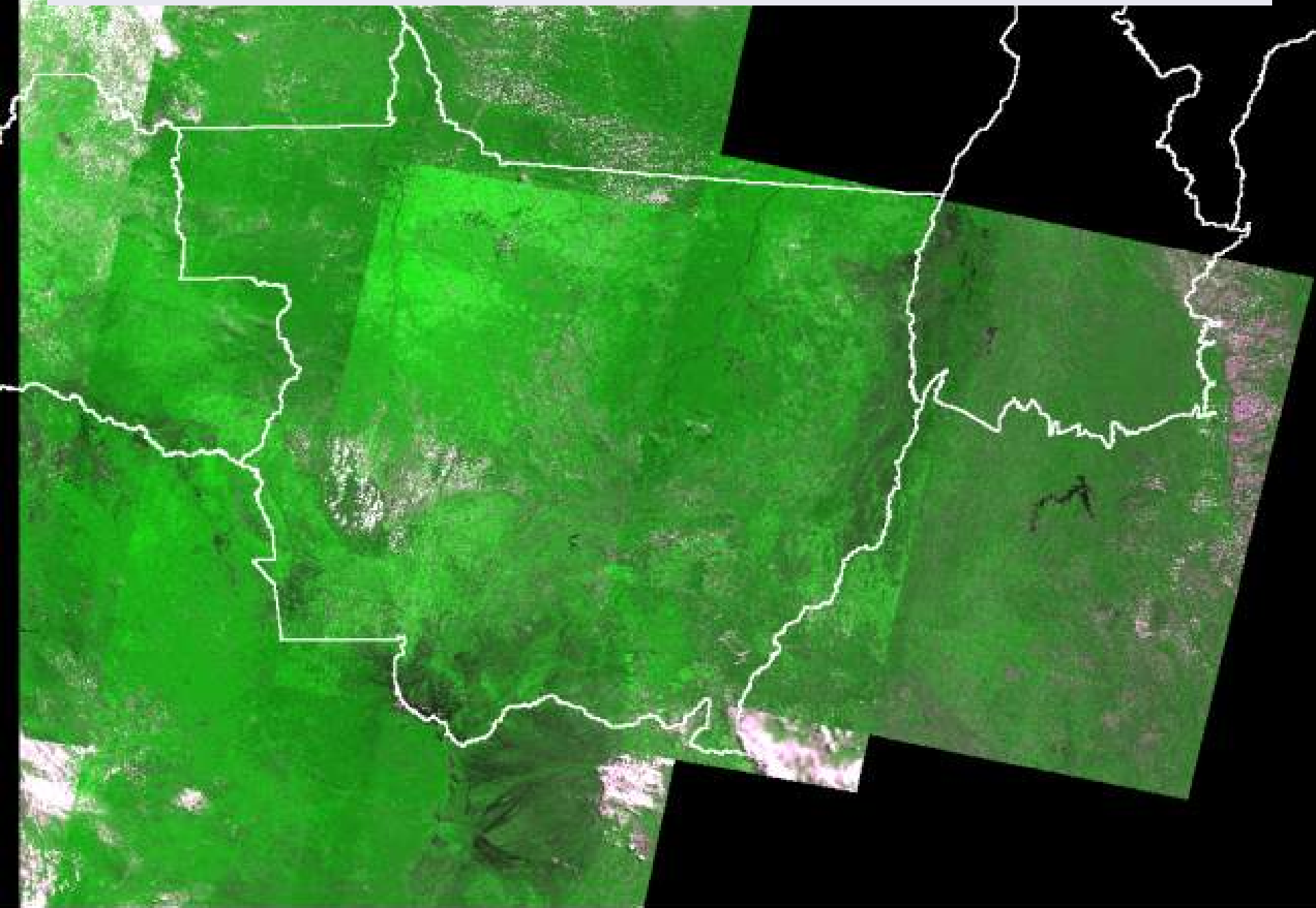


CBERS-2 CCD, Pradópolis, Brazil, Nov 200



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)

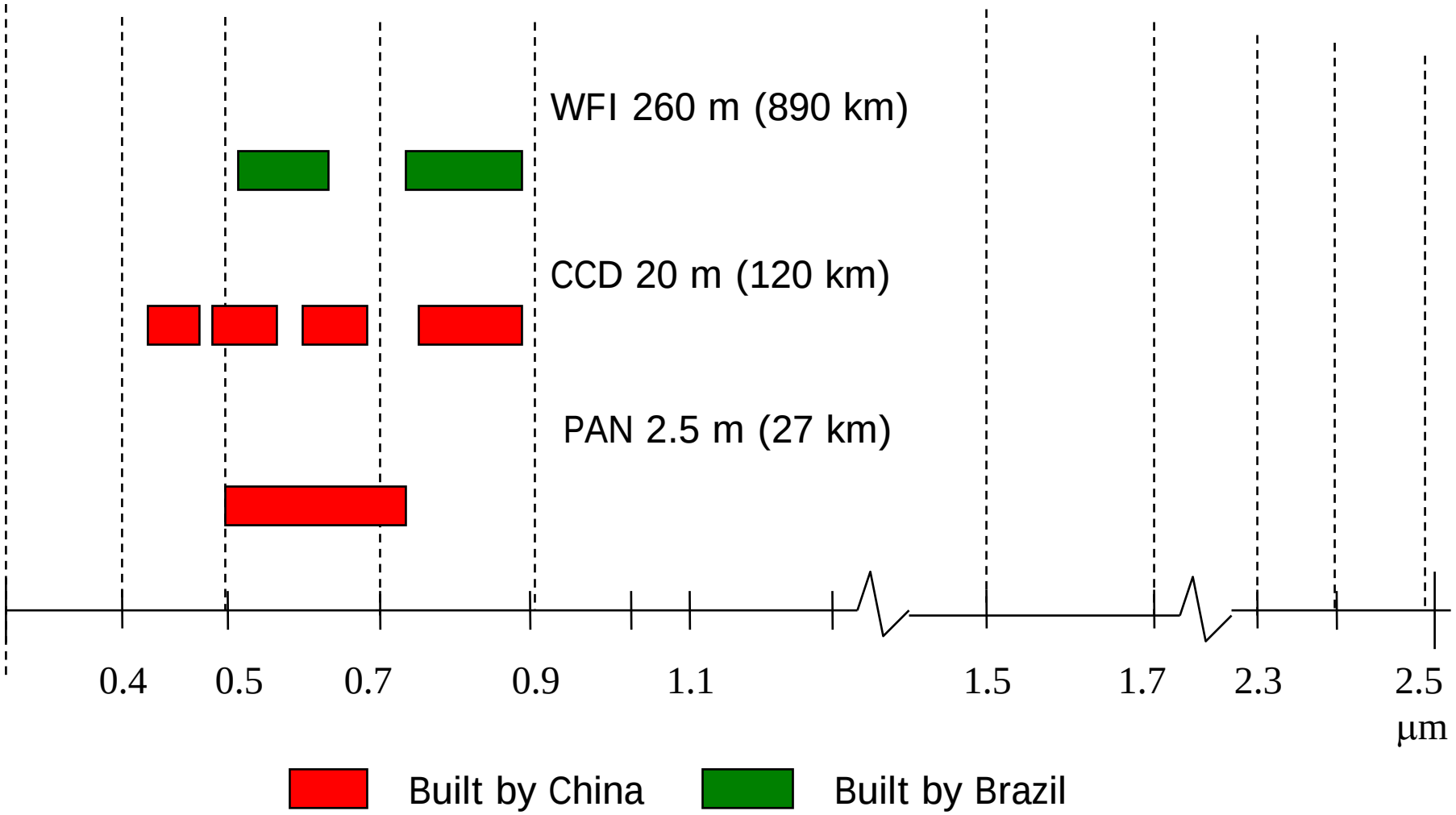
Integration of CBERS-2B in INPE (2006-2007)

