

Some Recent SiB Tidbits

(and some non-SiB stuff too)

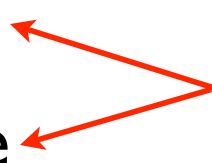
Ian Baker, the Denning Group, and multiple
collaborators

Colorado State University

CMMAP Team Meeting

7-9 August, 2012

Items

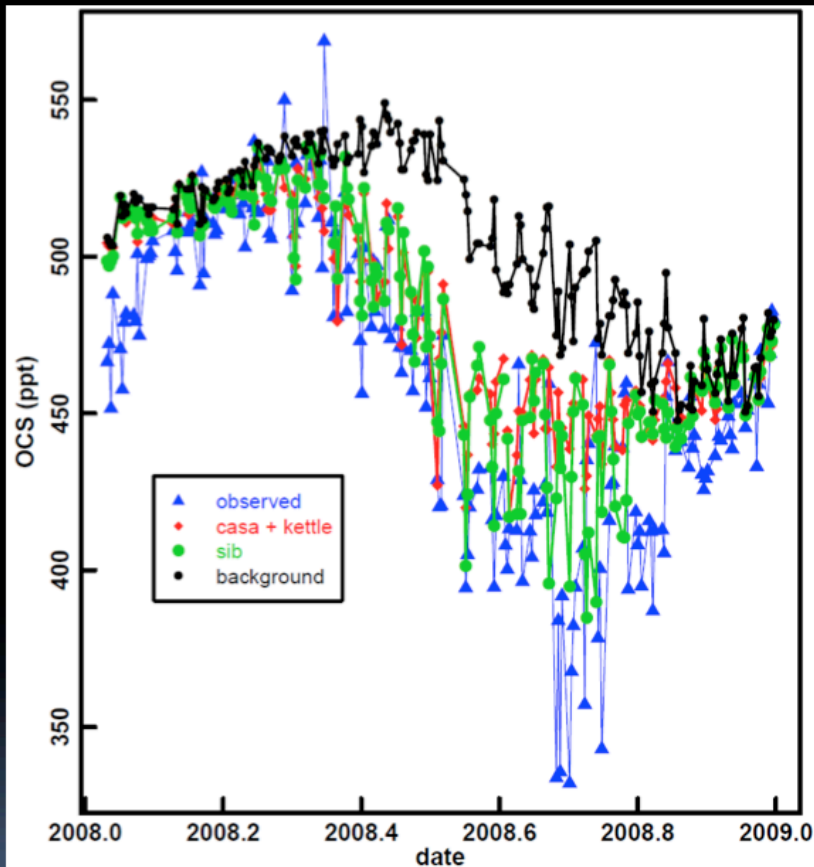
1. Carbonyl Sulfide (OCS)
 2. Chlorophyll Fluorescence
 3. SiB4
 4. Distributed land in CESM
- mechanisms to constrain GPP
- 

GPP

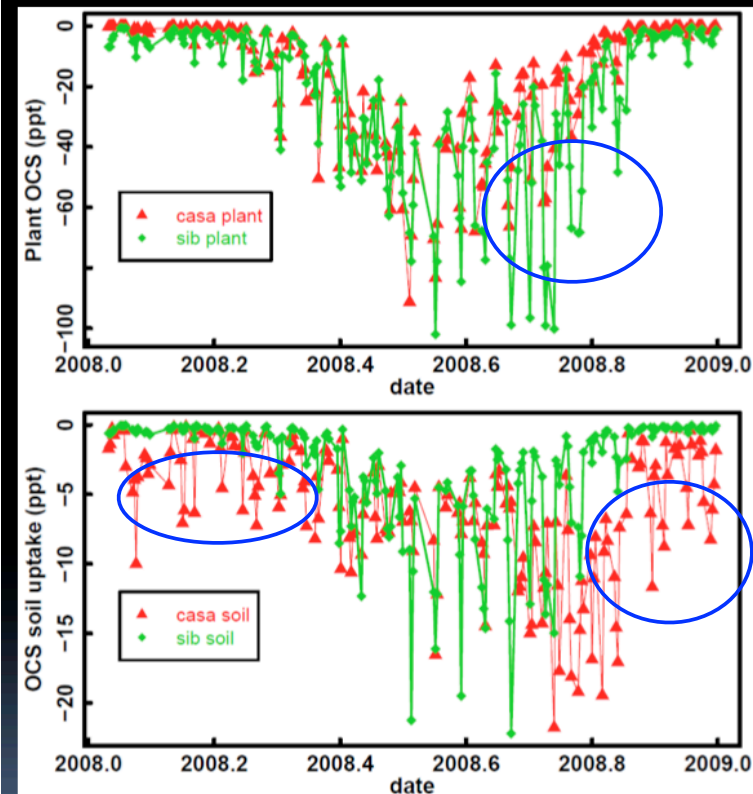
- Multiple models obtain similar NEE results, with factor-of-2 differences in GPP (Huntzinger et al, 2011)
- Constraining GPP in our models is important

