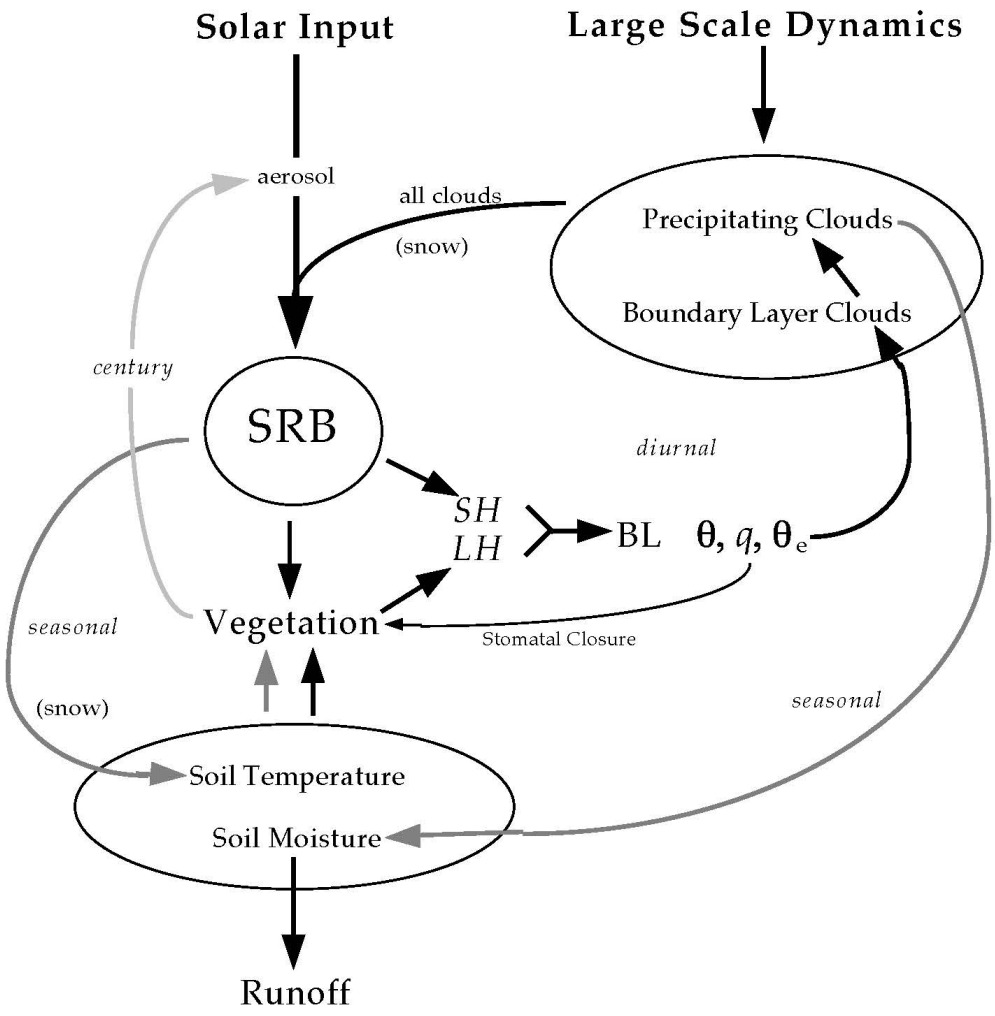
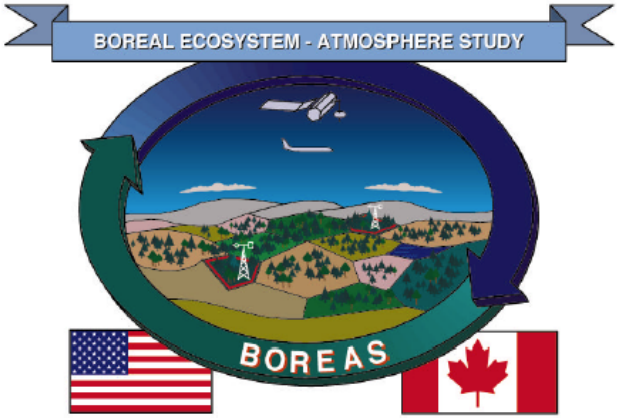
David Fitzjarrald
ASRC SUNY Albany





BOREAS Science White Papers

BOREAS Science Team
November 15, 1995

3.3.4 Summer IFC

a. Diurnal and seasonal coupling of fluxes of CH_4, H_2O and CO_2 at the fen sites is controlled by the water table and by temperature.

b. The radiation and temperature responses of leaf scale photosynthesis is the same throughout the growing season so that one set of parameters suffices.

c. A small increase in temperature or a decrease in solar radiation causes the system to change from a CO_2 sink to a source.

d. Carbon use efficiency is conservative with respect to species and temperature.

e. Diurnal and seasonal fluctuations in soil CO_2 efflux are controlled by physiology of tree roots and foliage.

f. Fluxes and physiology vary with the weather from one year to the next.

g. Atmospheric feedbacks determine surface conductance and physiological activity of foliage, and vice versa, rather than soil water.

h. Clouds have a major impact on the positive feedback between surface conductance and atmospheric boundary layer development.

i. Microscale variation in soil hydraulic properties is more relevant to the development of the atmospheric boundary layer than in mesoscale variation.

Two tower flux trajectories: FIFE → BOREAS
ABLE-2,3 → BOREAS

"remotely sensible science" ← → "Boy Scout science" ← → "aleatoric science" (WV)

Two approaches: long-term fluxes ← → intensive field campaigns

Slow growth in belief that eddy fluxes could be long-term efforts
Mysteries dealing with 'energy balance closure' problem.

1993: First BOREAS 'test' deployment.

Discussion with Dennis B et al.: long-term continuous fluxes necessary!
(San Diego AgFor meeting—lunchtime debate!)

