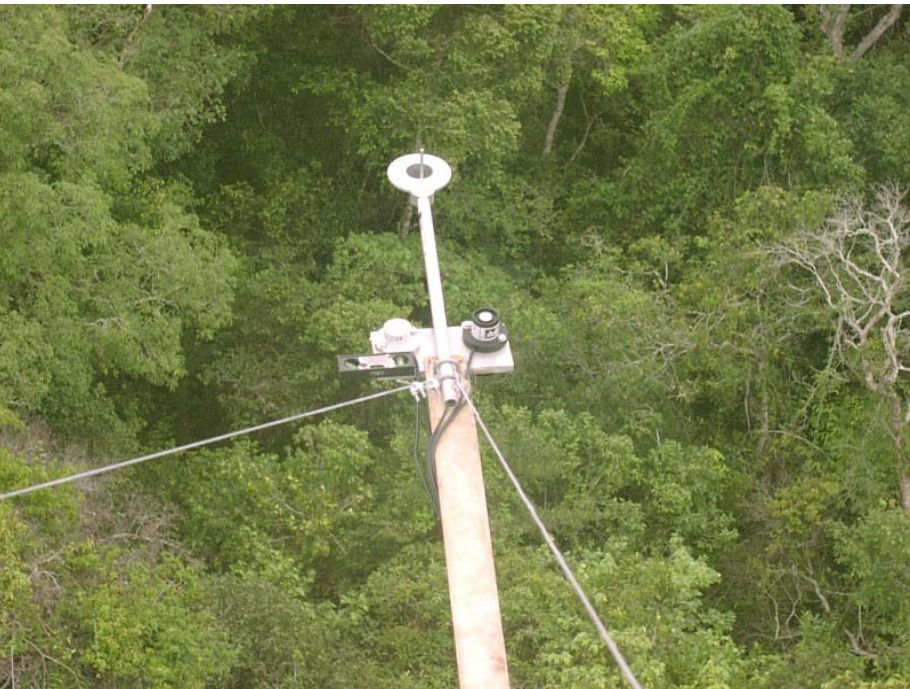
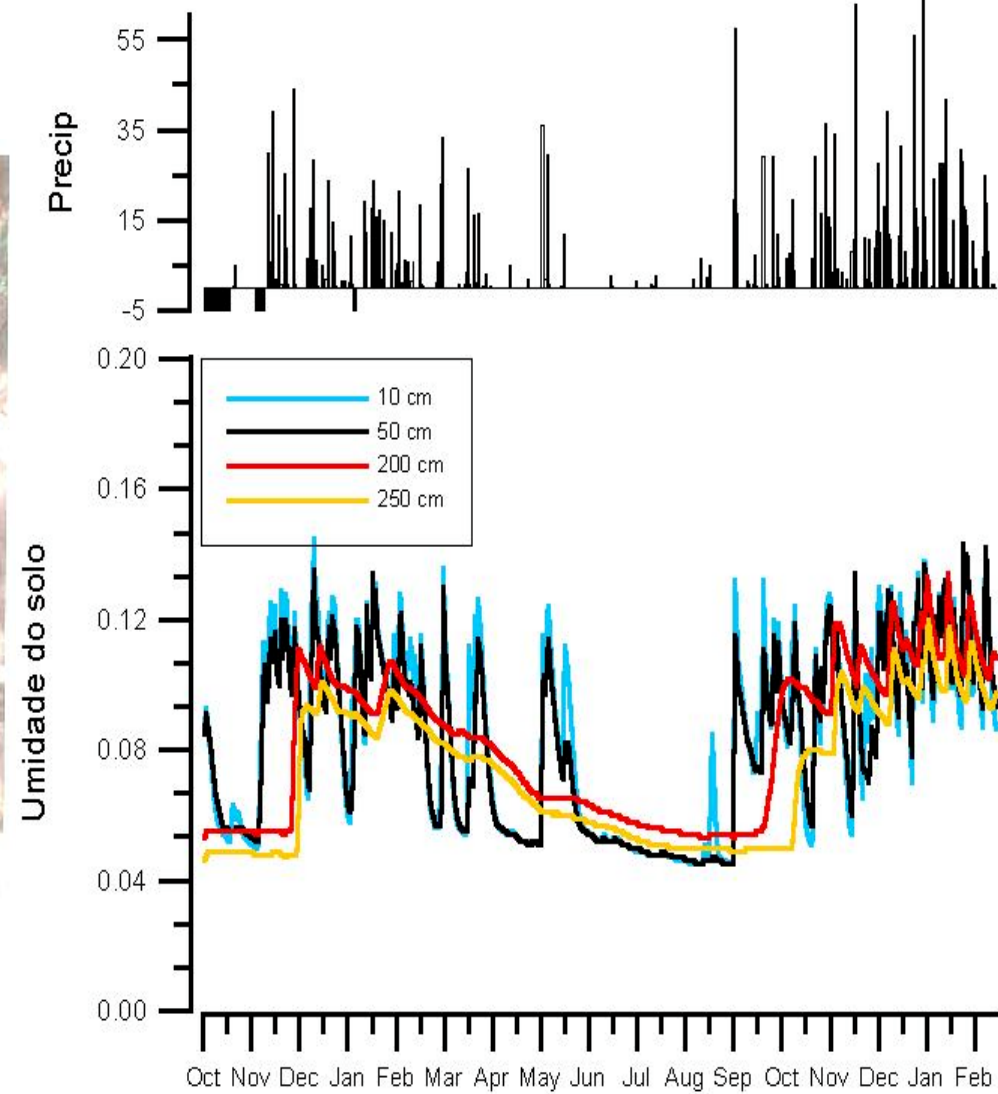


