Multi-scale Synthesis and Terrestrial Biosphere Model Intercomparison Project (MsTMIP)

MsTMIP Team:	**Deborah Huntzinger (Science PI)** Anna Michalak (PI)	U. of Michigan
	Kevin Schaefer	NSDC, U. of Colorado
	Andrew Jacobson	NOAA, U. of Colorado
	Mac Post; Robert Cook; Yaxing Wei	Oak Ridge National Lab
Collaborators	Peter Thornton, Forrest Hoffman, Rama Nemani, Weile Wang, Josh Fisher, Philippe Ciais, Nicolas Viovy, Philippe Peylin	

Simulations start May, 2011

- Global
  - 0.5° by 0.5°
  - CRU-NCEP with rescaled precipitation
- Regional (North America)
  - 0.25° by 0.25°
  - NARR with rescaled precipitation and SW
- Site level
  - Site Synthesis towers
  - NARR meteorology

Infrastructure

- Model evaluation: C-LAMP (now iLAMB)
- Model team support (mini-grants)
- Output Subroutine Library

NACP Site Synthesis Analysis Projects

Kevin Schaefer

NACP Site Synthesis Team

Flux Tower PIs

Modeling Teams

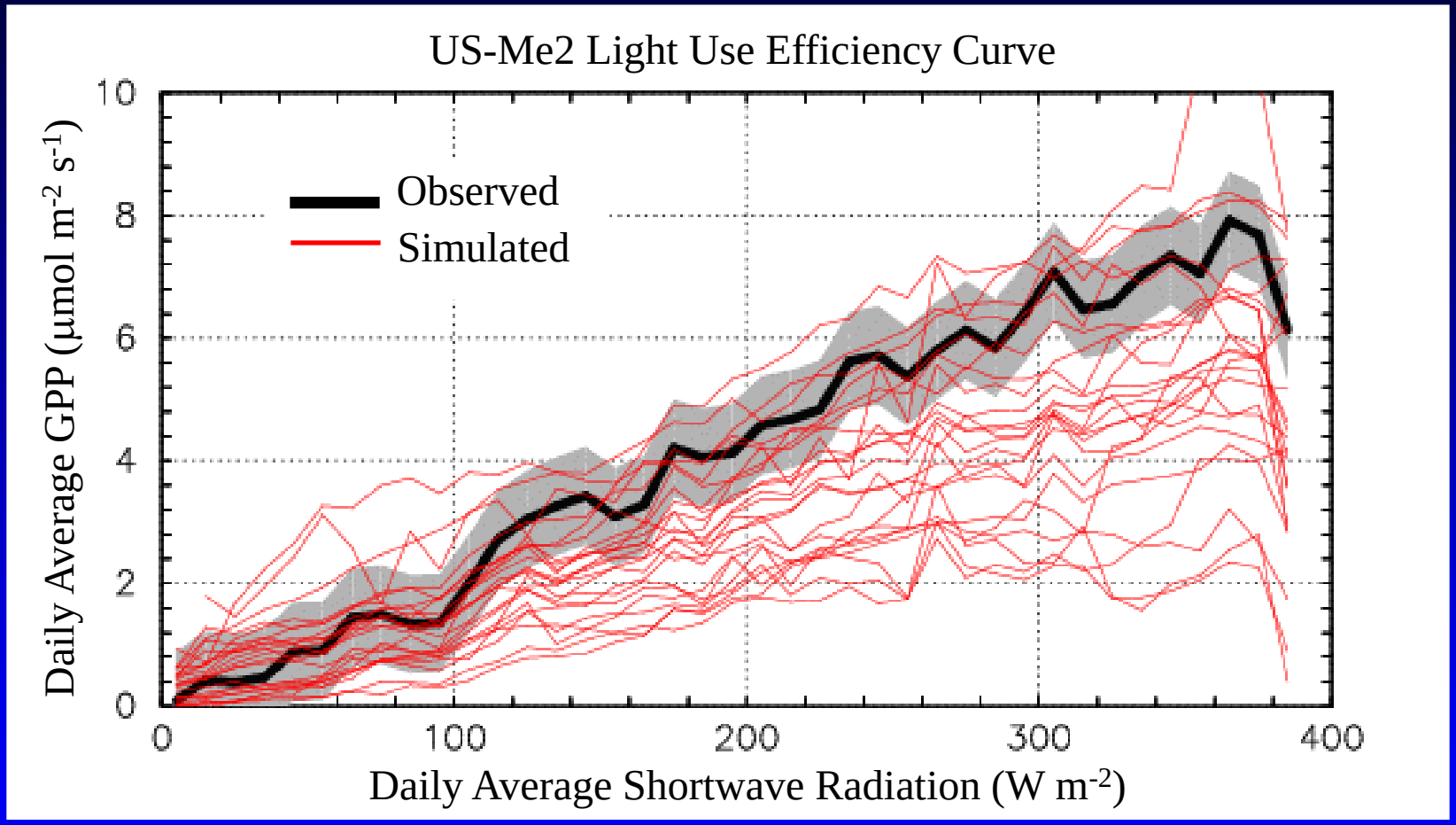
General Status

- Now in Analysis phase
- Gap-filled fluxes V2 ready (V3 soon)
- Model Survey V2

Site Synthesis Analysis Projects

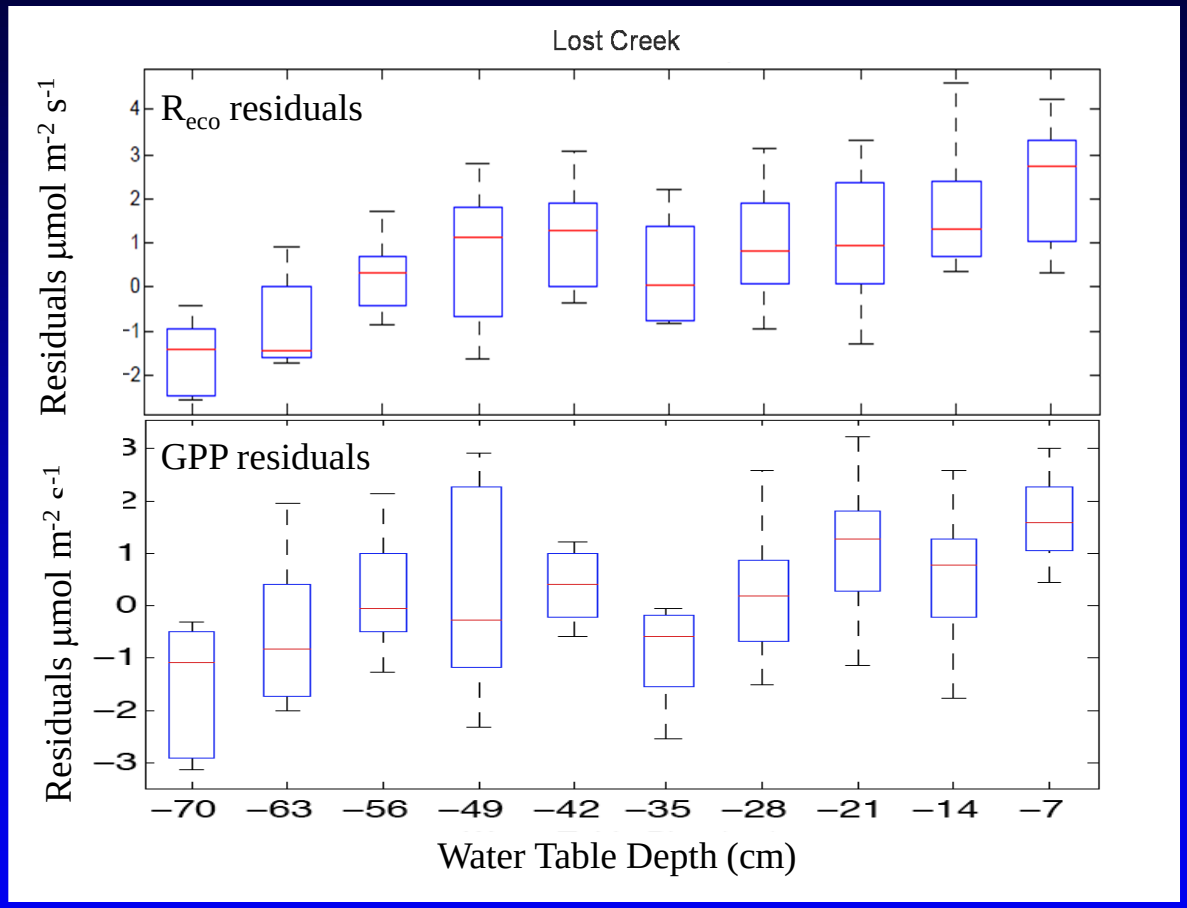
Num	Status	Title	Lead
1	Published	NEE Seasonal	Schwalm et al. [2010]
2	In Review	Crop Sites	Erandi Lokupitiya
3	In Review	NEE Spectral	Michael Dietze
4	Writing	Flux Uncertainty Analysis (2 papers)	Alan Barr
5	Writing	GPP	Kevin Schaefer
6	Writing	NEE wavelet coherence	Paul Stoy
7	Writing	Phenology:	Andrew Richardson
8	Writing	Regional vs. Tower	Brett Raczka
9	Writing	Sensitivity to meteorology forcing data	Dan Ricciuto