Using OCS to constrain model photosynthesis

Model vs. observations

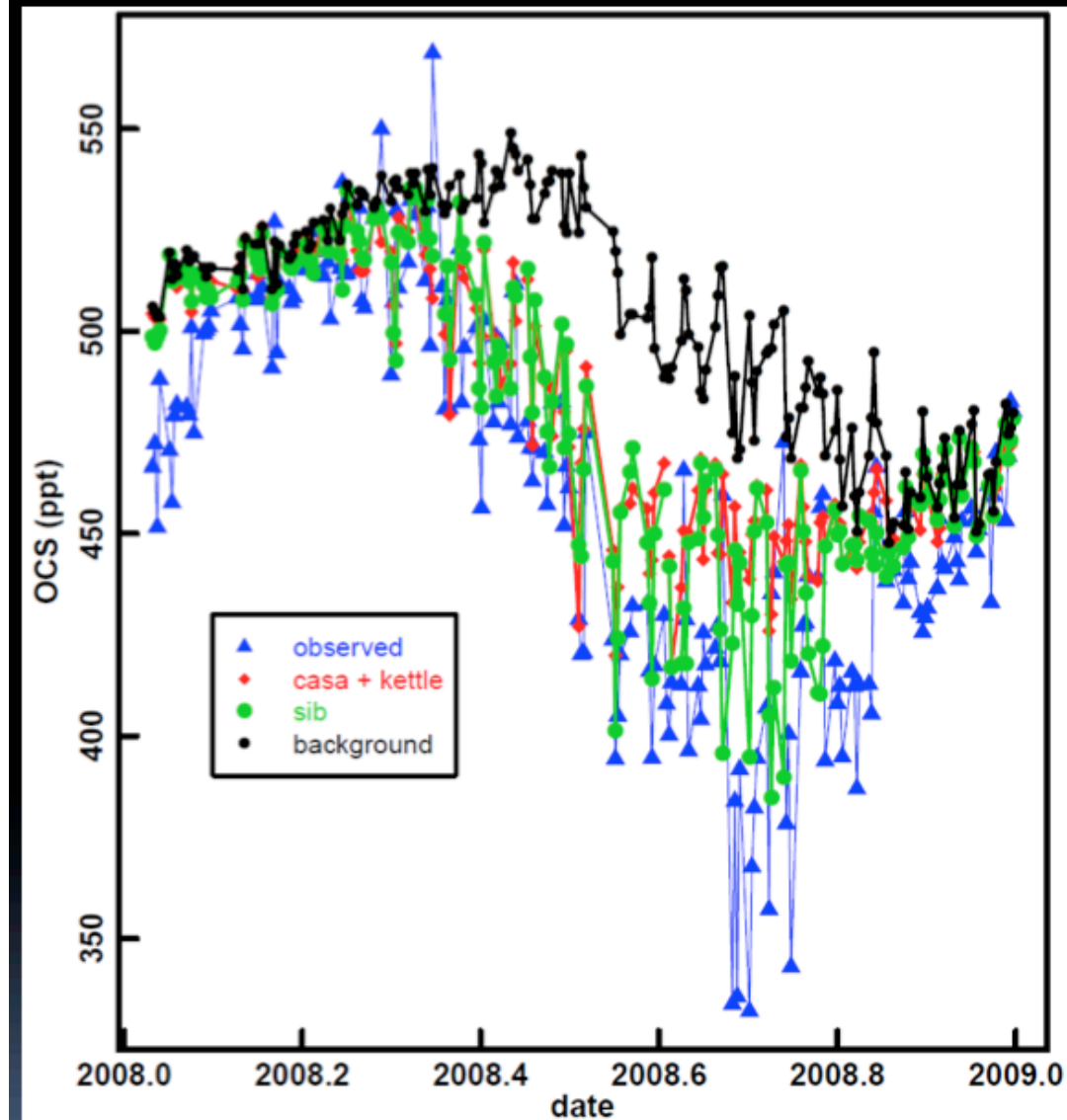


Simulated plant and soil uptake



WLEF

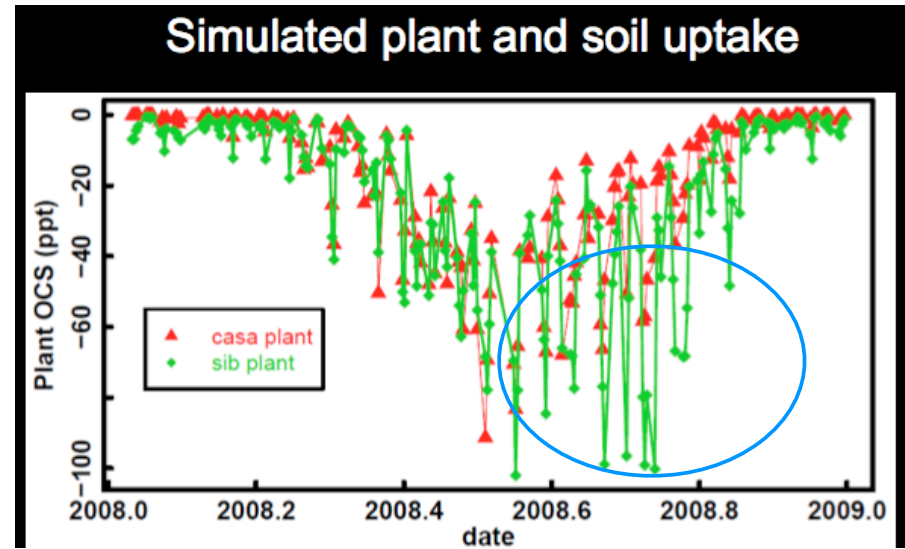
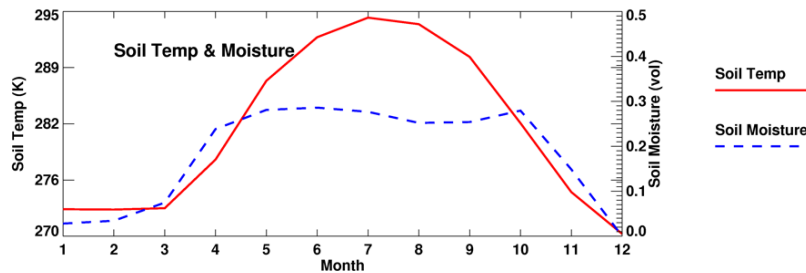
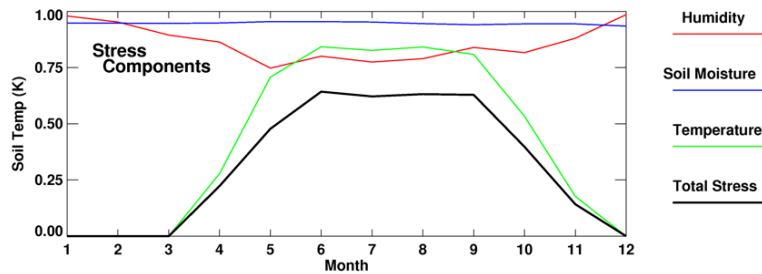
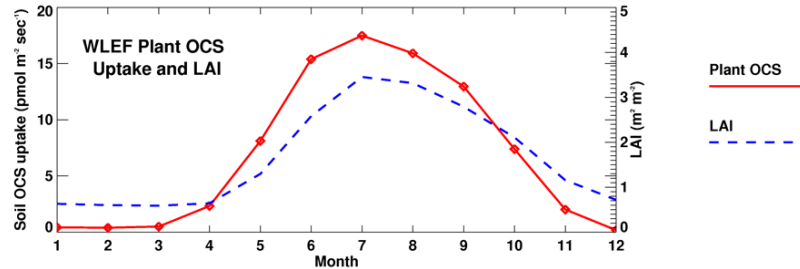
Model vs. observations