BOREAS role in 'birthing' FLUXnet ; changes in BOREAS plan 1994 → 1996 "White Papers"

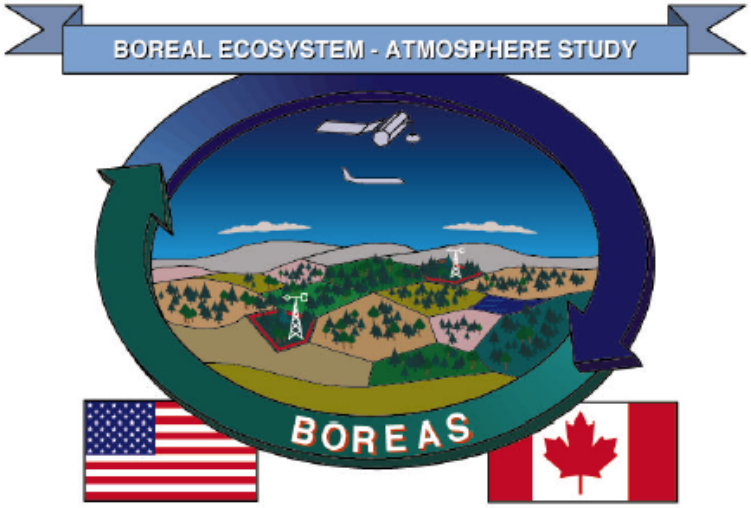
(At a meeting in La Thuile, Italy during 1995….)
→ the real "Boy Scout Science" with merit badges!

…

Winnipeg Workshop 1993 “Essence without substance” Award
Toronto Workshop 1996 “Truth in Jest” Award

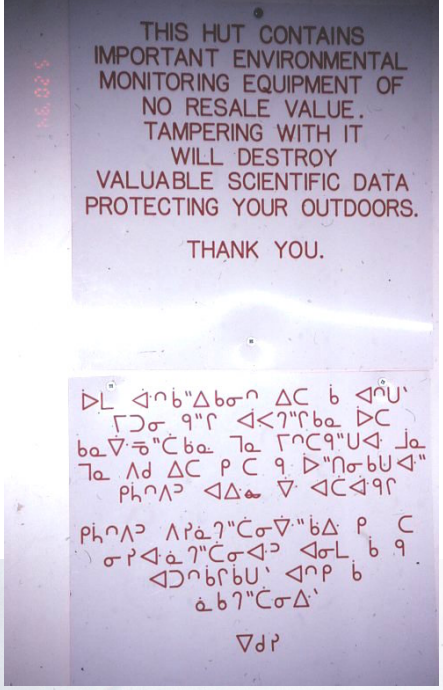
Positive surface-atmospheric boundary layer drying feedback:

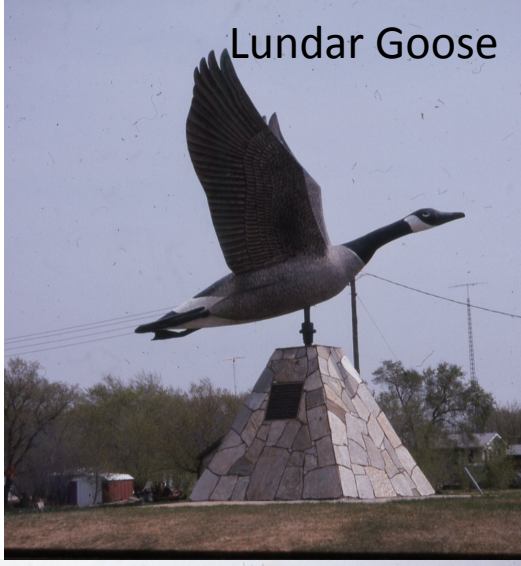
"…Teleologists would propose that this implies that the ecosystem is out of sync with its climate while strict Darwinists (Dawkins faction) might argue that this apparent reduction in ecosystem efficiency is to be expected from game theory. More data for a different kind of year would help to resolve some of these issues."



BOREAS Science White Papers

BOREAS Science Team
November 15, 1995


THIS HUT CONTAINS
IMPORTANT ENVIRONMENTAL
MONITORING EQUIPMENT OF
NO RESALE VALUE.
TAMPERING WITH IT
WILL DESTROY
VALUABLE SCIENTIFIC DATA
PROTECTING YOUR OUTDOORS.
THANK YOU.


Lundar Goose


A-M-I
LEASING
CARS • TRUCKS • EQUIPMENT

NSA-OJP

Positive surface-atmospheric boundary layer drying feedback:

"…Teleologists would propose that this implies that the ecosystem is out of sync with its climate while strict Darwinists (Dawkins faction) might argue that this apparent reduction in ecosystem efficiency is to be expected from game theory. More data for a different kind of year would help to resolve some of these issues."

Could we have been more *erudite* 21 years ago?

….or was this just BS? You decide.

At present, the surface meteorological measurements from BOREAS are being used to drive both local stand level SVAT models and regional ecosystem models. These models require long continuous time-series of forcing variables.

3.3.4 Summer IFC

a. Diurnal and seasonal coupling of fluxes of CH_4, H_2O and CO_2 at the fen sites is controlled by the water table and by temperature.

