Observed and modeled carbon and energy fluxes for agricultural sites

under

North American Carbon Program (NACP)

site-level interim synthesis

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A brief introduction..

- Croplands are quite different compared to the natural ecosystems
- USA is a main producer of maize (40%), soybean (>50%), and wheat (13%) crops in the world
- Predictability of carbon and energy fluxes from agricultural ecosystems is important
- Model-data comparison for ag sites under NACP site interim synthesis considers 5 sites and 20 models

Objectives

- evaluate the model performance against the observed carbon and energy fluxes
- Find which crops, sites, and variable/s were better simulated
- Compare model performance based on basic model formulation

Models

Hourly/sub hourly	Daily	Monthly	Weekly
AGROIBIS	*BEPS*	*ECLUE EDCM*	*ISAM*
CAN-IBIS	*BIOME-BGC*		
CNCLASS	*DLEM*		
ECOSYS	*DNDC*		
ED2	*EPIC*		
LOTEC	*TRIPLEX*		
ORCHIDEE-STICS			
SIB3			
SIBCASA			
SIBCROP			
SSIB2			
TECO			

Input data

weather data (gap-filled) and site specific ancillary data

Sites

ARM-SGP site, OK

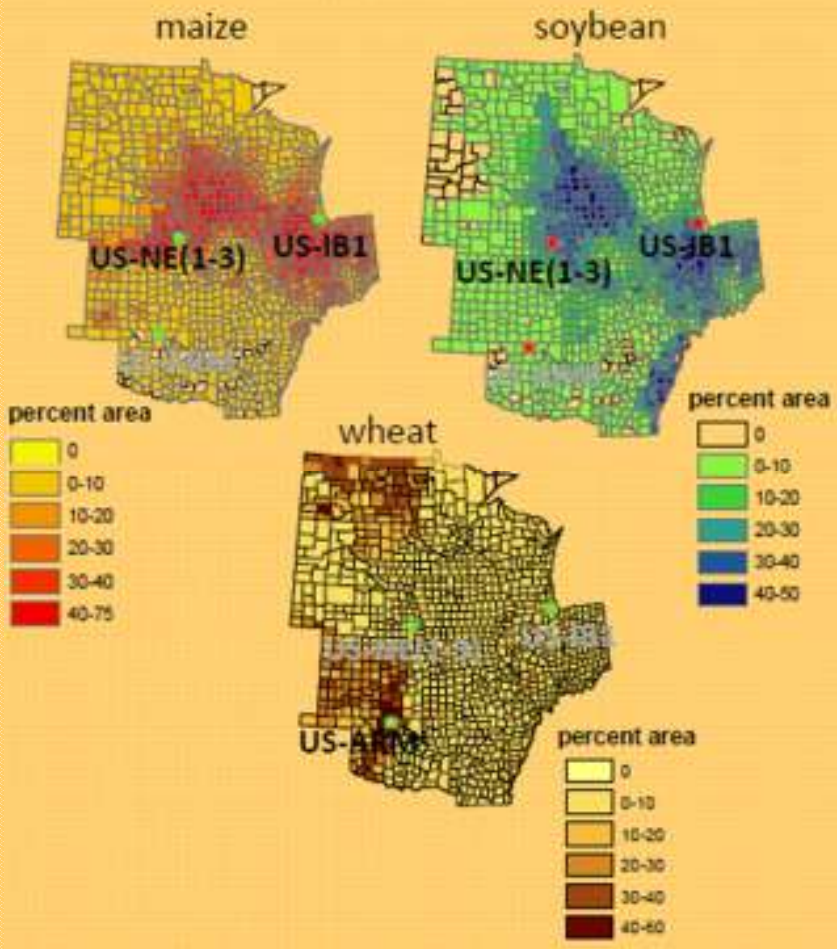
- US-ARM (wheat)

Fermi agricultural site, IL

- US-IB1 (maize and soybean)

Mead, NE sites

- US-NE1 (irrigated maize)
- US-NE2 (irrigated maize and soybean)
- US-NE3 (rainfed maize and soybean)



Analyses

- Variables analyzed
  - net ecosystem exchange (NEE; i.e. (respiration-photosynthesis)
  - latent heat flux (LE)
  - sensible heat flux (H)

