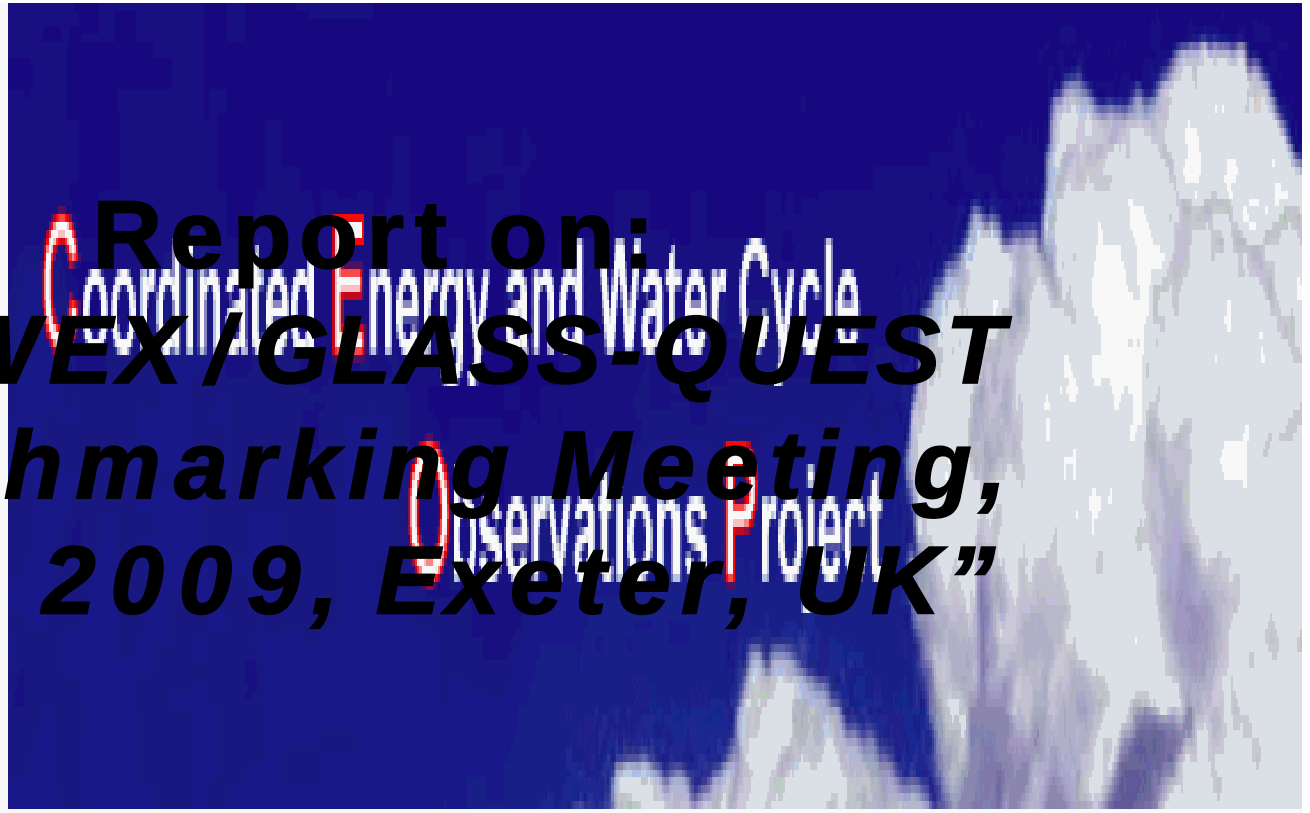



# Report on:
# "GEWEX/GLASS-QUEST Benchmarking Meeting, June 2009, Exeter, UK"

**Michael Ek, NCEP/EMC**

**3rd CEOP meeting**

**19-21 August 2009,**

**BoM, Melbourne, Australia**

# GLASS / QUEST Benchmarking Meeting

Martin Best (martin.best@metoffice.gov.uk)

Exeter University, 22-24 June 2009

- GEWEX/GLASS (Global Land Atmosphere System Study)
- QUEST ("Quantifying and Understanding the Earth System", UK Natural Environment Research Council)

# *What is benchmarking?*

- ***Validation***
  How good is our model?
  What might we need to improve?

- ***Benchmarking***
  Is our model good enough?
  What needs to be improved?

# Key Questions / Issues

- What do we need to benchmark?
- Do we have the right data sets?
- What is *good enough?*
- Need to define what metrics should be.

# *Goal of Meeting*

- Have an internationally accepted tool for benchmarking land surface models available to the community (*Ultimate Goal*)
- Define an agreed set of benchmarks that can be applied to land-surface models for *Energy, Water & Carbon* (*Make Progress*)
- Write a review article on current benchmarking/validation activities & what is still needed.

# Preliminary Summary

- Presentations on benchmarking-related activities: weather & climate/research & ops.
- Categories for benchmarking: NWP, Climate Systems, Process Studies, and Impacts on Humans and Ecosystems.
- Variables: surface energy & water budgets, near-surface meteorol., land states/surface conditions, e.g. vegetation/biomass, snow, ecosystem variables, trace gasses, etc.
- Data sets: in-situ and remote sensing.
- Next steps: Continue/extend existing activities, e.g. ”C-LAMP”, ”ILAMP”, etc.