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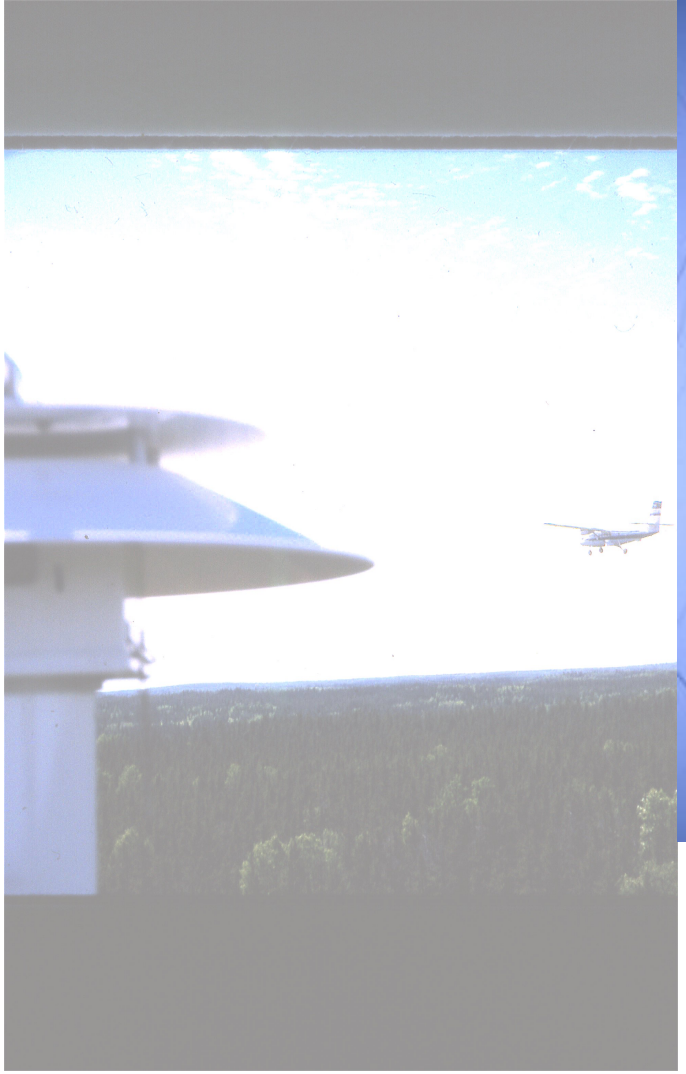
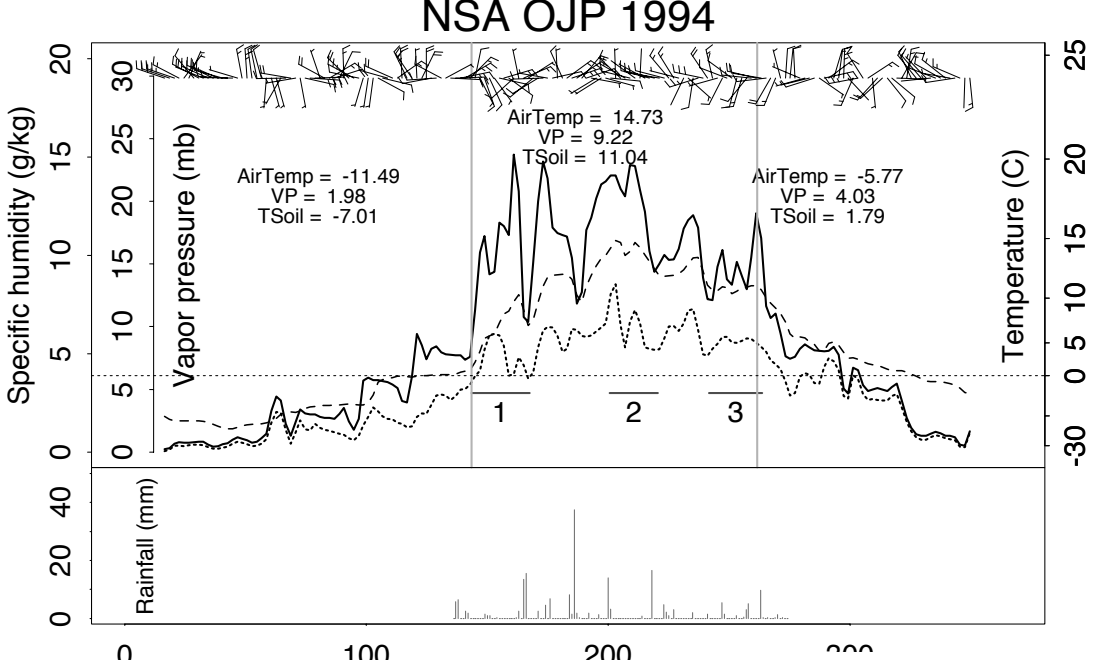
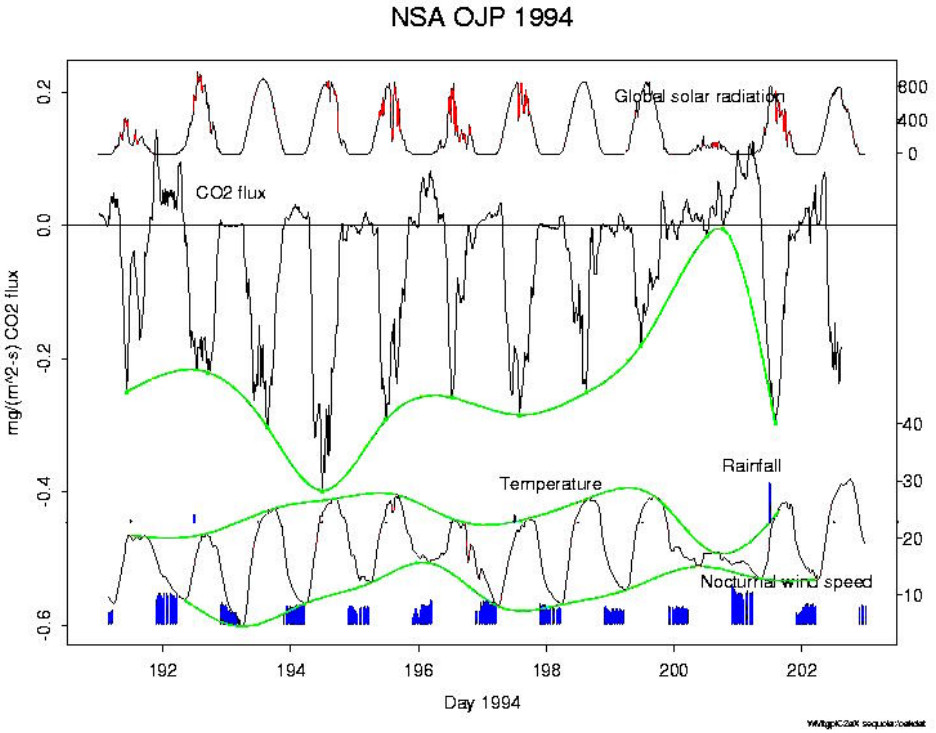



NSA OJP 1994
Specific humidity (g/kg)
Vapor pressure (mb)
Temperature (C)
Rainfall (mm)
AirTemp = -11.49
VP = 1.98
TSoil = -7.01
AirTemp = 14.73
VP = 9.22
TSoil = 11.04
AirTemp = -5.77
VP = 4.03
TSoil = 1.79
1
2
3


NSA OJP 1994
Global solar radiation
CO2 flux
Temperature
Rainfall
Nocturnal wind speed
mg/(m^2-s) CO2 flux
Day 1994

Links between clouds, boundary layer & surface fluxes, including carbon:

Still working on BOREAS data:

Case study: BOREAS stratus breakup. August 8, 1994. (with Kara Sulia…)

Clouds, light fluctuations & C uptake: the great diffuse light enhancement story.

