

Comparing Simulated and Observed Gross Primary Productivity

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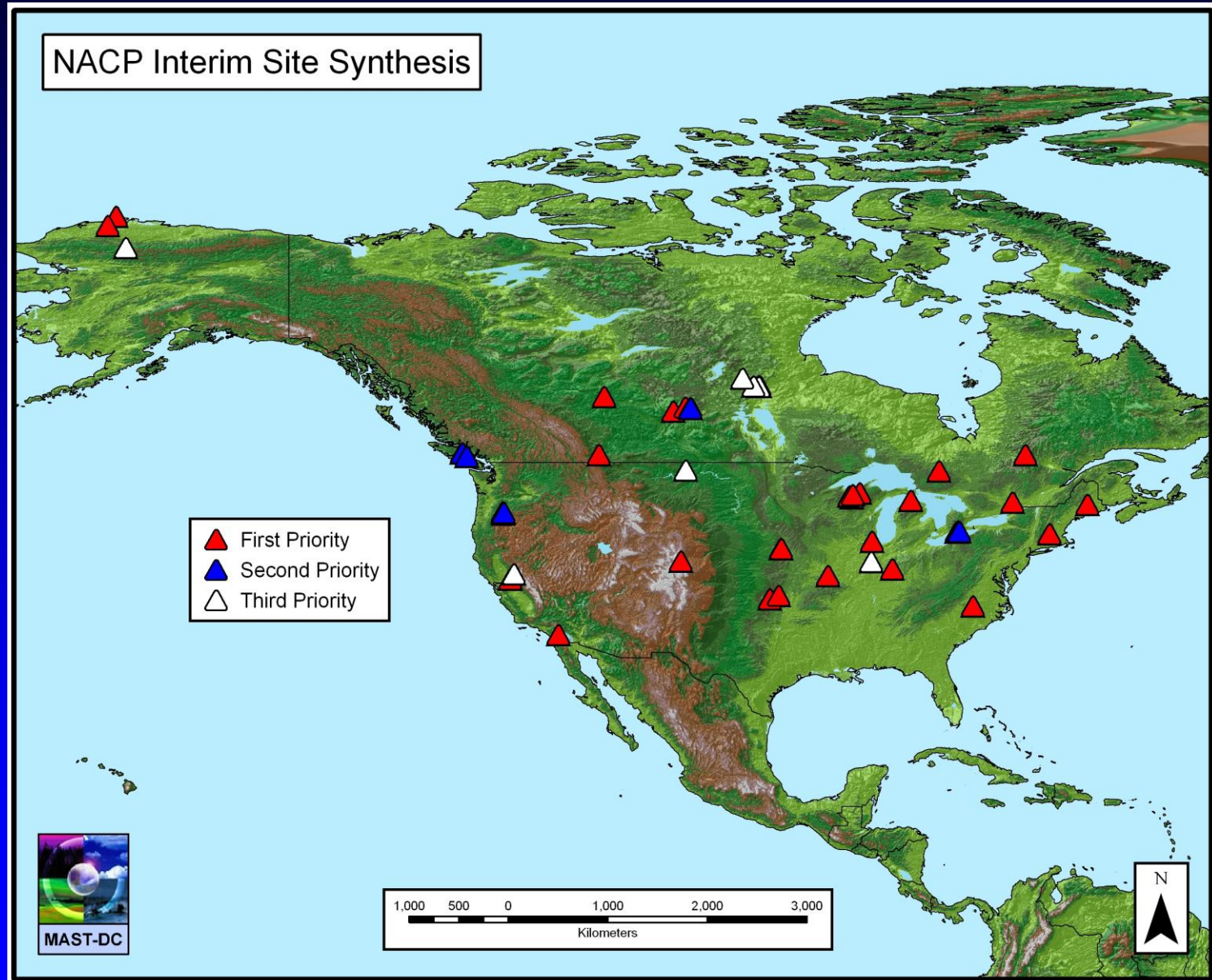
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Objectives

