



Summary of Met Office activities

SRNWP ET meeting, Zurich, September 2010

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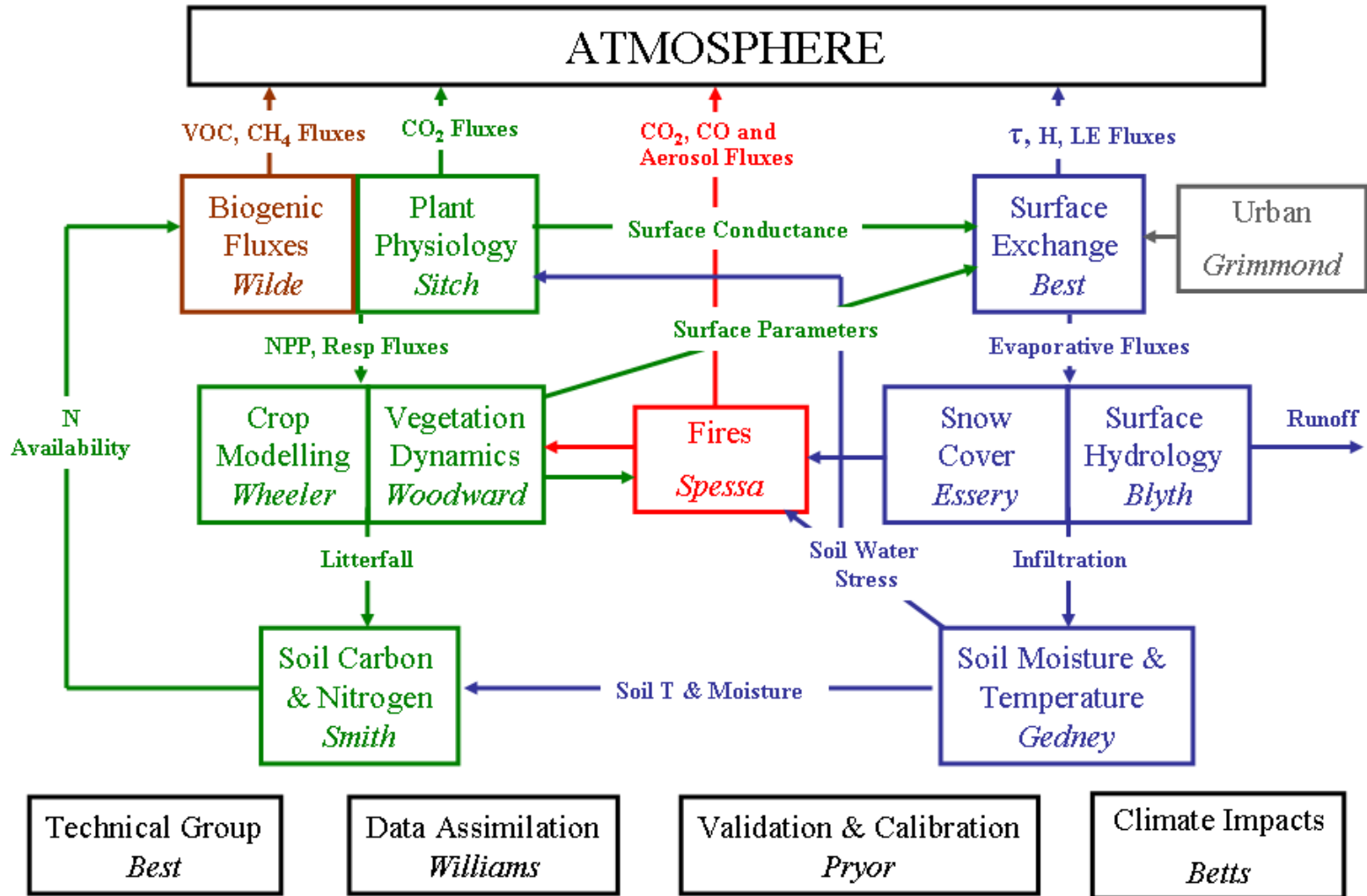
- JULES and the UM
- Land Data Assimilation
- Snow
- Urban
- Lakes



JULES

Joint UK Land Environment Simulator

JULES themes





Flexibility

The JULES code has been designed for maximum flexibility. Design features include:

