Apr 24, 2025

kw35262

“Big Leaf” v.s. “Big Tree”:

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

Koutian Wu[1], Lingcheng Li[2], Daniella Rempe[1], Ashley Matheny[1], Zong-Liang Yang[1]
(1) Jackson School of Geosciences, UT Austin, Austin, TX, USA
(2) Atmospheric Sciences and Global Change Division, PNNL, Richland, WA, USA

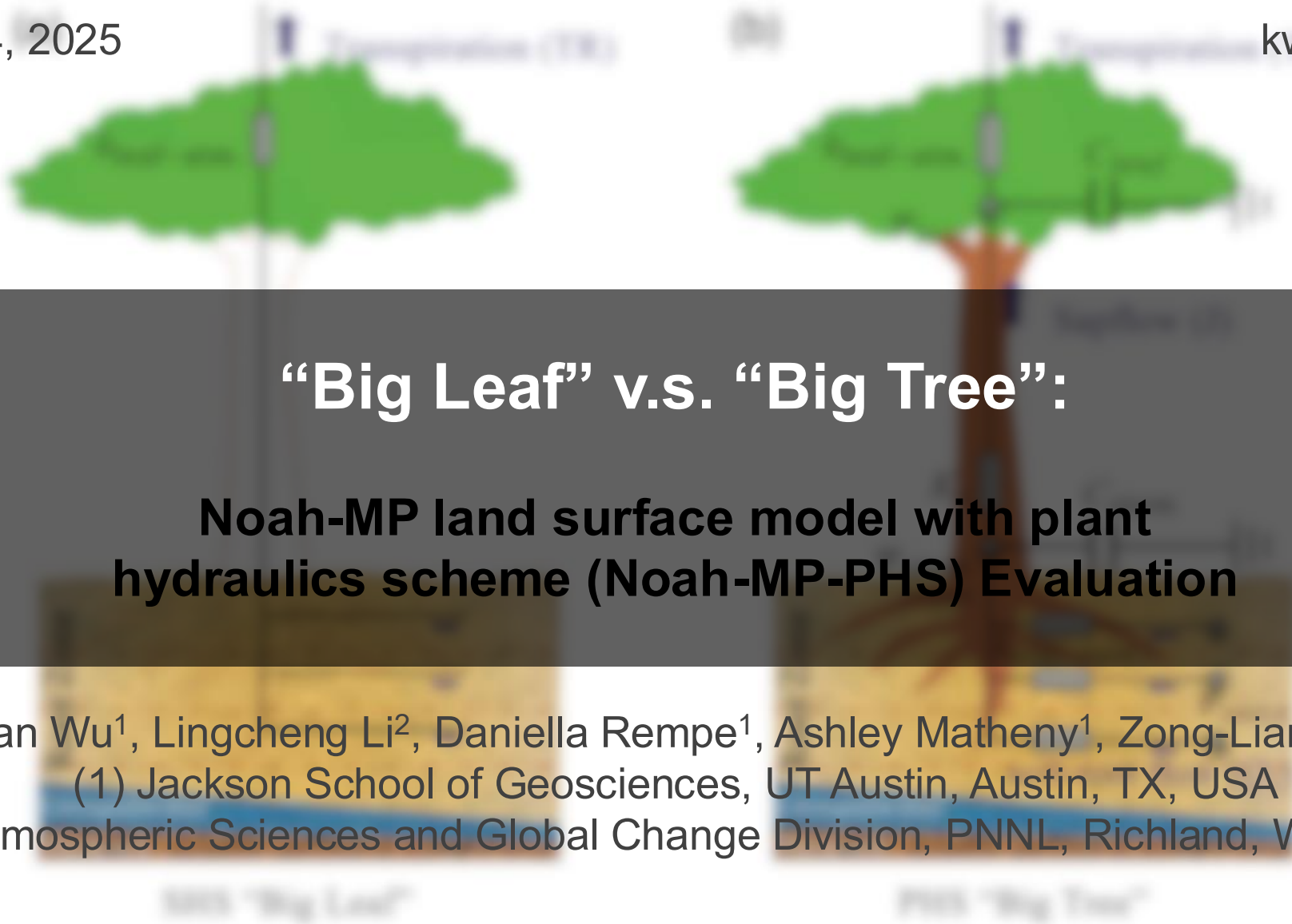


Fig. Difference between the “Big leaf” and “Big tree” approach (extracted from Li et al., 2021).

What are “Big Leaf” and “Big Tree”?