BOREAS efforts 1995

OJP as part of multiple site ensembles 2016: (with Sergey Kivalov)

Carbon enhancements *but also with some hope to identify the mechanism*

Ag & Forest Met. Conference Abstract 1995:
Reviewers' abstract

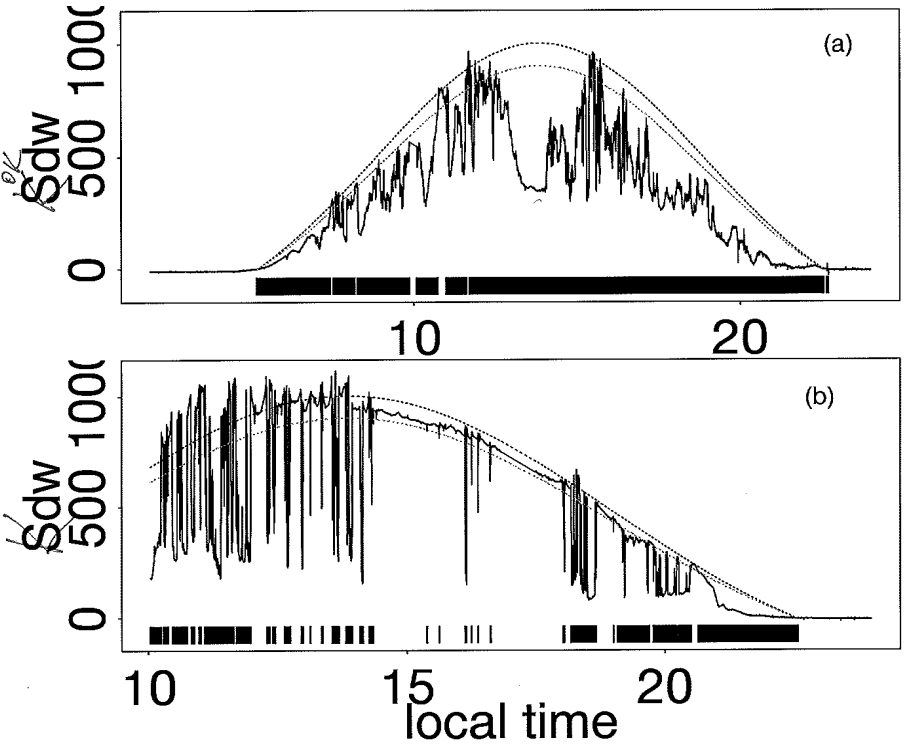
How does forest carbon uptake depend on
fluctuating light level?
David R. Fitzjarrald, Ricardo K. Sakai,
Kathleen E. Moore, and Jeffrey M. Freedman

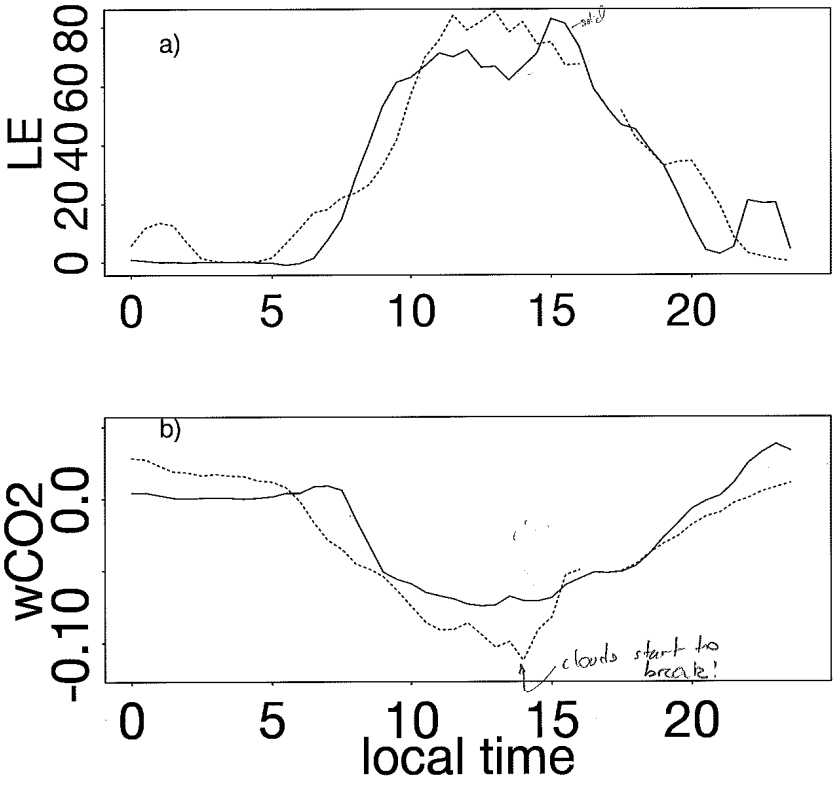
Atmospheric Sciences Research Center,
University at Albany, SUNY, Albany, NY