Huilin can make
CASA resemble obs
by multiplying ground
uptake by 3X Kettle,
to 1/3 of total uptake

SiB did not give
realistic results in this
inversion framework:
Does component
behavior give any
insight?

SiB-plant uptake



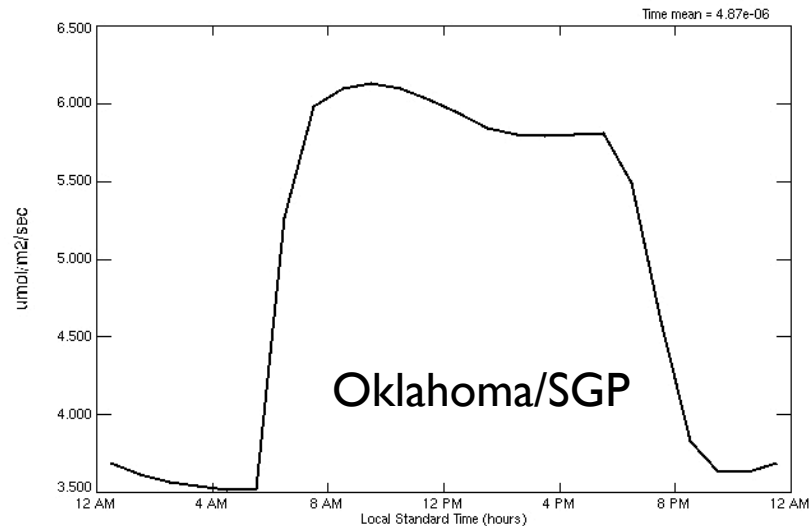
SiB-CASA GPP are similar until late summer, early fall, when SiB GPP is larger.

SiB: plant uptake

Mar 20, 2012

COS ASSIMILATION - Diurnal composite

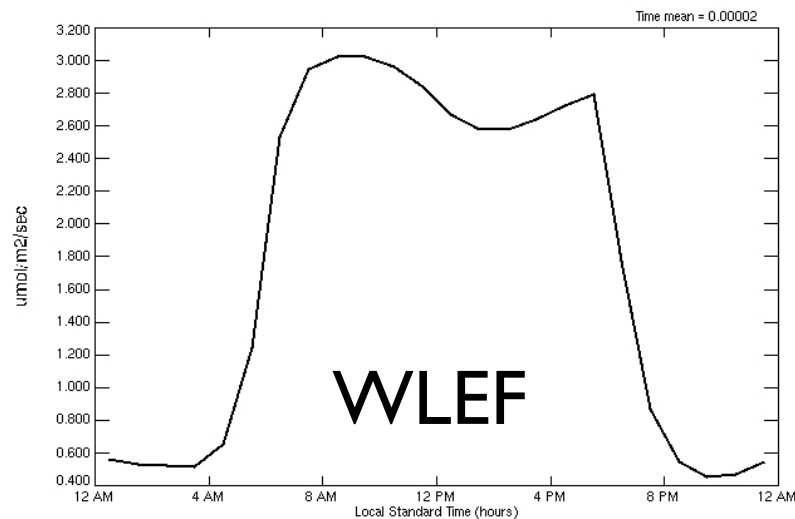
Lat: 37.52, Lon: -96.86



Mar 21, 2012

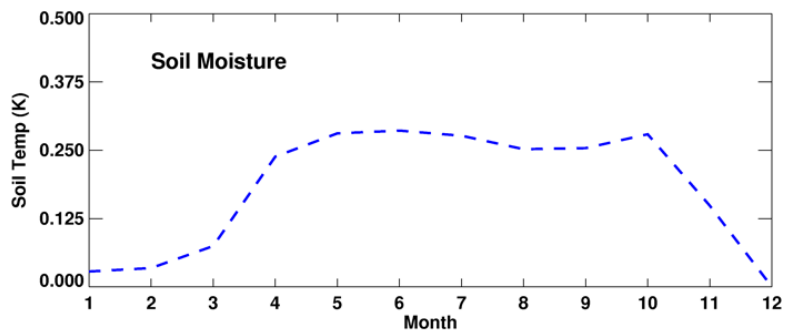
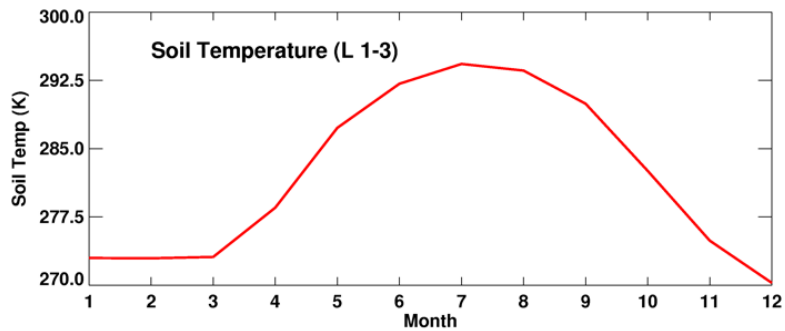
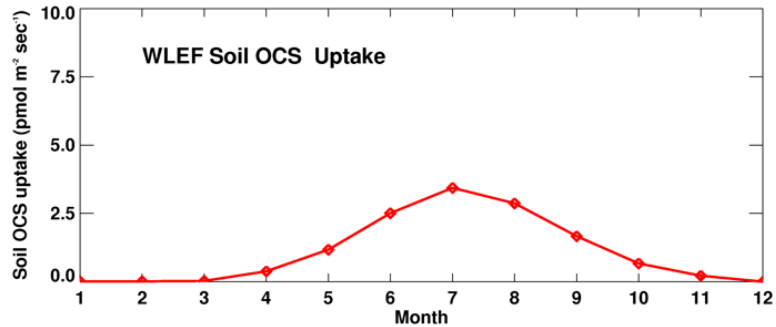
COS ASSIMILATION - Diurnal composite