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



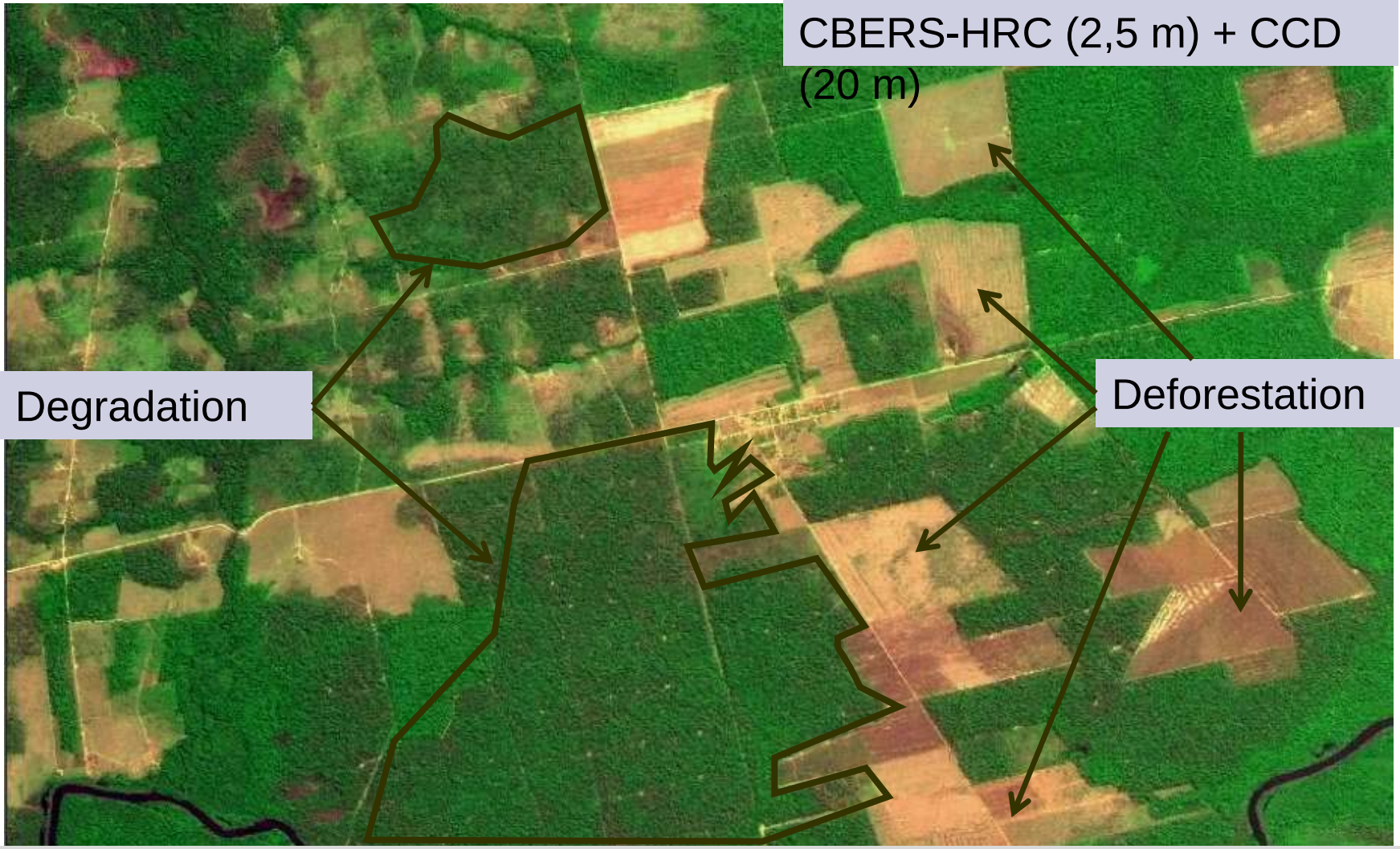
CBERS-2B

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

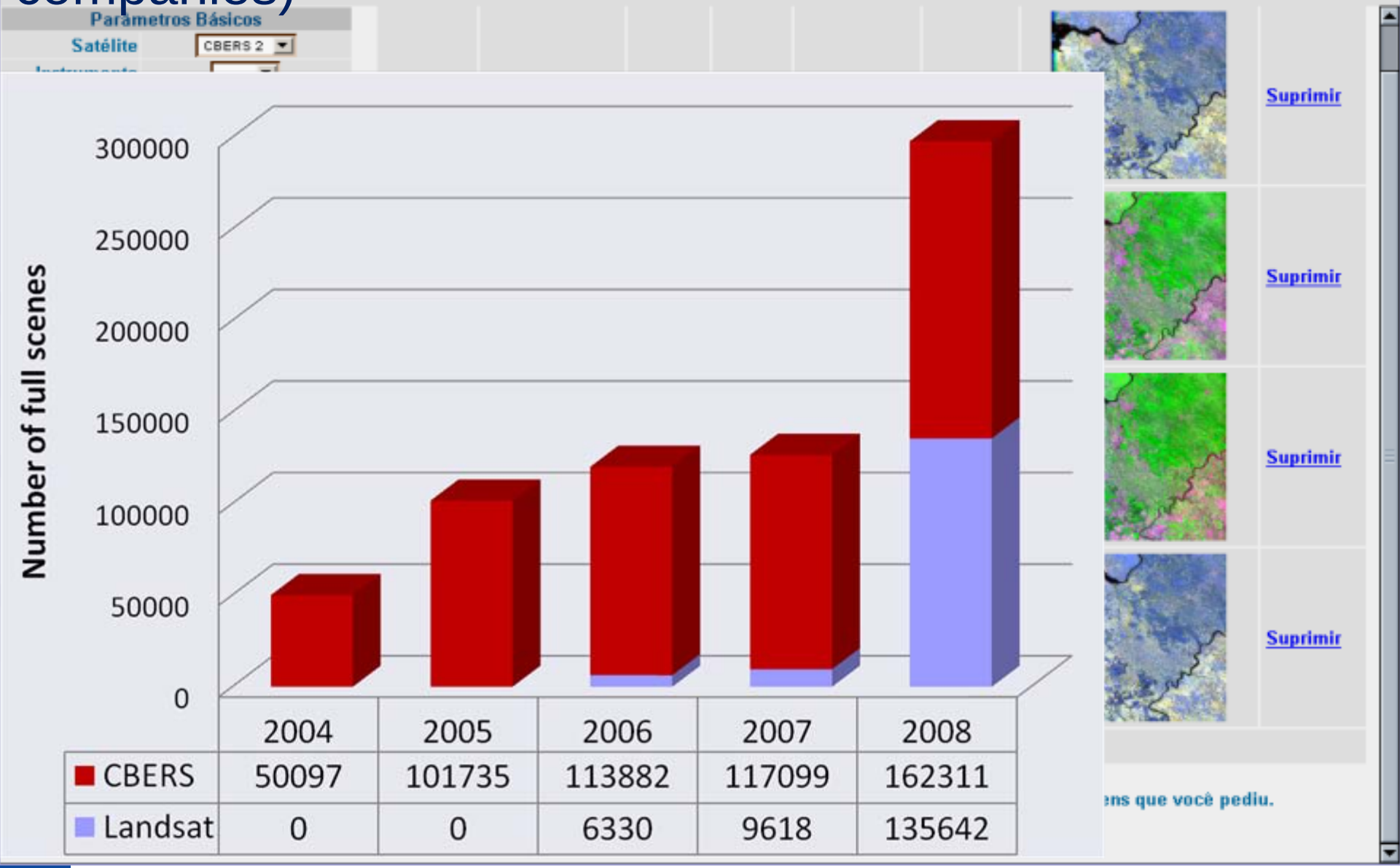