- Quantify how well models simulate GPP
- Identify sources of error

32 Flux Tower Sites



21 Models, 3 MODIS, 2 Model Mean

AGROIBIS	LPJ
BEPS	MODIS_alg
BIOMEBGC	MODIS_C5
CAN-IBIS	MODIS_C5.1
CNCLASS	ORCHIDEE
DLEM	SIB
DNDC	SIBCASA
ECLUEEDCM	SIBCROP
ECOSYS	SSIB2
ED2	TECO
ISAM	TRIPLEX
ISOLSM	Mean (all)
LOTEC	Mean (diurnal)

Model Runs

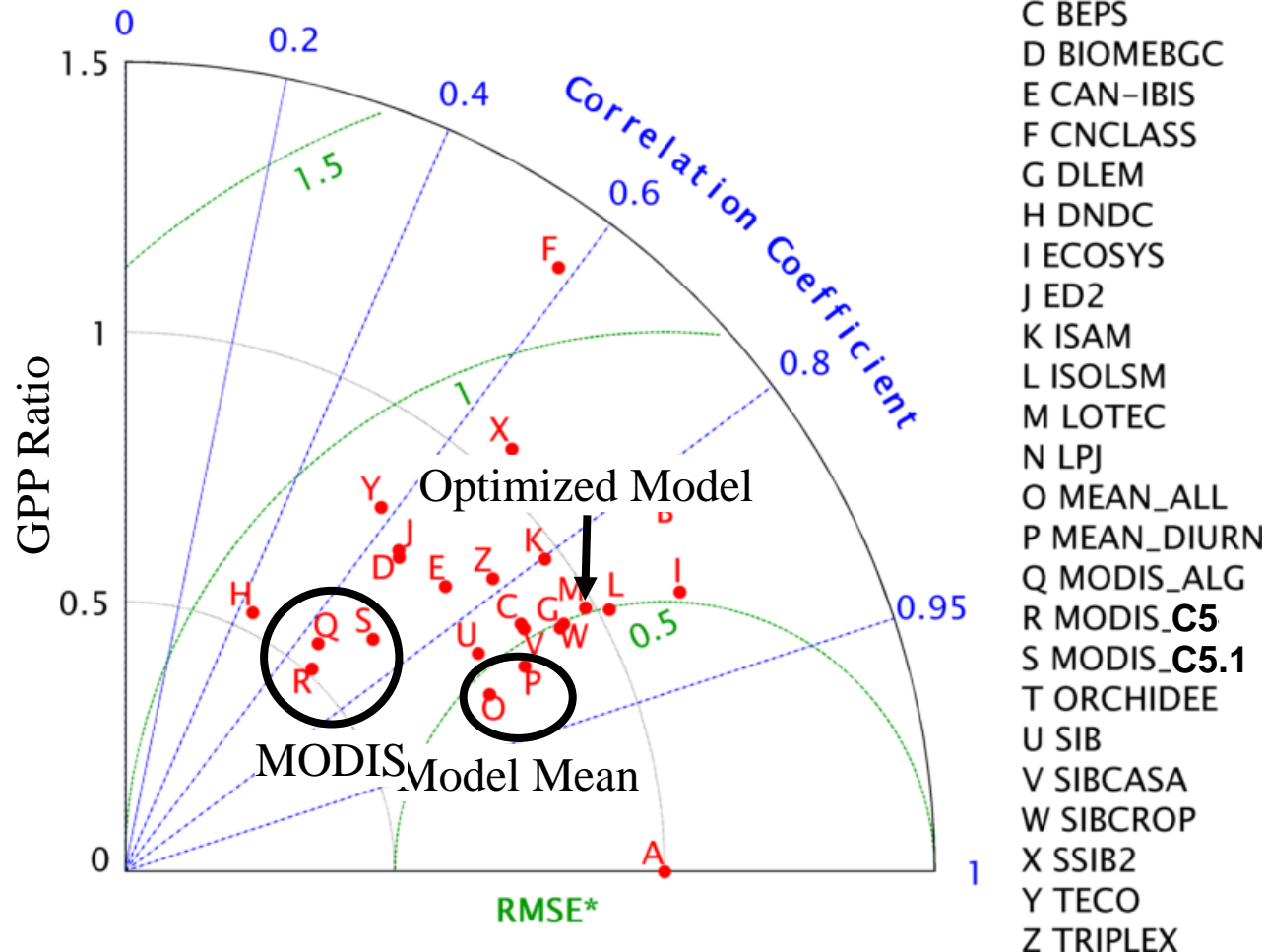
- Gap-filled observed weather
- Steady state
- Observed NEE partitioned into GPP & respiration
- GPP Uncertainty
 - Random
 - U^* filtering
 - Gap-filling
 - Partitioning

