

What the devil are we doing?

- next step(s) in Brazil



Local circulations and climate data in the eastern Amazon region

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Moraes⁽²⁾,
Otávio C. Acevedo⁽²⁾, Matthew J. Czikowsky⁽¹⁾
Maria F. Silva Dias⁽³⁾, Raimundo Cosme⁽⁴⁾

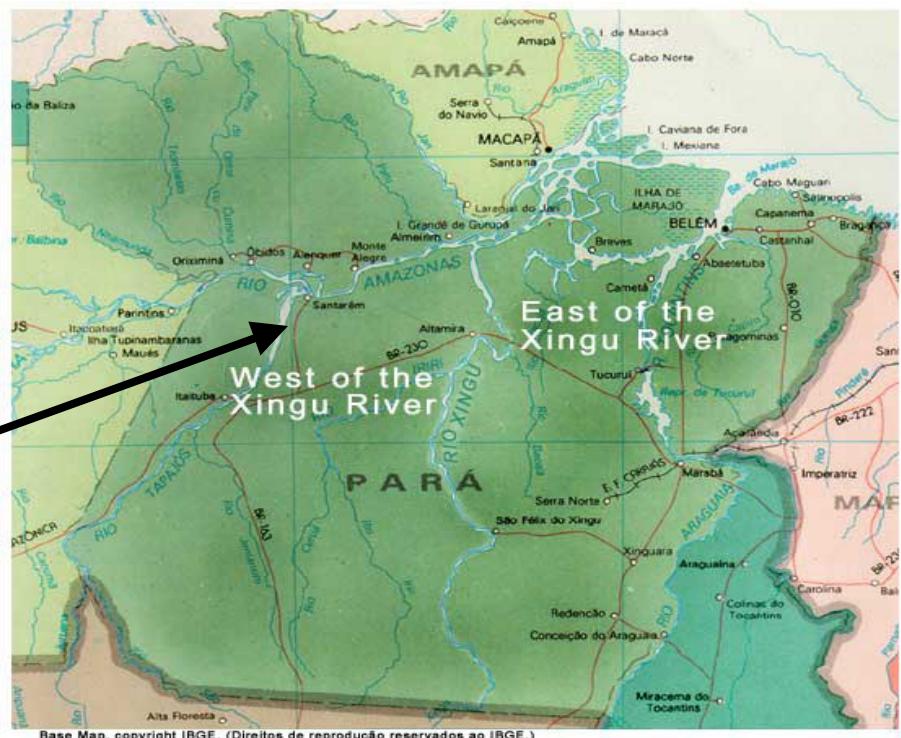
Jungle Research Group

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NY, USA
- (2) Universidade Federal de Santa Maria, RS
- (3) Universidade de São Paulo
- (4) EMBRAPA, Santarém

LBA research sites

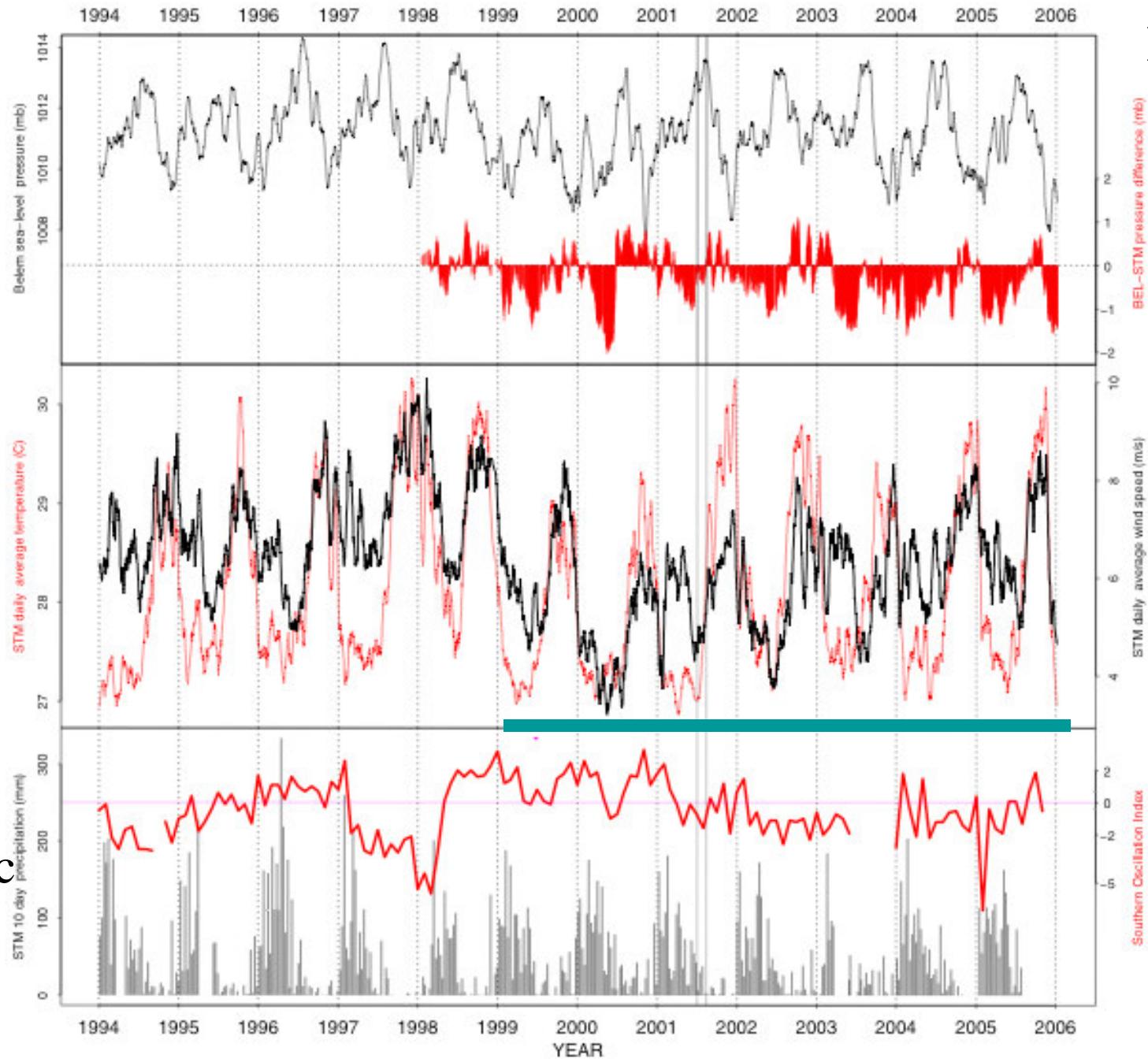


LBA-ECO
Santarém

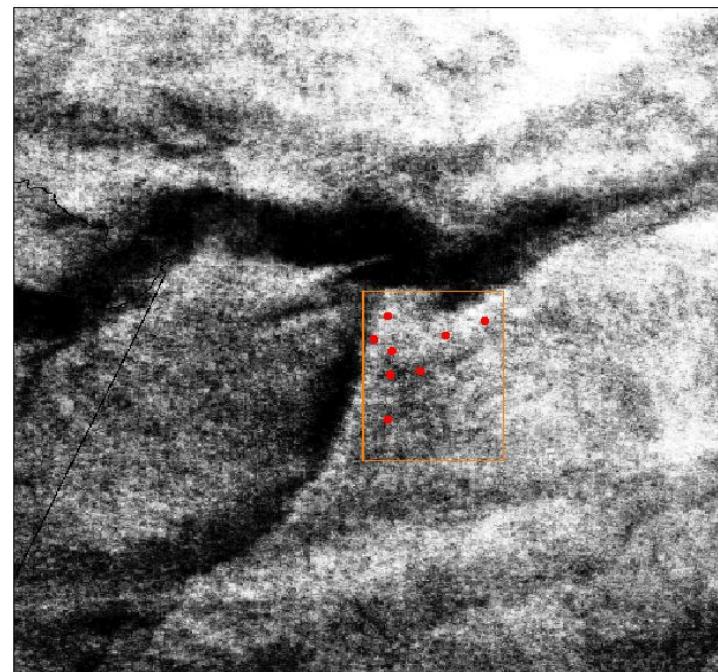
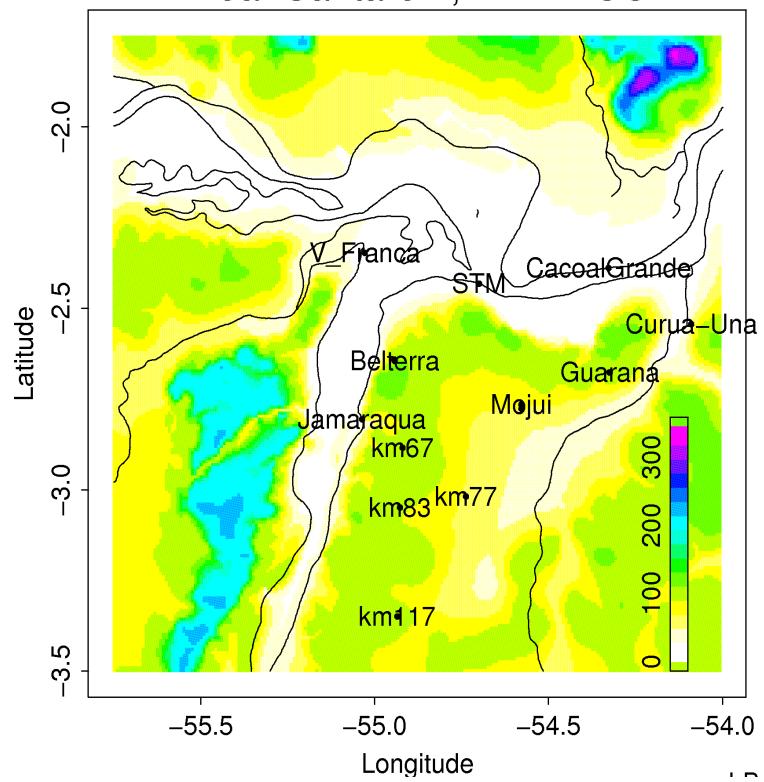