Lat: 45.81, Lon: -90.08



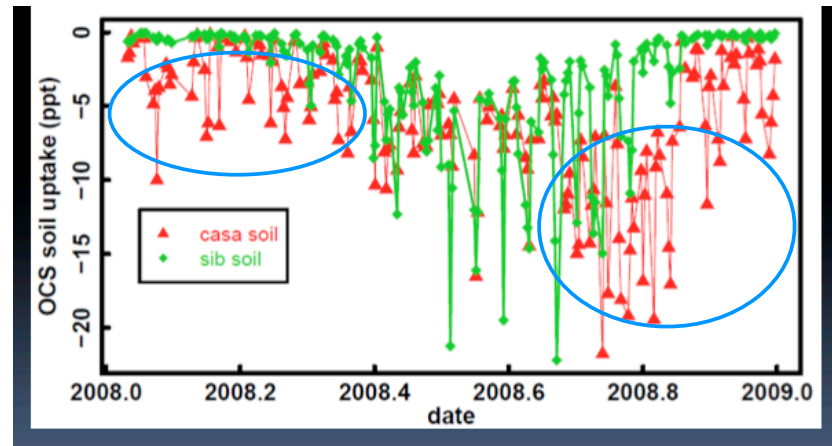
- Photosynthesis (not shown) goes to zero at night
- OCS uptake by plants does not
- Reason: stomatal conductance does not go to zero

SiB-soil uptake

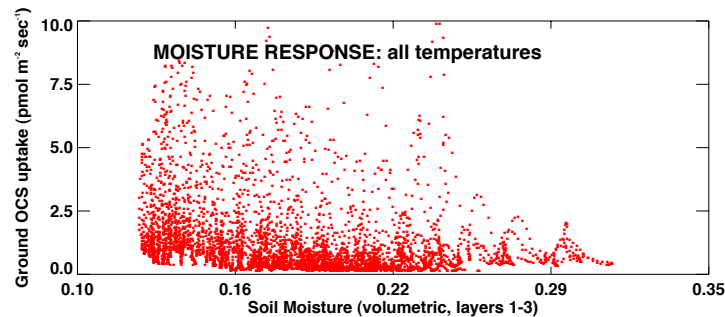
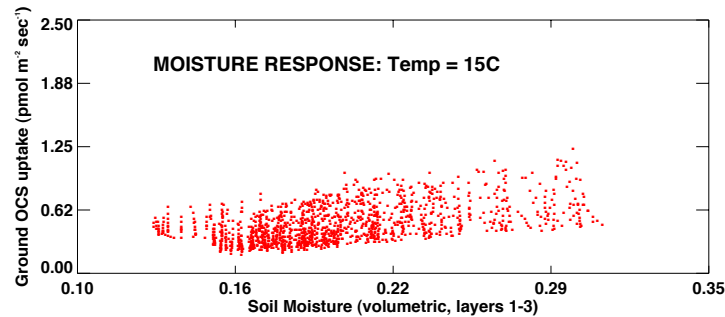
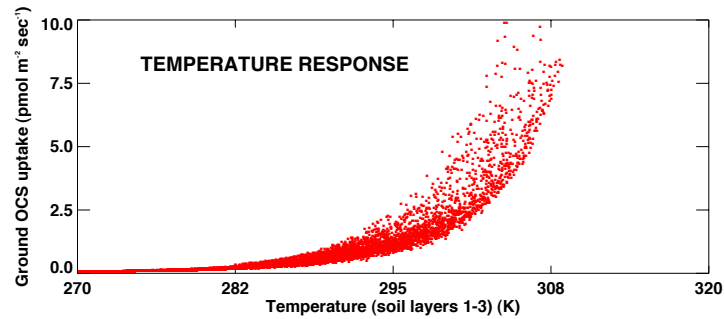


Simulated plant and soil uptake

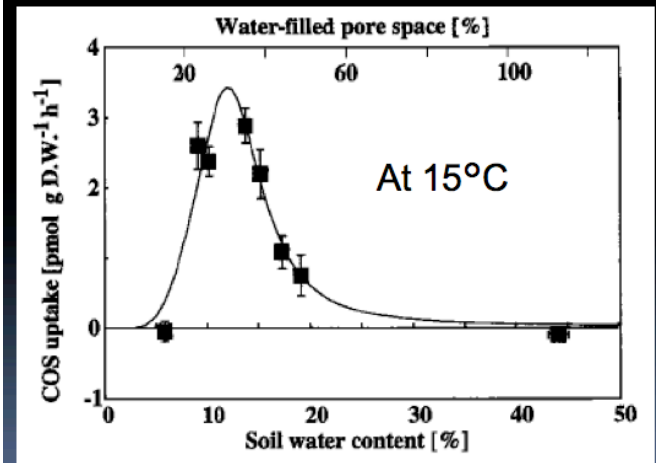
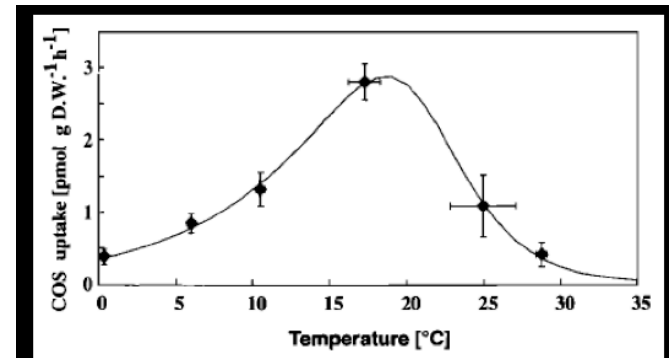
Soil OCS uptake is somewhat opposite of GPP; more CASA uptake in fall, winter (strong temperature response in SiB; footprint?)



