

Apr 24, 2025

kw35262

“Big Leaf” v.s. “Big Tree”:

Noah-MP land surface model with plant hydraulics scheme (Noah-MP-PHS) Evaluation

Koutian Wu¹, Lingcheng Li², Daniella Rempe¹, Ashley Matheny¹, Zong-Liang Yang¹

(1) Jackson School of Geosciences, UT Austin, Austin, TX, USA

(2) Atmospheric Sciences and Global Change Division, PNNL, Richland, WA, USA

Fig. Difference between the “Big leaf” and “Big tree” approach (extracted from Li et al., 2021).

What are “Big Leaf” and “Big Tree”?

“Big Leaf”

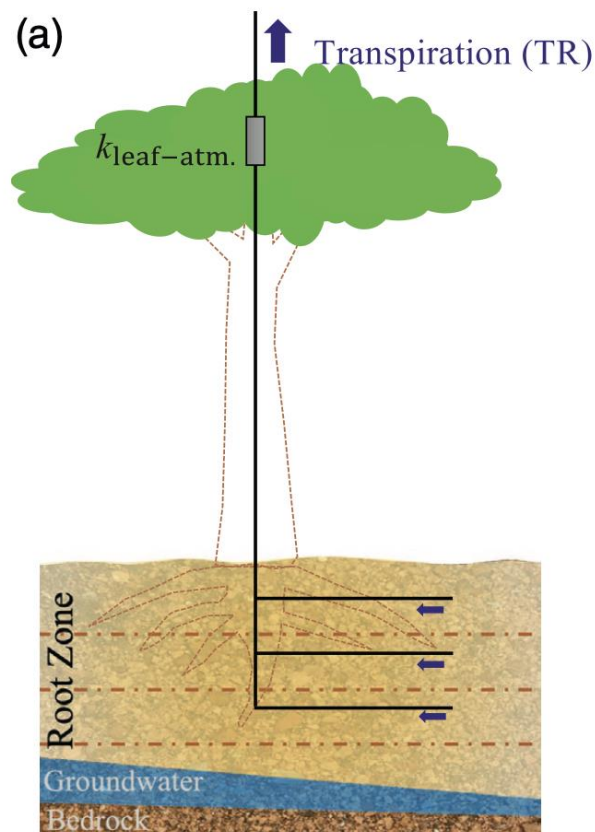
Soil moisture



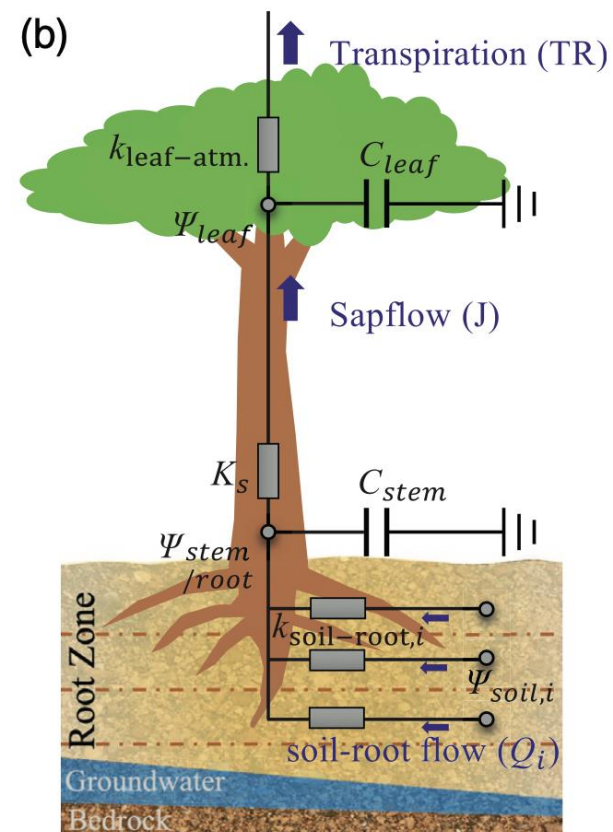
Carbon and water simulations



Uncertainties



SHS “Big Leaf”



PHS “Big Tree”

“Big Tree”

Soil moisture
<add> whole-plant hydraulics



Carbon and water simulations



Uncertainties
expect to reduce

Difference between the “Big leaf” and “Big tree” approach (extracted from Li et al., 2021).

What are “Big Leaf” and “Big Tree”?