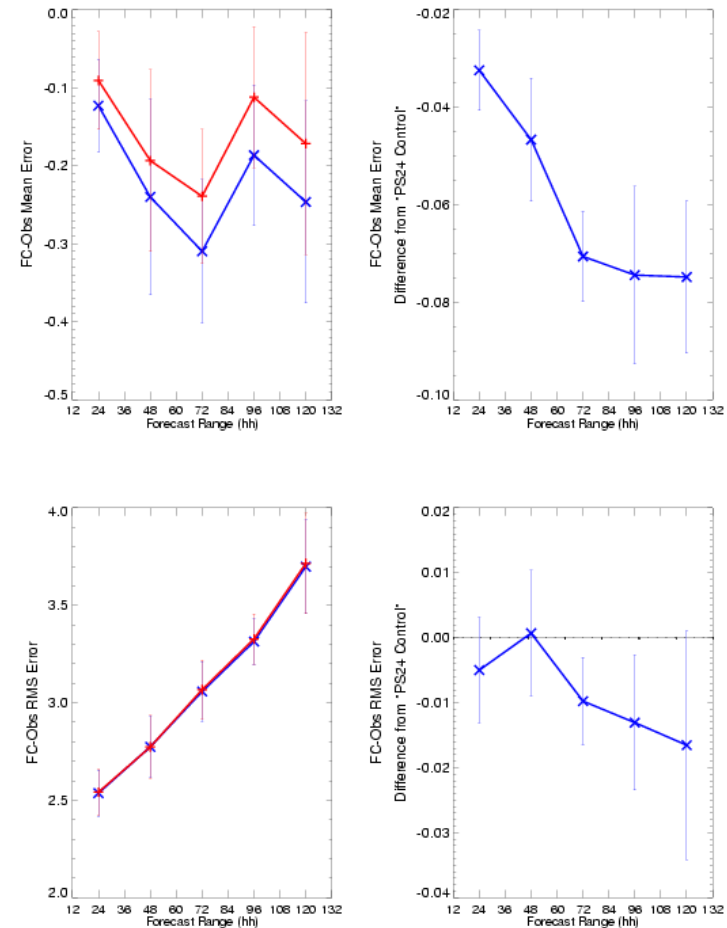
- A modular structure (following the science themes) that enables alternative or new modules to be easily included
- User defined tile structure for surface heterogeneity specified at run time
- Sub-surface modules on alternative grids to the surface

Operational Plans for JULES

Temperature (Kelvin) at Station Height: Surface Obs
 Northern Hemisphere (CBS area 90N-20N)
 Equalized and Meaned from 1/12/2006 12Z to 31/1/2007 12Z

Cases: +— PS24 Control x— PS24 with JULES

- JULES now fully in the UM system (from 7.5)
- Performance matches existing scheme
- Move to JULES operationally early next year





