# Thermal coupling between boundary layer and land surface: The GLASS perspective

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ECMWF/GABLS Workshop on diurnal cycles and the stable atmospheric boundary layer

7th – 10th November 2011, ECMWF

# GLASS perspective:

No current interest in night time (stable BL)

Only studying daytime (unstable BL)!

# Overview

- GLASS overview
- Surface physics
- GABLS-3 results: A GLASS perspective
- Possible GLASS/GABLS joint project?

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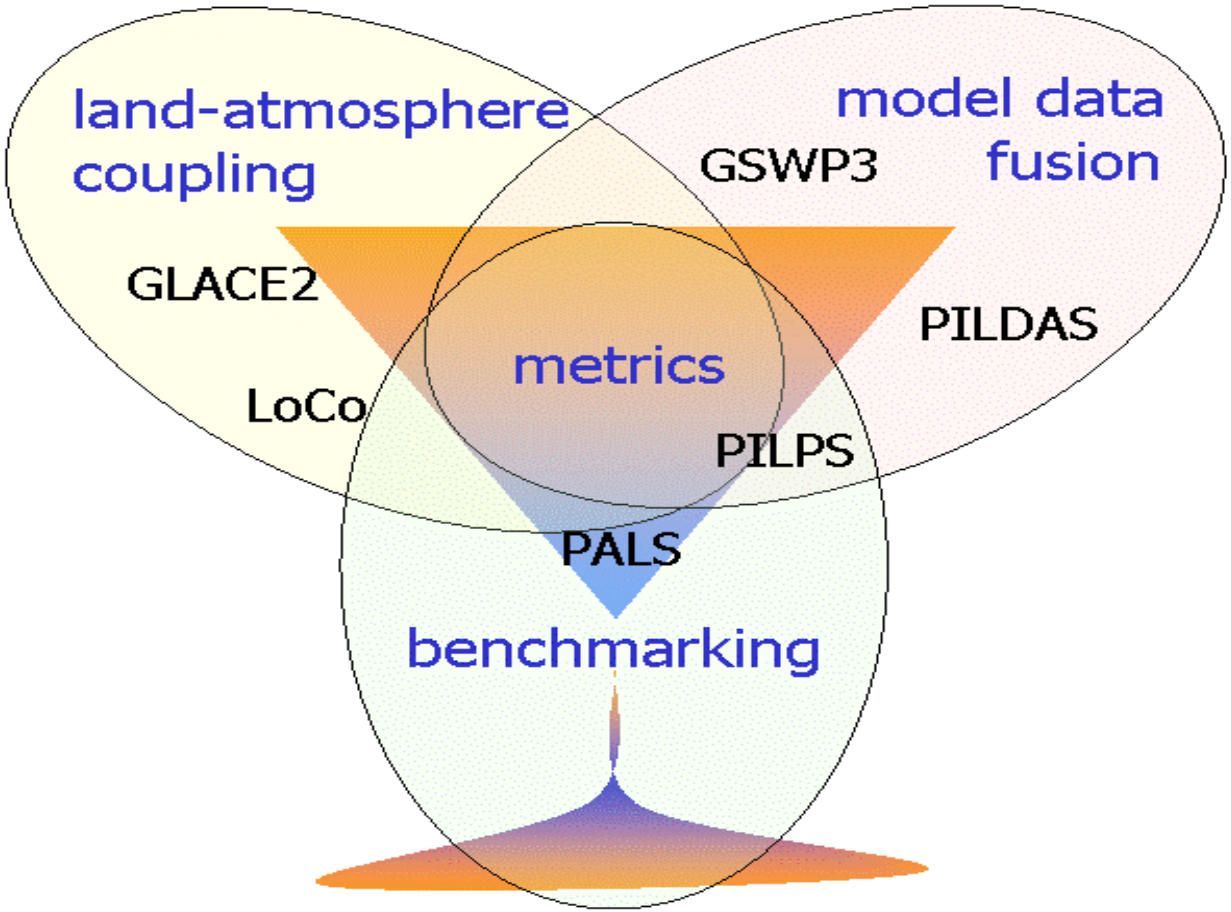
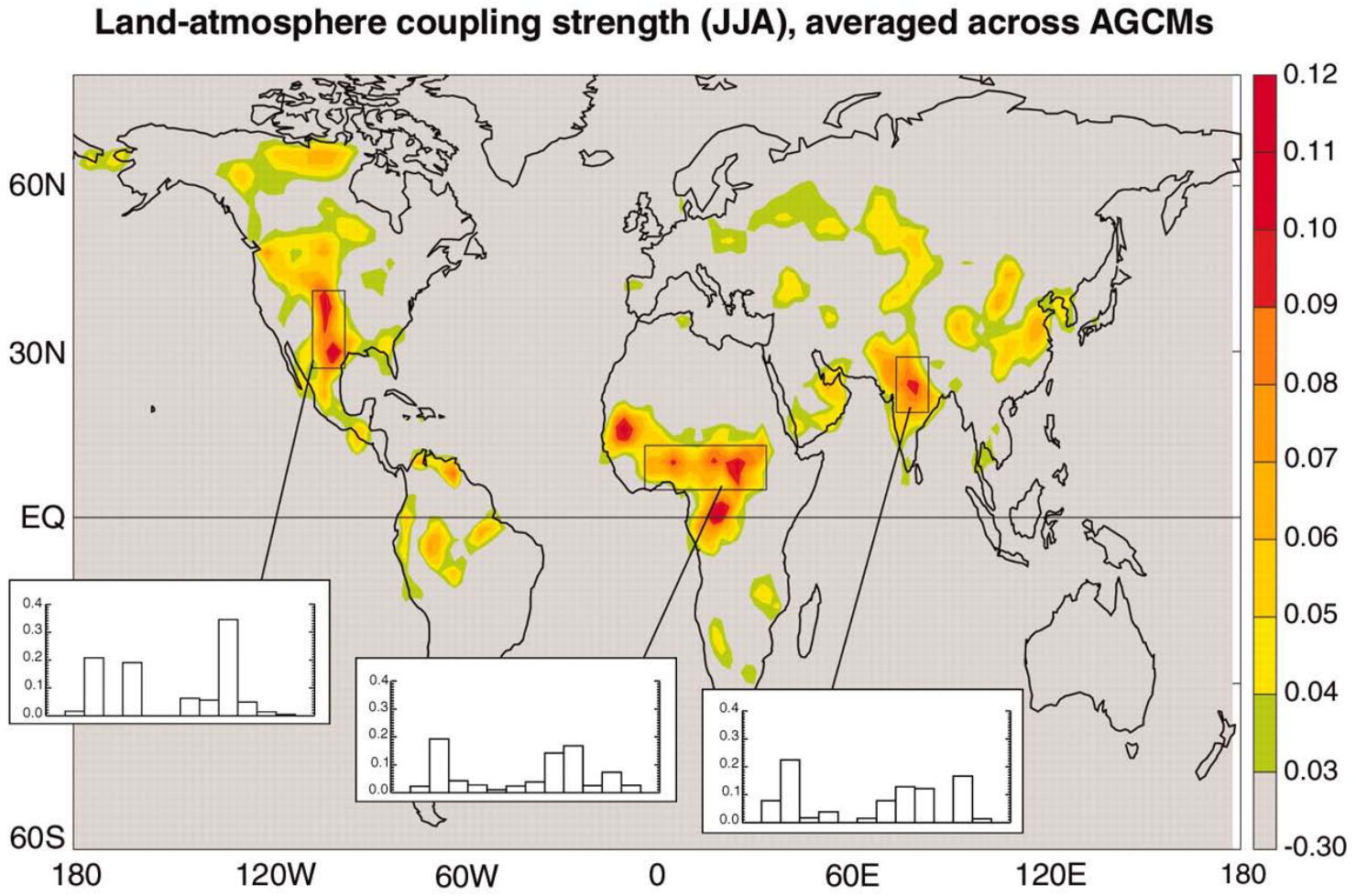
# GLASS overview

