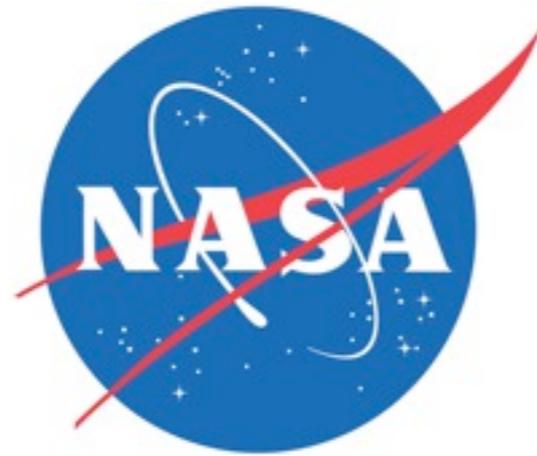


Regional Ecophysiology in Tropical South America



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LBA-DMIP Workshop
Biosphere 2, Arizona
18-19 April, 2011

Inversion Results (Rodenbeck)

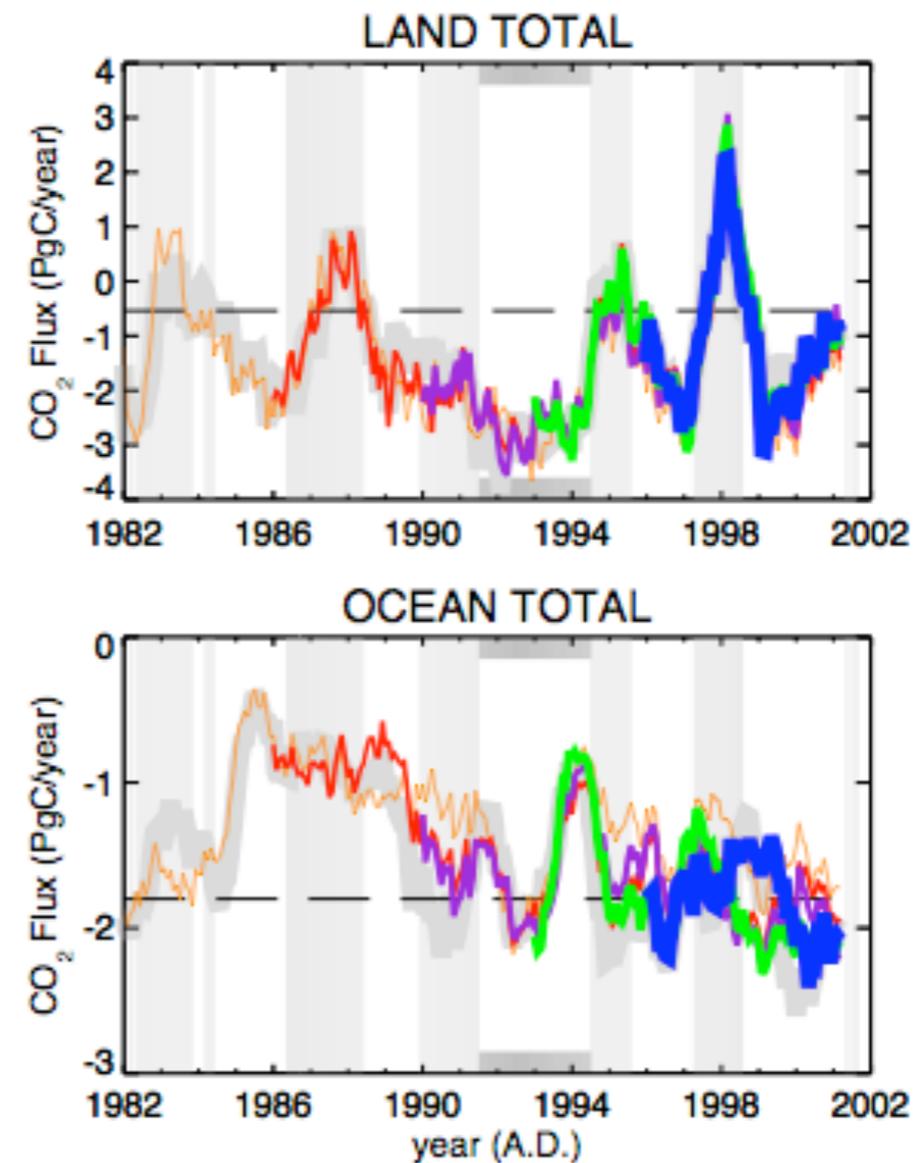
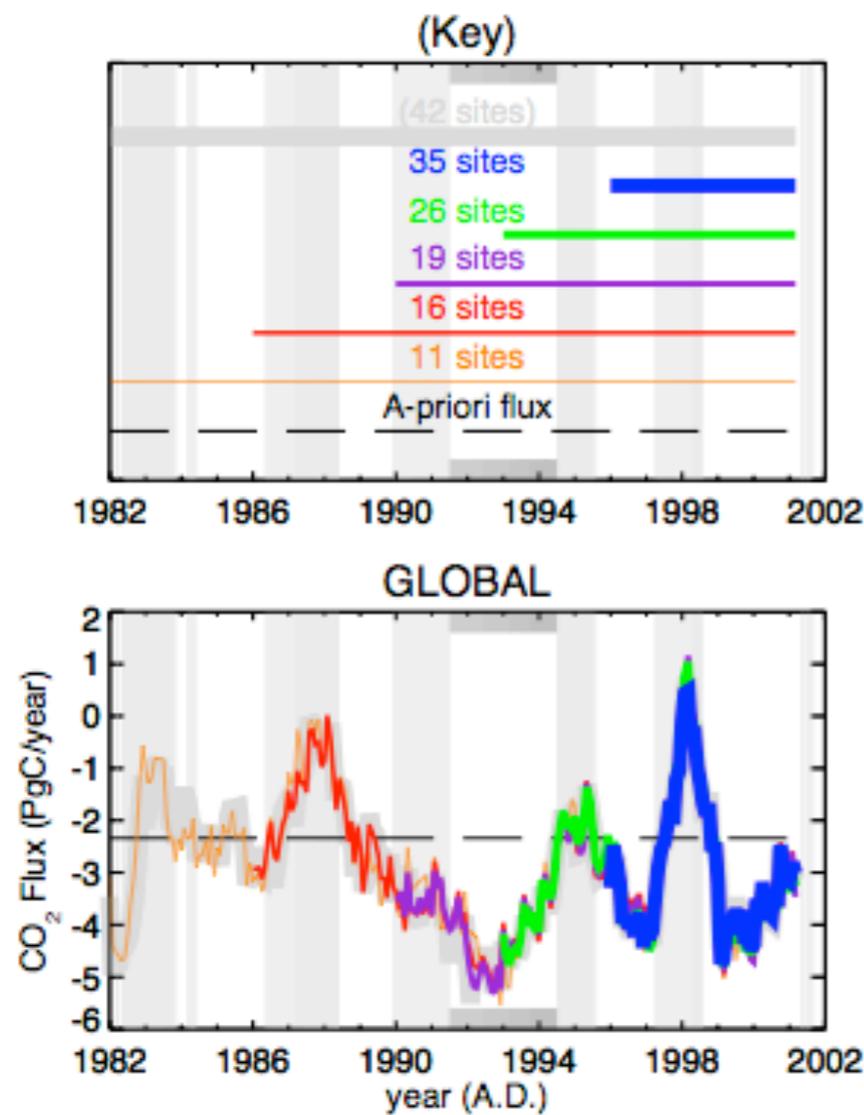