“Big Leaf”

Soil moisture

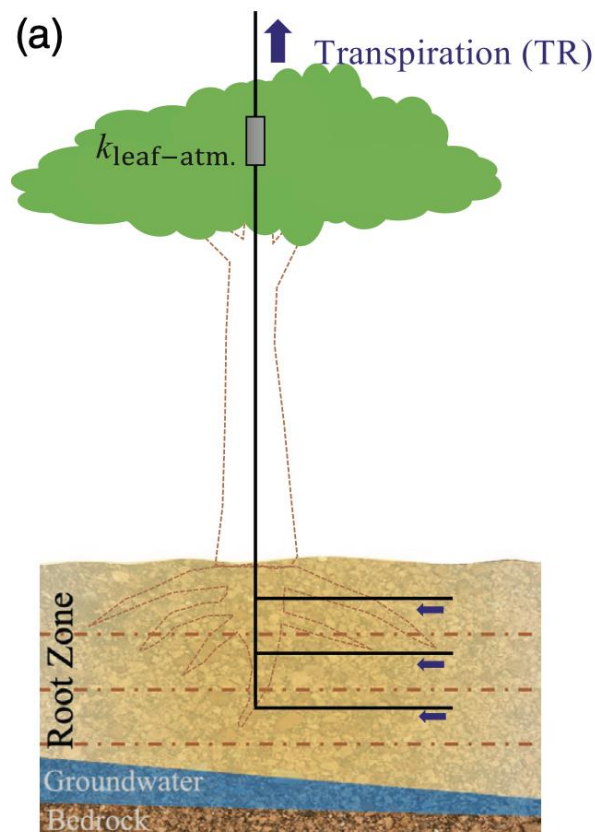


Carbon and water simulations

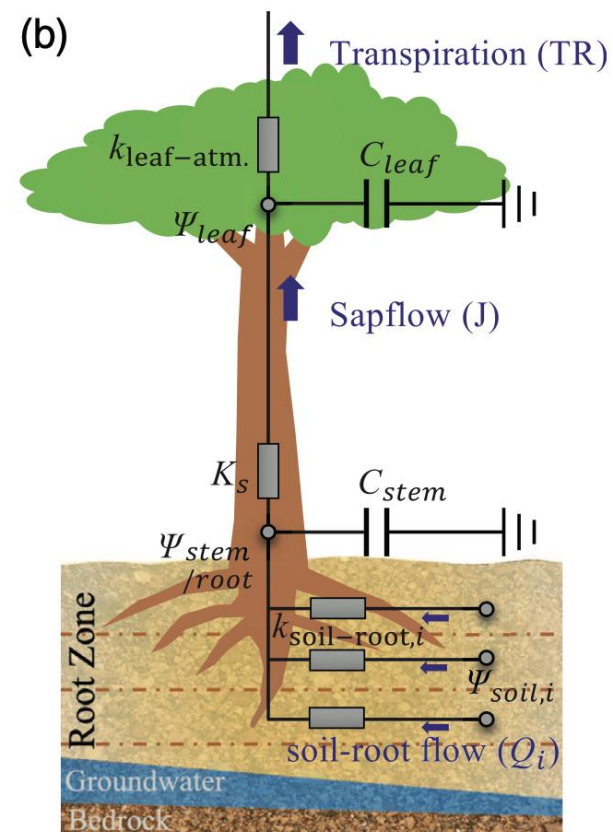


Uncertainties

Most land surface models, e.g.,
Noah-MP



SHS “Big Leaf”



PHS “Big Tree”

Difference between the “Big leaf” and “Big tree” approach (extracted from Li et al., 2021).

“Big Tree”

