La Plata Basin Experimental Campaign PLATEX and Super Site

Implementation plan

Buenos Aires 28-30 March 2007

Why do we need an intensive field campaign?

To seek answers to scientific questions and understand processes that need special measurements not made operationally and too costly to be made routinely.

LPB Platex and Super Site Questions

- *Why are the LPB MCS so remarkable in a world wide perspective concerning their physical properties detected by remote sensing?*
- *What is the role of biomass burning products in the evolution of MCS in the LPB?*
- *What is the role of land use and land cover change on the rainfall patterns in the LPB?*

Why are the LPB MCS so remarkable in a world wide perspective concerning their physical properties detected by remote sensing?

- What is the role of topography and land use on MCS lifecycle?
- What is the typical MCS for the three different types of low level jet: CJE NCJE and LLJA
- What are the constraints on MCS predictability?
- What are the typical cloud microphysical processes involved in local convection, mesoscale convective systems and cold fronts?
- What are the rain volumes associated with the MCS in the LPB?

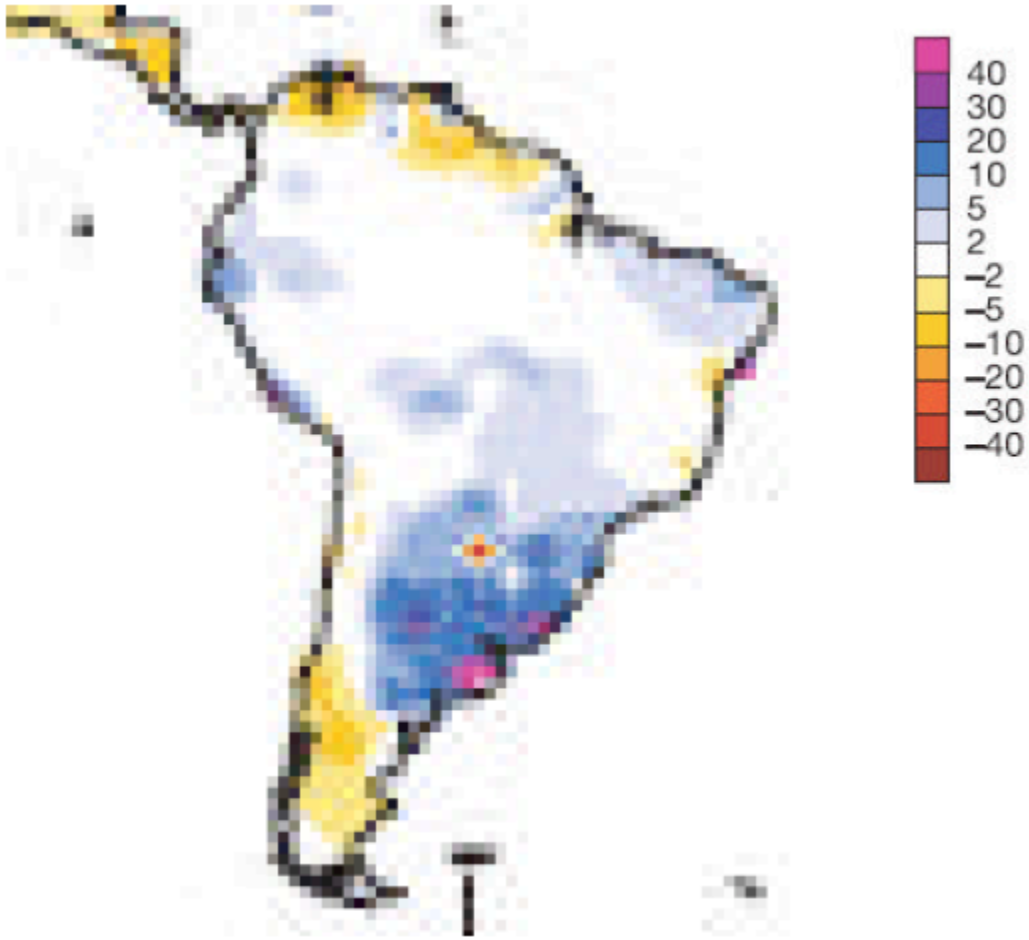
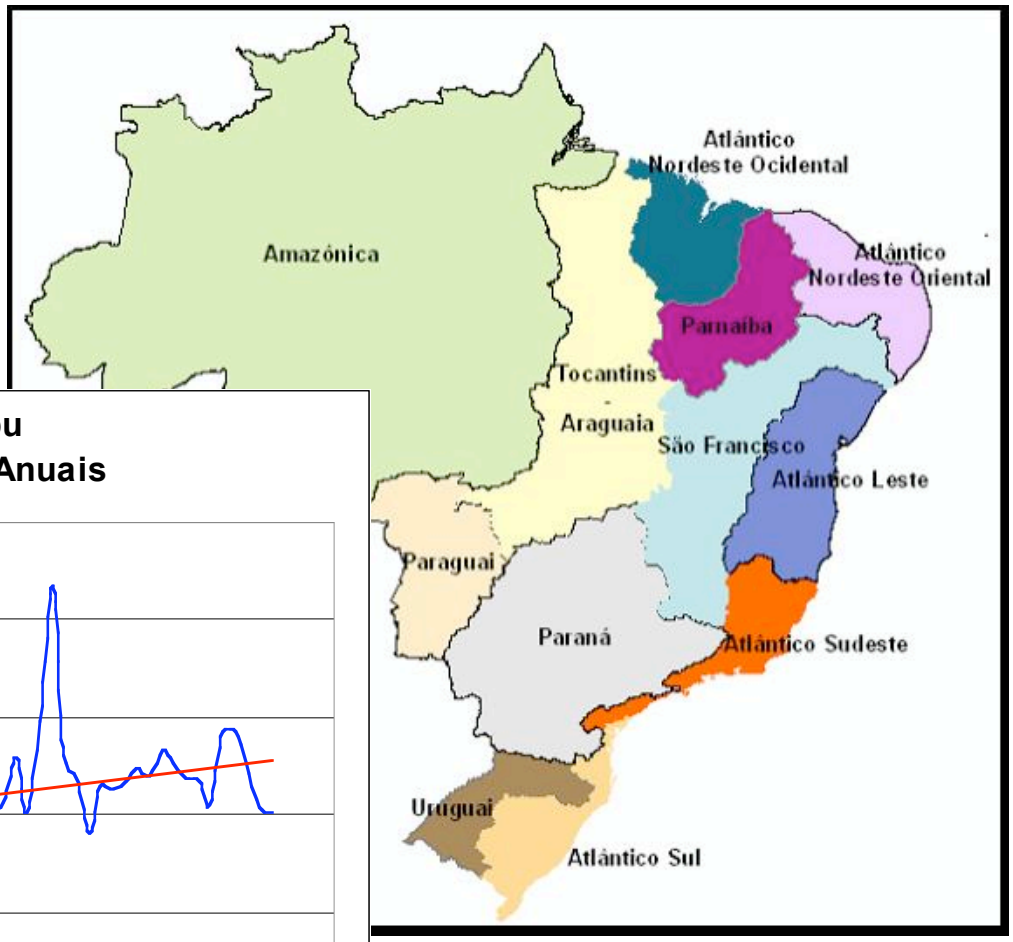
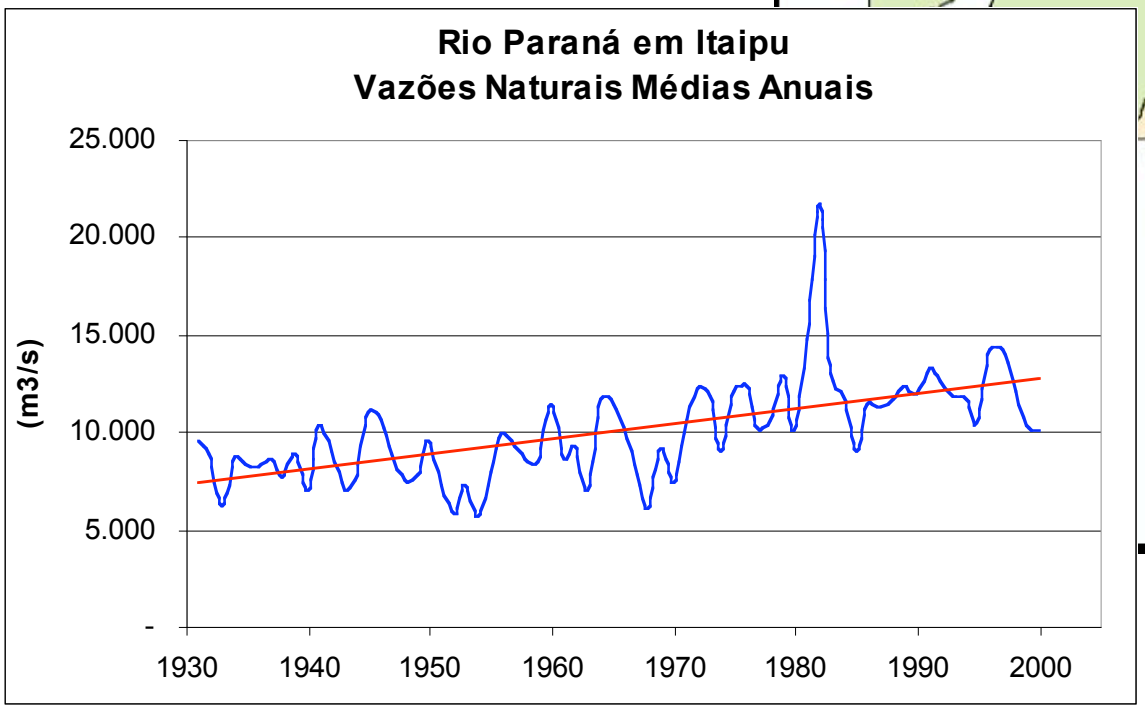


***Figura 5**. Mudança relativa de vazões durante o Século XX na América do Sul. Valores são em percentagem (%) para o período 1971-98 em relação ao 1900-70. Escala de cor aparece na direita (Relatório 1-Marengo 2007).*