Model-Data Comparison

- Daily average GPP
- Performance Measures
 - Chi-squared statistic
 - Root Mean Squared Error
 - Normalized Mean Absolute Error
 - Bias

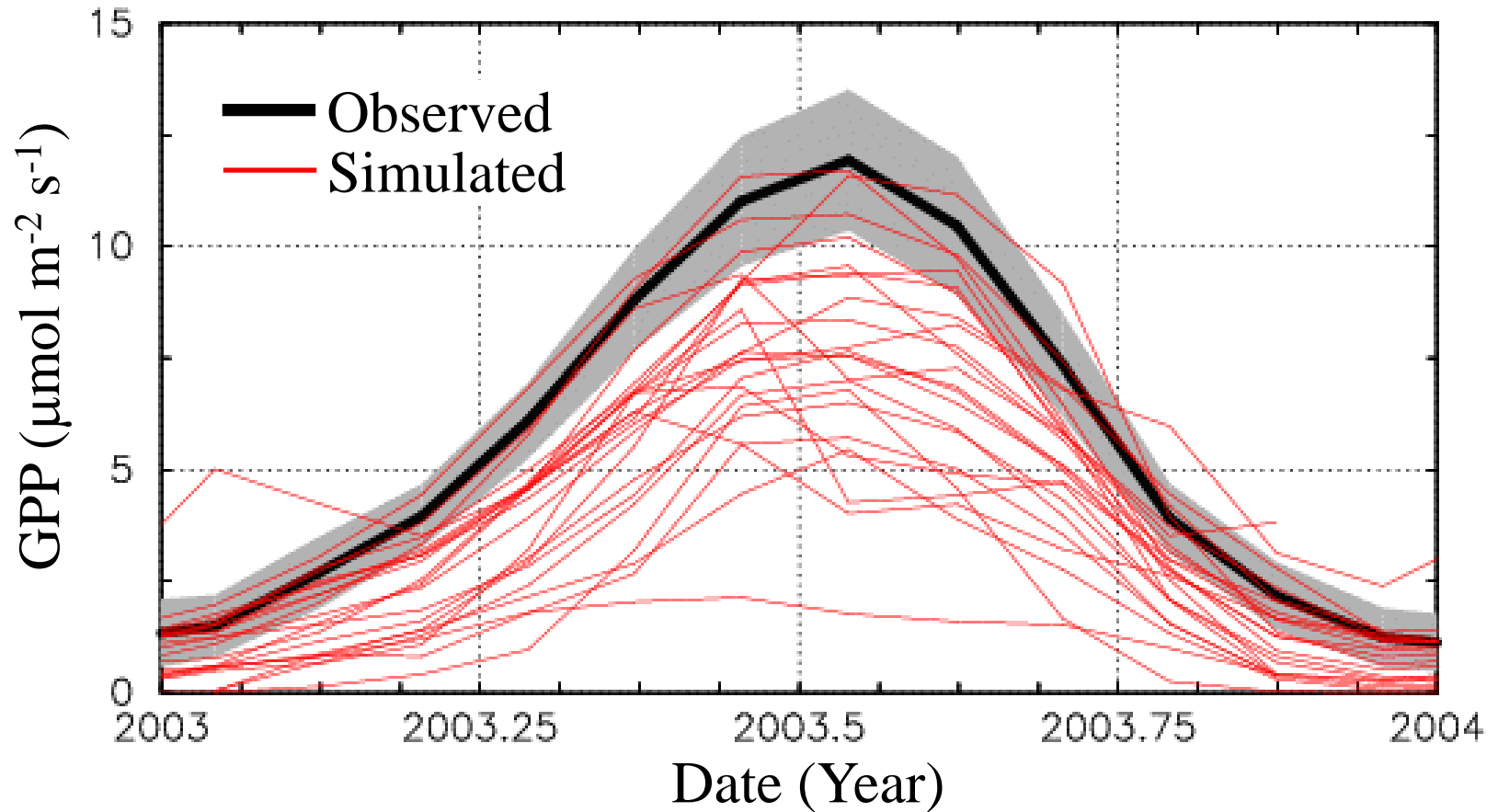