Fig. 5. Part I: Time series of the global surface CO_2 flux as estimated by our inversion (standard set-up). The fossil fuel component (as given by the a-priori assumption) has been subtracted. Positive values denote a net source of non-fossil fluxes into the atmosphere. Fluxes are deseasonalized by summing over running yearly intervals. The five solid color lines correspond to inversions with differently large sampling networks (Table 3). They extend only over those time intervals in which all participating data records fulfill our requirement of high homogeneity in time (see Sect. 2.2.1). The grey curve denotes the case with maximal 42 sites, where the number of actually available sites strongly changes in time. The dashed line denotes the a-priori flux values. The background stripes in each panel indicate a classification of the months into “El Niño” (light grey) or “La Niña” (white) periods (values of the MOI index (Wolter and Timlin, 1993) above or below 0.05, respectively), except for a “Post-Pinatubo” period (dark gray horizontal bars).

Fig. 5. Part II: Breakup of the standard estimates into land-atmosphere and ocean-atmosphere fluxes.

Land

Note
the
units!

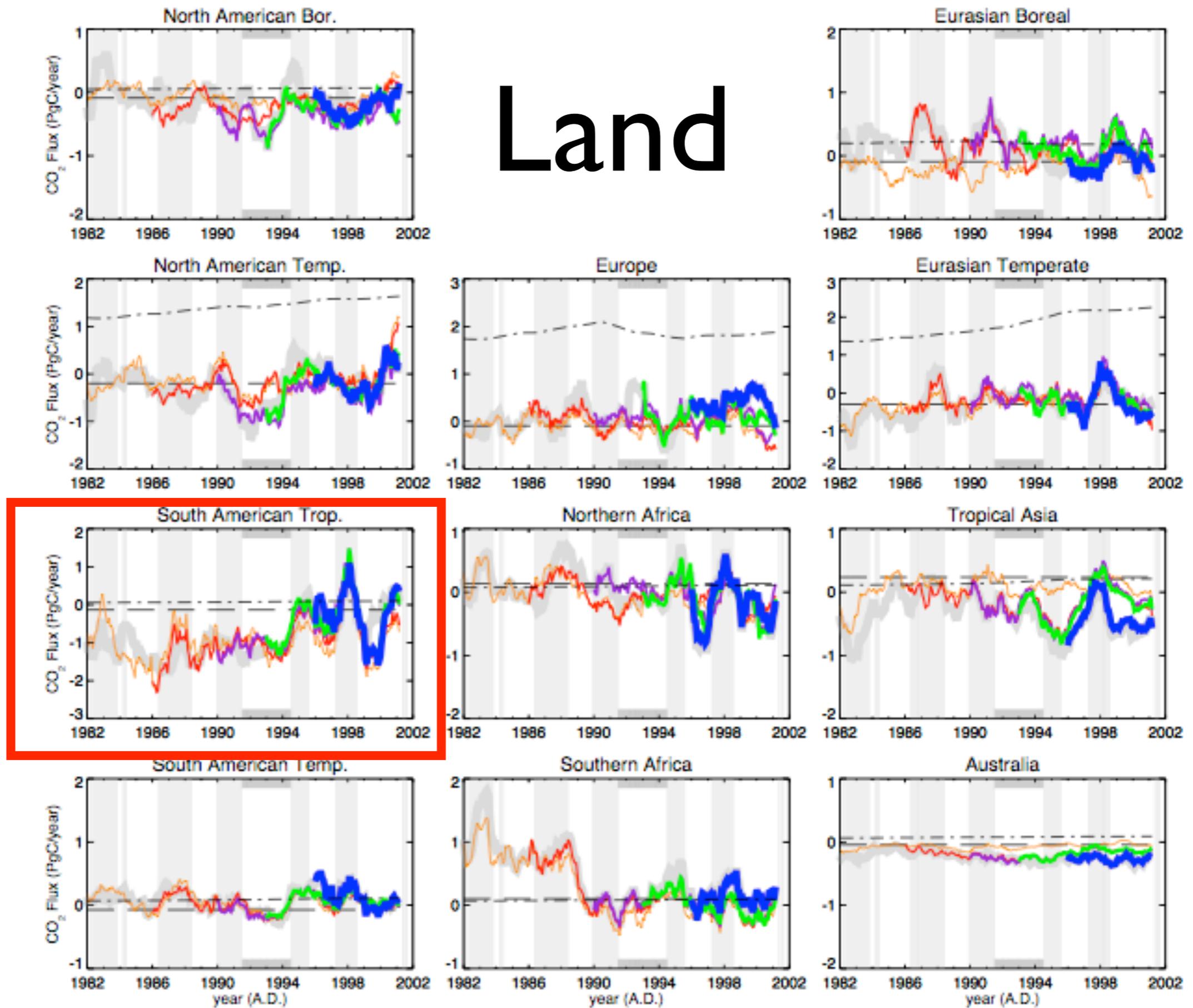


Fig. 5. Part IV: Breakup of the standard flux estimates into the 11 land regions of TransCom3. For a map of the regions see Fig. 6. As an additional information, the a-priori assumed fossil fuel component is shown here as a dash-dotted black line.