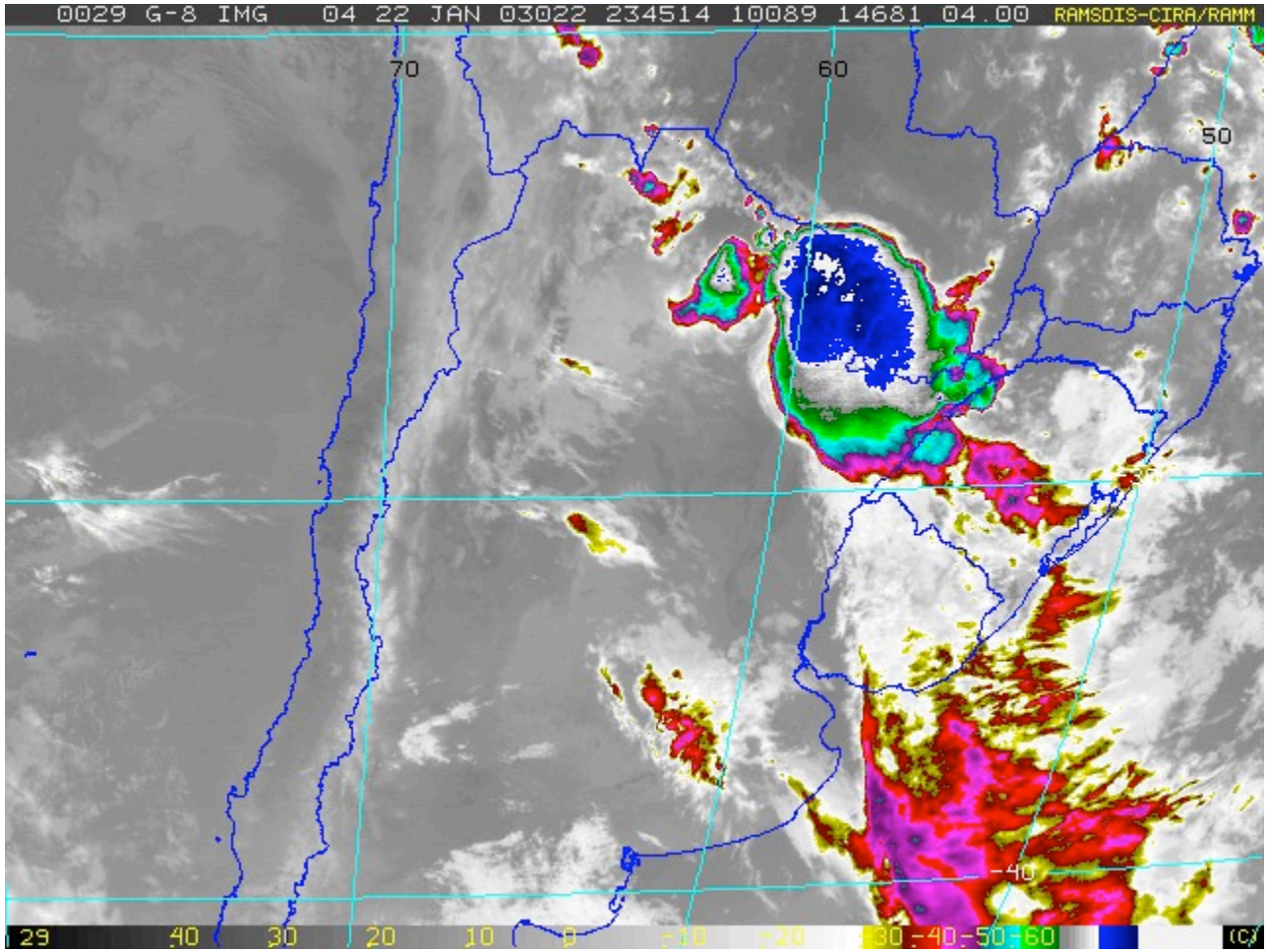
BACIA DO RIO PARANÁ

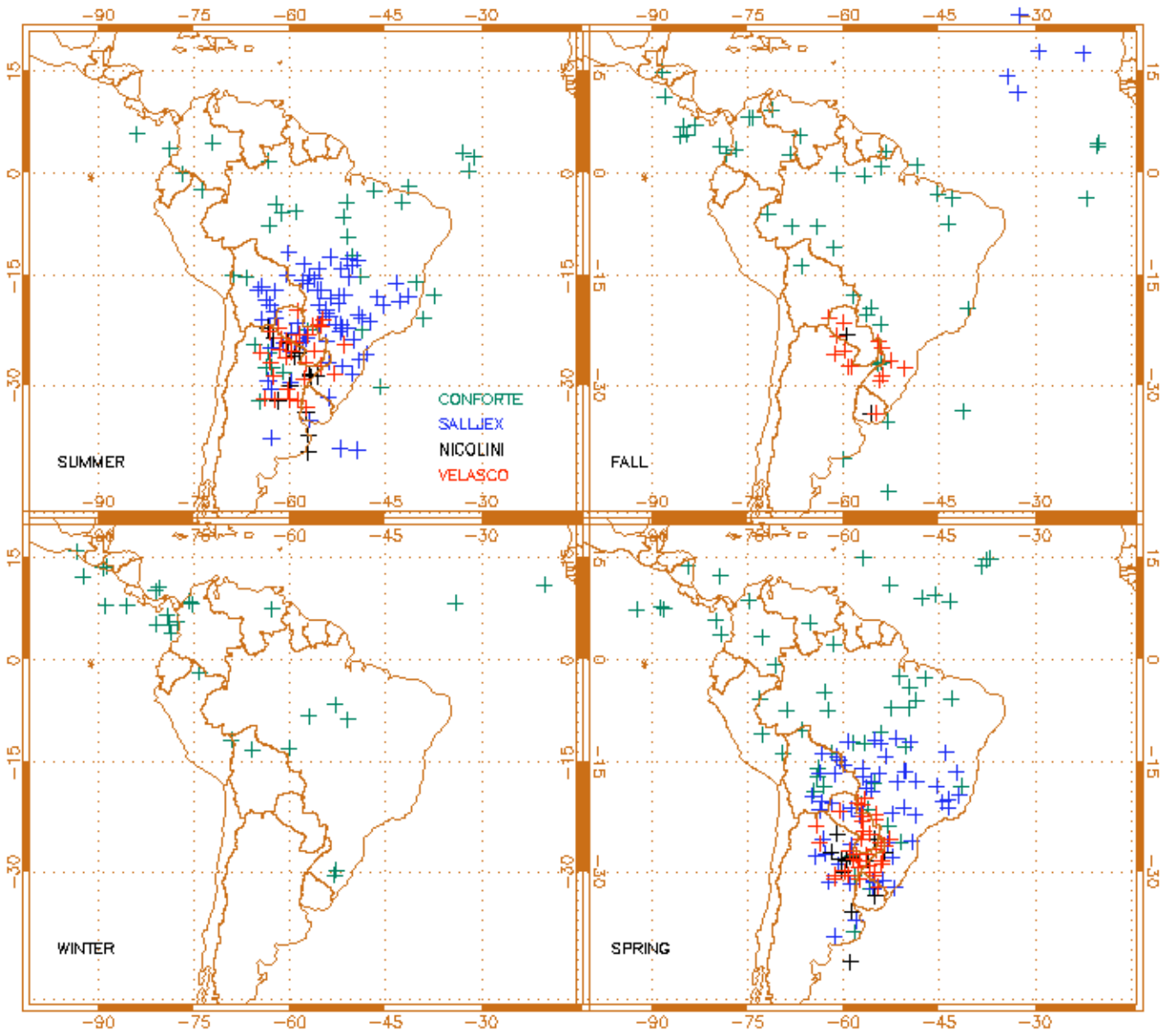




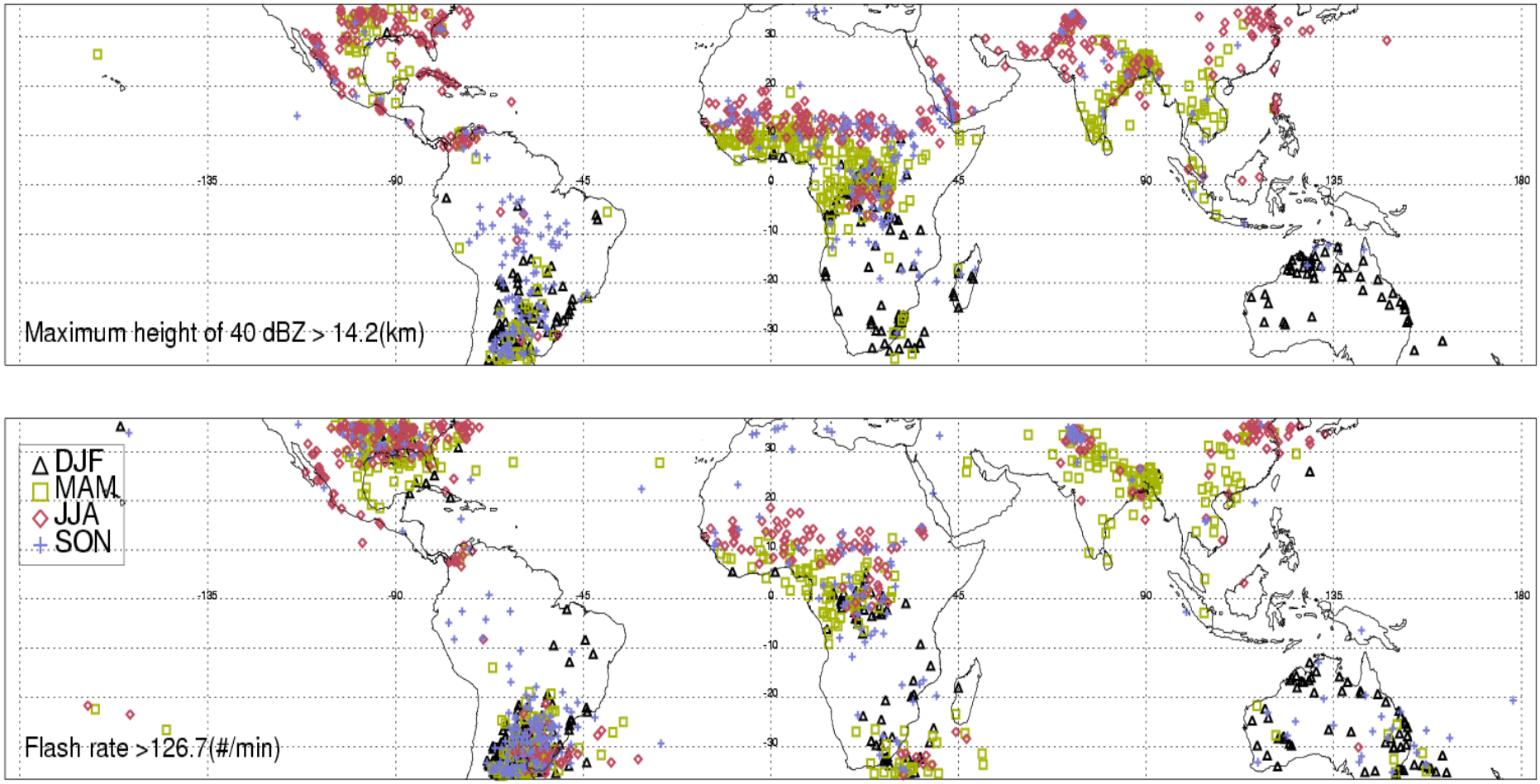
Gondin, 2007

Mesoscale Convective System




CONFORTE
SALLJEX
NICOLINI
VELASCO
SUMMER
FALL
WINTER
SPRING

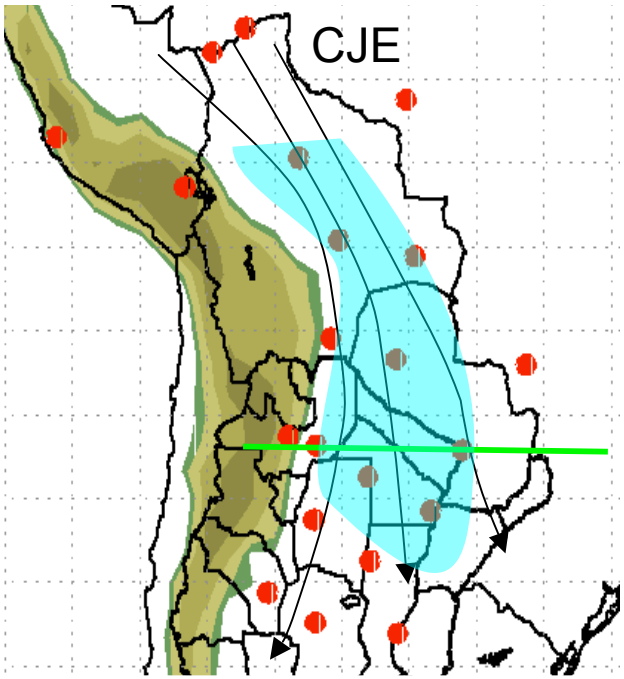
Tempestades Severas Monitoradas pelo satélite TRMM



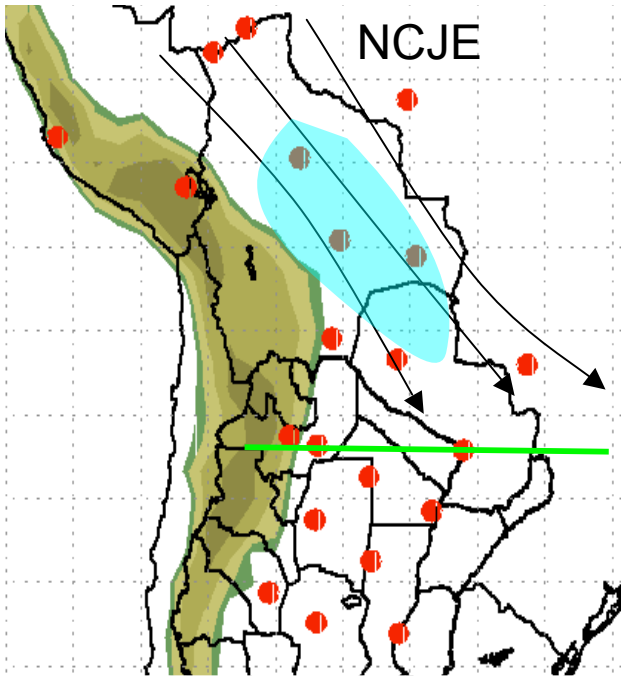
(Zipser, 2004)

Low Level Jets

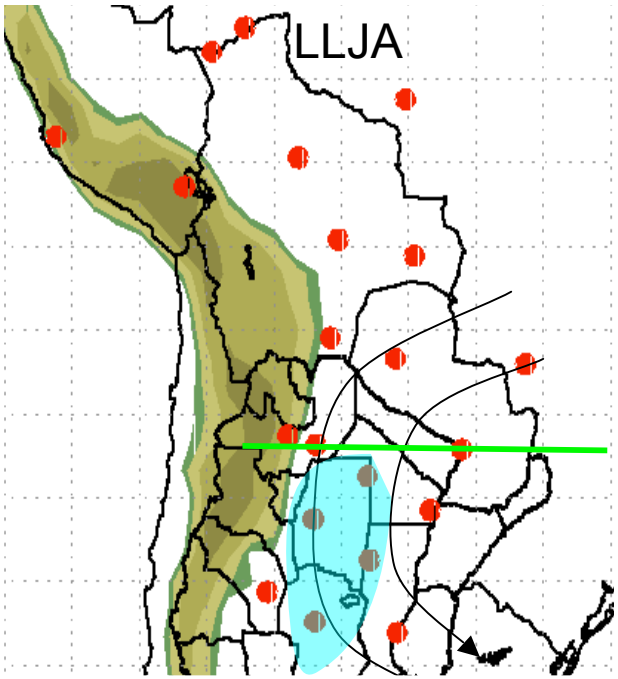
Chaco Jet Events



Non Chaco Jet Events



Low Level Jet i Argentina



Shaded blue indicates area where wind speed in > 12 m/s

Green line indicates latitude of 25S

From Salio and Nicolini (2005)

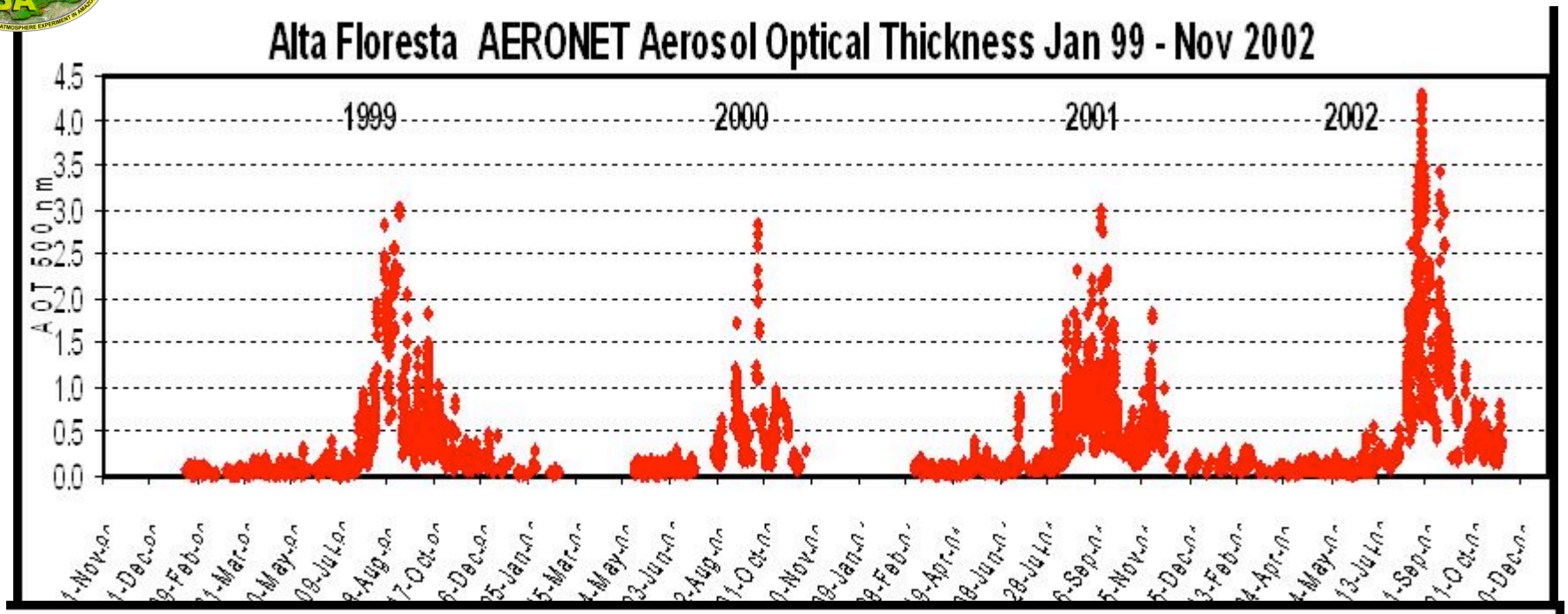
	SON	%	DJF	%	Total
CJE	69	25	56	21	125
NCJE	38	14	40	15	78
LLJA	40	15	38	14	78
NOLLJ	126	46	136	50	262

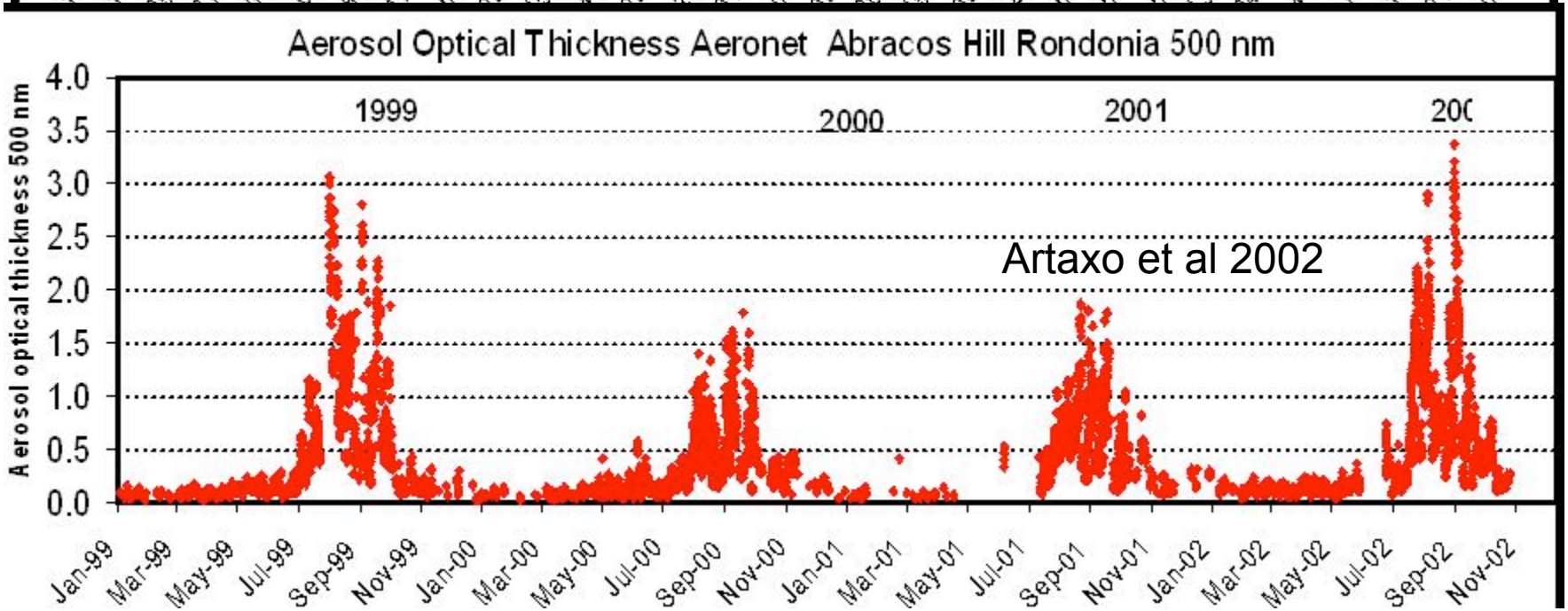
Observation period: 2000-2003

What is the role of biomass burning products in the evolution of Mesoscale Convective Systems in the LPB?

- What are the typical cloud microphysical processes involved in local convection, mesoscale convective systems and cold fronts? How aerosol contributes to the cloud processes in each case?
- What is the impact of advected aerosol on the surface heat and moisture budgets?
- What is the radiative effect in the MCS life cycle?
- Is the rain volume affected by biomass burning?