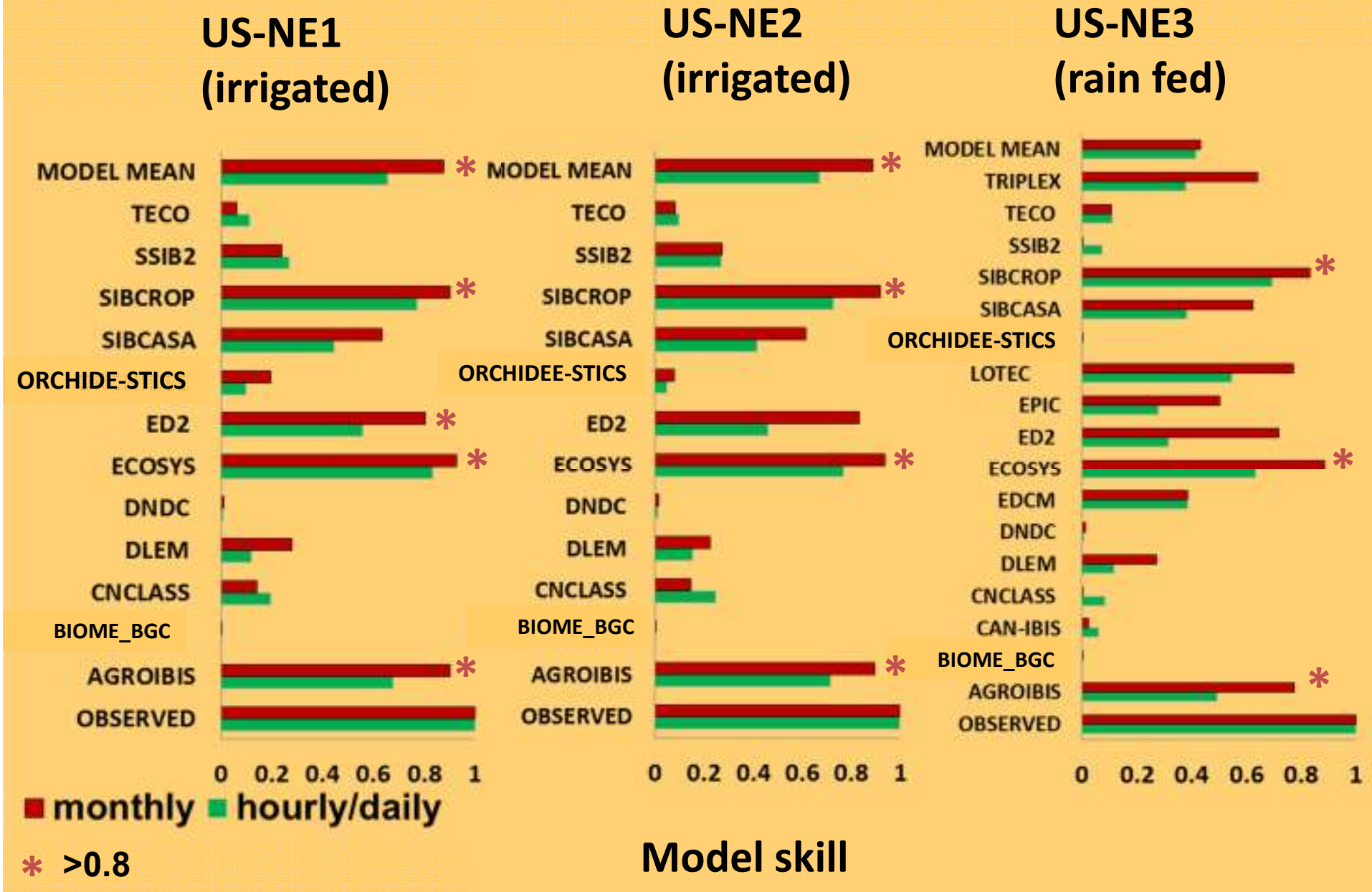
- Overall model-data comparison by site and by crop

- Diurnal cycles, annual cycles, and interannual variability

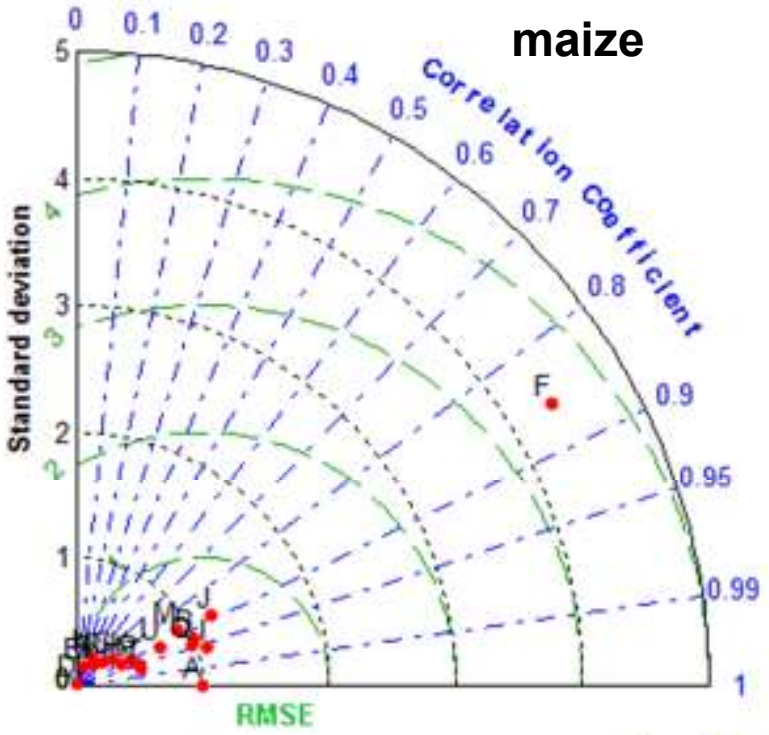
- Model performance based on basic model formulation