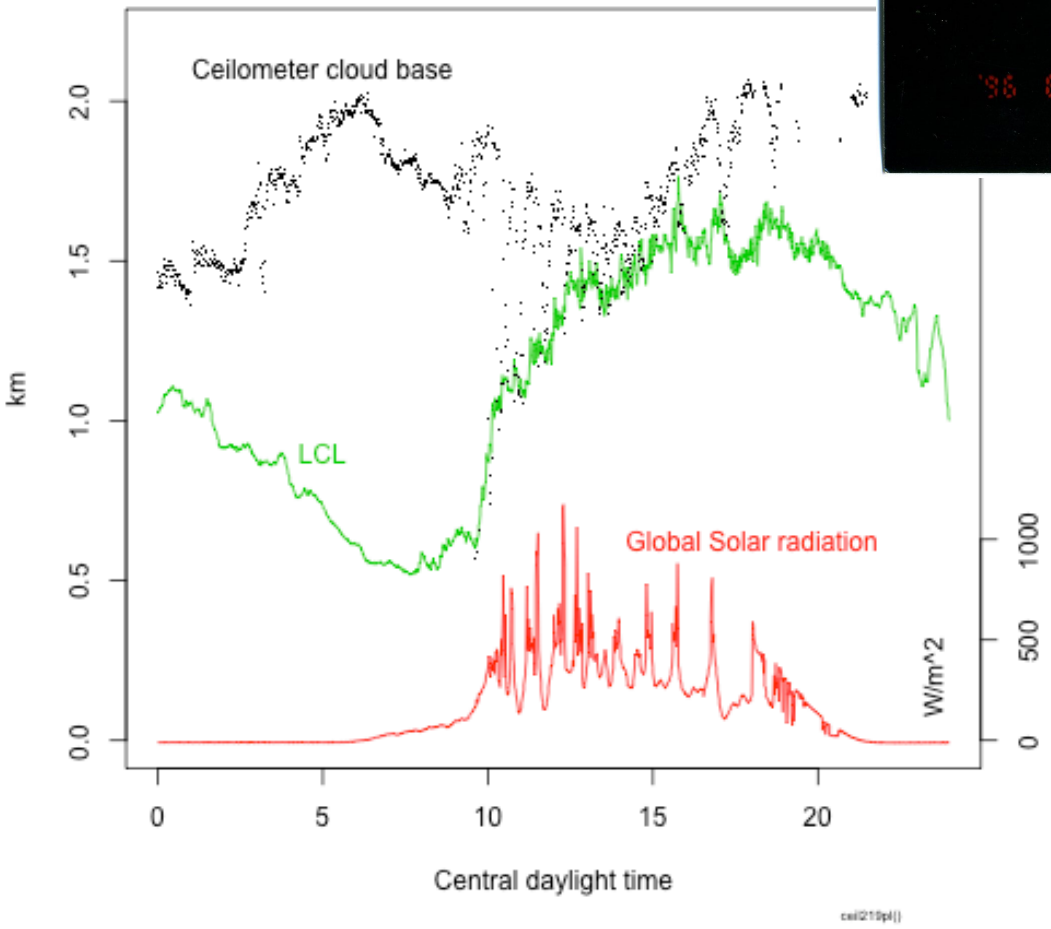
HOW DO FOREST SURFACE FLUXES DEPEND ON FLUCTUATING LIGHT LEVEL?

Ricardo K. Sakai, David R. Fitzjarrald, Kathleen E. Moore, and Jeffrey M. Freedman

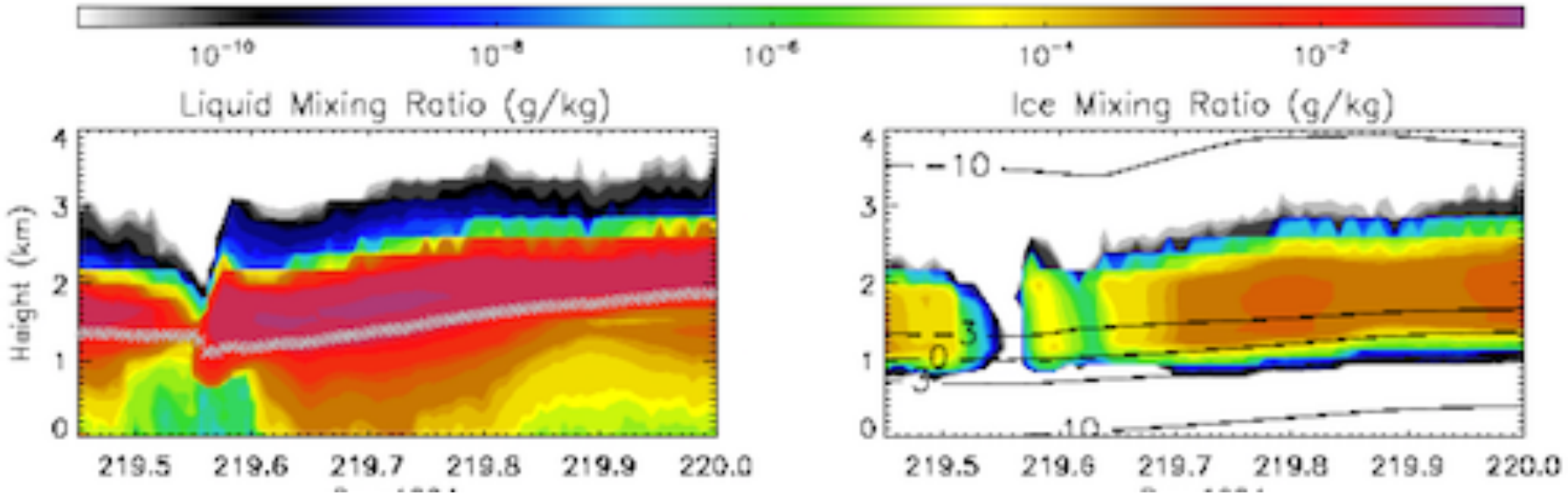
Clouds and forest C uptake—first findings…

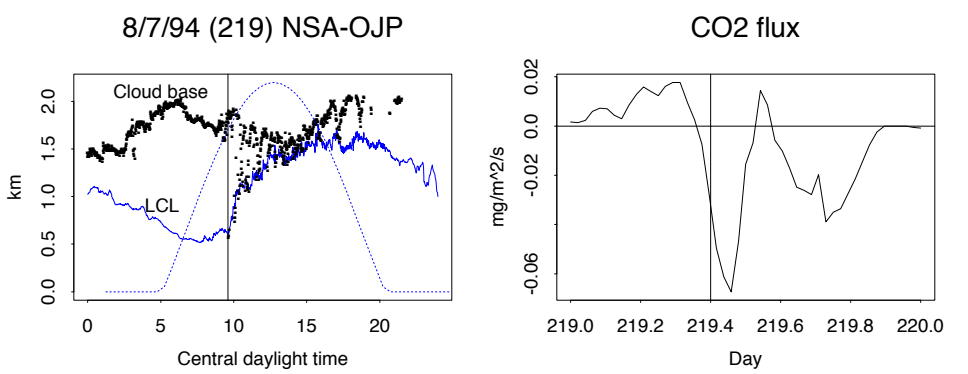




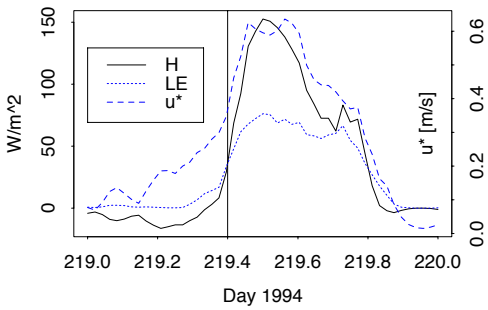

Ceilometer cloud base
LCL
Global Solar radiation
km
W/m^2
0.0
0.5
1.0
1.5
2.0
0
500
1000
0
5
10
15
20
Central daylight time

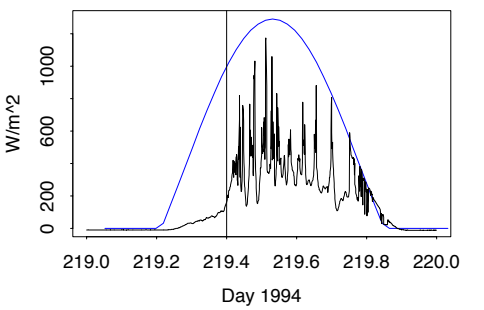
Kara Sulia (ASRC/SUNY) WRF simulation.