Prec

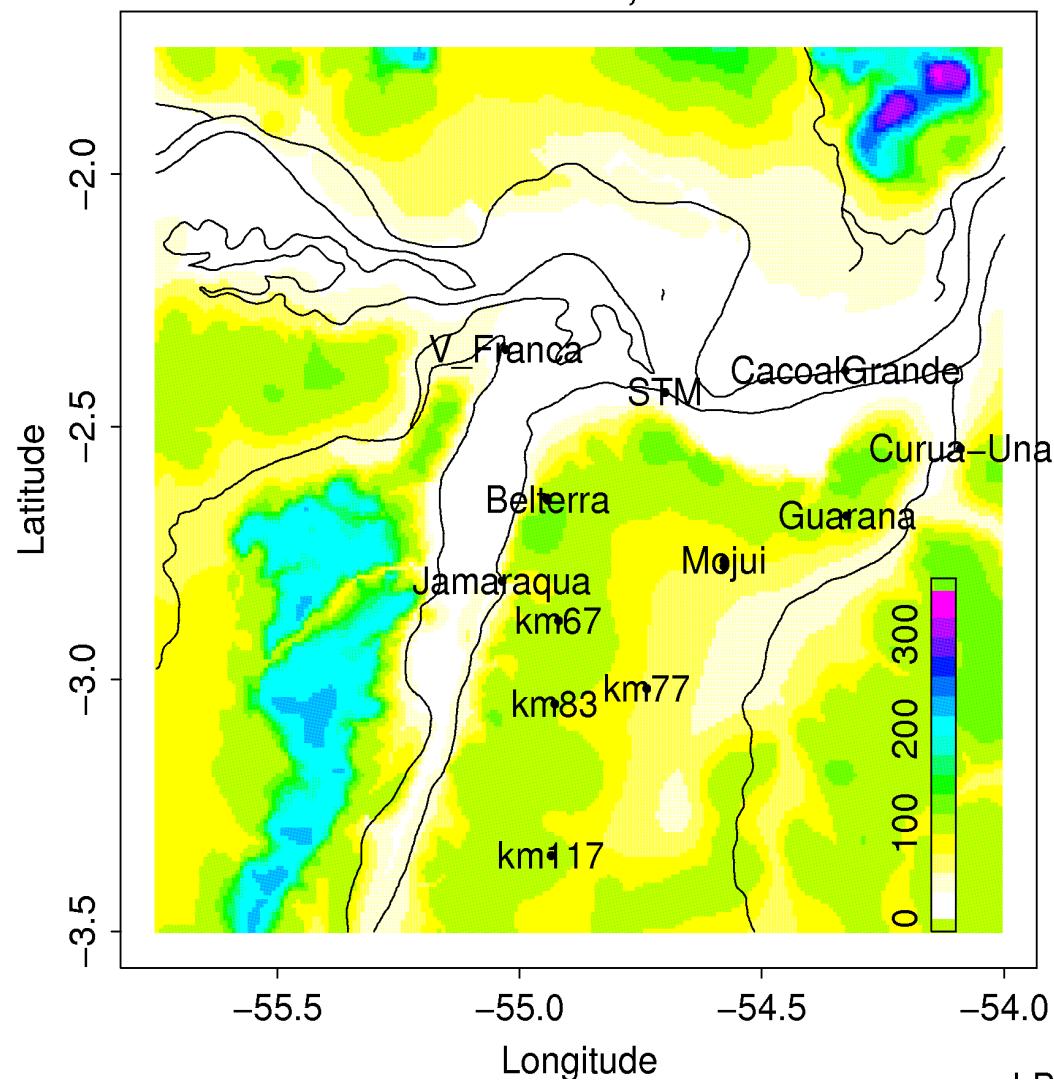
T



Weather and flux stations
near Santarem, LBA-ECO



Weather and flux stations near Santarem, LBA-ECO





Installed July 1998

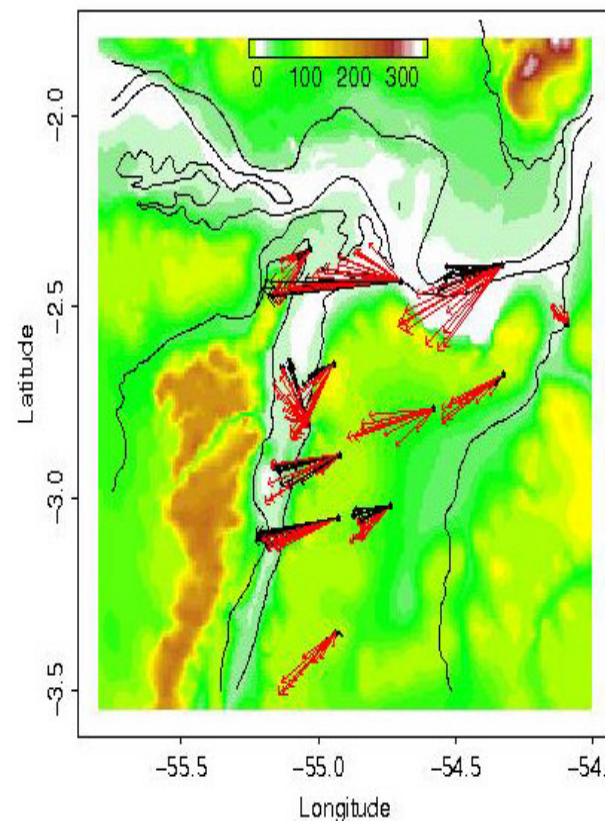
Original Belterra LBA station

km117 station

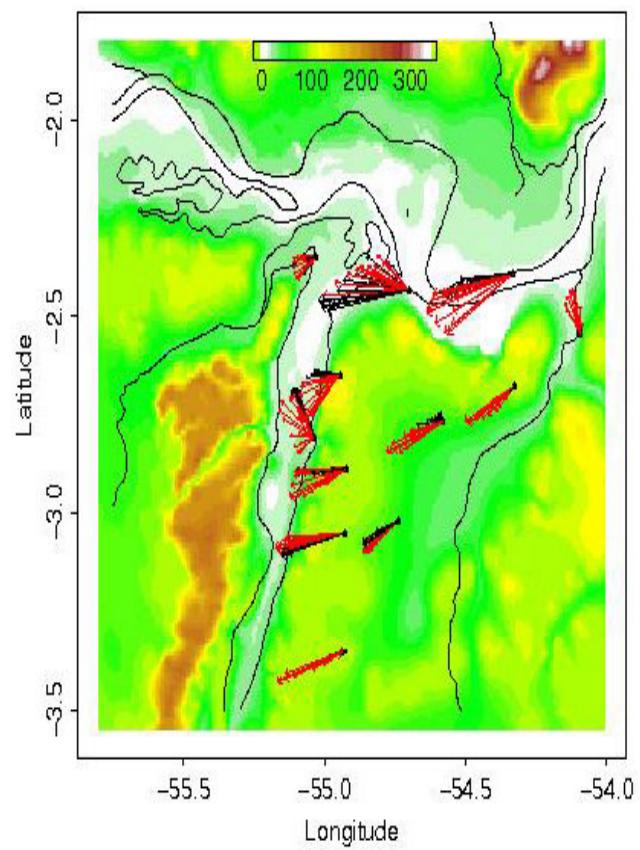




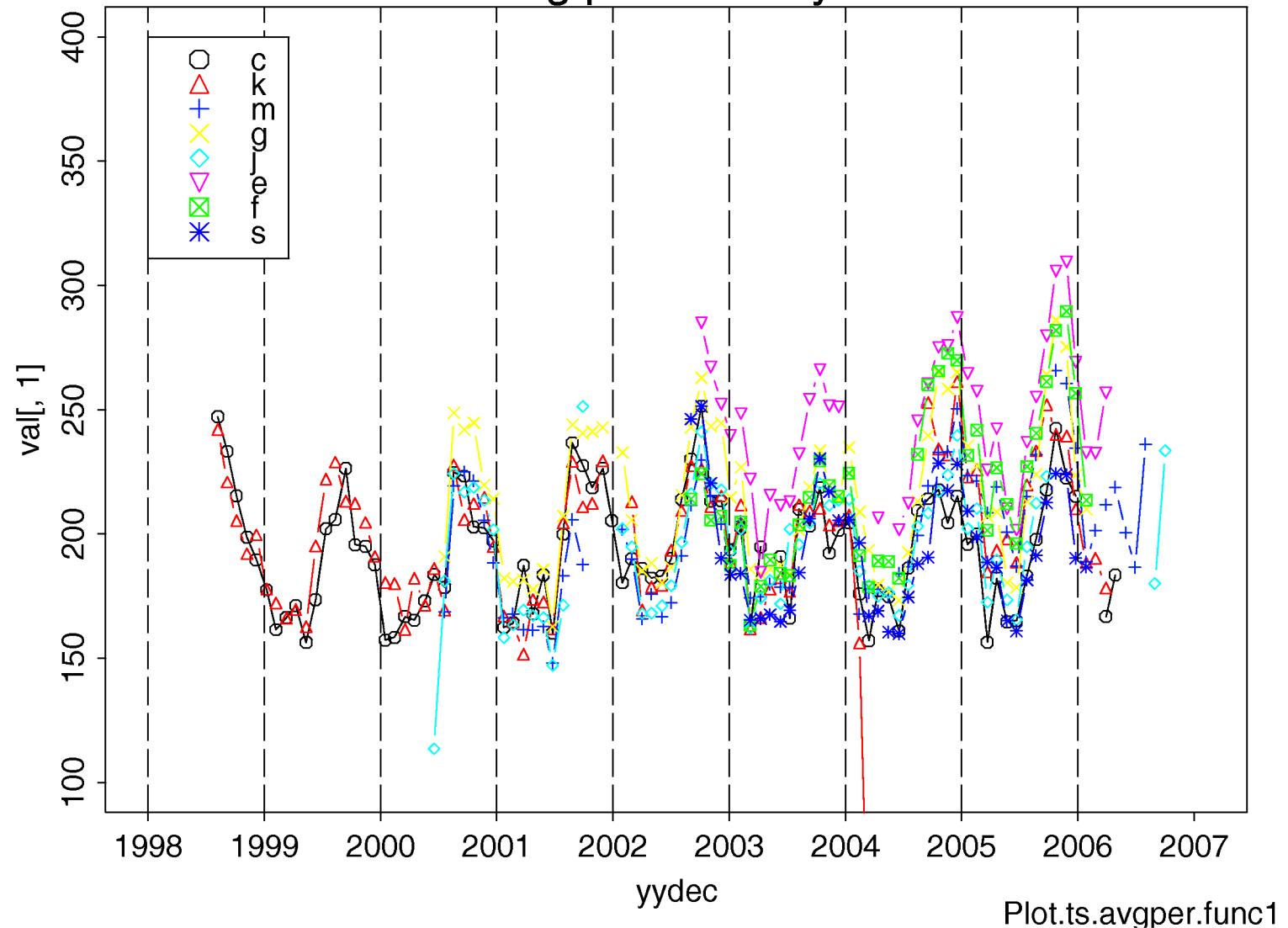
LBA Tapajos region Dry season

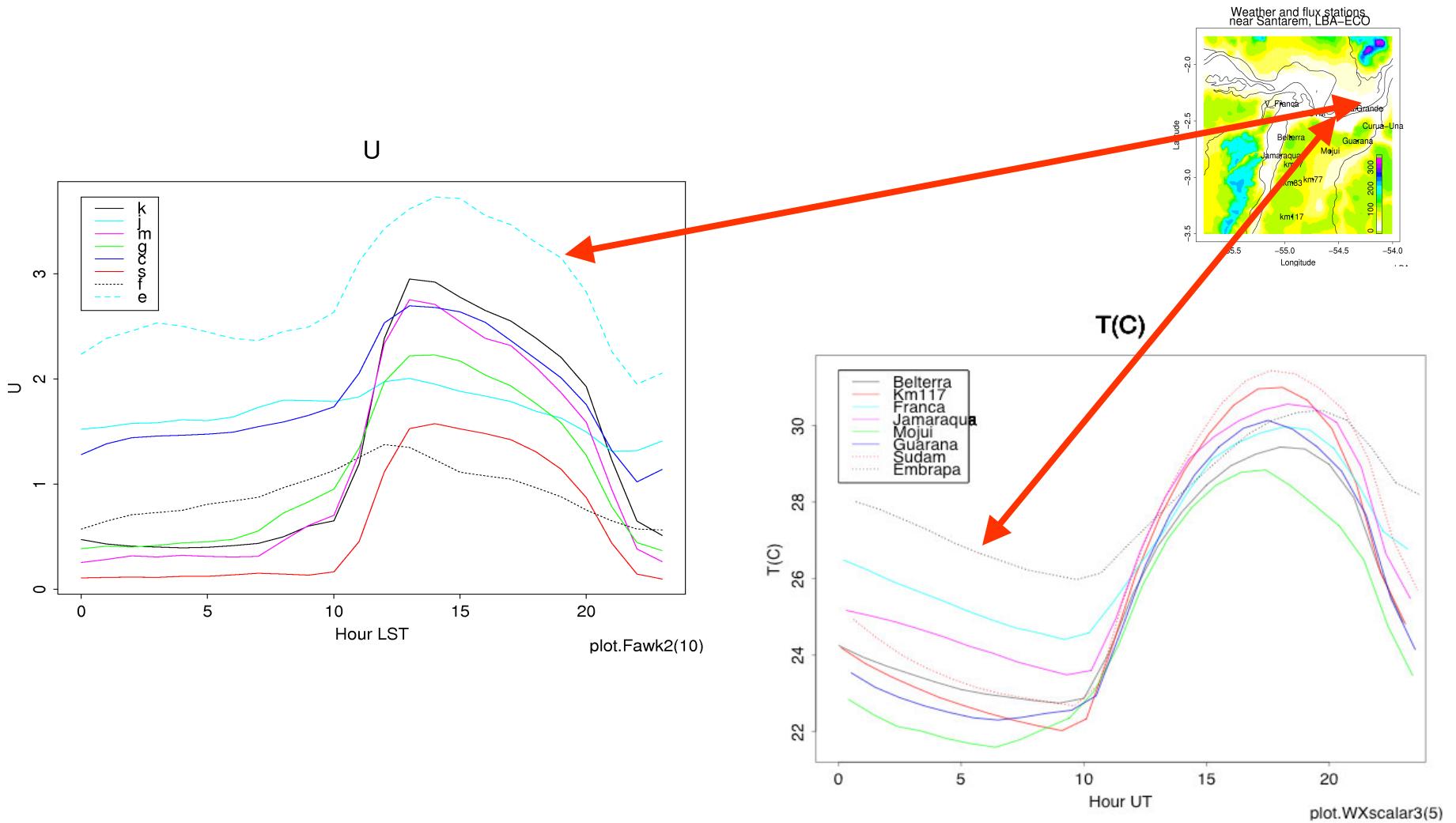


LBA Tapajos region Wet season

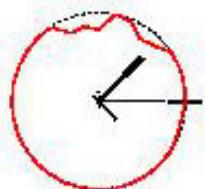


LBA: Met Stations – Sdw avg.per= 31 days





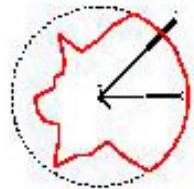
km83 flux tower



E



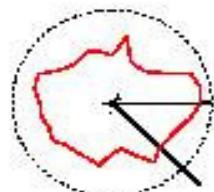
Embrapa



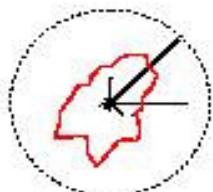
W

Fujita's transmission factors; wind roses

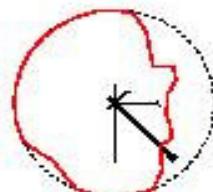
Belterra



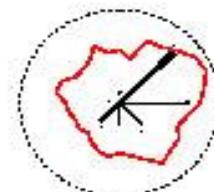
Franca



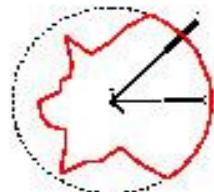
Jamaraqua



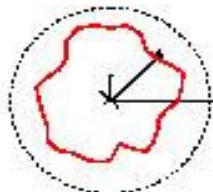
Mojui



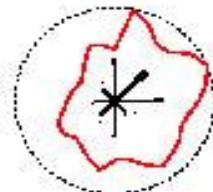
Embrapa



Guarana



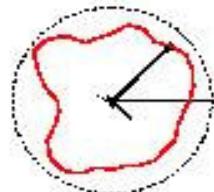
Km117



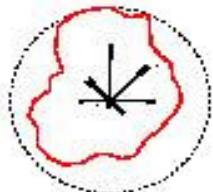
Sudam



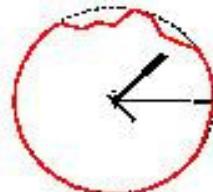
km67 flux tower

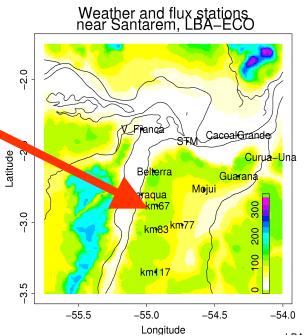


km77 flux tower

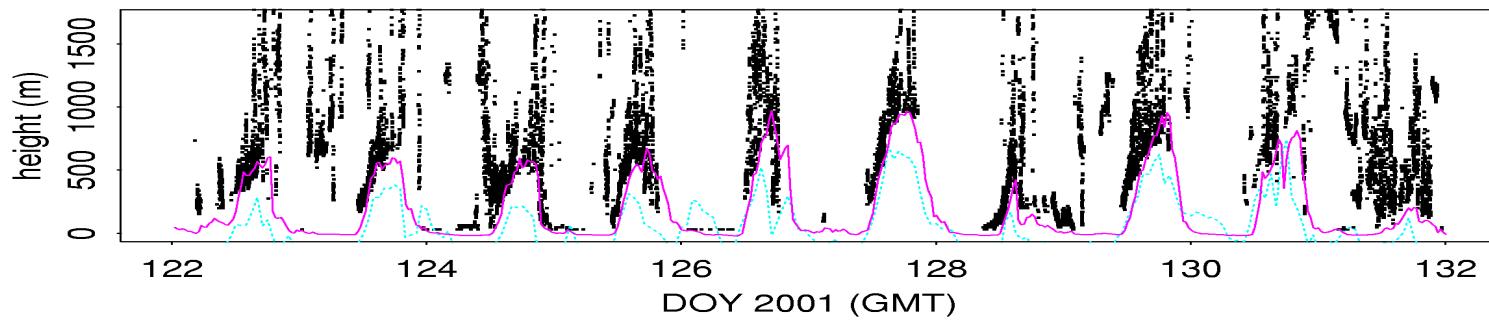


km83 flux tower

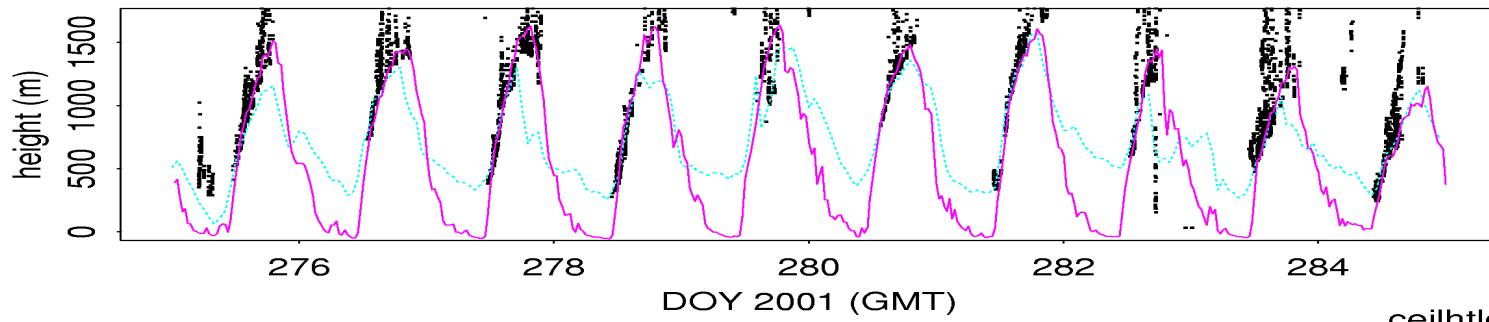




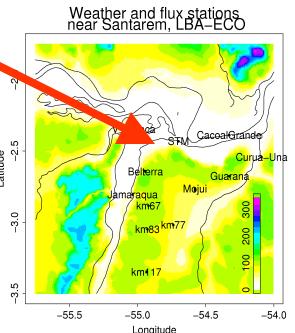
Km67 cloud base, LCL; pasture LCL, wet season