Soil moisture
<add> whole-plant hydraulics



Carbon and water simulations



Uncertainties
expect to reduce

Noah-MP-PHS

From Problem to Collaborators



Lingcheng Li

**Plant hydraulic
modeling**

PNNL



Daniella Rempe

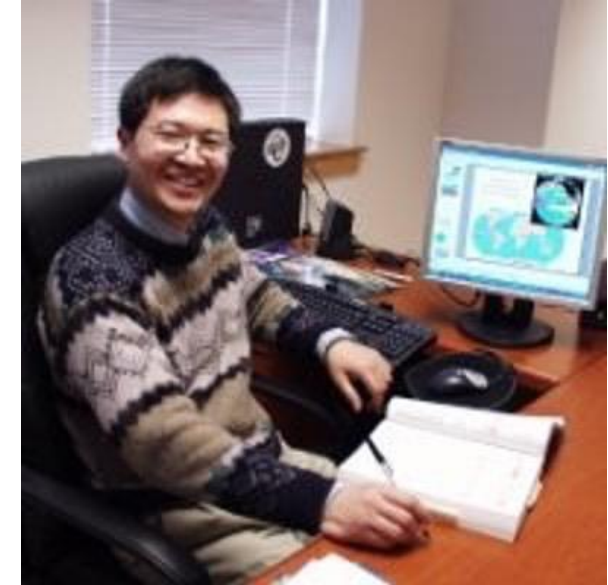
**Near-surface
hydrology**

UT-Austin



Ashley Matheny

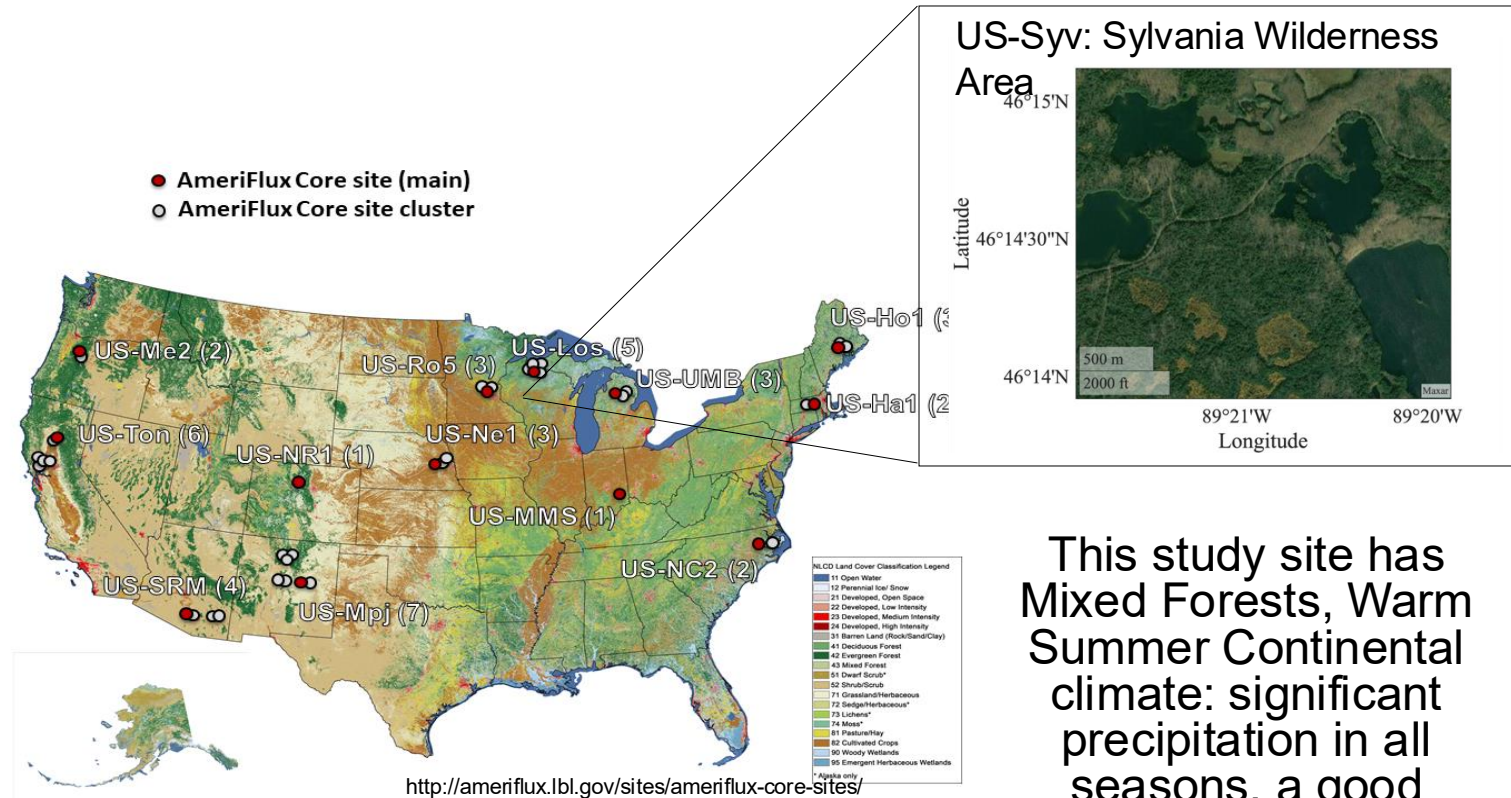
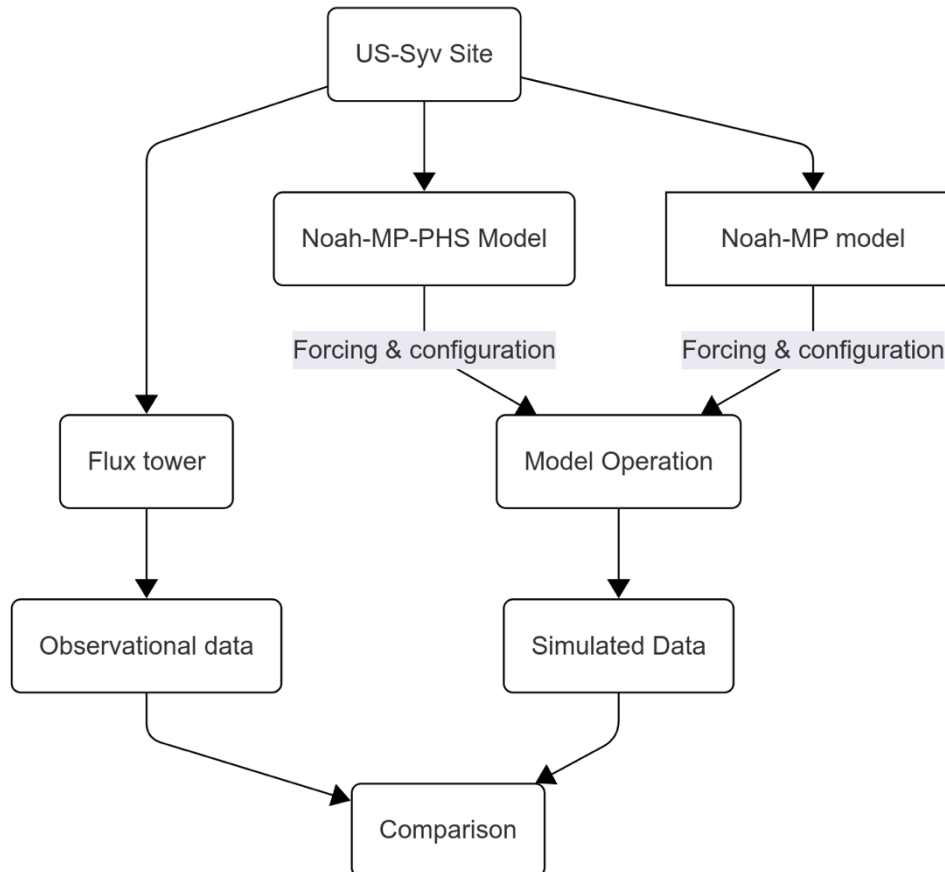
**Ecohydrologist
UT-Austin**