# Using CEOP data for model evaluation and development

**Michael Ek[1] and Sid Katz[2]**

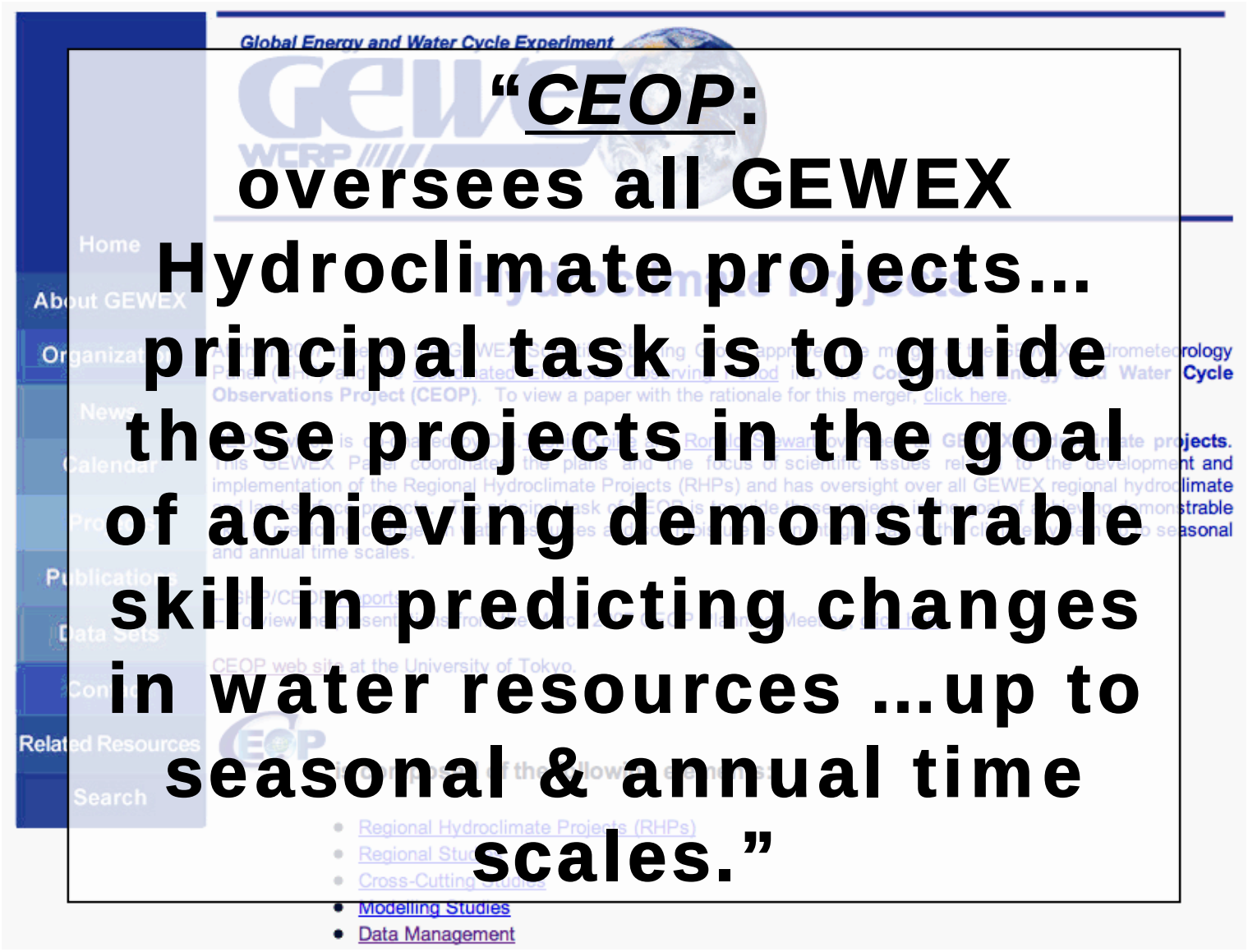
***National Centers for Environmental Prediction (NCEP)***