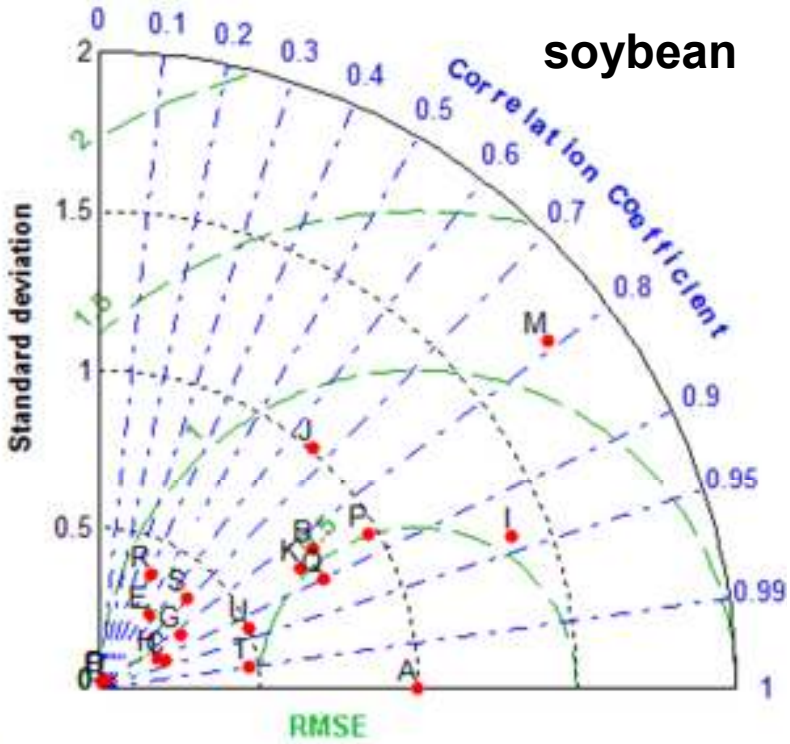
Some Results..

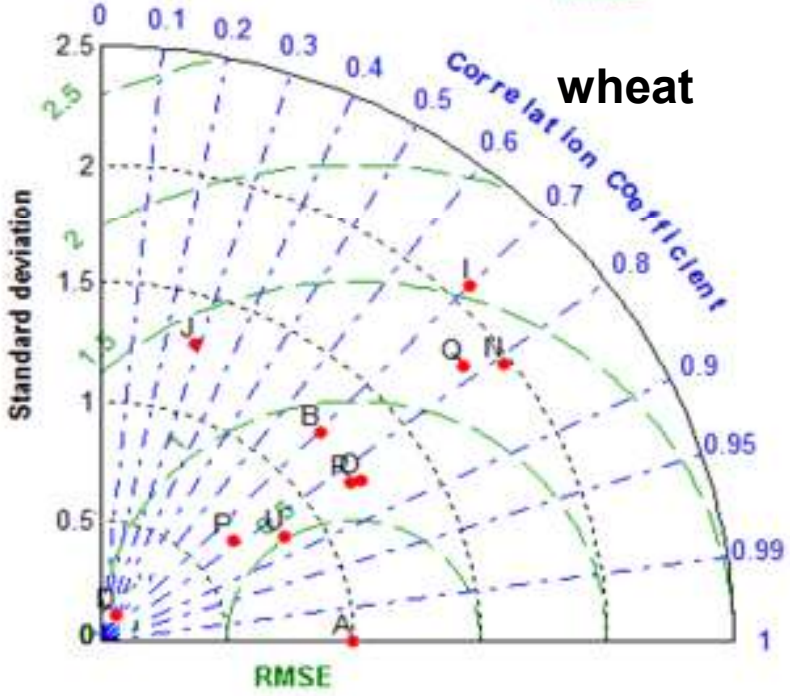
Maize NEE- performance at Mead, NE sites