“Big Leaf”

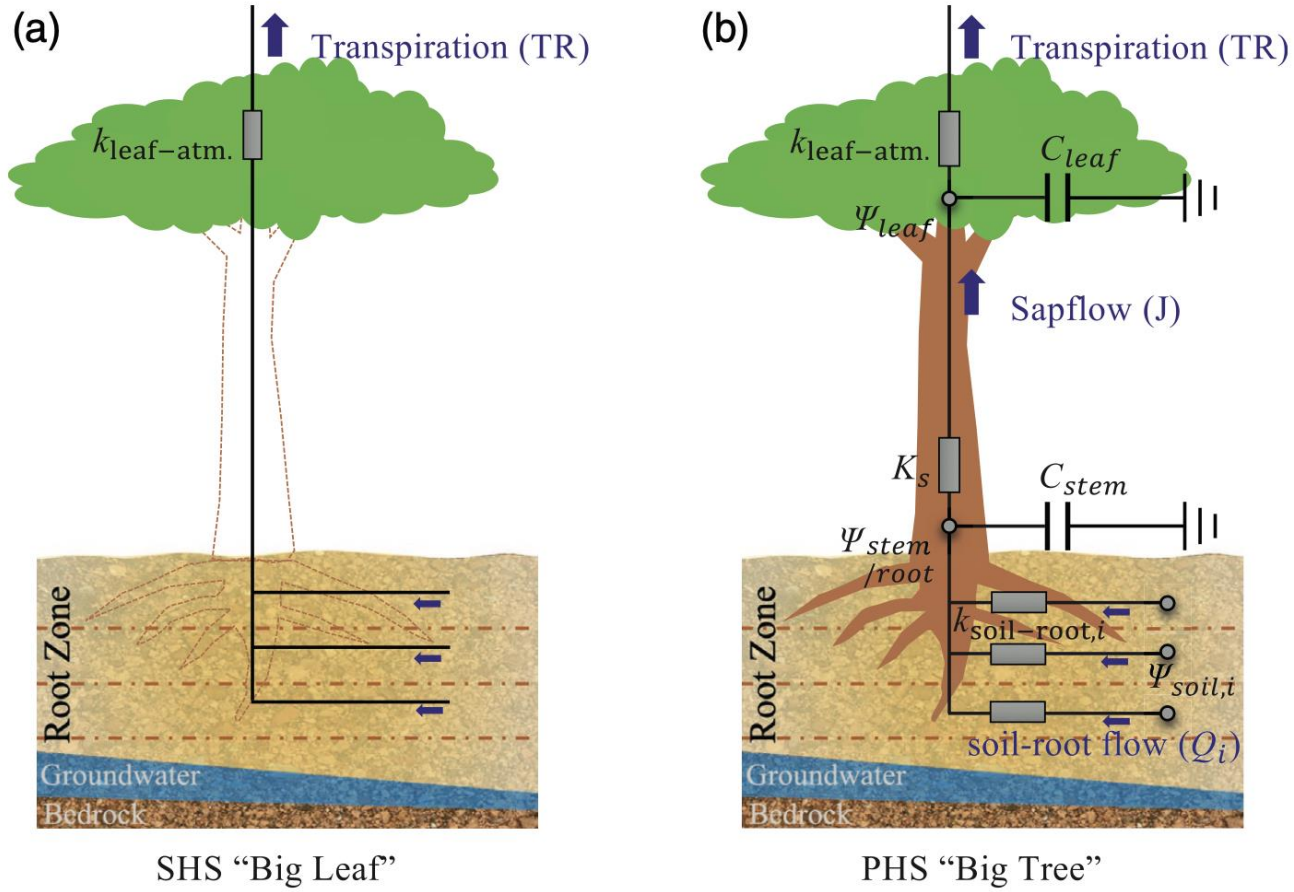
Soil moisture

→

Carbon and water simulations

→

Uncertainties



SHS “Big Leaf” PHS “Big Tree”

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

What are “Big Leaf” and “Big Tree”?

“Big Leaf”