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Land Data Assimilation



EKF Land DA system: Initial project scope

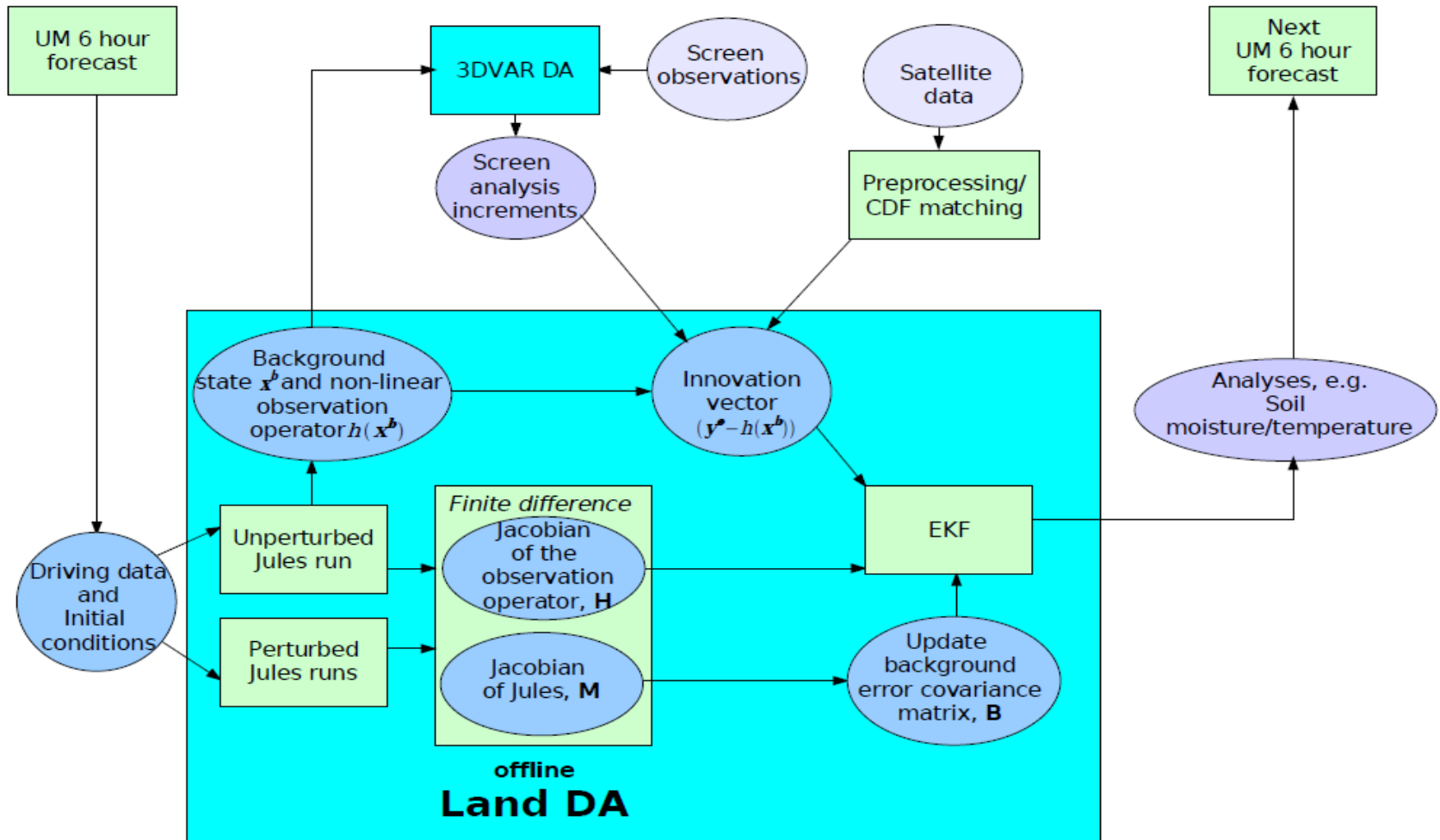
- Only consider implementation in the global UM.
 - The NAE, UKV and CAMs use interpolated global UM soil moisture.
- Priority will be given to analysis of soil moisture and soil temperature.
- Priority will be given to assimilation of screen variables and ASCAT surface soil wetness.
- In this phase of the development, the EKF land DA scheme will NOT be tested with a dynamic vegetation model and consequently analysis/assimilation of vegetation fields/observations will not be possible. However, code will be written in a flexible manner so that a later project can add this functionality to the EKF land DA scheme.
- Development will be on the supercomputer and Linux desktops.
- Pre-operational trials of the developed system will be performed.



Suggested time line

- 2011: Test a Jules based EKF land DA system using screen based observations and ASCAT surface soil wetness.
- 2012: Examine using more accurate atmospheric forcing data such as from UKPP for the UK area and from NLDAS for the United States.
- 2012: Examine assimilation of SMOS brightness temperatures. ECMWFs Community Microwave Emission Model (CMEM) could be used as the observation operator.
- 2013: Examine assimilation of satellite derived land surface temperatures.
- 2015: Examine assimilation of satellite derived LAI and FPAR or direct assimilation of satellite measured surface reflectance.

Data flow diagram for EKF land DA system





Snow



Snow scheme development

Old scheme in MOSES

- single-layer scheme
- developed in 1990's

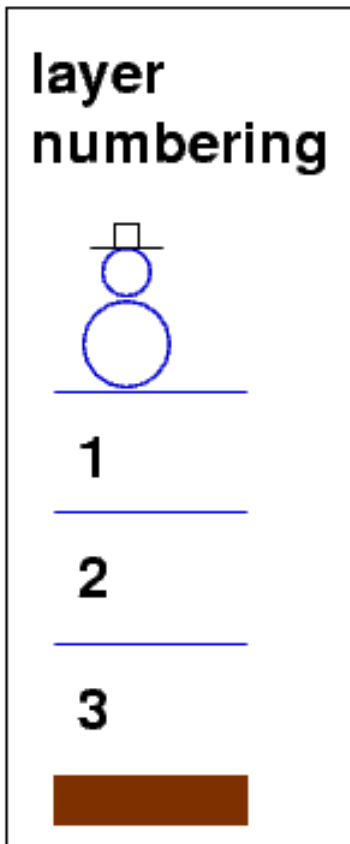
New scheme in JULES

- multi-layer scheme
- developed by Richard Essery, U of Edinburgh
formerly of the Hadley Centre
- an early example of Joint development
MetO collaboration agreement SC0237