SiB results, WLEF

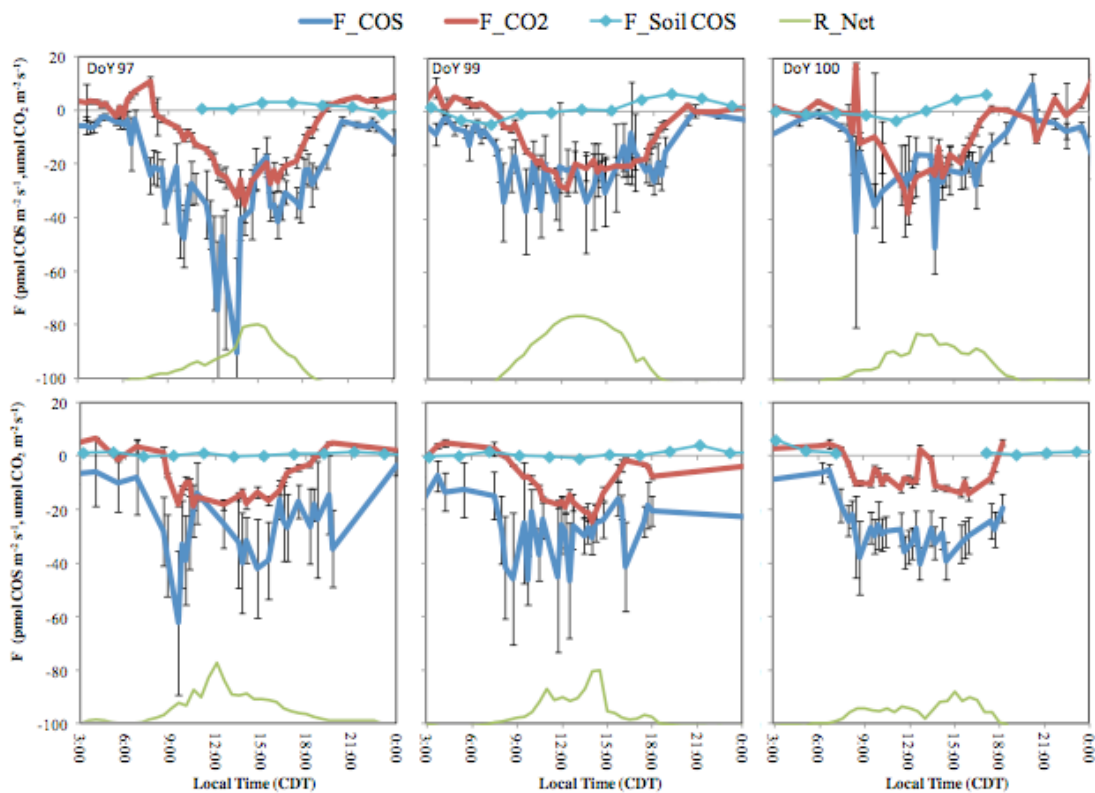


SiB: OCS ground uptake sensitivity

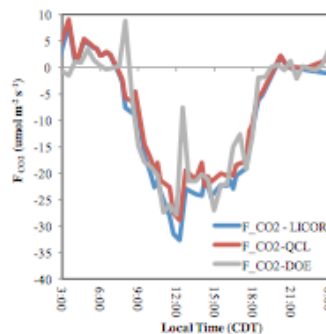


Kettle 2002

Canopy COS and CO₂ Flux Measurements

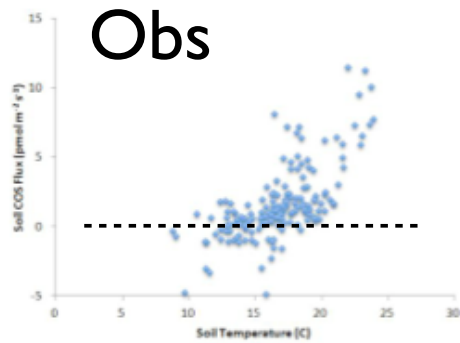


- ❑ CO₂ flux from QCL and IRGA show agreement with respect to diurnal variation and magnitude of flux.
- ❑ Significant diurnal variation in COS consistent with peak CO₂ uptake
- ❑ Scatter in COS reflective of large flux relative to background
- ❑ Soil COS flux is a source, contrary to most chamber and atmospheric tracer studies which consider the soils to be a sink
- ❑ Soil COS flux is small relative to canopy flux

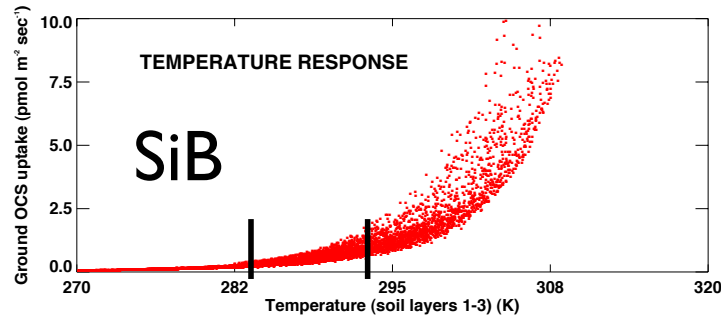


Observations:
ARM-SGP
results (Joe
Berry, Elliott
Campbell)