*[1]NCEP Environmental Prediction Center (EMC)*

*[2]NCEP Climate Prediction Center (CPC)*

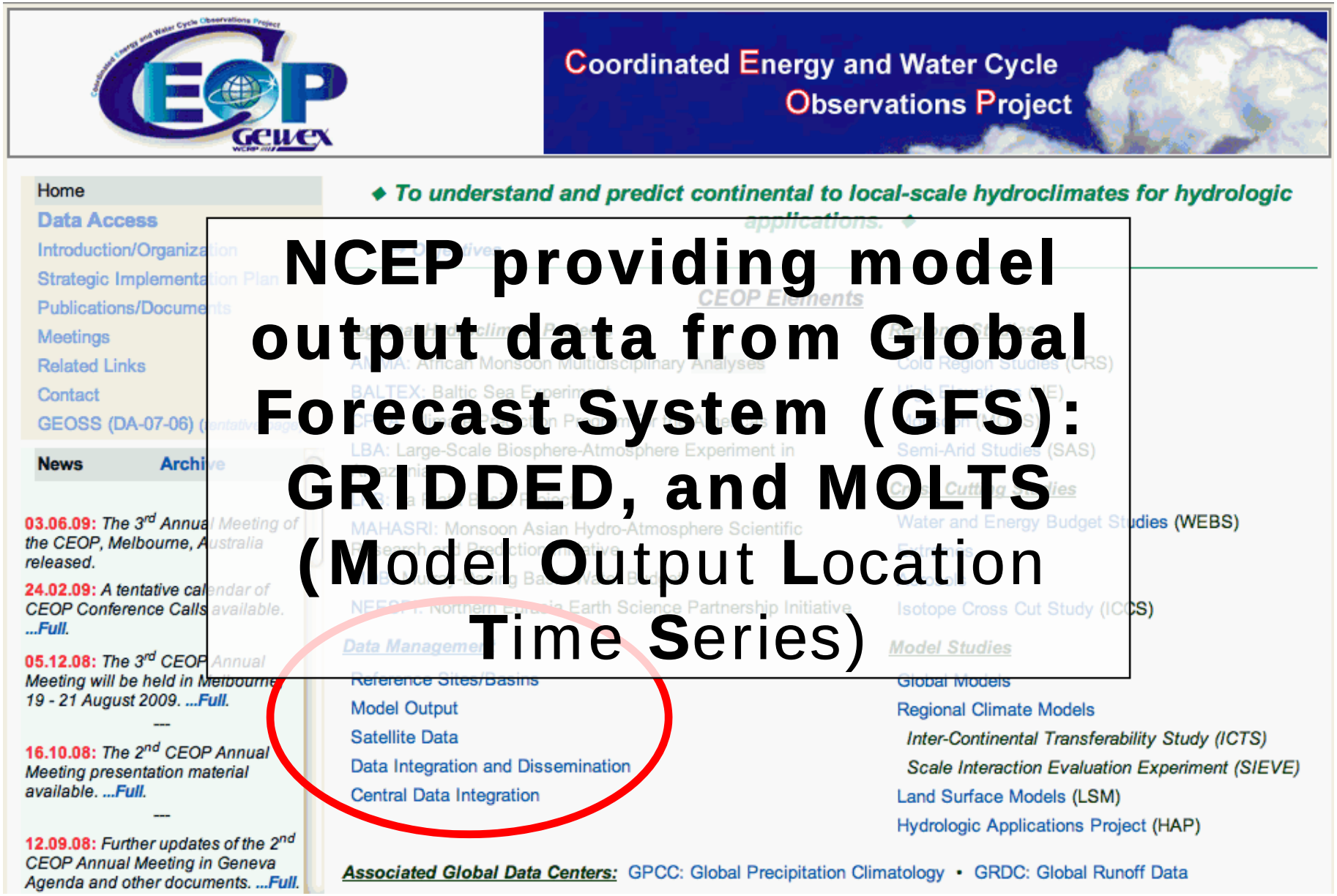
***Camp Springs, Maryland, USA***

*QUEST/GLASS Benchmarking meeting*
*22-24 June 2009, Univ. Exeter, UK*




**"*CEOP*: oversees all GEWEX Hydroclimate projects… principal task is to guide these projects in the goal of achieving demonstrable skill in predicting changes in water resources …up to seasonal & annual time scales."**

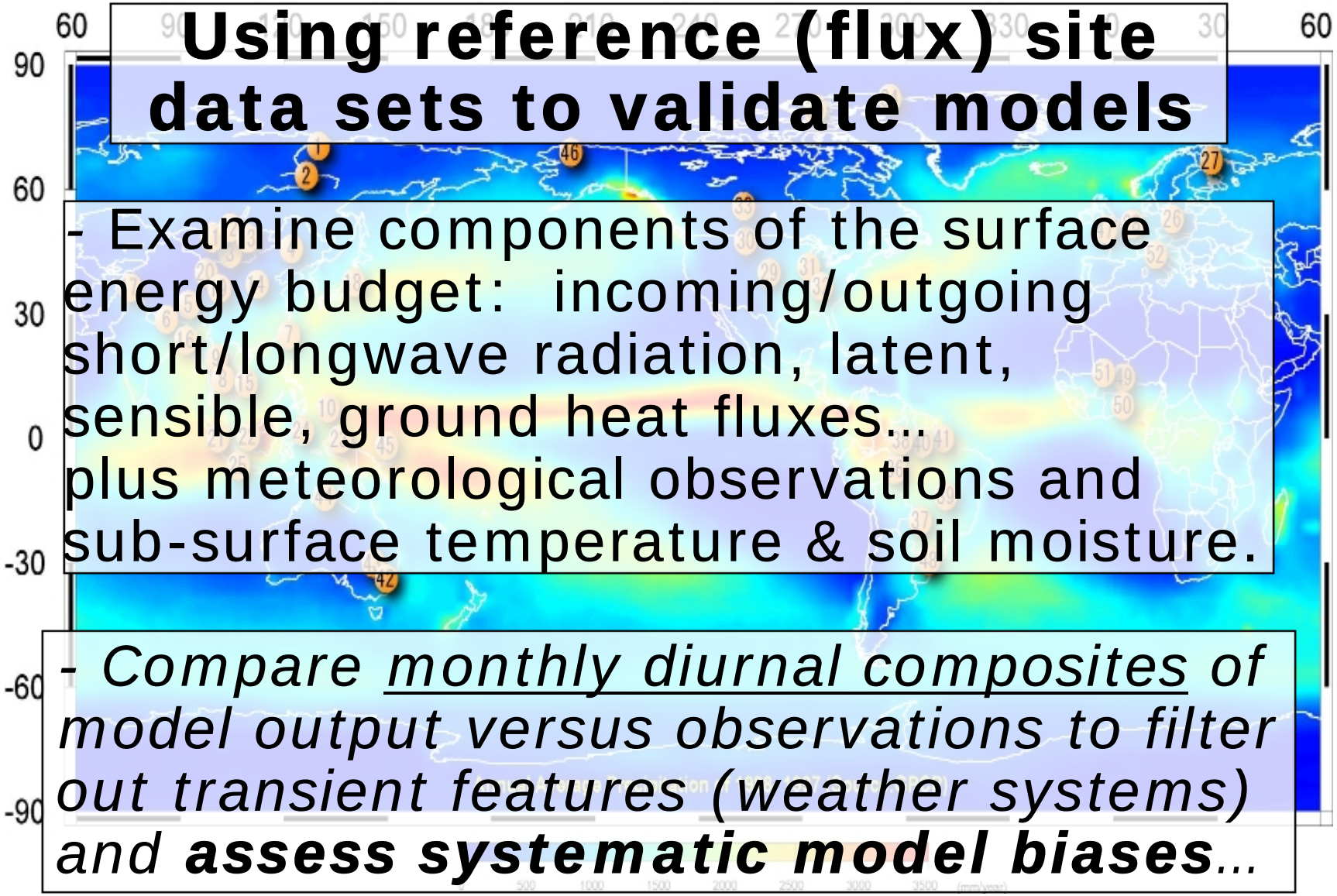
**www.gewex.org/projects-CEOP.htm**




# NCEP providing model output data from Global Forecast System (GFS): GRIDDED, and MOLTS (Model Output Location Time Series)