# Instrumentation



**Weather station:  
PAR & solar,  
net radiation,  
rainfall, wind  
speed, air  
pressure,  
humidity  
temperature**





**Reflectometers (frequency domain) CS615**

**Benefit: temporal variability**



# Croplands

Dynamic vegetation

Dynamic roughness

Roughness may depend on direction

Bowen ratio method for flux estimation

Tower over sugar cane in southeast Brasil (as of 1996)

## High frequency sensor (as of 2003)



**Low frequency sensors  
photovoltaic cells (power supply)**



# Radiation sensors in sugar cane site (Southeast Brasil) as of 2003

Net radiometer

PAR incident

PAR reflected

Pirgeometer

Global solar radiation

'98 4.21

# Tower Measurements-Tropical Forest Santarém km 83

## METEOROLOGY

PAR (up/down)	LiCor Quantum Sensors
Solar	Kipp & Zonen
Net Radiation	REBS Q*7
Rain	Tipping Bucket

## PROFILES

Wind (6 hrs)	Cup, 2D Sonic Anemometers
Temperature (6 hrs)	Campbell 107
CO <sub>2</sub> /H <sub>2</sub> O (12 hrs)	LI-7000 (Closed Path)

## FLUXES

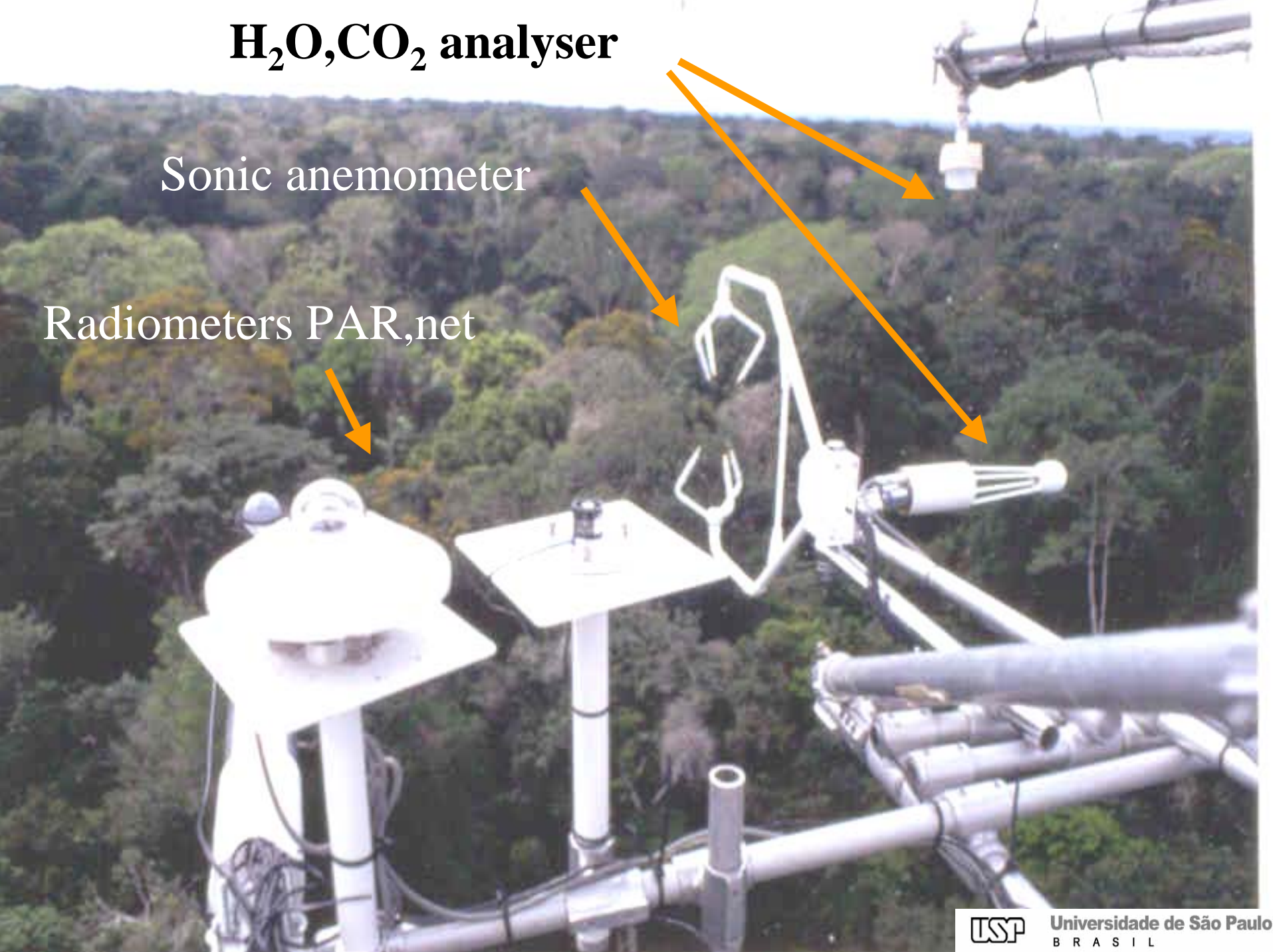
Momentum/Heat	Campbell CSAT3
• CO <sub>2</sub> /H <sub>2</sub> O	LI-7500 (Open Path)
• CO <sub>2</sub> /H <sub>2</sub> O	LI-7000 (Closed Path)

