



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.



Met Office
Hadley Centre

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

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Camp Springs, Maryland, USA

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

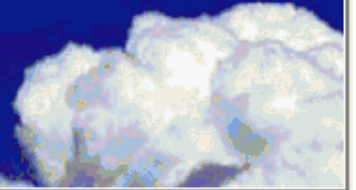
GEWEX
WCRP

**"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."**

- [Regional Hydroclimate Projects \(RHPs\)](#)
- [Regional Studies](#)
- [Cross-Cutting Studies](#)
- [Modelling Studies](#)
- [Data Management](#)

www.gewex.org/projects-CEOP.htm



Home

Data Access

Introduction/Organization

Strategic Implementation Plan

Publications/Documents

Meetings

Related Links

Contact

GEOS (DA-07-06)

News

Archive

03.06.09: The 3rd Annual Meeting of the CEOP, Melbourne, Australia released.

24.02.09: A tentative calendar of CEOP Conference Calls available. ...Full.

05.12.08: The 3rd CEOP Annual Meeting will be held in Melbourne 19 - 21 August 2009. ...Full.

16.10.08: The 2nd CEOP Annual Meeting presentation material available. ...Full.

12.09.08: Further updates of the 2nd CEOP Annual Meeting in Geneva Agenda and other documents. ...Full.

◆ To understand and predict continental to local-scale hydroclimates for hydrologic applications.

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

Data Management

Reference Sites/Basins

Model Output

Satellite Data

Data Integration and Dissemination

Central Data Integration

CEOP Elements

AMMA: African Monsoon Multidisciplinary Analysis

BALTEX: Baltic Sea Experiment

CEOP: Coordinated Energy and Water Cycle Observations Project

LBA: Large-Scale Biosphere-Atmosphere Experiment in Amazonia

MAHASRI: Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative

NEEP: Northern Eurasia Earth Science Partnership Initiative

Global Studies

Cold Region Studies (CRS)

High Flux Asia (HFA)

Monsoon Asia (MA)

Semi-Arid Studies (SAS)

Cross Cutting Studies

Water and Energy Budget Studies (WEBS)

Isotope Cross Cut Study (ICCS)

Model Studies

Global Models

Regional Climate Models

Inter-Continental Transferability Study (ICTS)