Snow Layering

prescribed layer depths (m)

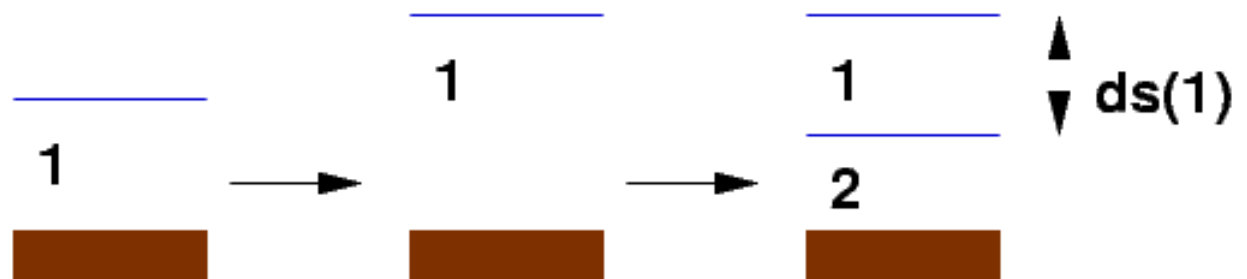
$dzsnow = \{0.1, 0.2, 0.2\}$



LAYERSNOW

IN
snowdepth

OUT
nsnow
ds





Other features

- Canopy interception and throughfall as in MOSES
- Layer compaction from a function of
 - mass above the layer centre
 - layer density and temperature
 - Kojima(1967), Pitman et al.(1991), Lynch-Steiglitz(1994)

$$\delta\rho_k = 0.5 \times 10^{-7} \rho_k g M_k \delta t \exp\left(14.643 - \frac{4000}{T_k} - 0.02\rho_k\right)$$

- Heat conduction
- Ice melt, liquid infiltration and re-freezing



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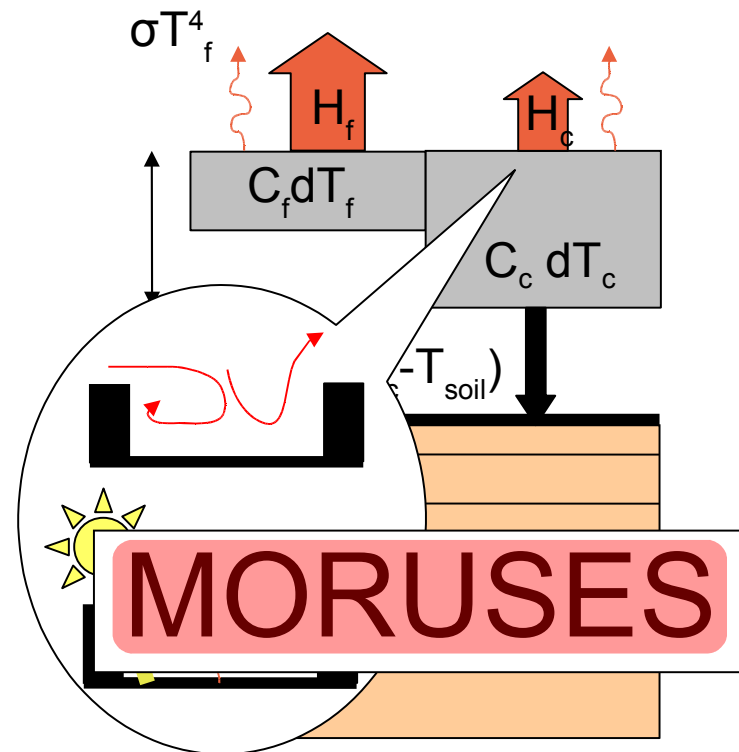
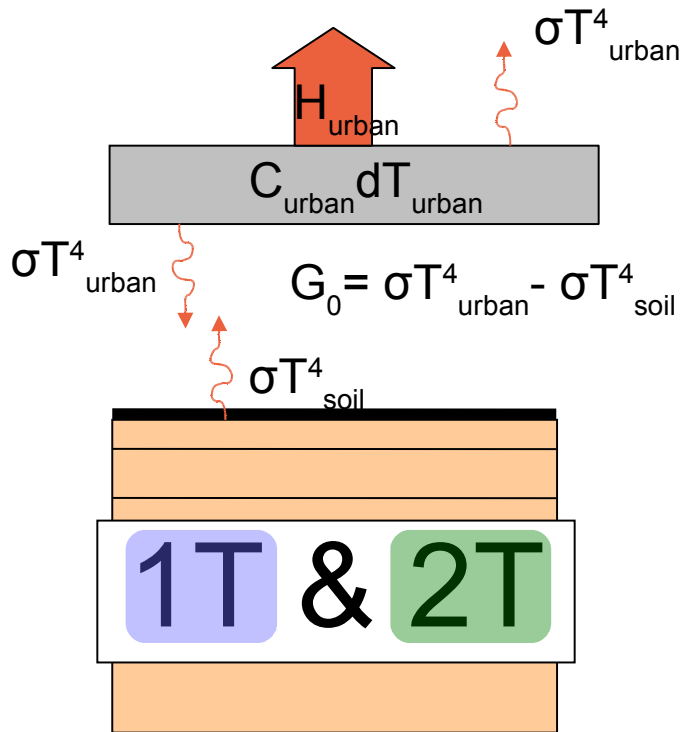
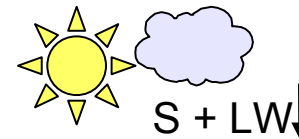
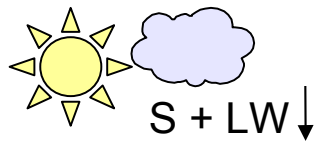