Zong-Liang Yang

**Land-surface
modeling
UT-Austin**

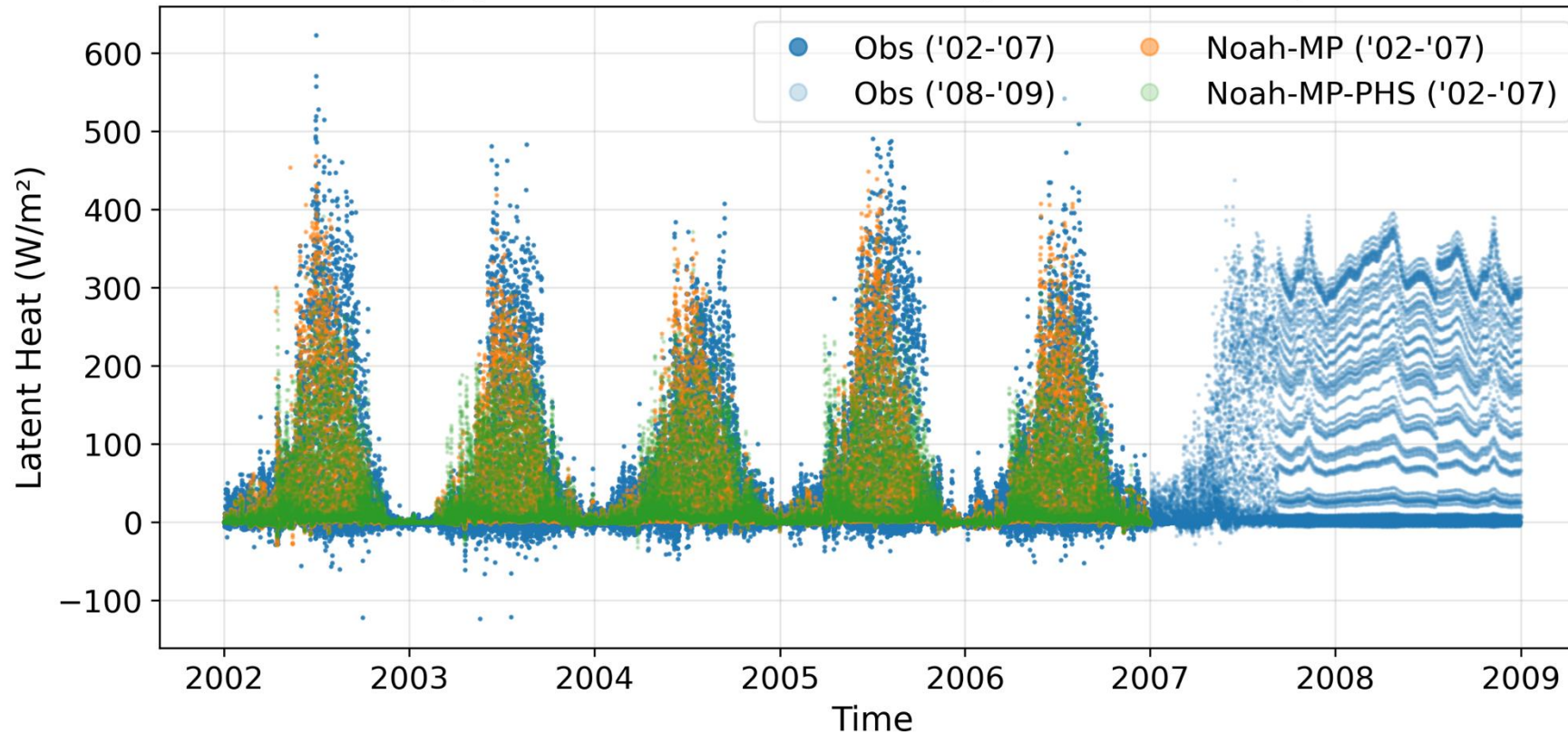
A specific problem: Noah-MP vs Noah-MP-PHS



This study site has Mixed Forests, Warm Summer Continental climate: significant precipitation in all seasons, a good testbed for model evaluation.

Results: Noah-MP vs Noah-MP-PHS

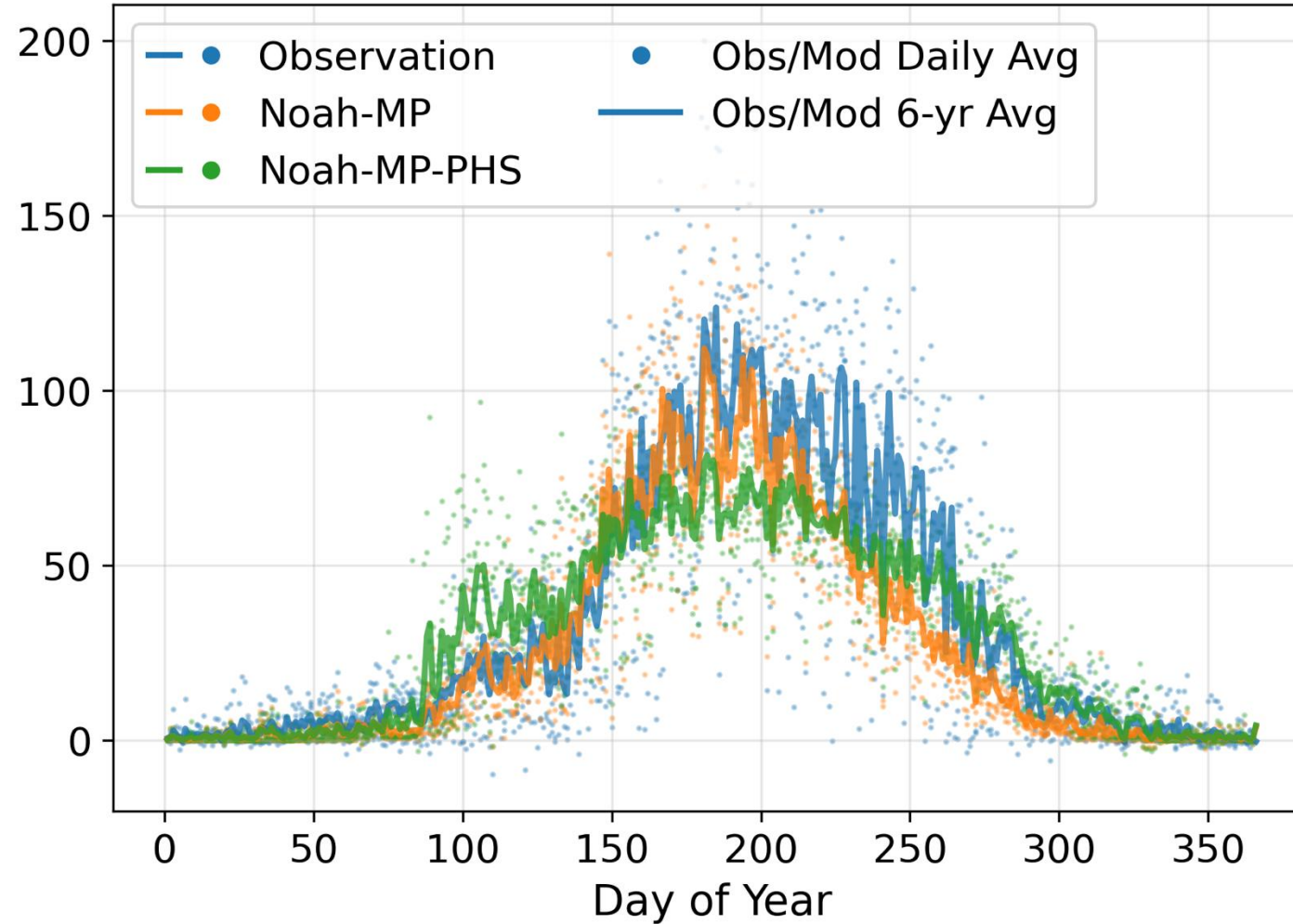
(a) Latent Heat Time Series (resolution: hour)