Performance by crop: Taylor diagrams for NEE monthly means







A-Observed
B- AGROIBIS
C- BEPS
D- BIOME_BGC
E- CAN-IBIS
F- CNCLASS
G- DLEM
H- ECLUE EDCM
I- ECOSYS
J- ED2
K- EPIC
L- ISAM
M- LOTEC
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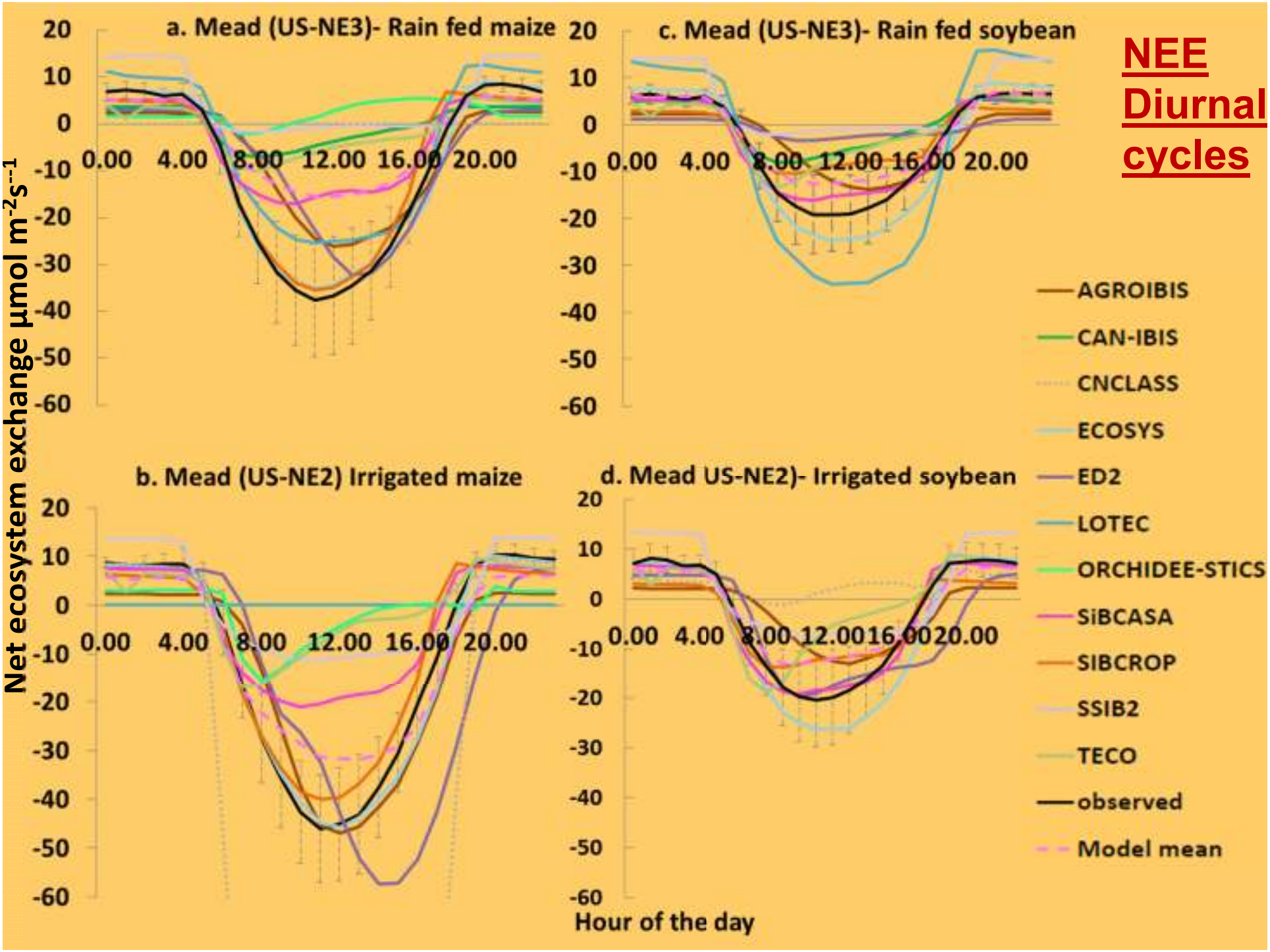
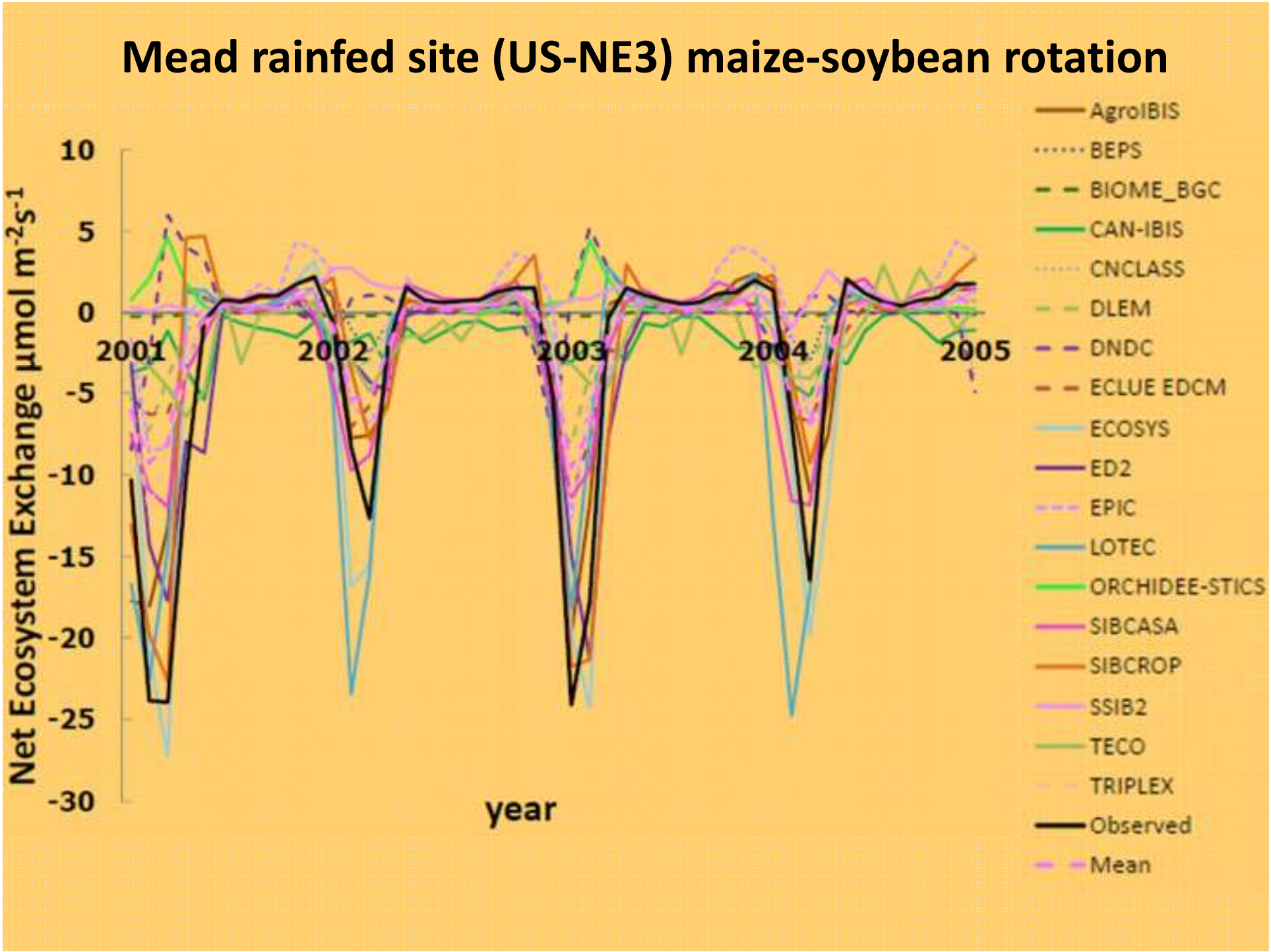
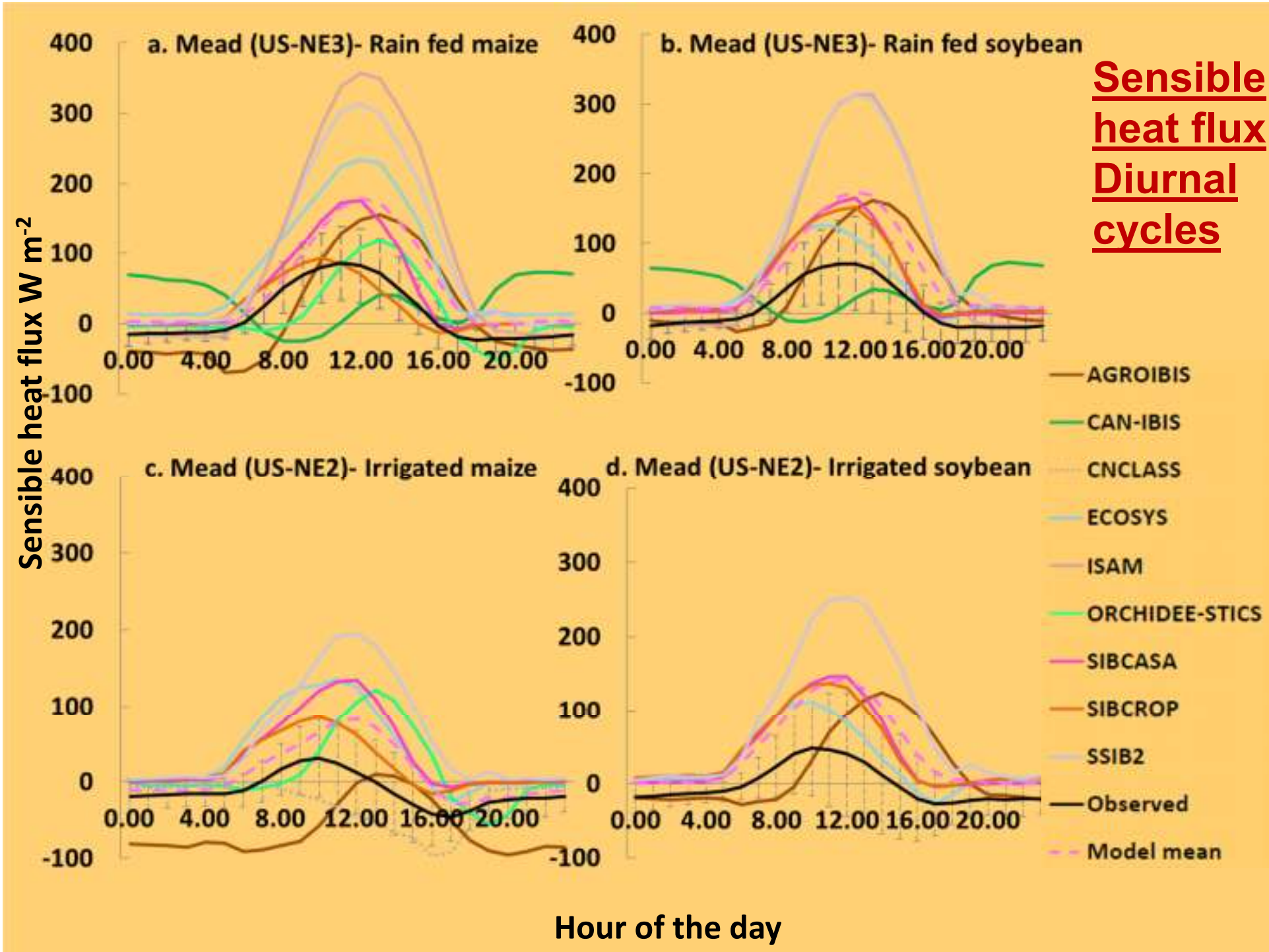
O- SIB
P- SIBCASA
Q- SIBCROP
R- SSIB2
S- TECO
T- TRIPLEX
U- Model mean


