

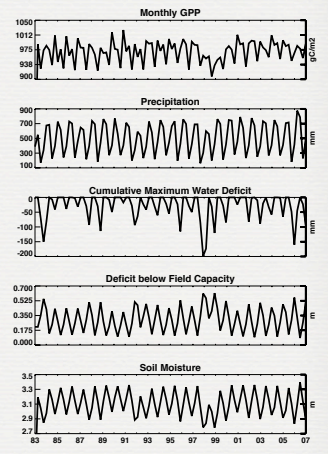
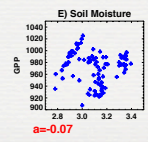
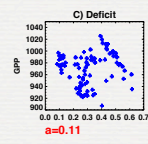
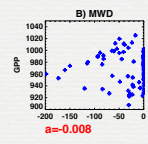
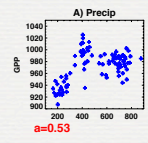
HOW CAN MMF HELP US UNDERSTAND AMAZON DROUGHT RESPONSE?



Anna Harper, Aug. 3, 2010
CMMAP Team Meeting, Ft. Collins, CO

WHEN IS THE FOREST STRESSED?

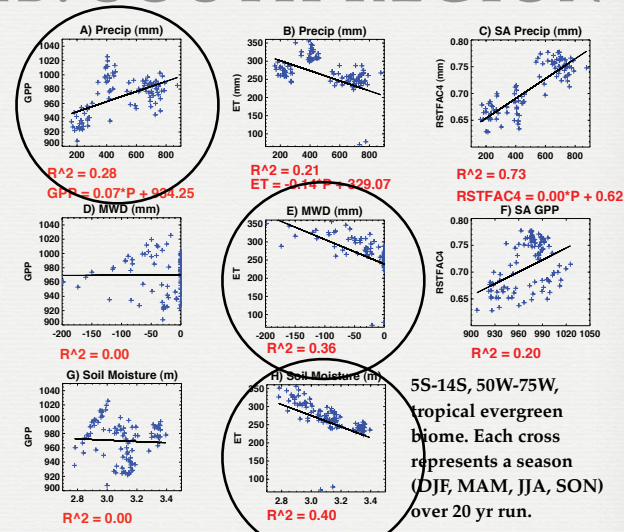
- Commonly used maximum monthly cumulative water deficit - basically an accumulation of P-E.
- This can define drought-like periods but doesn't take into account ecophysiological adaptations, variations in water table depth etc.



Southern Amazon, biome 1
 based on seasonal averages
 (DJF, MAM, JJA, SON)

DROUGHT STRESS IN OFFLINE SIB: SOUTH REGION

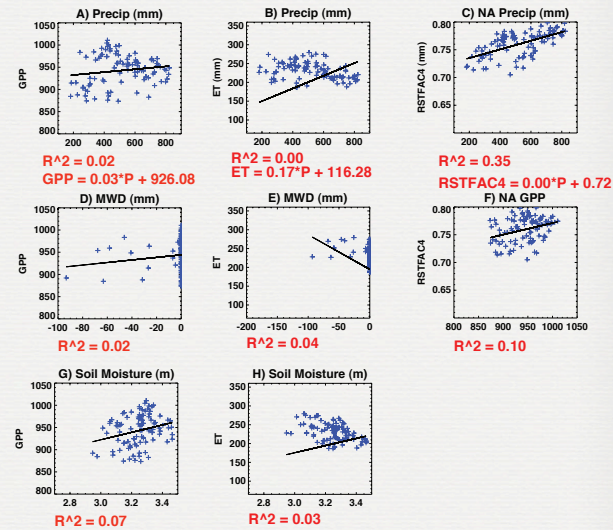
- What affects/limits photosynthesis & evaporation rates?
- Strongest correlation between ET and Soil Moisture
- Also MWD and ET, but NOT GPP
- 2 responses of GPP to precipitation



Linear regressions between different variables in the southern Amazon. Each point represents a three-month average (DJF, MAM, JJA, or SON). Only points classified as tropical broadleaf evergreen are considered.

DROUGHT STRESS IN OFFLINE SIB: NORTH REGION

- Very little drought stress in northern/equatorial Amazon
- The same rules don't apply everywhere!

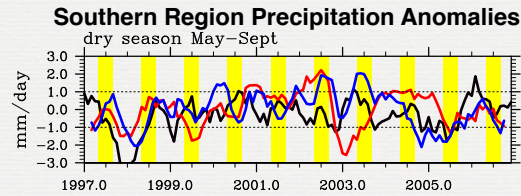
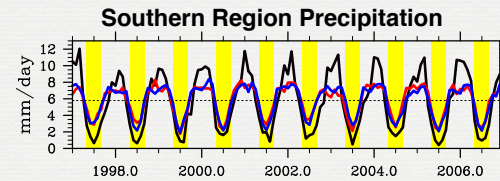


Linear regressions between different variables in the northern Amazon. Each point represents a three-month average (DJF, MAM, JJA, or SON). Only points classified as tropical broadleaf evergreen are considered.

SiB/BUGS5 GCM

Some robust
droughts:

- 1997/98 El Nino
- 2005 - actually more pronounced in model w/ stronger surface evaporation ...



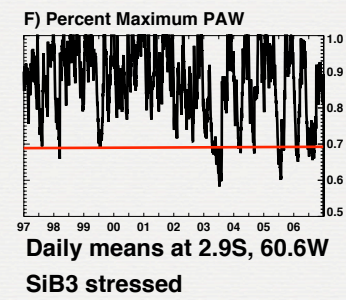
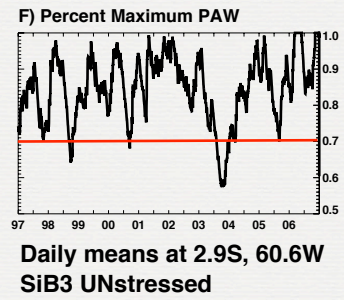
— GPCP — Stressed model — Unstressed model

Precipitation anomalies for 5S-14S, 50W-75W. Bottom time series are deseasonalized & standardized, w/ a 5 month running mean applied. Only points classified as tropical evergreen are included. Define "droughts" as months with negative precipitation anomalies great than 1 mm/day (-1 standard deviation).

OBSERVATIONS

- experimental drought study found increased tree mortality when PAW dipped below 70% of PAW max*
- But it took 3 years before large differences showed up
- Also used leaf water potential to define a water stress integral - found a threshold in this value for when tree mortality increased.

*Nepstad et al, 2007, *Ecology*



Unstressed model has much less variability in % PAW max.
Also max. possible PAW is much greater in Unstressed SiB.

FEEDBACK TO ATMOSPHERE

- forest drought response depends on
 - when the forest feels stress
 - small-scale forest adaptations to seasonal drought
- how the forest response affects the atmosphere, and so on