NSA-OJP





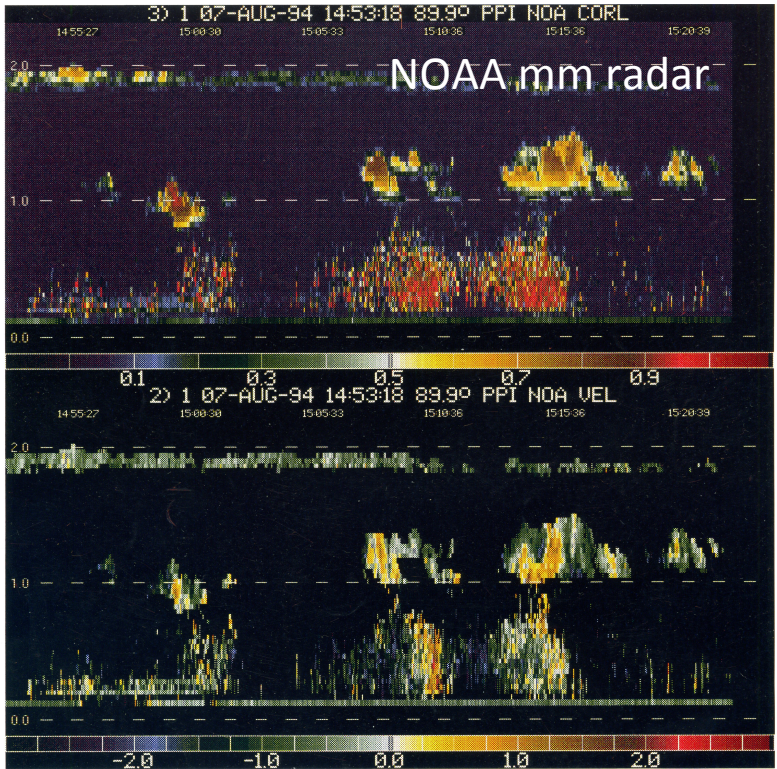
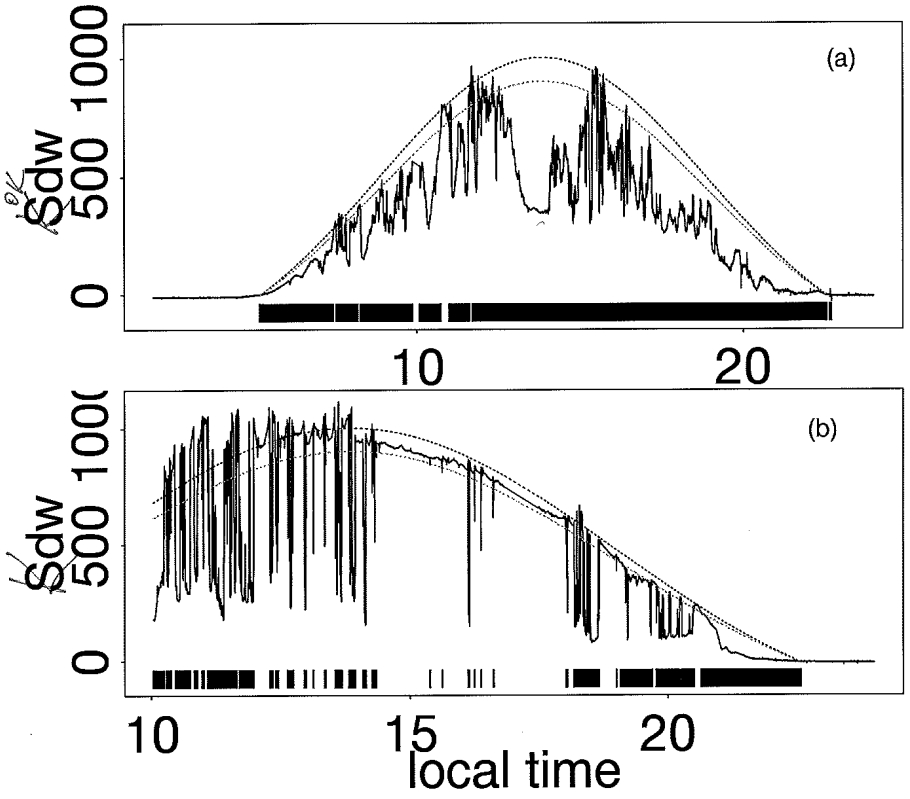