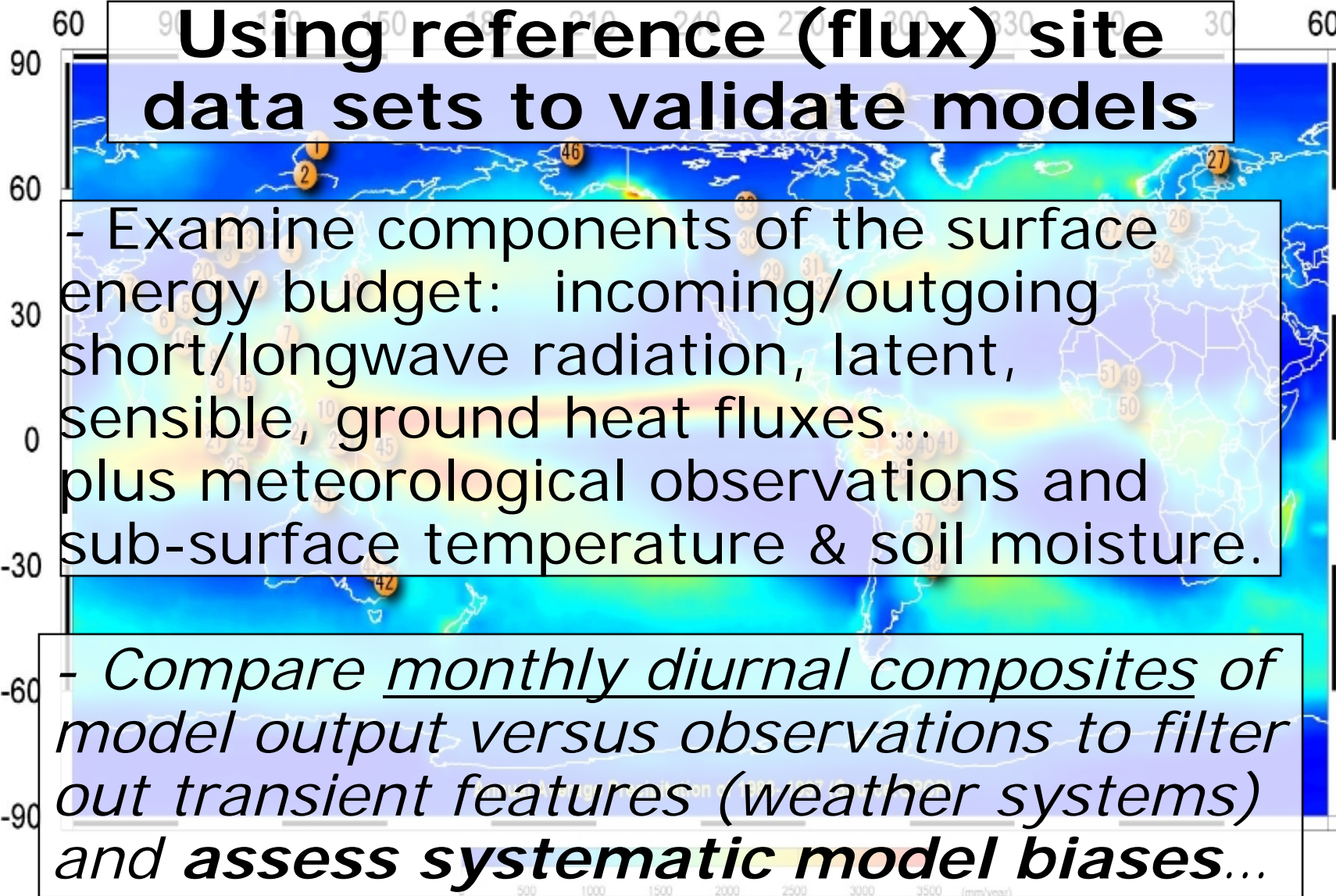
Scale Interaction Evaluation Experiment (SIEVE)

Land Surface Models (LSM)

Hydrologic Applications Project (HAP)

Associated Global Data Centers: GPCP: Global Precipitation Climatology • GRDC: Global Runoff Data