10	Writing	Wetland Sites	Ankur Desai
11	Started	Disturbance History effect on fluxes	Peter Thornton
12	Started	Forest Ecosystems at diurnal to seasonal time scales	Bill Munger
13	Started	Hot Spots in Inter-annual Variability	Guerric Lemaire
14	Started	Interannual Variability	Trevor Keenan
15	Started	Intra- and Inter-Model Uncertainties for TECO	Ensheng Weng
16	Started	Isotope analysis	Chun-Ta Lai
17	Started	Latent and Sensible Heat Flux	Alok Sahoo
18	Started	Model Parameter Comparison	Hans Verbeeck
19	Started	Soil Temperature, Moisture, & Snow	Kevin Schaefer
20	TBD	Algorithm Comparison	Dave Hollinger
21	TBD	Biomass Comparison	Leo Liu
22	TBD	Eastern Temperate Forests	Michael Dietze
23	TBD	Fluxes and soil temperatures at permafrost sites	Kevin Schaefer
24	TBD	Grassland Sites	TBD
25	TBD	Nutrient cycling and Carbon Fluxes	Peter Thornton
26	TBD	Precipitation Patterns and Carbon Flux	Sebastian Leuzinger
27	TBD	Prognostic LAI, Soil Temperature and Soil Moisture	Maoyi Huang
28	TBD	Representation Error for Transport Inversions	Scott Denning
29	TBD	Spatial Residual Analysis	Philippe Peylin
30	TBD	Temperature and Light Response Curves	TBD
31	TBD	Weather Events and Carbon Fluxes	Hanqin Tian

GPP Annual Bias (*Schaefer et al.*)



- Slope of LUE Curve drives Annual bias
- Models need better V_{max}, leaf-to-canopy scaling, …

Wetland Sites (Desai et al.)



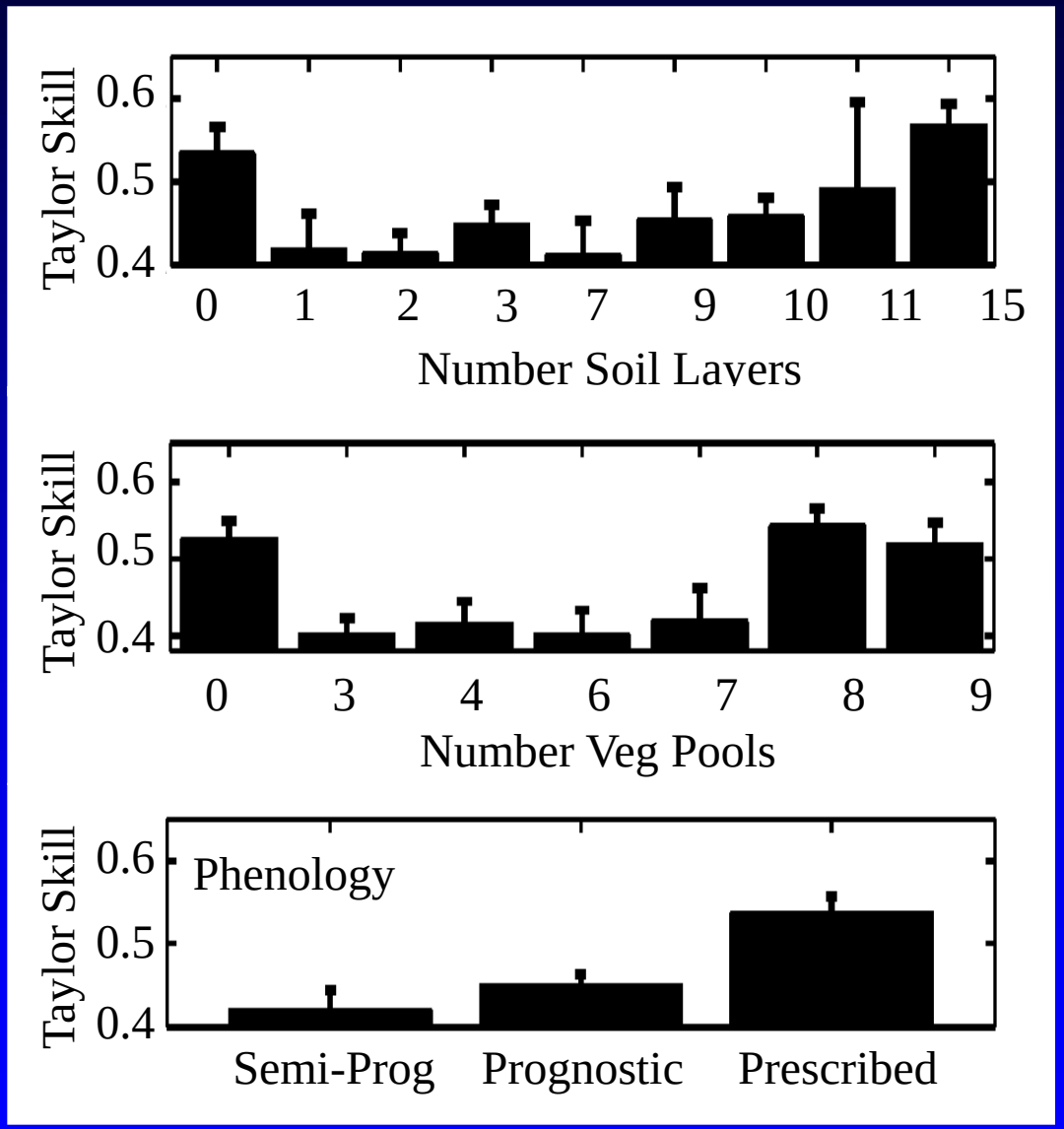
- Residuals correlate to water table depth
- Models should include water table dynamics

