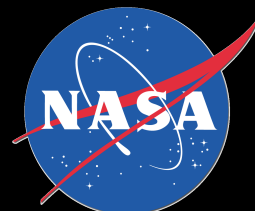


How can we exploit fluorescence simulations and retrievals?

(or: what am I doing here?)

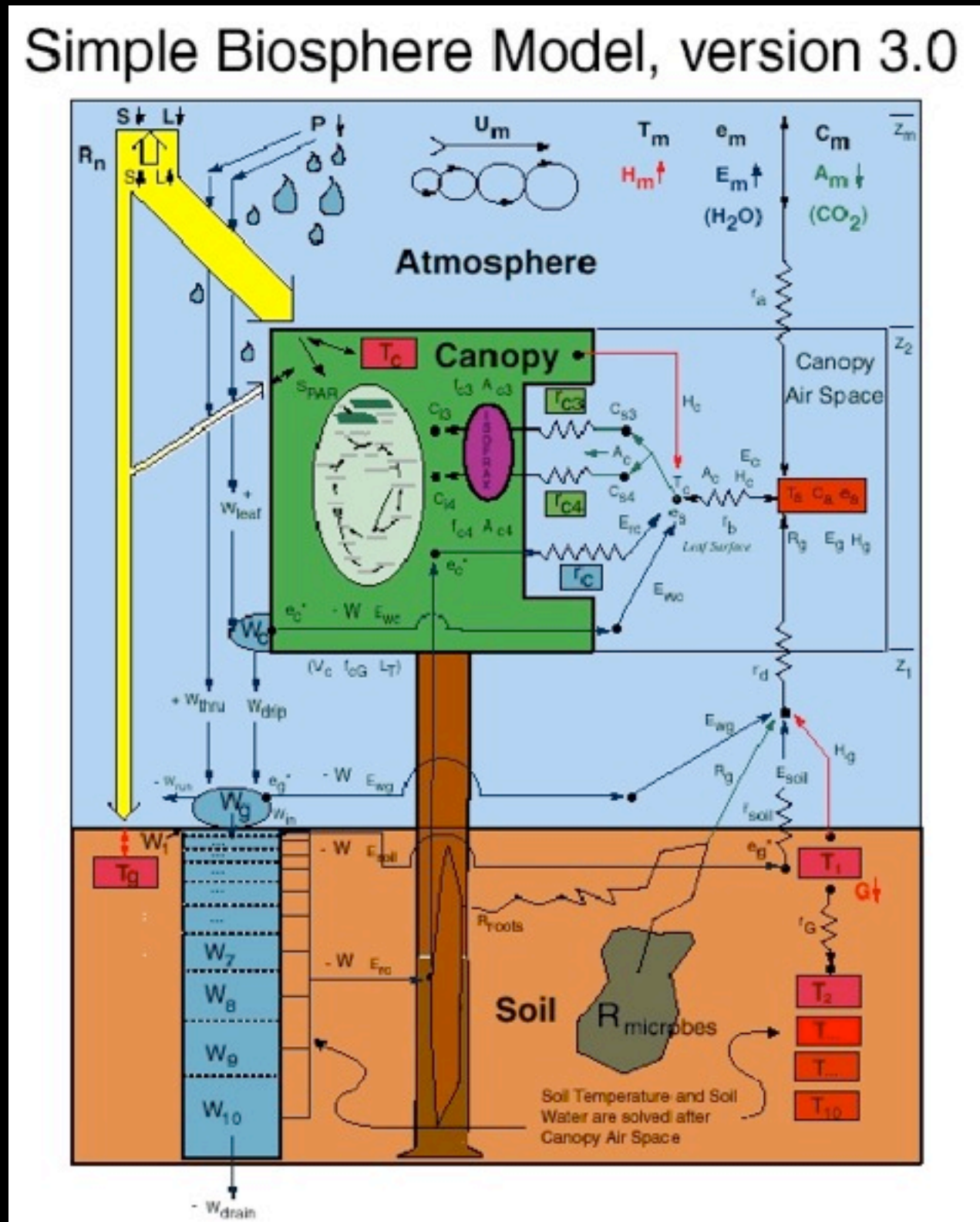


Ian Baker
Colorado State University



Simple Biosphere Model (SiB)

- Enzyme-Kinetic model (Farquhar, Collatz, Ball-Berry)
- Lower boundary for atmospheric models- but with ecology!
- process-based; mechanisms
- Self-consistent (LE, H, Carbon)
- short timestep (10 min)