2008-09: Might
observational
instrument
failure
-->
Did not analyze

Results: Noah-MP vs Noah-MP-PHS

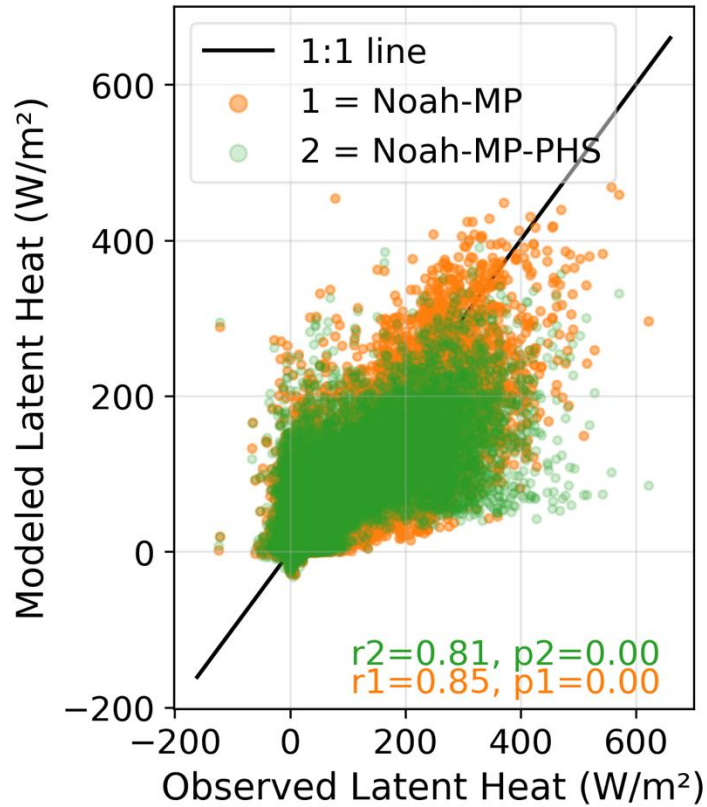
(b) Latent Heat Seasonal ('02-'07)