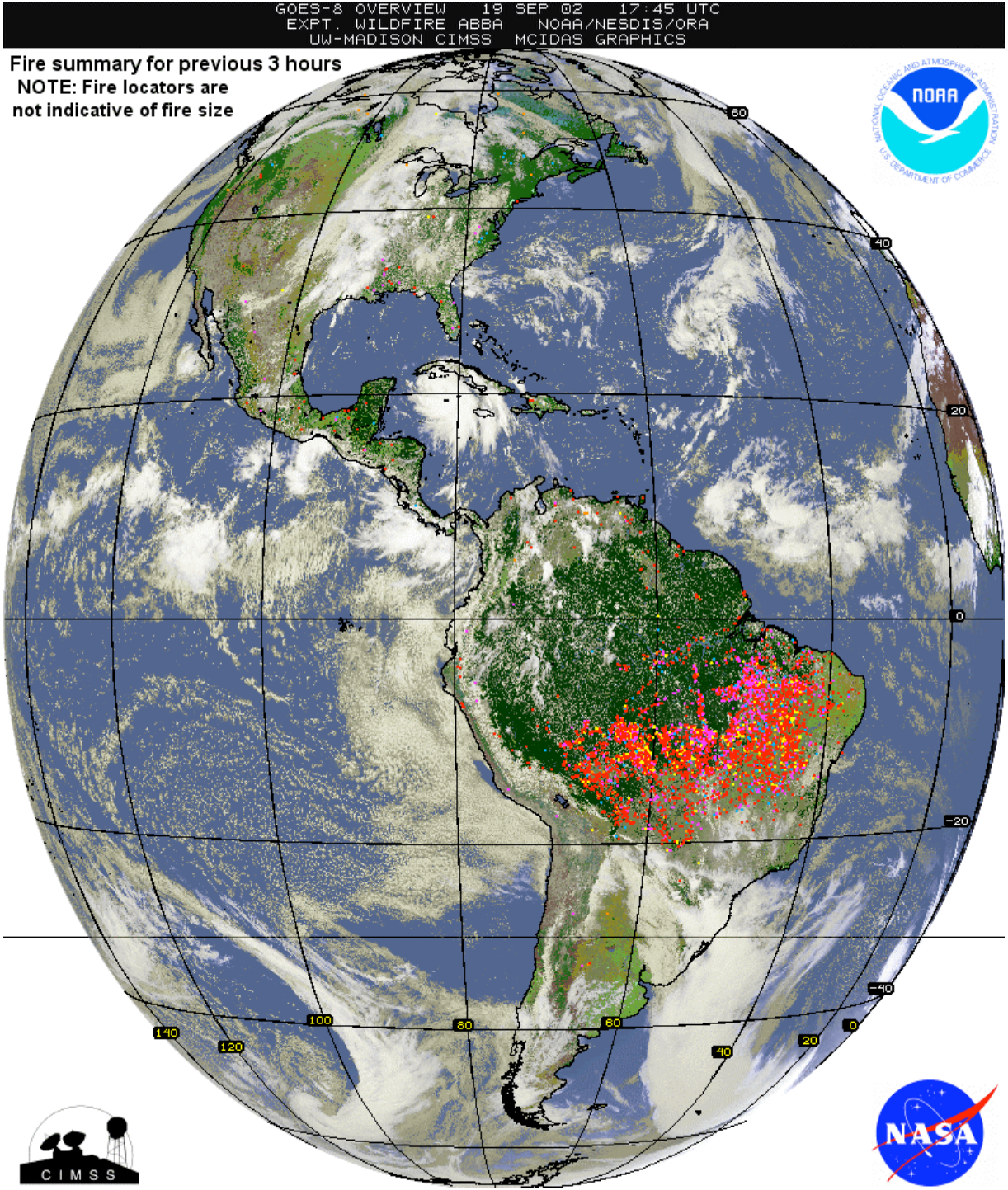
Aeronet measurements in Alta Floresta and Rondonia 1999-2002





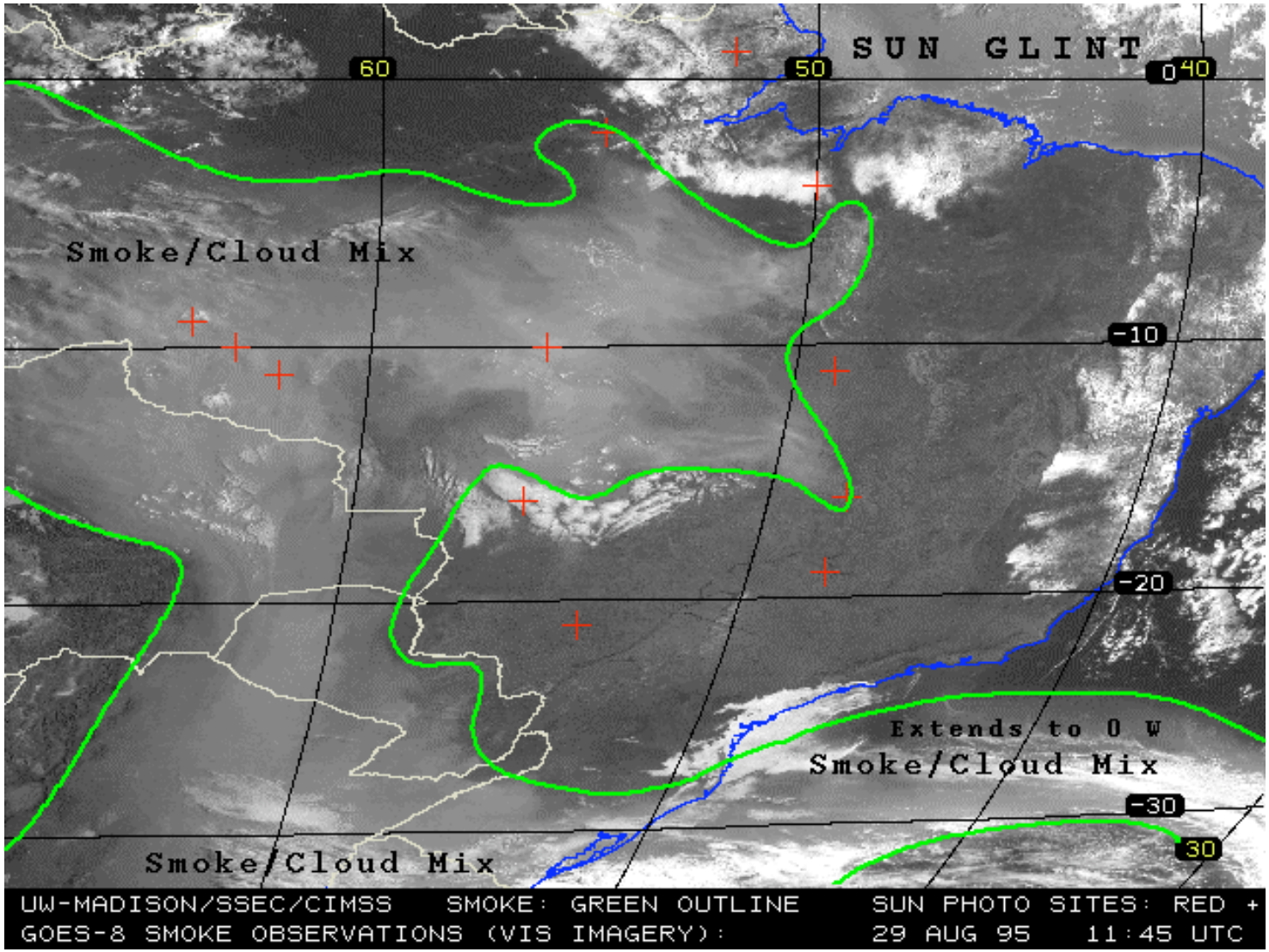
GOES-8 ABBA FIRE PRODUCT

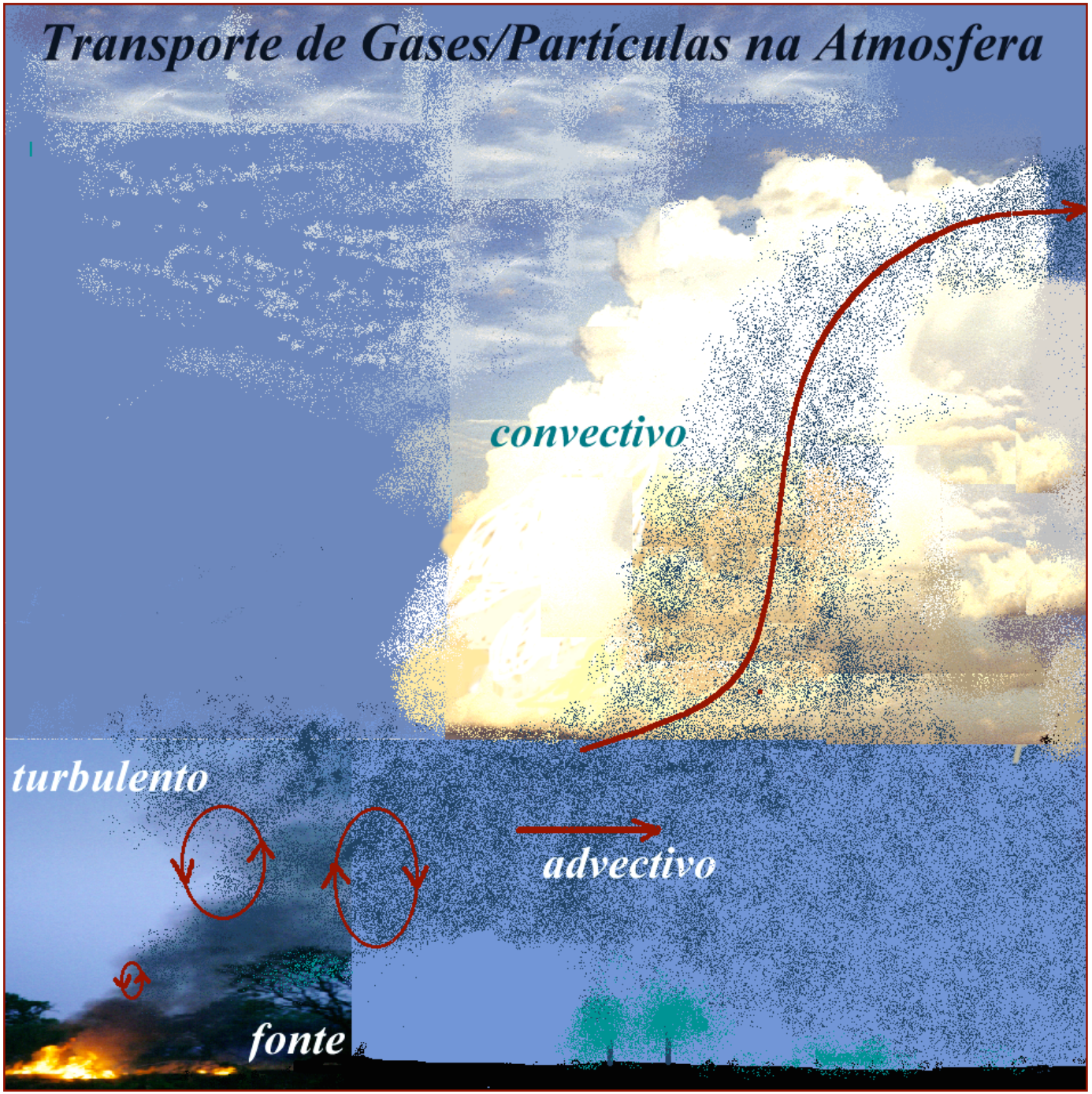
1745Z
19 SEP 2002



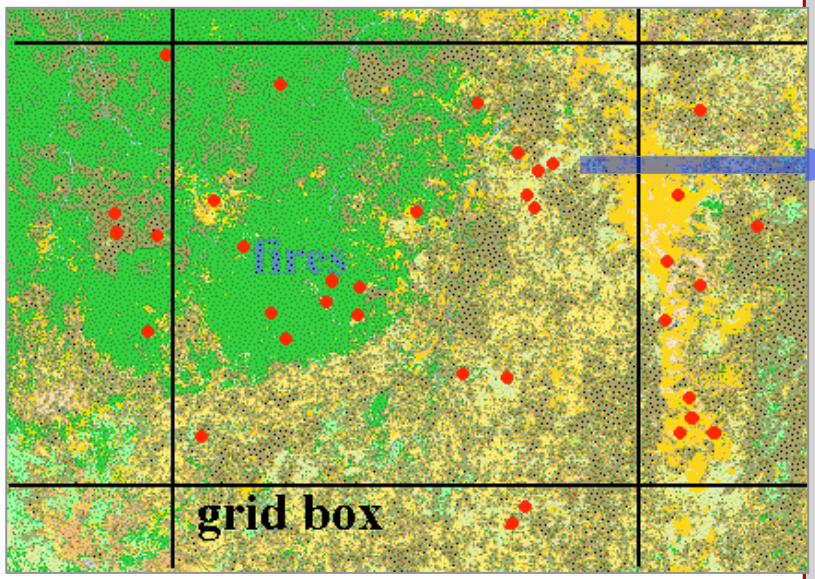
Big Plumes from Biomass Burning: Local Scale

Big Plumes from Biomass Burning: Continental Scale




Transporte de Gases/Partículas na Atmosfera
convectivo
turbulento
advectivo
fonte

Source Emission Parameterization



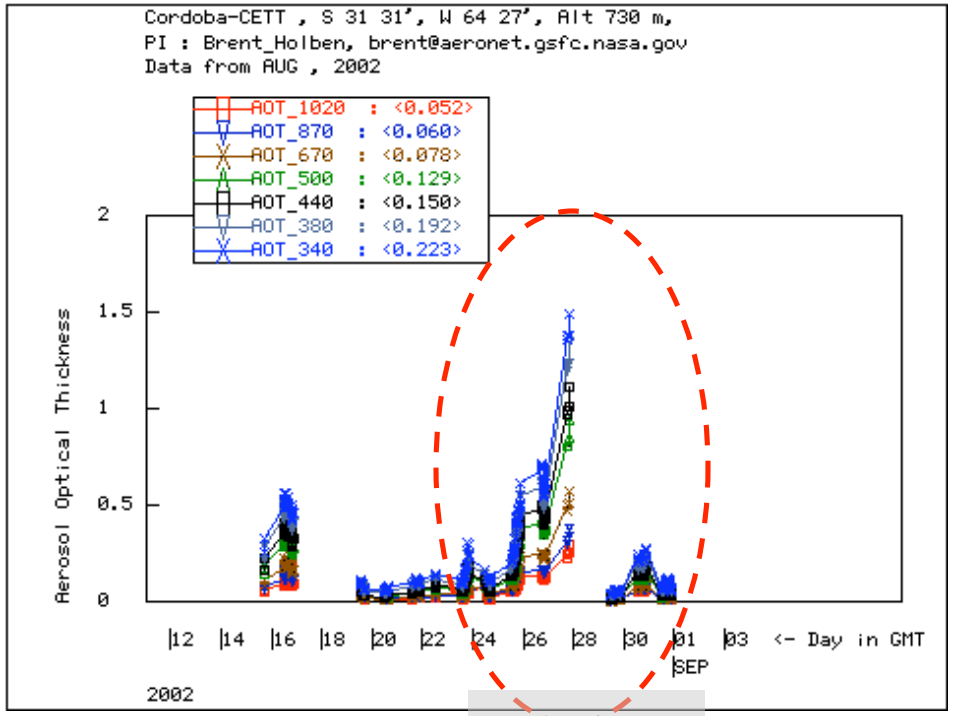
- **Mass of the tracer emitted:**

$$M[\eta] = \alpha_{veg}.\beta_{veg}.\mathrm{E}f_{veg}^{[\eta]}.a_{fire},$$

- α, β, E_f : D. Ward et al., 1992, Ferek et al., 1995.
- a_{fire}, position: GOES-8 ABBA Fire Product.
- veg : IGBP (v 2.0) 1km resolution.
- η : CO_2, CO, PM2.5, CH_4.