NEE Seasonal Cycle (*Schwalm et al.*)

Add soil layers

Add vegetation pools

Improve prognostic phenology

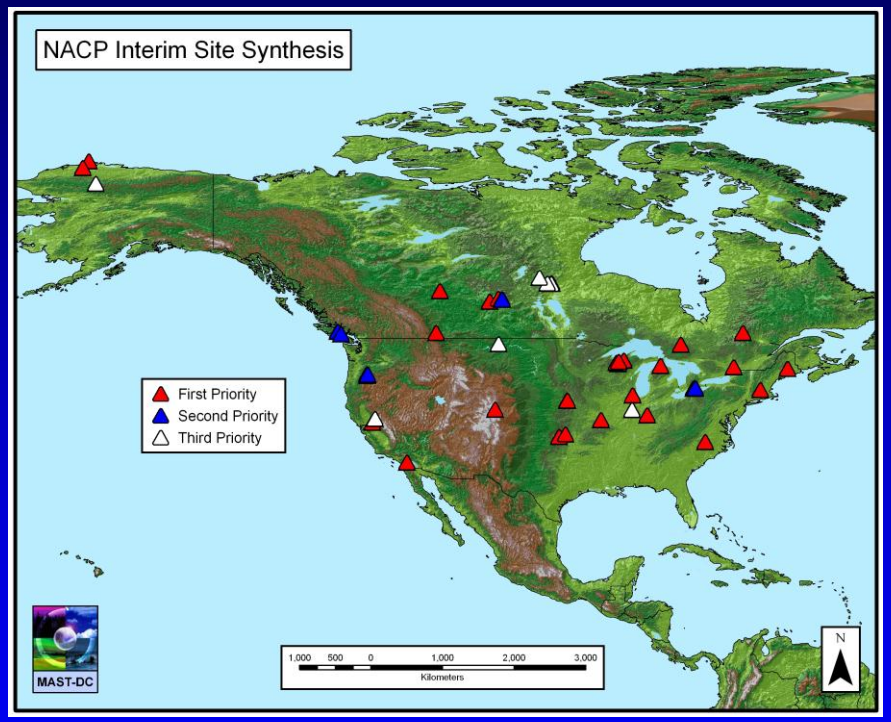


Areas For Model Development

- Better Phenology
- More soil layers
- More vegetation pools
- Slopes to LUE curve
- Water table dynamics
- Crop parameterizations

Towers and Models

47 Flux Tower Sites



36 AmeriFlux

11 Fluxnet Canada

30 Models

Num	Model	Num	Model
1	Agro-IBIS	16	GTEC
2	BEPS	17	ISAM
3	Biome-BGC	18	ISOLSM
4	Can-IBIS	19	LoTEC
5	CLM-CASA'	20	LoTEC-DA
6	CLM-CN	21	LPJ_wsl
7	CN-CLASS	22	ORCHIDEE
8	DAYCENT	23	ORCHIDEE-STICS
9	DLEM	24	SiB3
10	DNDC	25	SiBCASA
11	ecosys	26	SiBCrop
12	ED2	27	SIPNET
13	EDCM	28	SSiB2
14	EPIC	29	TECO
15	GFDL LM3V	30	TRIPLEX-Flux