Soil moisture

→

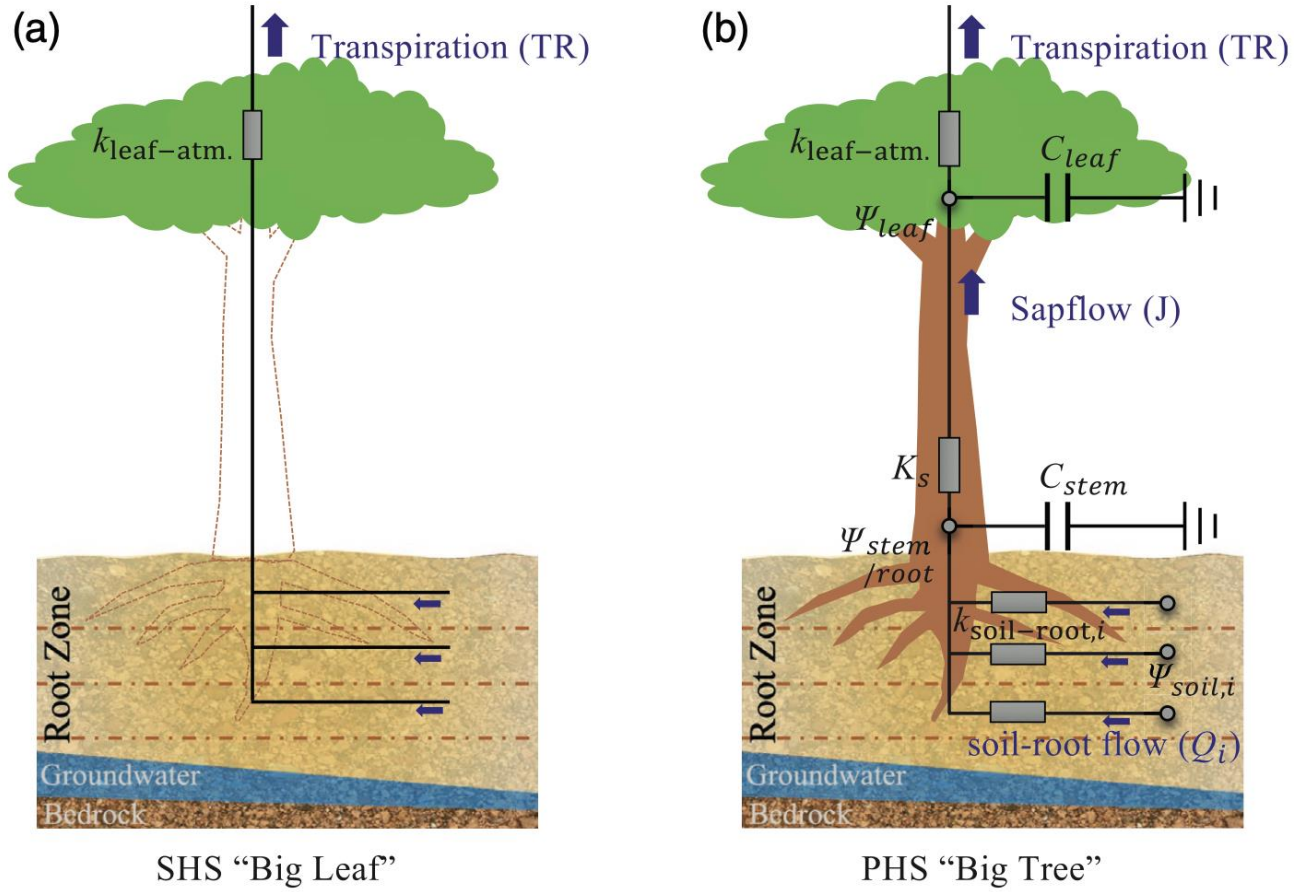
Carbon and water simulations

→

Uncertainties

Most land surface models, e.g.,

Noah-MP



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