Overall Model Performance

Daily GPP Taylor Plot



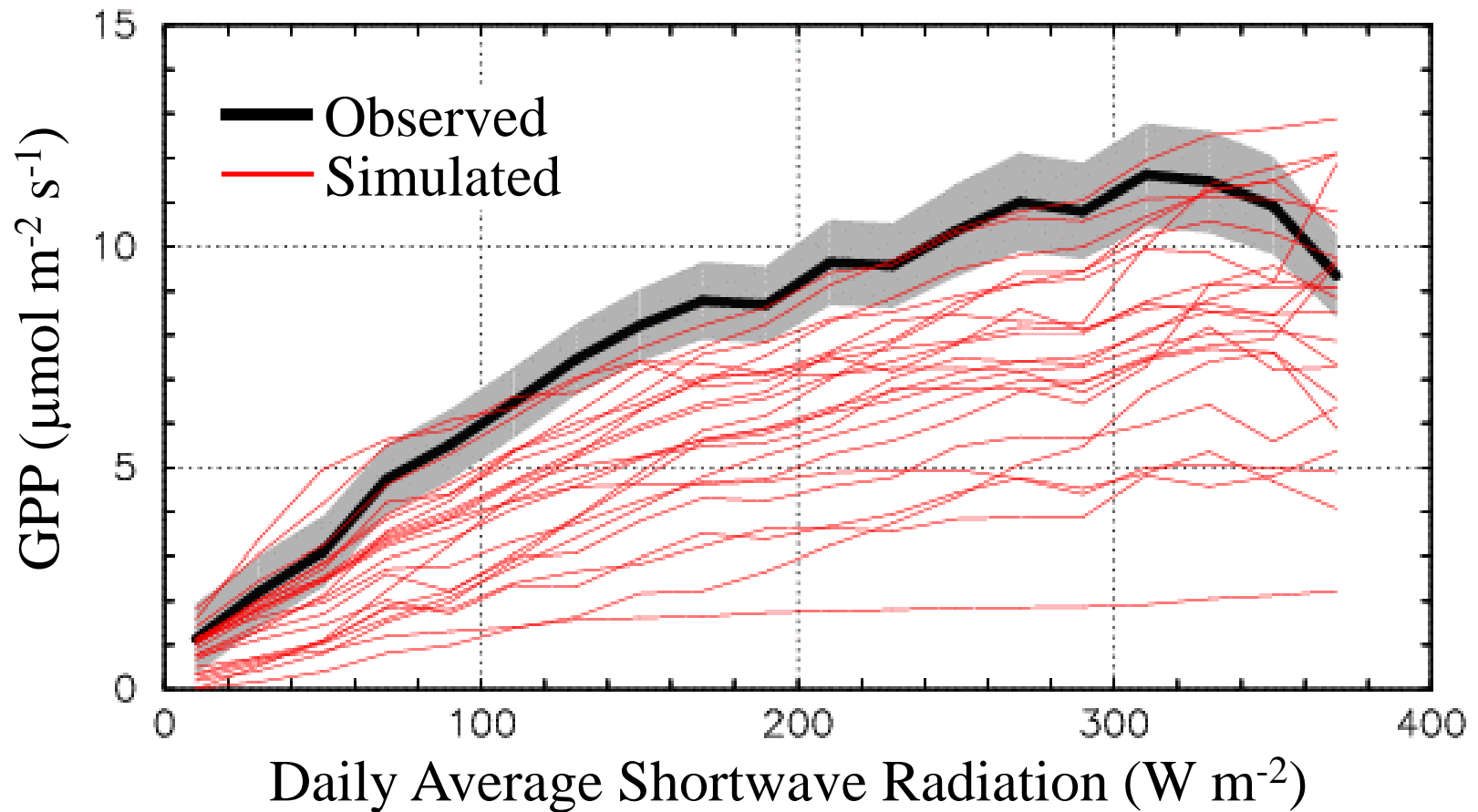
Typical GPP

Monthly Average GPP for CA-Ca1



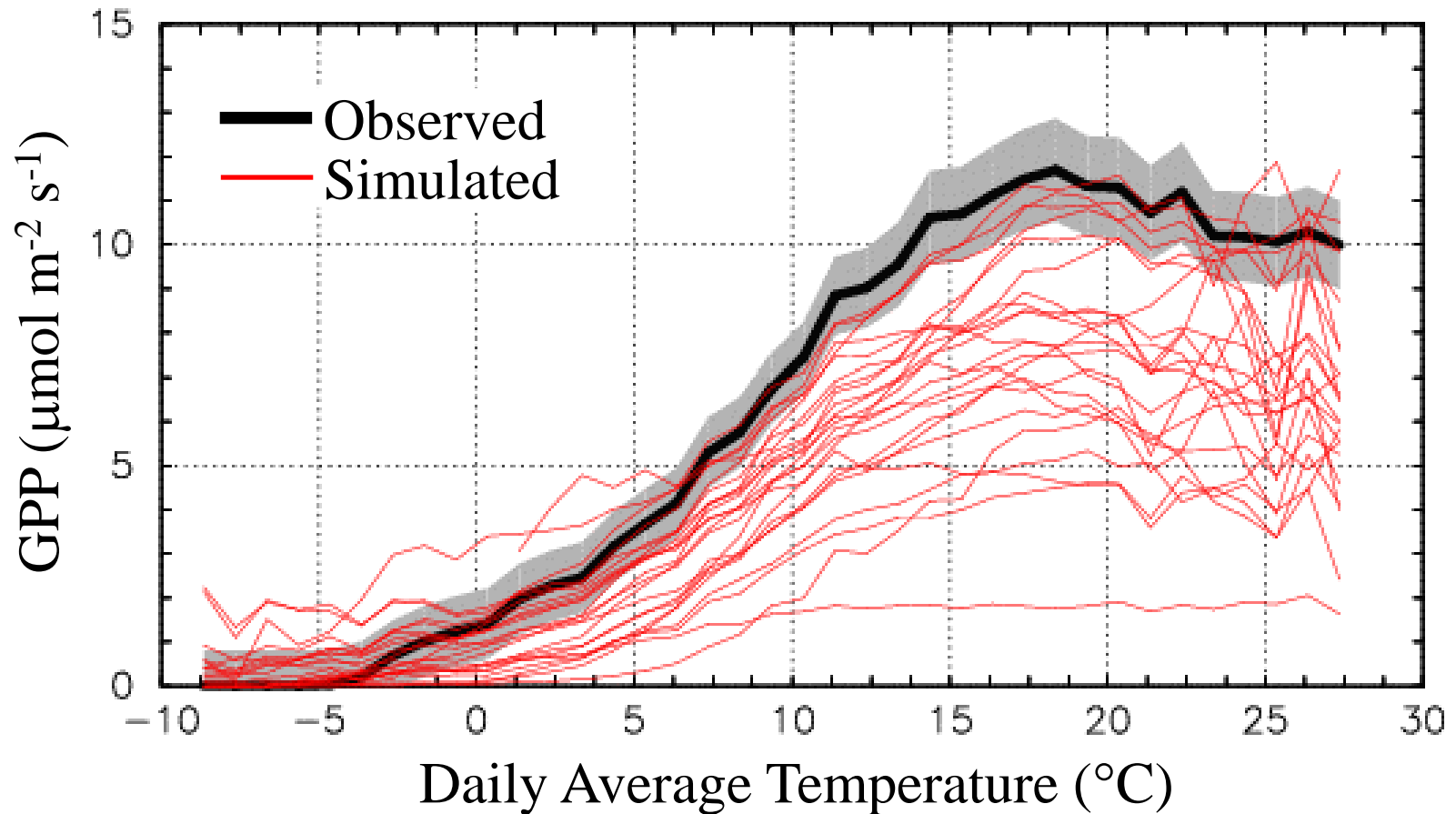
Light Use Efficiency Curves

Daily Average GPP for CA-Ca1



Temperature Response Curves

Daily Average GPP for CA-Ca1



Conclusions

- Models don't simulate GPP well
- Bias in seasonal amplitude
- Improve LUE
- Improve Temperature Response