Urban



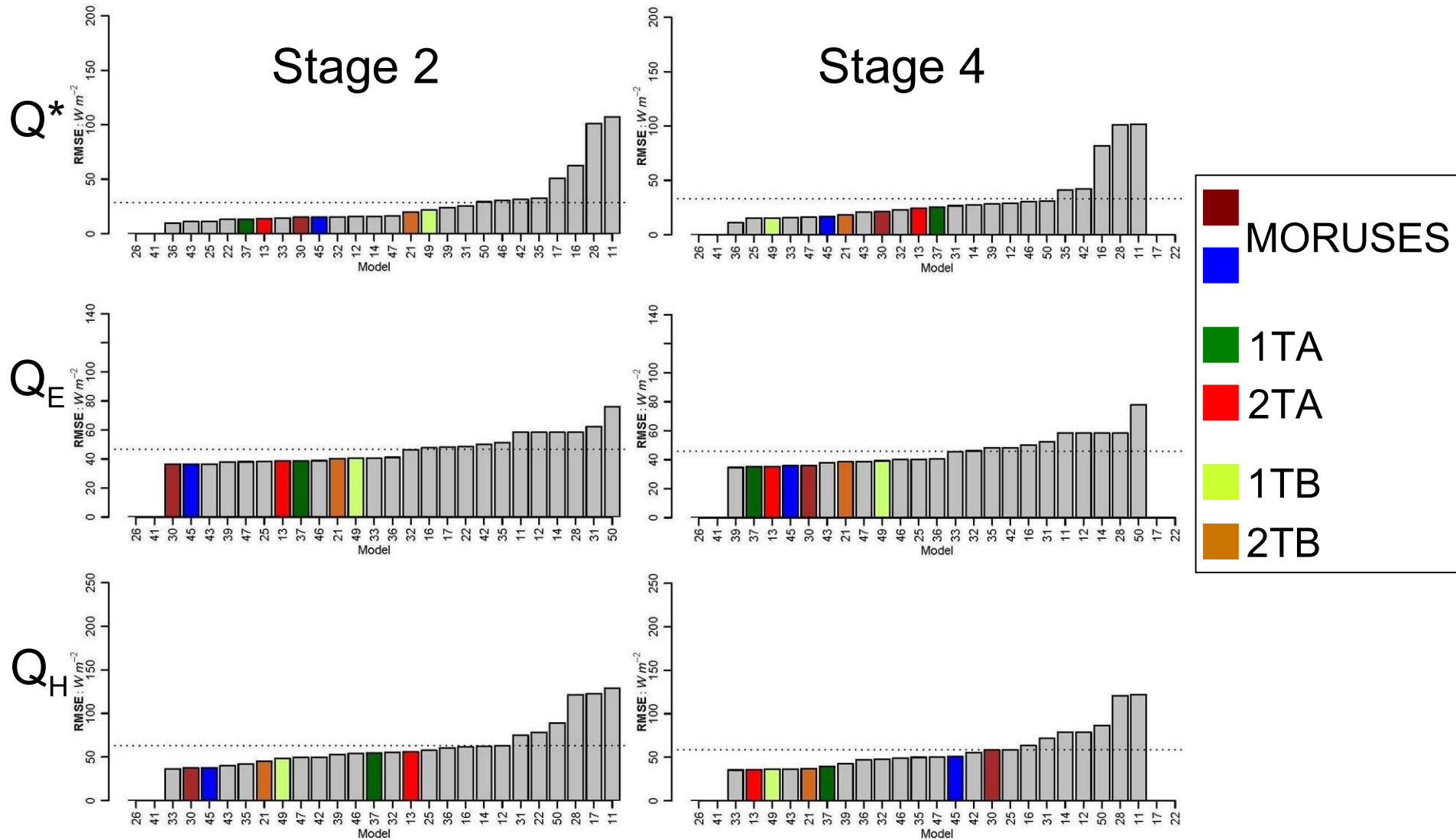
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Urban scheme options