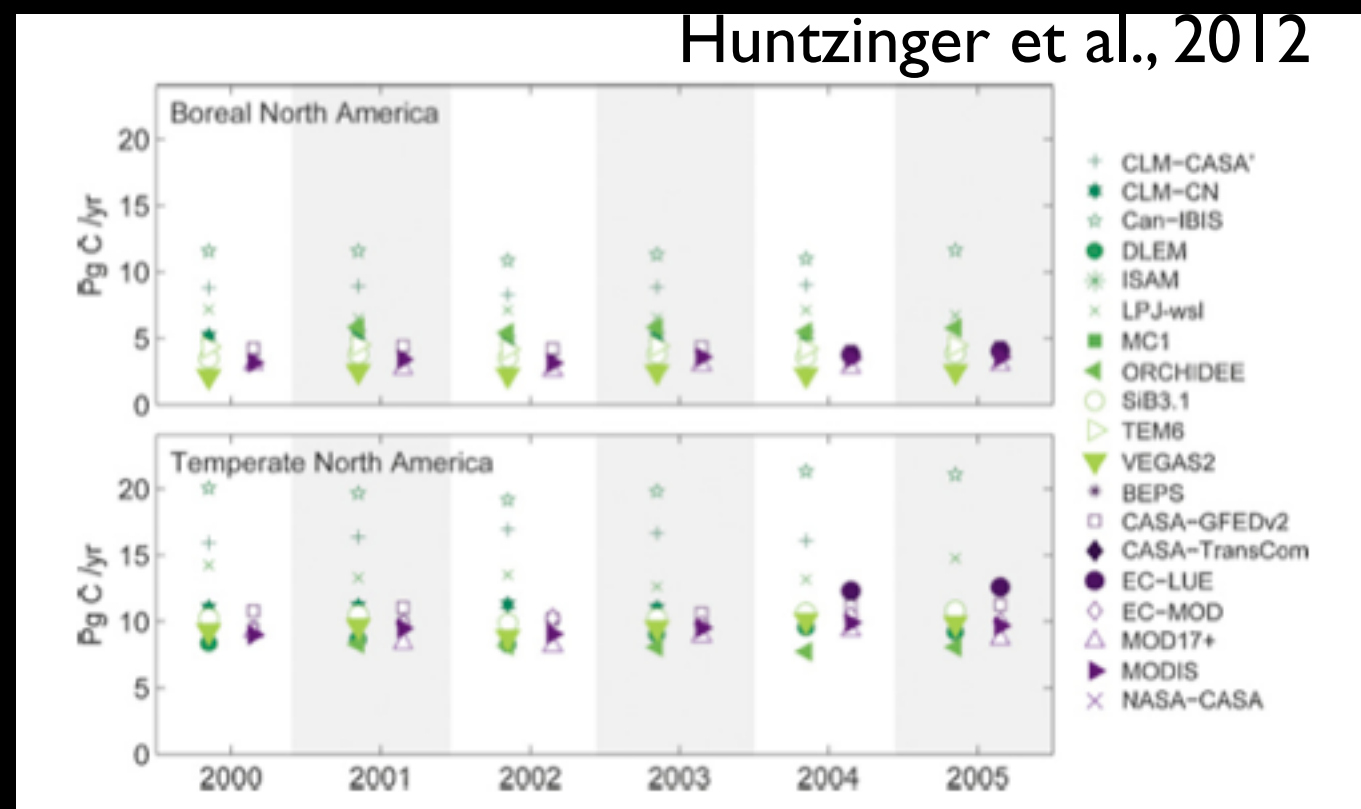
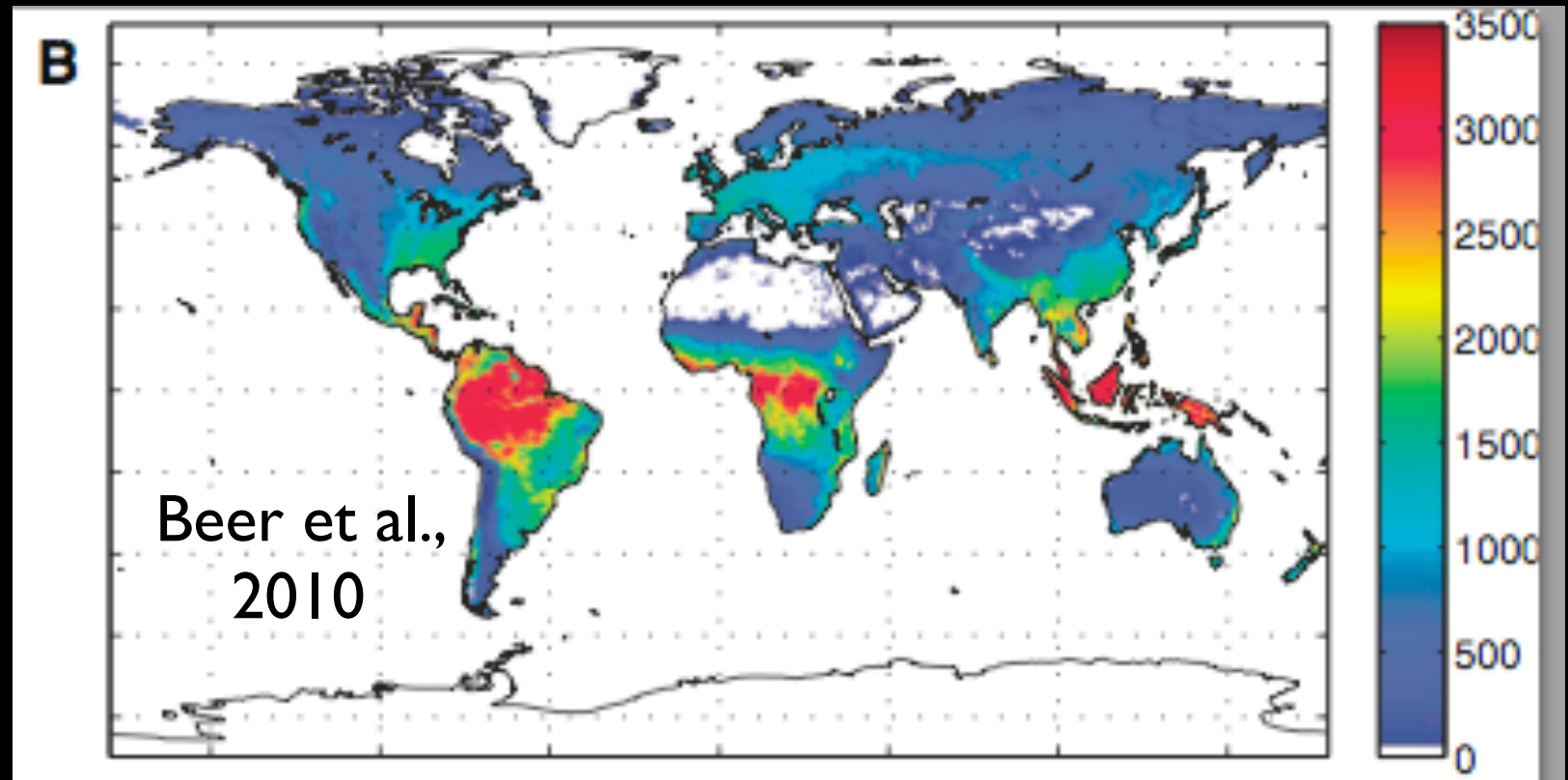


GPP; What do we think?

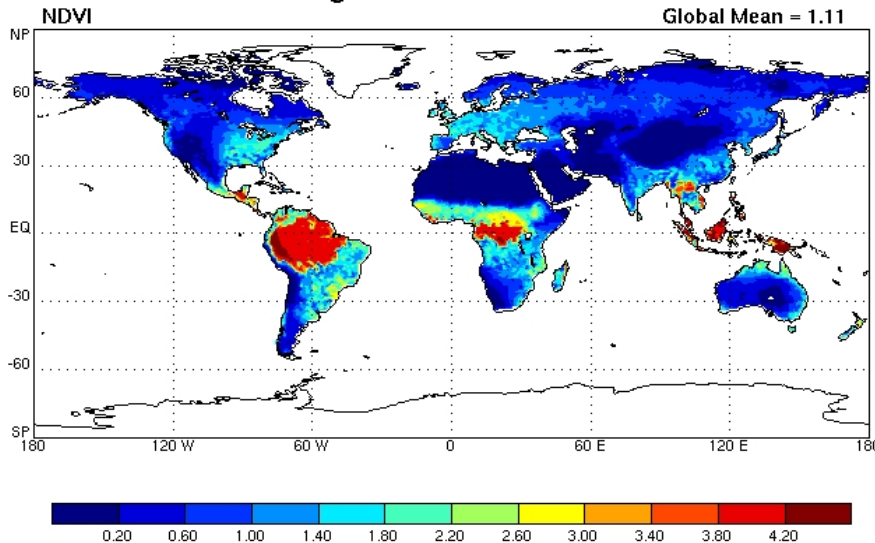
- Global total
 - 120-125 GT (Beer; IPCC)
 - 150-175 (Welp)
 - 120-140 (SiB)

- Spatial Distribution?