CBERS-2B – Forest Degradation



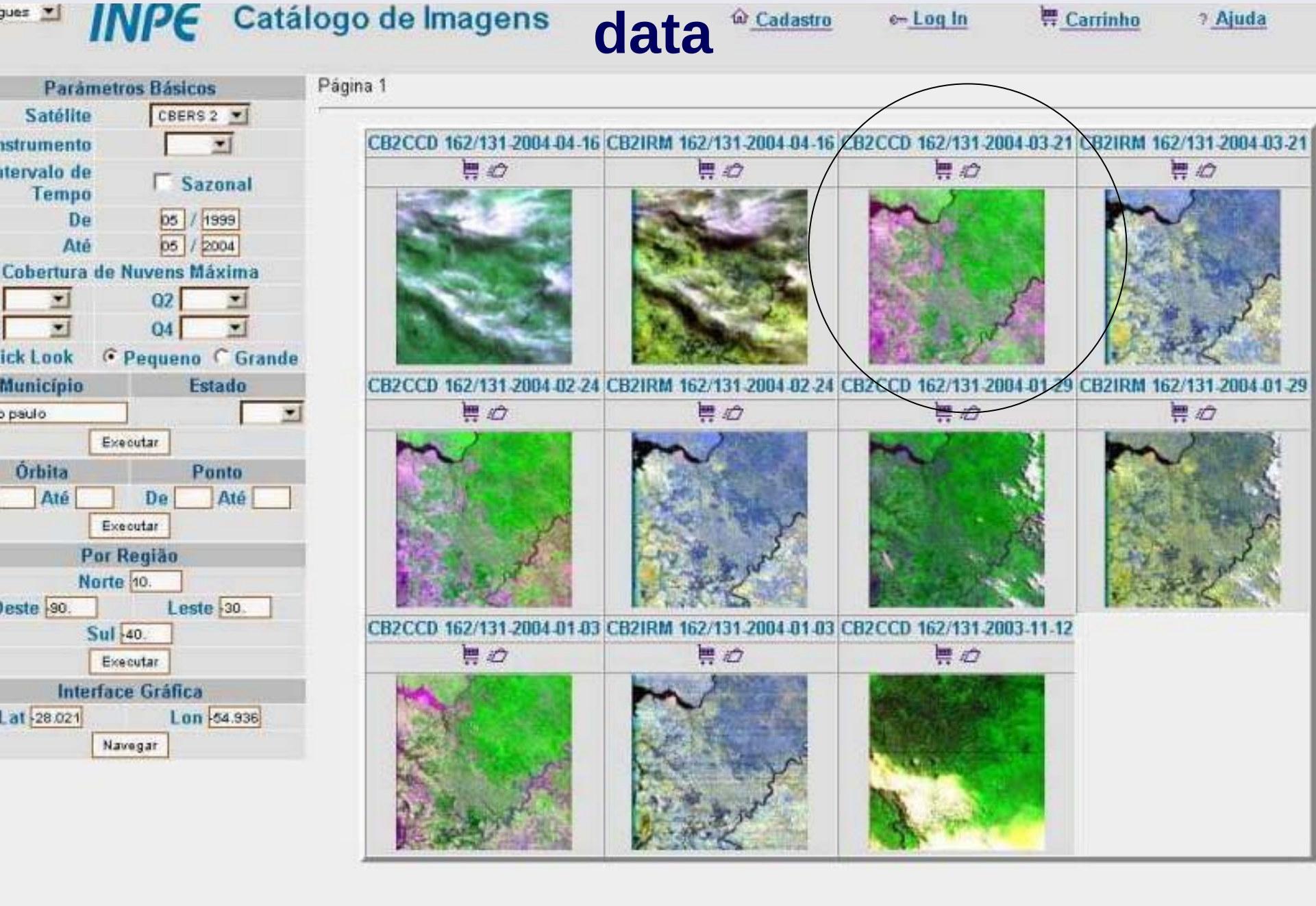
CBERS-2B HRC allows better detection of forest degradation (region of Marcelandia, Mato Grosso, Brazil)