Urban model comparison experiment: ALPHA results



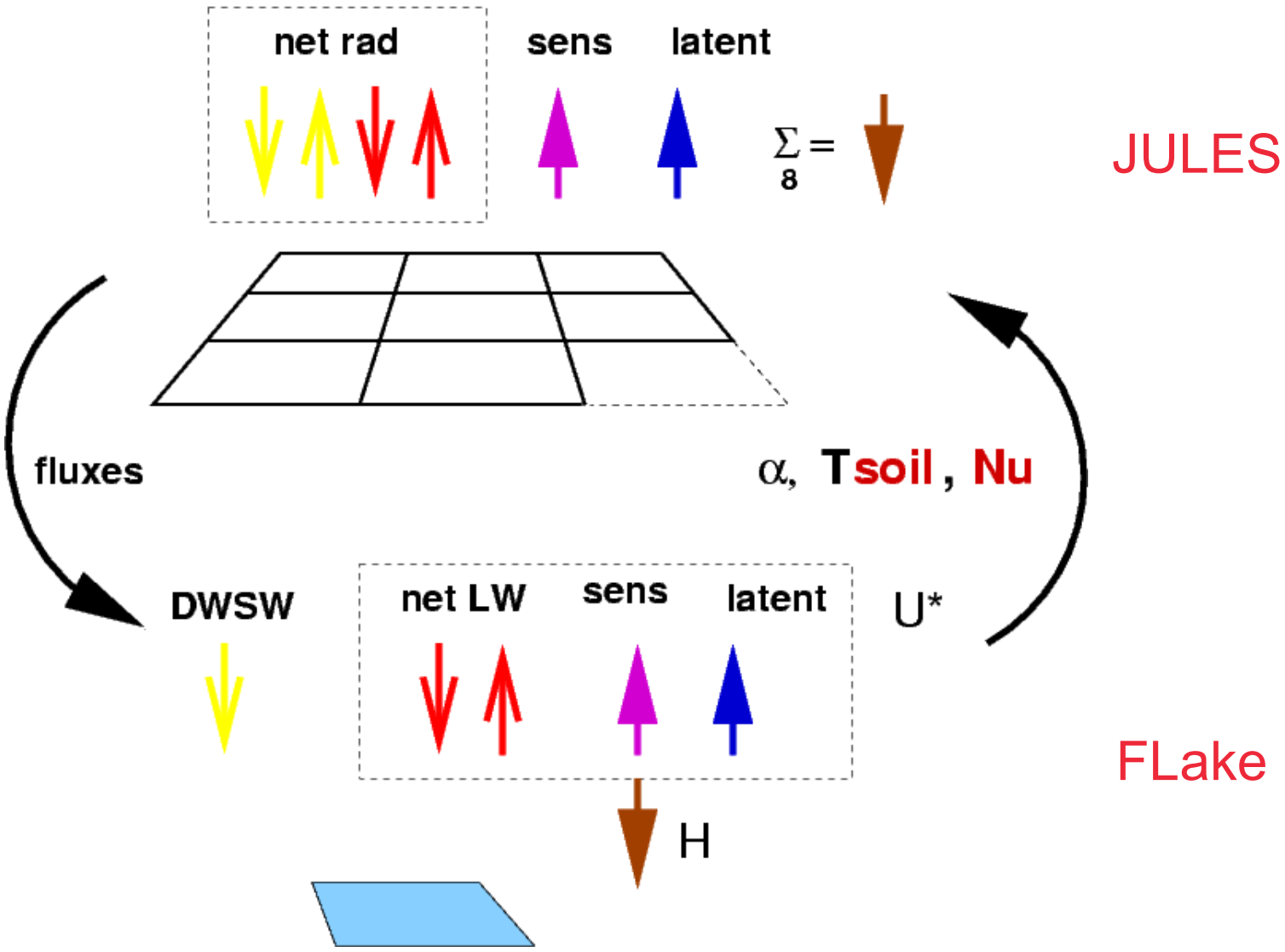