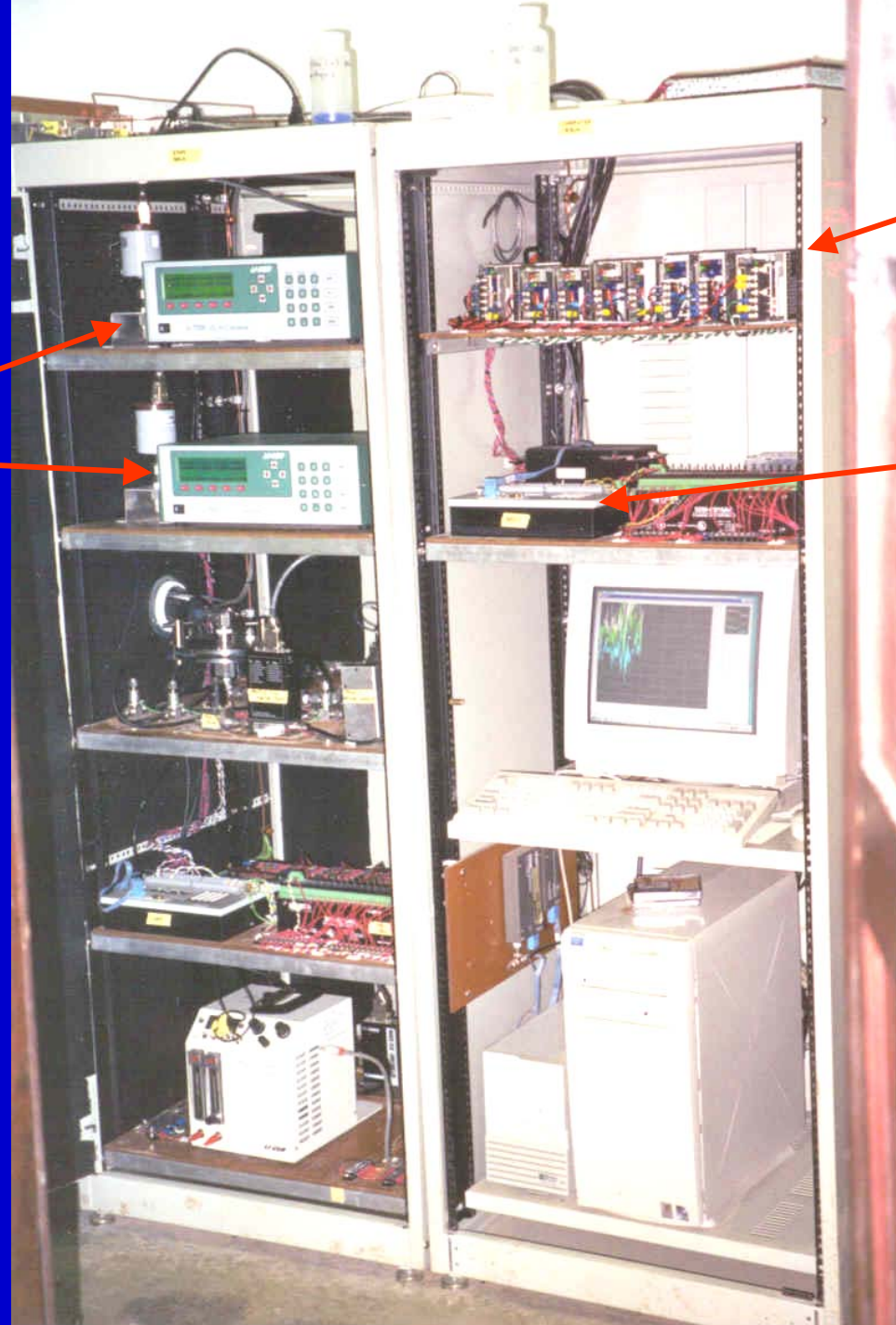


**H<sub>2</sub>O,CO<sub>2</sub> analyser**

Sonic anemometer

Radiometers PAR,net





IRGAS

Calibration  
Equipment

Power  
Distribution  
(AC Power)