Soil COS Flux and Temperature

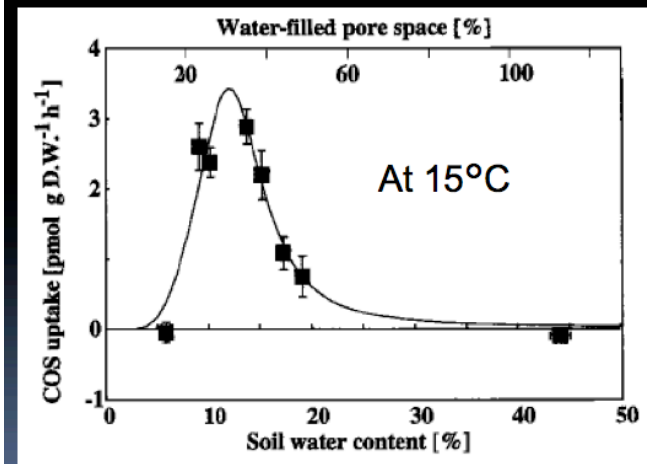
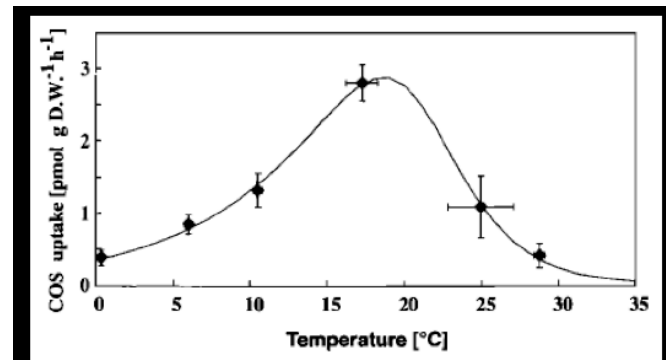


- At soil temperatures above 20°C, COS production dominates
- Between 10-20°C soil can be a sink or source
- Possibly both temperature and plant activity influence diurnal soil COS flux variations



- Obs and SiB plots have opposite sign conventions
- The ground uptake has become more complicated
- As usual, there is no 'magic bullet'

More Obs (ARM):



Kettle 2002

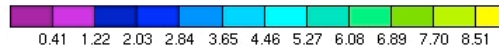
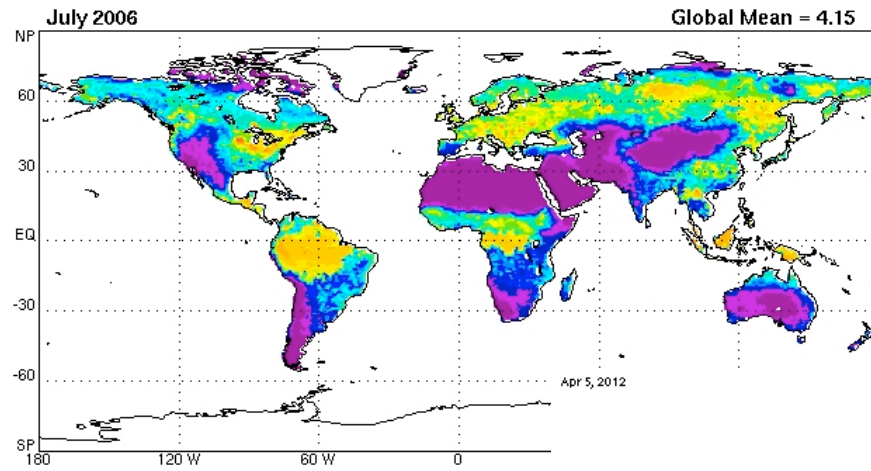
what have we learned, and how can we use it?

- SiB has very little moisture response for soil OCS uptake; temperature response is strong, and very different from Kettle
- ARM-SGP Obs are different still; we have work to do with respect to OCS flux at the soil-air interface
- CASA shows continued OCS uptake by soil through the winter; realistic?
- SiB/CASA are similar through midsummer. We've identified some differences in soil uptake, what about GPP (magnitude, timing)?

Apr 5, 2012

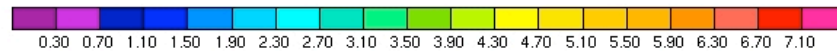
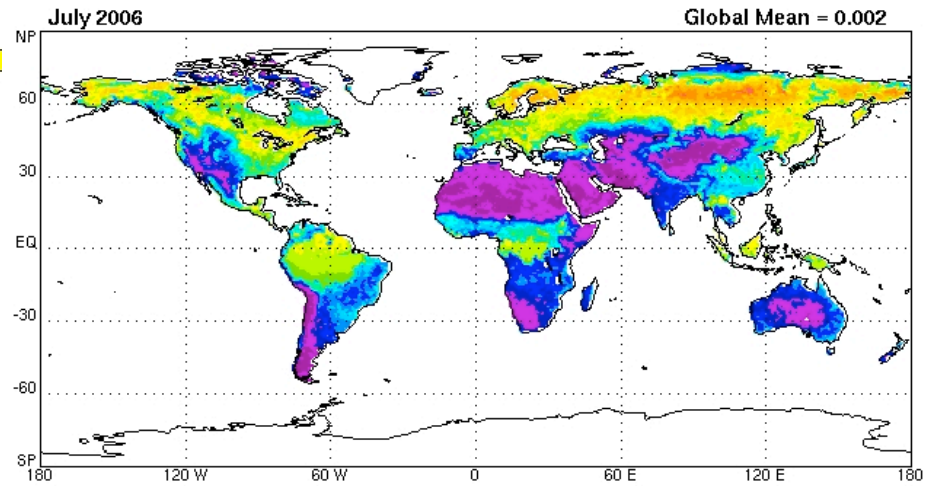
CANOPY PHOTOSYNTHESIS