**monsoon.t.u-tokyo.ac.jp/ceop2**

# Reference Site / Basin Data Archive

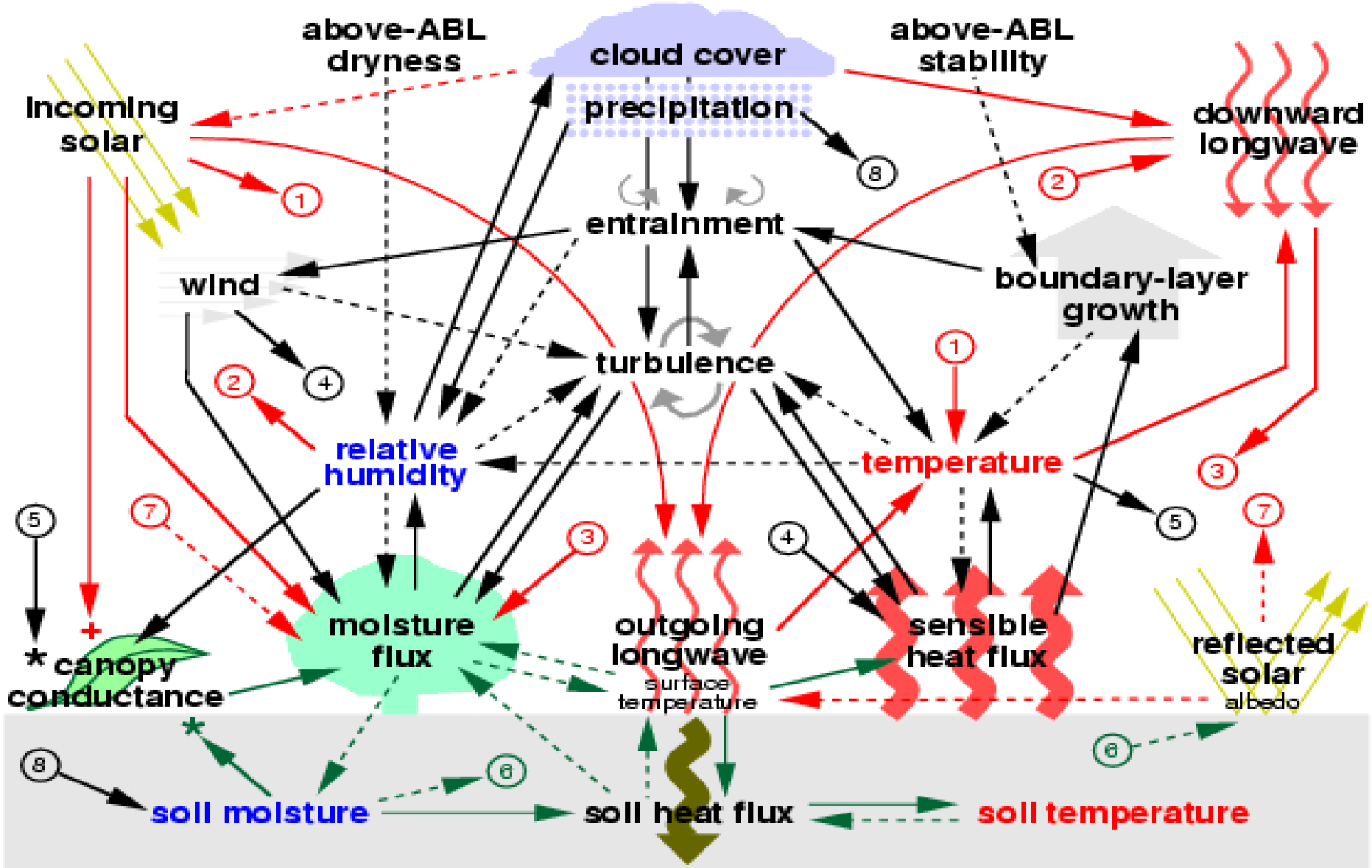


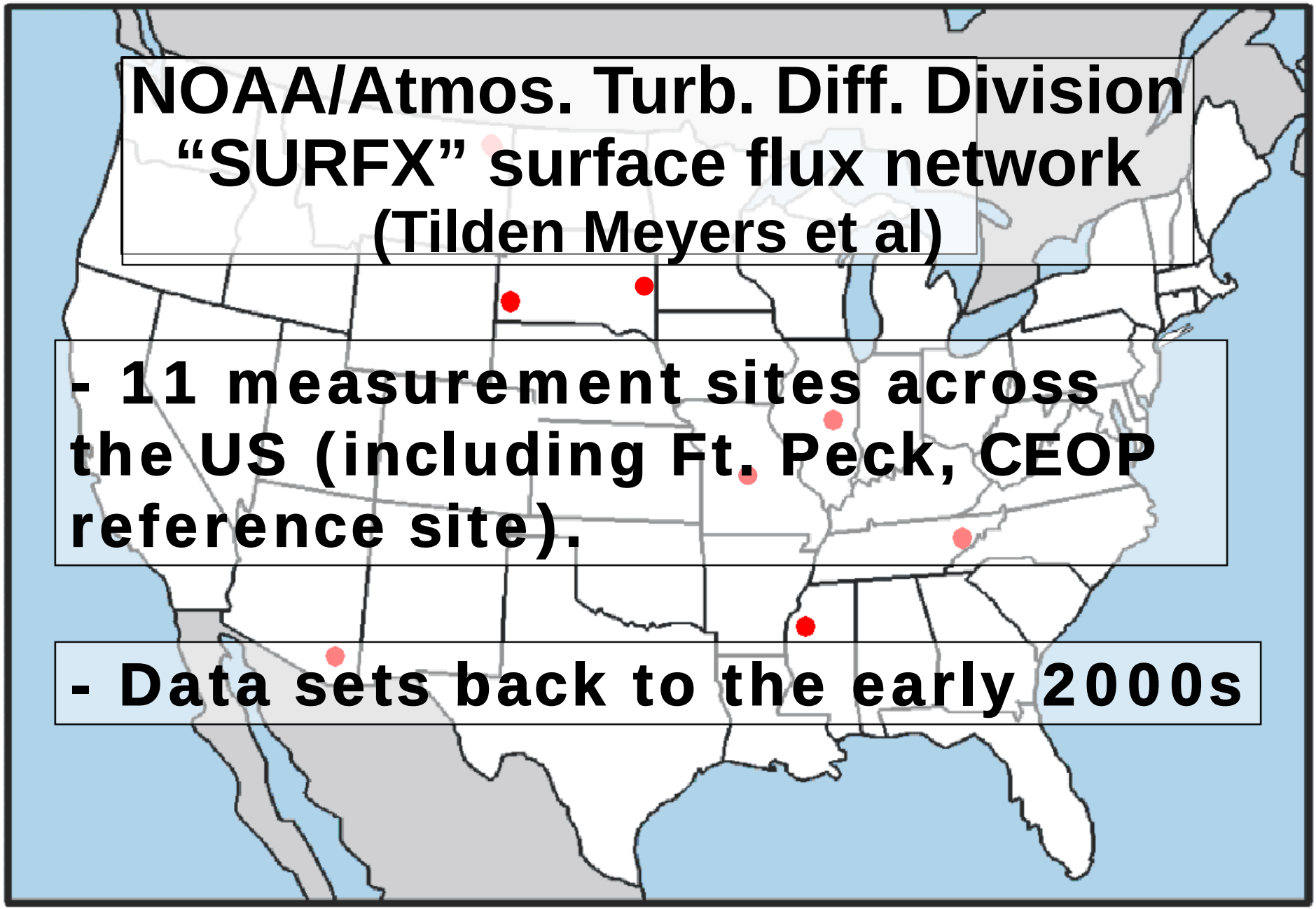

## Using reference (flux) site data sets to validate models

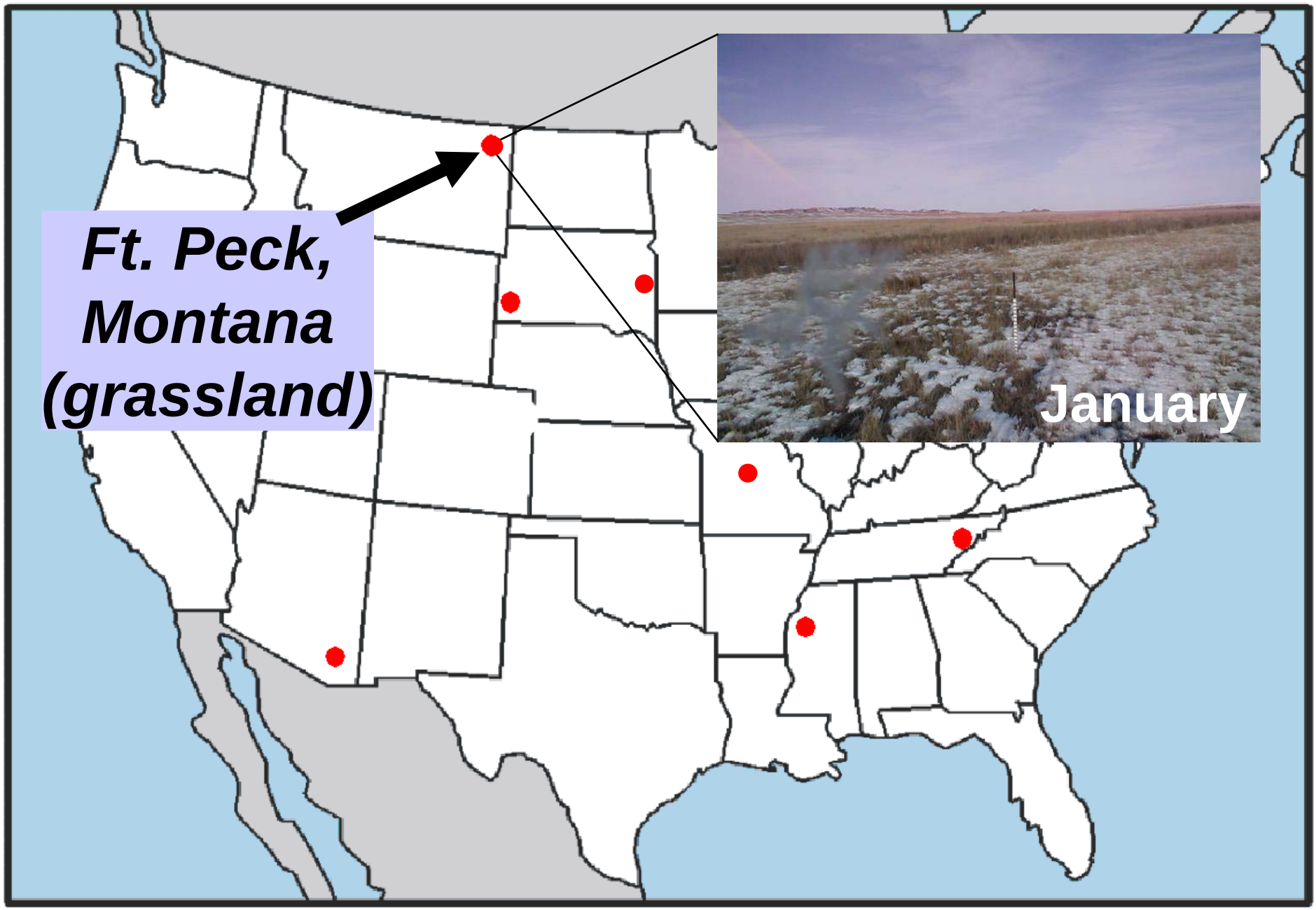
- Examine components of the surface energy budget: incoming/outgoing short/longwave radiation, latent, sensible, ground heat fluxes…
plus meteorological observations and sub-surface temperature & soil moisture.