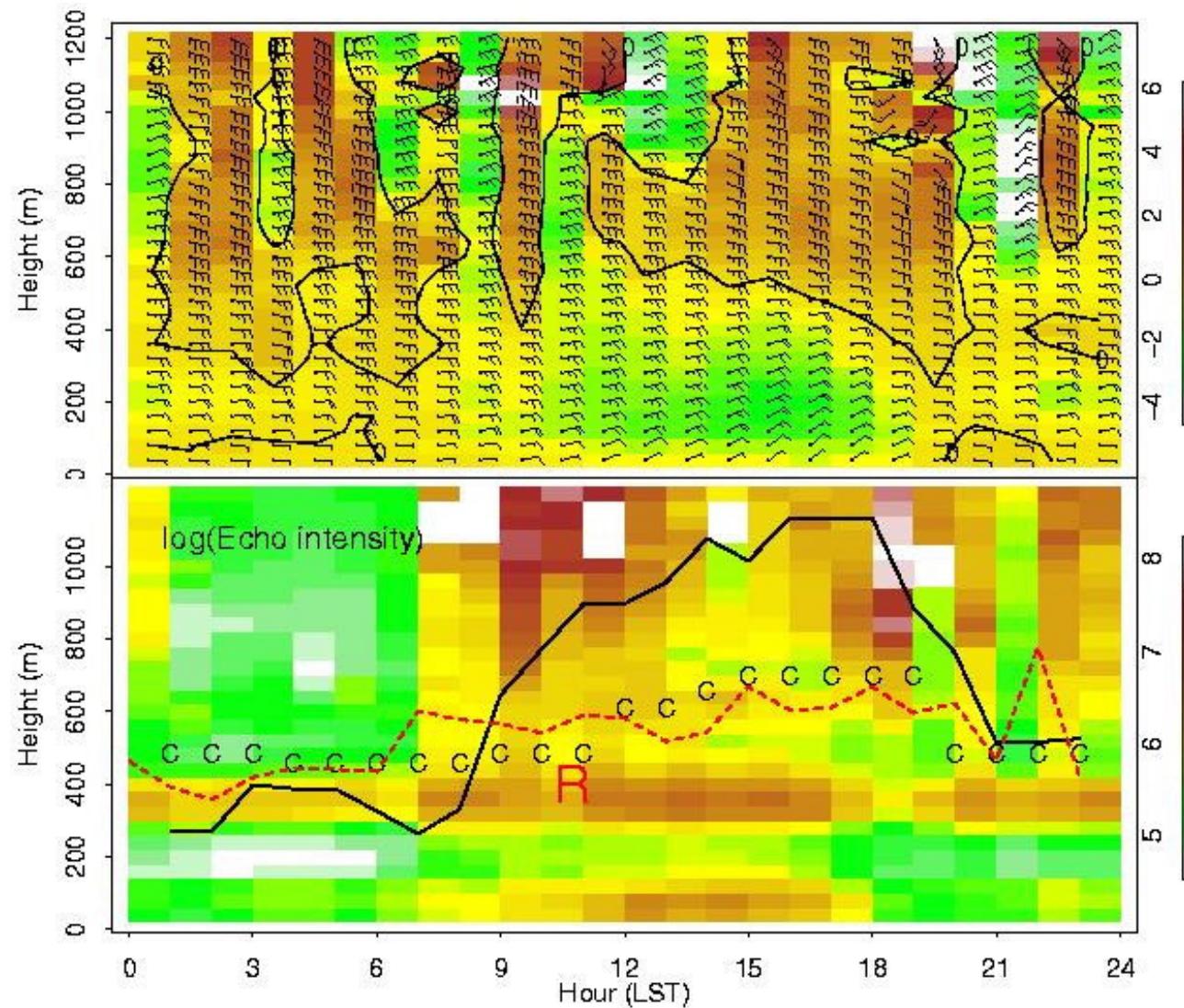
Km67 cloud base, LCL; pasture LCL, dry season



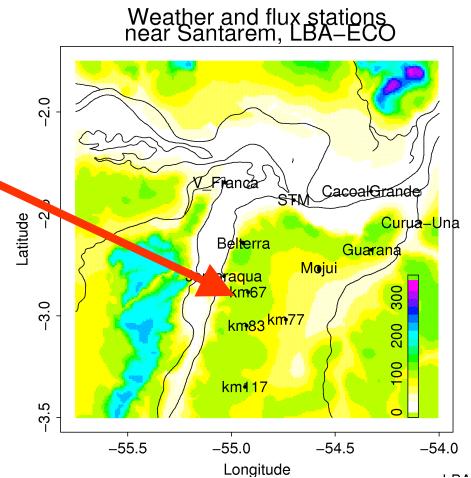
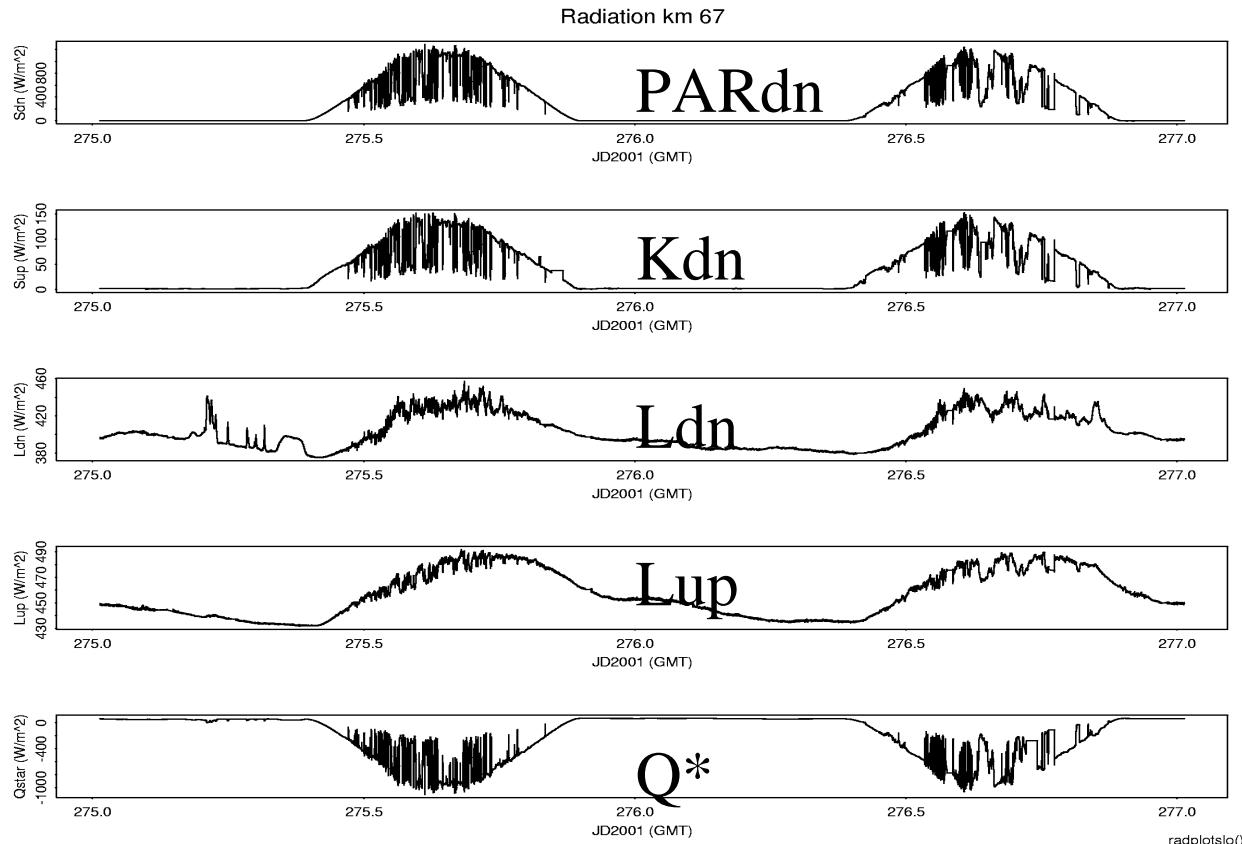
`ceilhtlcl()`



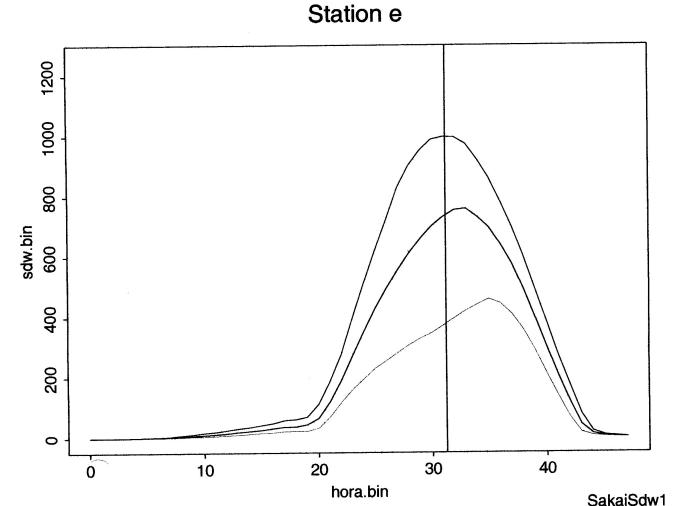
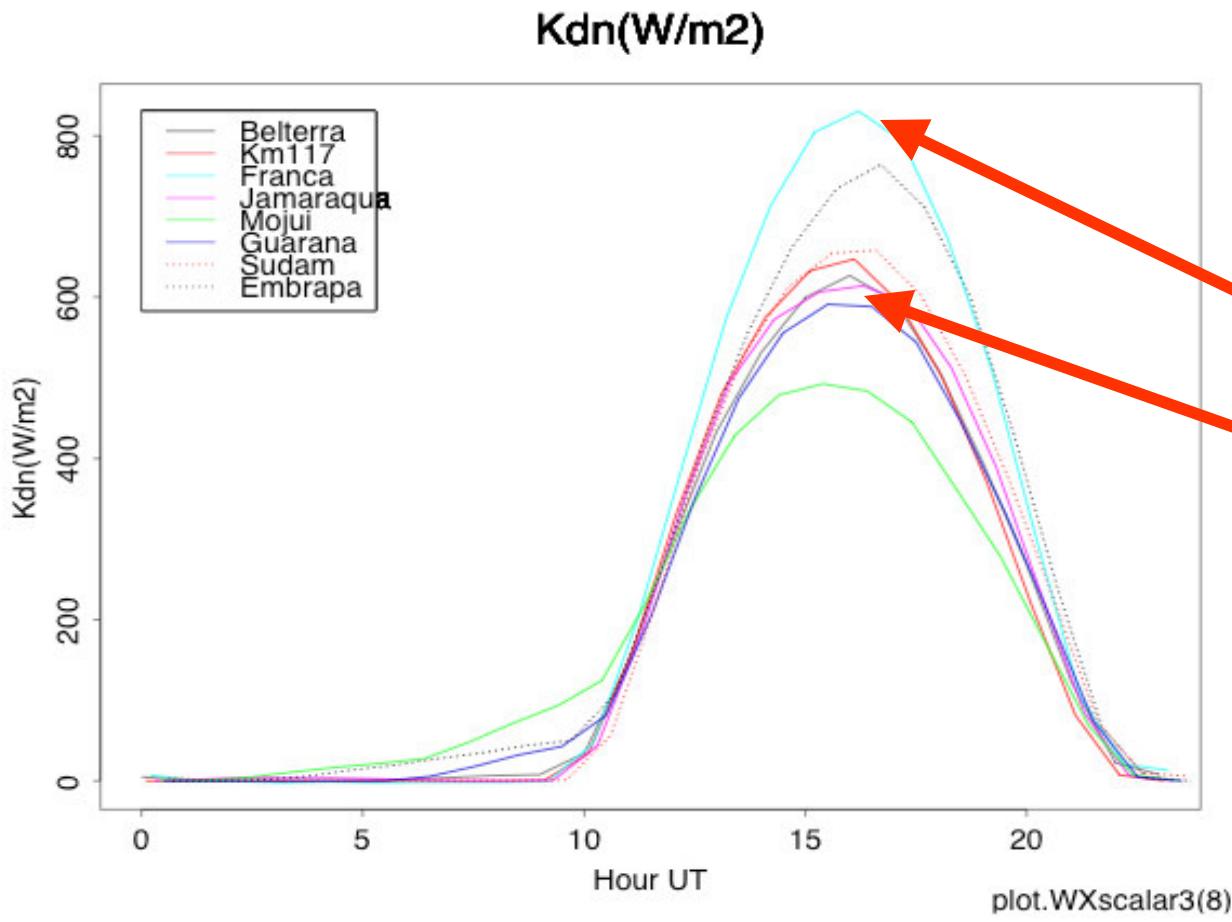
Santarem airport Mean wind July 24–July 31 2001



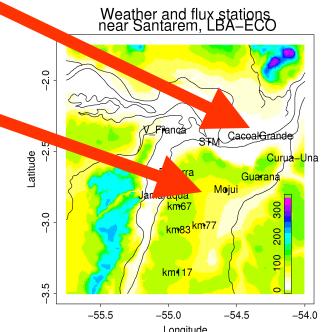
Radiative fluxes at the km67 site



Appreciably more global solar radiation
near the river...

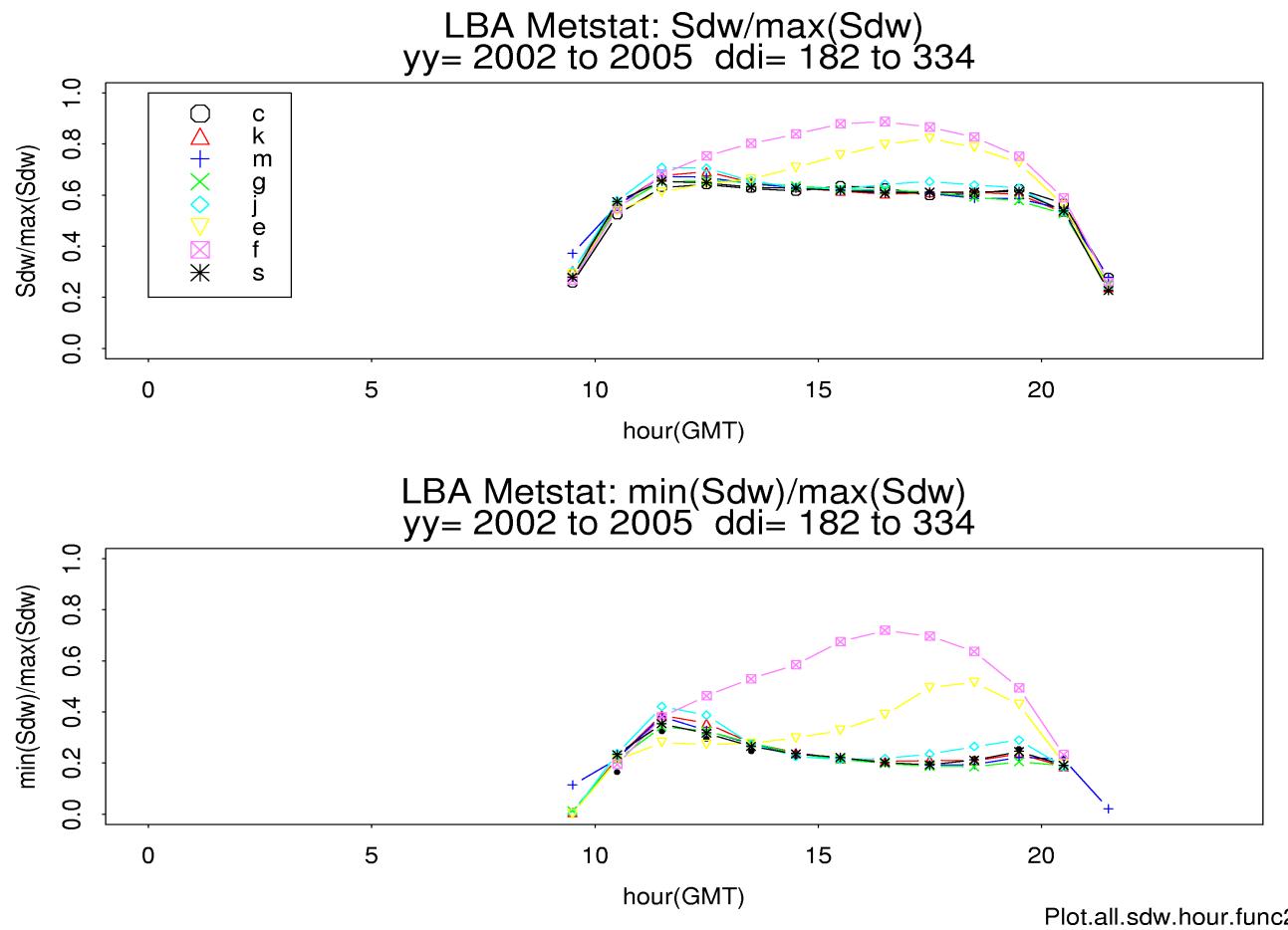


Clocks are OK!