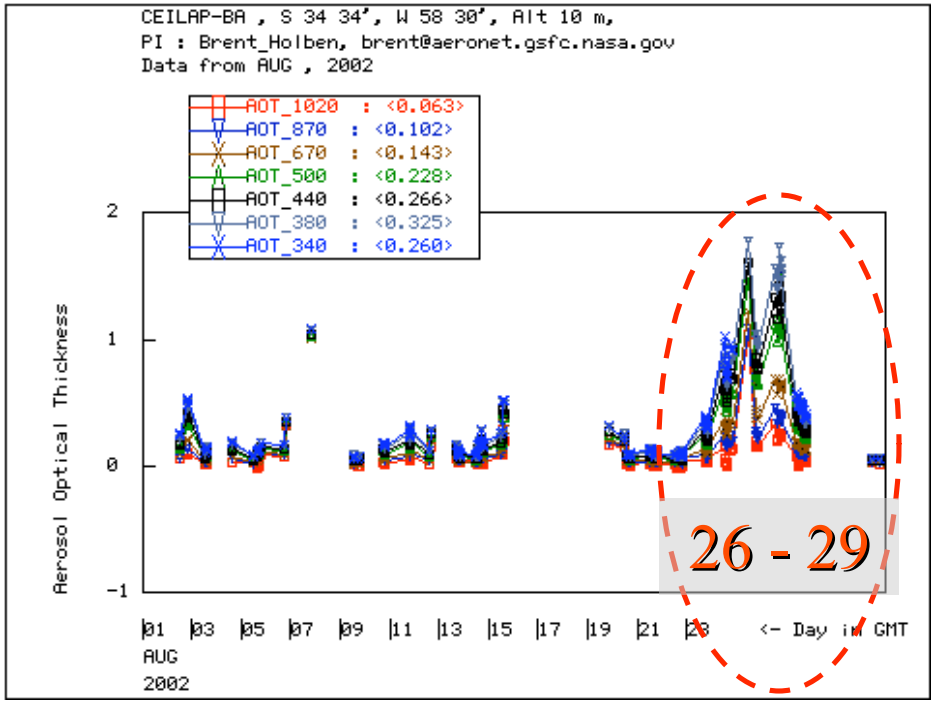
Low Troposphere and Long Range Transport of CO - case study 26-29/08

Cordoba - AOT Aug 2002

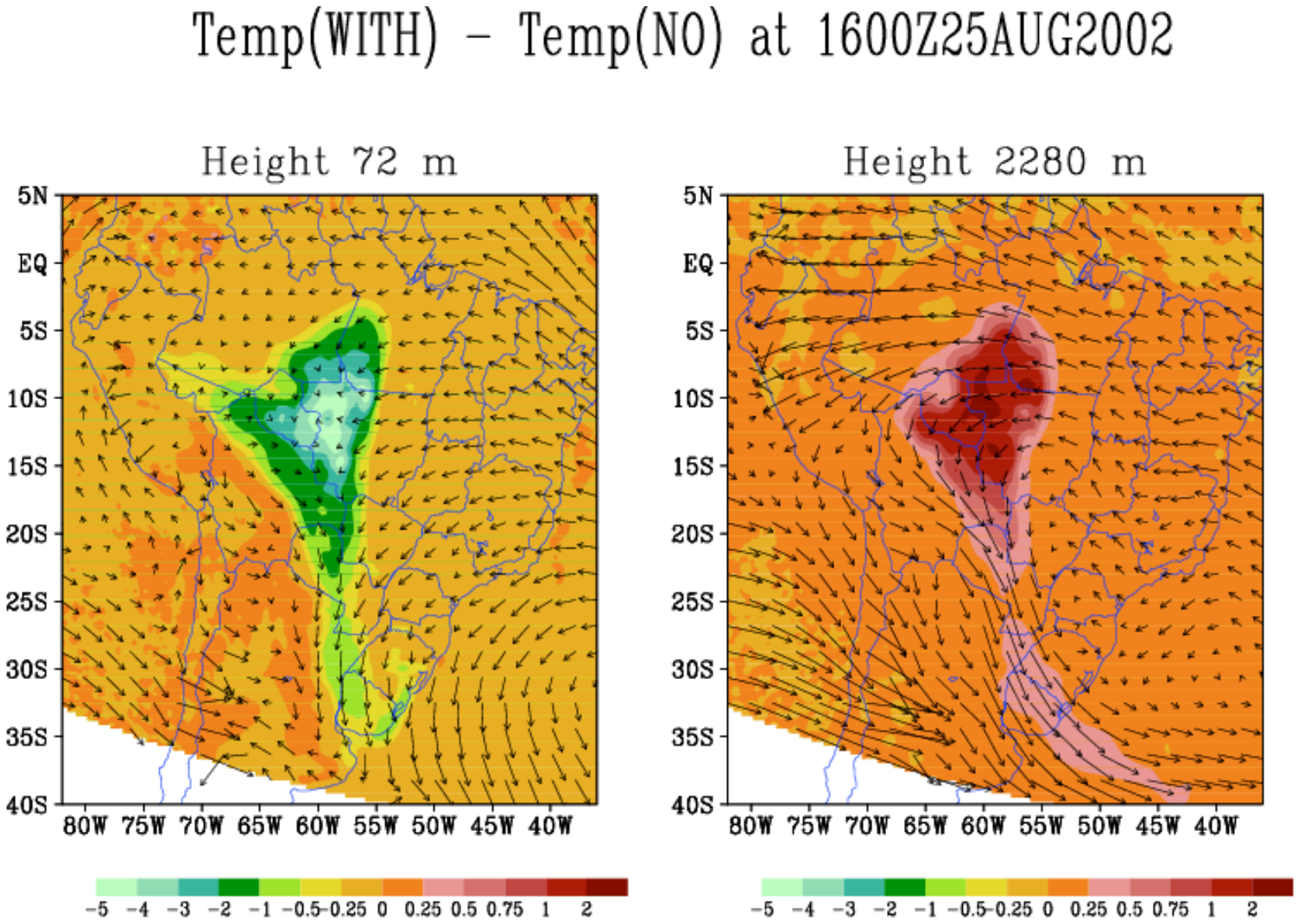


aeronet.gsfc.nasa.gov

Buenos Aires - AOT Aug 2002

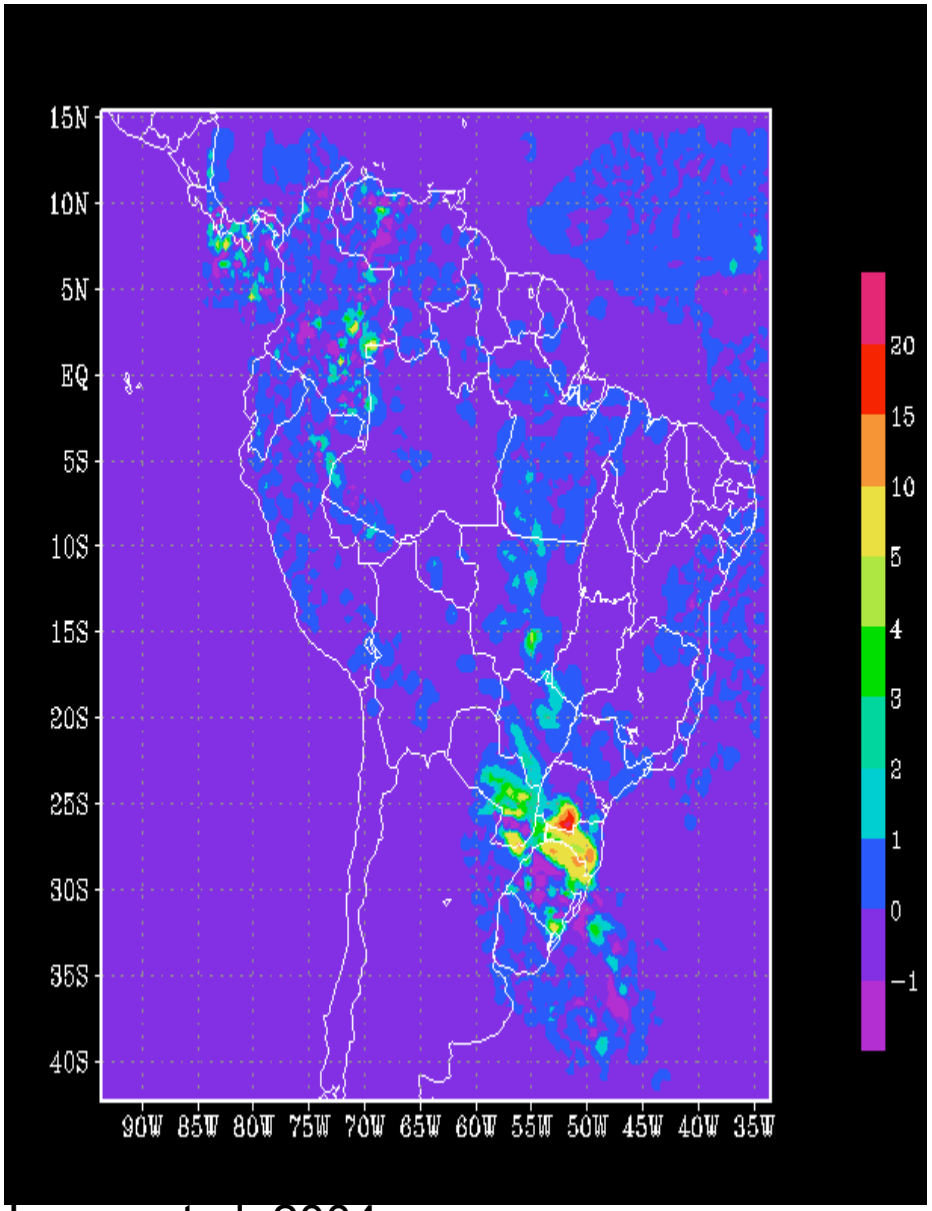


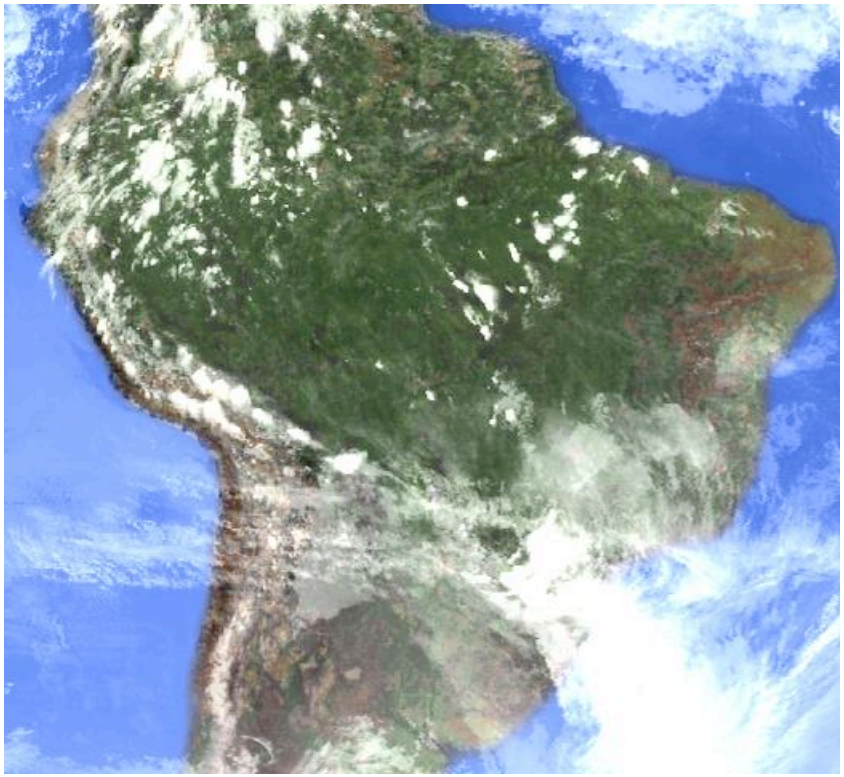
Aerosol Particles Radiative Effects on the Atmosphere



Reduction on the Convective precipitation (mm)

$$\Delta P = (P - P_{aer})$$

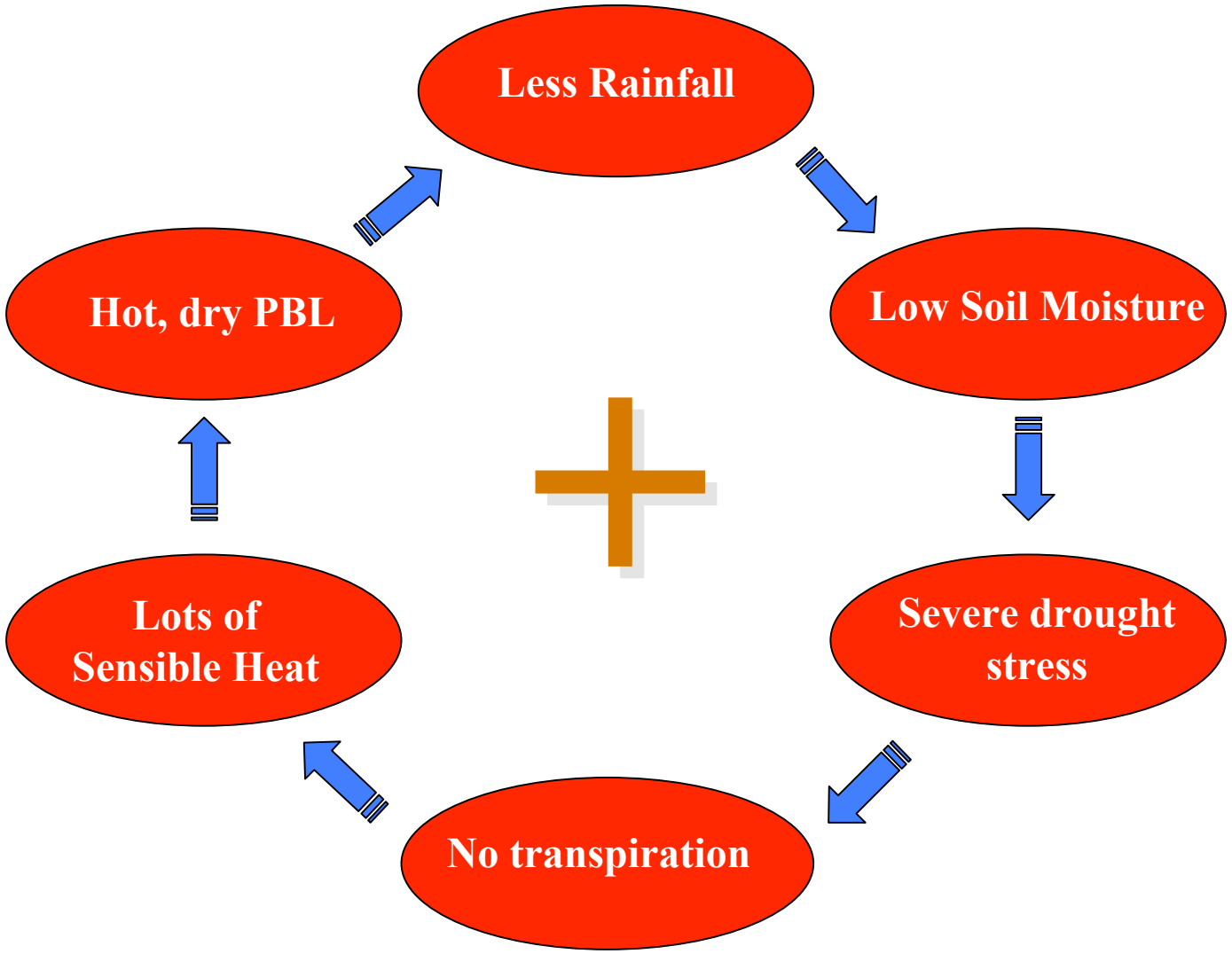




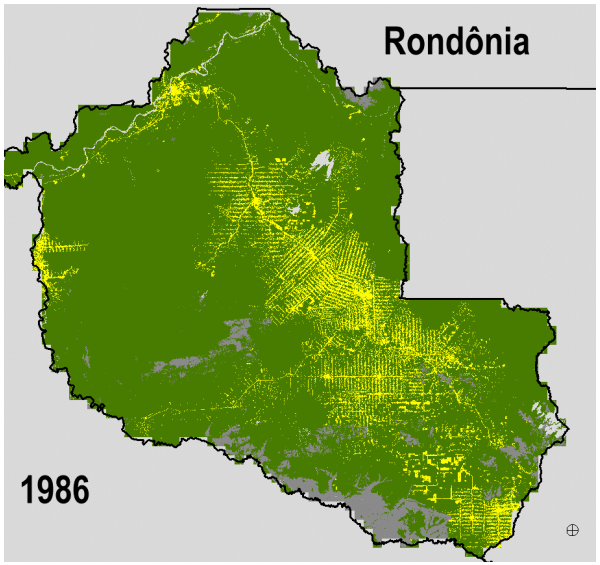
Longo et al. 2004

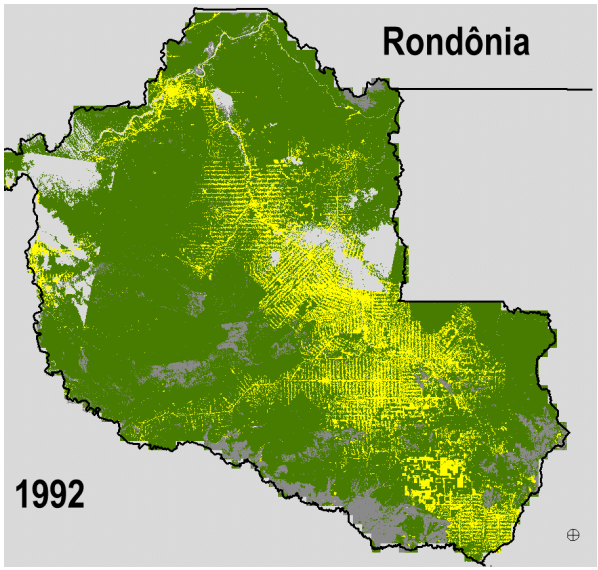
What is the role of land use and land cover change on the rainfall patterns in the LPB?