Reference Site/Basin Data Archive

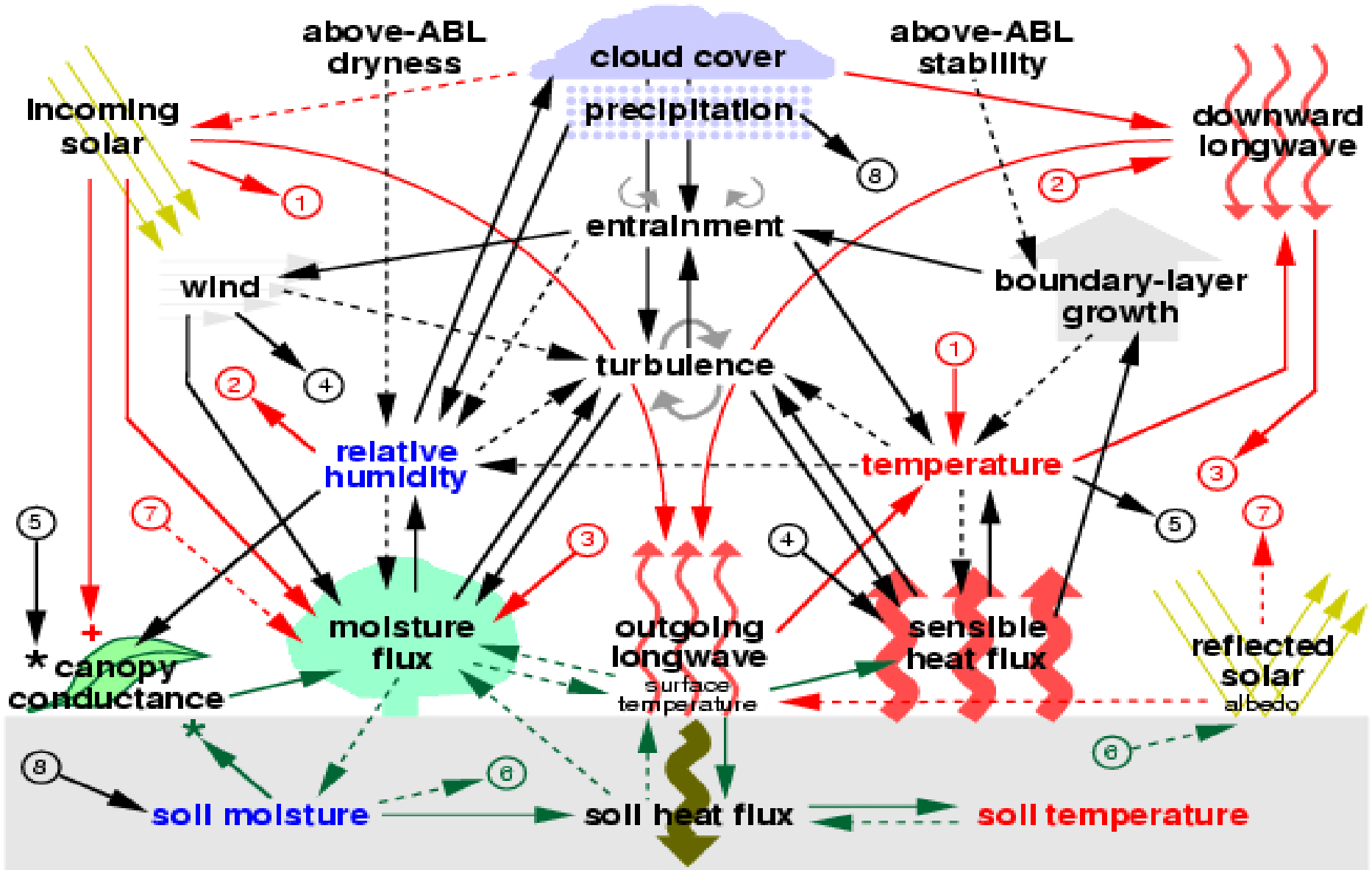
A world map showing reference sites marked with numbered orange circles. The map uses a color scale from blue (low values) to red (high values). The sites are numbered 1 through 52, with some numbers appearing multiple times in different locations. The map includes latitude and longitude markings.

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 monthly diurnal composites of model output versus observations to filter out transient features (weather systems) and **assess systematic model biases**...*

land-surface - ABL - radiation interactions



+ positive feedback for C3, C4 plants, negative feedback for CAM plants

* negative feedback above optimal values

——▶ surface layer/ABL processes
 ——▶ land-surface
 ——▶ radiation
 - - - -▶ negative feedback



**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)***

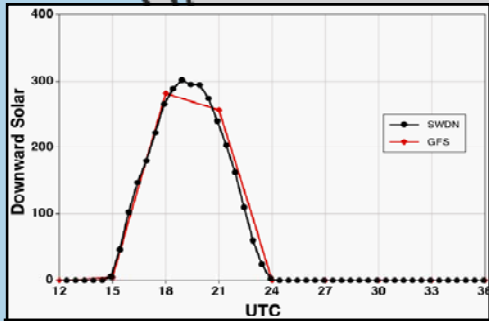


January

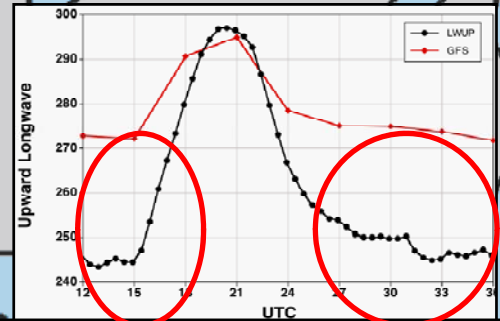
***Ft. Peck,
Montana
(grassland)***



Ft. Peck, Montana
(grassland)