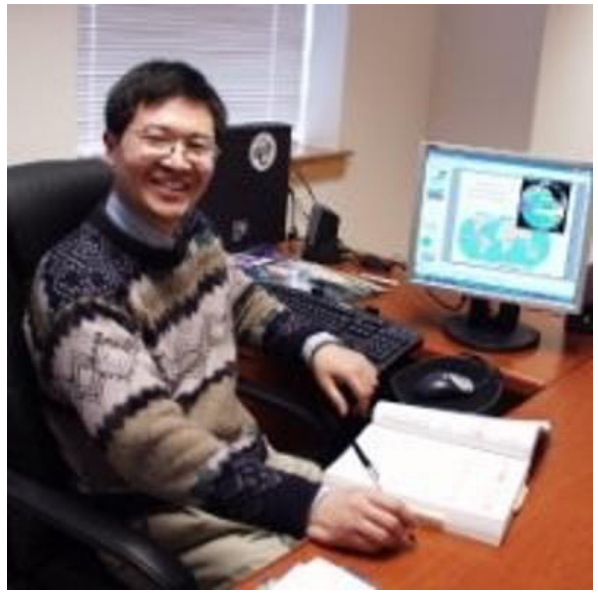
Near-surface hydrology

UT-Austin

Ashley Matheny

Ecohydrologist

UT-Austin

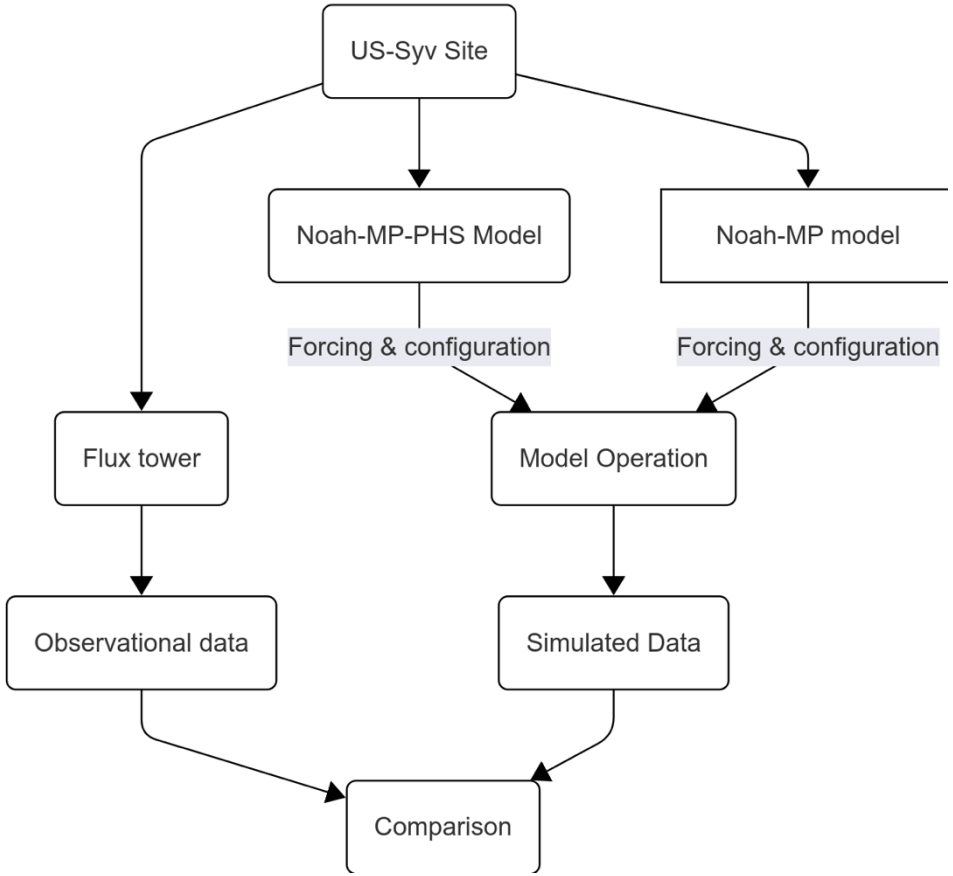