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

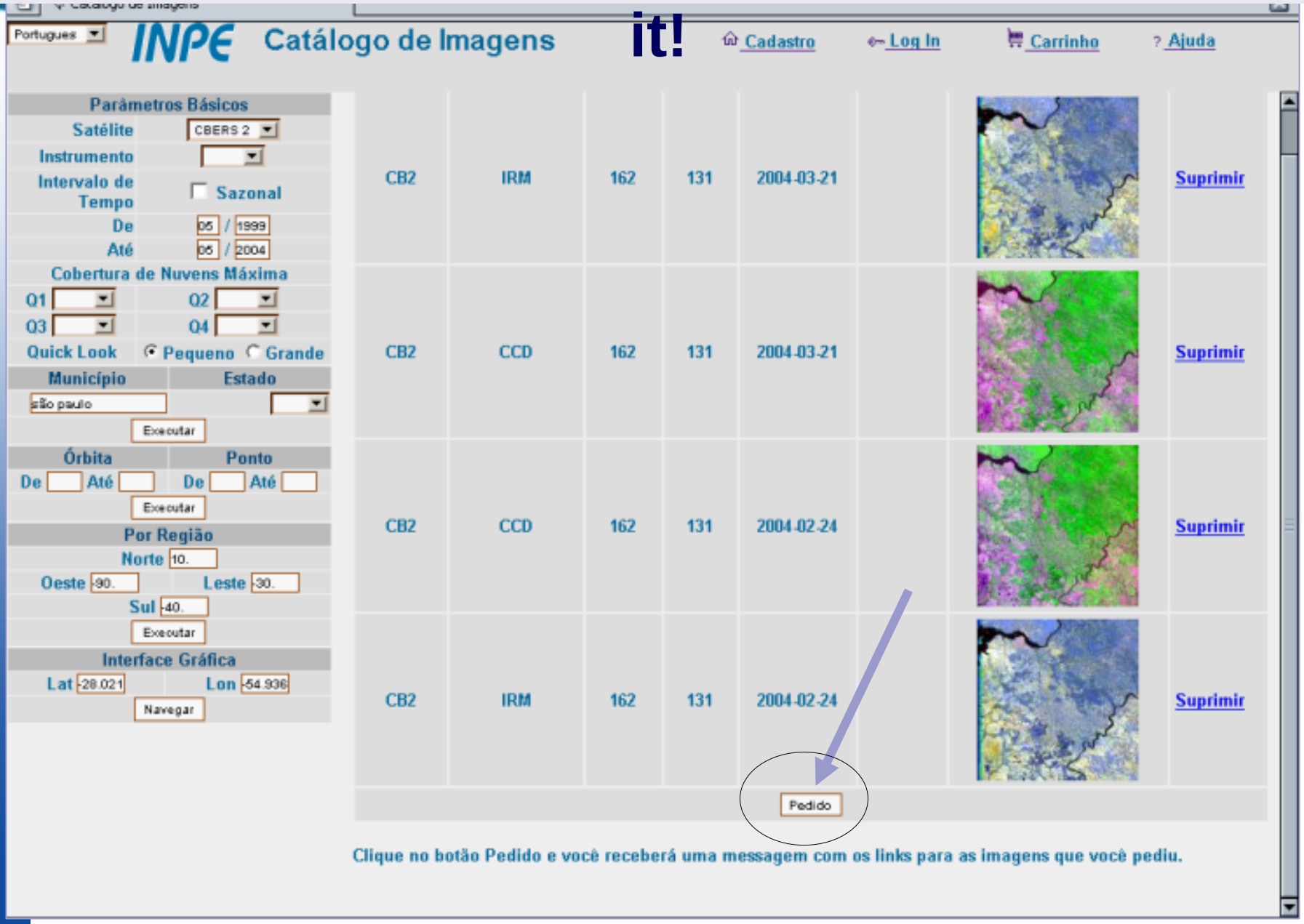
INPE Image Distribution: CBERS and LANDSAT (2004-2008) 16,000 User institutions (51% are private companies)