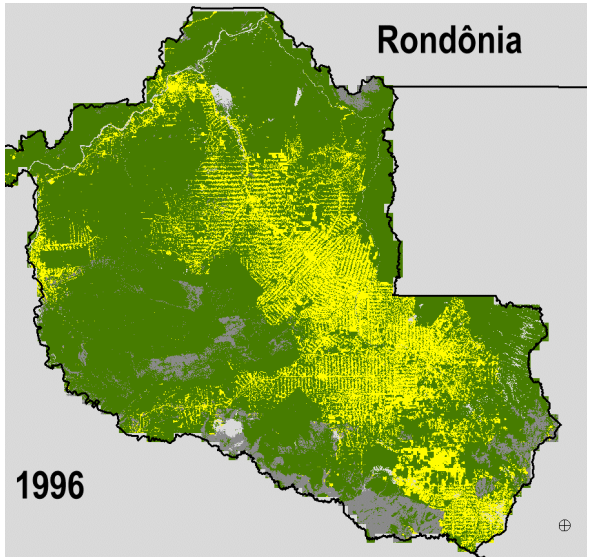
- Is the surface condition as defined by land use, important for the convective development?
- How are the surface fluxes of sensible and latent heat affected by agricultural practices?
- How important is the large scale forcing vs local condition?
- Is the LPB rainfall dominated by the impact of baroclinic distrubances in such a way that local conditions are irrelevant?


Less Rainfall
Low Soil Moisture
Severe drought stress
No transpiration
Lots of Sensible Heat
Hot, dry PBL

Realistic deforestation patterns: increase or decrease of precipitation?







What do models tell us about deforestation impact on precipitation?

Global models – complete deforestation of the Amazon

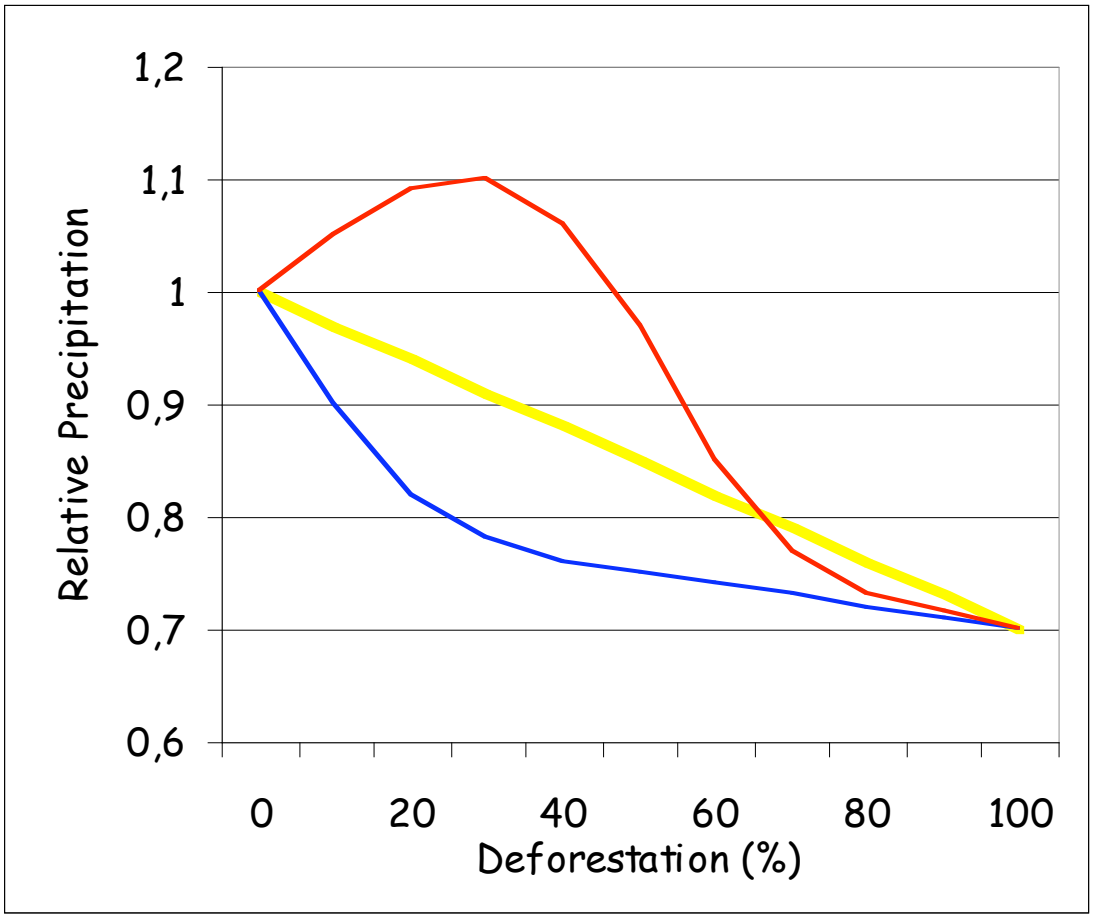
Total Deforestation on the Amazon – 3.5 *10^6 km^2

Response of the Amazon Climate

Author	albedo	Rugosity	Δ T	Δ P	Δ E
			(° C)	(mm)	(mm)
Dickinson & Henderson -Sellers (1988)	0,12/0,19	2,00/0.05	+3,0	0	-200
Lean & Warrilow (1989)	0,136/0,188	0,79/0,04	+2,4	-490	-310
Nobre *et al*. (1991)	0,13 /0,20	2,65/0,08	+2,5	-643	-496
Dickinson & Kennedy (1992)	0,12/0,19	2,00/0,05	+0,6	-511	-256
Mylne & Rowtree (1991)	0,135/0,200	—	-0,1	-335	-176
Henderson -Sellers *et al*. (1993)	0,12/0,19	2,0/0,2	+0,6	-588	-232
Lean & Rowtree (1993)	0,136/0,188	0,79/0 ,04	+2,1	-296	-201
Pitman *et al*. (1993)	0,12/0,19	2,00/0,05	+0,7	-603	-207
Polcher & Laval (1994a)	0,098/0,177	2,30/0,06	+3,8	+394	-985
Polcher & Laval (1994a)	0,135/0,216	2,30/0,06	-0,1	-186	-128
Sud *et al* . (1996)	0,092/0,142	2,65/0,08	+2,0	-540	-445
McGuffie *et al*. (1995)	0,12/0,19	2,0/0,2	+3,0	-437	-231
Lean *et al* . (1996)	0,13/0,18	2,10/0,03	+2,3	-157	-296
Manzi & Planton (1996)	0,13/0,20	2,00/0,06	-0,5	-146	-113
Hahmann & Dickinson (1997)	0,12/0,19	2,00/0,05	+1,0	-363	-149

Based on Hahmann & Di ckinson, 1997.

Conceptual models of deforestation impact on precipitation - Avissar et al, 2002 - JGR



What does remote sensing indicate?

Satellite and weather radar

"More precipitation over deforested areas in the wet season, less in the dry season: increased seasonality - possible northward shift of the equatorial-tropical transition zone" - *Durieux, Machado & Laurent, 2003 The effect of deforestation on cloud cover*...

Dry season

More shallow clouds over deforested areas during the afternoon, and less deep convection at night

Wet season

Convection stronger at night over deforested areas

savanization...?

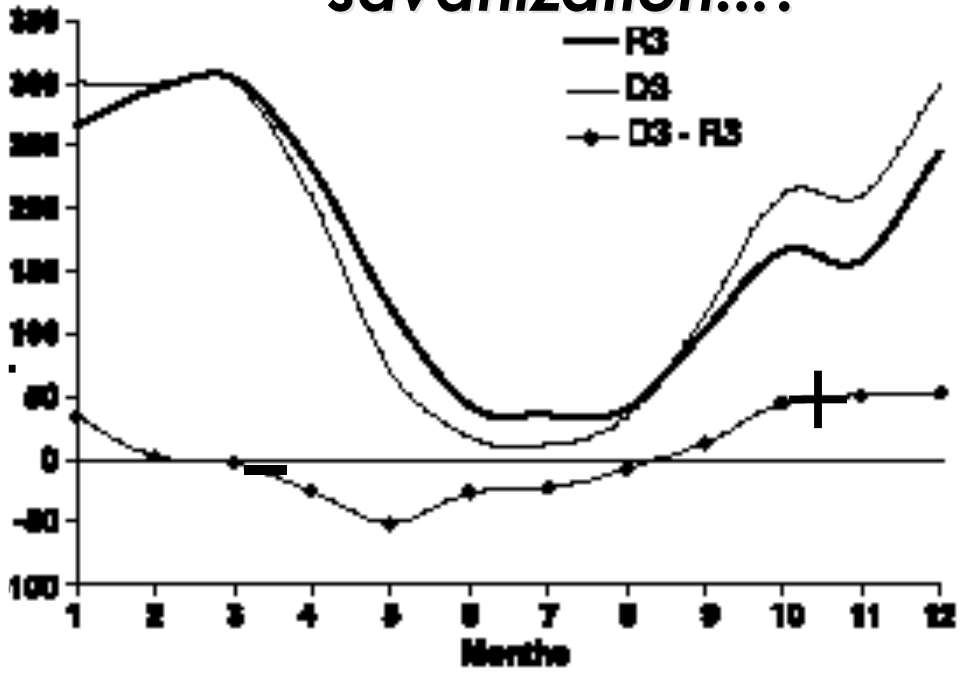


Fig. 6. Mean monthly precipitation for R_3 and D_3 and difference $D_3 - R_3$.

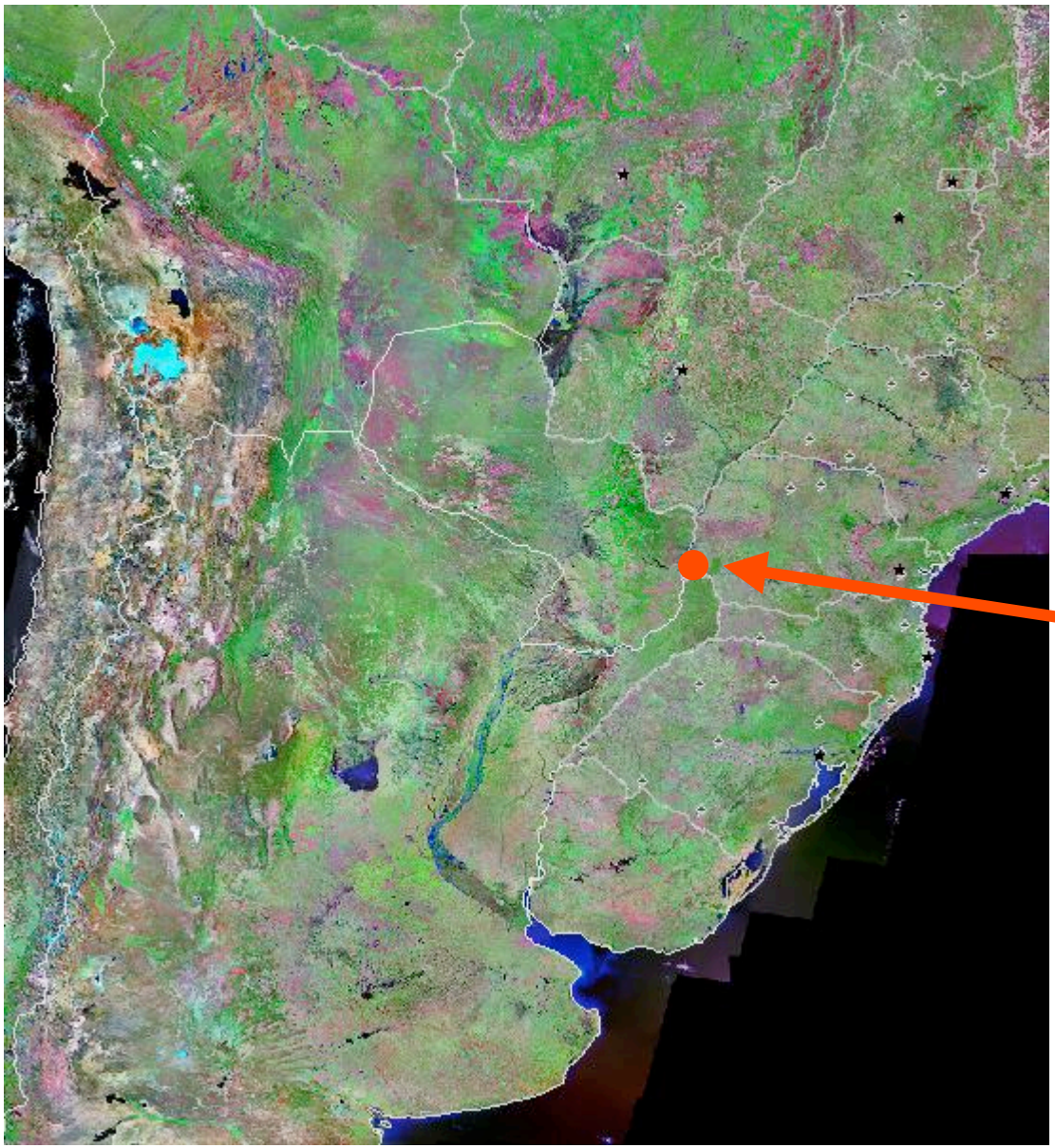
Need long time series to be able to answer the question ...

- operational radars in regions undergoing land use and land cover change
- long time series of satellite derived rainfall and cloudiness features
- ...a supersite for continuous monitoring

Some questions need a PLATEX,
others perhaps not...
both would benefit from a
LPB Supersite
for continuous monitoring