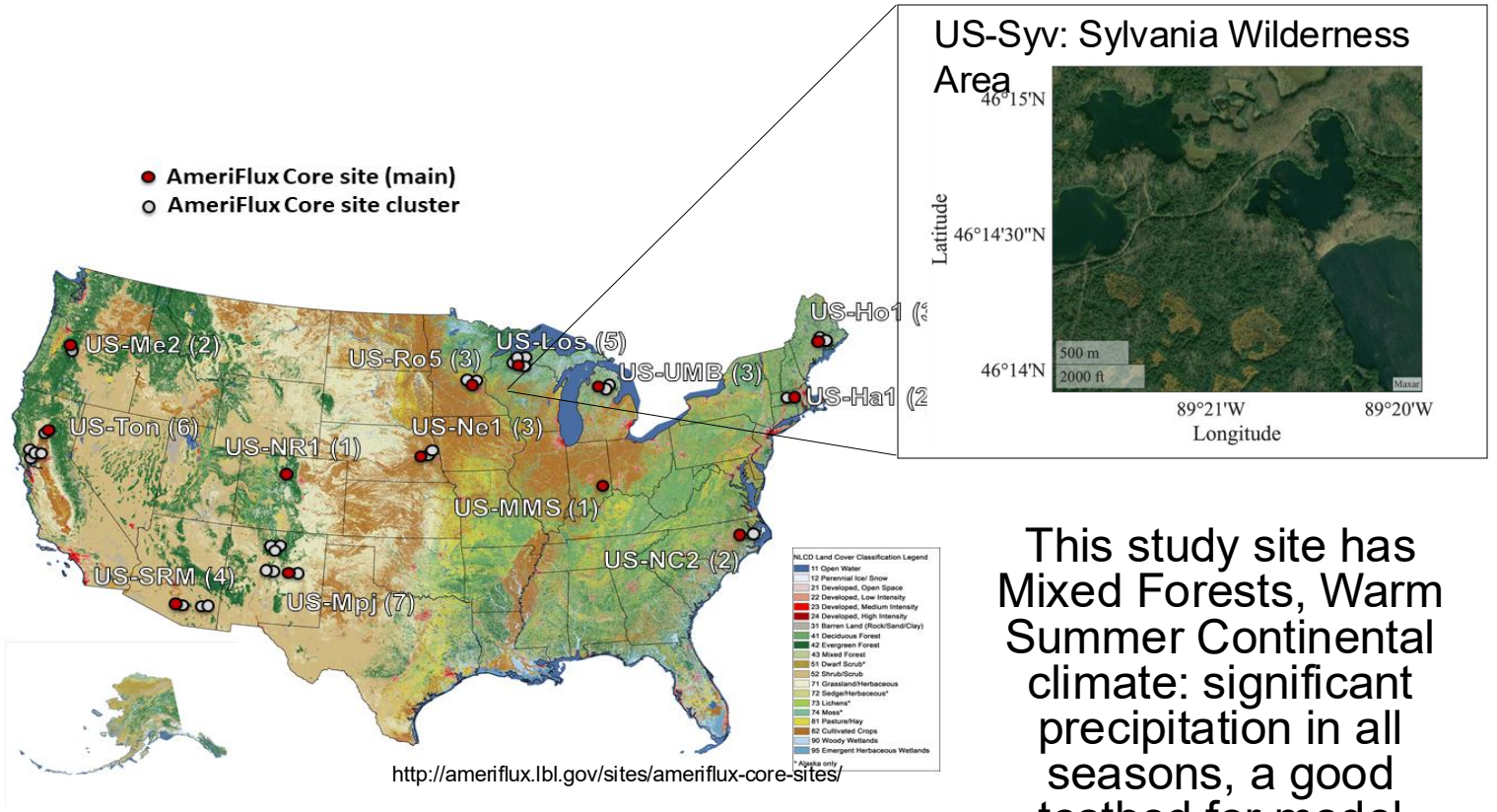
Zong-Liang Yang

Land-surface modeling

UT-Austin

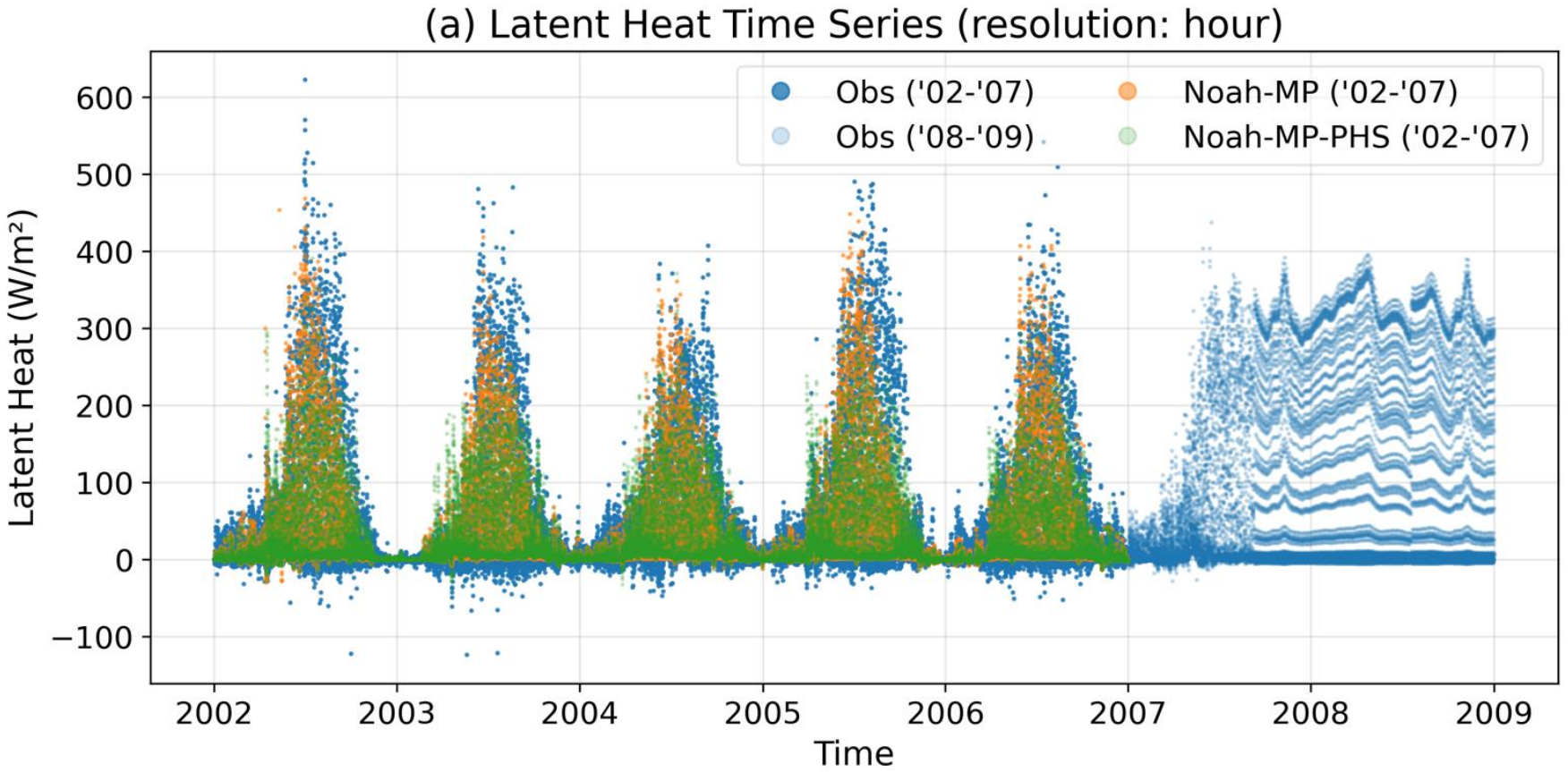
A specific problem: Noah-MP vs Noah-MP-PHS