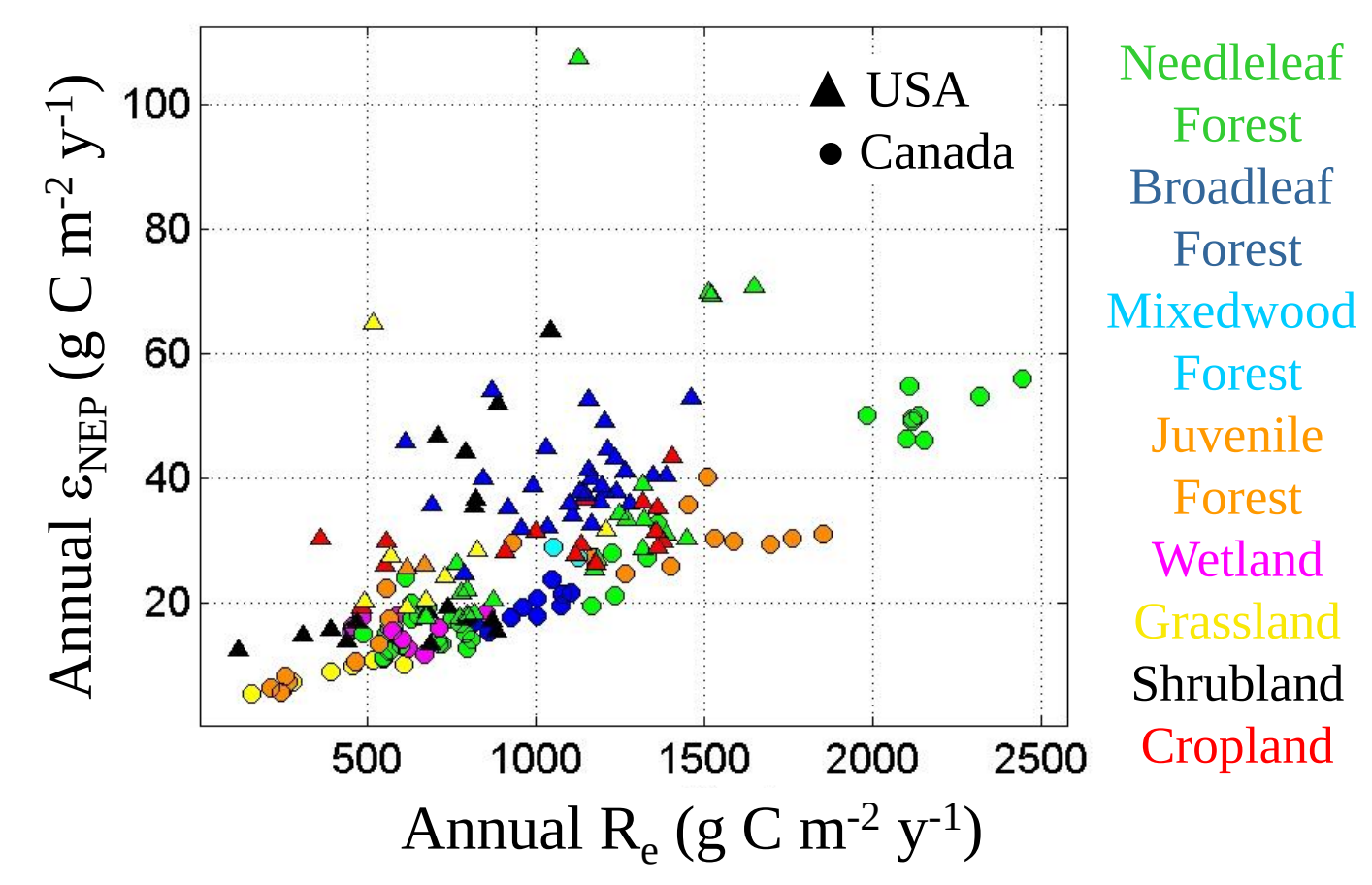
24 submitted output

10 runs per site

Products Derived from Flux Data

- Gap-filled observed weather (Ricciuto et al.)
- BADM files (everyone)
- Gap-filled fluxes & Uncertainty (Barr et al.)
  - Random
  - U* threshold
  - Gap-filling Algorithm
  - Partitioning Algorithm

Random Uncertainty (Barr et al.)



- Random ε_{NEP} ~4% R_e
- U^*_{th} ε_{NEP} ~1.3% R_e

BADM Files

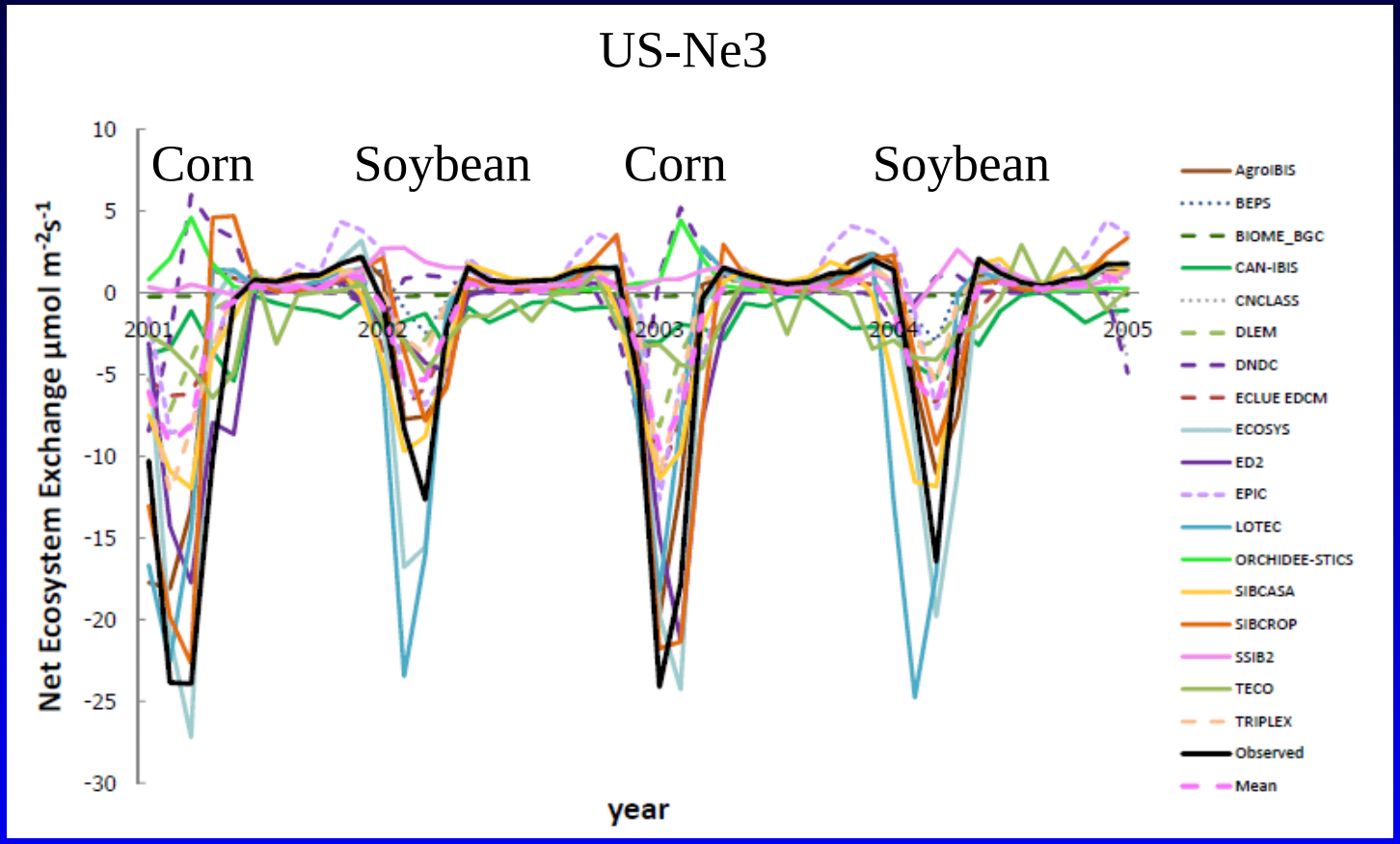
- Extremely useful to modelers
  - Soil texture
  - Site history
  - Initial pools sizes
  - Leaf Area Index
- We strongly encourage more submissions

Weather Uncertainty (*Ricciuto et al.*)

	Swdown (W m-2)	Delta (%)
Observed	65.38	
LaThu	65.74	0.55
ECMWF	74.76	14.35
NARR	83.98	28.45
NCEP	90.7	38.73
NCEP2	84.24	28.85
Princeton	69.18	5.81
NLDAS	79.6	21.75
CRU-NCEP	62.45	-4.48