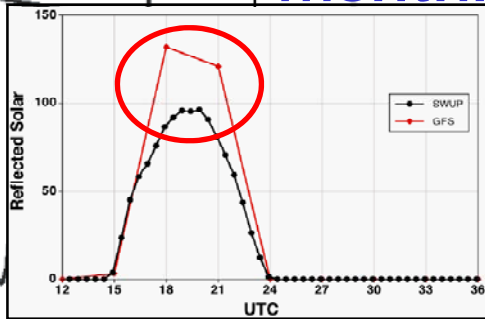


Downward Solar

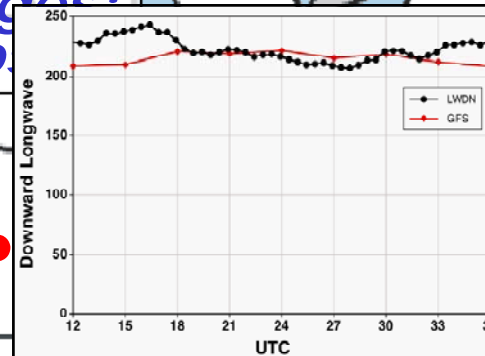


Upward Longwave

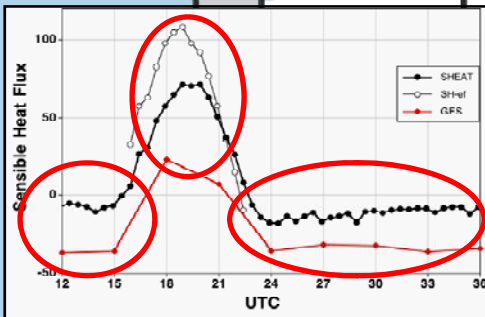
SURFACE ENERGY BUDGET TERMS
January 2008
monthly averages: model vs ob