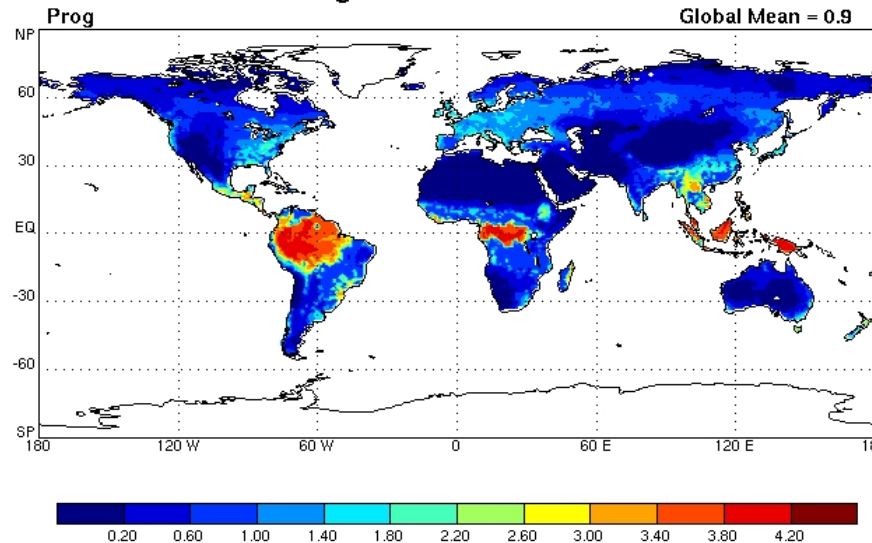
North America?



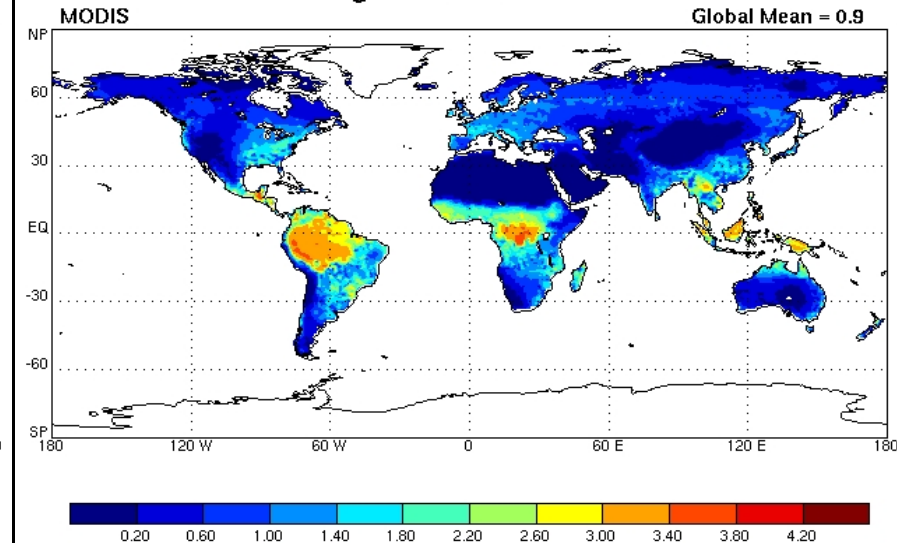
Mean GPP 2000-2006
kg CO₂ / m² / month



Mean GPP 2000-2006
kg CO₂ / m² / month

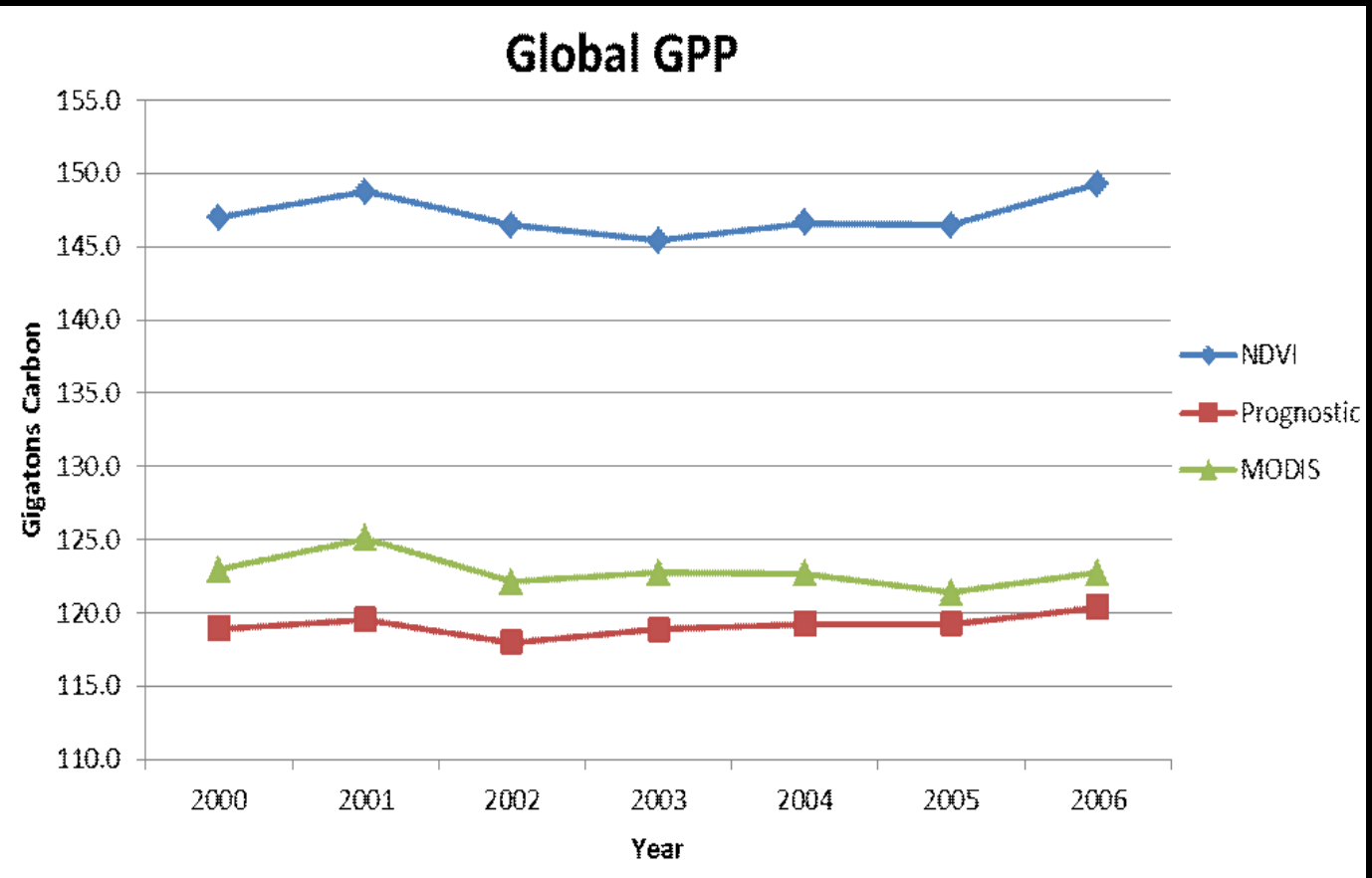


Mean GPP 2000-2006
kg CO₂ / m² / month



SiB GPP; Variability

- With a single model (SiB), we can get multiple GPP solutions based on phenology



Hemes et al., 2010

How can we constrain the model(s)?