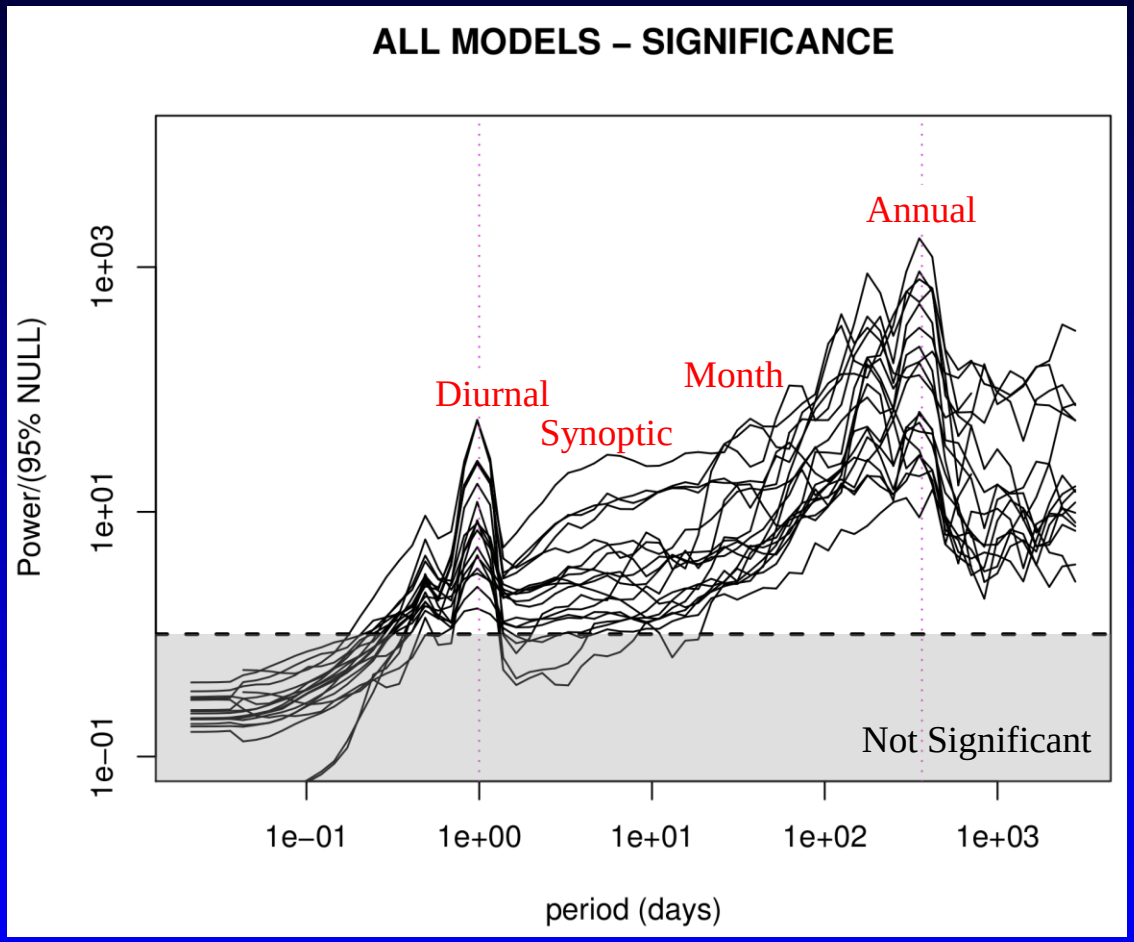
- Bias in radiation produces bias in GPP

Agriculture Sites (Lokupitiya et al.)



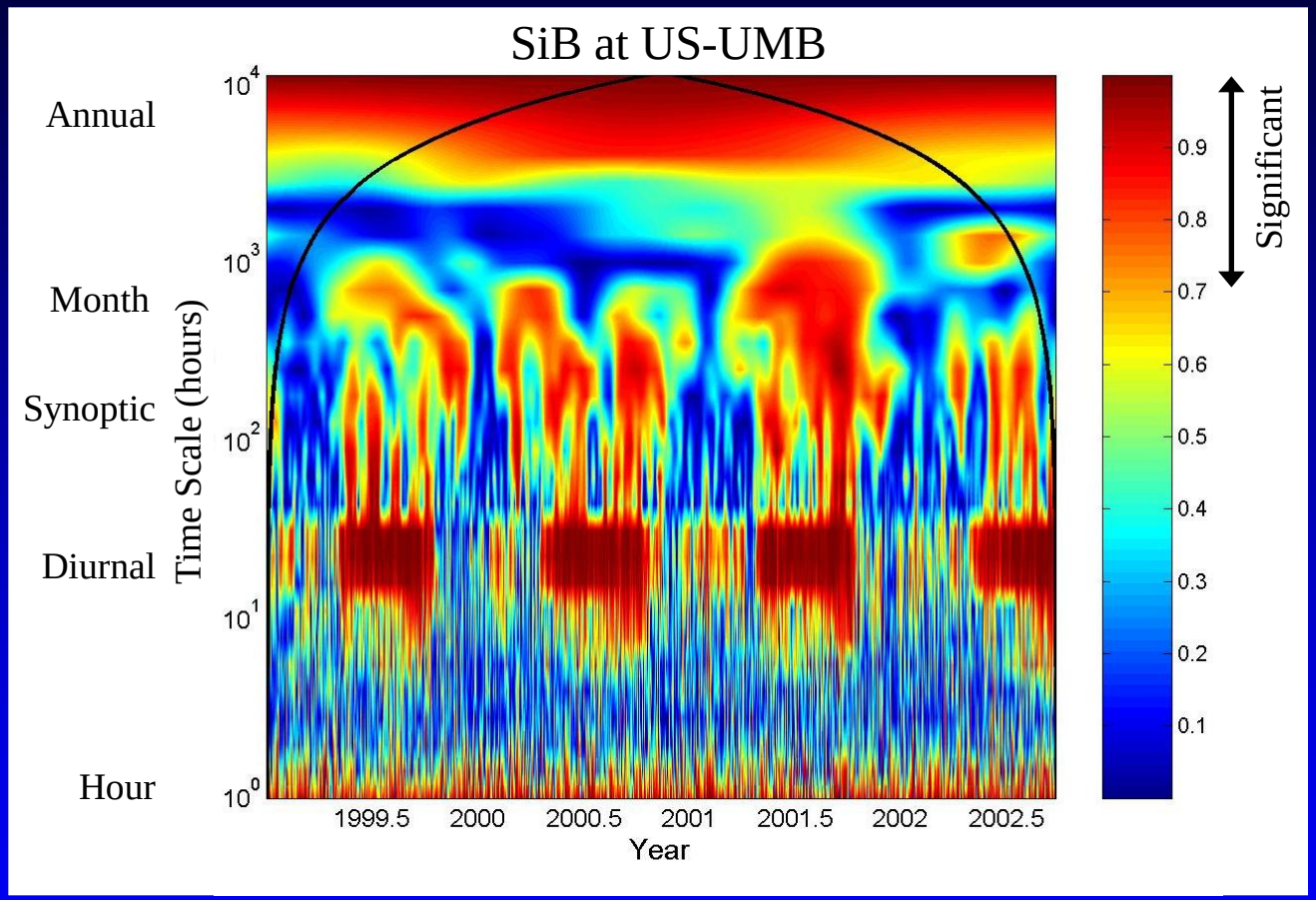
- Need crop specific parameterizations

Spectral NEE Error (*Dietze et al.*)