# Global Land Atmosphere System Study (GLASS)

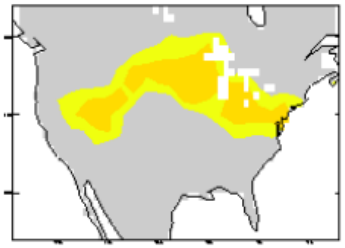


# GLACE “hotspot” regions

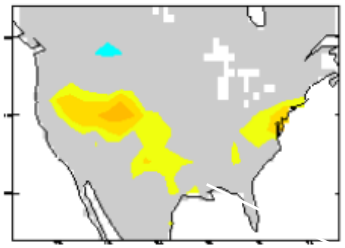


# GLACE 2: Forecast skill

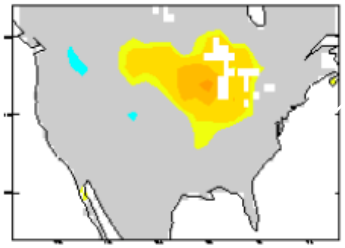
All Start Dates



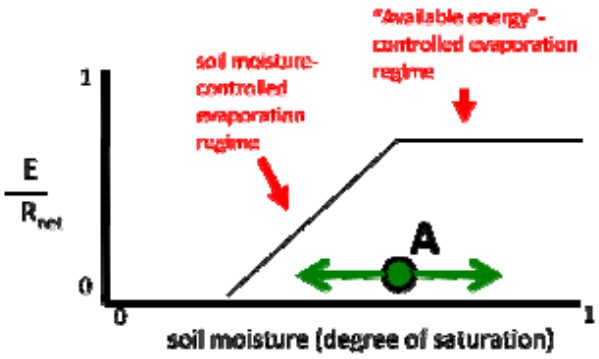
Wet Half of Start Dates

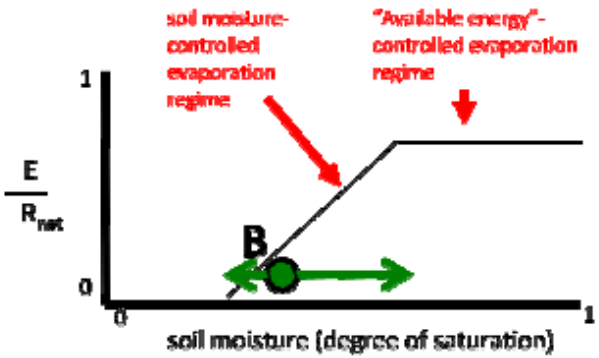


Dry Half of Start Dates



Temperature Forecast Skill, Days 31-45


Wet/dry quantiles

# LoCo: Mixing diagrams

## Summary of IHOP-2002 Study

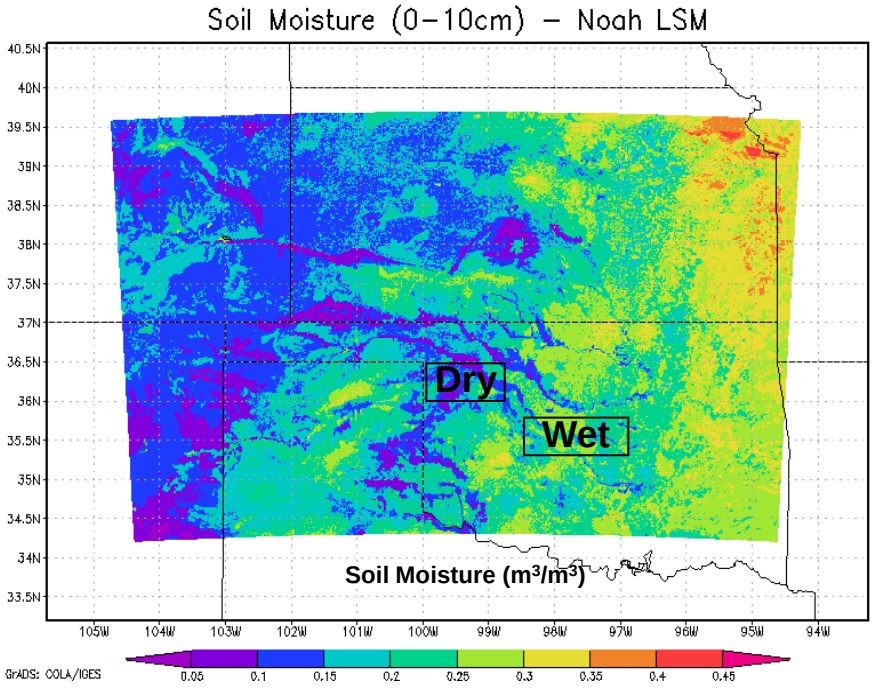