- isotopes (Suits et al., 2005)
- OCS (Berry et al., 2012)
- fluorescence

SiB Fluorescence Parameterization

Semi-Empirical

photosynthesis yield = $J_e/J_o = x$

rate constants

$$k_n = 0.05043 * \exp(5.1473 (1-x))$$

$$k_f = 0.05$$

$$k_d = 0.95$$

$$k_p = 4.0$$

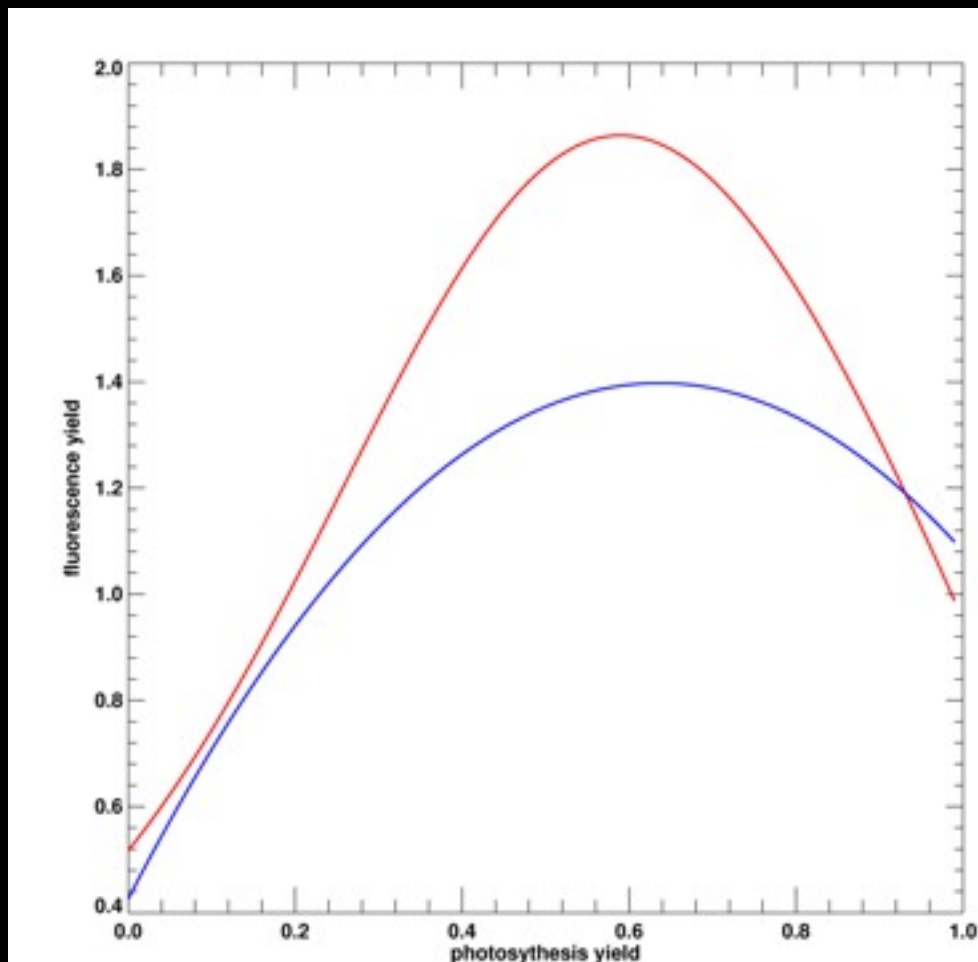
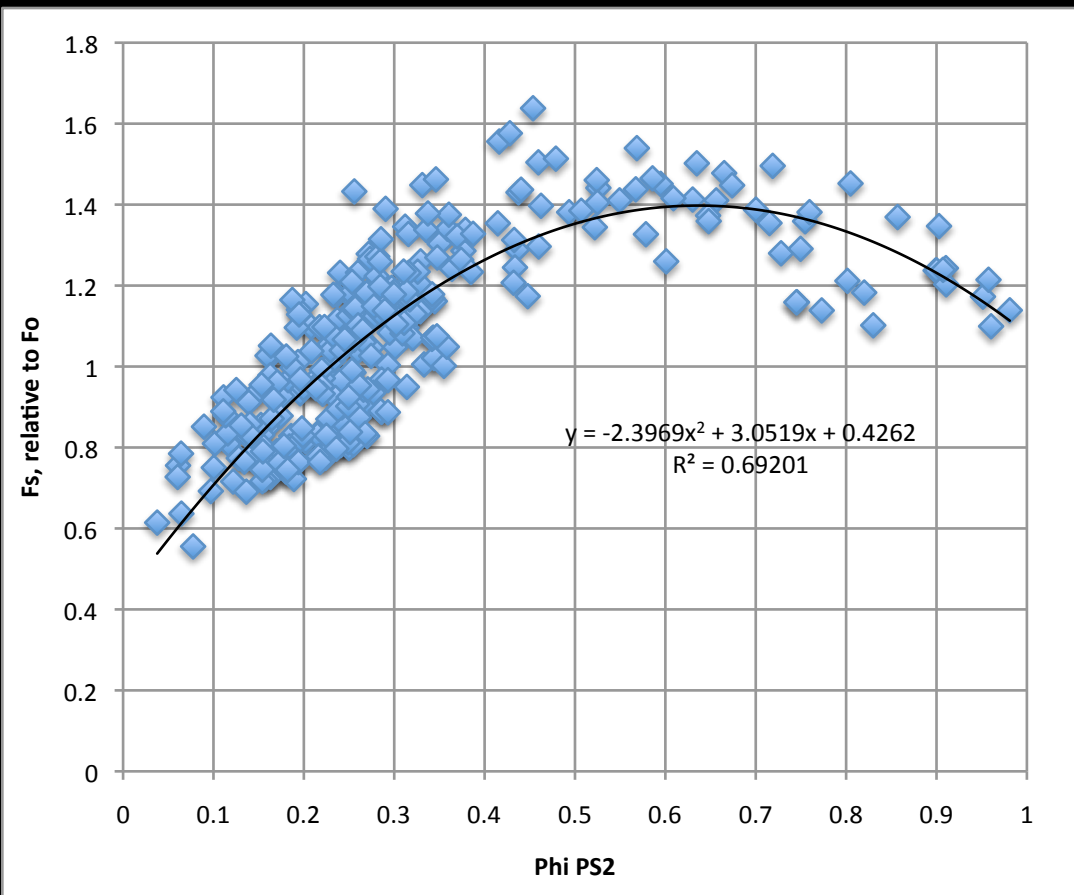
$$f_o = k_f / (k_f + k_d + k_n + k_p)$$