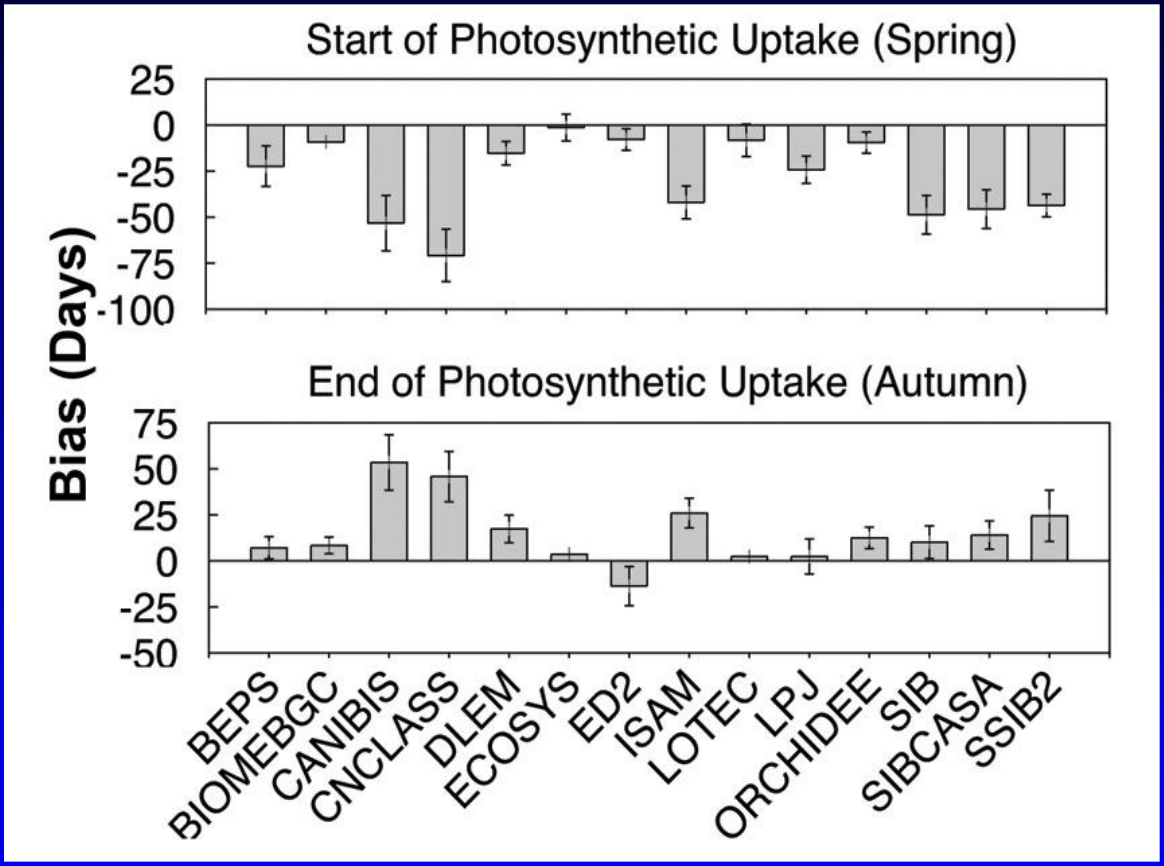
- Error peak at diurnal & annual time scales
- Errors at synoptic & monthly time scales

NEE Wavelet Coherence (*Stoy et al.*)



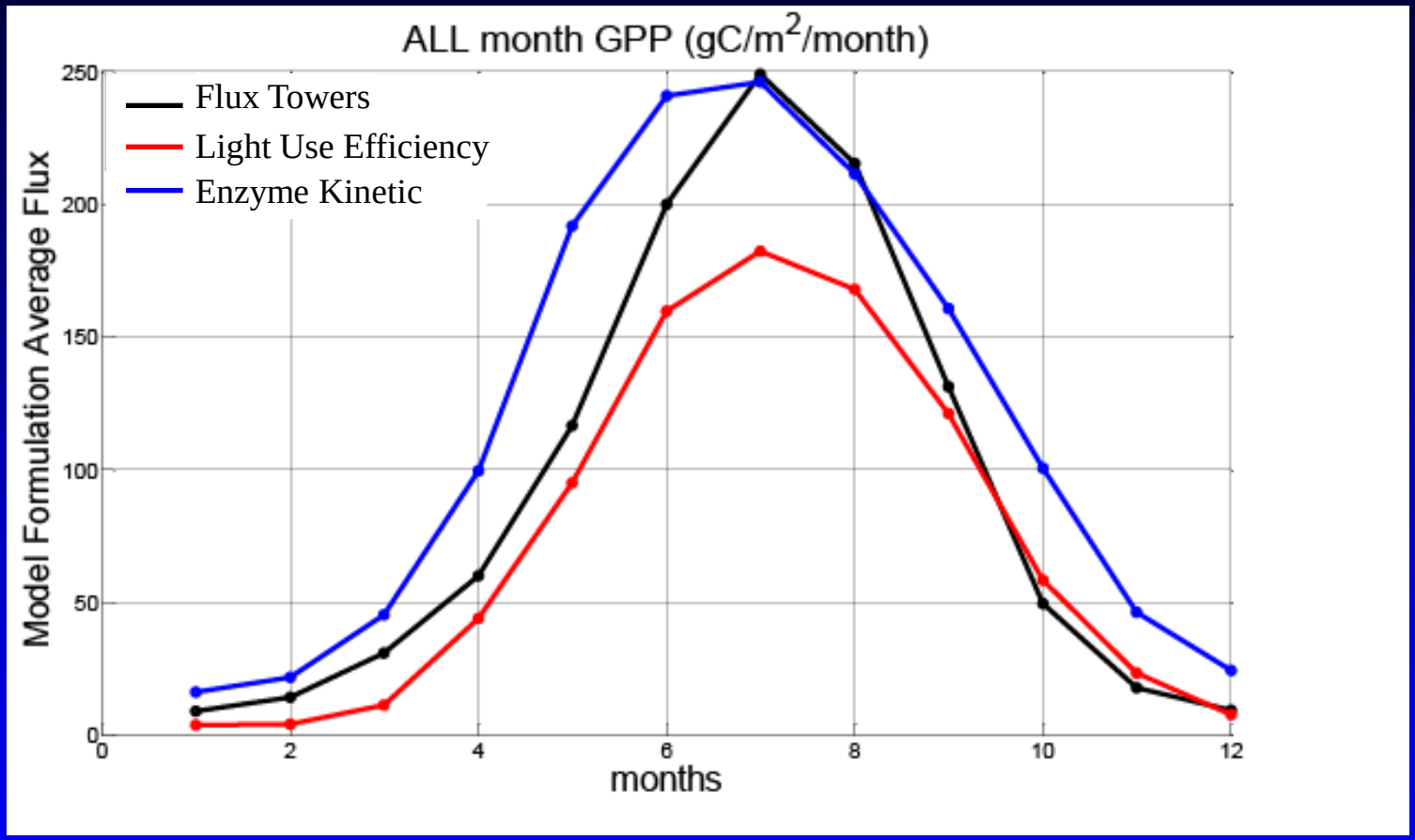
- Models match observations only some of the time