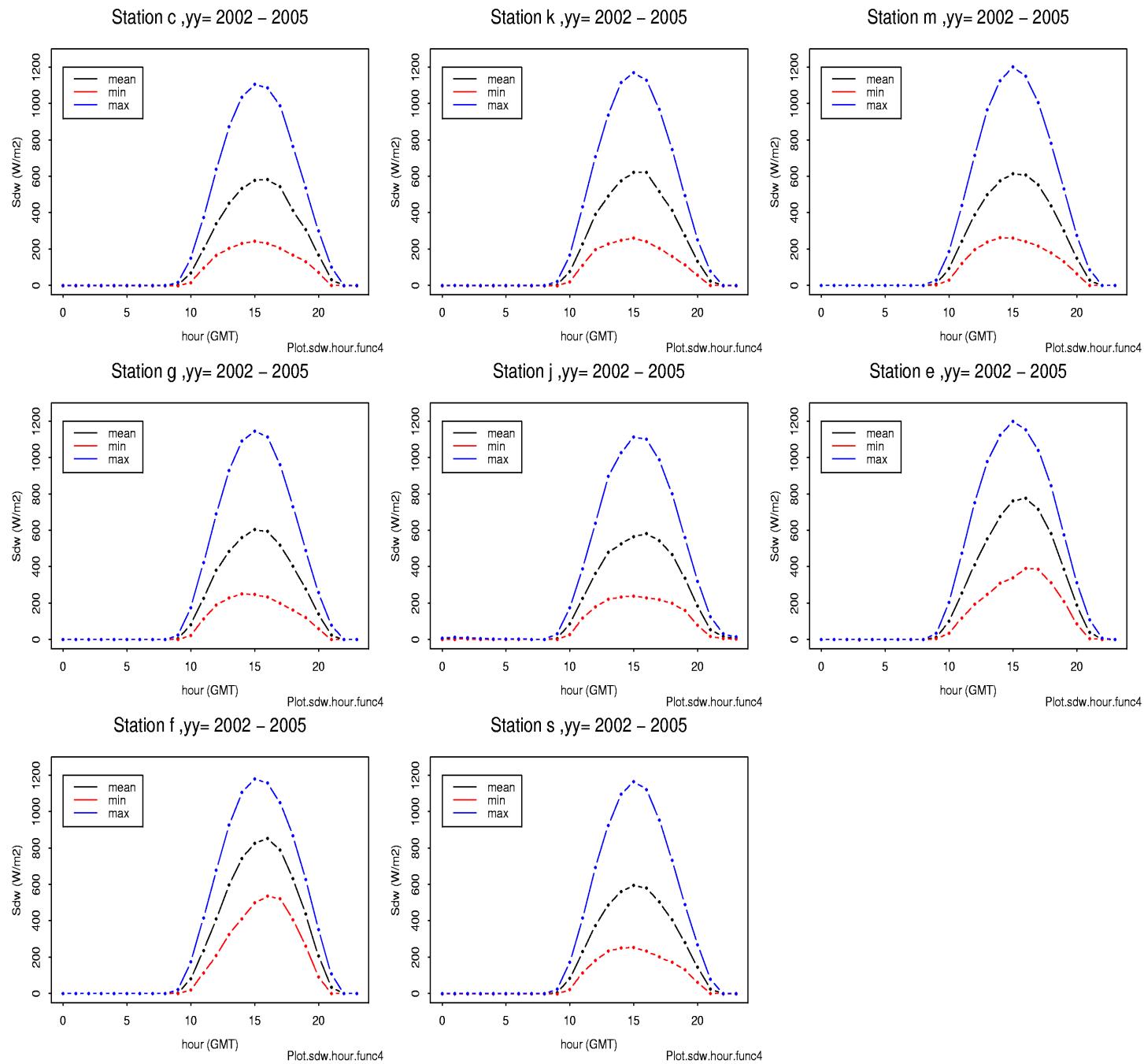


Diurnal asymmetry in mean K_{dn}
results from similar asymmetry
in cloudiness.

Use the half-hourly statistics to infer cloud effects...