fig.2

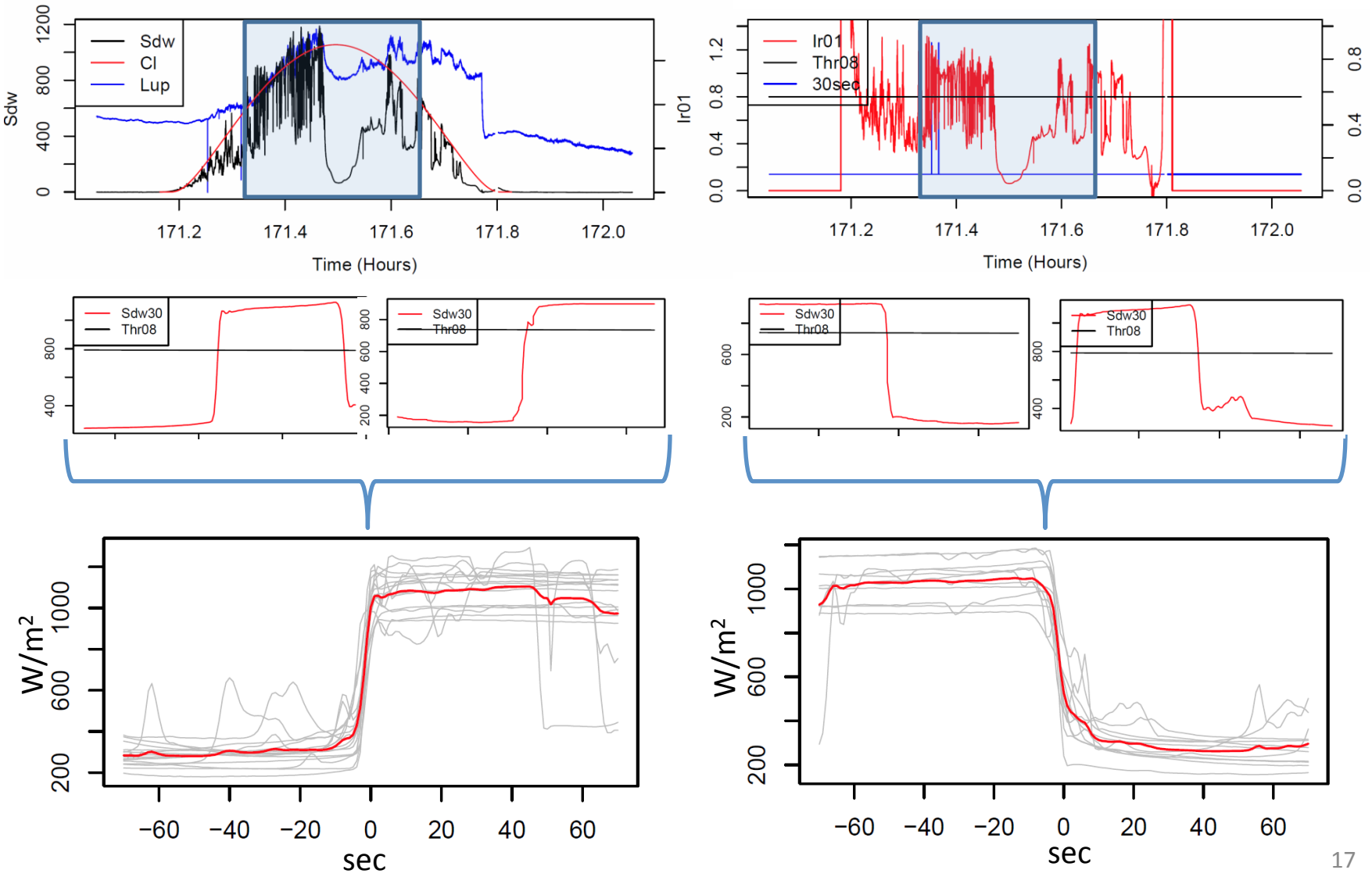
Sakai et al. 1995

OK!



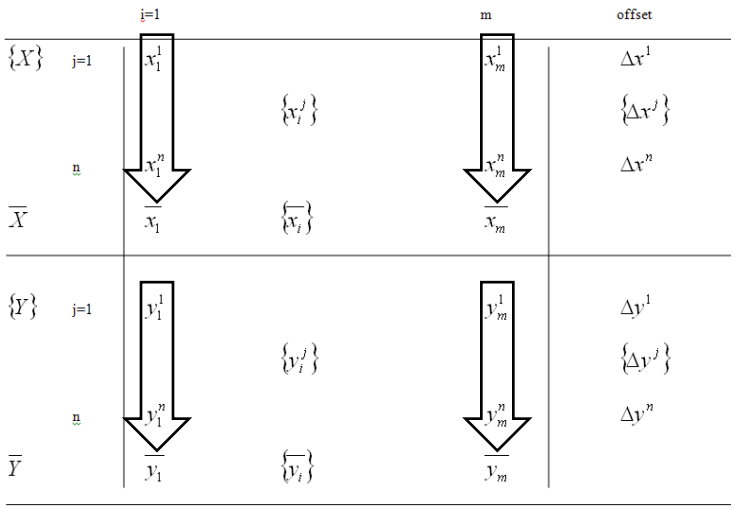
Reynolds ensemble for Irradiances
methodology example

•Light and dark 80+sec samples from June 2006

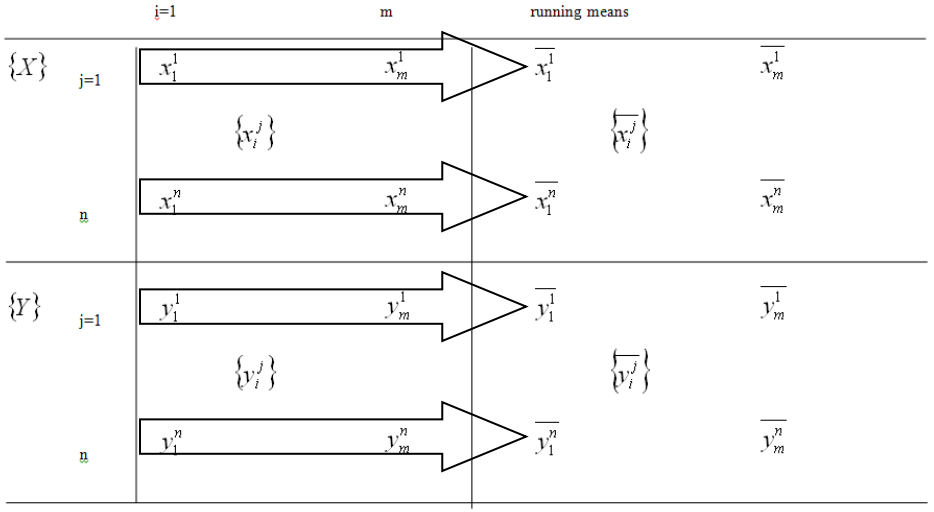


Reynolds ensemble flux

"True" Reynolds ensemble flux with instrumental offsets



Short time flux with mean removal



Two sets of sequences length $i = 1,m$:

$$X^j = \{x_i^j\} = \{\overline{x_i} + \Delta x^j + x'^j_i\}$$
$$Y^j = \{y_i^j\} = \{\overline{y_i} + \Delta y^j + y'^j_i\}$$

"True" ensemble flux is calculated by the formula:

$$Flux\_X \uparrow = \overline{X \cdot Y} - \overline{X} \cdot \overline{Y} + \overline{\Delta x \cdot \Delta y} - \overline{X \cdot \Delta y} - \overline{\Delta x \cdot Y}$$