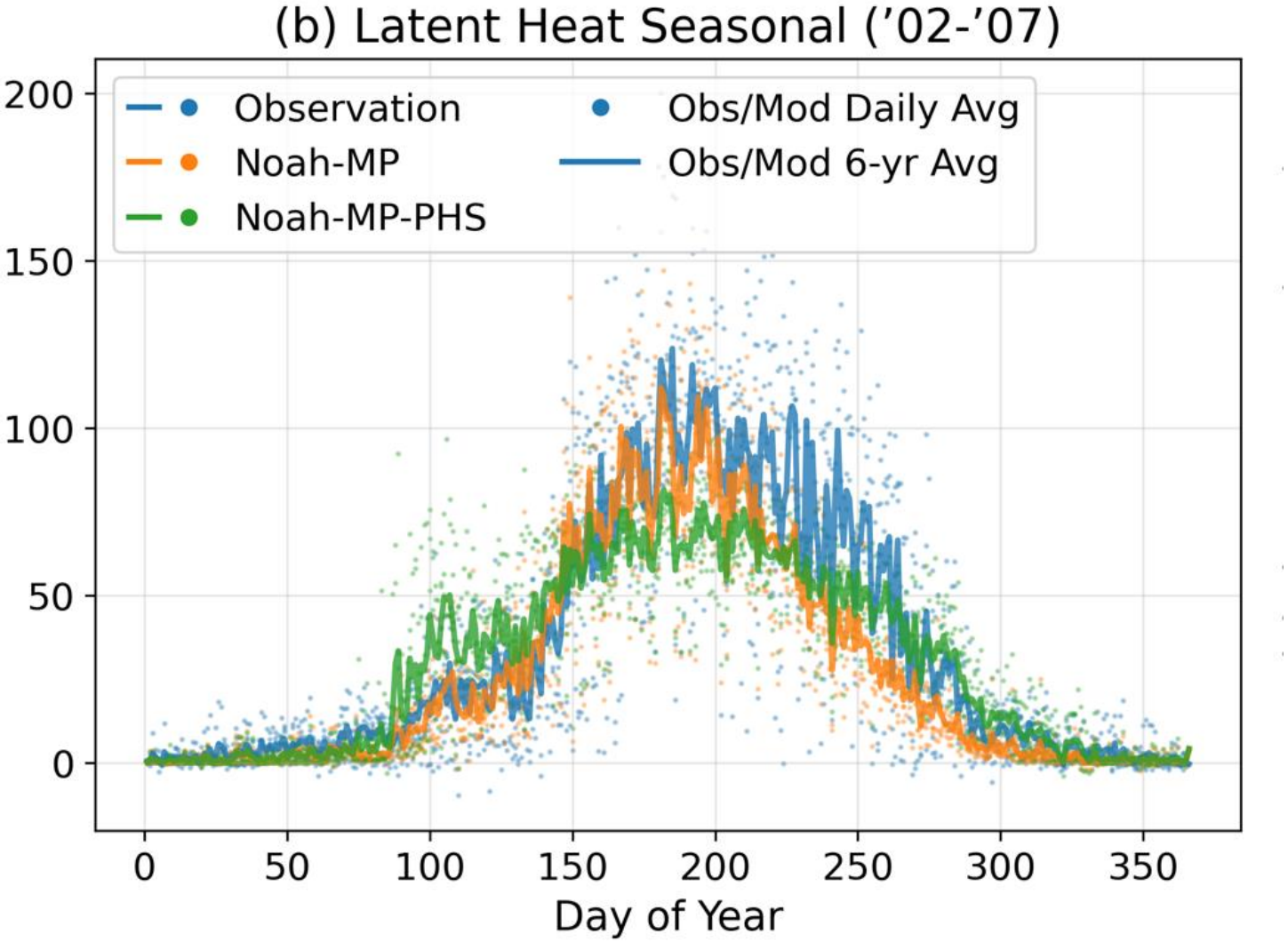
This study site has Mixed Forests, Warm Summer Continental climate: significant precipitation in all seasons, a good testbed for model evaluation.

Results: Noah-MP vs Noah-MP-PHS



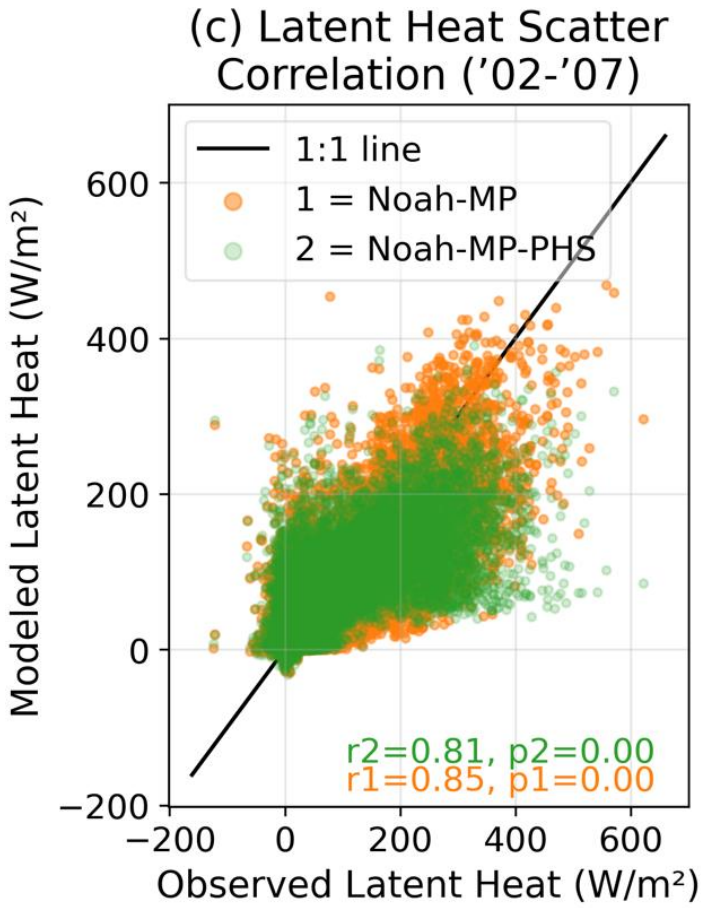
2008-09: Might observational instrument failure
-->
Did not analyze