moles/m²/s



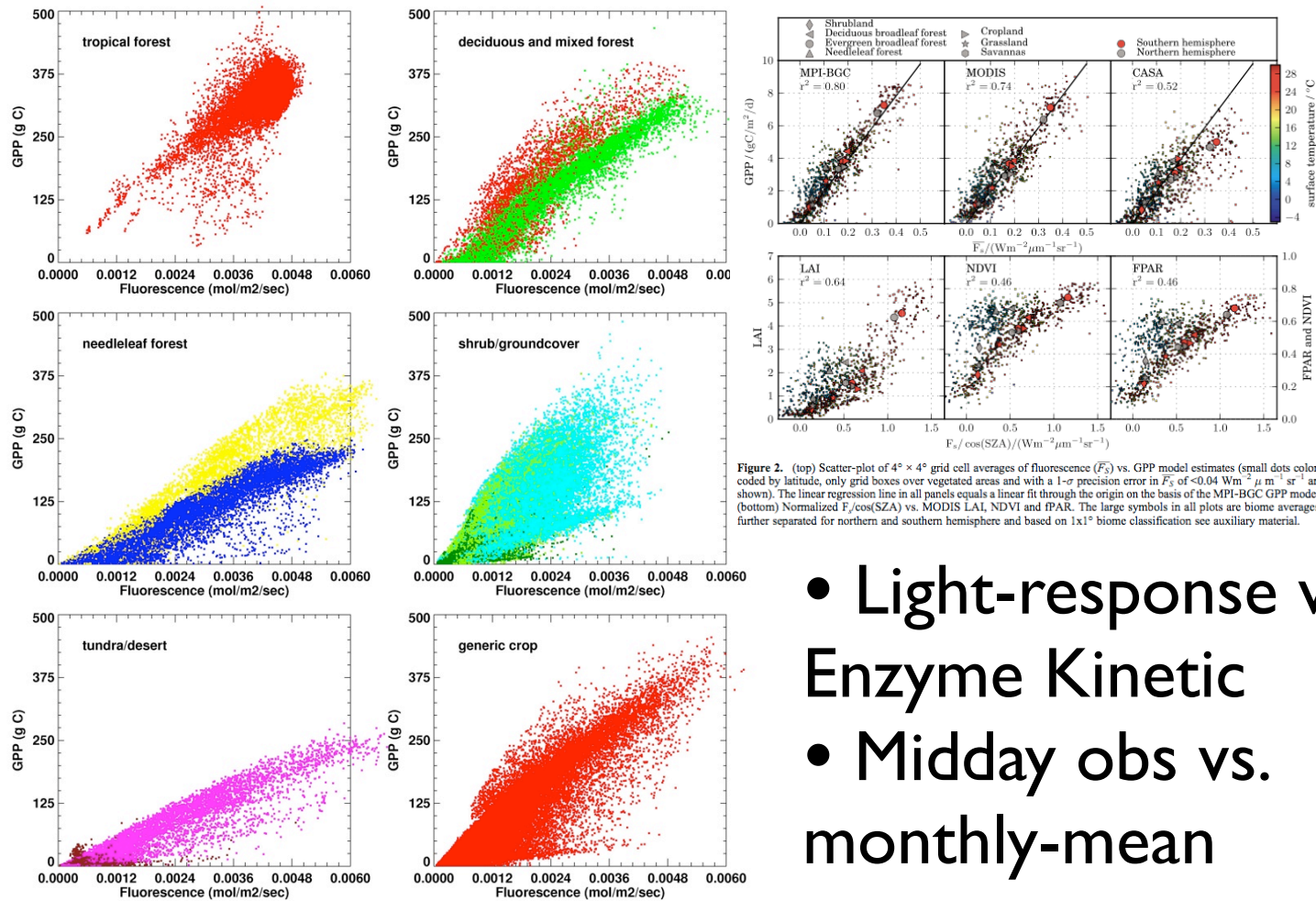
FLUORESCENCE

mol/m²/sec



SiB3 results, Monthly-mean diagnostics

Frankenberg et al., 2011

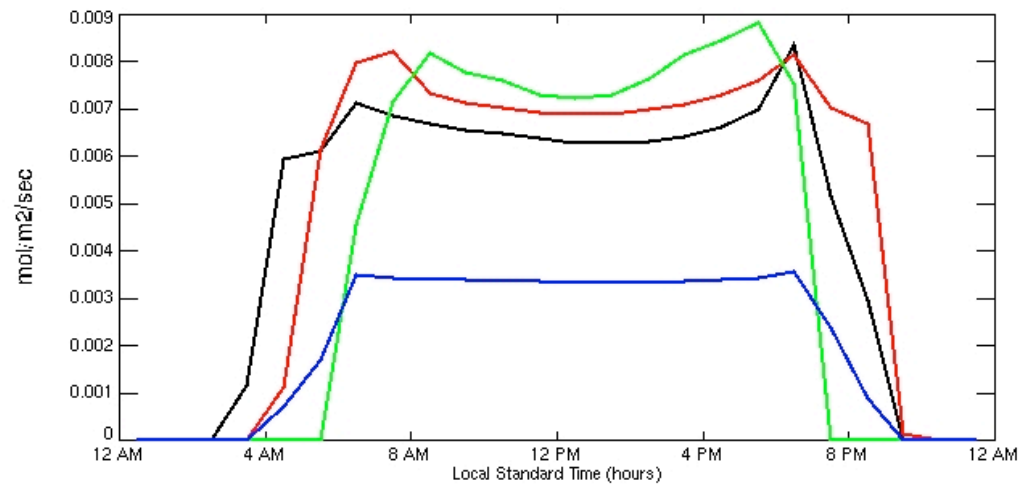


- Light-response vs Enzyme Kinetic
- Midday obs vs. monthly-mean

Apr 5, 2012

FLUORESCENCE - Diurnal composite

Lat: 45.81, Lon: -90.08



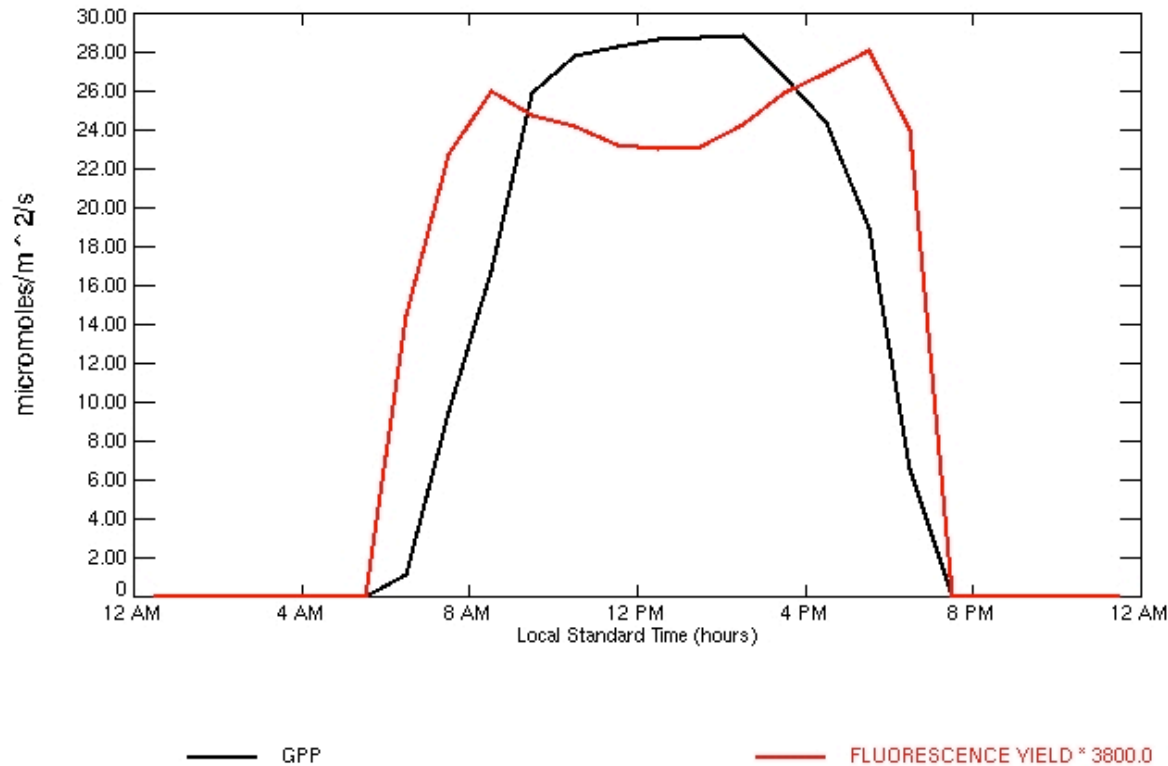