**Fig. 1:** Near-surface soil moisture map of the Southern Great Plains as simulated by LIS-WRF.

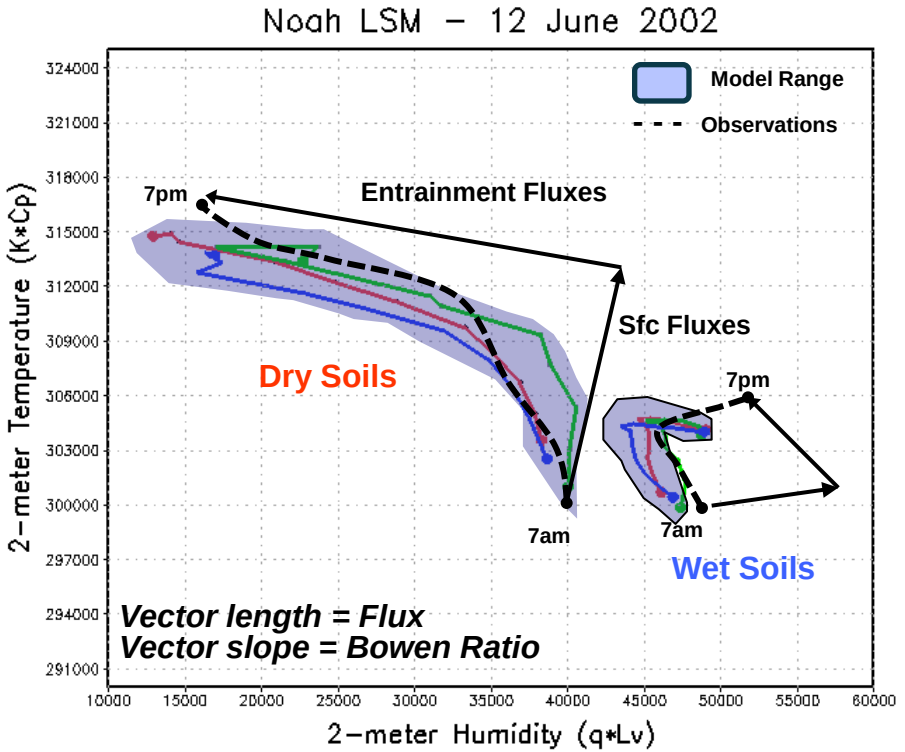
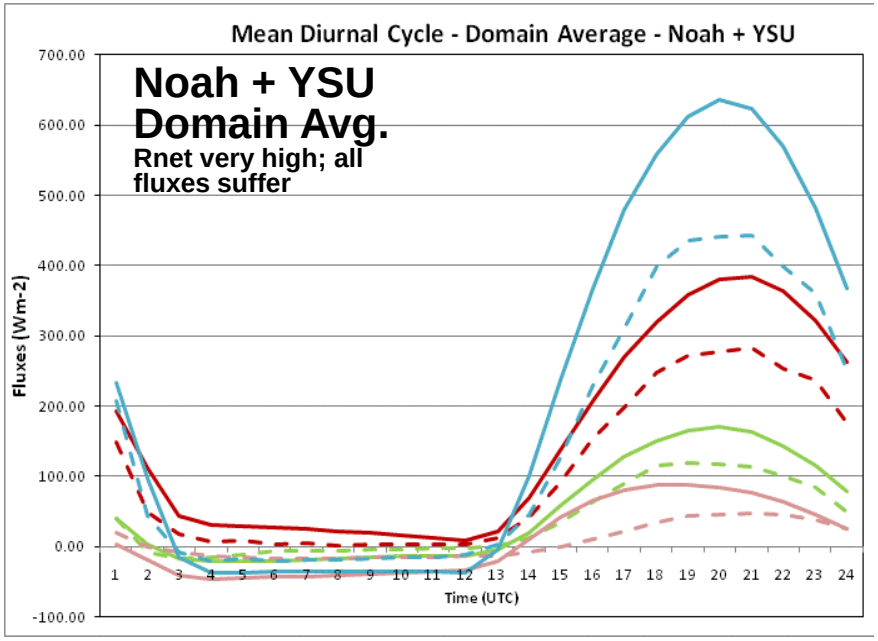
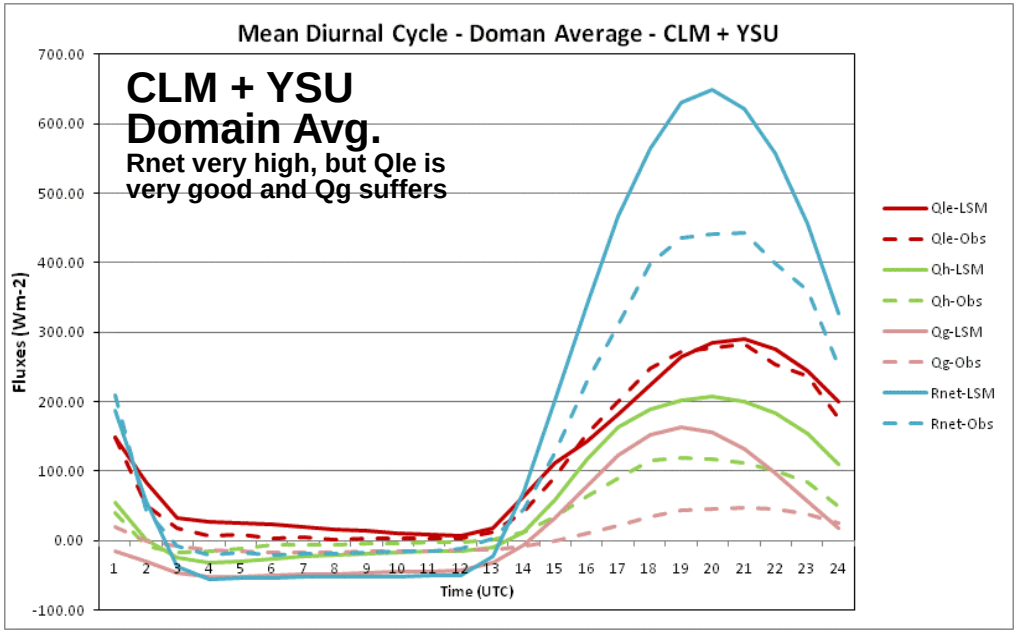



**Fig. 2:** Daytime evolution of specific humidity vs. potential temperature for the dry and wet soil moisture locations in Fig. 1

**Santanello, J. A., C. Peters-Lidard, and S. Kumar, C. Alonge, and W.-K. Tao, 2009**: A modeling and observational framework for diagnosing local land-atmosphere coupling on diurnal time scales. *J. Hydrometeor.*, **10**, 577-599.