Phenology (*Richardson et al.*)



- Early/late uptake means positive GPP bias
- Models need better phenology

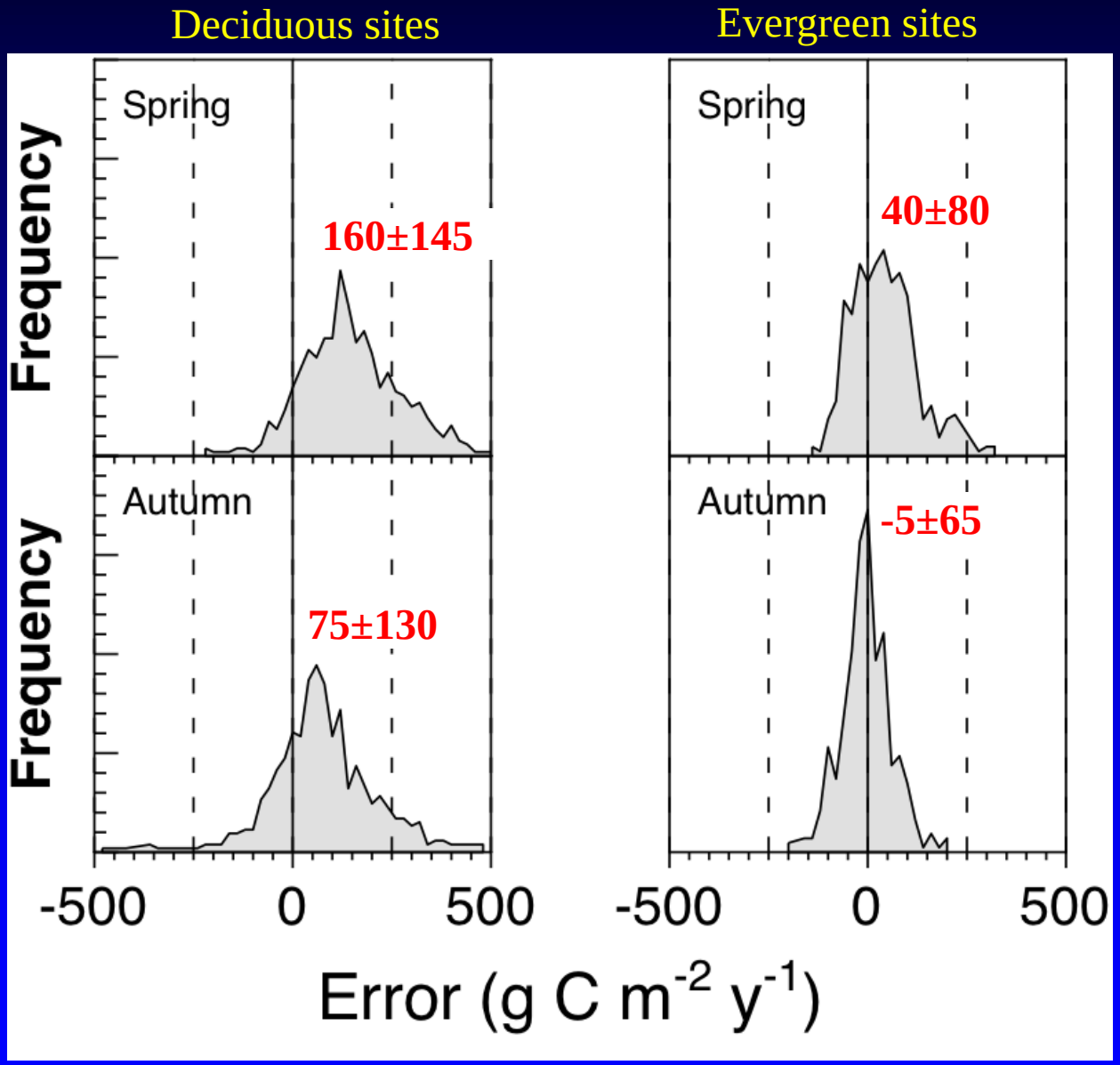
Regional vs. Site (*Raczka et al.*)