Inversion Results

- ‘Missing Sink’: approximately equivalent between ocean and land
- variability is more robust than magnitude
- more variability in land fluxes
- significant portion of land variability in tropics, especially SA

Observed Relationships: SST against SST and Precip

(Yoon and Zeng, 2010
and lots of others)

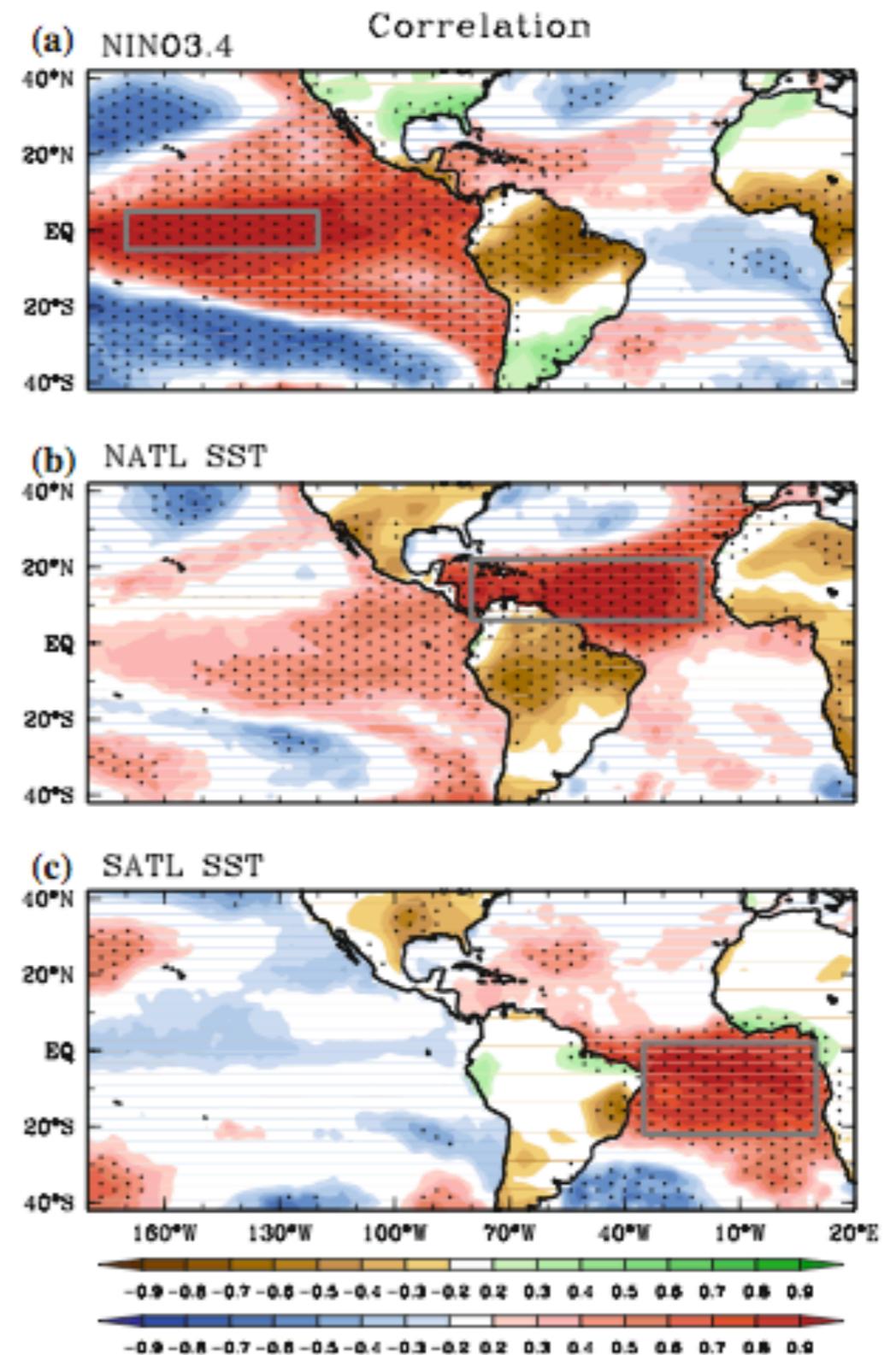
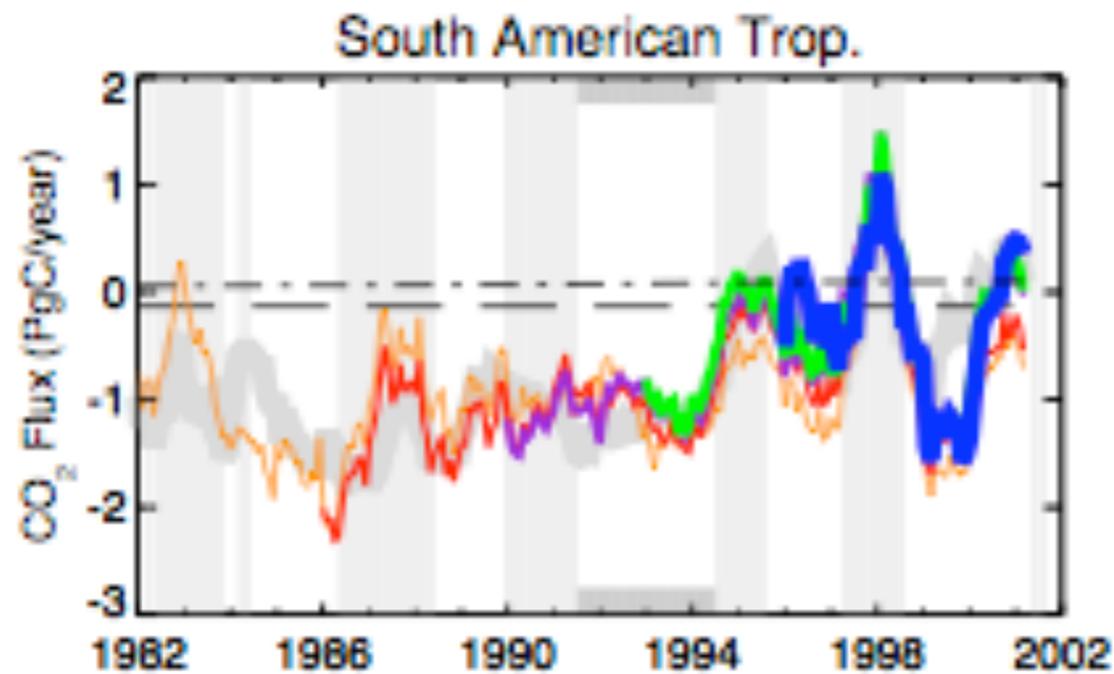


Fig. 2 All-season anomaly correlation of rainfall (land) and SST (ocean) with three SST indices: Niño-3.4 (°C), tropical North Atlantic SST (°C) averaged over the domain of 6–22°N and 80–15°W, and South Atlantic SST averaged over the domain of 25°S–2°N and 35°W–10°E (*boxed areas*) in a, b, and c, respectively. Both Niño-3.4 and NATL indices exhibit strong negative correlation with Amazon rainfall. *Dotted areas* are statistically significant at the 95% confidence level, using a sample size of 28 years



Here's the thinking:

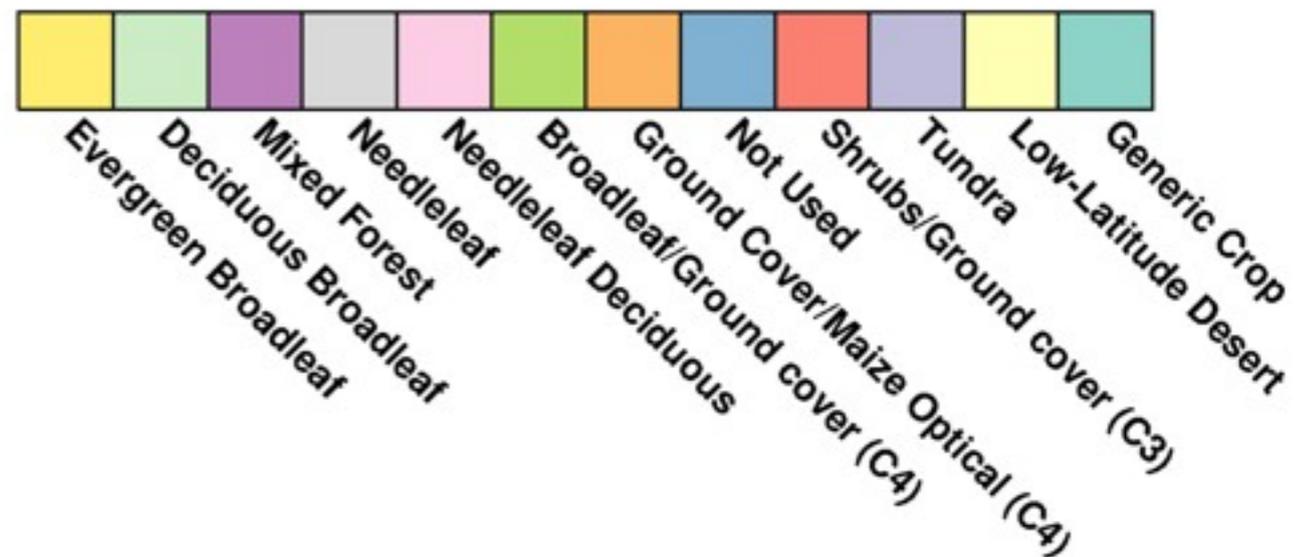
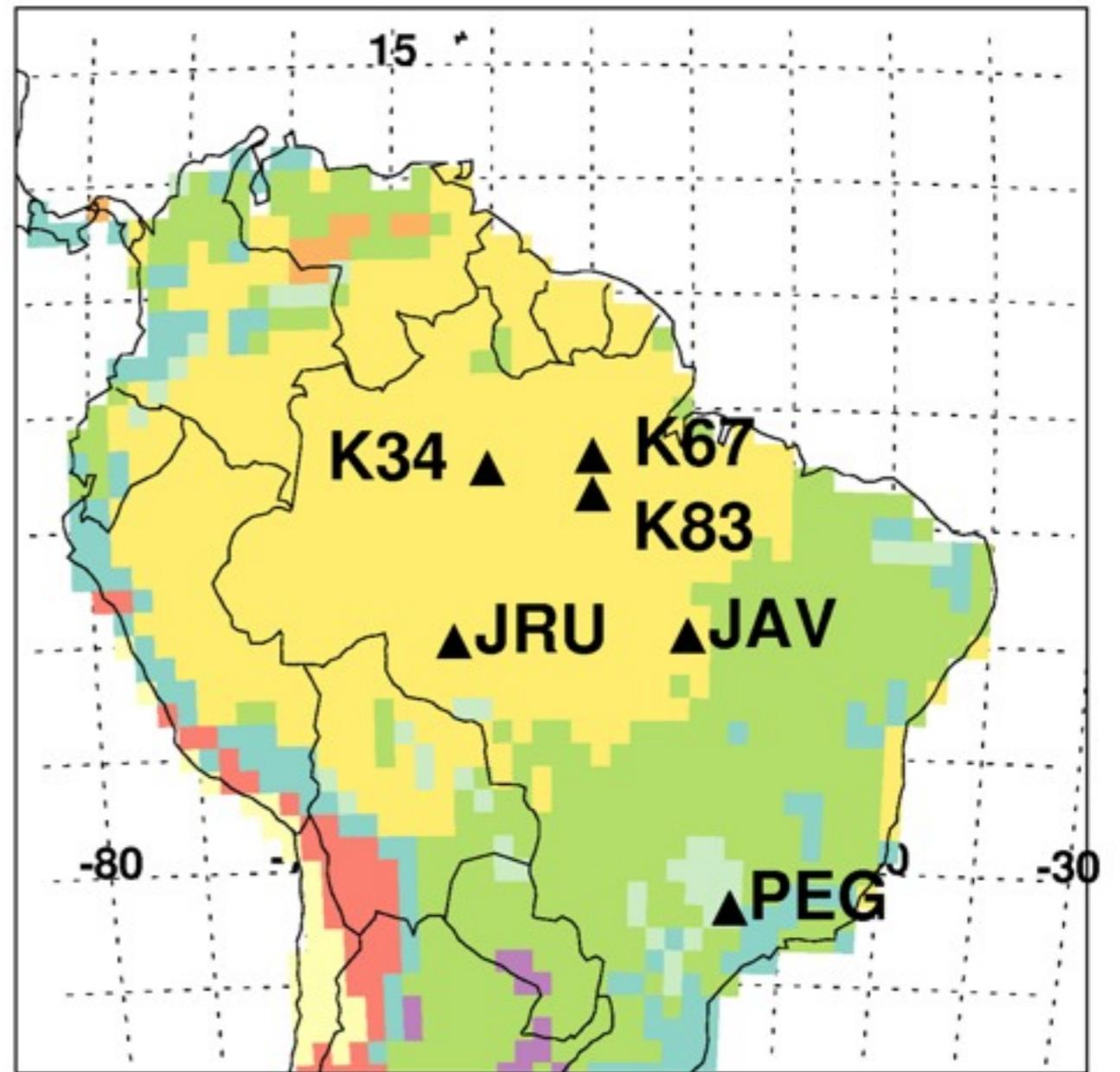
- Established: SA precip correlates with ENSO
- Relative drought means:
 - decrease in GPP (water stress)
 - increase in respiration (temperature)
- Zeng et al. (2006) calls this a 'conspiracy of processes'

But...