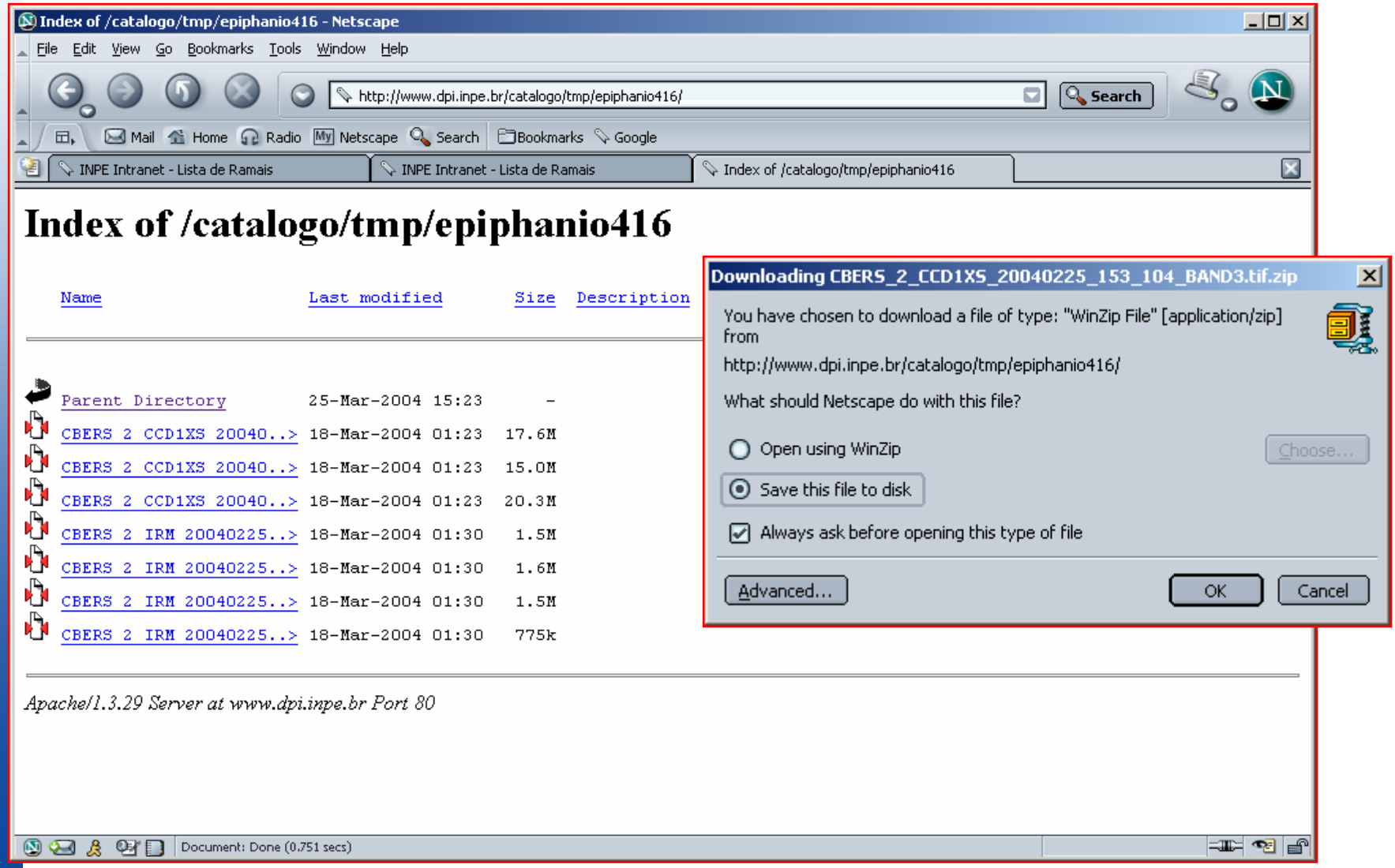
CBERS Image Catalogue (Internet): access to all data