System  
Control

Data Computer

# Automatic CO<sub>2</sub> soil respiration chambers

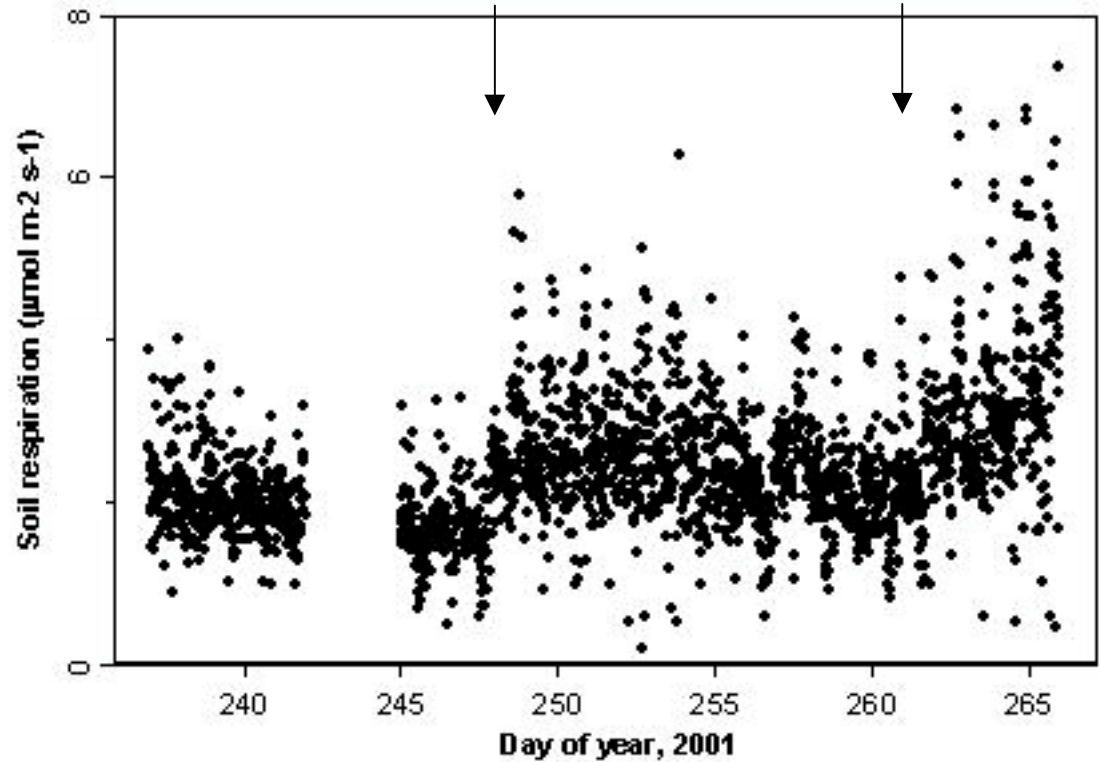


**Soil respiration (presumably decomposition)  
strongly affected by rain (presumably litter moisture)**  
Santarém km83 - Tropical rainforest site



Autochamber  
measurements  
of soil respiration

Heavy rains interrupt 2001 dry season



Portable soil  
respiration  
chamber  
EGM2 PPSystems  
Inc

Used in sugar cane  
site and savanna  
site (Southeast  
Brasil)