- We know there is a detach between vegetation and water; forests survive annual drought
- We anticipate resiliency against the most common drought periods beyond the annual (ENSO)
- Exclusion experiments generally support this (exclusion MIP)

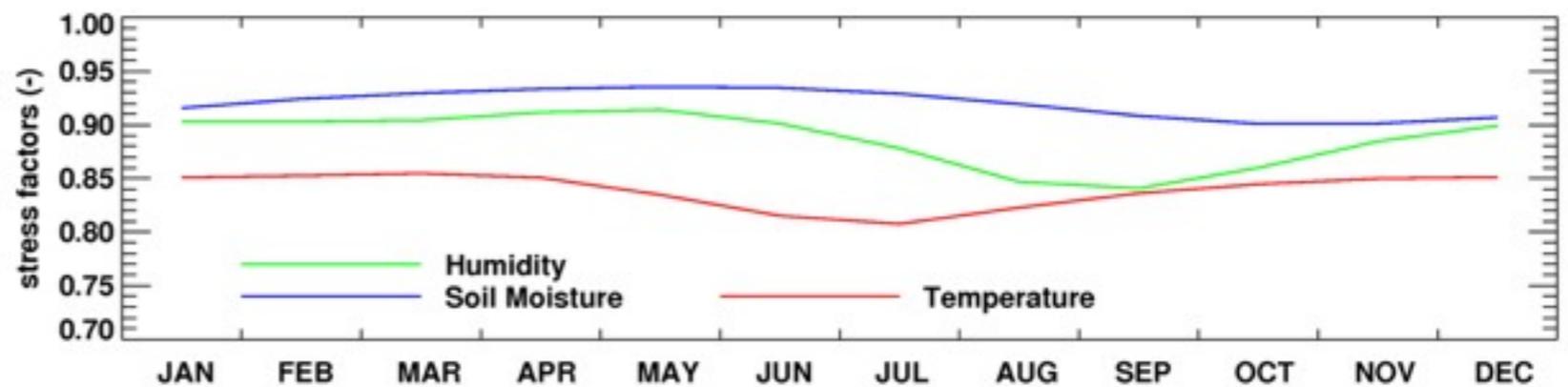
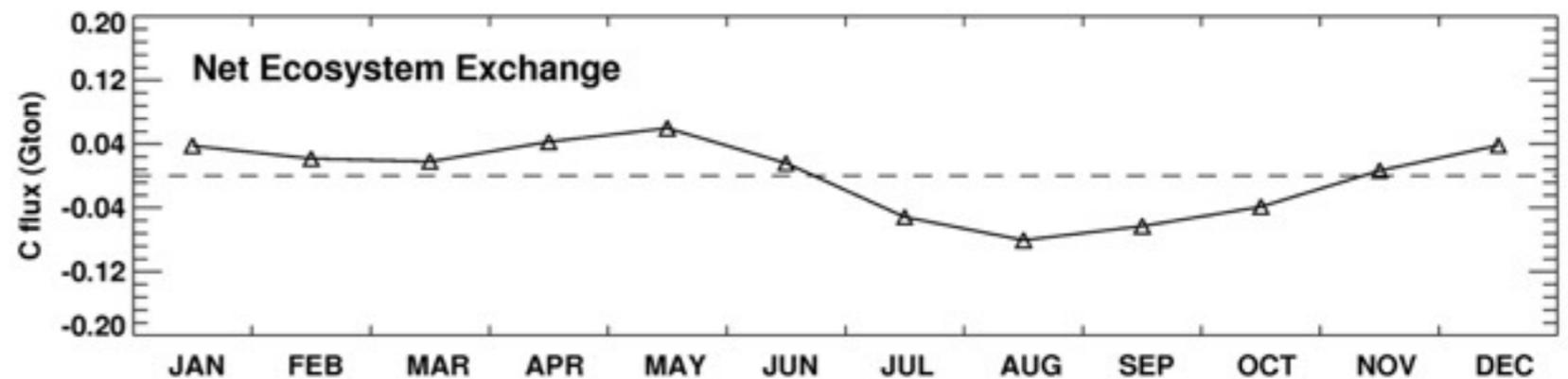
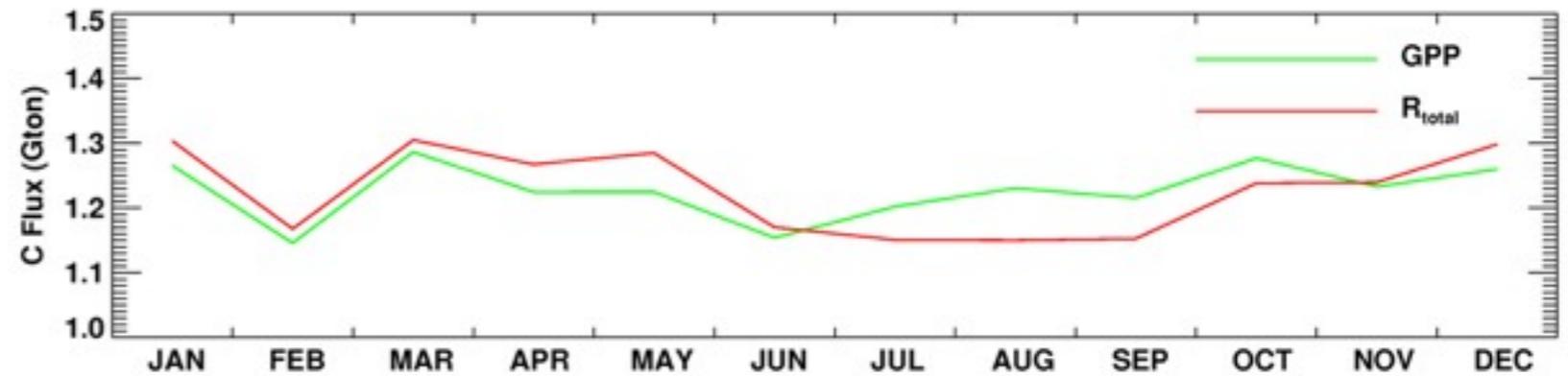
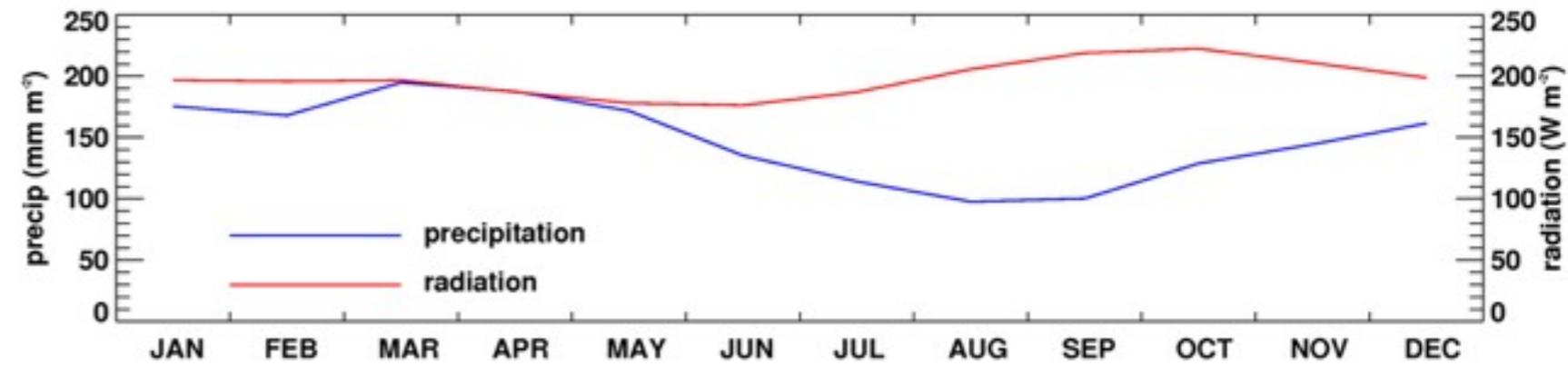
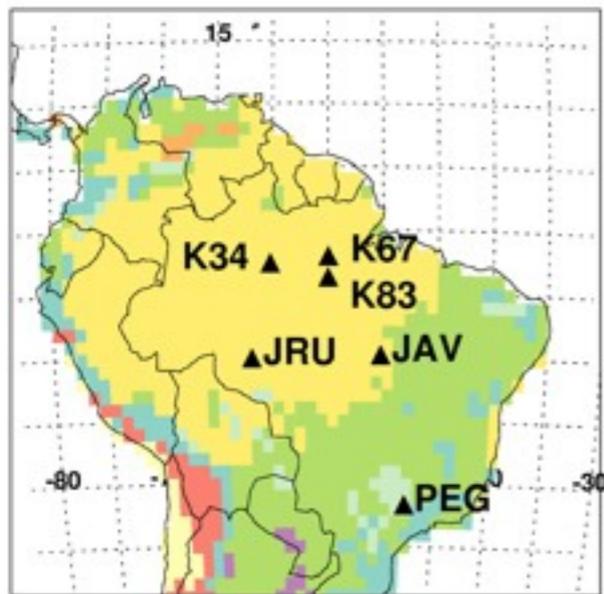
SiB Runs:

- Established against obs towers across veg/moisture gradients
- Forcing precip generally matches ENSO/precip correlations noted by others



Annual Cycles

- Remember: NH/SH seasonal opposition
- We show: uptake during SH dry season
- This is in conflict with other published results (Potter et al., 2005)

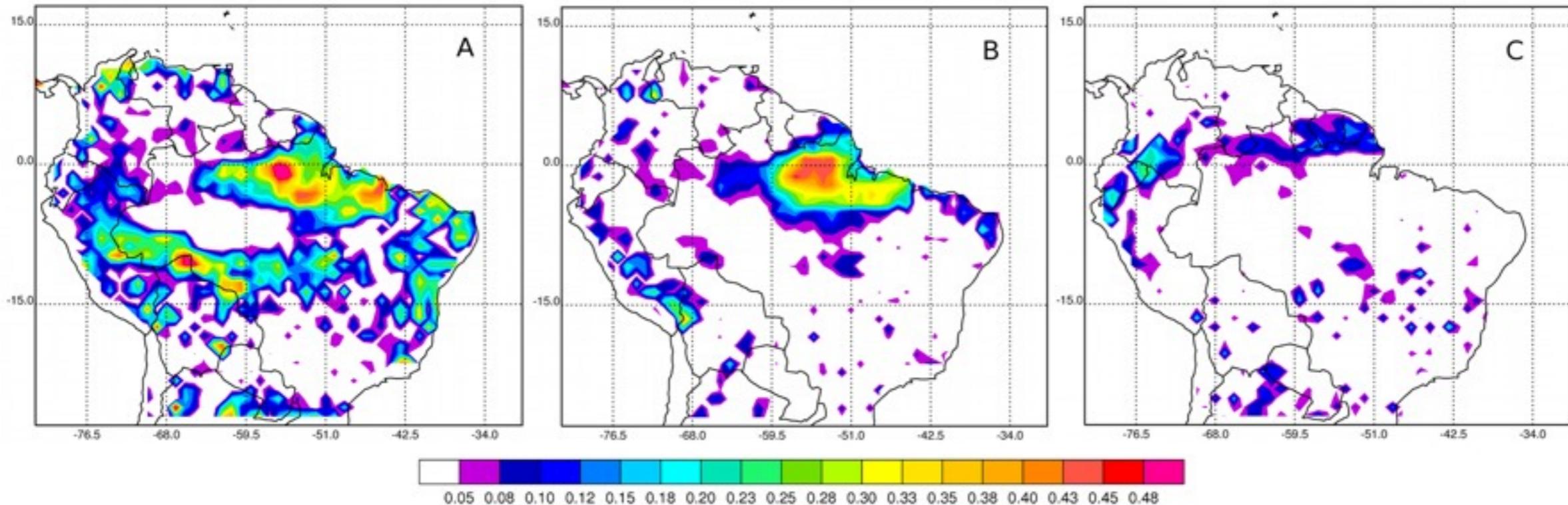


Modes of Climate Variability: regressed against NEE

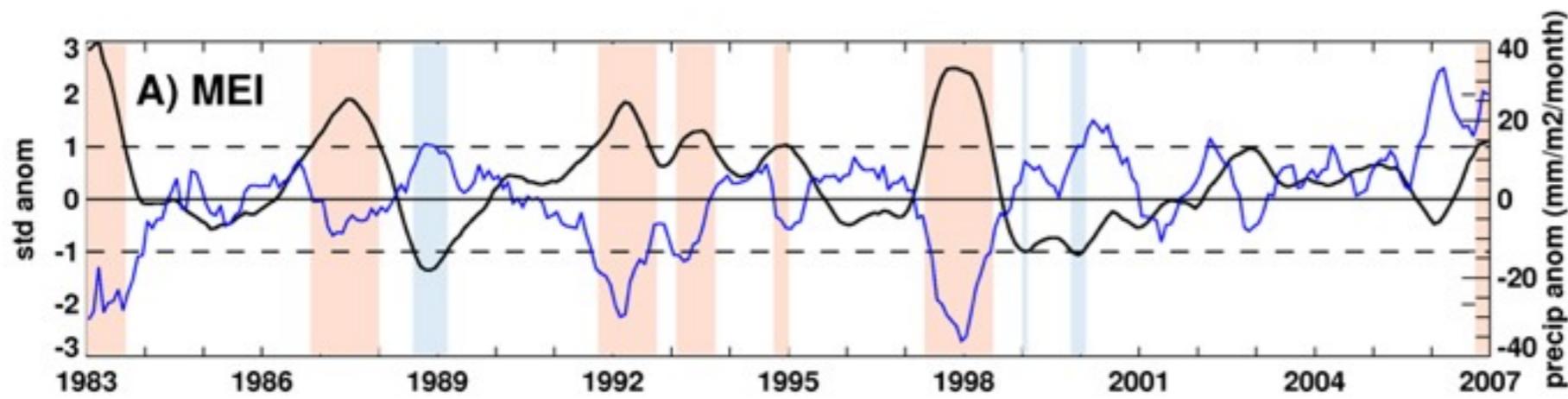
Multivariate Enso
Index (MEI)