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

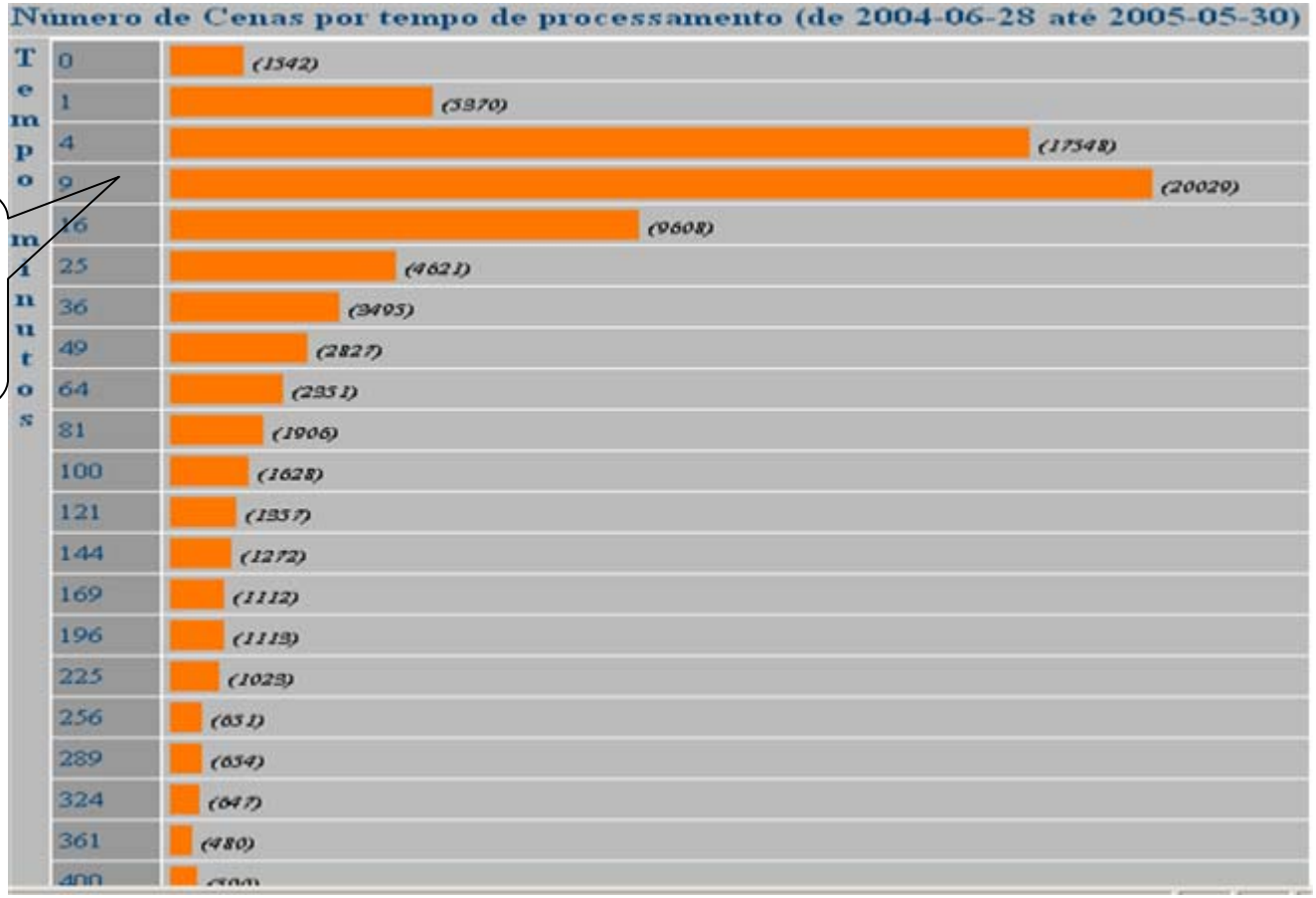


FTP area for User

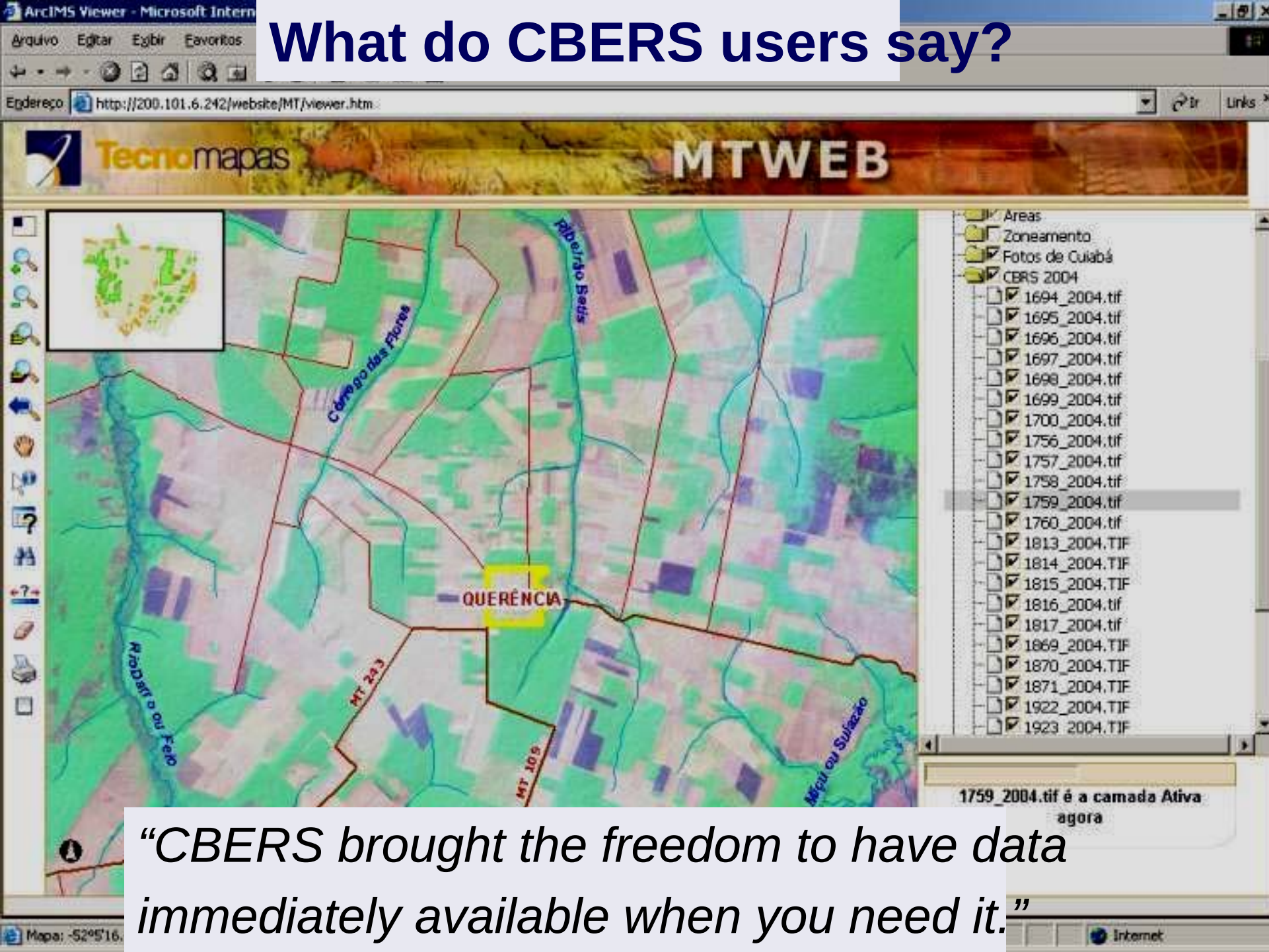


Time to respond to a user request

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

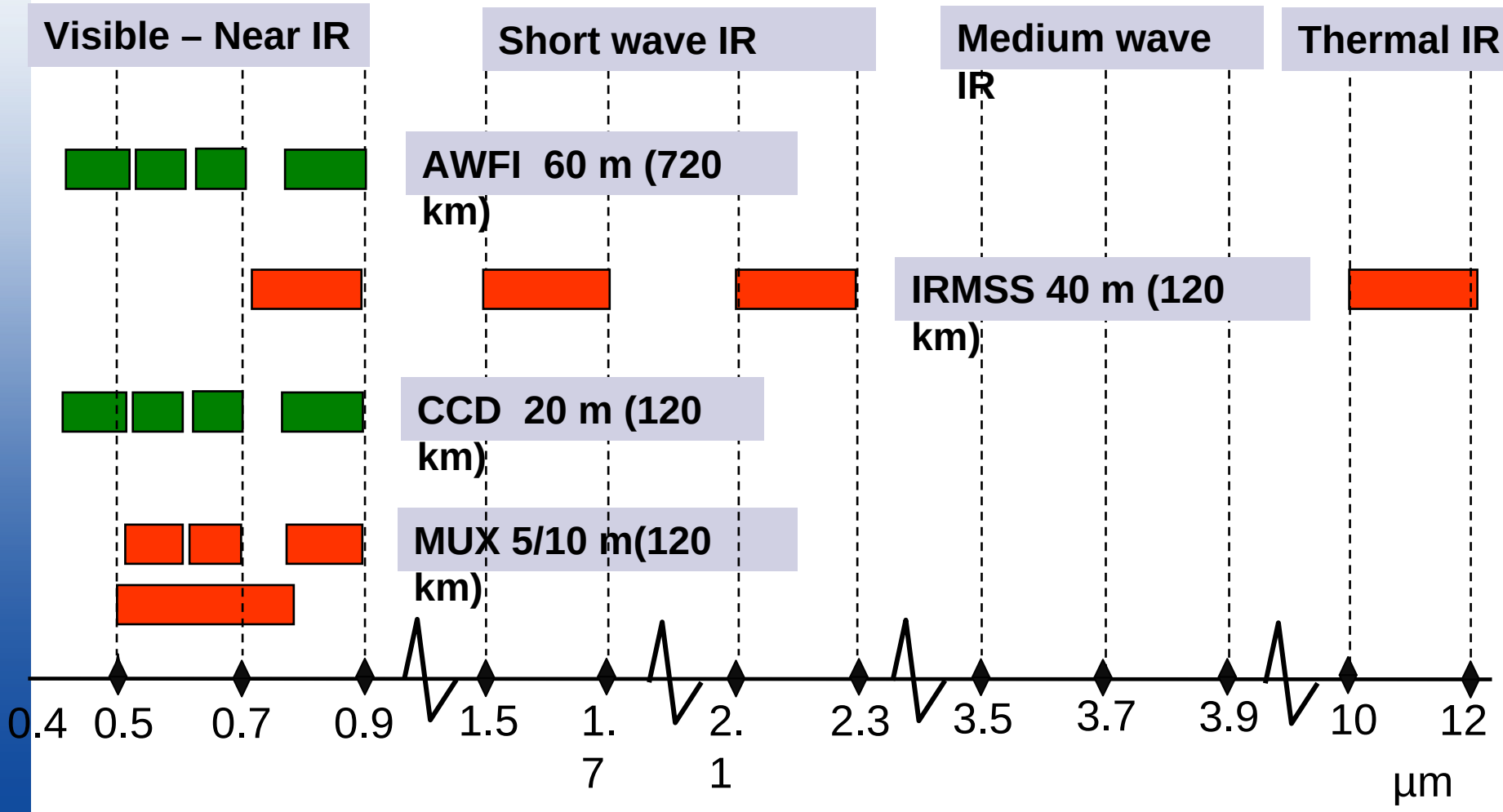
Creates jobs by reducing cost of data buys