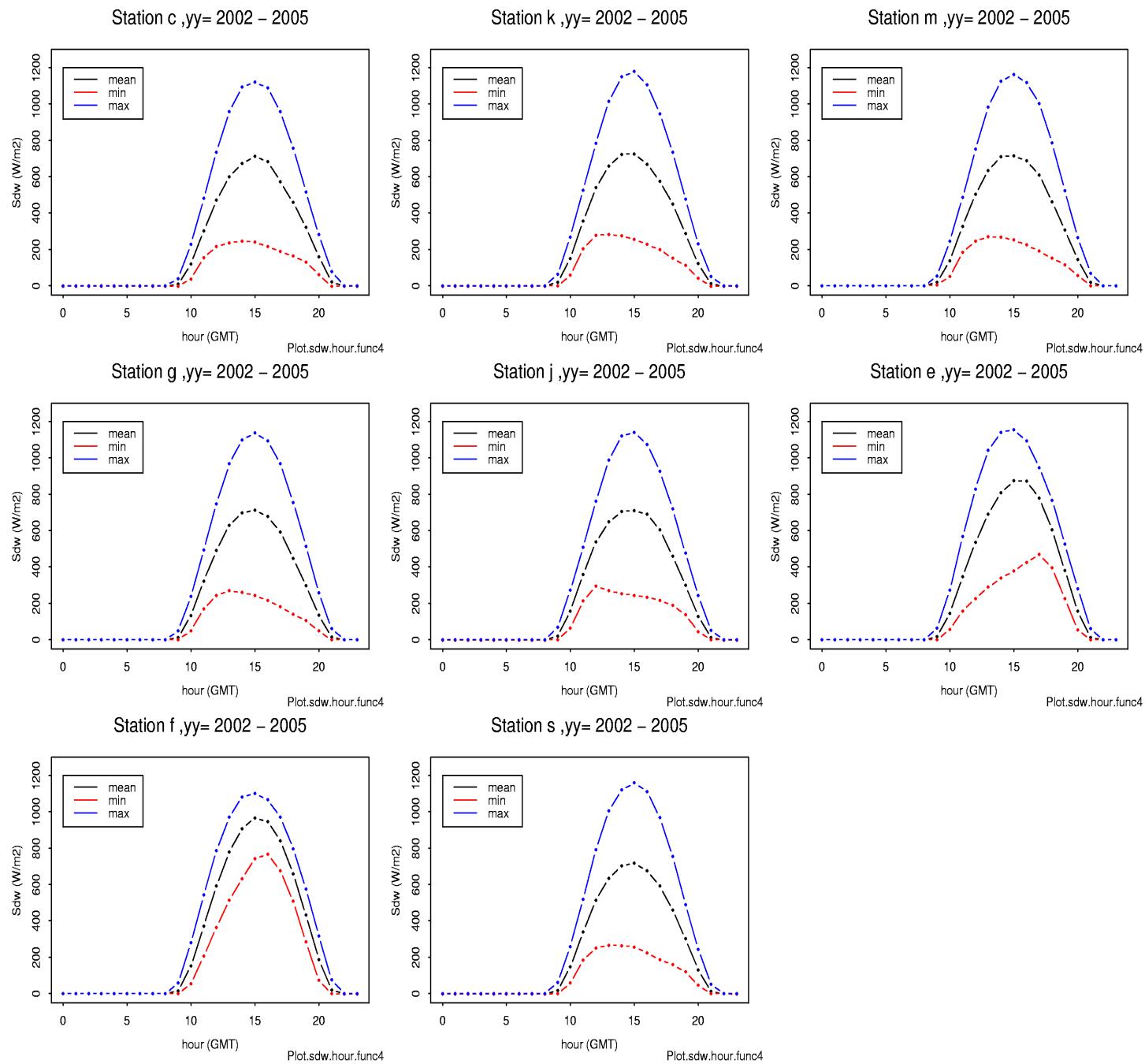


Max
Mean
Min



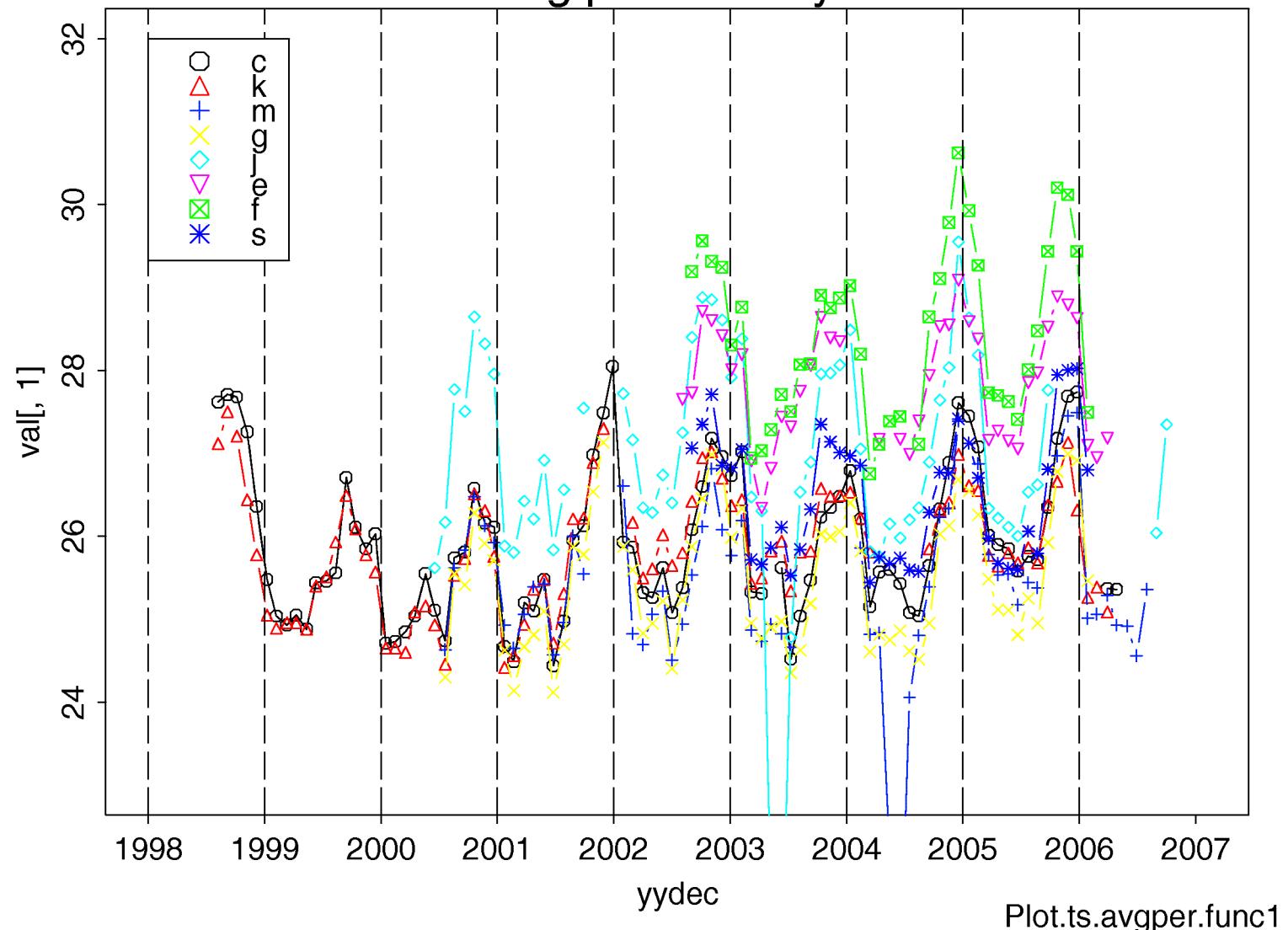
Wet season

Max
Mean
Min

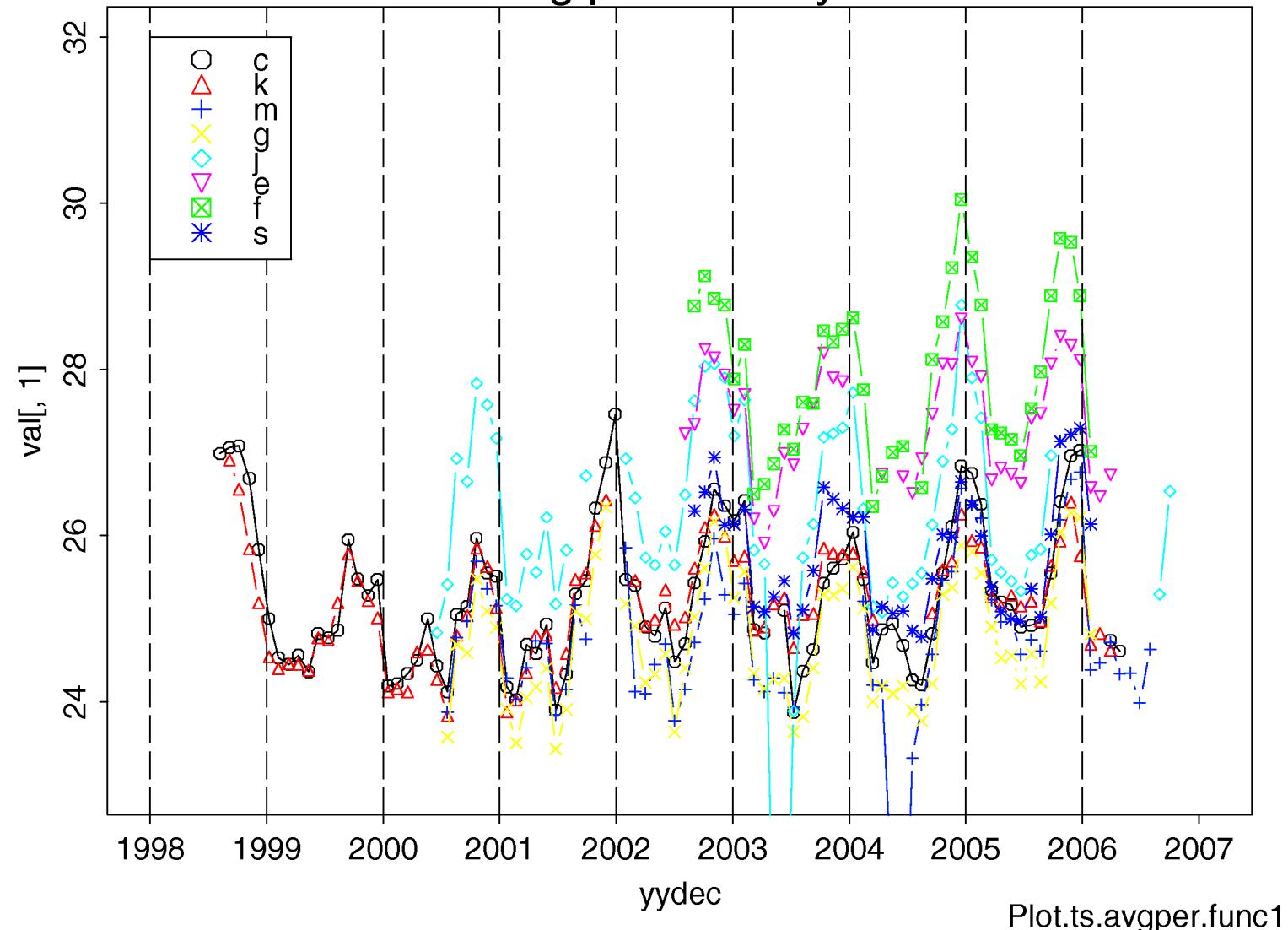


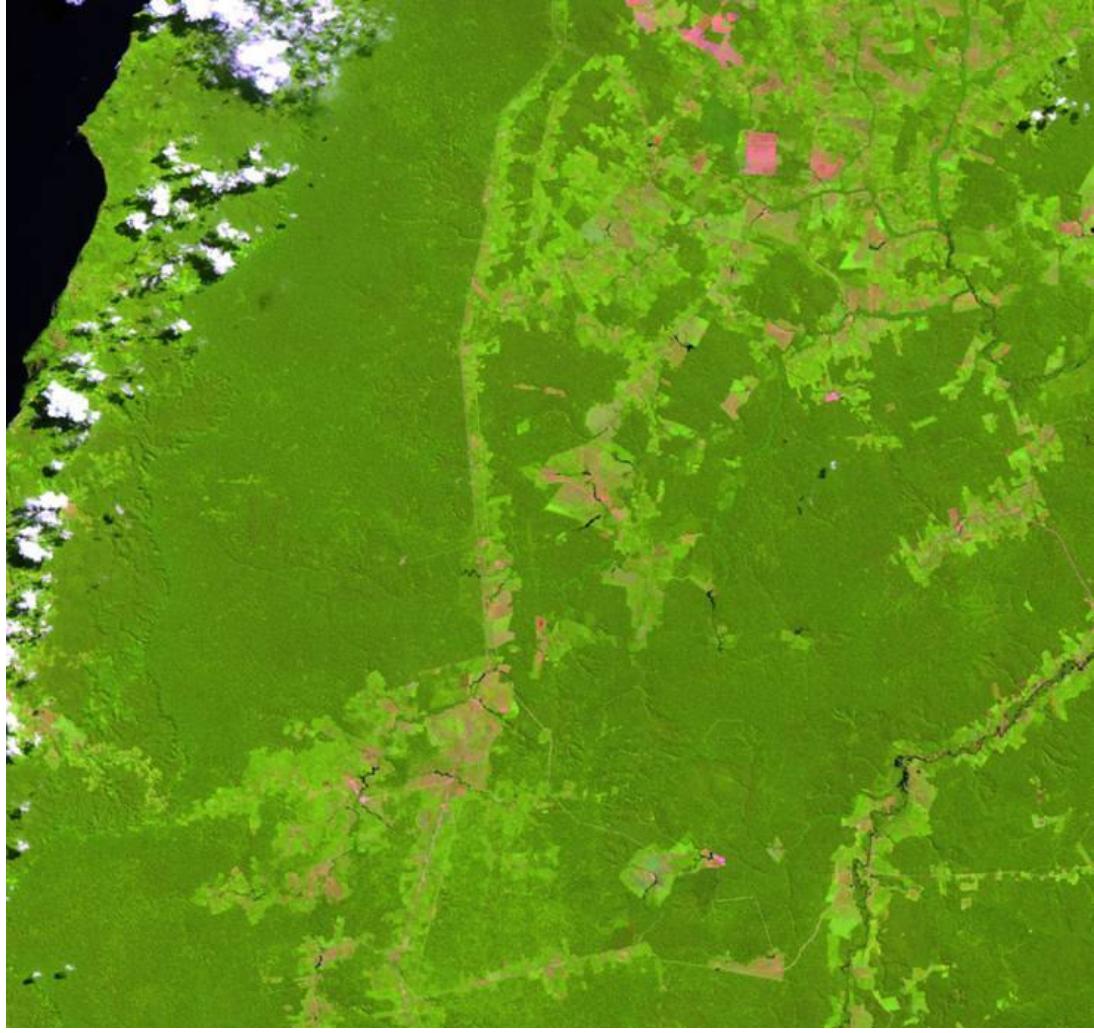
Dry season

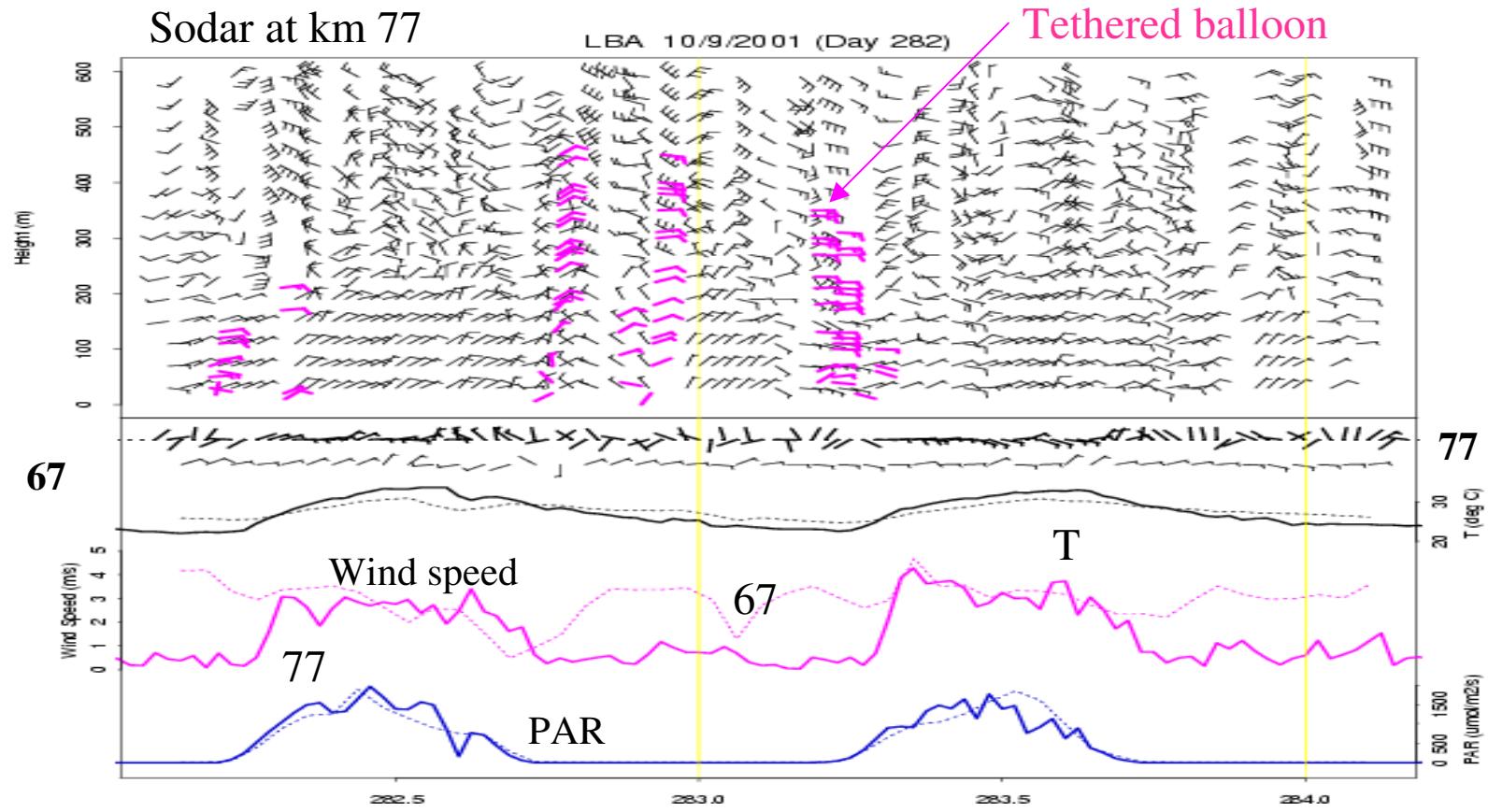
LBA: Met Stations – Tair avg.per= 31 days



LBA: Met Stations – min(Tair) avg.per= 31 days



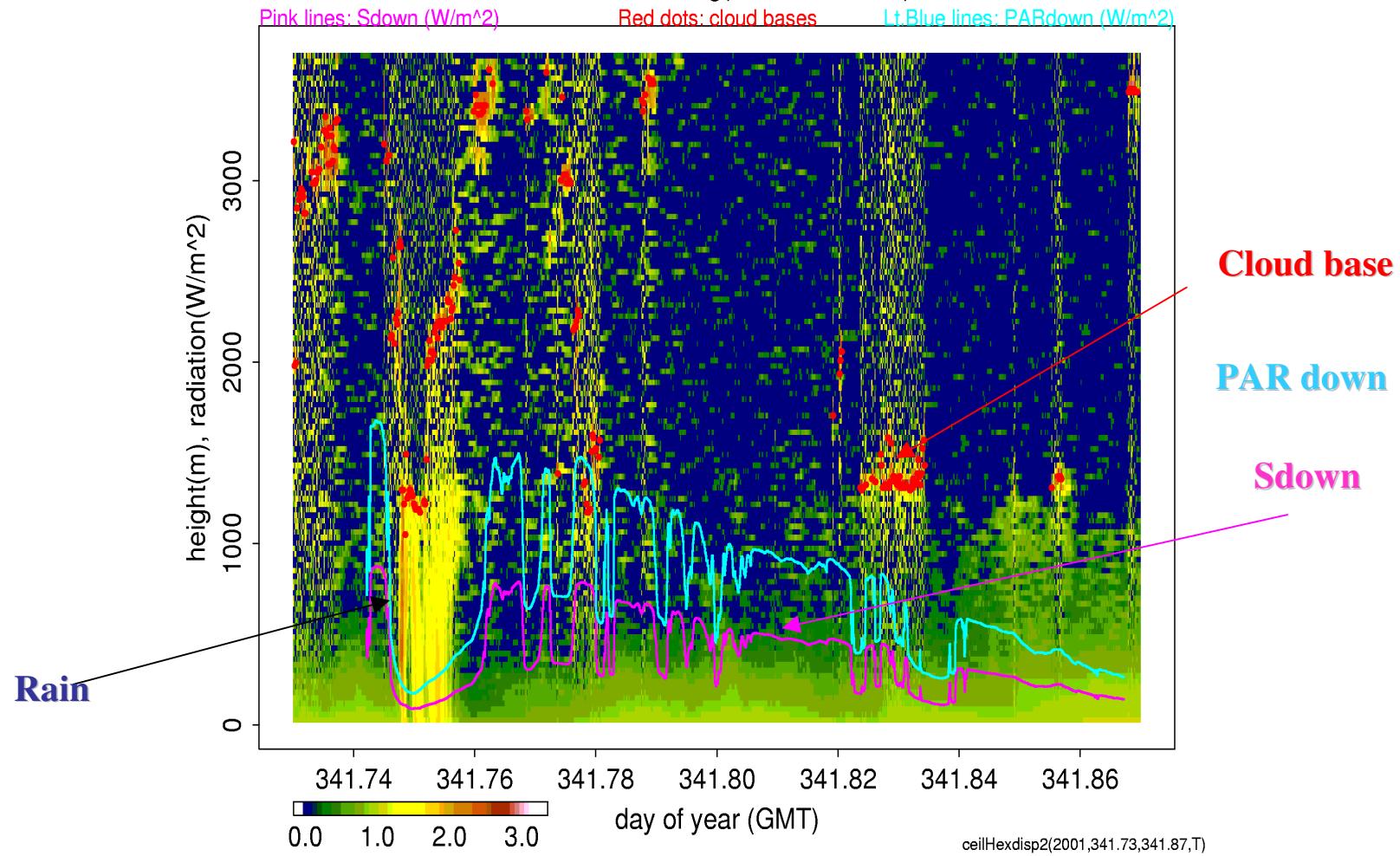




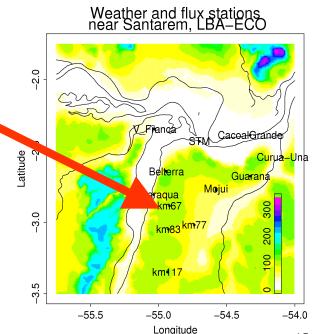
Old Growth Site/Pasture site comparison

Long-term average Sdw(km67)≈0.95 Sdw(km77)

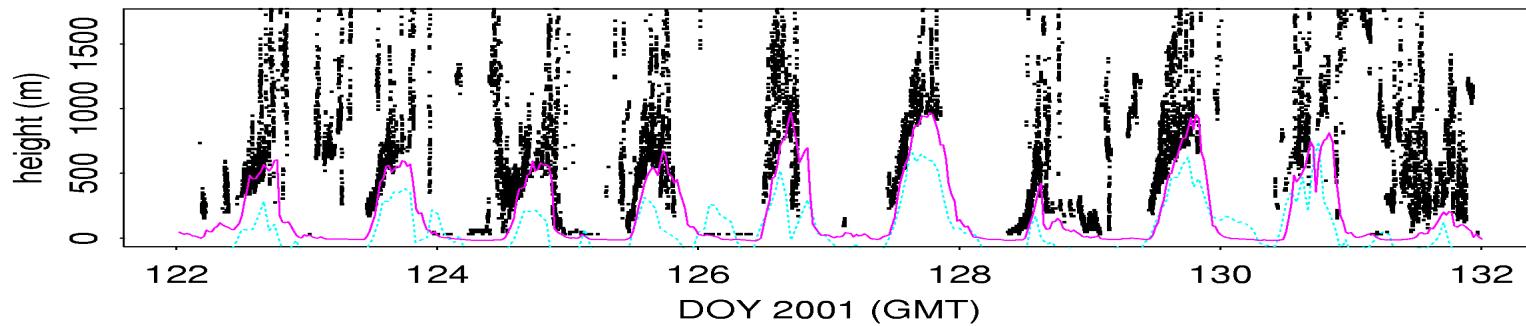
Km67 Raw Backscatter: Year: 2001 341.730104 to 341.869861 GMT
Backscatter units: $\log(10000 * \text{srad} * \text{km})^{-1}$



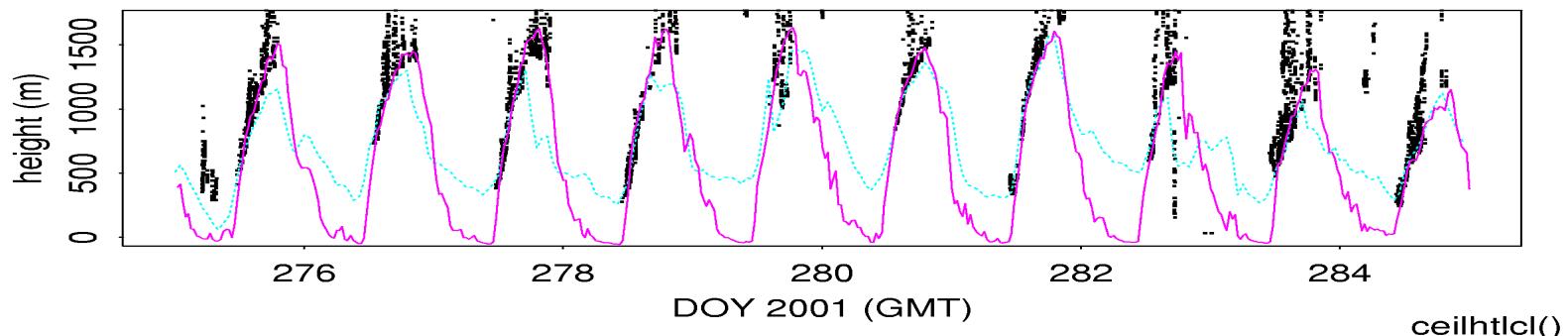
Cloud base at km67 is described by the LCL at km77 ‘pasture’ site, not by local variables (internal BL?)