$$f_m = k_f / (k_f + k_d + k_n)$$

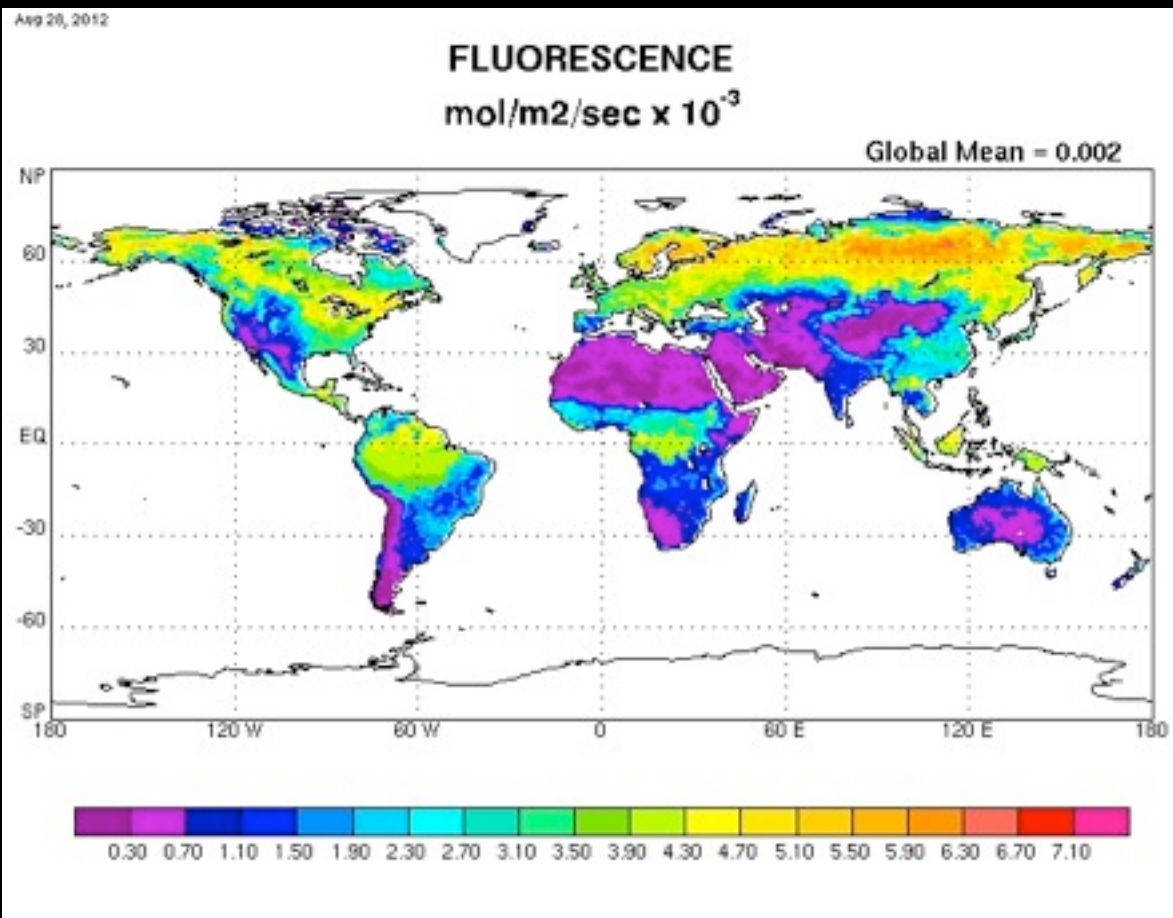
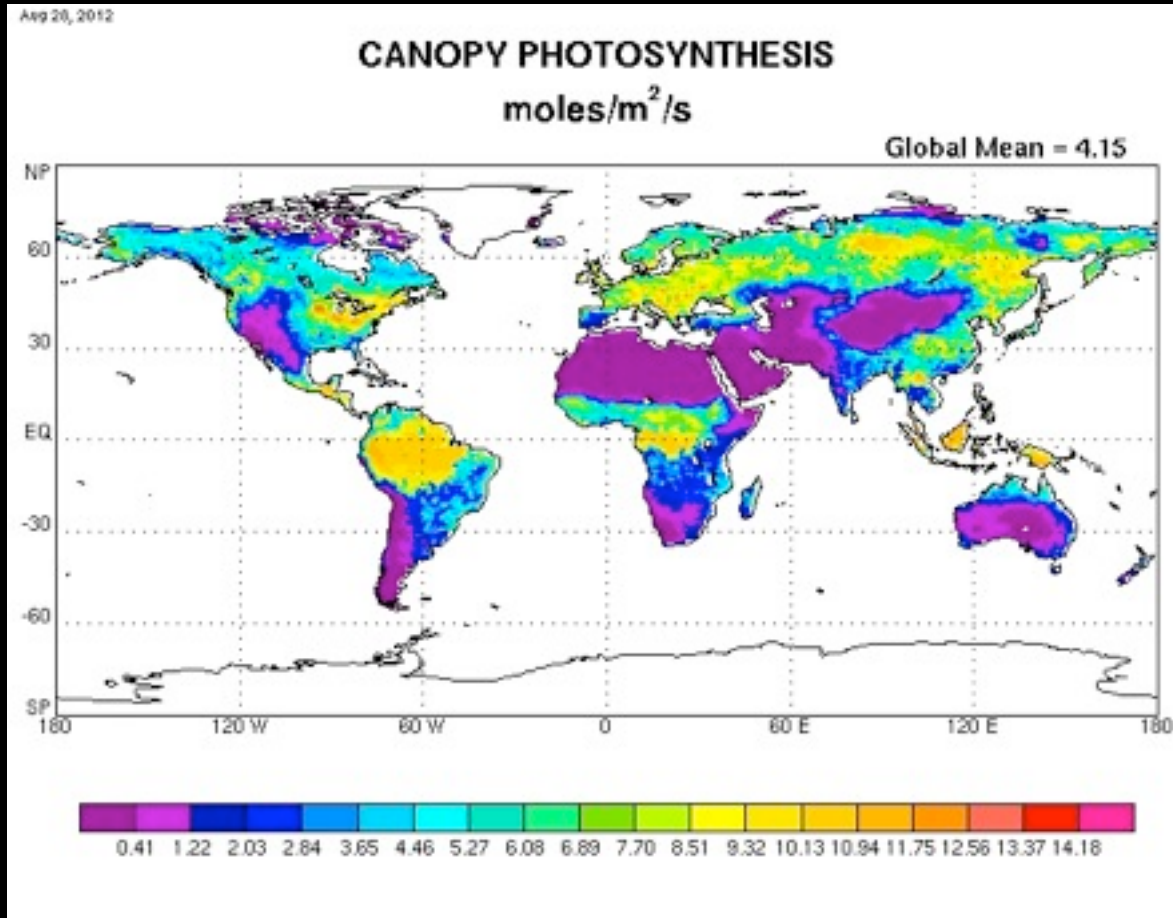
$$df_v = 0.8 * f_m * x$$