Increases quality by adding data previously unavailable

CBERS-3,4

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

CBERS 3 – 4 Sensors



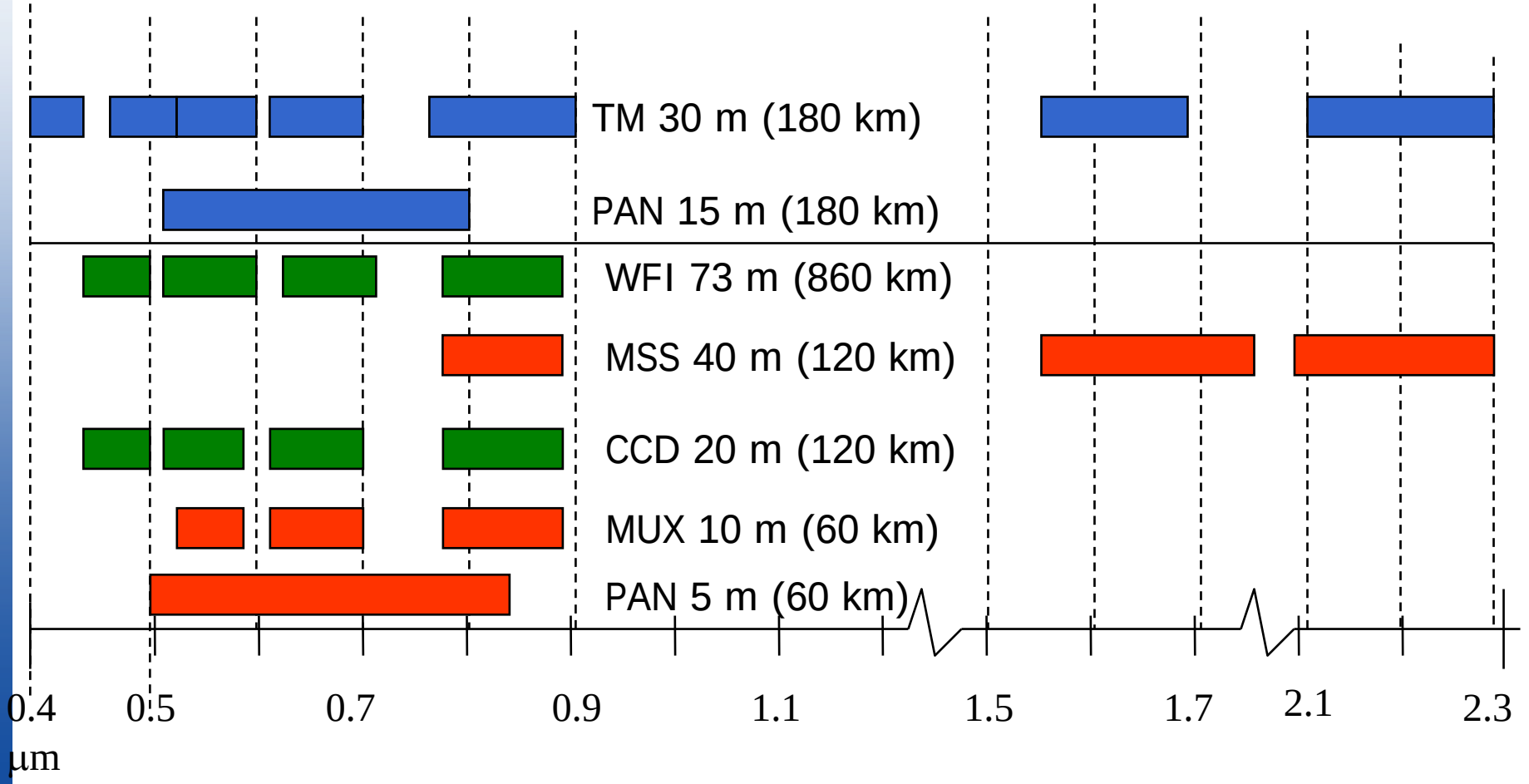
CBERS-3,4 Sensor Configuration: PANMUX, CCD