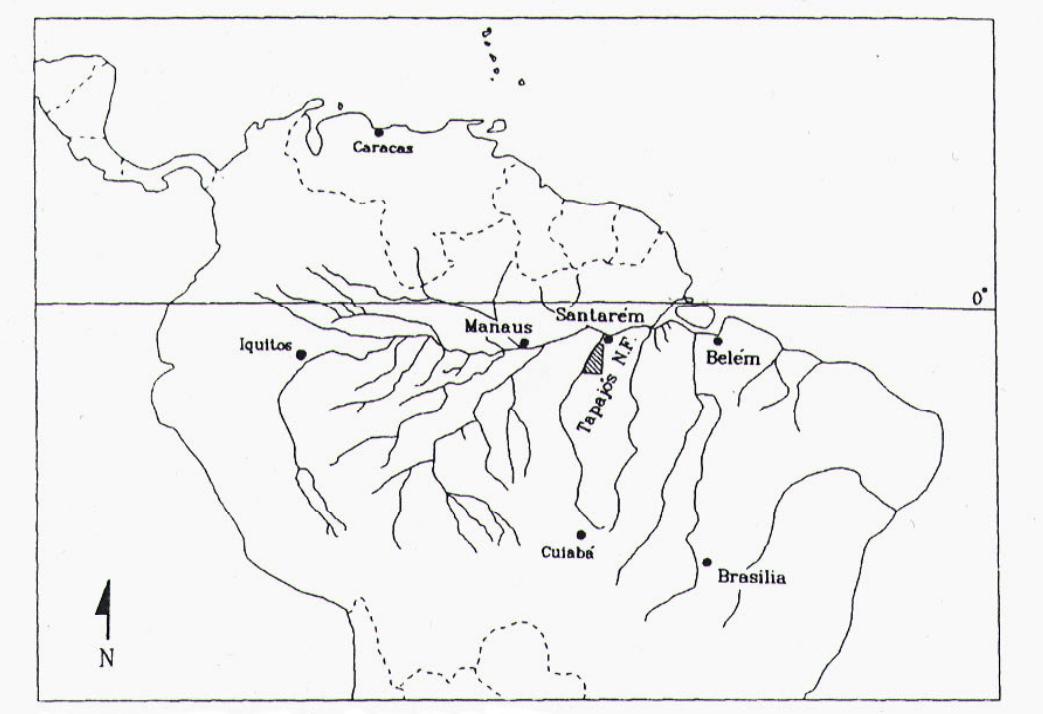


Km67 cloud base, LCL; pasture LCL, wet season



Km67 cloud base, LCL; pasture LCL, dry season





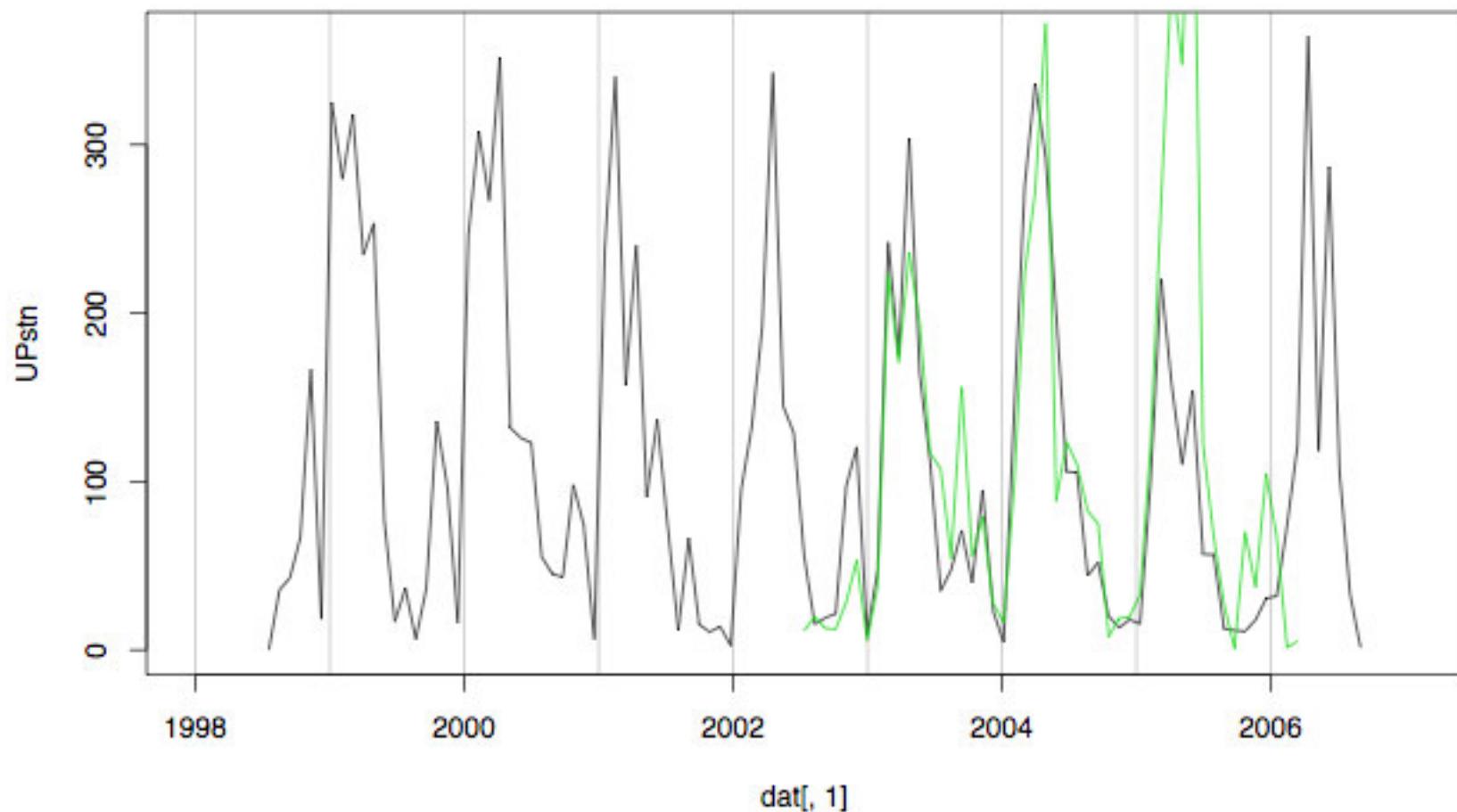
Precipitation

Connect the dots to get the rivers

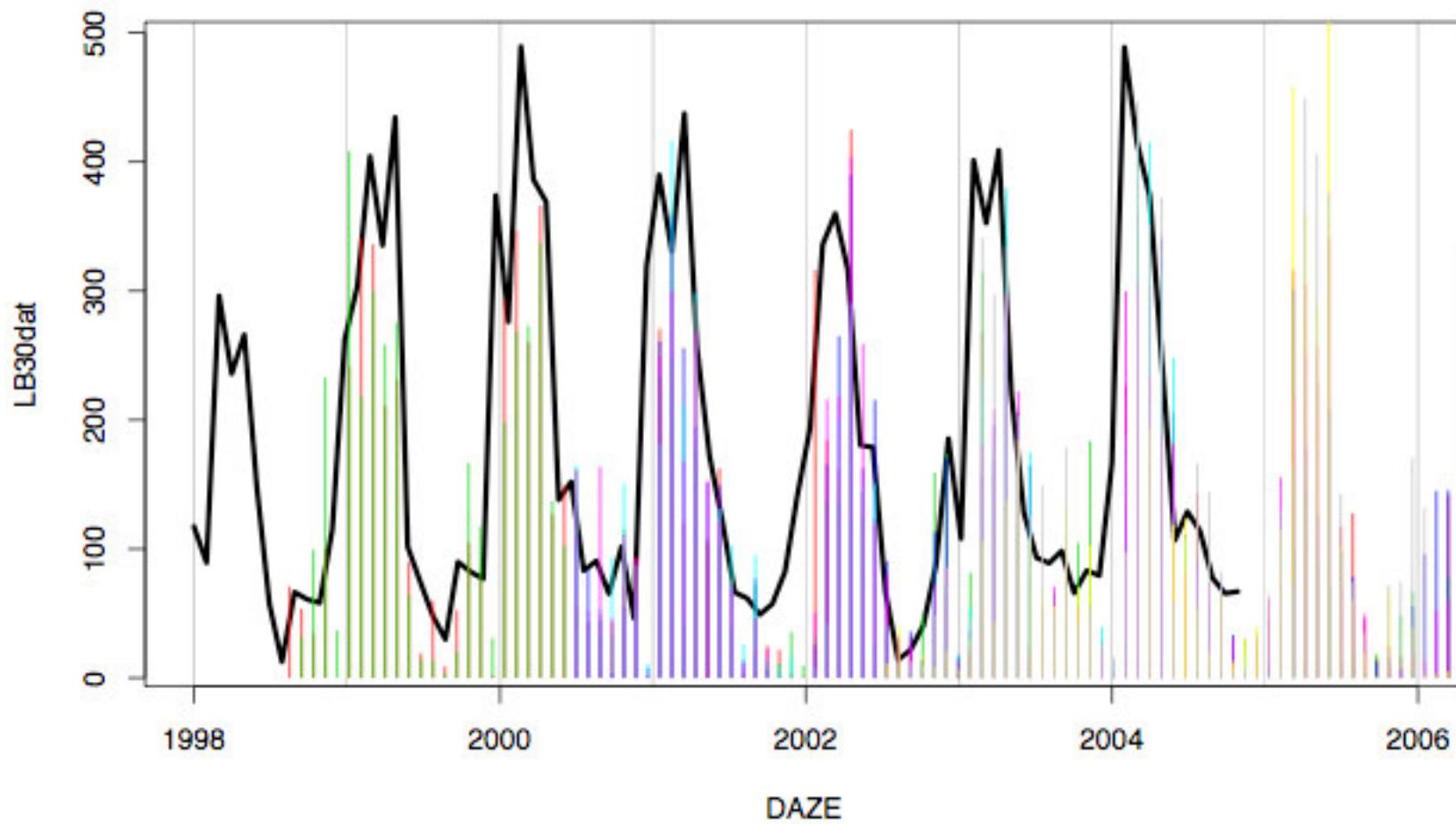
REDE DE ESTAÇÕES DE SUPERFÍCIE CONVENCIONAIS - INMET



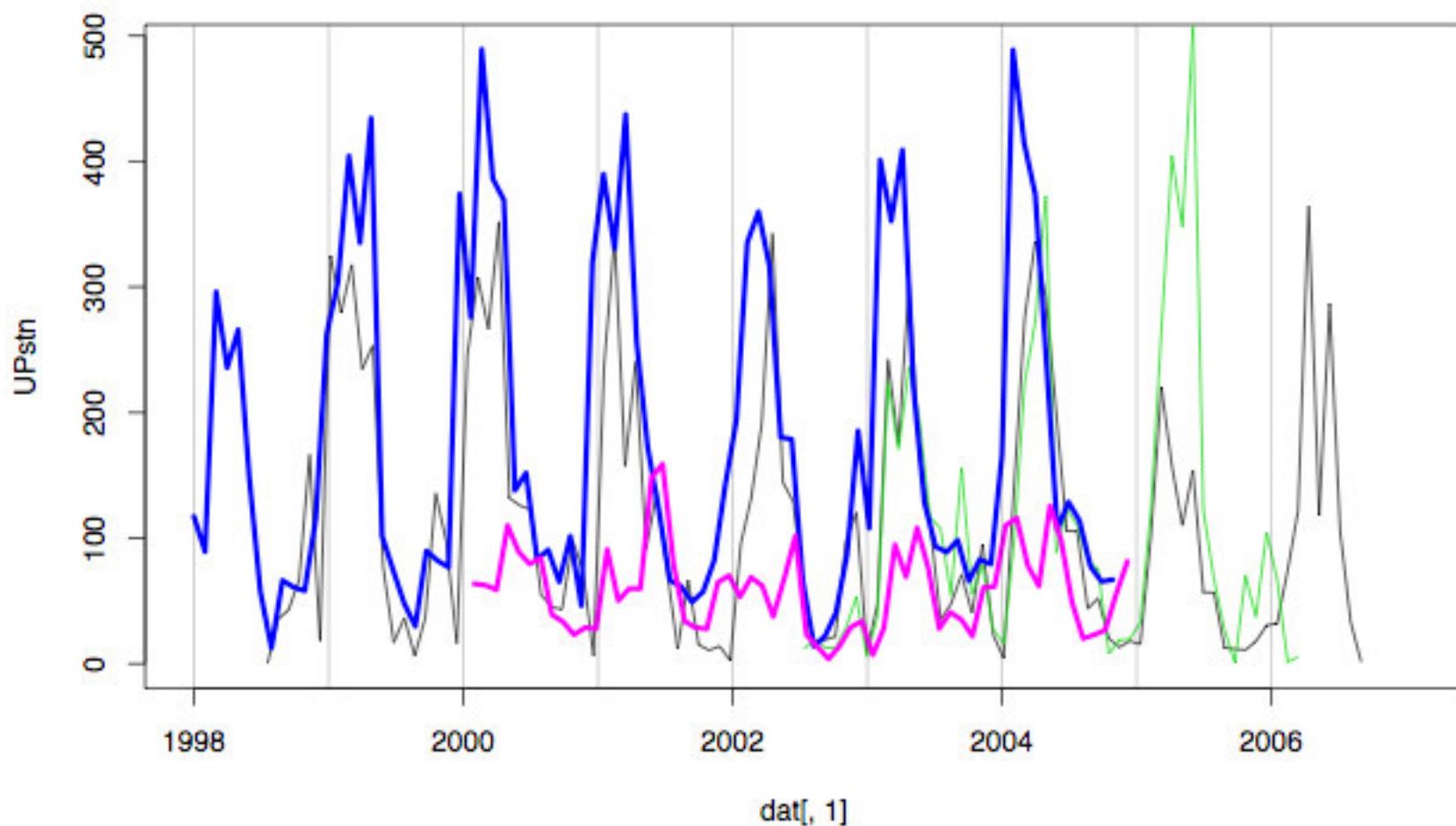
precipitation-upland vs near river (green)



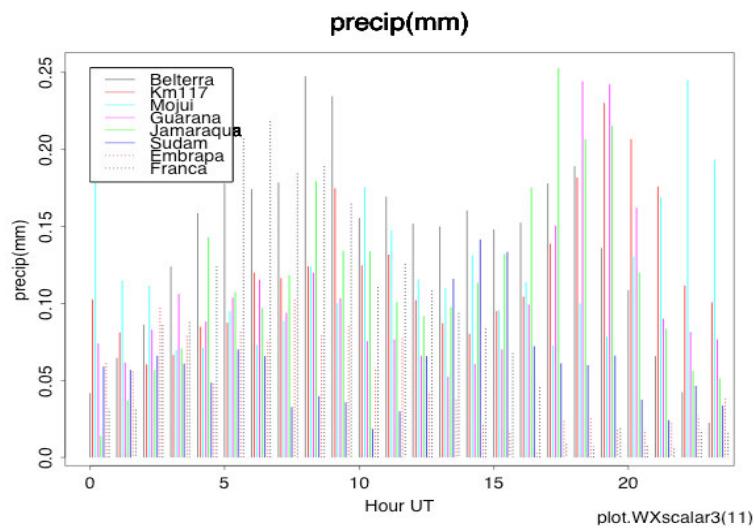
Tapajós region precipitation-30 day means



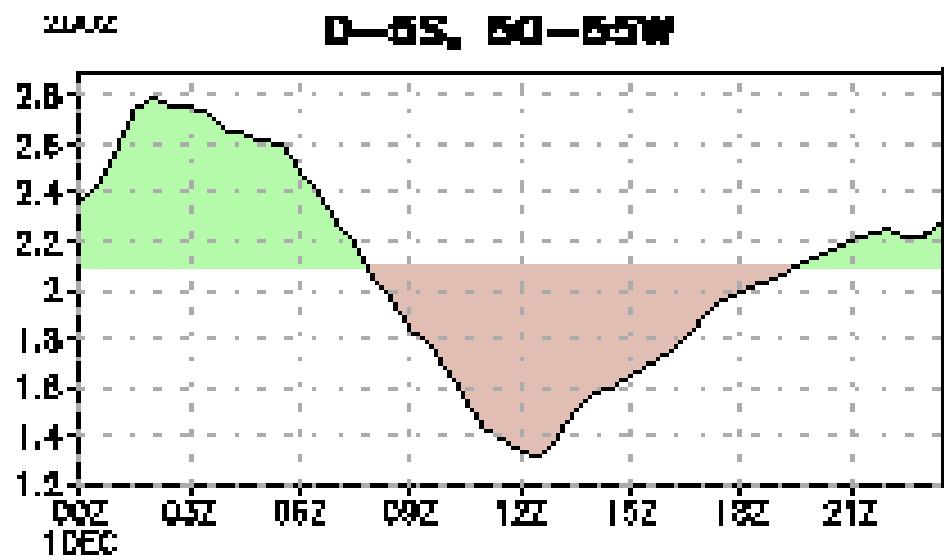
precipitation-upland vs near river (green)