# LoCo experiments




2007 Mean Diurnal Cycles

From: Joe Santanello

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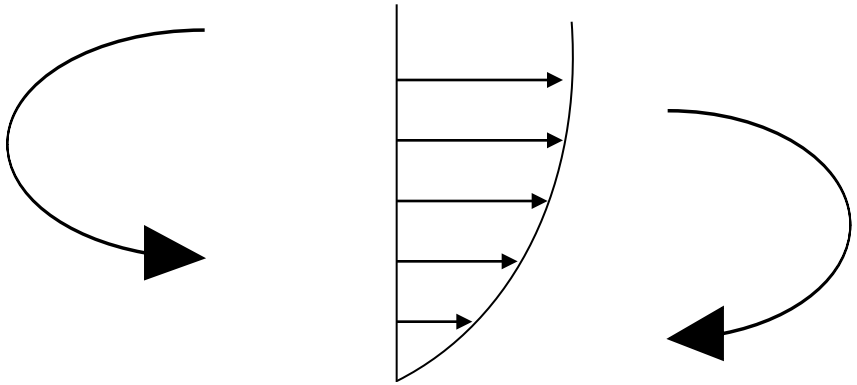
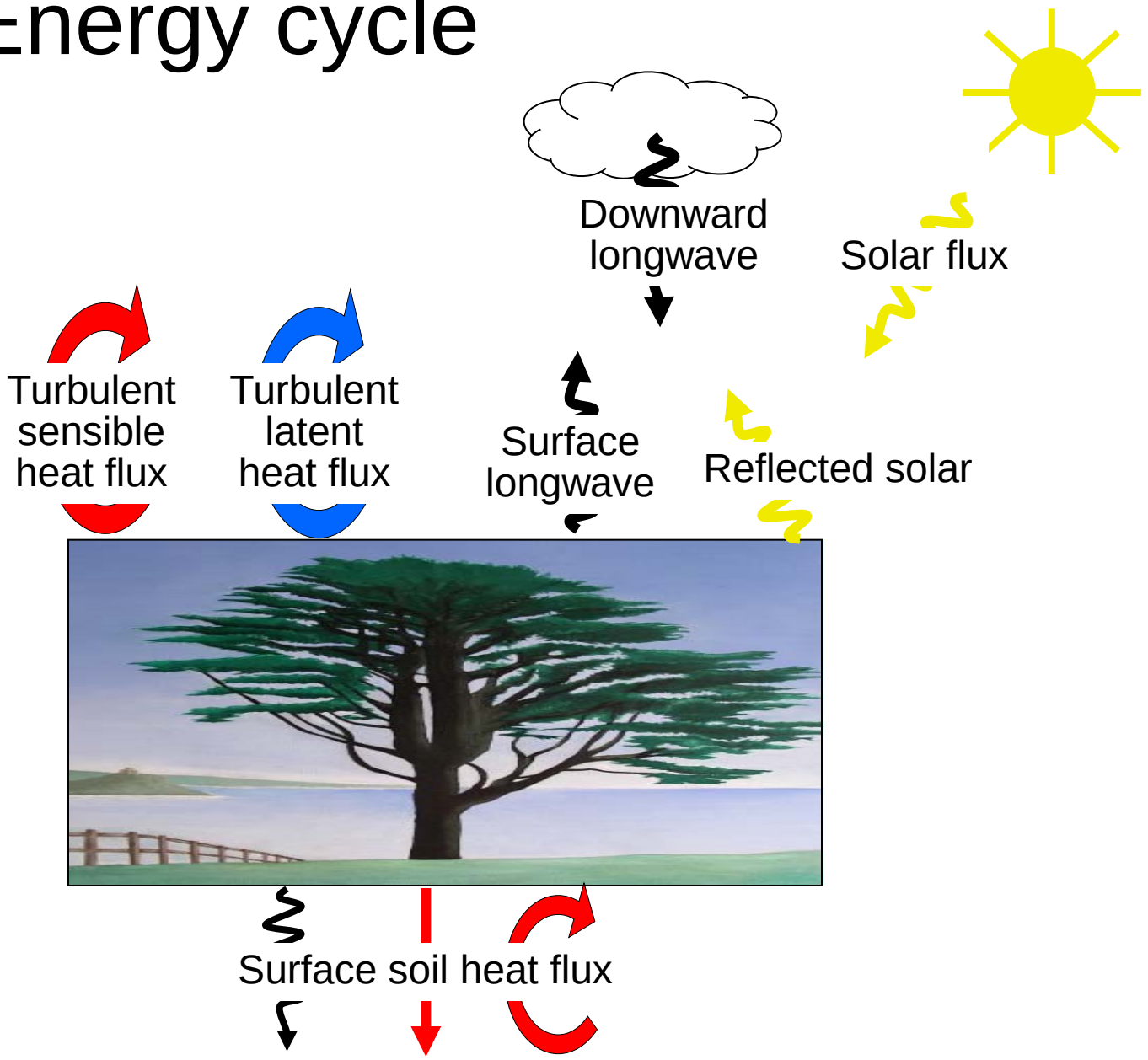
# Surface physics

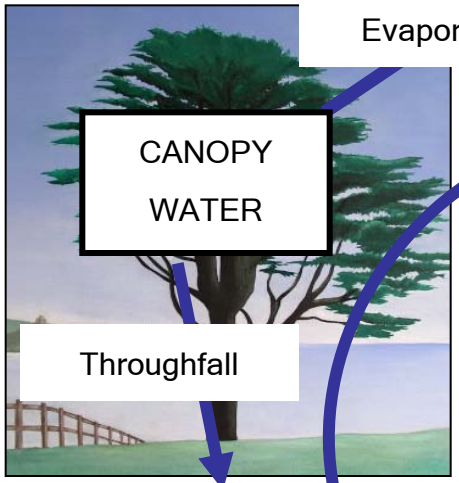
# Momentum exchange



# Energy cycle



# Water cycle


Rainfall
Total
Evaporation
Snowfall
Canopy
Evaporation
Sublimation
CANOPY
WATER
Soil Evaporation
& Transpiration
LYING
SNOW
Throughfall
Stomatal /
Surface
resistance
Snowmelt
Surface
Runoff
Infiltration
Darcian flow
between layers
SOIL
MOISTURE
Phase changes
Thermal properties
Free Drainage