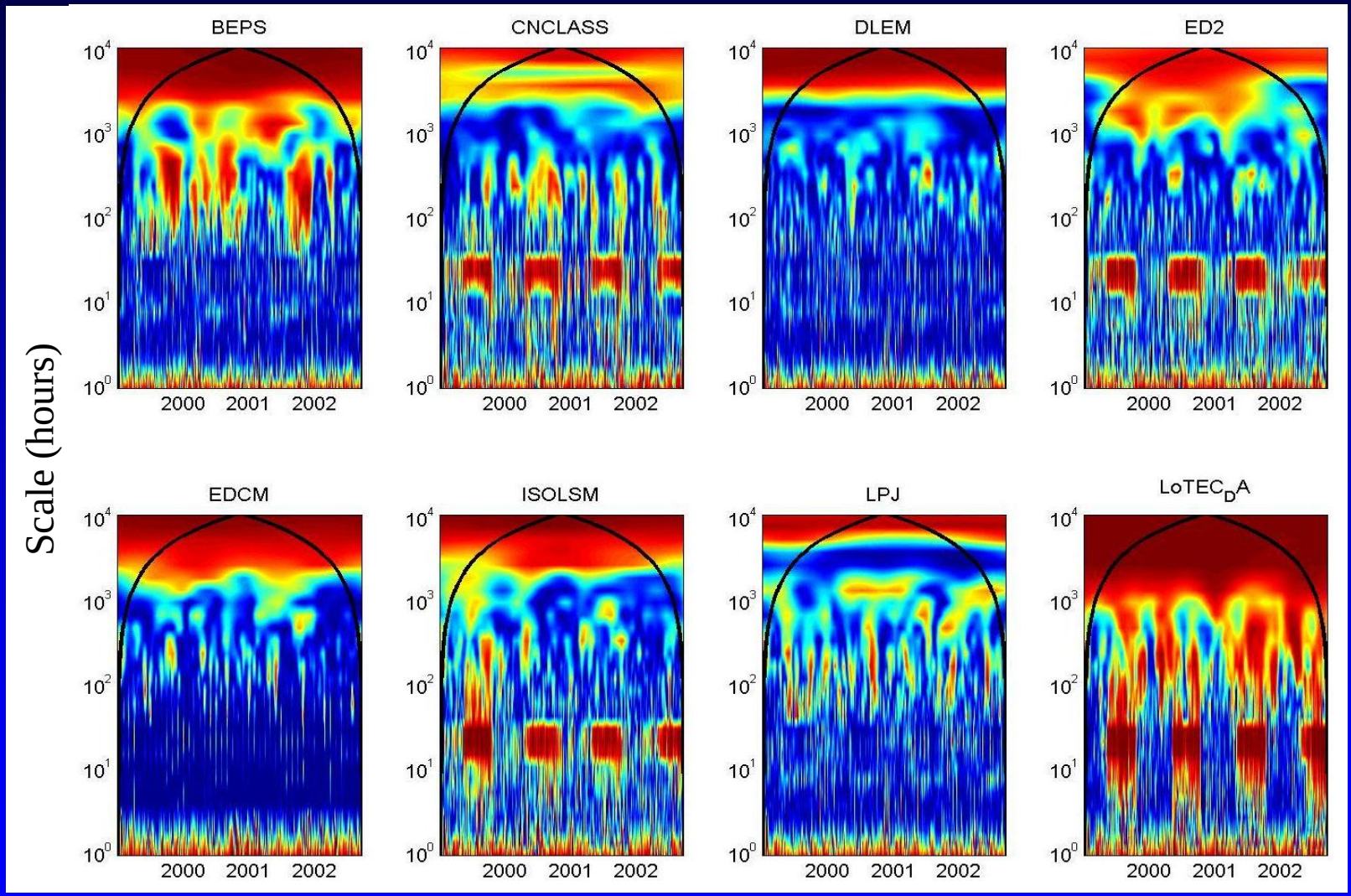
- Enzyme kinetic models biased high
- LUE models biased low

Extra Slides

Annual GPP Bias due to Phenology

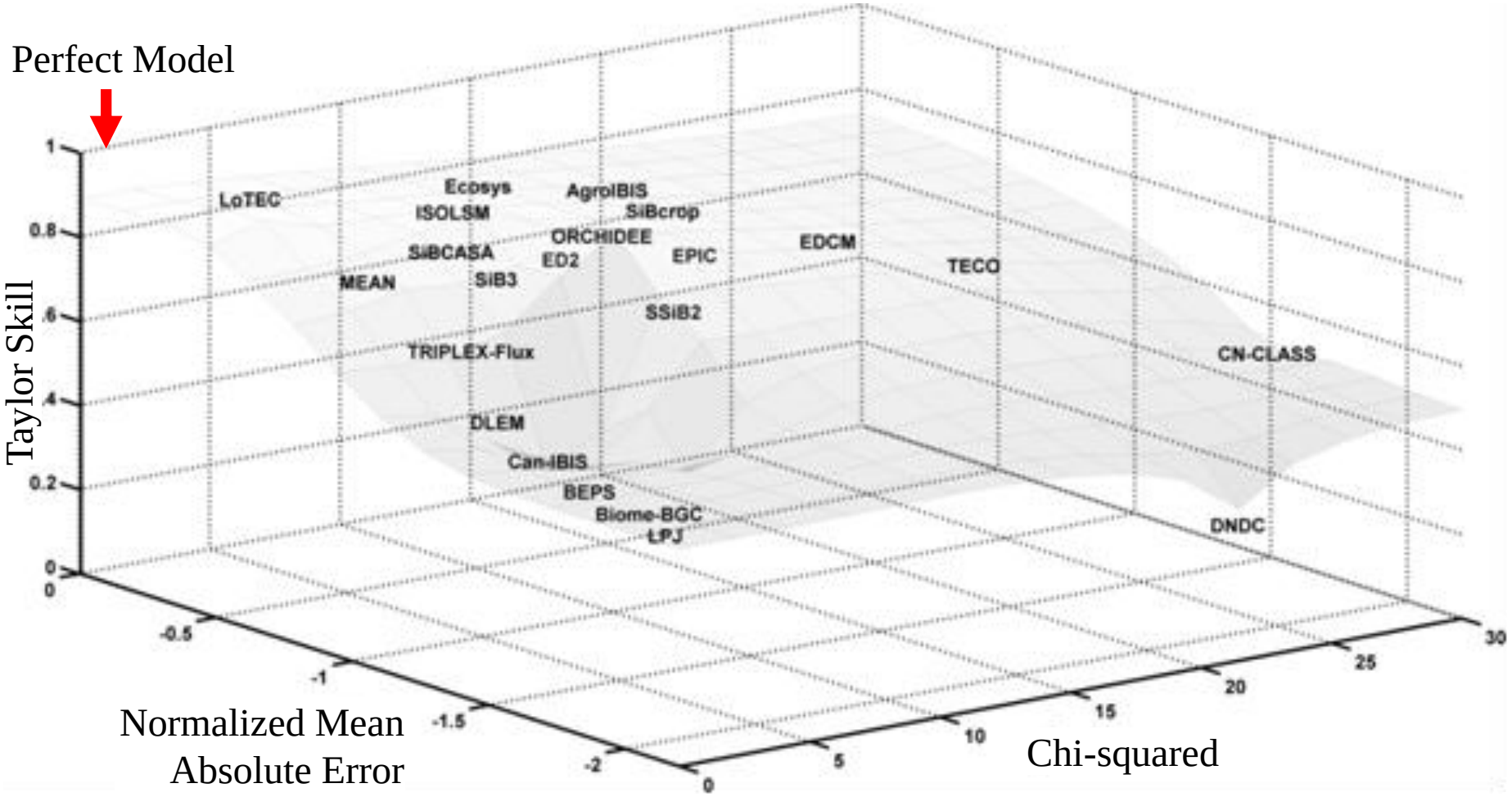


Multi-Model wavelet Coherence



NEE Seasonal Cycle (*Schwalm et al.*)

Our 1st published paper!



U*th vs. Random Uncertainty (*Barr et al.*)