Diurnal patterns of precipitation depend on proximity to river

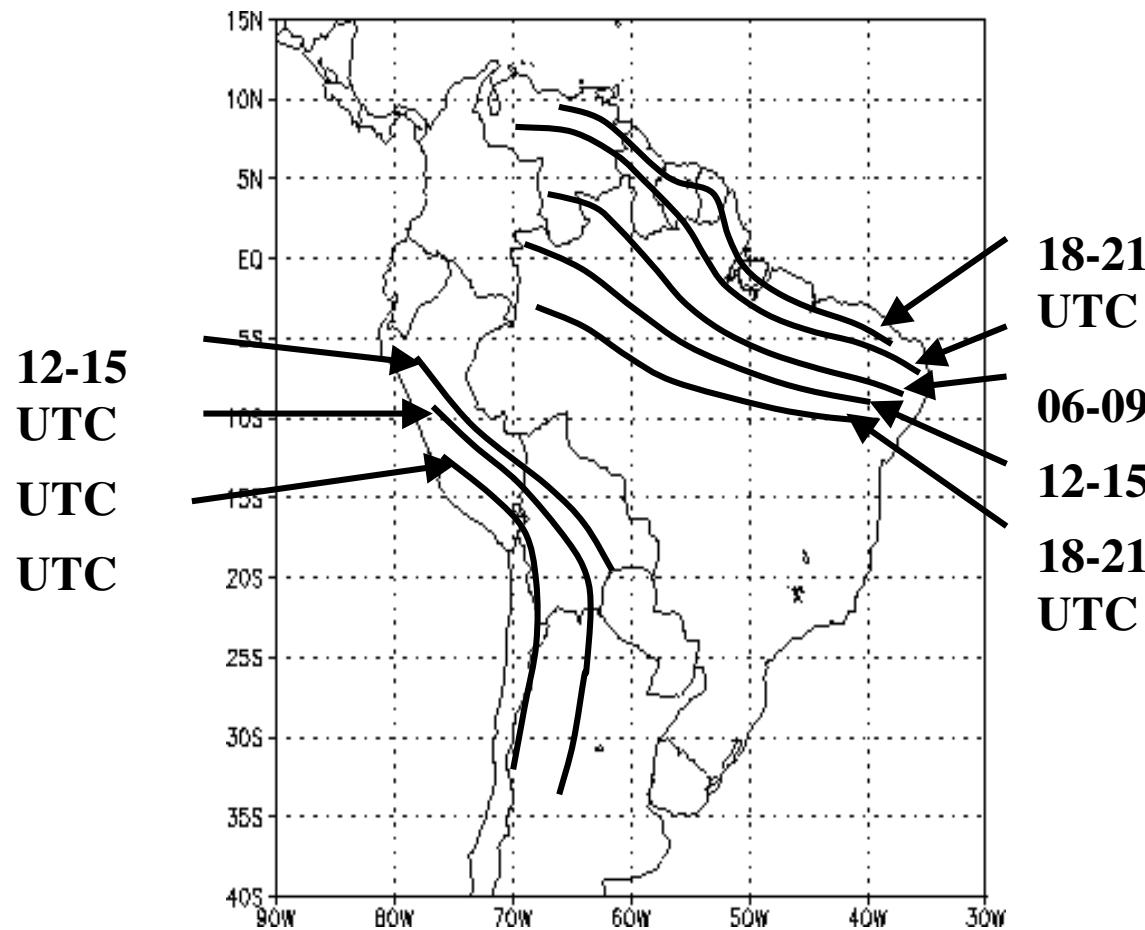


STM weather stations



CMORPH, Kousky et al. 2006

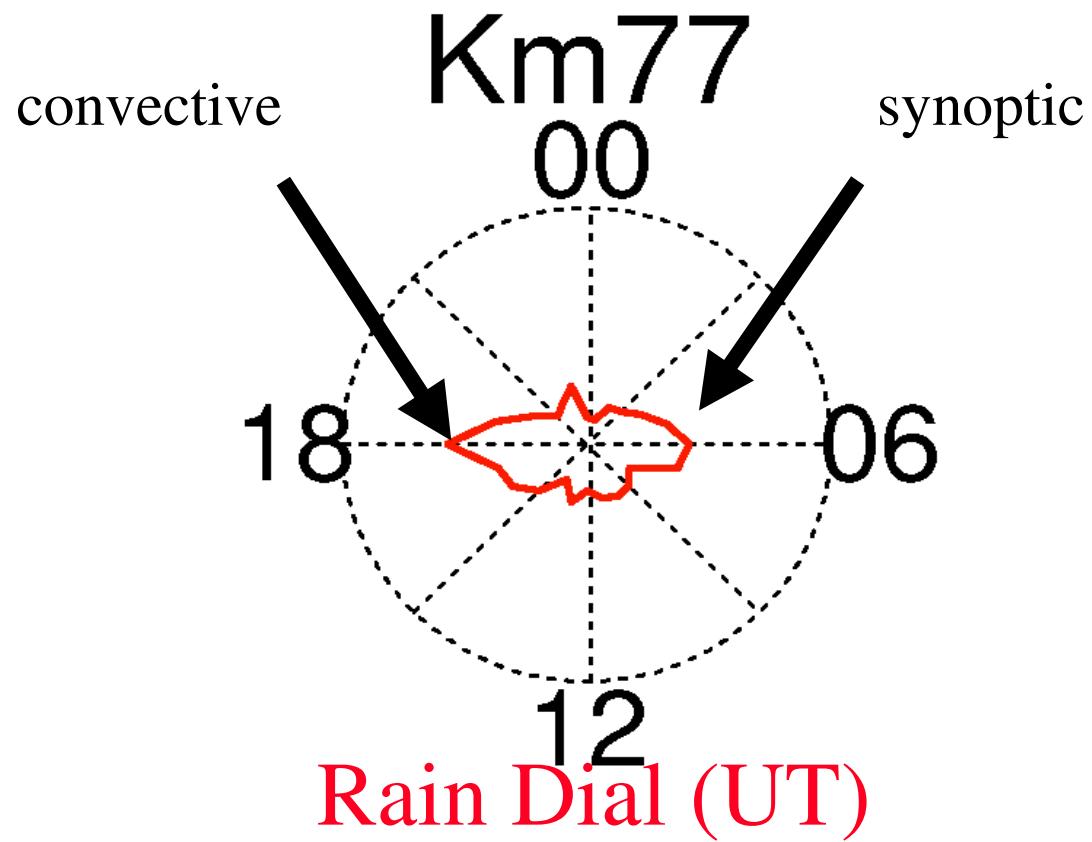
Influence of large scale ‘mega squall lines’ on precipitation

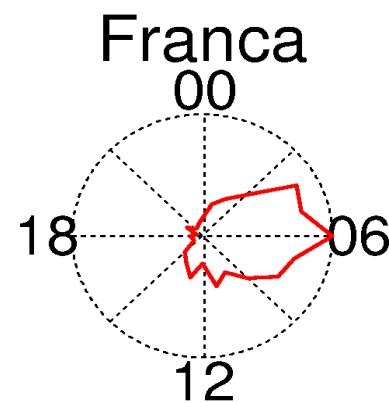
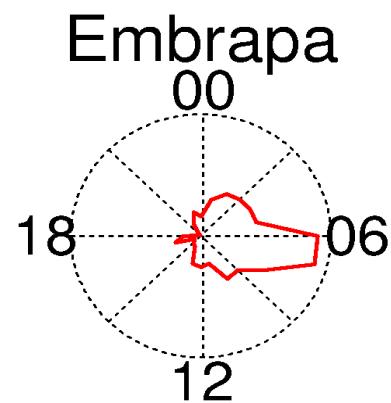
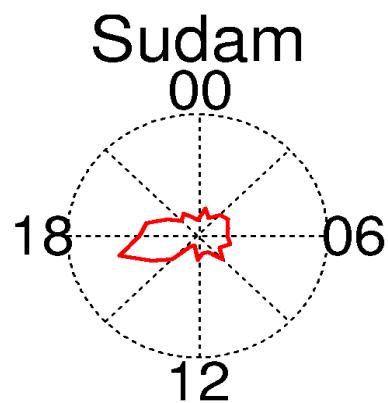
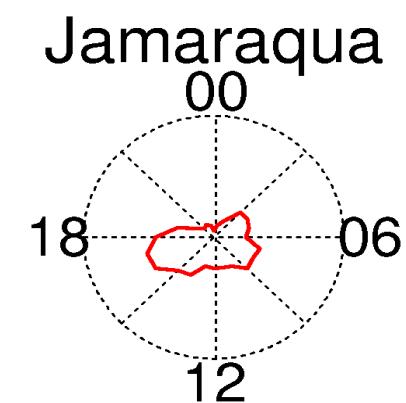
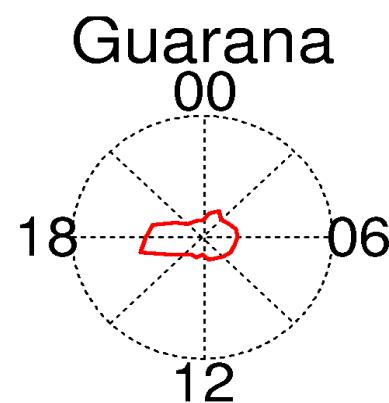
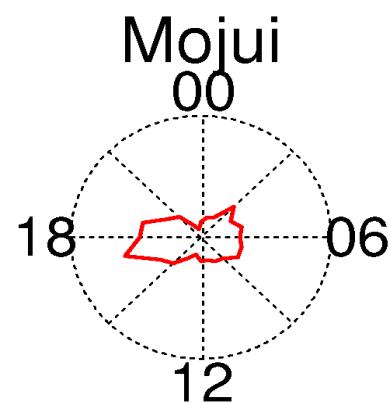
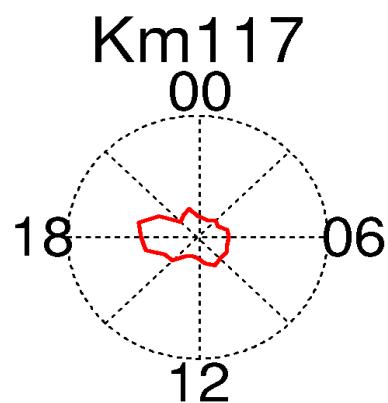
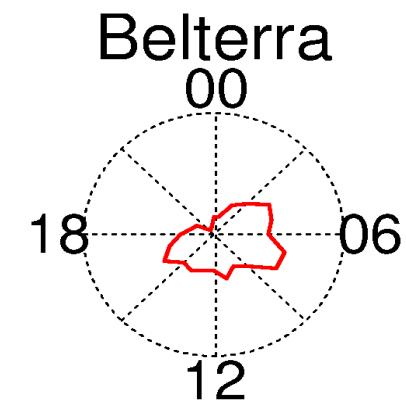
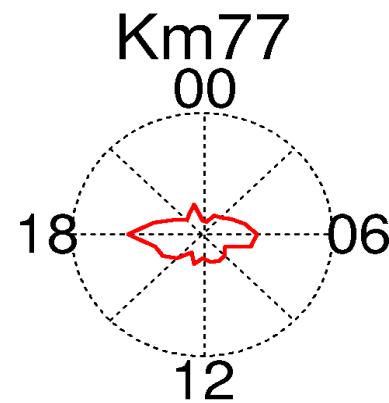
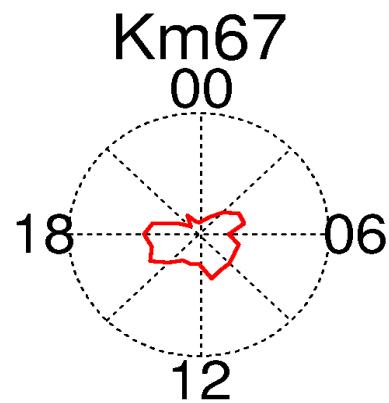
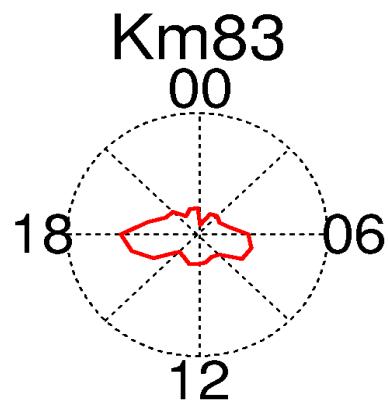


Time of ‘maximum precipitation rate’

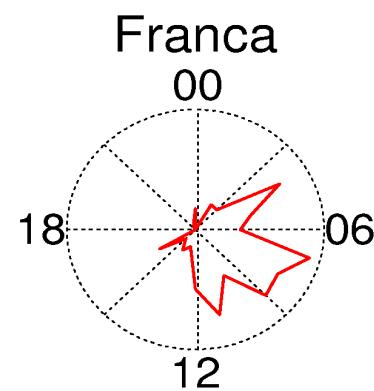
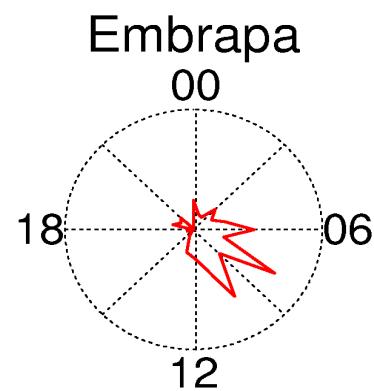
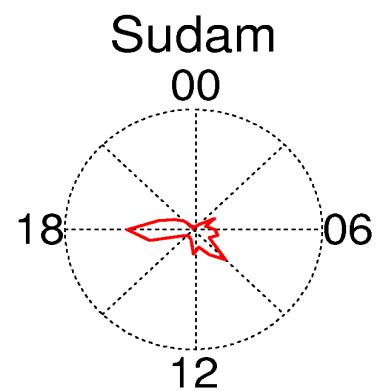
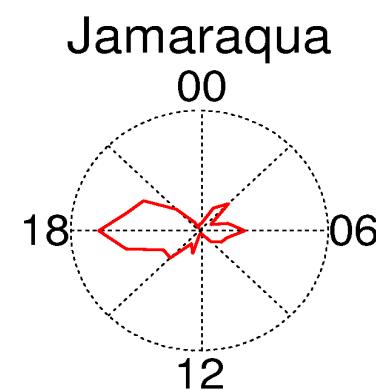
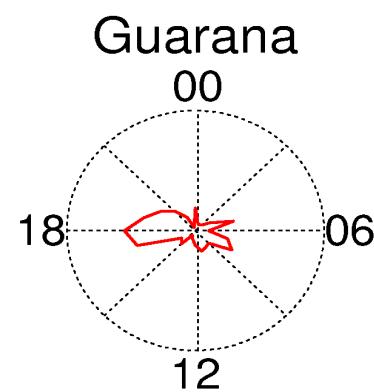
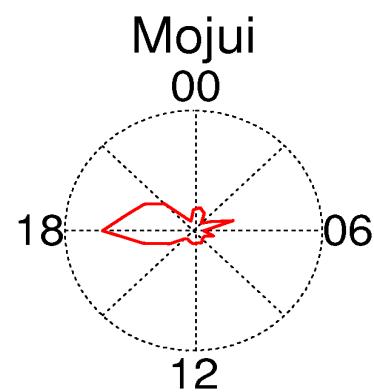
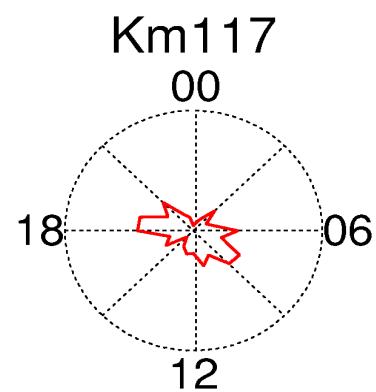
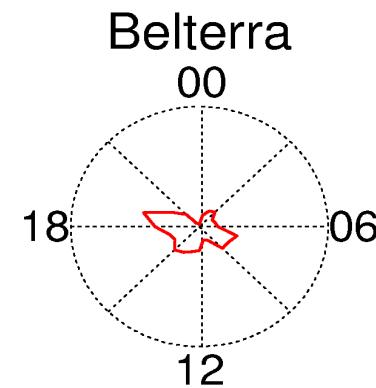
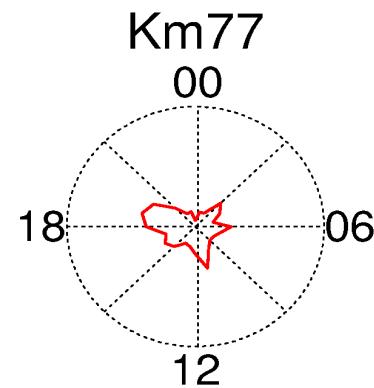
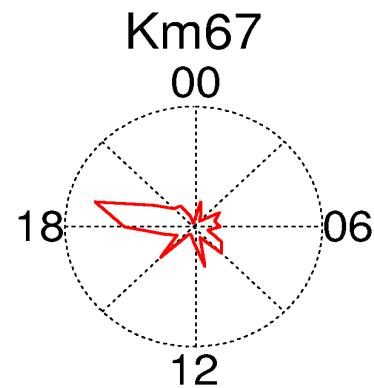
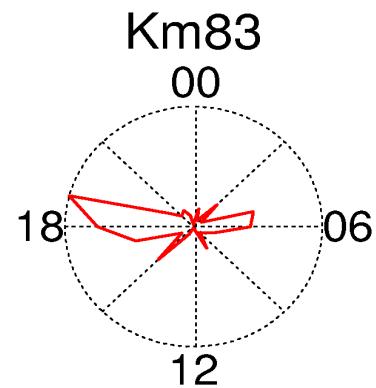
(From Kousky et al. 2006, CMORPH analyses)