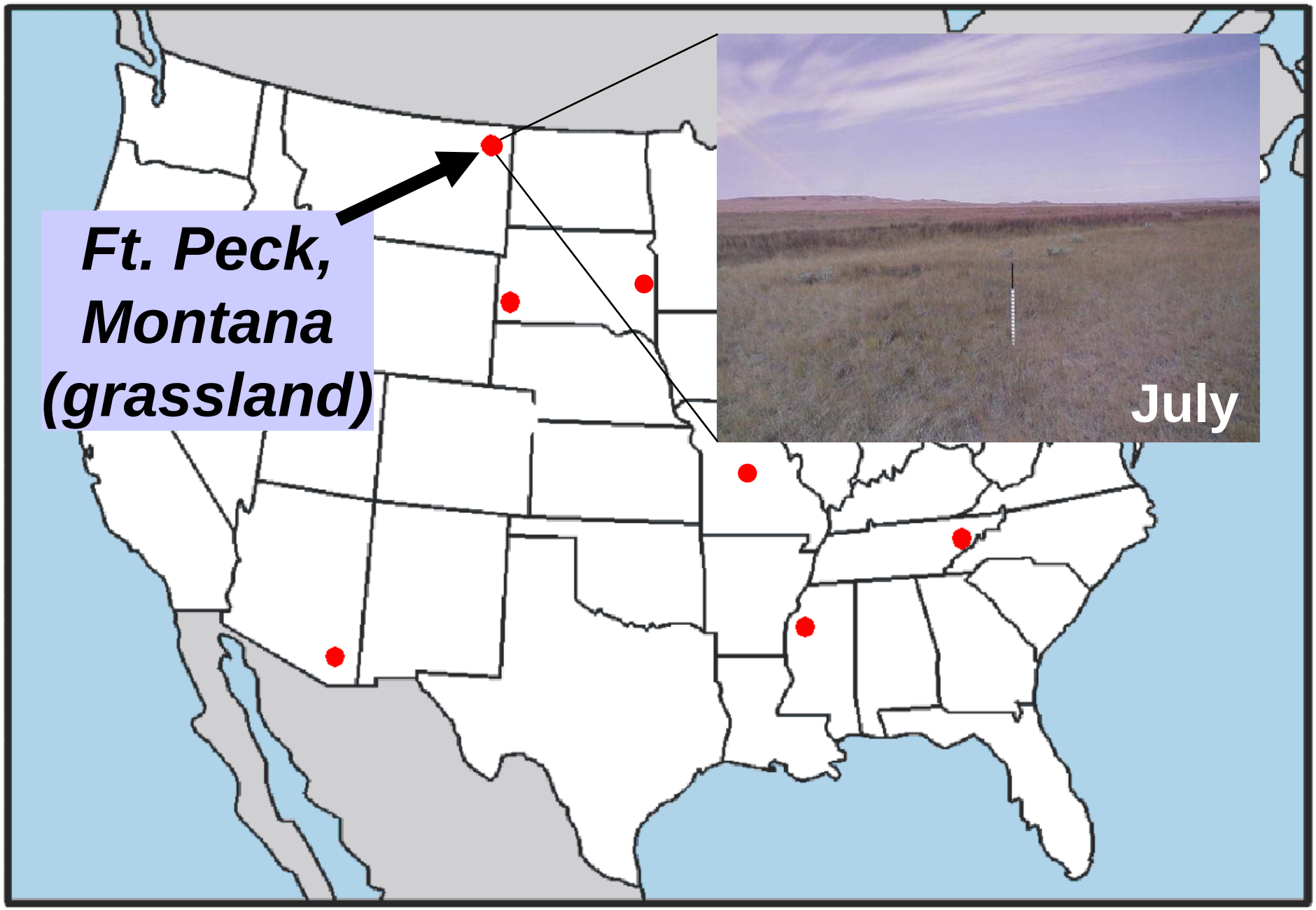
*- Compare <u>monthly diurnal composites</u> of model output versus observations to filter out transient features (weather systems) and **assess systematic model biases**…*

# land-surface - ABL - radiation interactions



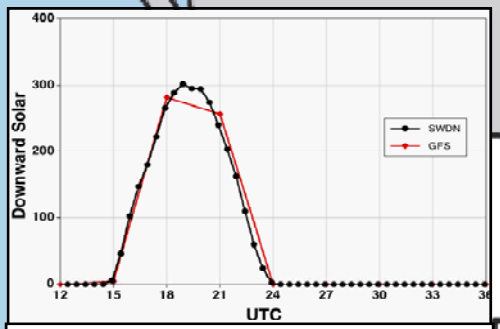

NOAA/Atmos. Turb. Diff. Division
"SURFX" surface flux network
(Tilden Meyers et al)
- 11 measurement sites across the US (including Ft. Peck, CEOP reference site).
- Data sets back to the early 2000s


Ft. Peck, Montana (grassland)
January

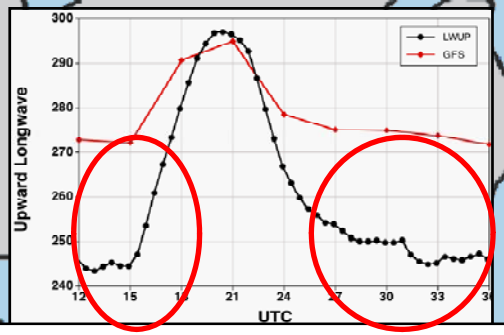

Ft. Peck, Montana (grassland)
July

Ft. Peck, Montana
(grassland)