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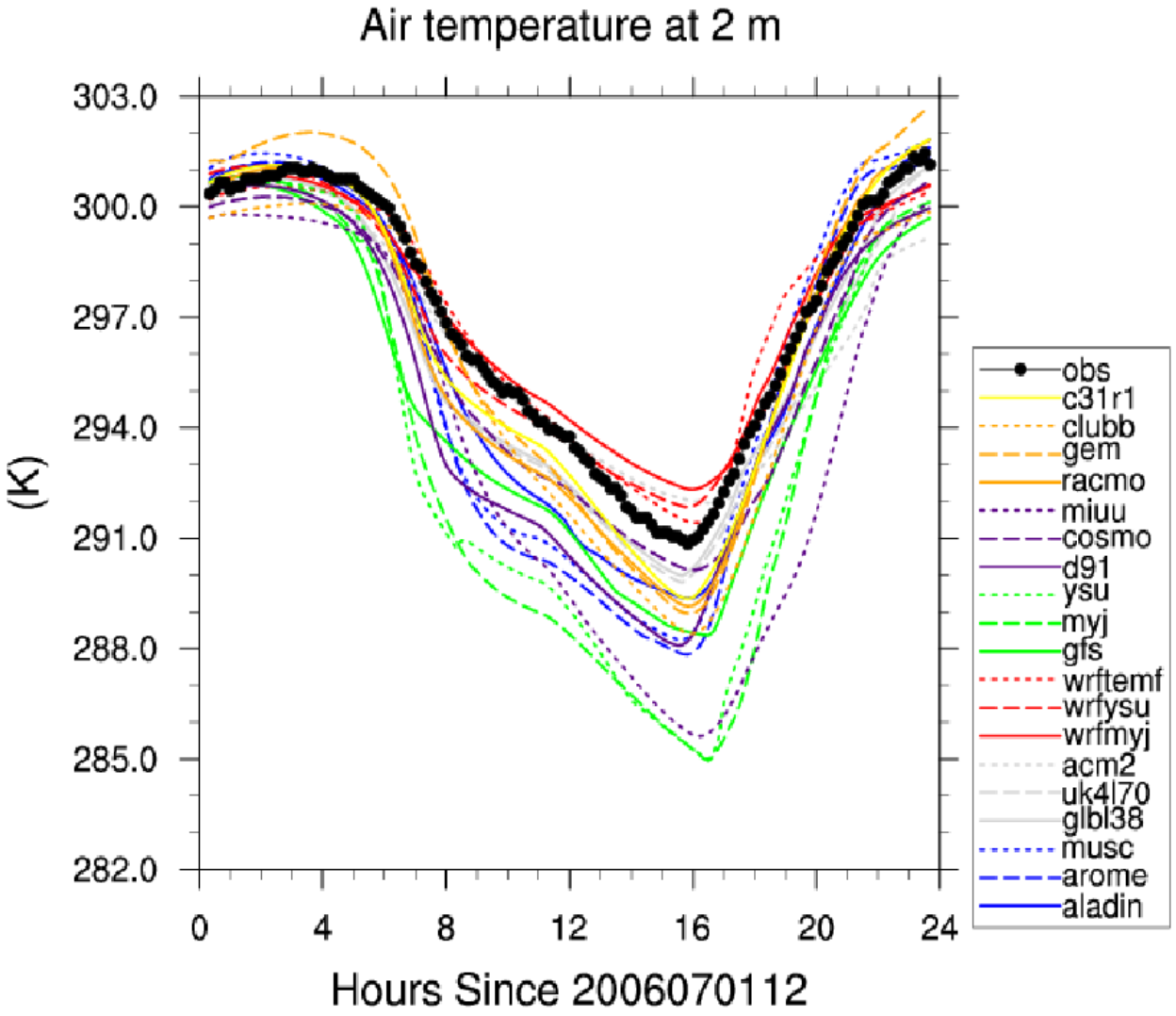
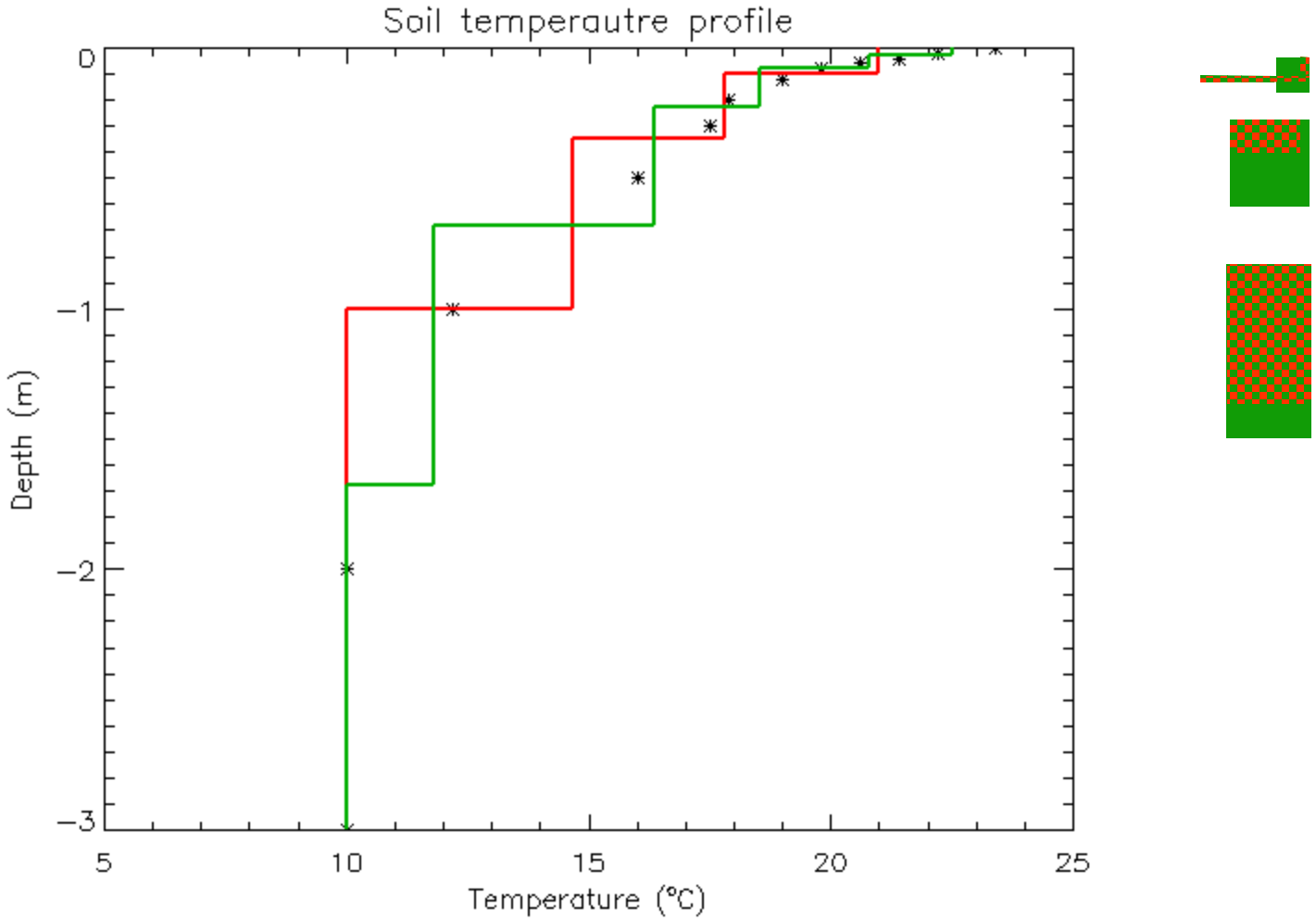
# GABLS-3 results: A GLASS perspective