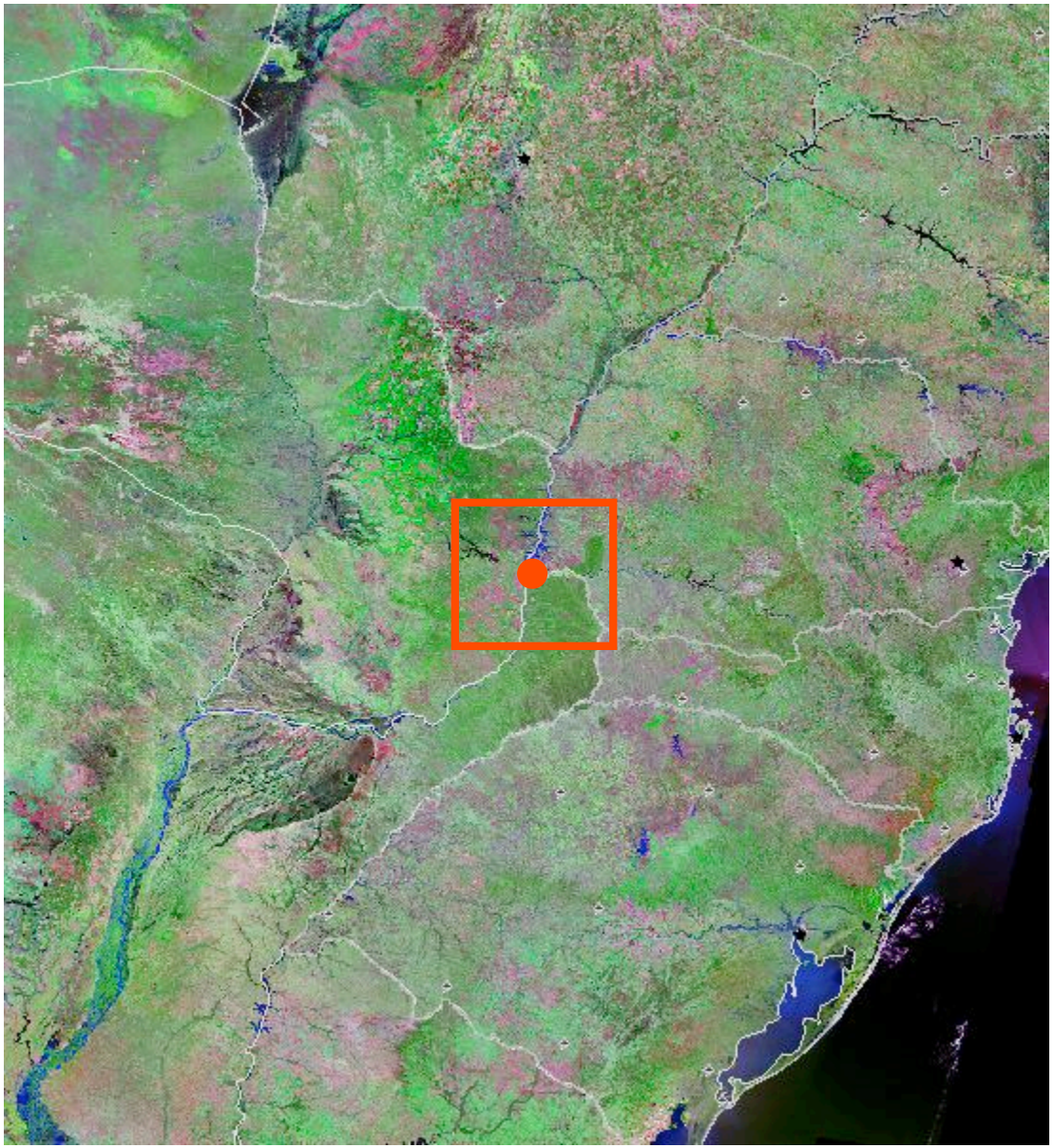

Peru
Bolivia
Brazil
Paraguay
Chile
Argentina
Uruguay

LPB Super Site



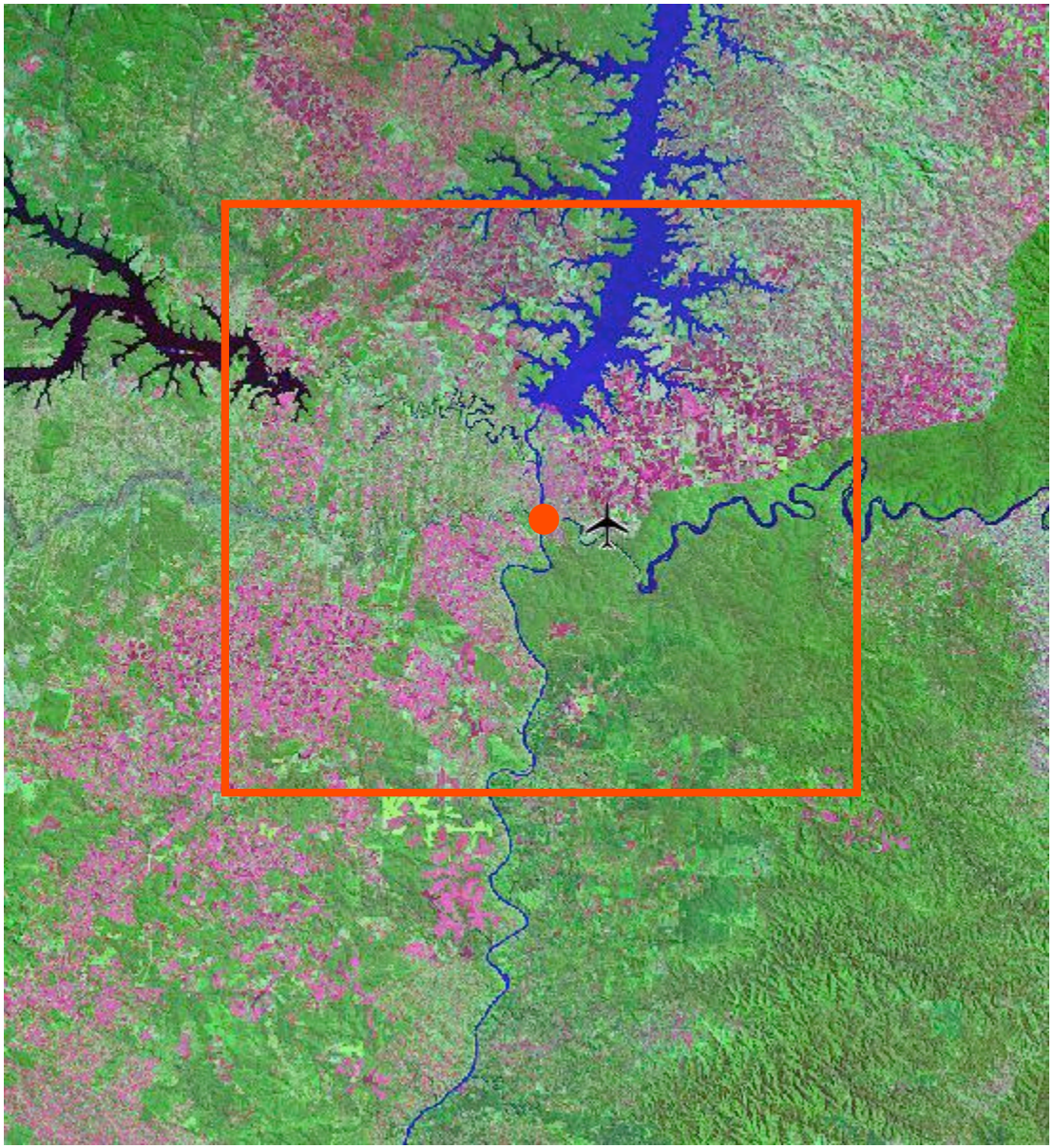
Foz do Iguaçu

(Iguaçu Falls)



200 km

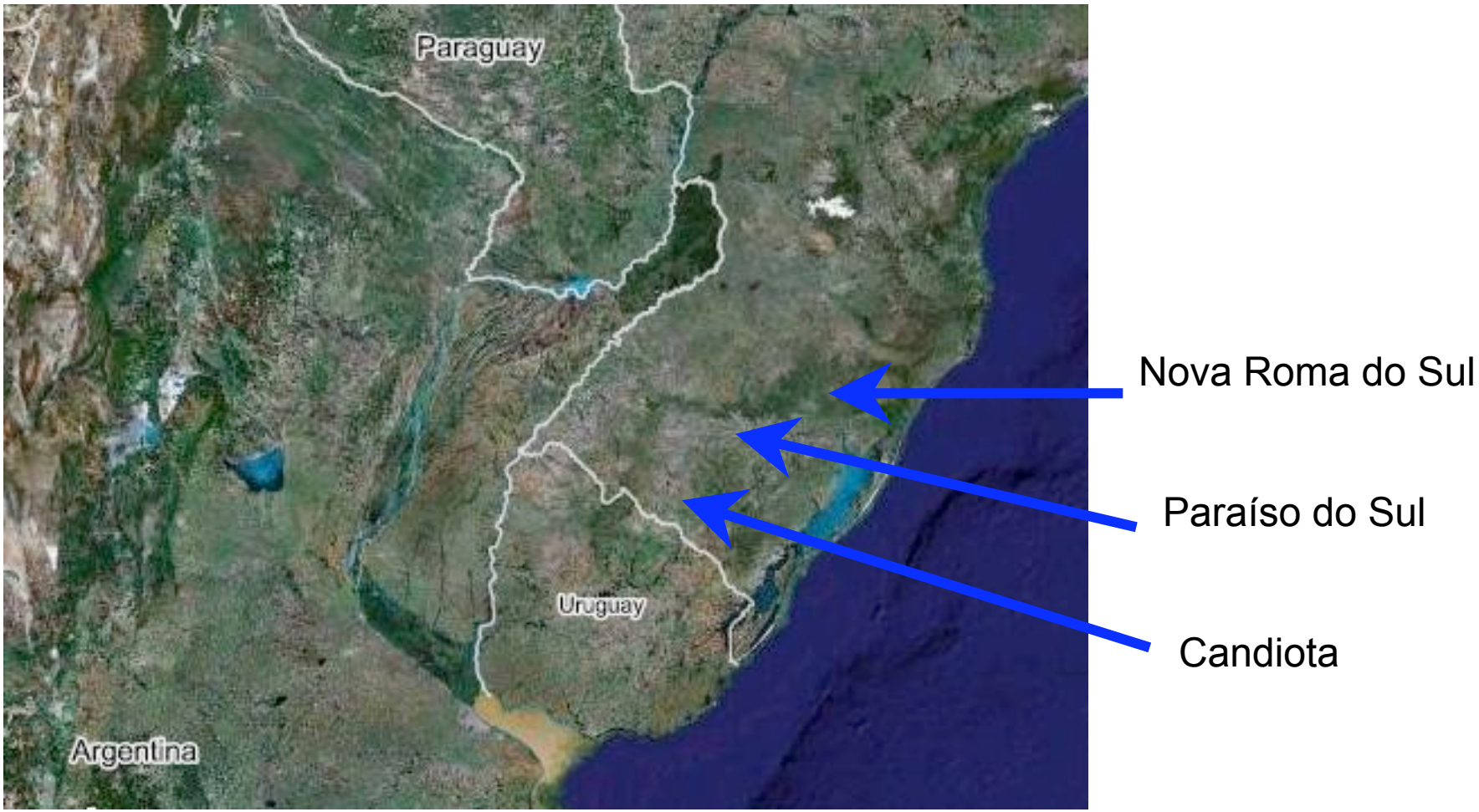
square



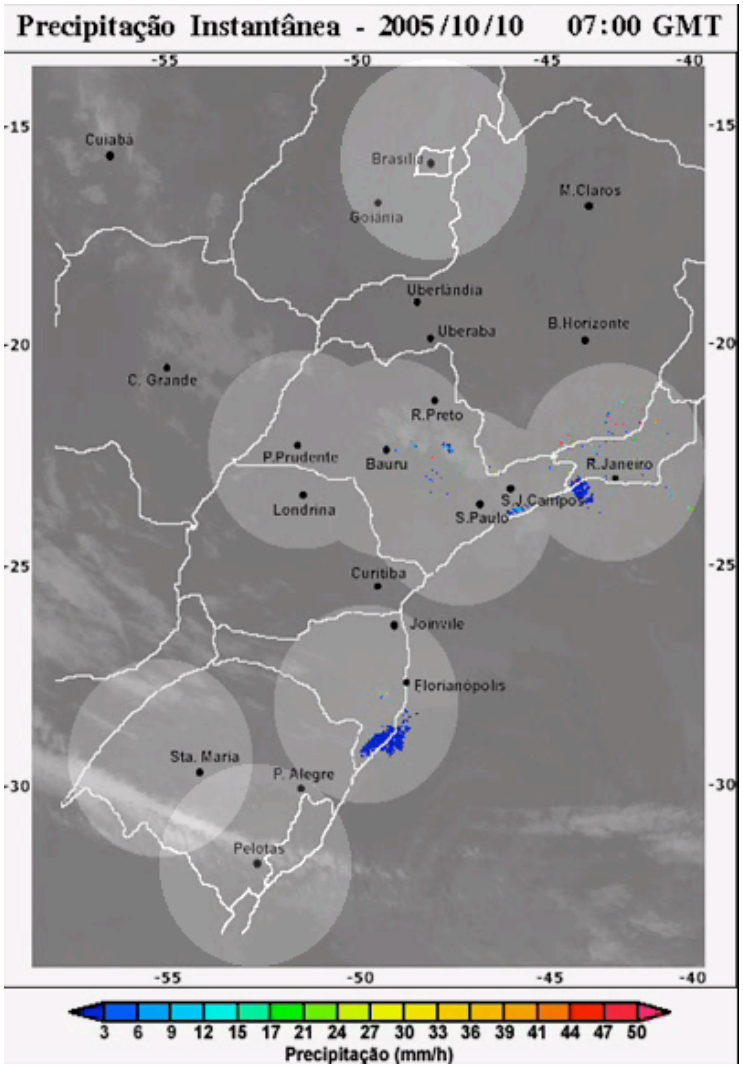
100 km
square:

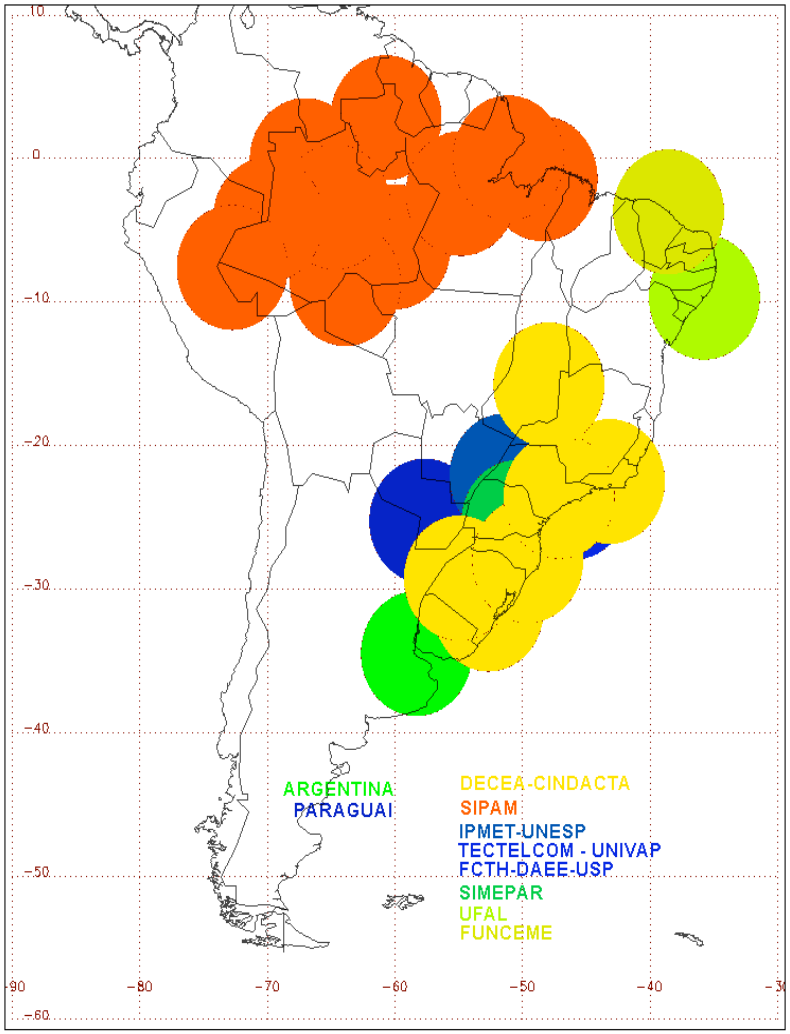
supersite

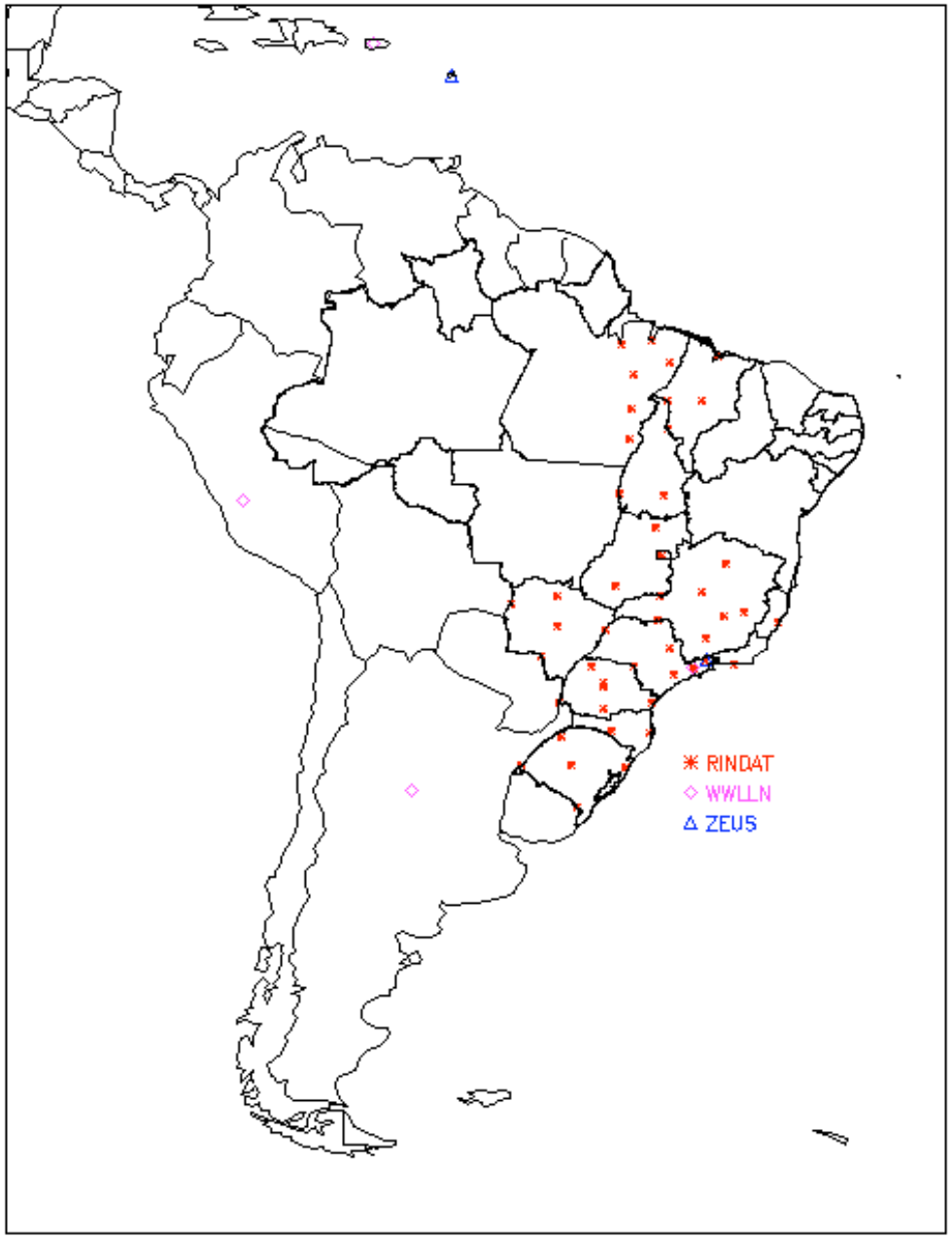
Flux observations in southern Brazil

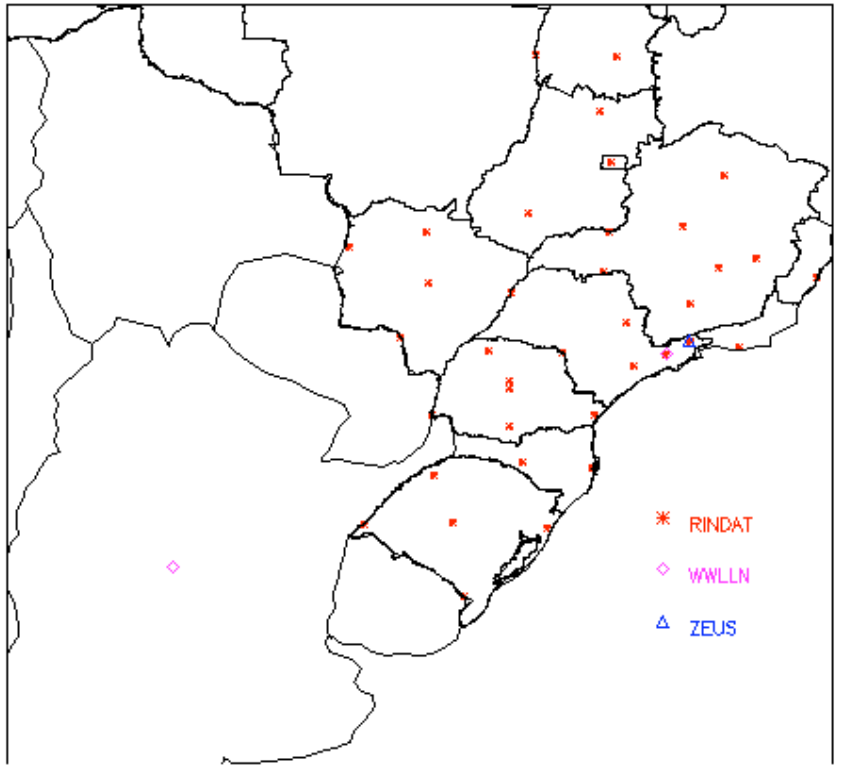


The Radar Network









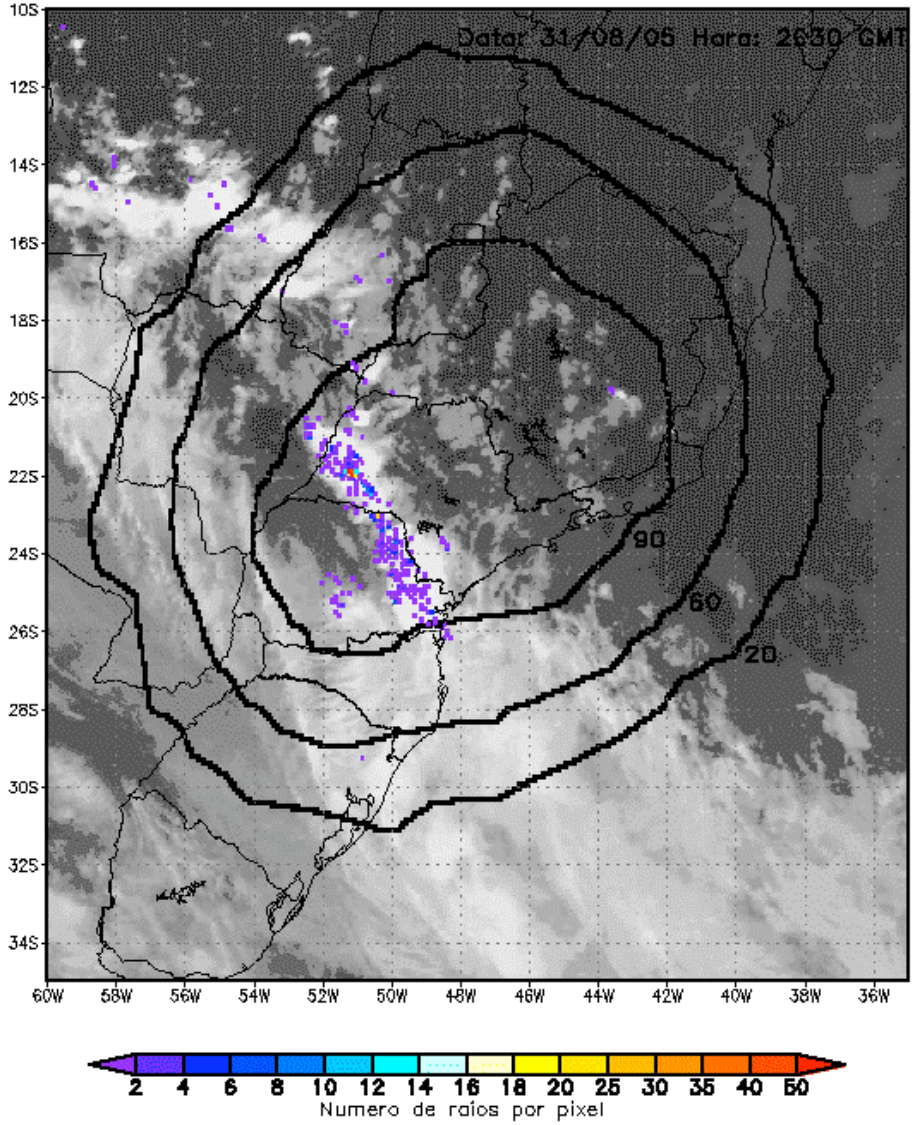
Position of the lightning sensors that operate in real-time over South America. The Brazilian lightning detection network (RINDAT) is defined in red (48 sensors), the World Wide Lightning Location Network (WWLLN) in purple (3 sensors) , and ZEUS lightning monitoring system in blue (2 sensors)

Descargas Elétricas

rede - RINDAT

Lightning detection network

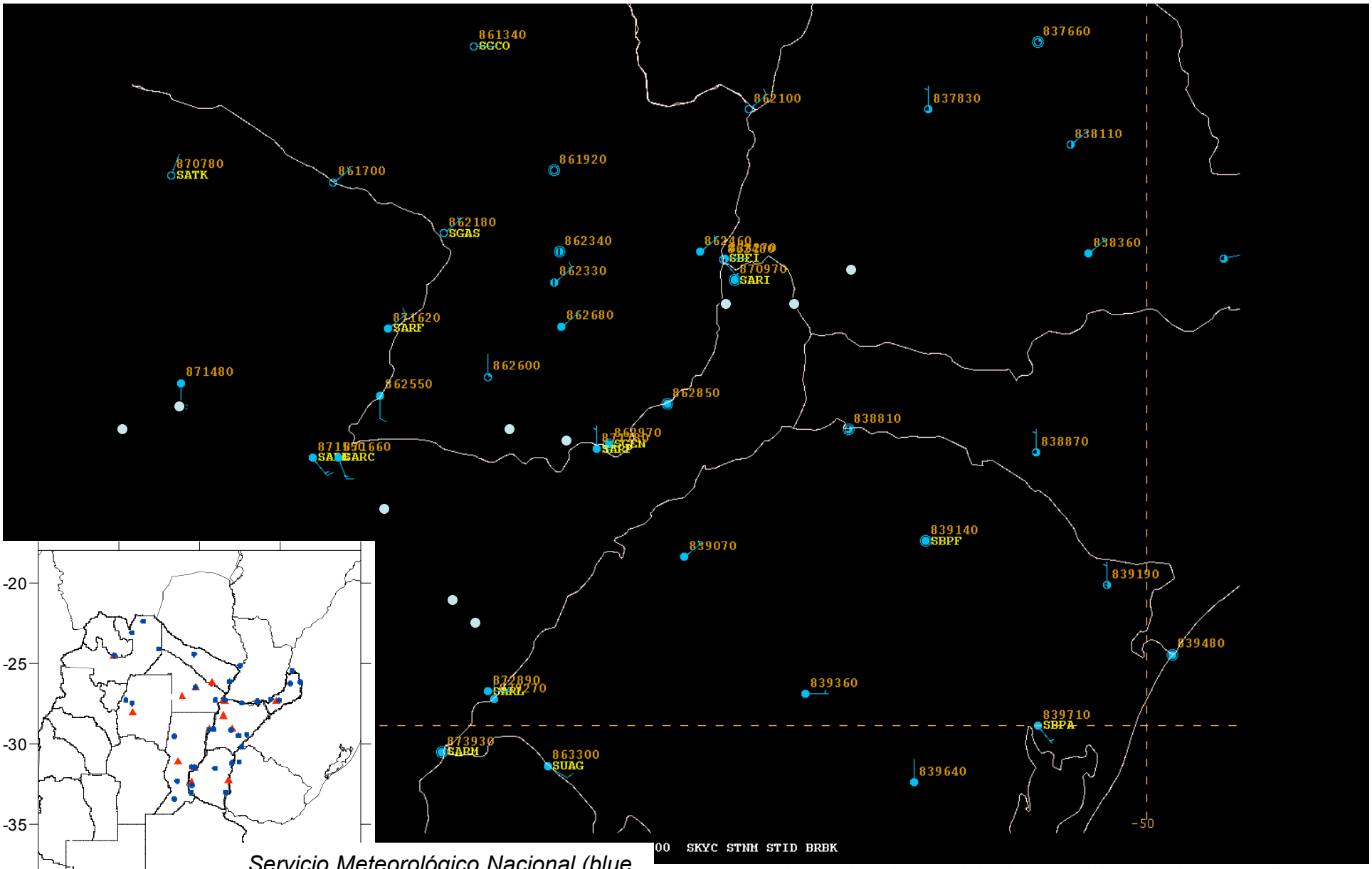
http://www.cptec.inpe.br/satelite



www.eol.ucar.edu: the NCAR facilities

- Research Aircraft
  - NSF/NCAR G-V GV: GV Investigator's Handbook
  - GV: Certification Process for HIAPER Instrumentation
  - GV: HIAPER Projected Development and Upgrade SchedulE
  - GV: Projected HAIS Instrumentation Availability
  - GV: Approved and Tested RAF Wires
  - NSF/NCAR C-130 C-130: Overview and Summary of Capabilities
  - Naval Research Lab P-3 Project Specialist Qualifications
  - Naval Survival Training Institutes
- University of Wyoming King Air
- Airborne Instrumentation
- Electra Doppler Radar (ELDORA)
- University of Wyoming Cloud Radar (WCR)
- Ground-based Remote Sensing
- S-band Dual Polarization Doppler Radar (S-Pol)
- CSU-CHILL Radar
- Raman-shifted Eyesafe Aerosol Lidar (REAL)*
- Surface and Sounding Systems
- GPS Advanced Upper-Air Sounding System (GAUS) and Mobile GAUS (MGAUS)
- Integrated Sounding System (ISS) and Multiple Antenna Profiler (MAPR)
- Integrated Surface Flux Facility (ISFF)
- GPS Dropsonde
- Driftsonde*
- *Note: instruments marked with an * are currently not funded by the DP and special funds are requested to deploy the system during a field campaign*

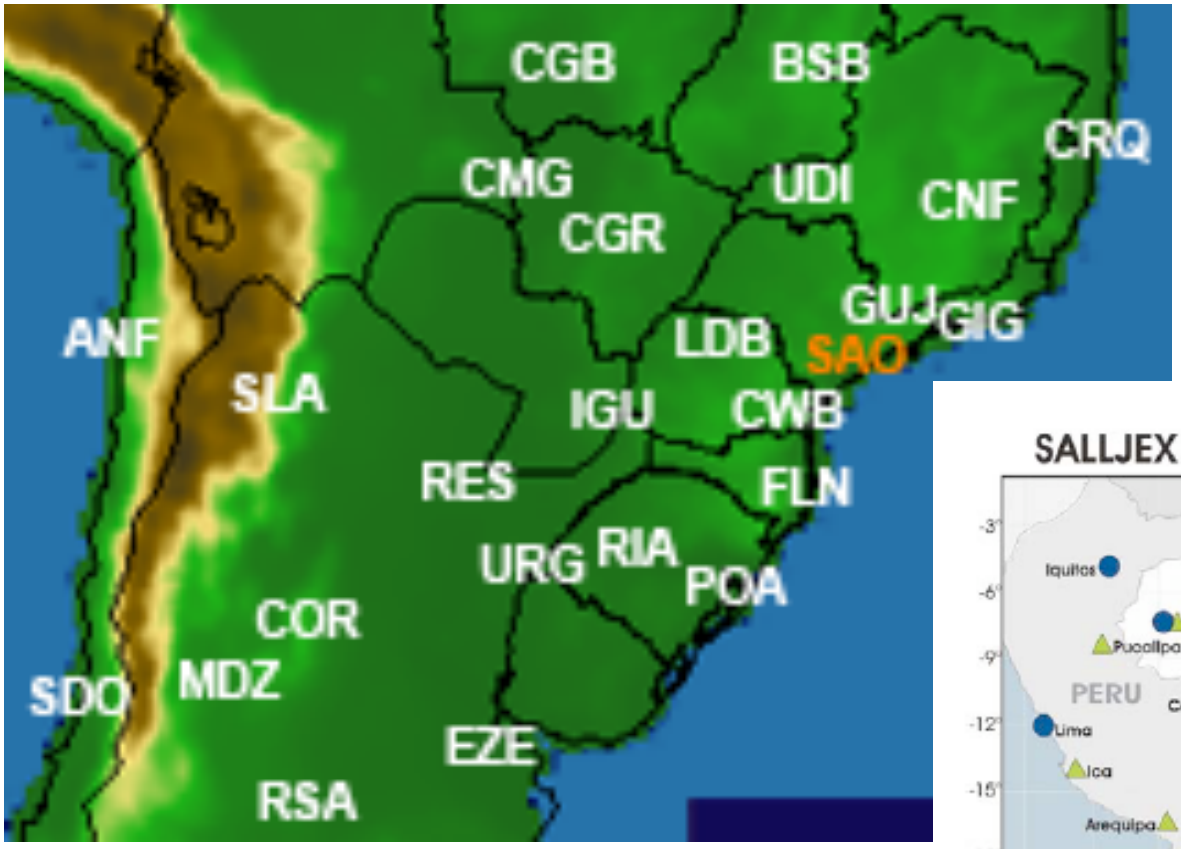
SYNOP STATIONS

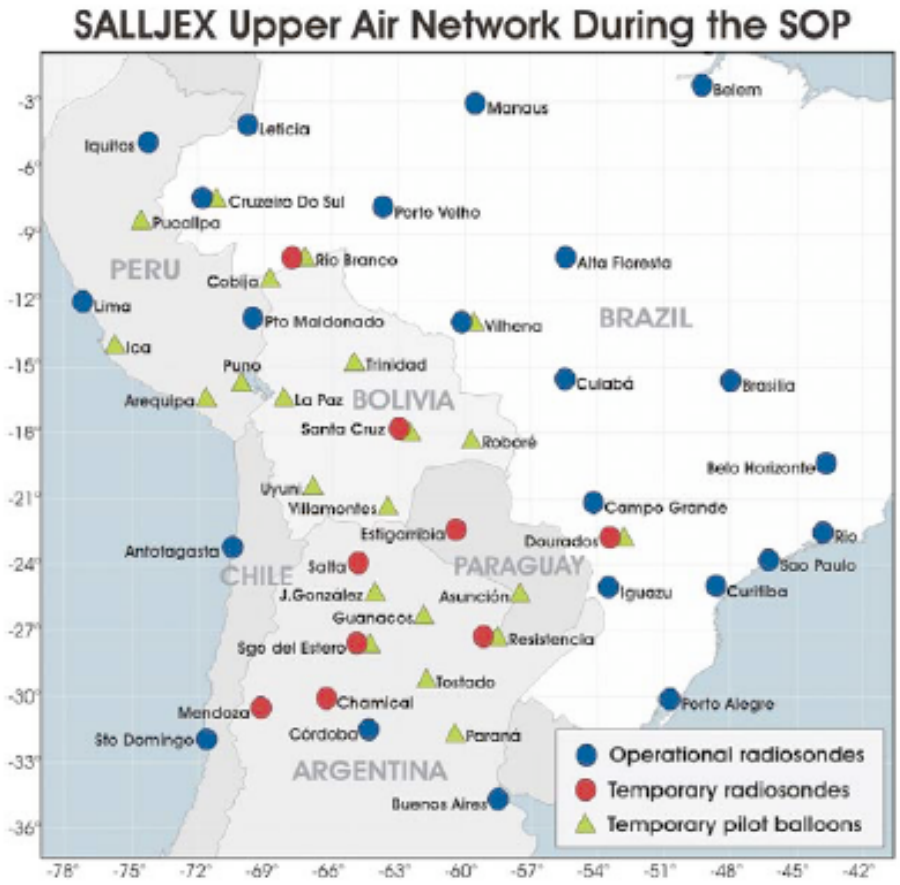


Servicio Meteorológico Nacional (blue circles) and INTA (red triangles).