Acknowledgments

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Statistics

Chi-squared

$$X^2 = \frac{1}{n} \sum \left(\frac{GPP_{mod} - GPP_{est}}{\mathcal{E}_{GPP}} \right)^2$$

$X^2 \sim 1$ model matches data
within uncertainty

Root Mean Square Error

$$RMSE = \sqrt{\frac{1}{n} \sum (GPP_{mod} - GPP_{est})^2}$$

$RMSE = 0$ perfect fit with data

Normalized Mean Absolute Error

$$NMAE = \frac{1}{GPP_{est} n} \sum |GPP_{mod} - GPP_{est}|$$

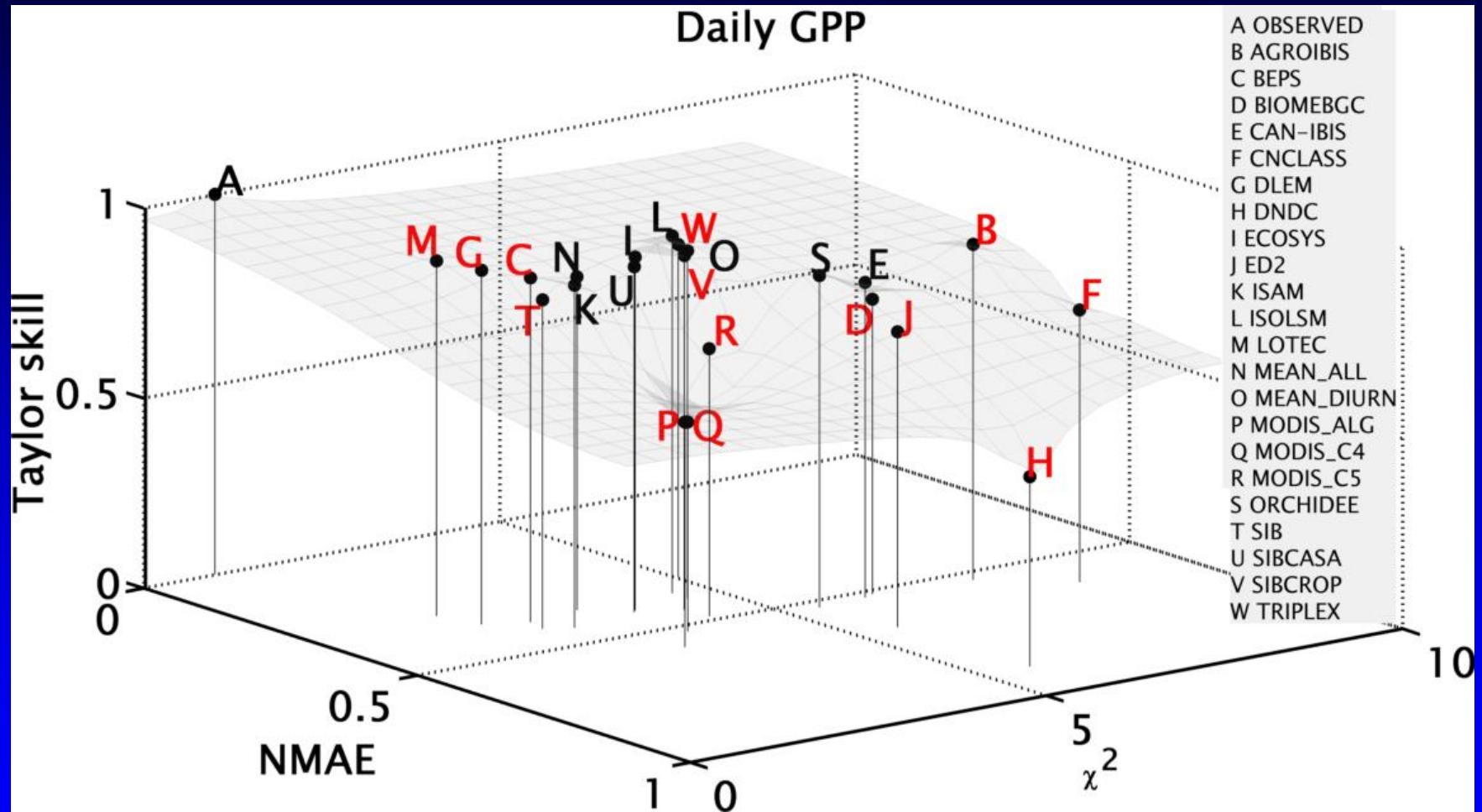
$NMAE = 0$ perfect fit with data

Bias

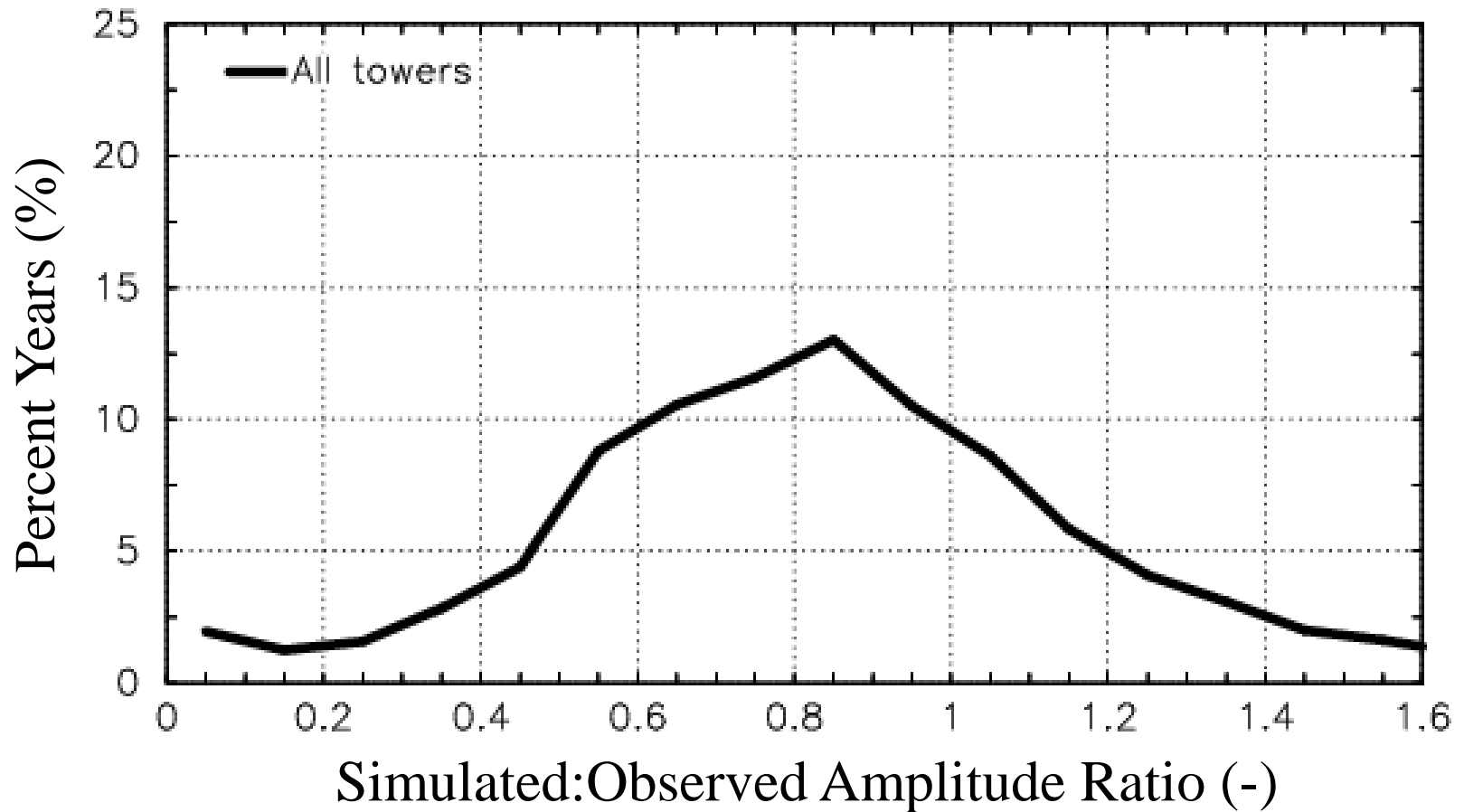
$$B = \frac{1}{n} \sum (GPP_{mod} - GPP_{est})$$