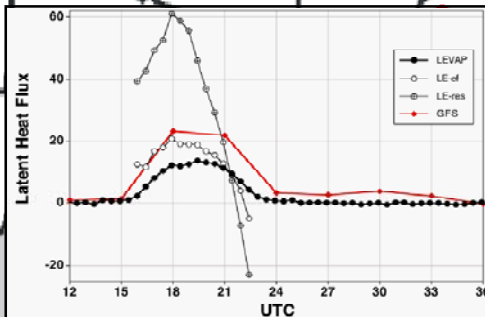
Reflected Solar



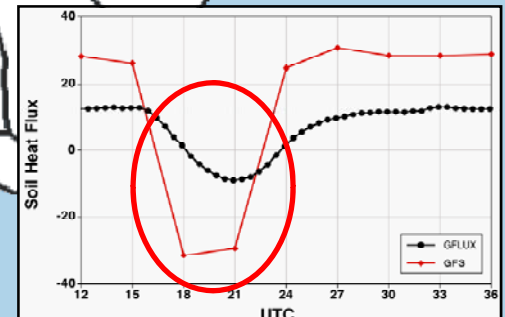
Downward Longwave



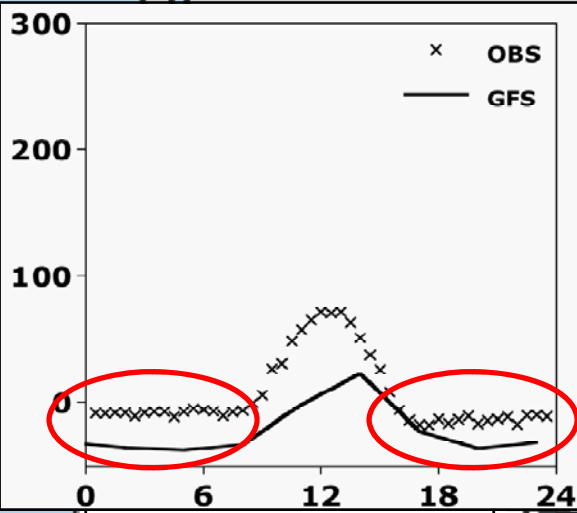
Sensible Heat Flux



Latent Heat Flux



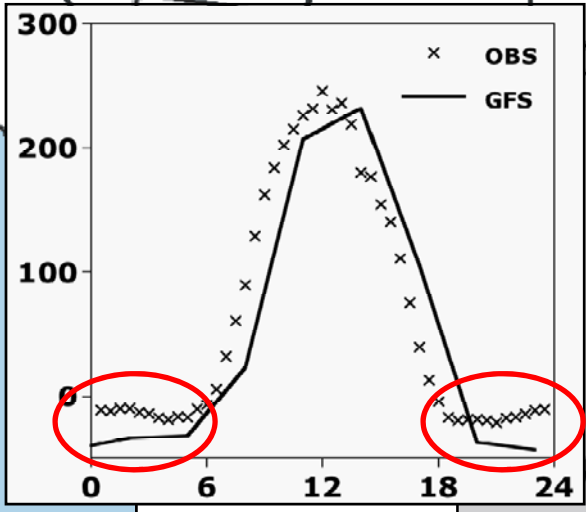
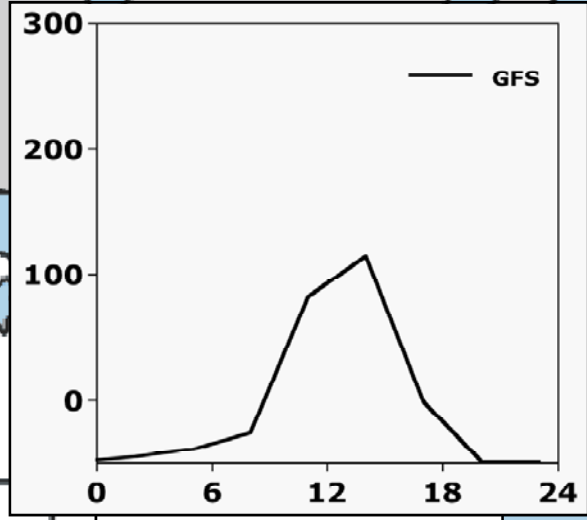
Ground Heat Flux



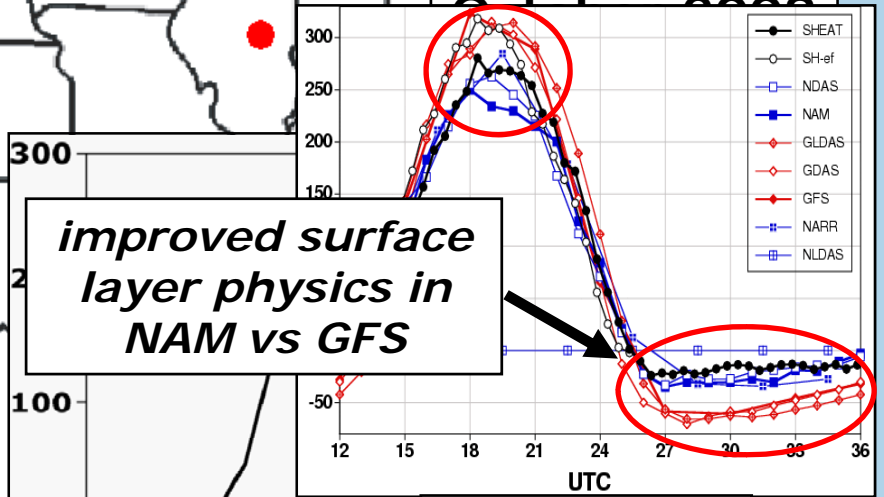
January 2008

Ft. Peck, Montana
(grassland)