Information by Waldenio Gambi and Olga Penalba

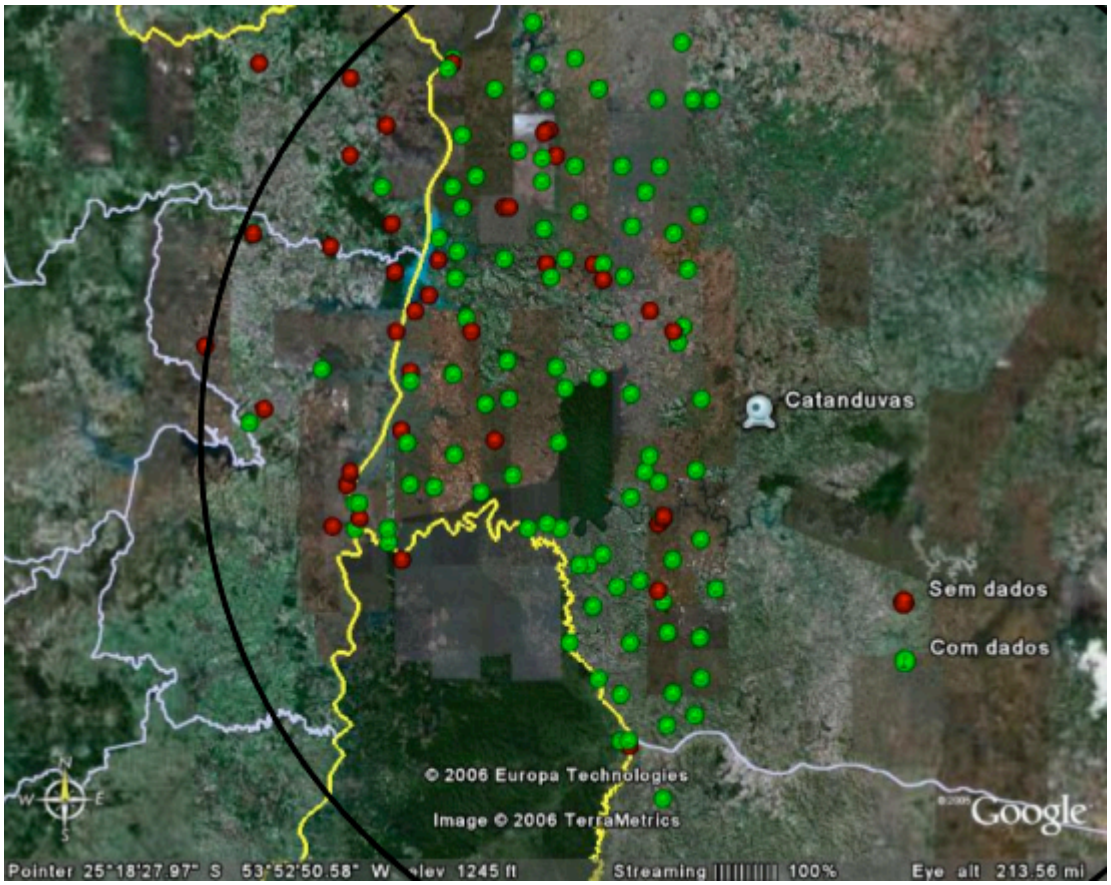
UPPER AIR STATIONS





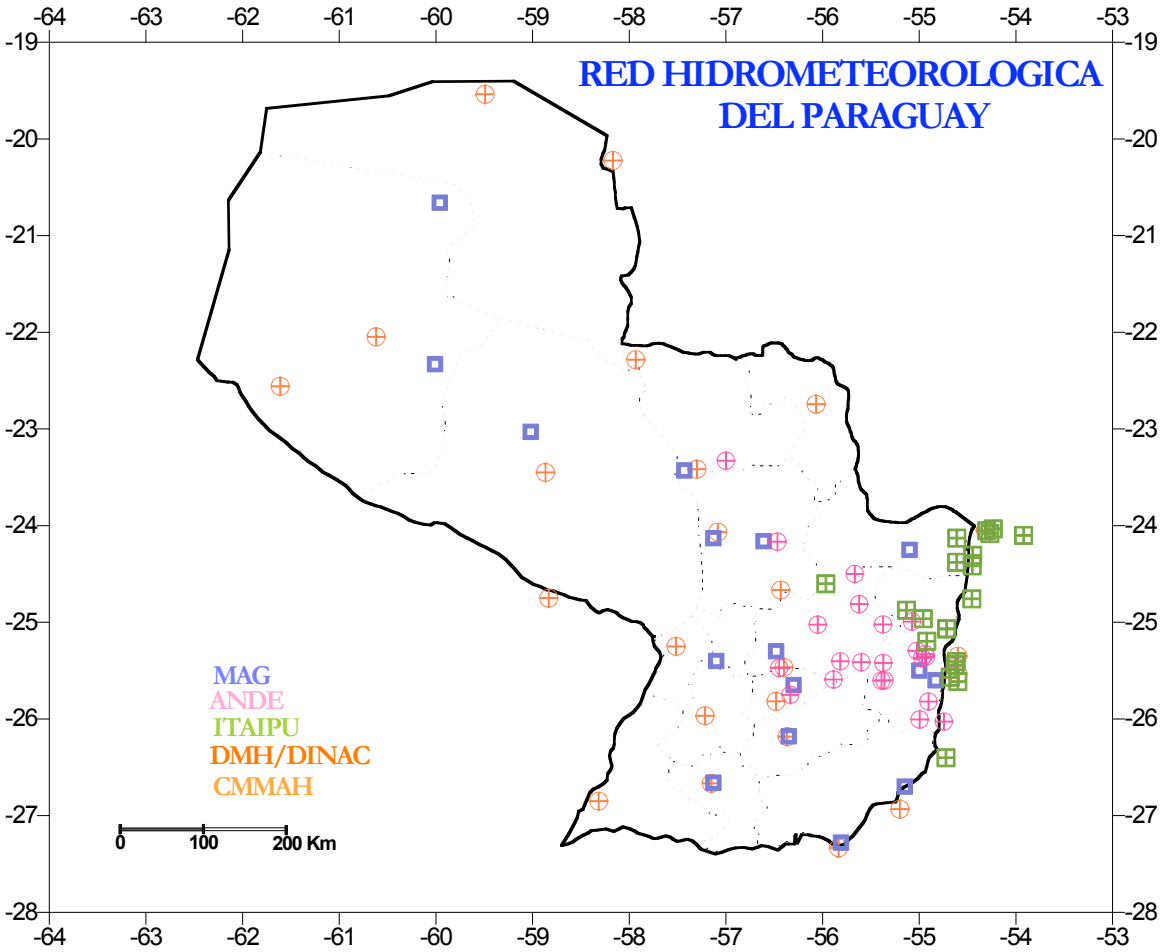
HYDROLOGICAL INFORMATION
(Brazil)

Precipitation data



Information by Walter Collischonn

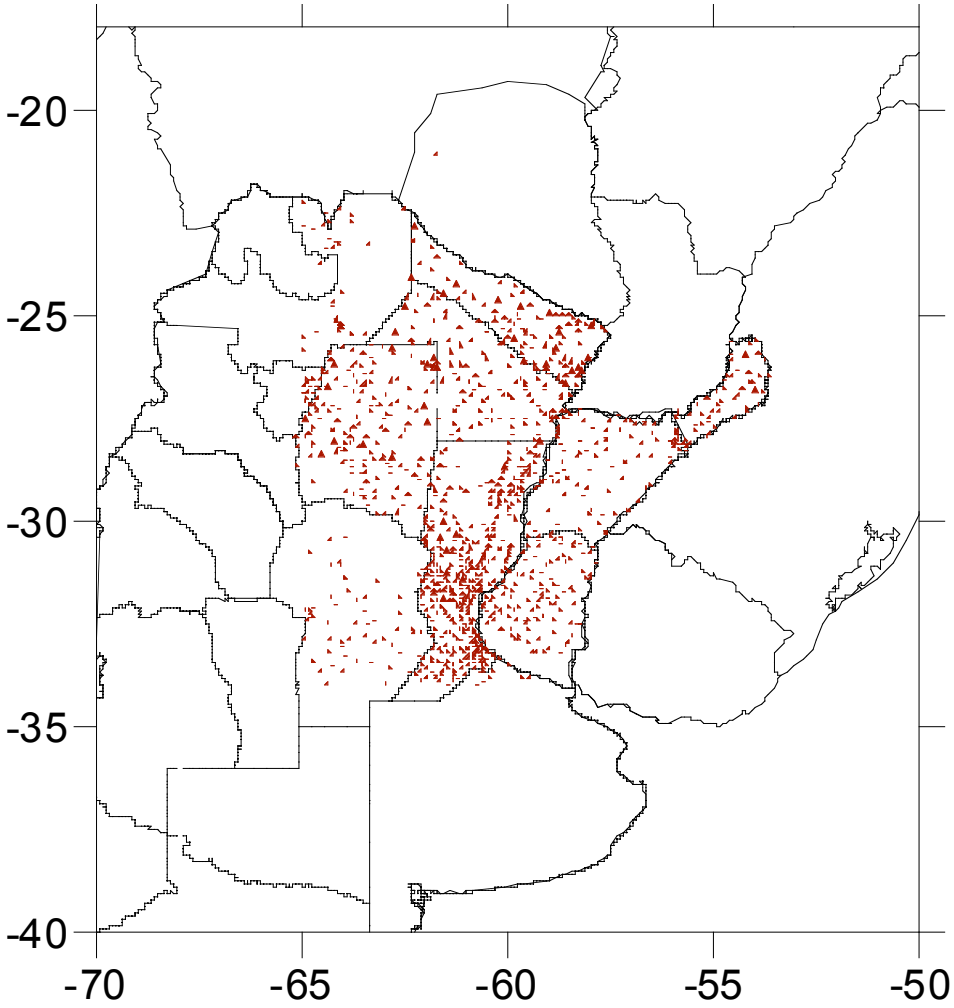
HYDROLOGICAL INFORMATION
(Paraguay)



Information by Roger Domec

HYDROLOGICAL INFORMATION
(Argentina)

Precipitation Data



Information by Olga Penalba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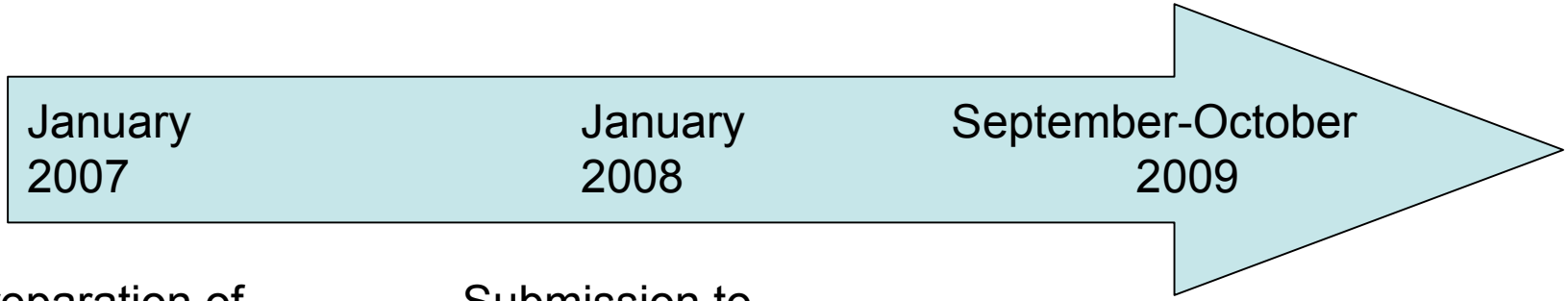
PARAGUAY
REPÚ
FEDER
R. Pilcomayo
San R. de la Nueva Orán
S. de Jujuy
FORMOSA
R. Bermejo
Río Paraguay
Cataratas del Iguazú
Puerto Iguazú
Formosa
CHACO
Pres. R. S. Peña
M. de Tucumán
Resistencia
Complejo Hidroeléctrico Yacyretá Apipé
Río Paraná
MISIONES
Posadas
Santiago del Estero
Corrientes (Arg.)
BR
R. Salado
NTIAGO DEL STERO
Reconquista
CORRIENTES
Goya
Río Uruguay
SANTA FE
ÓRDOBA
Córdoba
S. Francisco
Río Paraná
ENTRE RÍOS
Embalse Salto Grande
Concordia
Santa Fe
Paraná
REPÚBLICA ORIENTAL DEL URUGUAY
a. María
Río Cuarto
Rosario
Gualeguaychú
S. N. de los Arroyos
Venado Tuerto
Zárate
Pergamino
(Arg.)
BUENOS AIRES
Río Salado
La Plata
BUENOS AIRES
Clavarría

Paraná River

Uruguay River

ParaguayRiver

PLATEX Timetable

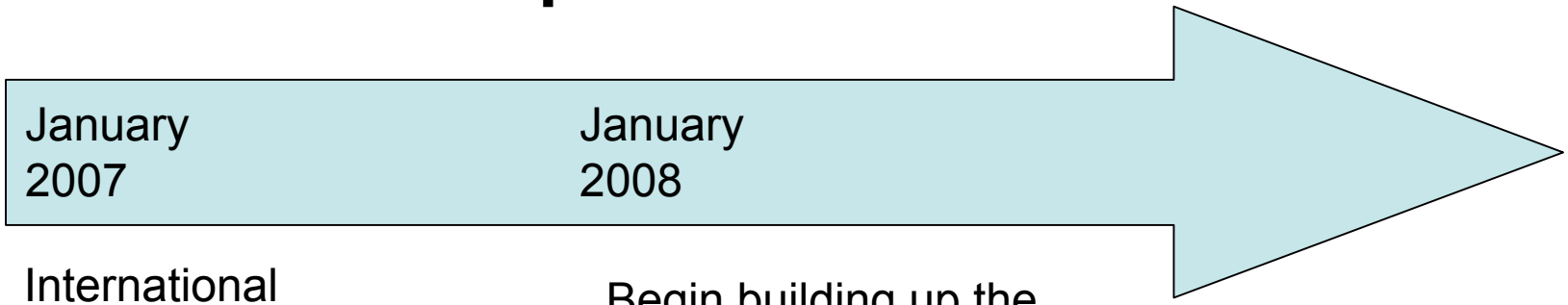


Preparation of experimental plan

Submission to NCAR and other agencies

Intensive field campaign

LPB Supersite Timetable



International agreements with help of GEF funding

Begin building up the observation infrastructure