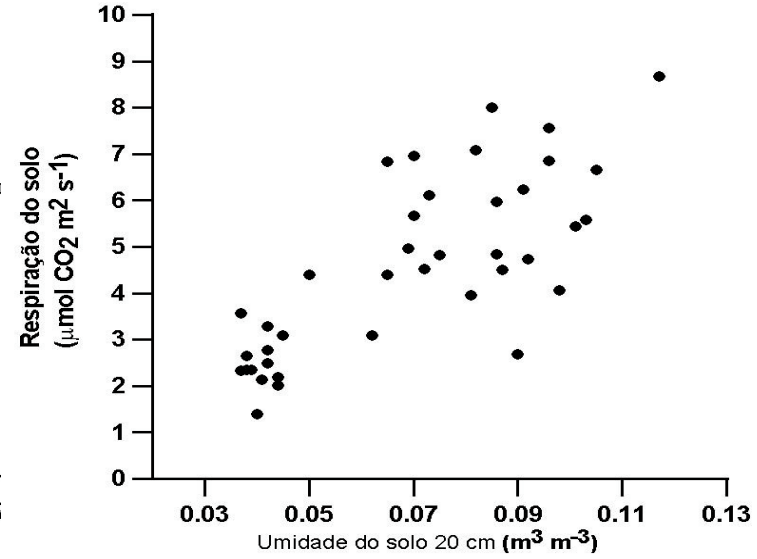
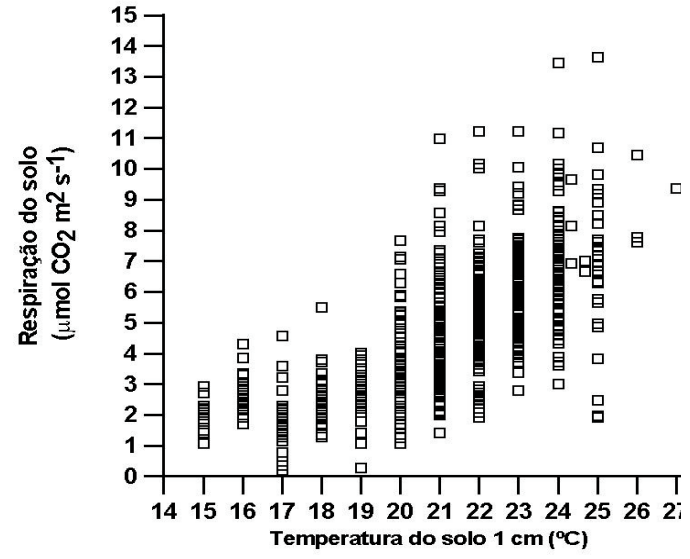
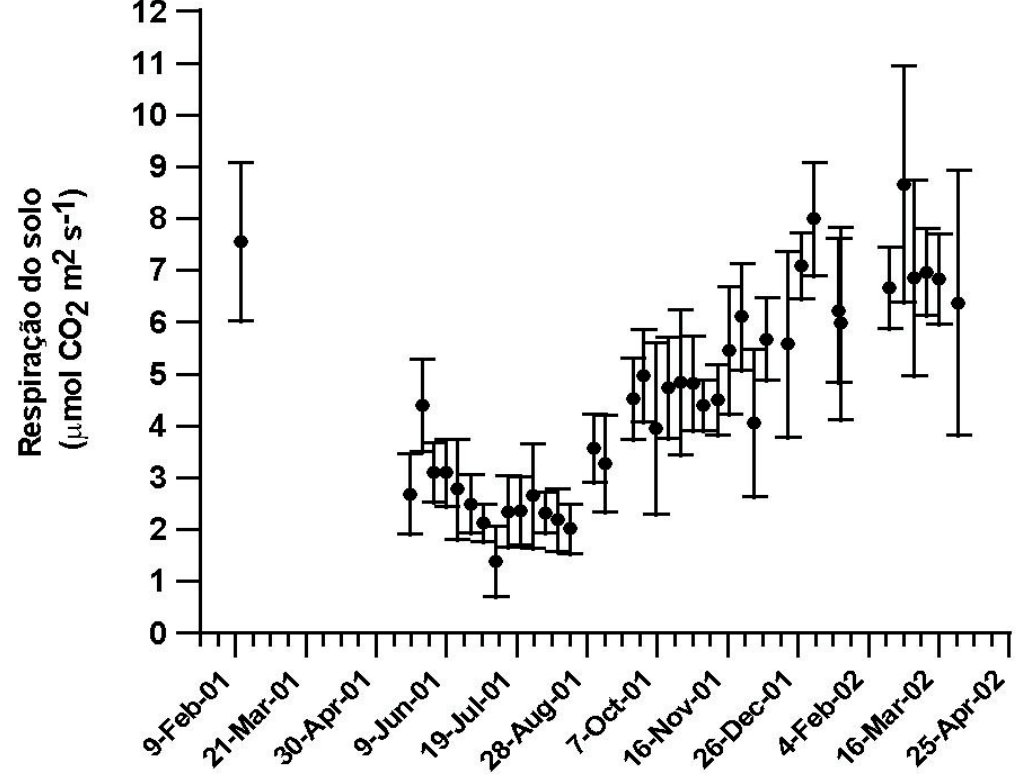


# Cerrado Restrito (savanna)

## Soil respiration

### correlation with temperature and soil moisture

Rocha et al 2004



## Models for fitting soil respiration with soil physical variables

$R_s$  = Soil respiration

$T_s$  = soil temperature (2 cm)

$\psi$  = soil matric potential (2 cm)

- Linear
- Exponential
- Linear + exponential
- Linear polynomial + exponential

$$R_s = a_1 T_s + a_2$$

$$R_s = e^{a_1 T_s + a_2}$$

$$R_s = e^{a_1 T_s} + a_2 \ln(-\Psi) + a_3 \ln^2(-\Psi)$$

$$R_s = a_1 \ln(-\Psi) + a_2 \ln^2(-\Psi) + a_3 T_s$$