Afternoon precipitation from local convective activity



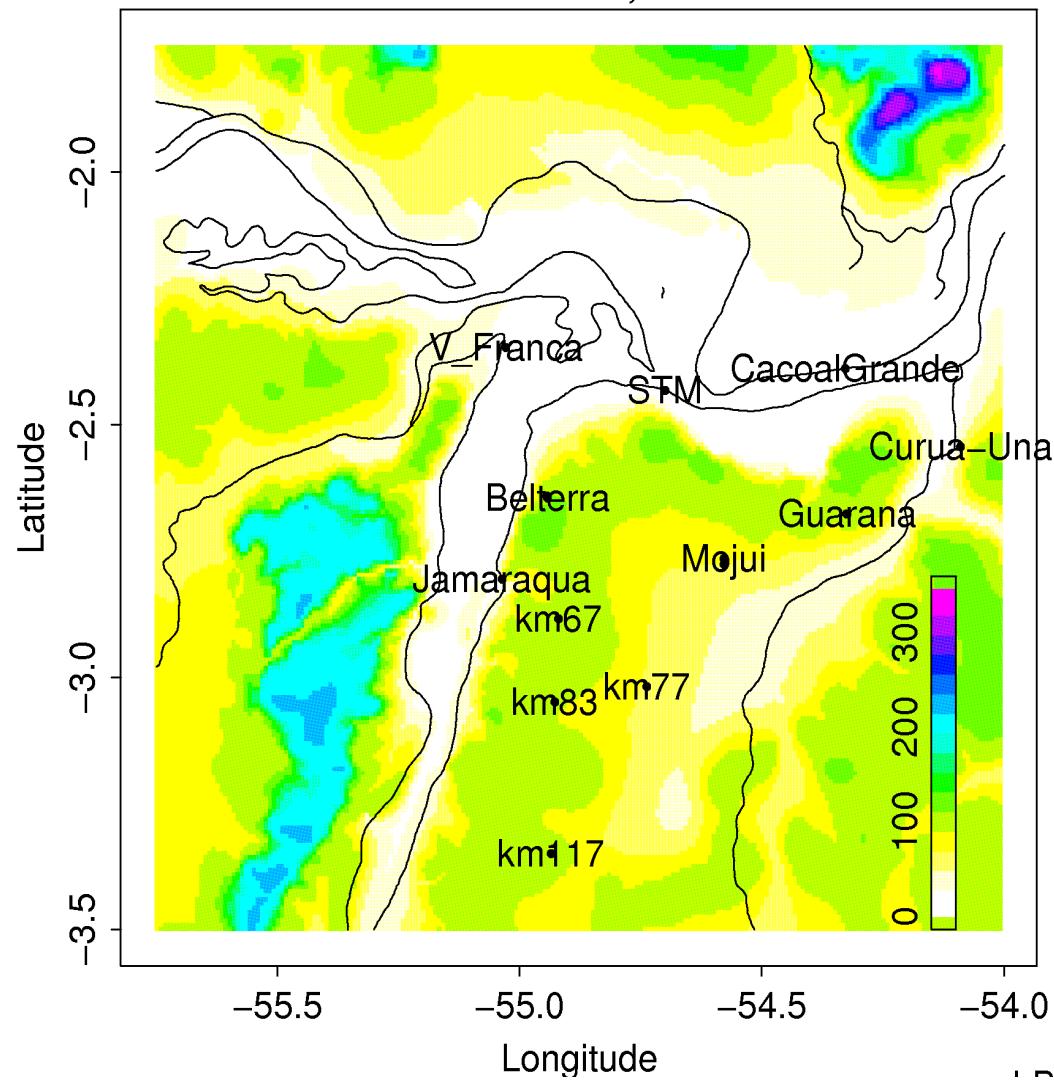


Wet season



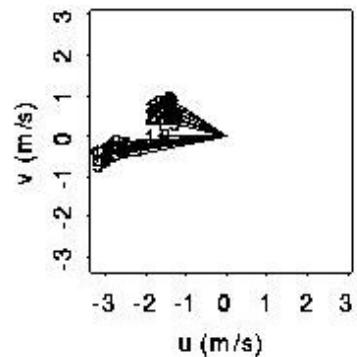
Dry season

Weather and flux stations near Santarem, LBA-ECO

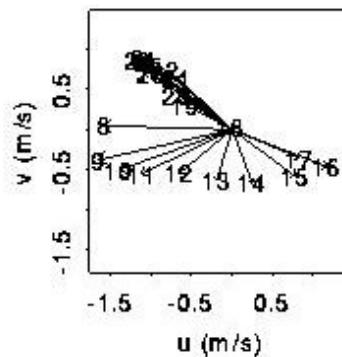


The Tapajós river breeze can overpower a weak easterly...

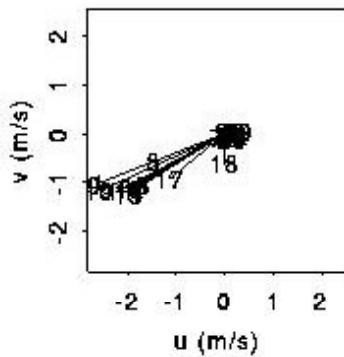
Belterra: $V > 1.9$ m/s



Belterra: $V < 1.9$ m/s

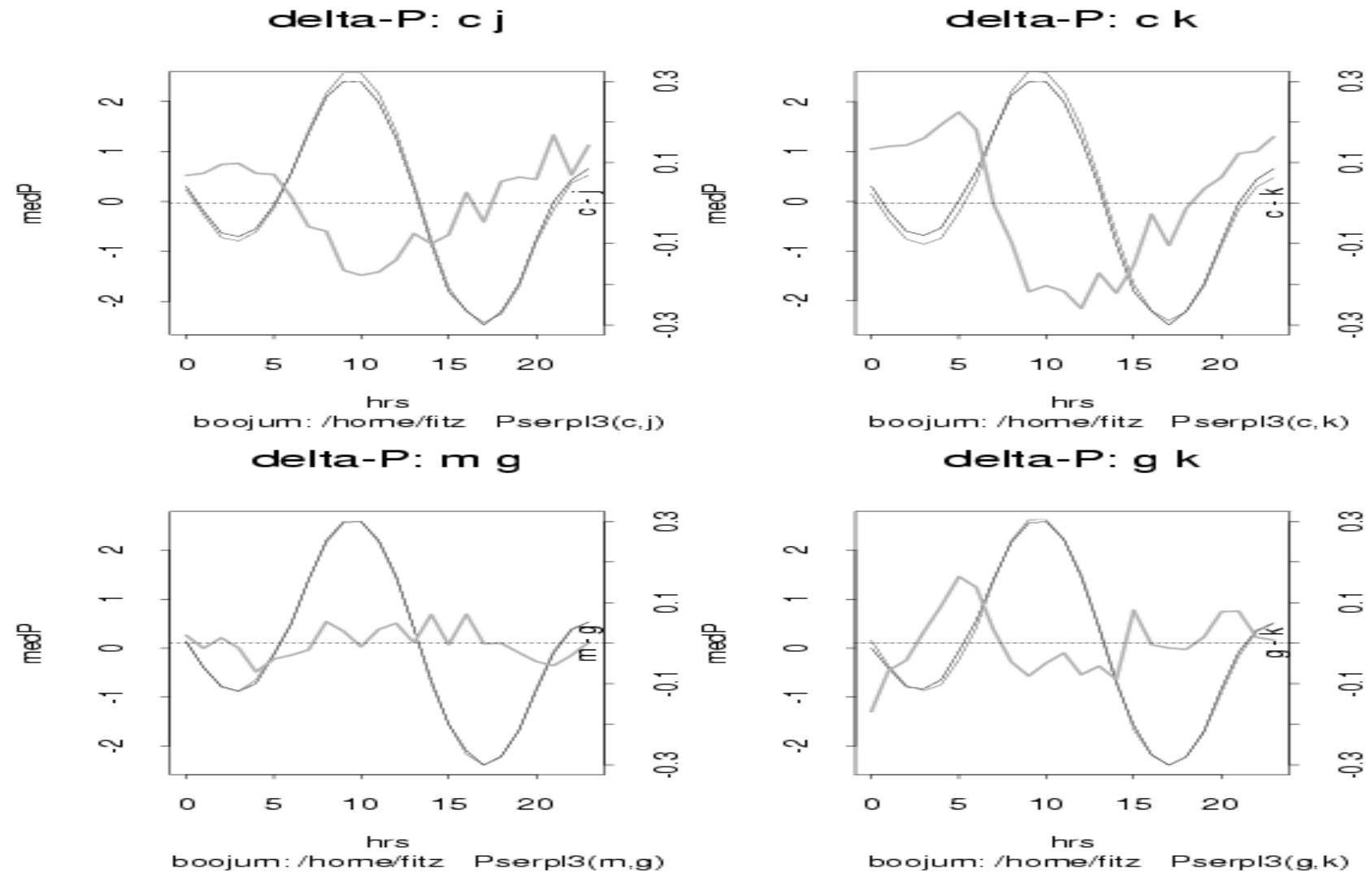


Km 117



plot.hod

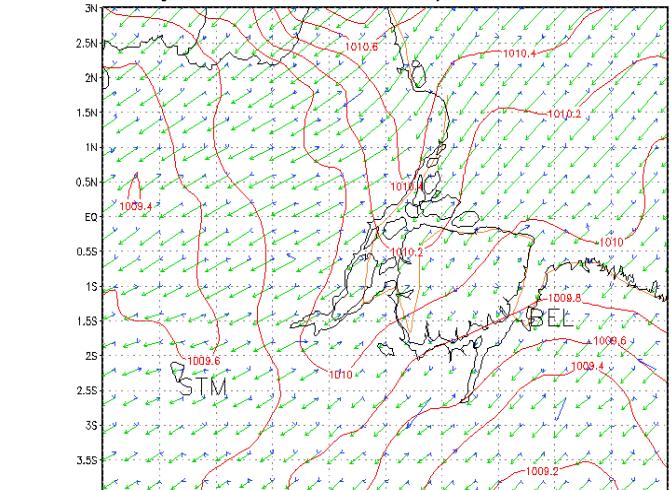
Seeking the river breeze mesoscale pressure gradient--diurnal difference superimposed on the semidiurnal tide.



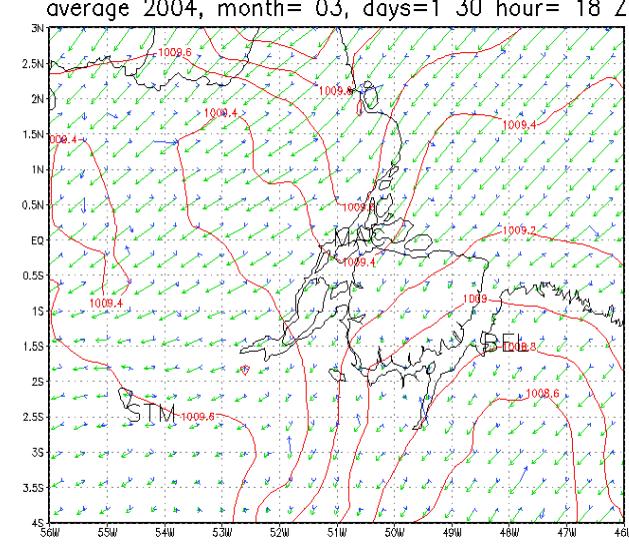
Seeking the large-scale pressure gradient that drives the ‘trade wind’

CPTEC Eta model reanalysis for LBA 30 day average flow & pressure contours

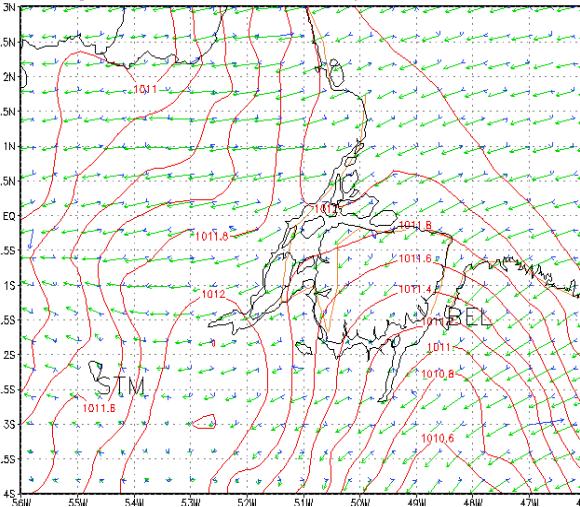
average 2003, month= 03, days=1 30 hour= 18 Z



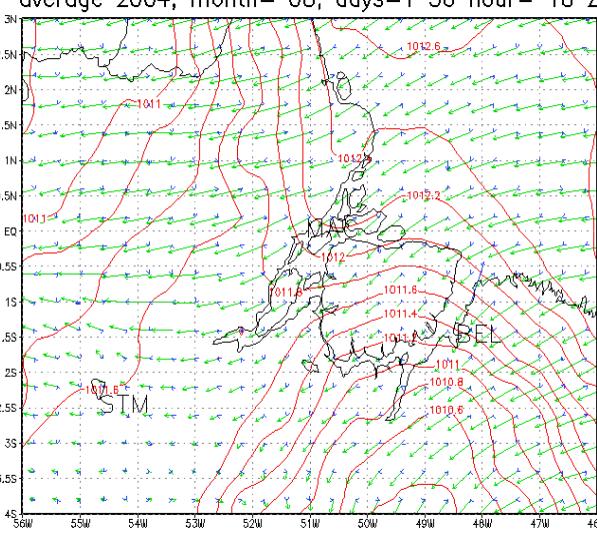
GRADS: COLA/IGES average= 20/204 month= 04 days=1 30 hour= 18 1/2



average 2003, month= 08, days=1 30 hour= 18 21



average 2004, month= 08, days=1 30 hour= 18 Z



River breeze important near the river (where the climate stations are)

Radiative flux bias at climate stations along river can be +30%

Precipitation bias can be bias difficult to determine
(compensating factors, intensification of ‘synoptic’ precip
near river; interior convective precip)

Interesting nocturnal CBL over river may have implications for the
recycling of CO₂ emitted from the water.

Local link to large scale via modulation of the steady easterlies.





AQUI O TURISTA É RESPEITADO
WE RESPECT TOURISTS HERE
AQUÍ EL TURISTA ES RESPETADO