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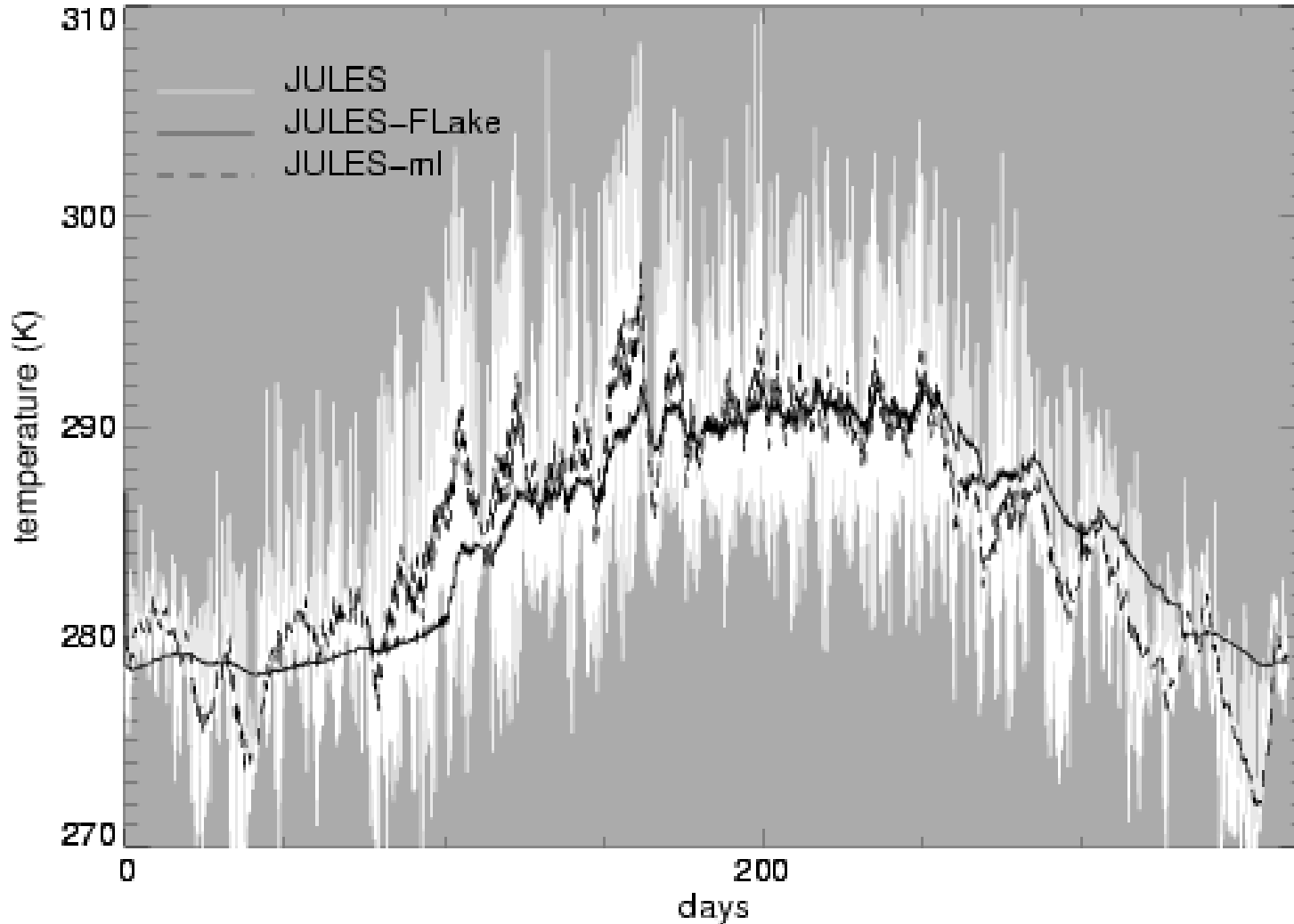