$$f_s = f_m - df_v$$

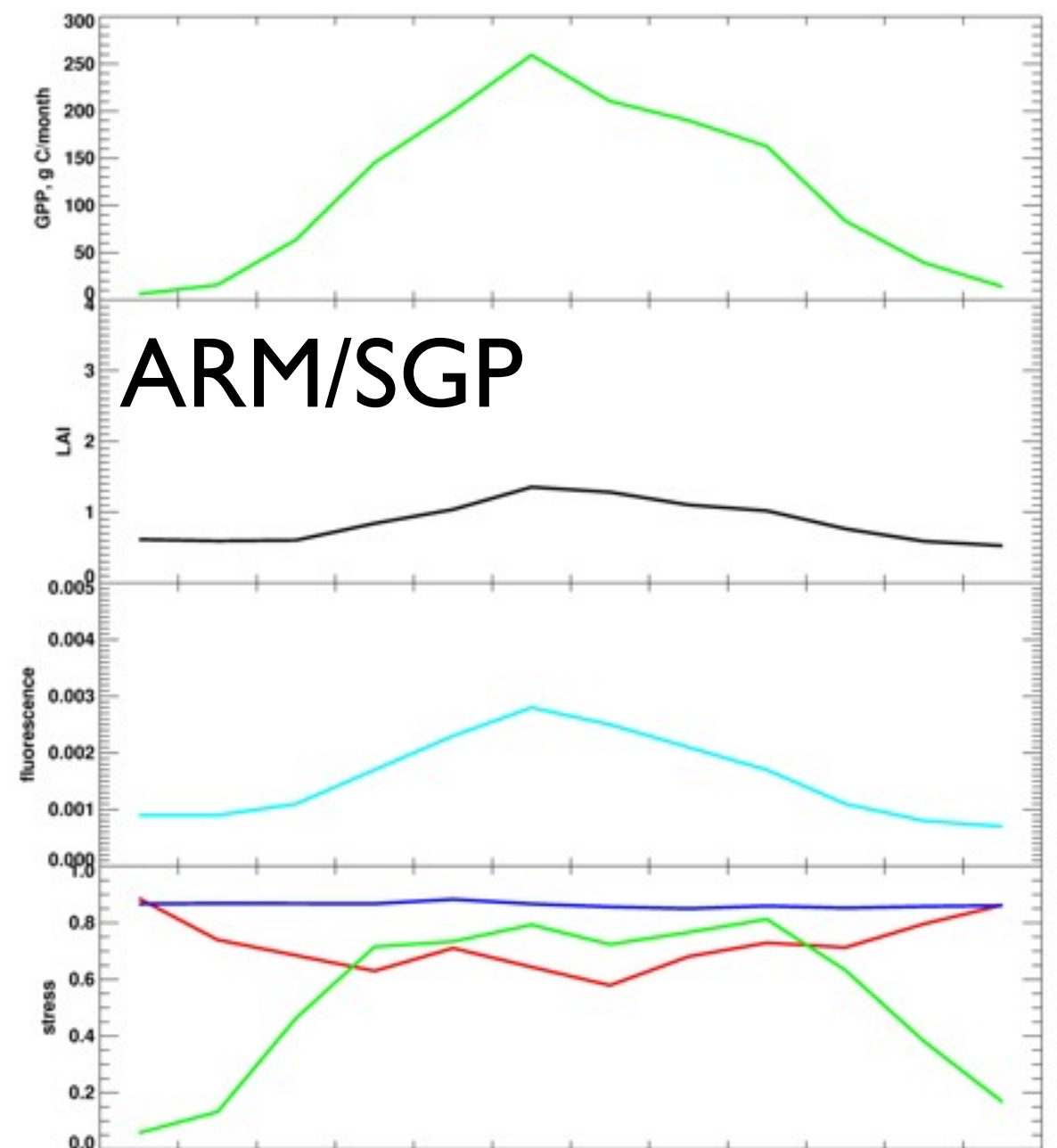
RTc is very simple (no BRDF)!