Two sets of sequences length $1,m$:

$$X^j = \{x_i^j\} = \{\overline{x_i} + x'^j_i\}$$
$$Y^j = \{y_i^j\} = \{\overline{y_i} + y'^j_i\}$$

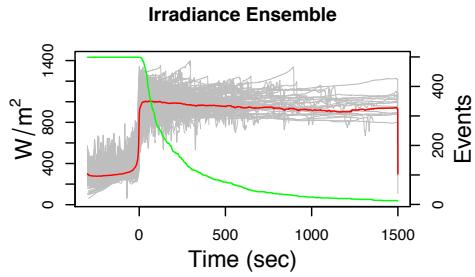
From the Eddy covariance method summation by i:

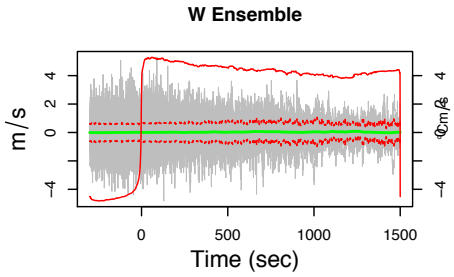
$$Flux_j = \left(x'^j_i \cdot y'^j_i\right)^j$$

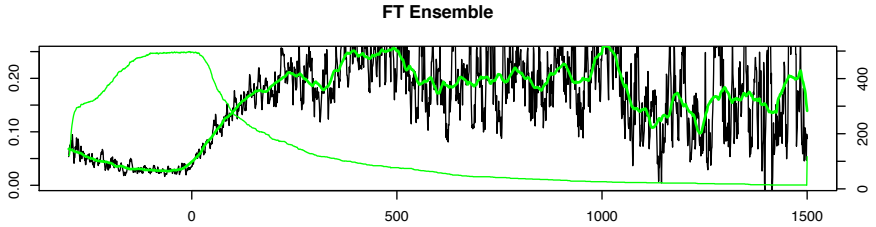
And from Ensemble averaging for fluxes:

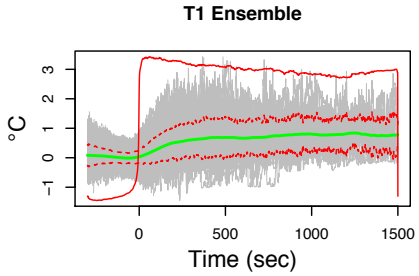
$$Flux = \overline{Flux_j}$$

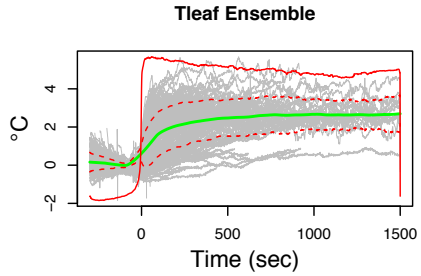
We will do both approaches, but here we present the examples for the first approach new to the observational literature on this topic

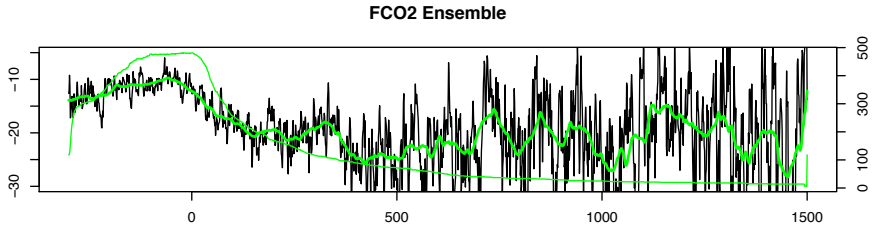

Irradiance Ensemble
W/m2
Events
Time (sec)

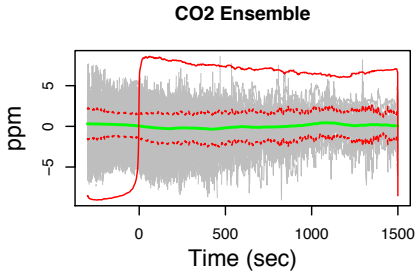

W Ensemble
m/s
Time (sec)

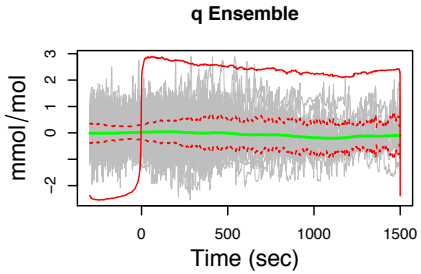

FT Ensemble

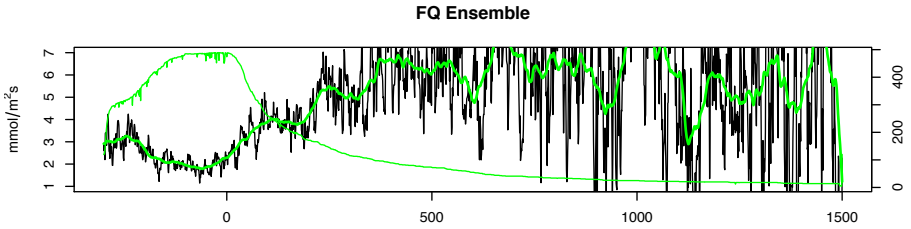

T1 Ensemble
°C
Time (sec)


Tleaf Ensemble
°C
Time (sec)


FCO2 Ensemble
µmol/m2s


CO2 Ensemble
ppm
Time (sec)


q Ensemble
mmol/mol
Time (sec)


FQ Ensemble
mmol/m2s


HONDA


BOW-MAC

SMELTER APPRECIATION NIGHT

JUNE 03, 94 ST. JOSEPH'S HALL

COCKTAIL 6:00 - 7:00

PRESENTATION 7:00

DANCE TO A LIVE BAND FOLLOWING PRESENTATION

COLD PLATE TO BE SERVED

DOOR PRIZES

TICKETS $10.00 EACH (CALL SMELTER TRAINING)

“…you don’t reach Serendib by plotting a course for it. You have to set out in good faith for elsewhere and lose your bearings … serendipitously.” ---The
— John Barth *Last Voyage of Somebody the Sailor*

“…remember that there's always another way of seeing things: that's the beginning of wisdom.”
— John Barth, *Giles Goat-Boy*