Lakes (FLake)

coupling

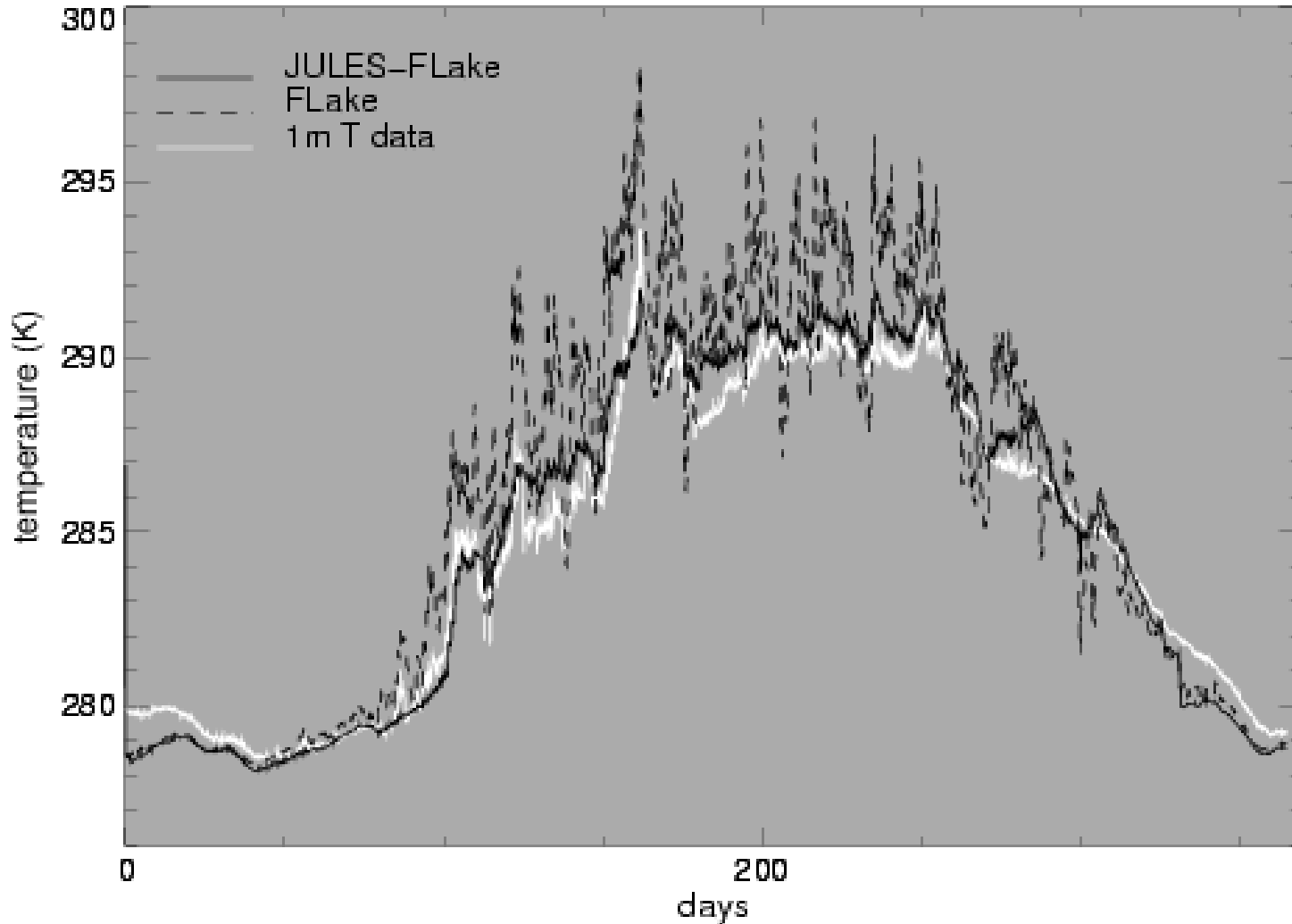


Surface temperature, Windermere



2007

Surface temperature, Windermere (2)



2007



Additional activities

- Investigate using retrieved LST for assessing model (and use in DA)
- Test impact of dynamic snow tile and more efficient use of tile options
- Investigate vertical resolution and heterogeneity of soil
- Investigate impact of elevation bands for tiles
- Review surface exchange turbulence scheme