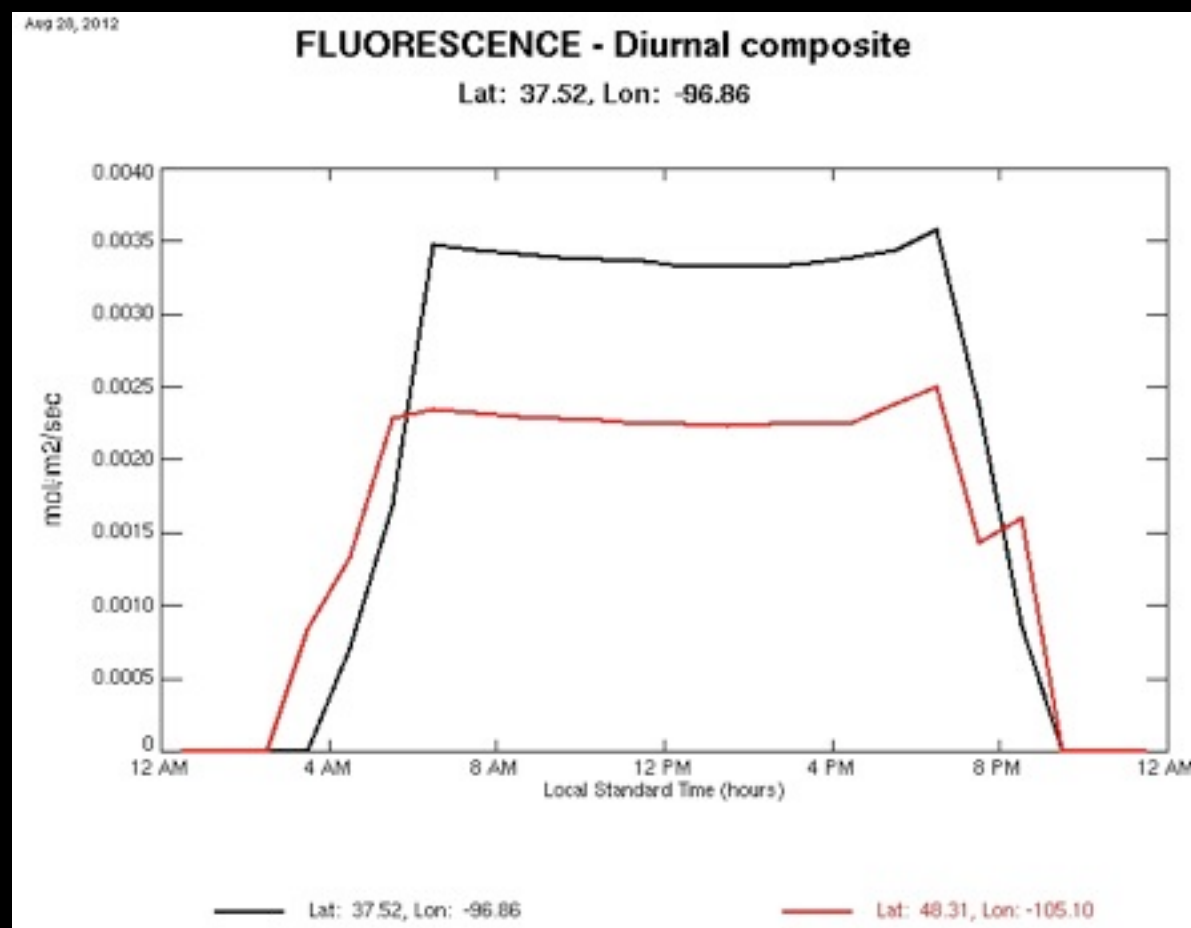
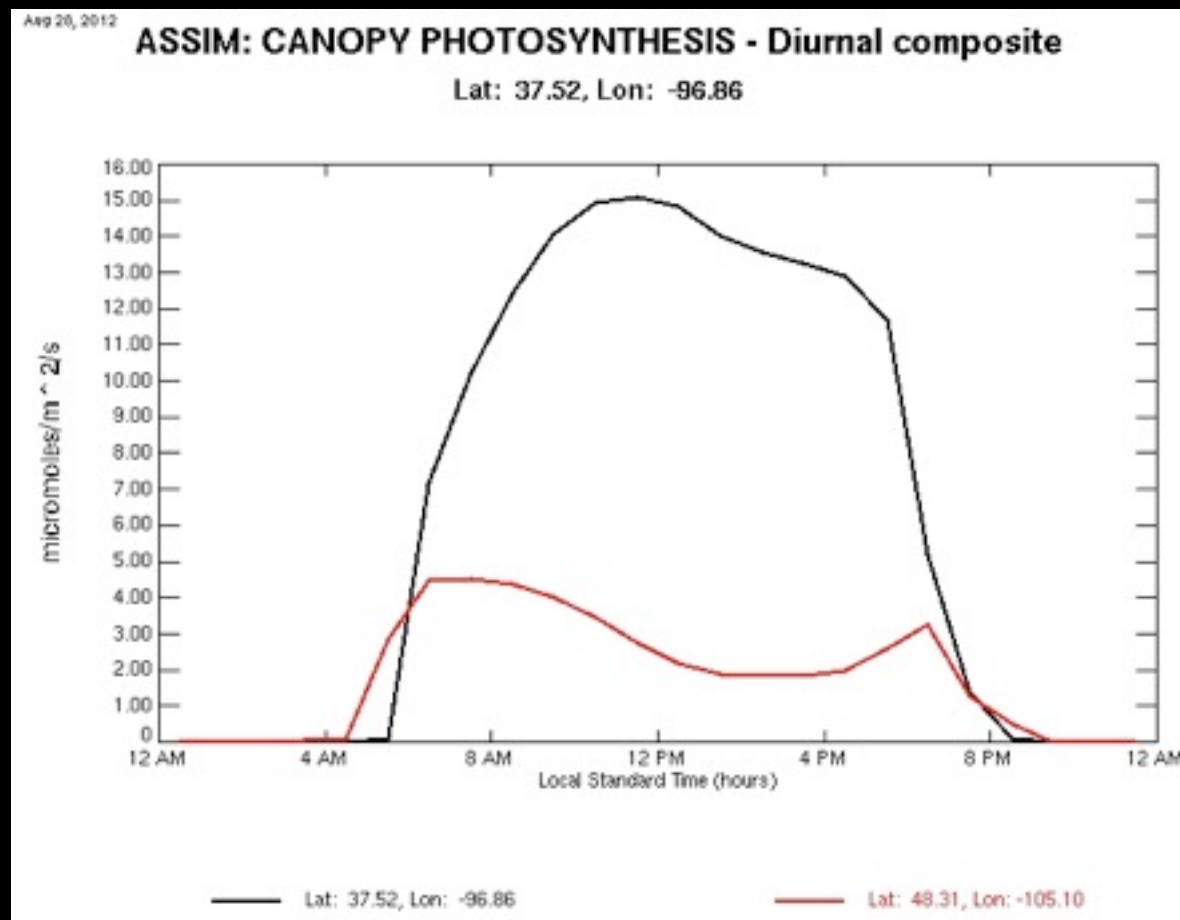