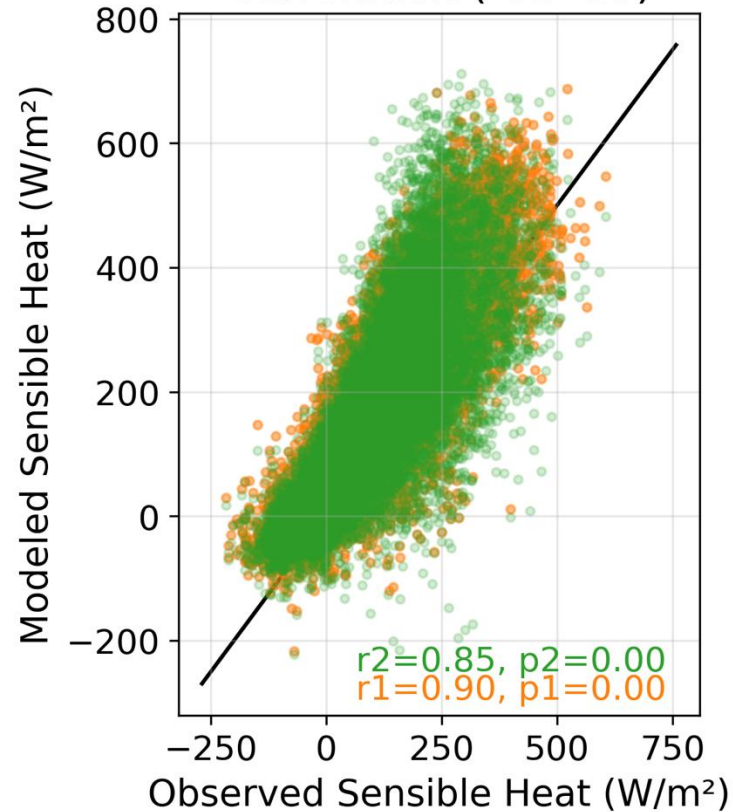
Differences:
Late spring
Summer (peak)
Fall

Results: Noah-MP vs Noah-MP-PHS

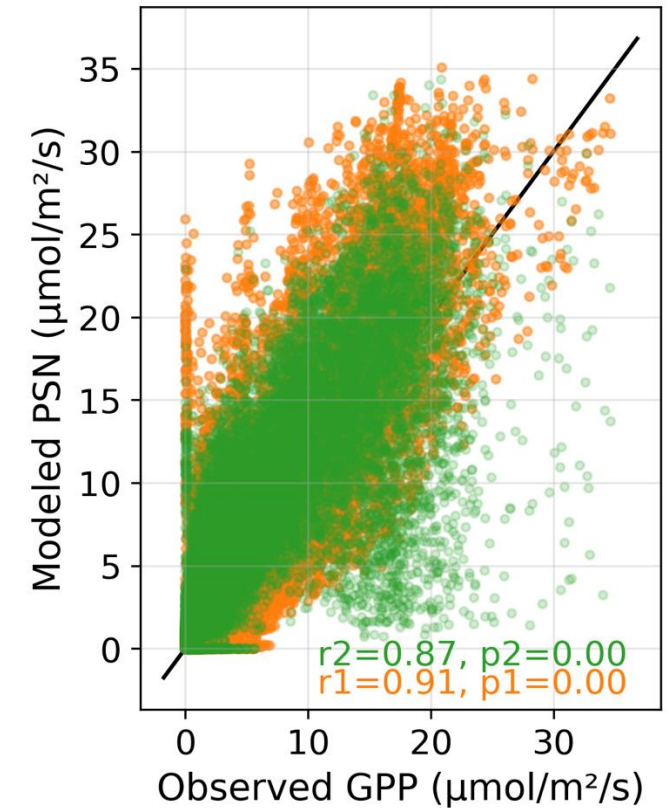
(c) Latent Heat Scatter Correlation ('02-'07)



(f) Sensible Heat Scatter Correlation ('02-'07)



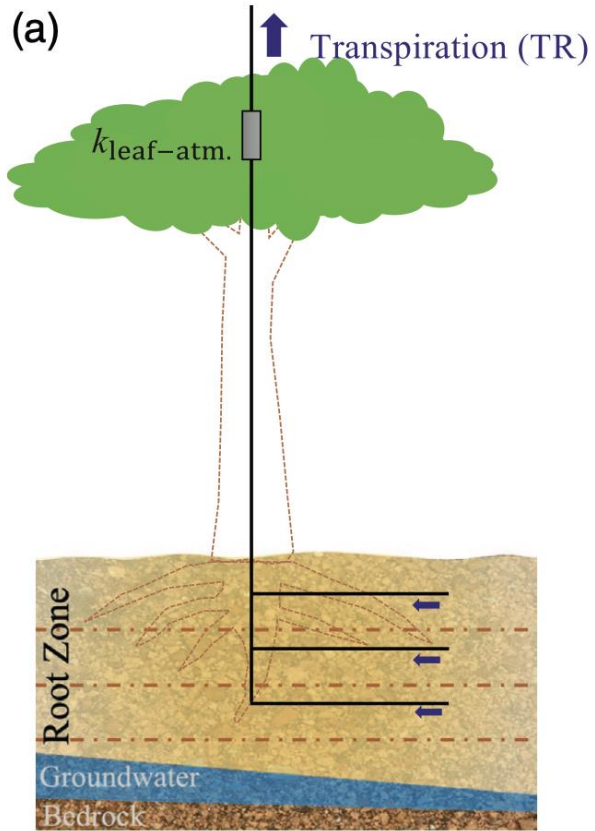
(i) GPP Scatter Correlation ('02-'07)