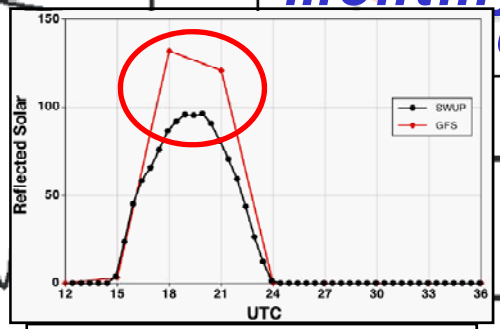
**SURFACE ENERGY BUDGET TERMS**
**January 2008**
**monthly averages:**
**model vs obs**



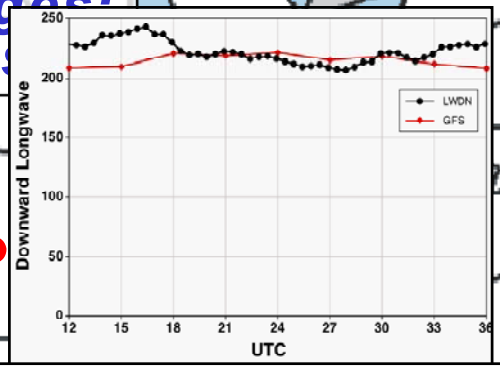

Downward Solar



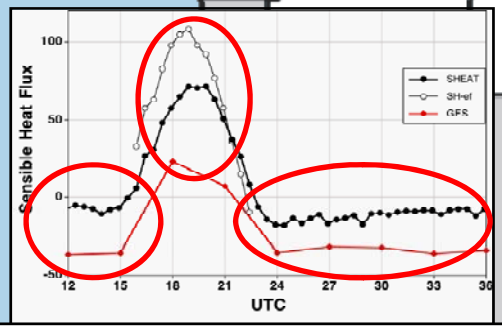

Upward Longwave



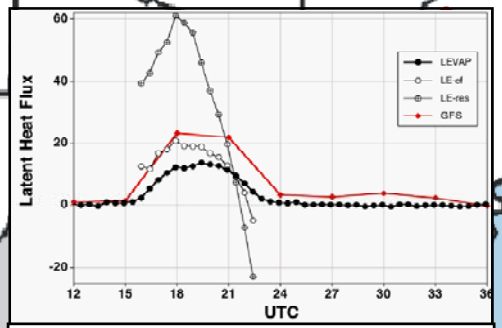

Reflected Solar



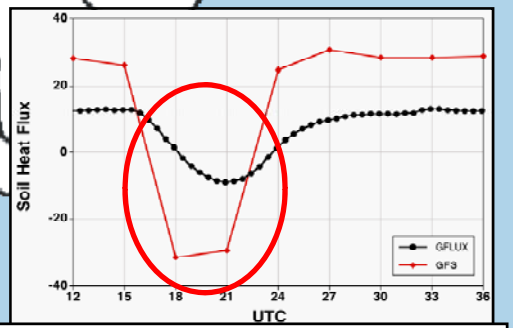

Downward Longwave



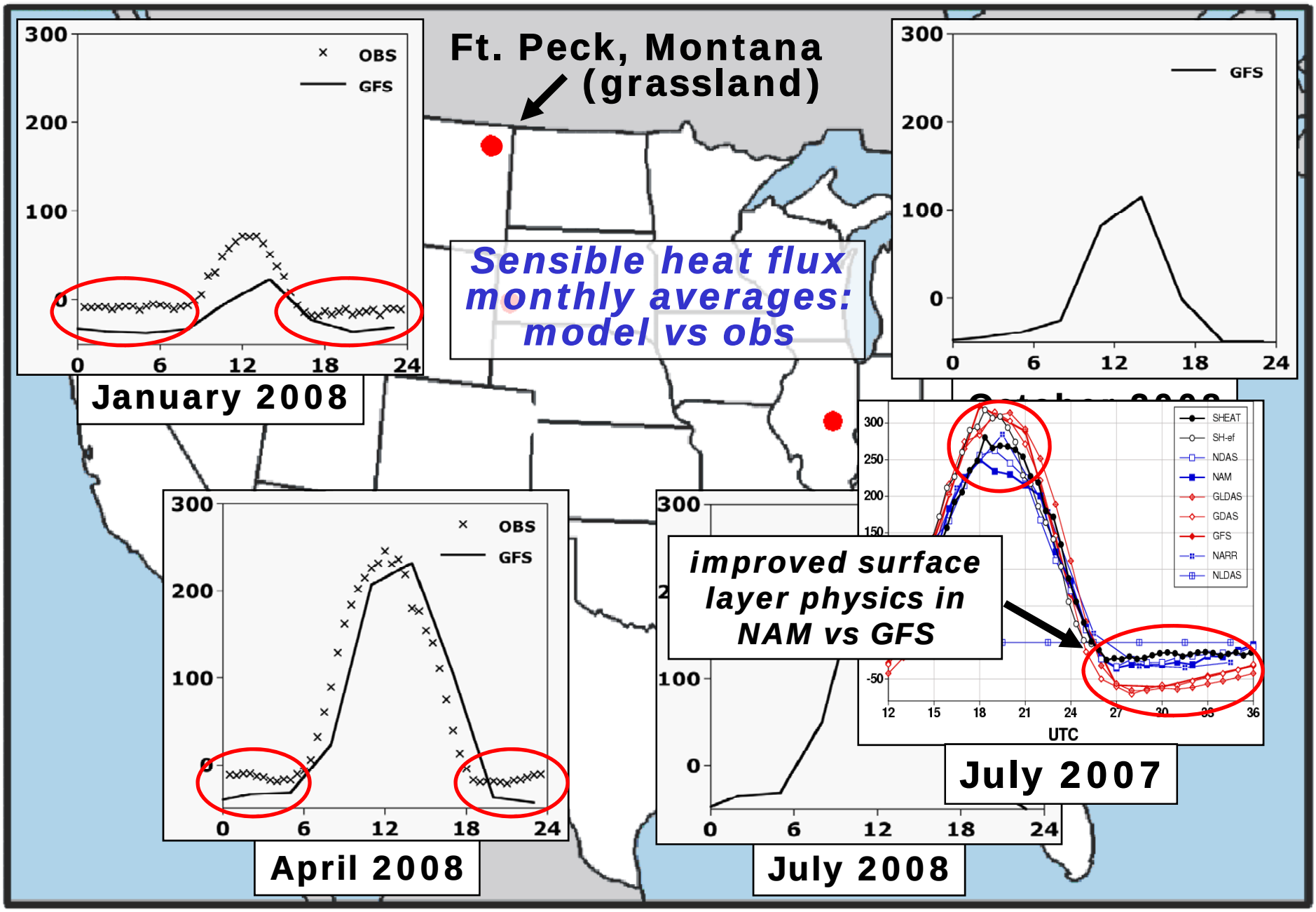

Sensible Heat Flux

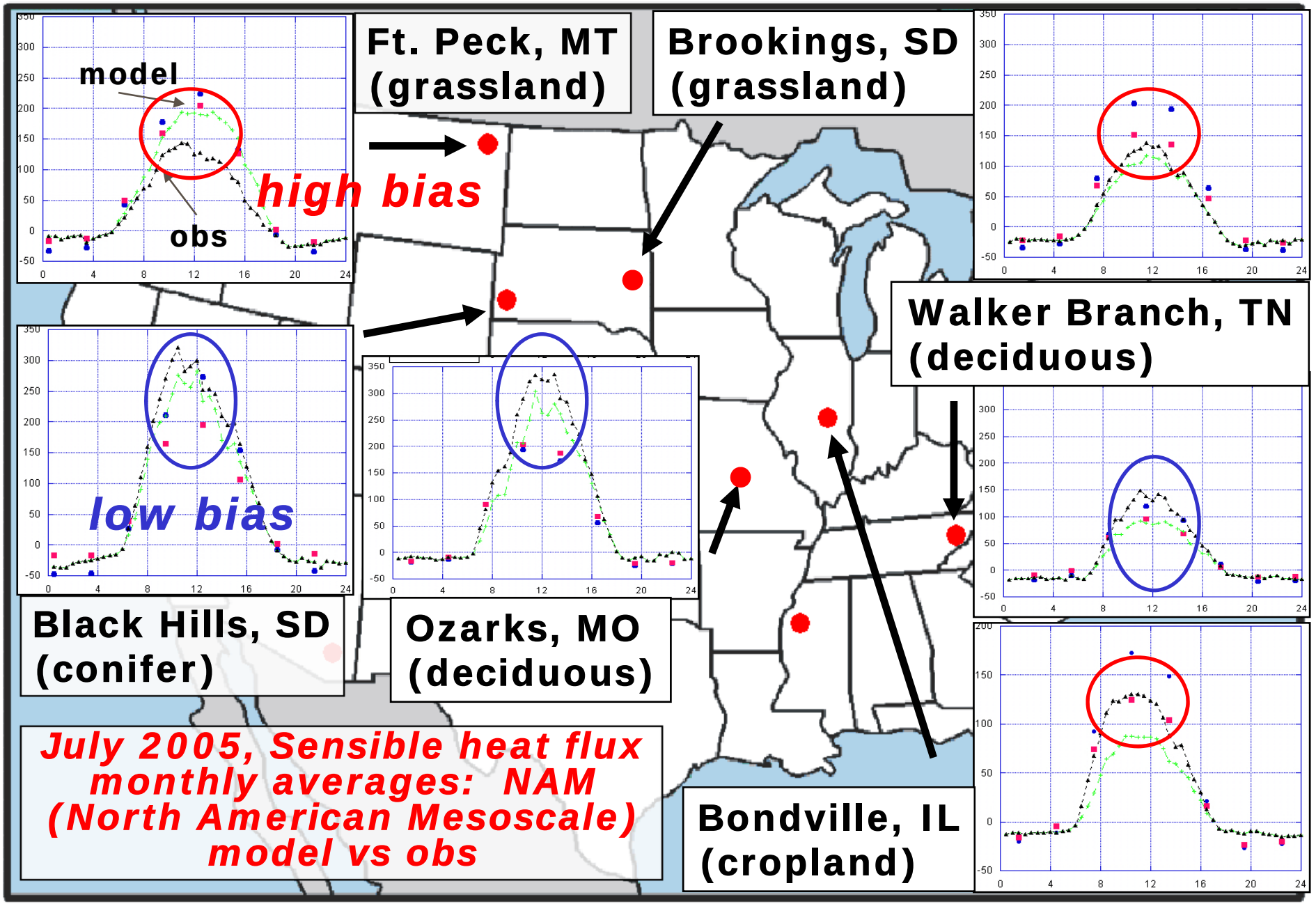



Latent Heat Flux




Ground Heat Flux


Ft. Peck, Montana
(grassland)
Sensible heat flux
monthly averages:
model vs obs
OBS
GFS
January 2008
April 2008
July 2008
July 2007
improved surface
layer physics in
NAM vs GFS
SHEAT
SH-ef
NDAS
NAM
GLDAS
GDAS
GFS
NARR
NLDAS
UTC


model
obs
high bias
Ft. Peck, MT
(grassland)
Brookings, SD
(grassland)
Walker Branch, TN
(deciduous)
low bias
Black Hills, SD
(conifer)
Ozarks, MO
(deciduous)
Bondville, IL
(cropland)
July 2005, Sensible heat flux monthly averages: NAM (North American Mesoscale) model vs obs

# Summary/Future

- NCEP providing GRIDDED and MOLTS (time series) model output to CEOP data archive for model evaluation; continue these CEOP efforts.

- As the CEOP system matures, further model validation for many different regions and seasons, systematically (i.e. benchmarking).

- Further model physics evaluation and development using reference (flux) site data sets, e.g. as applied to canopy conductance and surface-layer turbulence, systematically.