SiB fluor plots



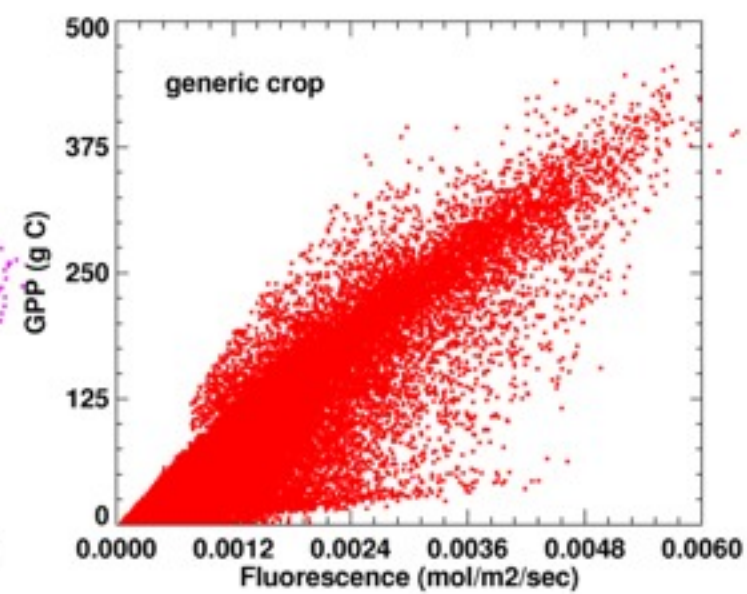
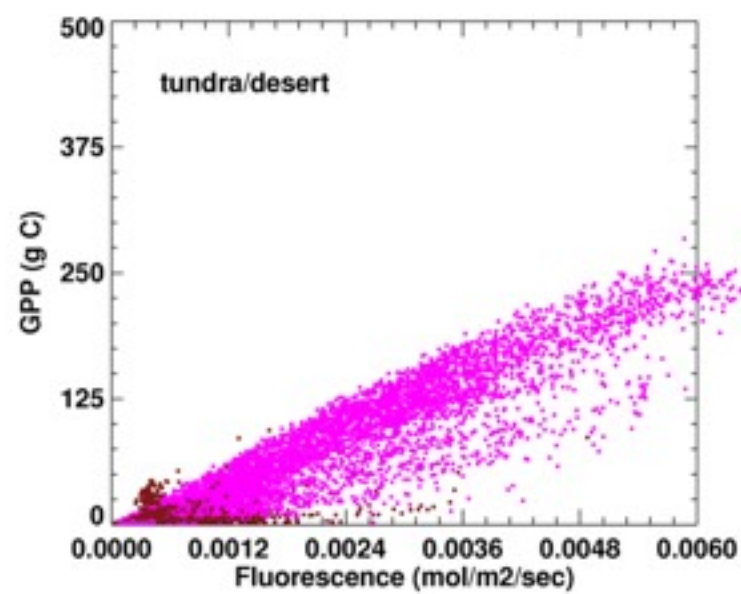
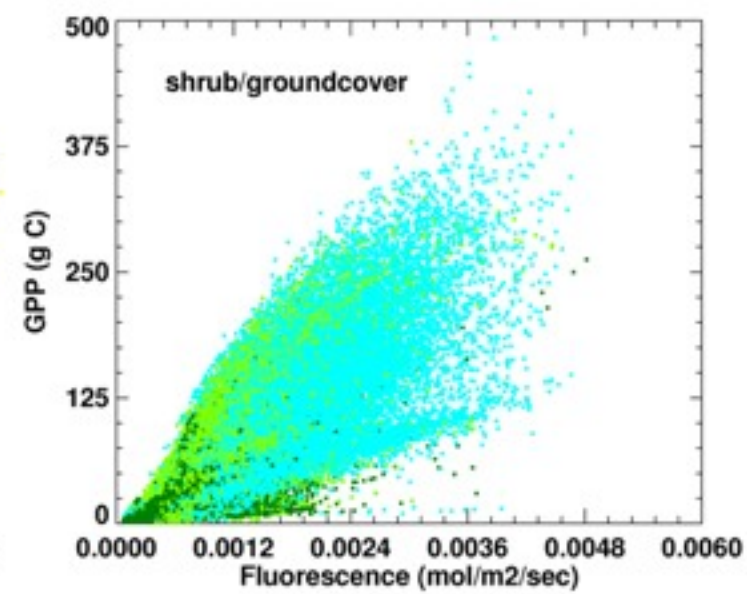
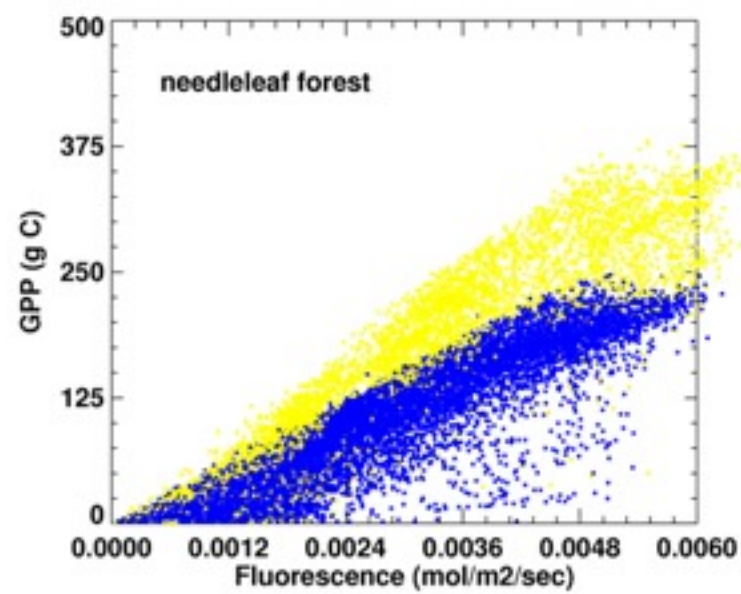
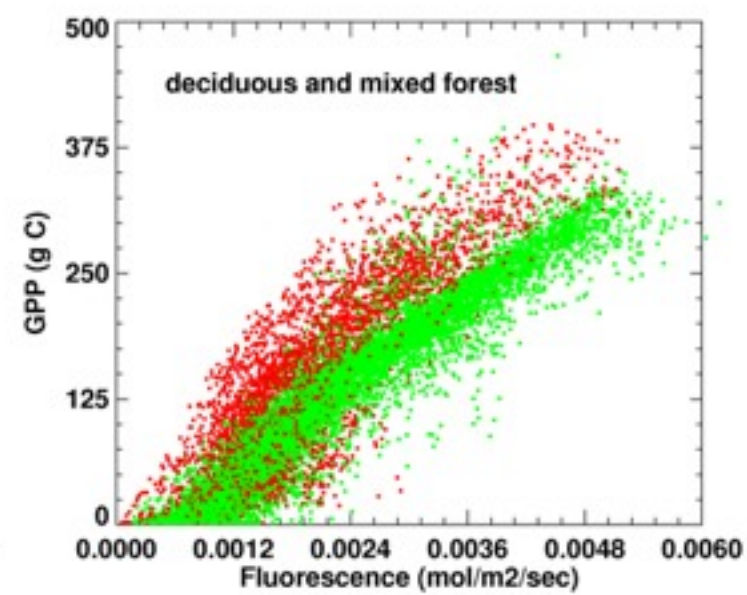
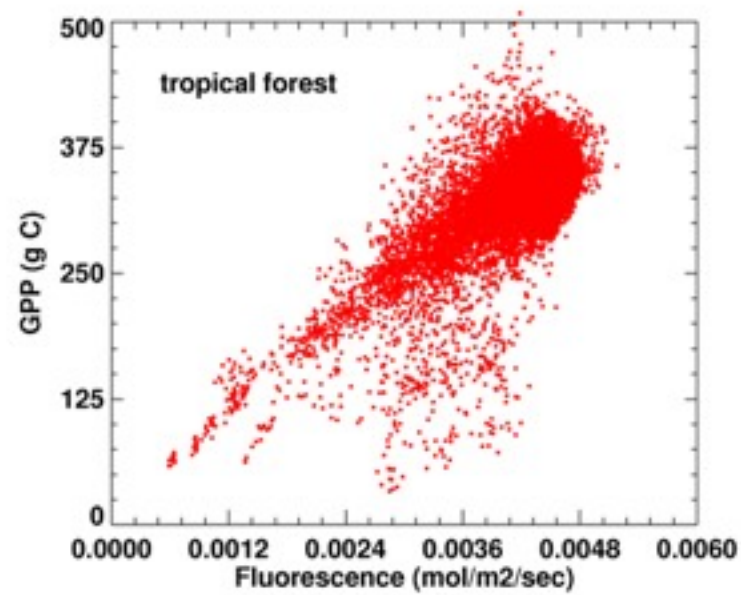
ARM/SGP





SiB: diurnal composites

- stressed (red) and nonstressed (black) sites
- GPP shows pattern similar to what was seen in Jaume's talk
- But...Fs doesn't
- What does this tell us?



Why am I here?

- What do I want?
 - input from plant physiologists
 - multiple models
- What can I contribute?
 - coupler between physiology and retrieval
 - evaluation?