— WLEF
— Harvard Forest
— Tapajos Nat'l Forest, Brazil
— ARM/SGP

- Fluorescence multiplied x 3600 to fit on graph
- Radiative transfer?

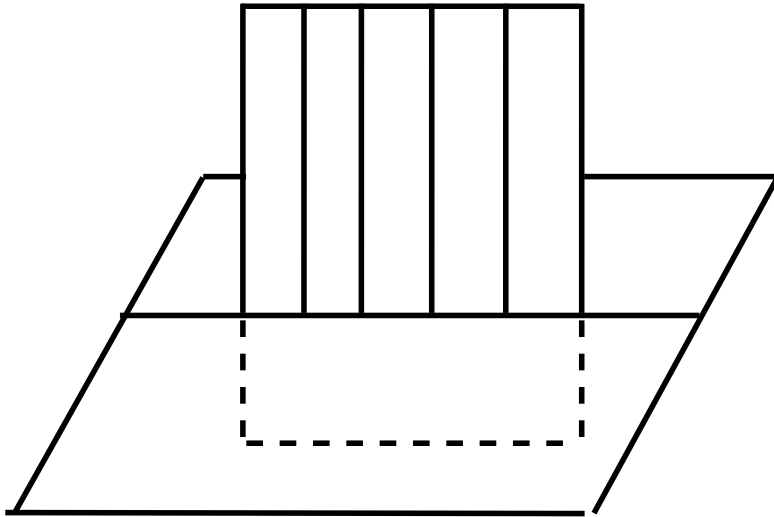
Apr 5, 2012

GPP and Fluorescence Yield

Lat: -2.86, Lon: -54.96

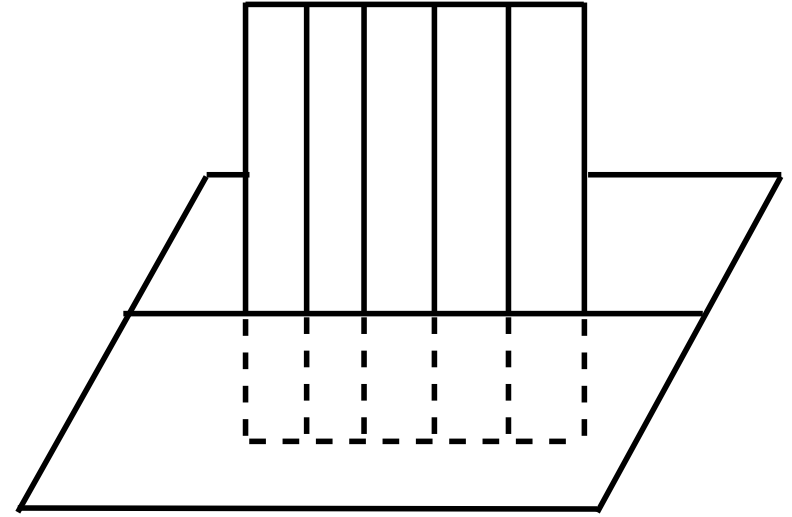


CESM/CLM



OLD

- Distributed land in CESM
- What experiments do we want to run?



NEW