*Sensible heat flux
monthly averages:
model vs obs*

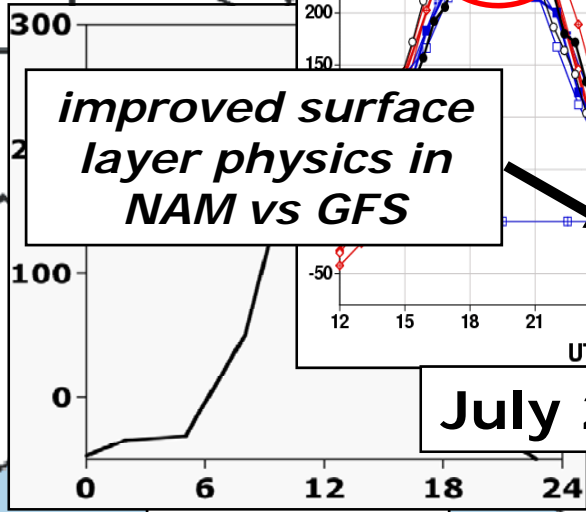


April 2008



*improved surface
layer physics in
NAM vs GFS*

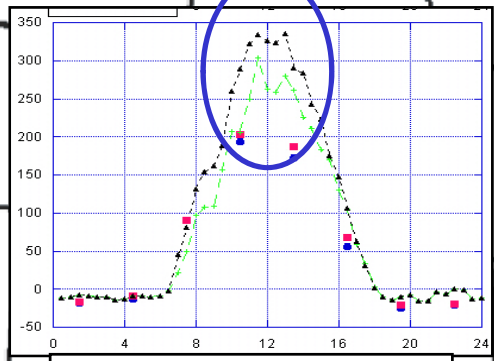
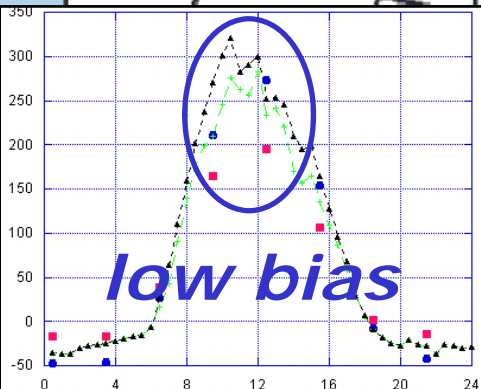
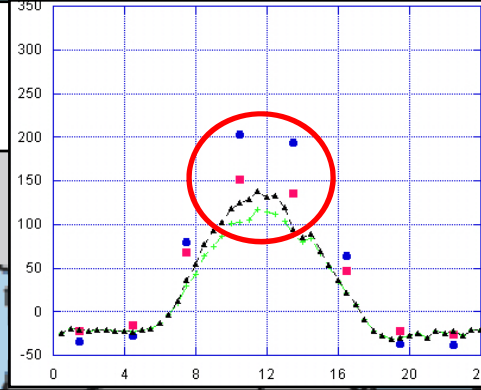
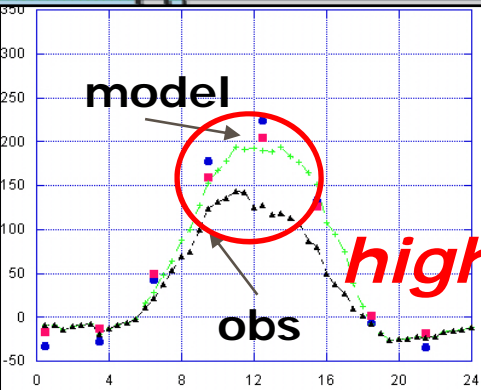
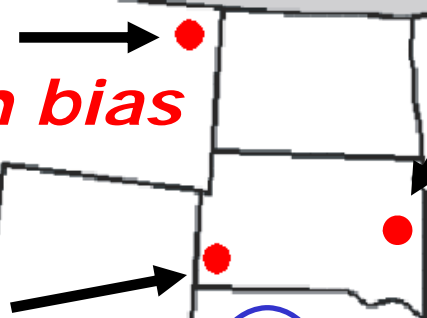
July 2007



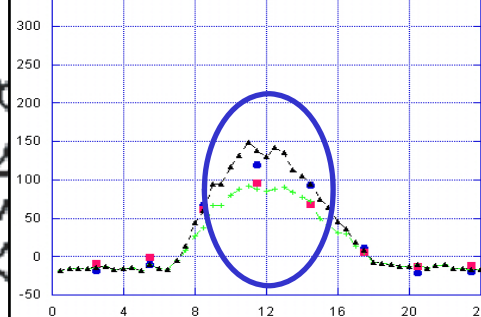
July 2008

**Ft. Peck, MT
(grassland)**

**Brookings, SD
(grassland)**



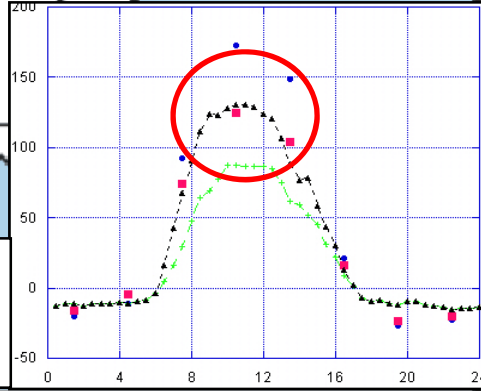
**Walker Branch, TN
(deciduous)**



**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.