Sensor	Bands (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

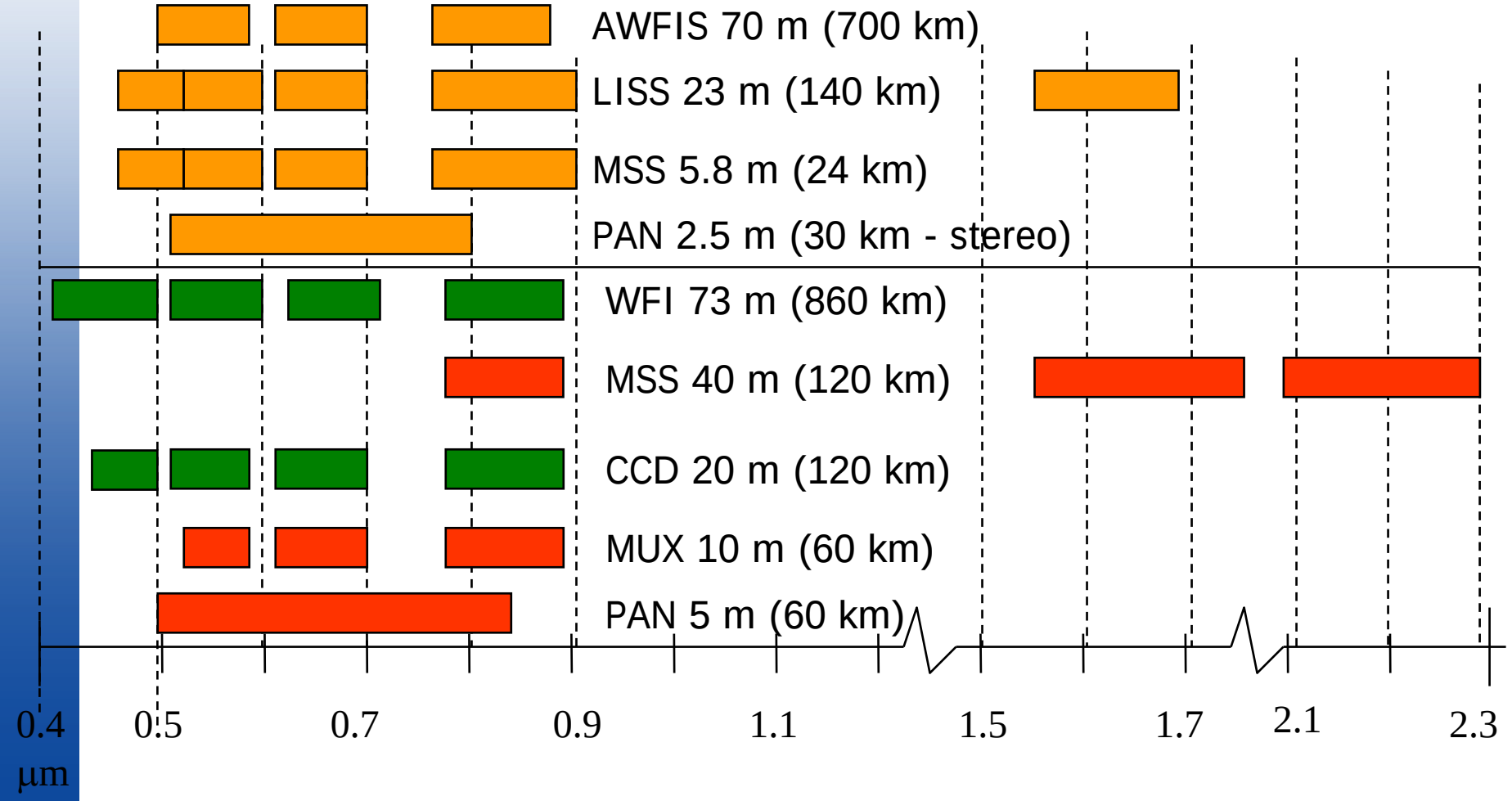
CBERS-3,4 Sensor Configuration: IRMSS, AWFI

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	**0.45 – 0.52**	840	70
(10 bits)	**0.52 – 0.59**	840	70
	0.63 – 0.69	840	70
	0.77 – 0.89	840	70

CBERS 3/4 x LANDSAT-7

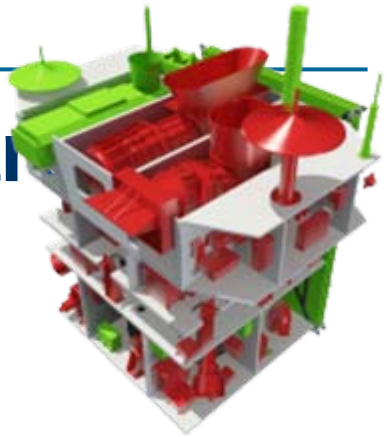


CBERS 3/4 x IRS-P6 e IRS-P5



CBERS-3 Structural Model Tests (2008-2009)

CBERS-3,4 Subsystem Work Shar



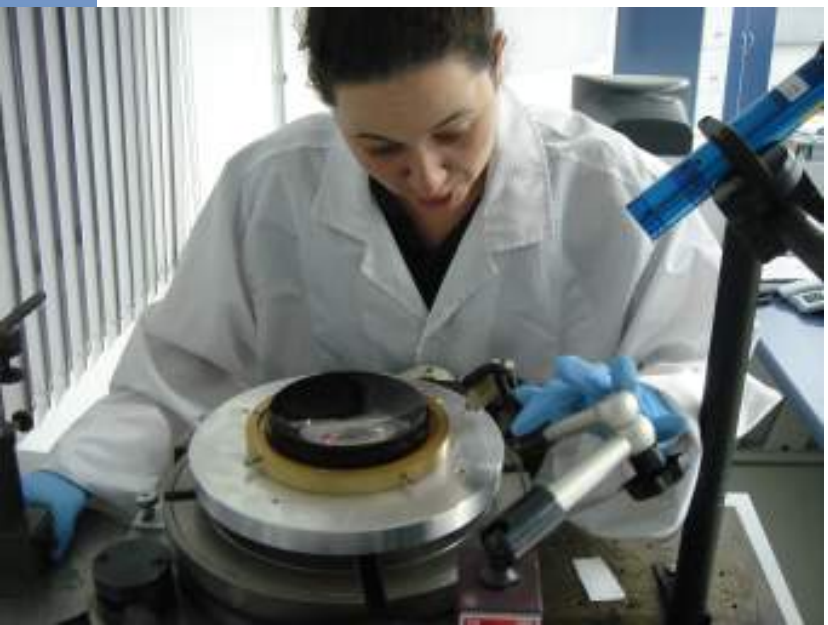
China	Brazil
TCS - Thermal Control	Structure
AOCS - Attitude Control *	EPSS - Electrical Power Supply **
OBDH - Onboard Data Handling *	TTCS – Service Telecommunications **
SCS - System Circuitry	MUX camera (20m)
PAN camera (5m)	WFI-2 camera (73m)
IRS camera (40m)	DDR – Data Recorder
SEM – Space Environment	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, electronical, 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 30^0N and 30^0S


Thank you!