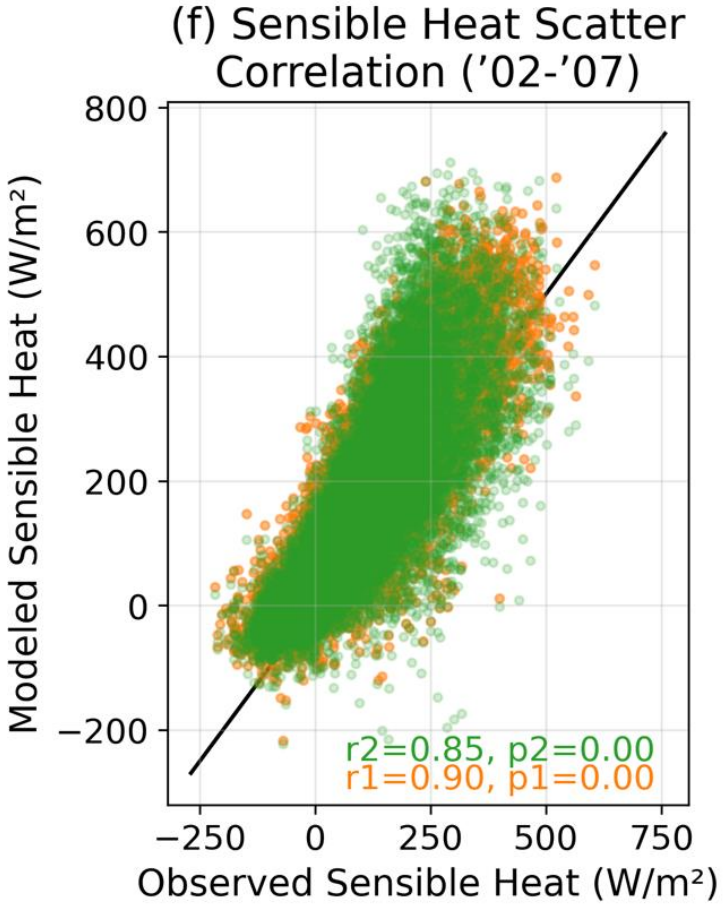
Results: Noah-MP vs Noah-MP-PHS

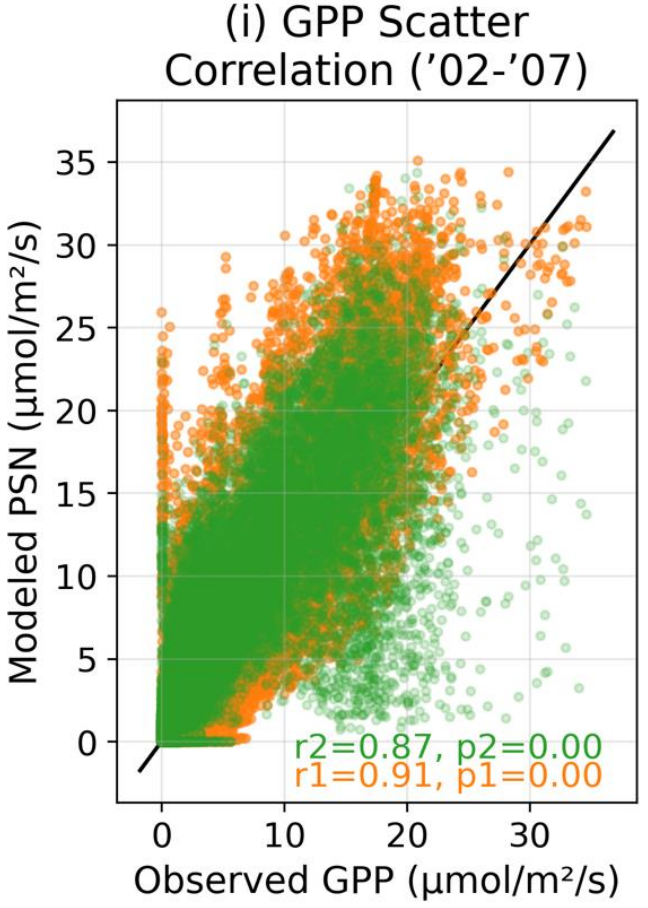


Differences:
Late spring
Summer (peak)
Fall

Results: Noah-MP vs Noah-MP-PHS



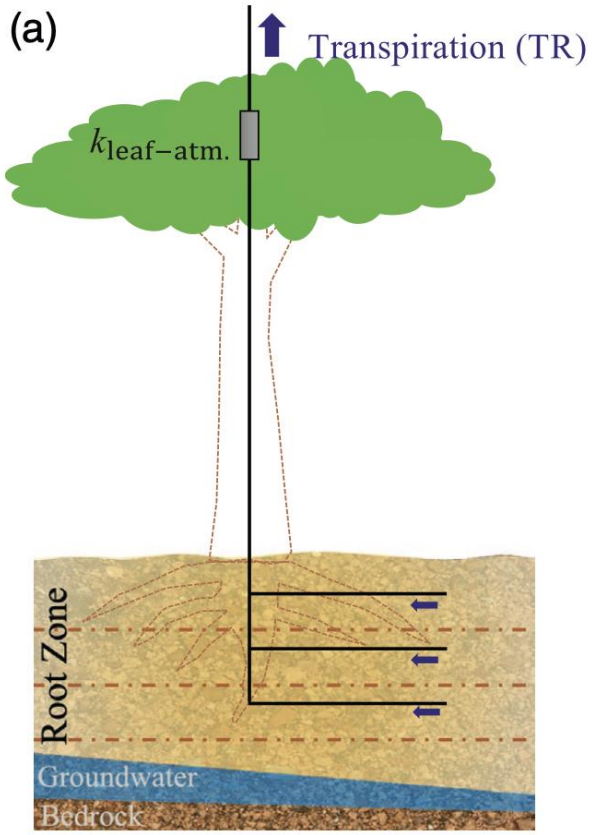




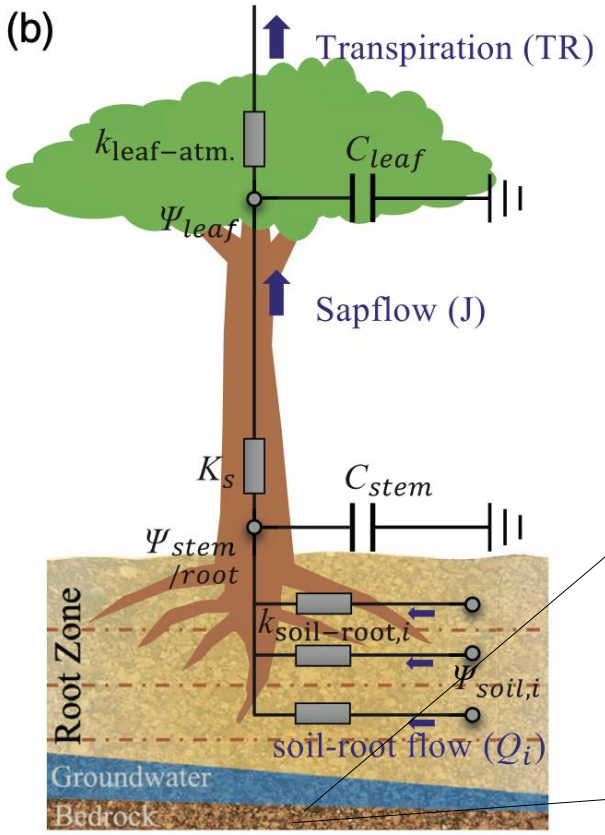