# Results from GABLS-3

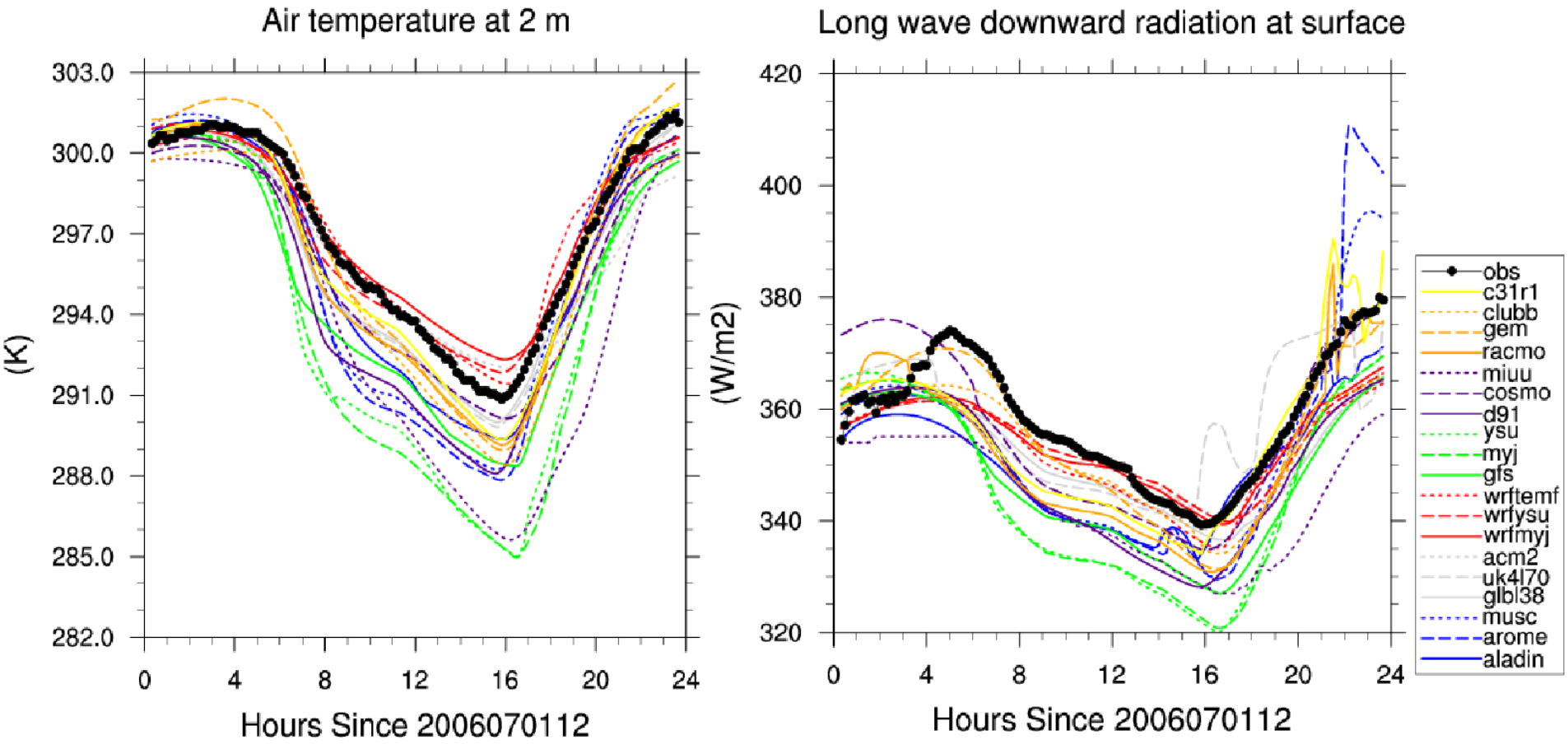



From: Holtslag_GABLS@WGNE_oct2010

# GABLS – 3 initialisation



# Results from GABLS-3




From: Holtslag_GABLS@WGNE_oct2010

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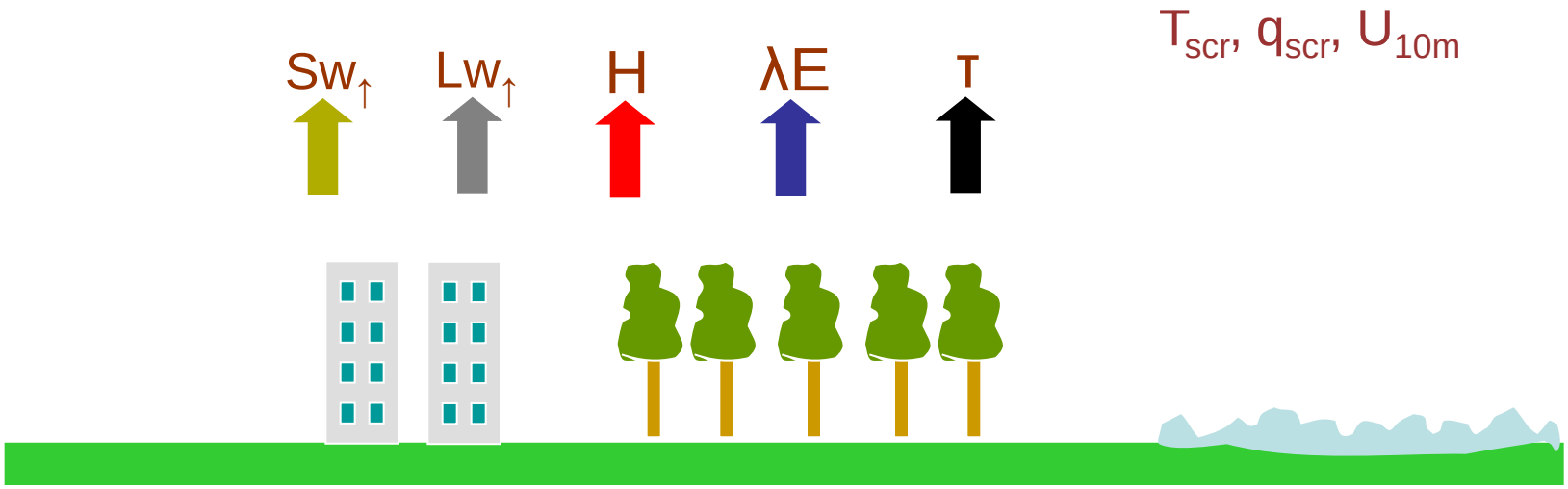
# Possible GLASS/GABLS joint project?