TNA

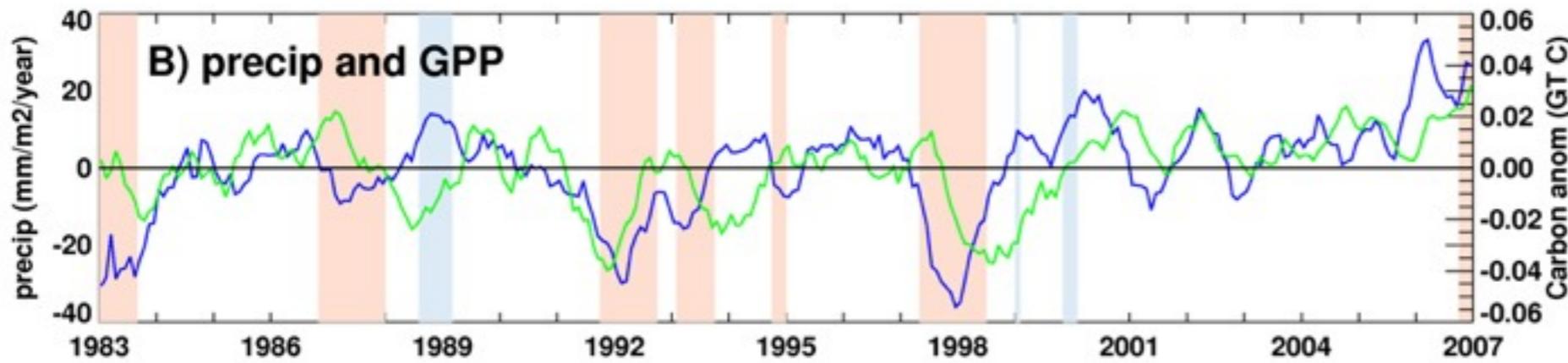
TSA



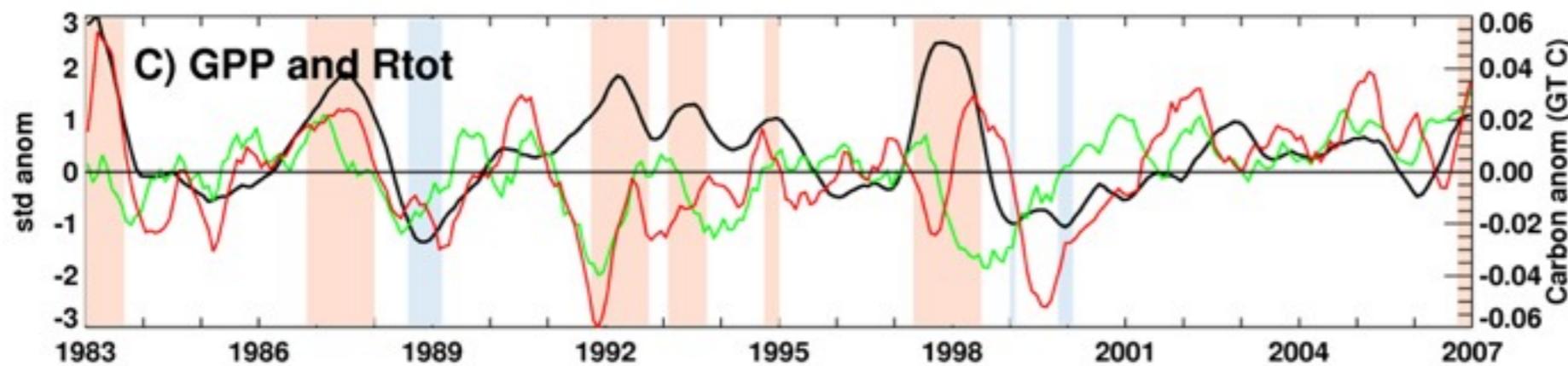
- Plots show amount of variability explained
- NEE combines GPP and R_{total}



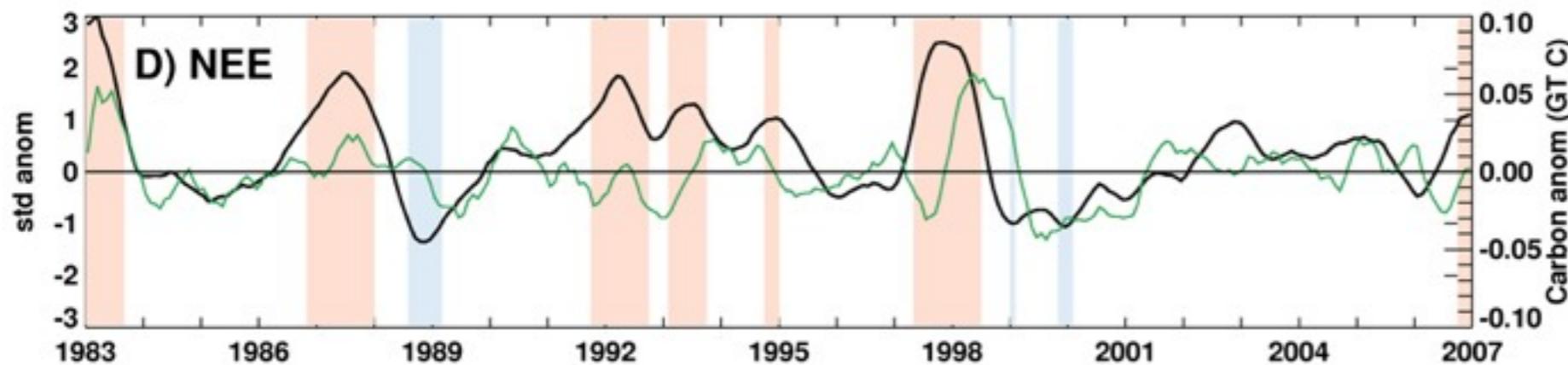
Precip follows MEI
 Disregard 1982-1983
 El Nino; 1991-1995
 has Pinatubo influence