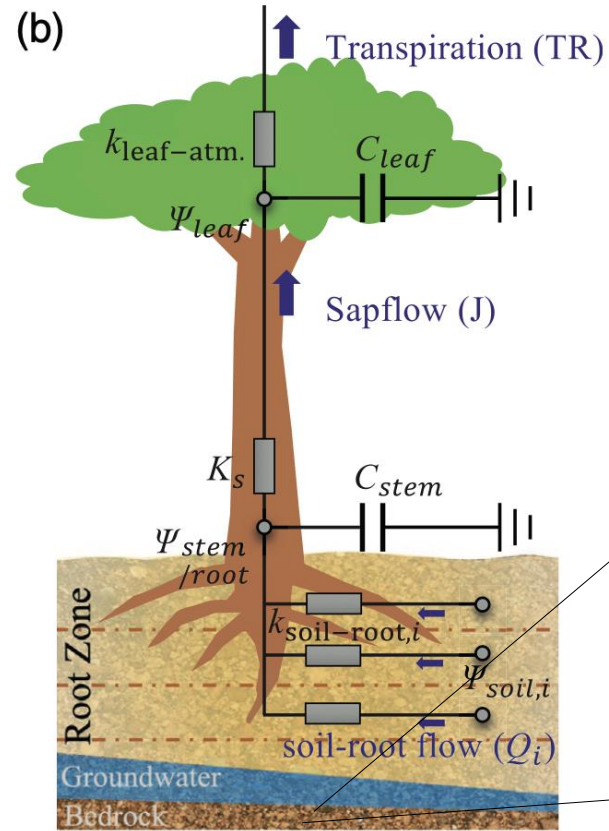
Results: Noah-MP vs Noah-MP-PHS

The **Noah-MP-PHS** land surface model robustly (not so robust as **Noah-MP**) simulates water–carbon coupling at the US-Syv (Sylvania Wilderness Area) site during 2002–2007. The simulation results exhibit strong agreement with observational data, showing correlation coefficients for latent heat flux, sensible heat flux, and carbon flux as measured by Gross Primary Production (GPP).

Future: Noah-MP-PHS+X



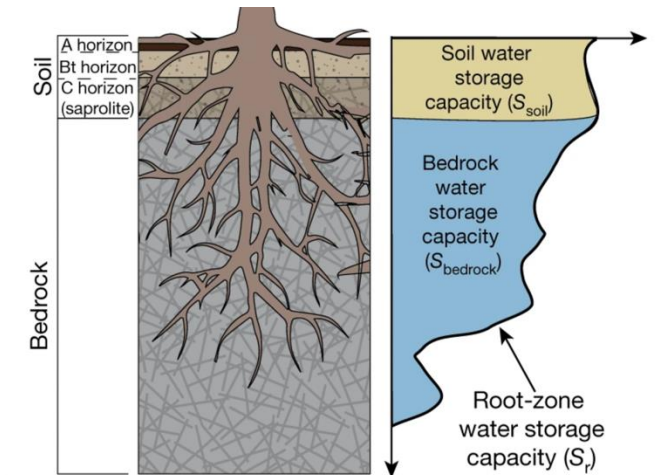
SHS "Big Leaf"



PHS "Big Tree"

X=
Bedrock...
...
Richards equation...
...

McCormick et al. (2021)



ACKNOWLEDGMENTS

KW is sponsored by Jackson School Graduate Teaching Assistant Research Funds. Simulation performed on TACC supercomputer system.

REFERENCES

1. Desai 2024, AmeriFlux BASE US-Syv [Dataset]
2. Li et al. 2021, JAMES, Plant hydraulics in Noah-MP

Thank you!

Any questions?

Koutian Wu, ktwu@utexas.edu