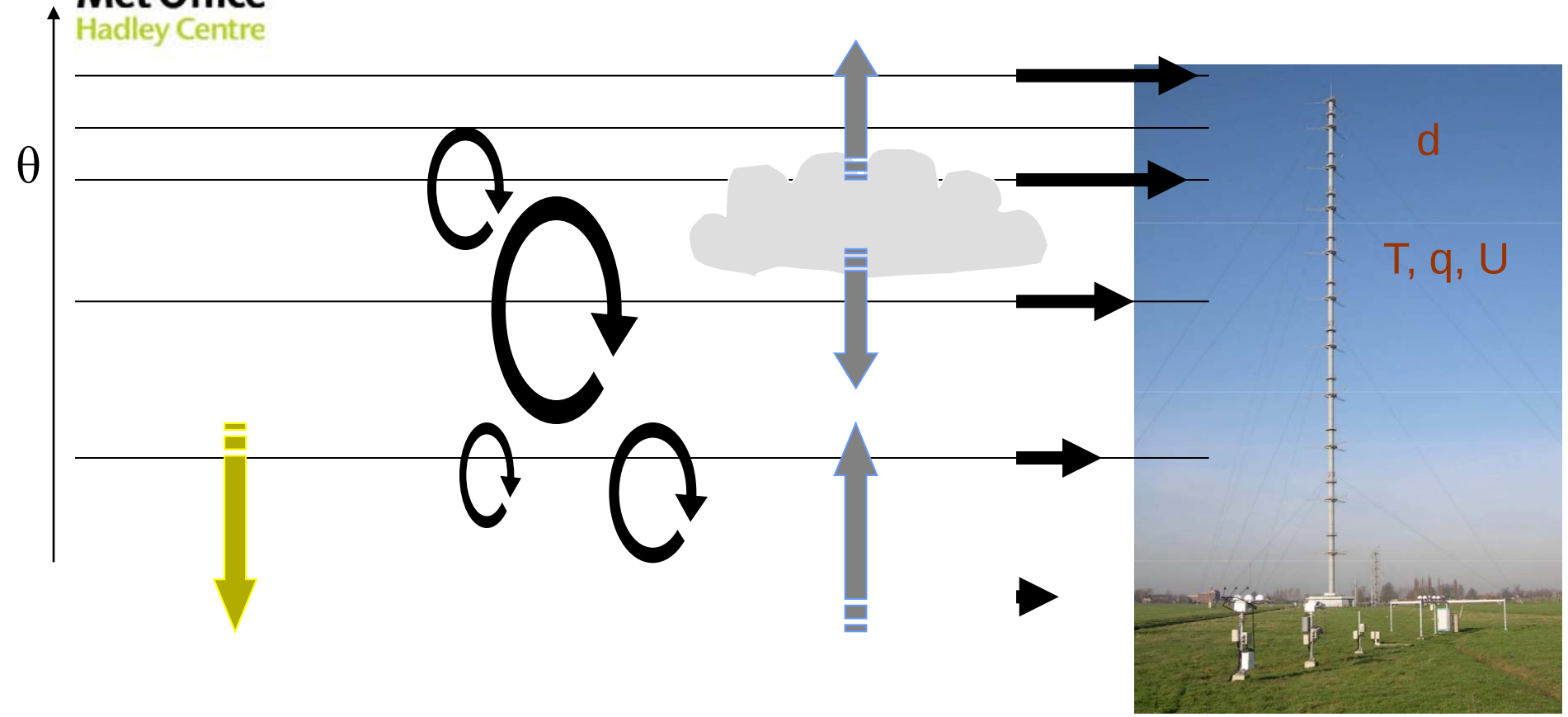
# The surface

$P, Sw_{\downarrow}, Lw_{\downarrow}$

$T, q, U$

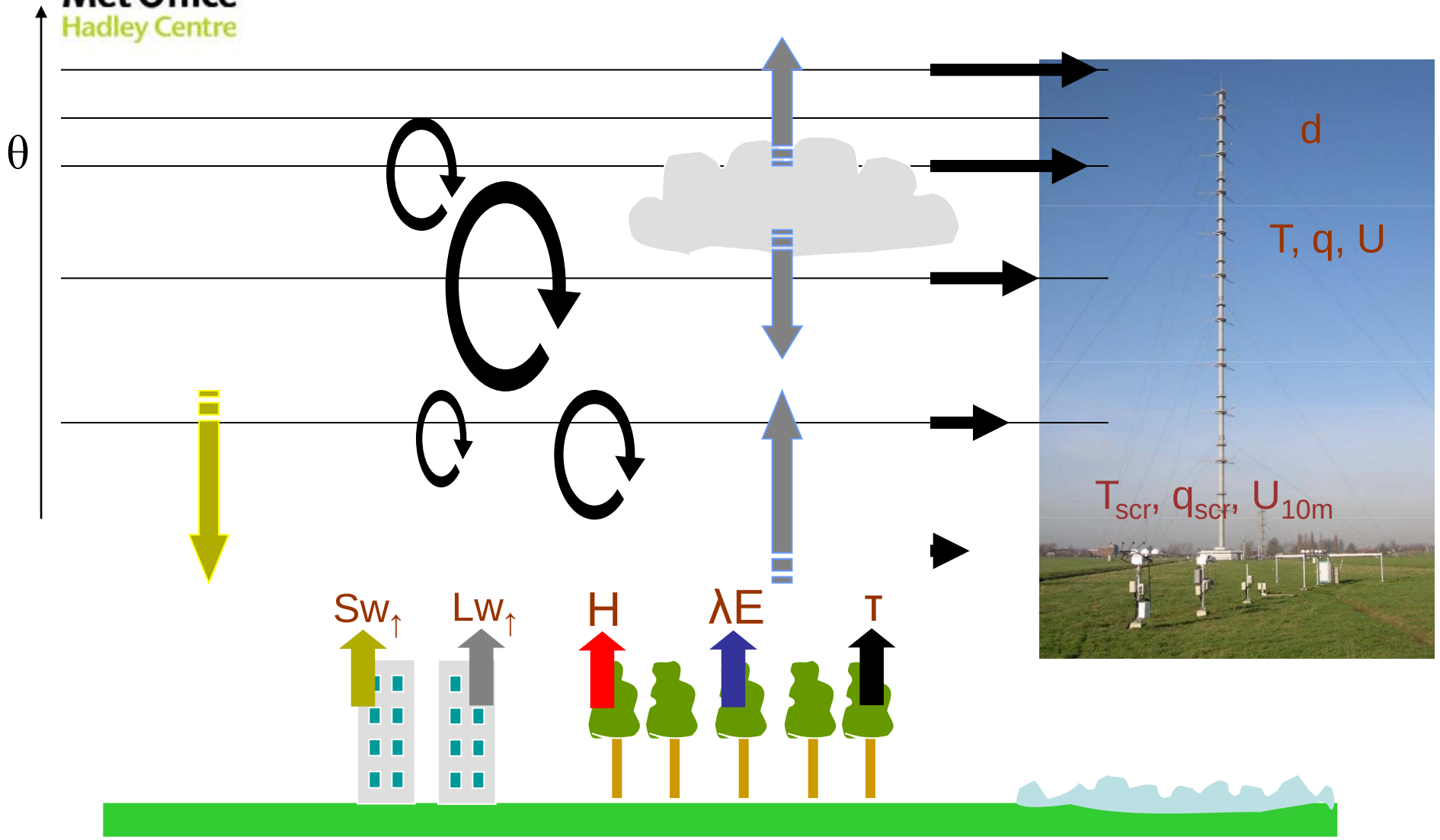


# The boundary layer




$Sw_{\uparrow}$ $Lw_{\uparrow}$ H λE τ

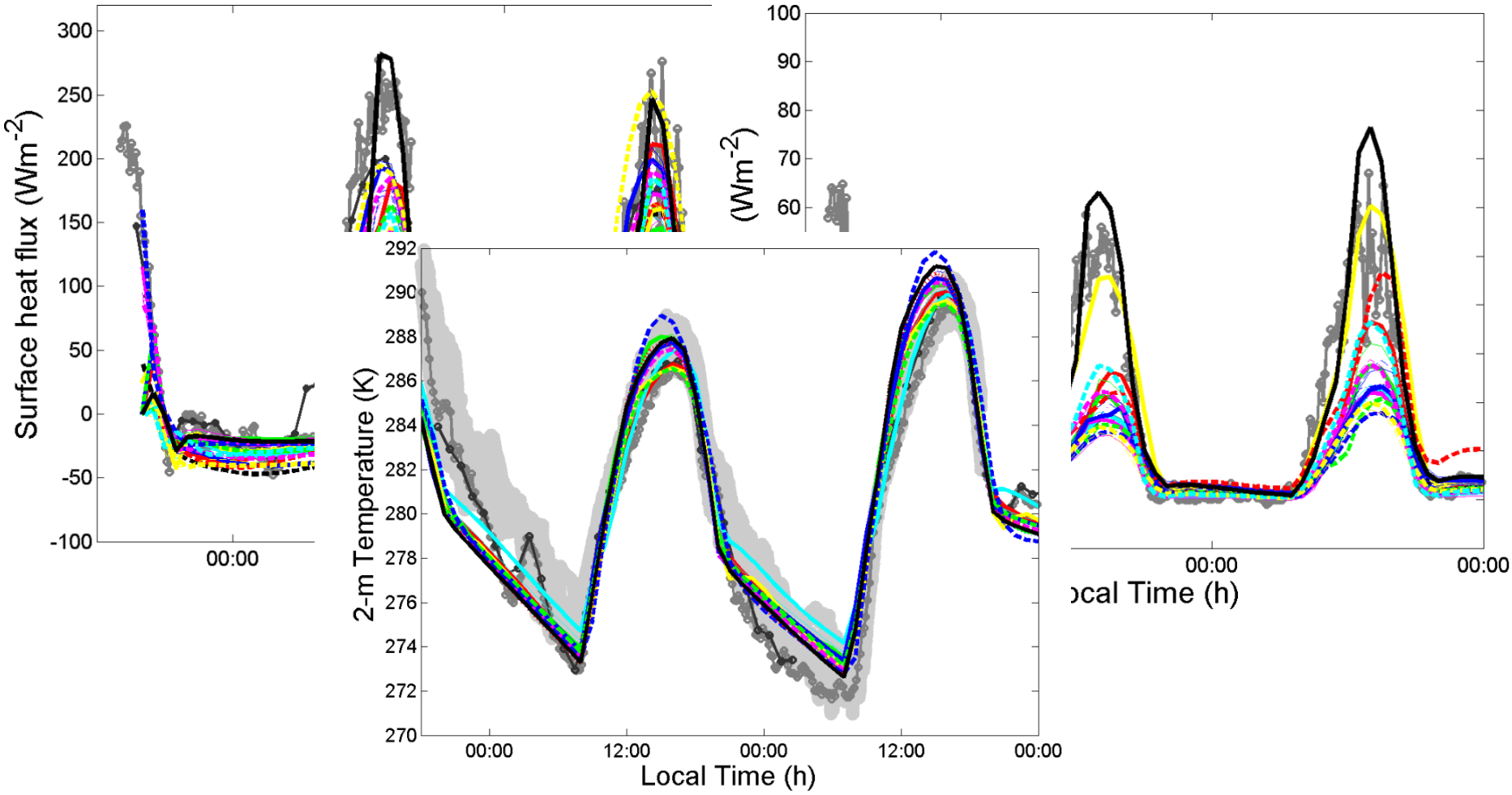
# The coupled system



# Simulations for analysis

| | Default initial run | Optimised run | Consistent surface turbulence run |
|---|---|---|---|
| Surface | | | |
| B.L. | | | |
| Coupled | | | |