NEE Diurnal cycles
a. Mead (US-NE3)- Rain fed maize
c. Mead (US-NE3)- Rain fed soybean
b. Mead (US-NE2) Irrigated maize
d. Mead US-NE2)- Irrigated soybean
Net ecosystem exchange µmol m-2s--1
Hour of the day
20
10
0
-10
-20
-30
-40
-50
-60
0.00
4.00
8.00
12.00
16.00
20.00
AGROIBIS
CAN-IBIS
CNCLASS
ECOSYS
ED2
LOTEC
ORCHIDEE-STICS
SiBCASA
SIBCROP
SSIB2
TECO
observed
Model mean

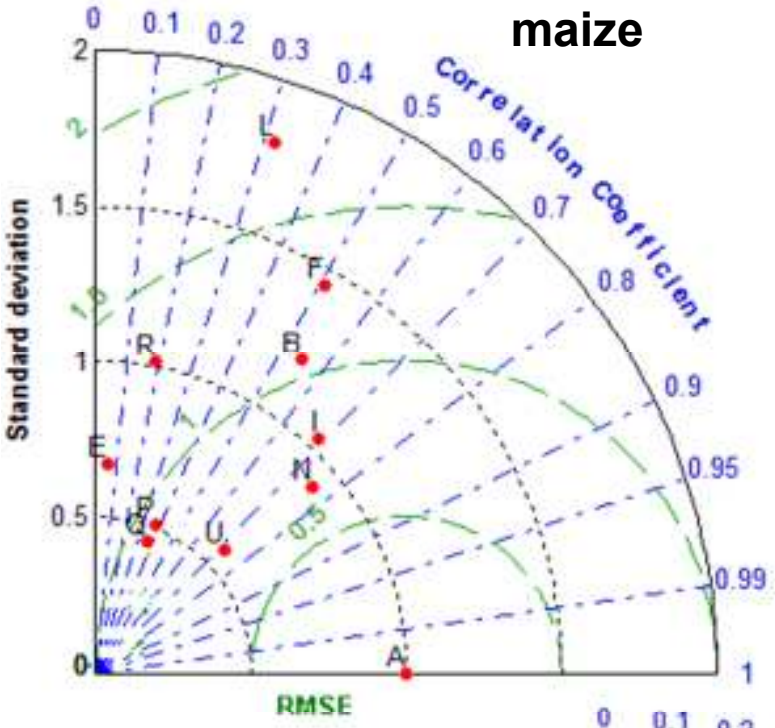
Mead rainfed site (US-NE3) maize-soybean rotation