$B > 0$ model greater than data

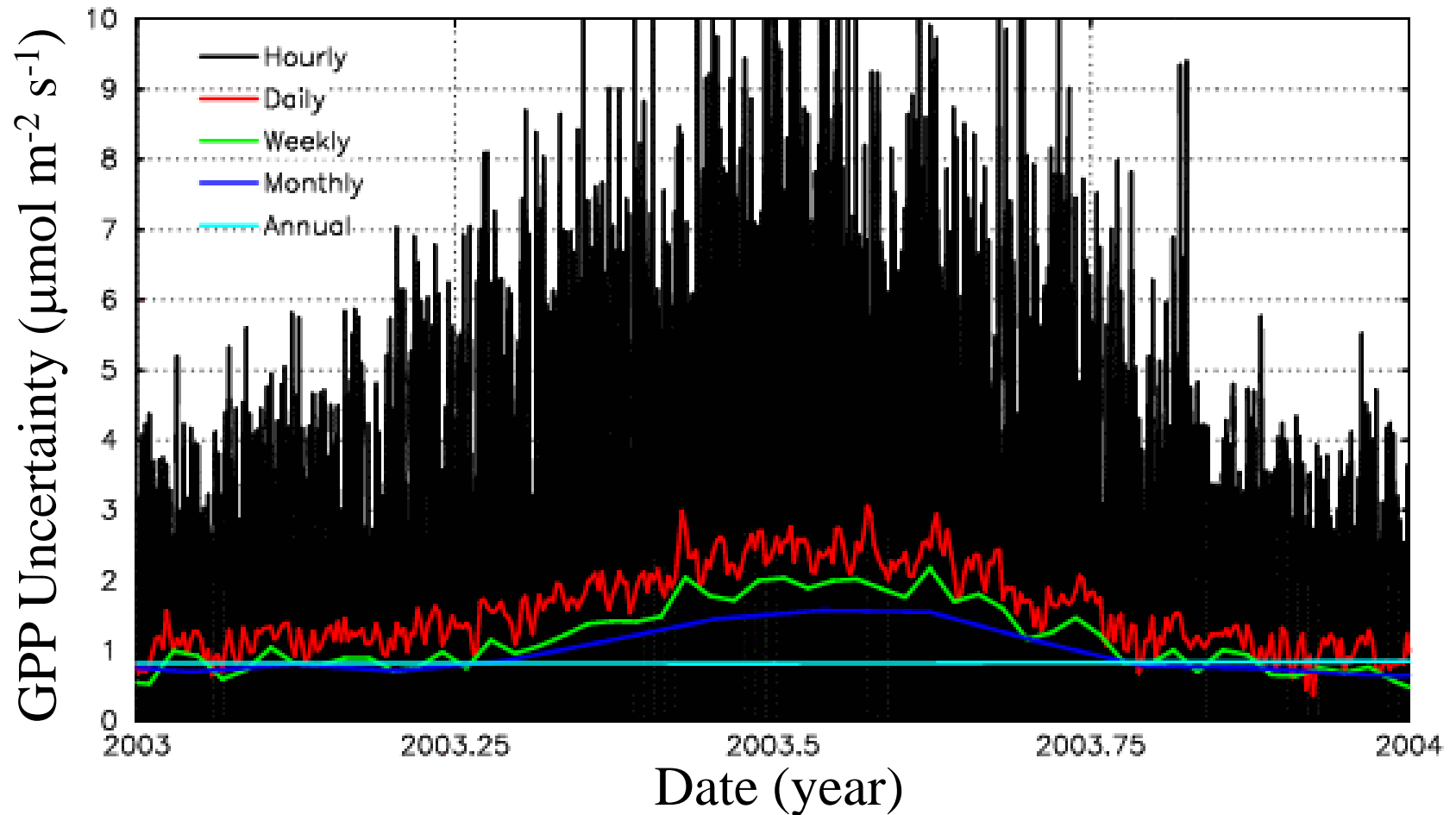
Overall Performance by Model



Ratio of Annual GPP Amplitude



GPP Total Uncertainty for CA-Ca1



GPP Uncertainty for CA-Ca1

Daily Average GPP