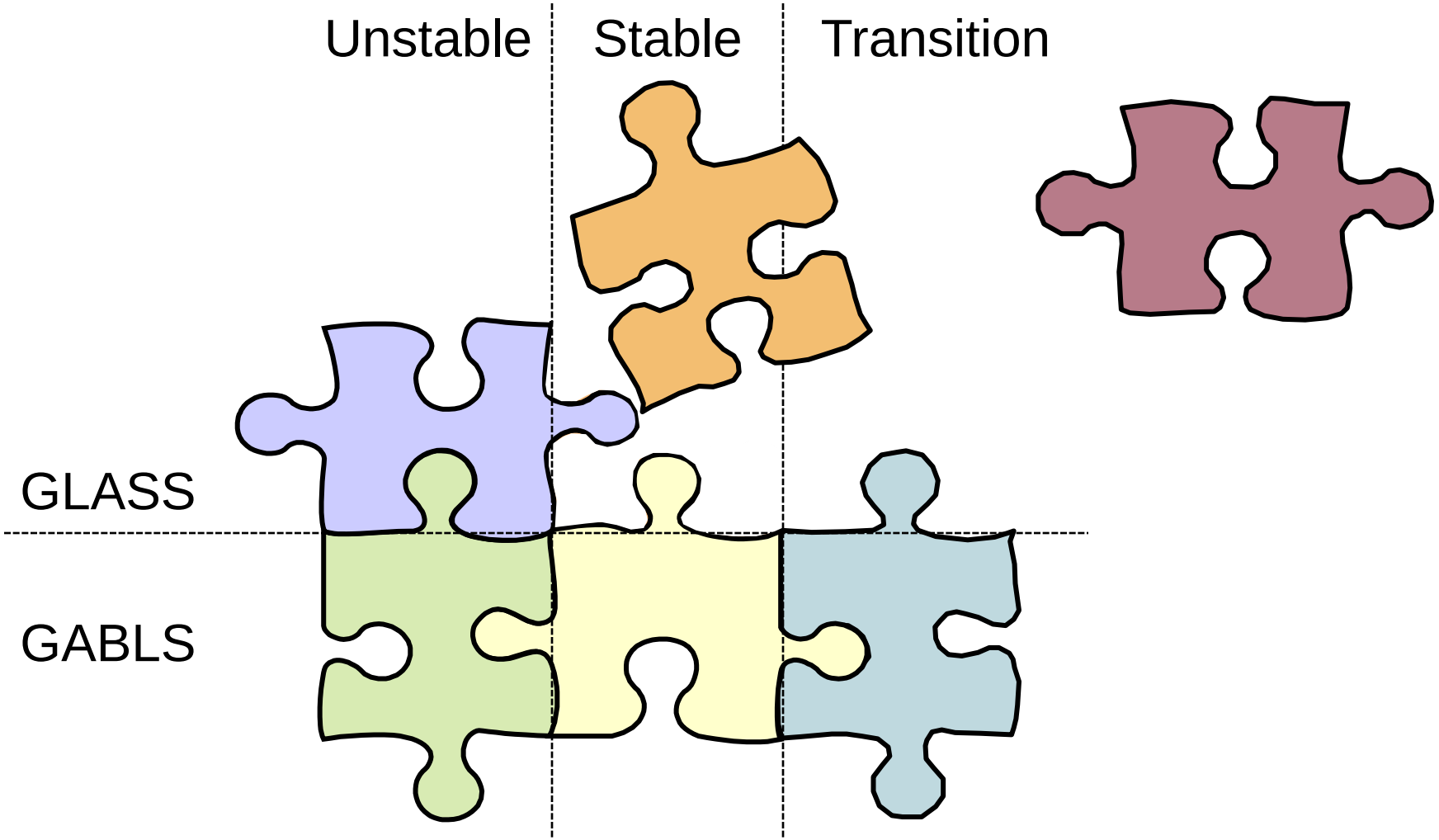
# GABLS-2 results






From: http://www.misu.su.se/~gunilla/gabls/Results/index.html

# Anticipated interest in results



# What next?

- GLASS + GABLS representatives to firm up on project design and plan
- Each modelling centre to undertake runs and complete initial analysis on their model
- Workshop session at the pan-GASS meeting at Boulder in September 2012

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# Questions