Results: Noah-MP vs Noah-MP-PHS

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

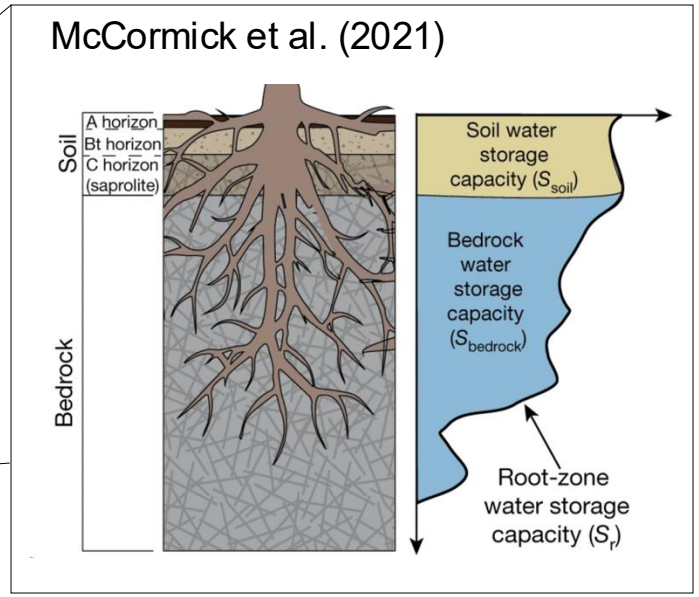


SHS "Big Leaf"



PHS "Big Tree"

X=
Bedrock…
…
Richards equation…
…



Last but not least…

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*