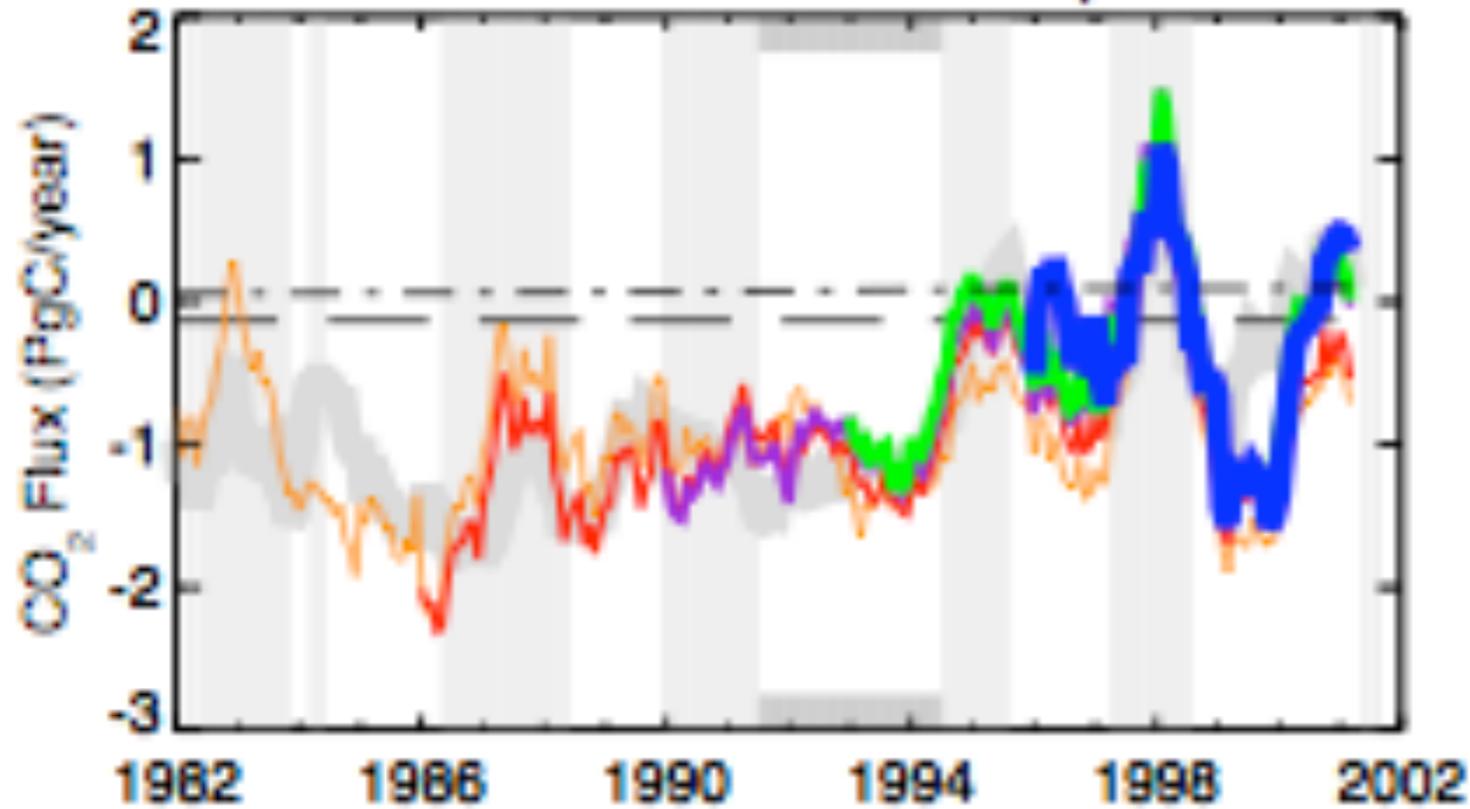
Lag:
 1987, 1989, 1993, 1998, 2001
 Precede: 1985, 1992
 Coincident: 1991, 2002, 2005



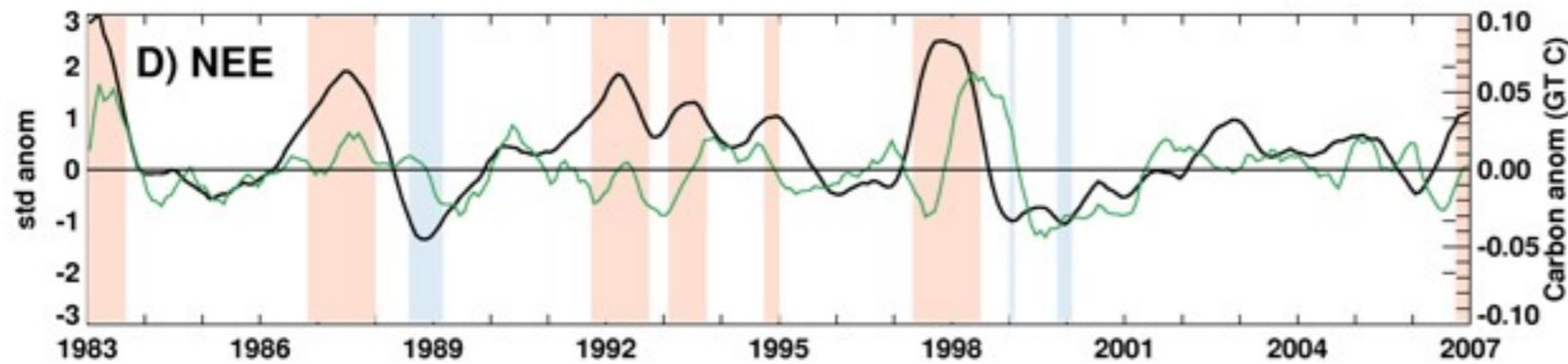
GPP/Rtot
 phase
 determines
 NEE:
 Relationships
 are complex



South American Trop.



So How do We Compare to Rodenbeck?



Remember: SiB operates on a balanced basis: We're looking at trends, not magnitudes

Some things to Remember

- Tropics are very unconstrained in inversions
- Uncertainty:
 - different flask networks
 - inconsistent response to ENSO (Bousquet et al., 2000; Schwalm et al., 2011)

What Can we Learn in a Regional MIP?

- Basin-wide seasonal cycles
- Response to ENSO (compare to inversions)
- Time lags (GPP/R_{tot}/NEE)
- light- and water- limitation

What Can we Learn in a Regional MIP? (cont.)

- Tipping points?
- Impose perpetual El Nino/NATL conditions?
- Runoff?
-