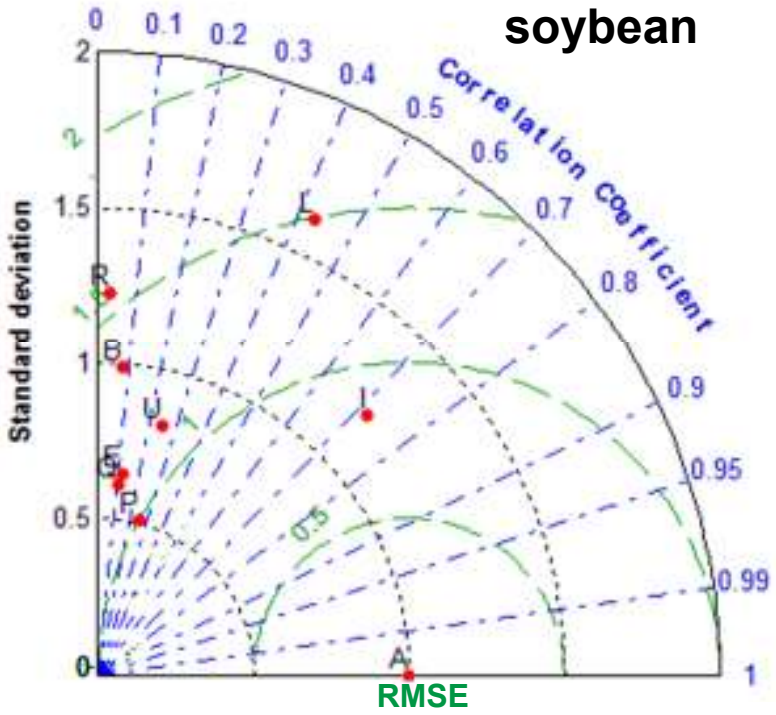
Sensible heat flux Diurnal cycles



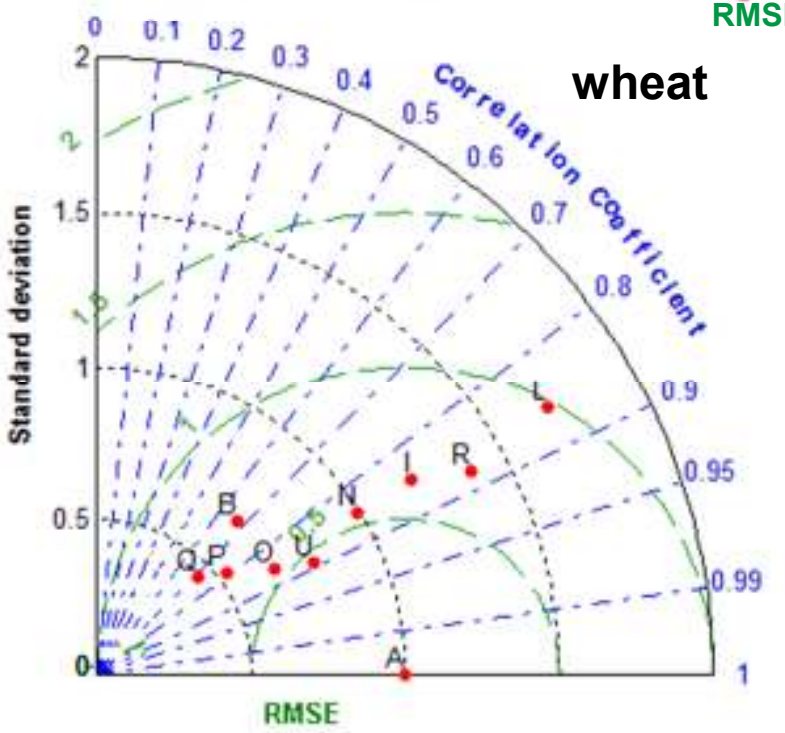
maize



soybean



wheat



Taylor diagrams for sensible heat flux monthly means

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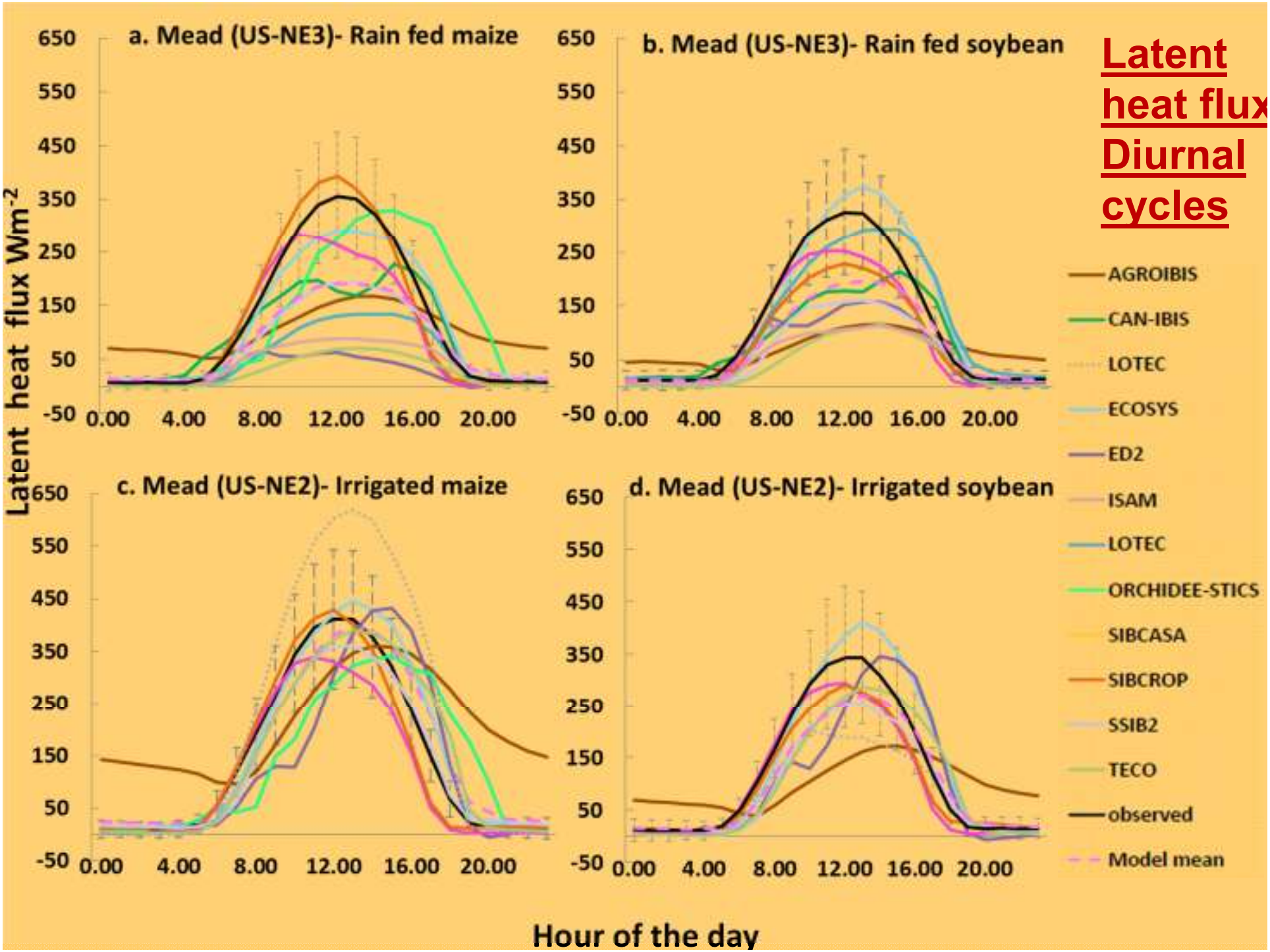
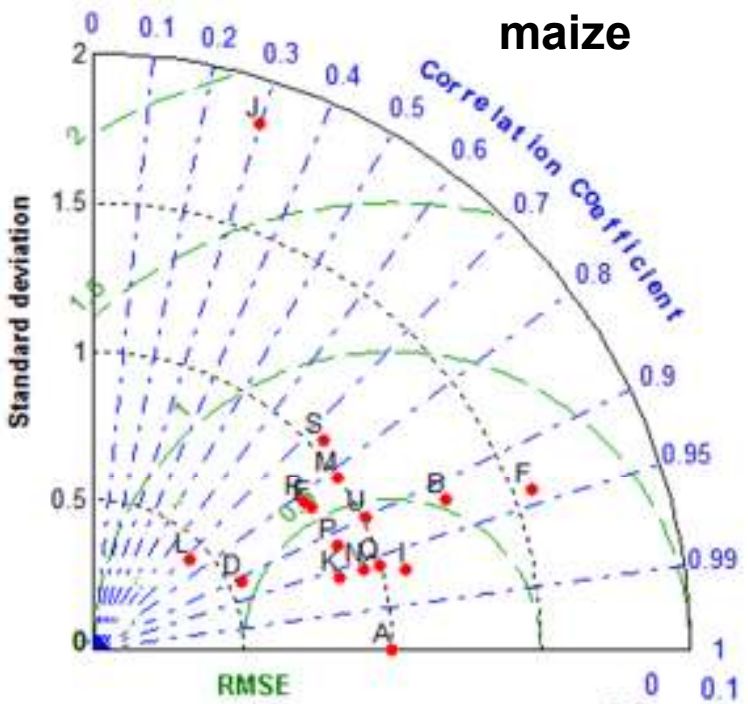
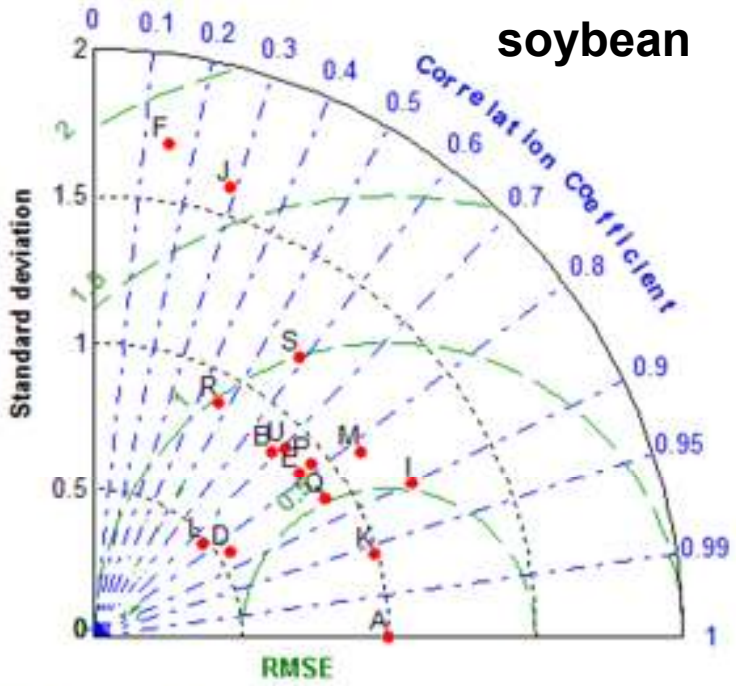
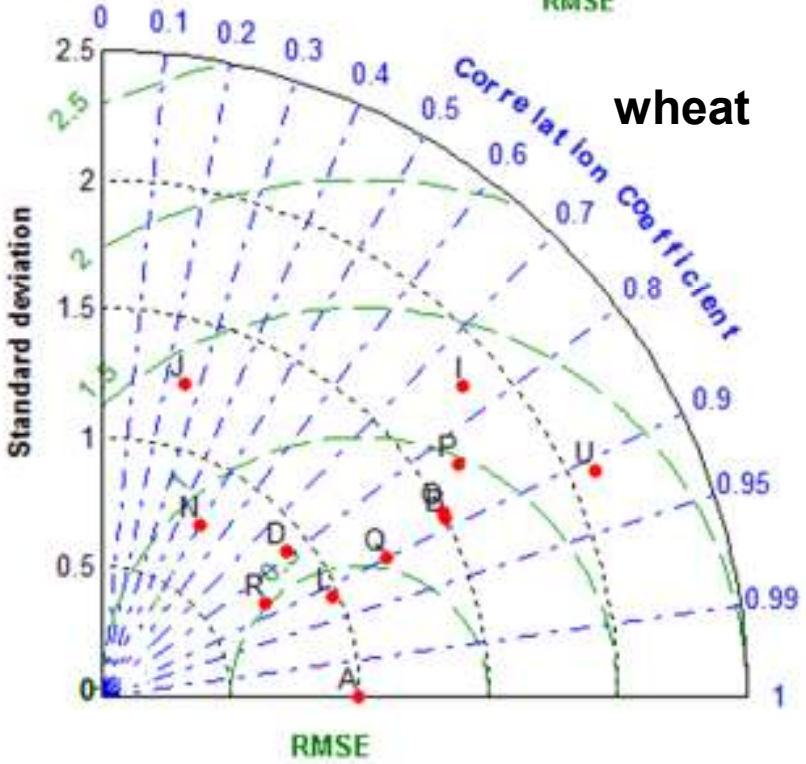
Latent heat flux Diurnal cycles









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Summary and conclusion

- Latent heat flux was the best simulated variable; models do well in simulating stomatal conductance and transpiration fluxes
- Models with crop specific parameterization performed better in NEE simulation (including the interannual variability)
- The models in general have much higher sensible heat fluxes and Bowen ratios (H/LE) than the observations, which needs attention
- There was no significant difference in model performance for NEE based on the method of GPP or phenology