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JULES-ZOOM coupling and assessing the surface runoff characteristics of JULES for the Kennet catchment

HyDEF Project Meeting

27 June 2012

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British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

UCL

University of Reading

Living With Environmental Change

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Outline

- JULES - ZOOM coupling
- Surface runoff
- Drainage volume
- Soil moisture
- Representing heterogeneity

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Data

JULES input type	Source data description	Source
1 km catchment grid	1) 50 m resolution raster file 2) catchment outlet	http://edina.ac.uk/digimap/ ttp://www.environmentagency.gov.uk/hiflows/station.aspx?39016
Vegetation cover	1) 50 m IGBP 2007 land cover map 2) land use reclassification scheme (from 17 IGPB classes to 9 JULES classes) (Smith et al, 2006)	http://webmap.ornl.gov/wcsdown/dataset.jsp?ds_id=10004
Soil parameters	1 km NSRI soil maps (van Genuchten parameterisation) based on Simota & Mayr (1996)	http://www.landis.org.uk/data/
Meteorological inputs	Daily, 1 km CHESS data	Personal communications with CEH
Observations	1) Daily flow data 2) Neutron probe soil moisture (Warren Farm)	http://www.ceh.ac.uk/data/nrfa/data/search.html Personal communications with CEH

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JULES

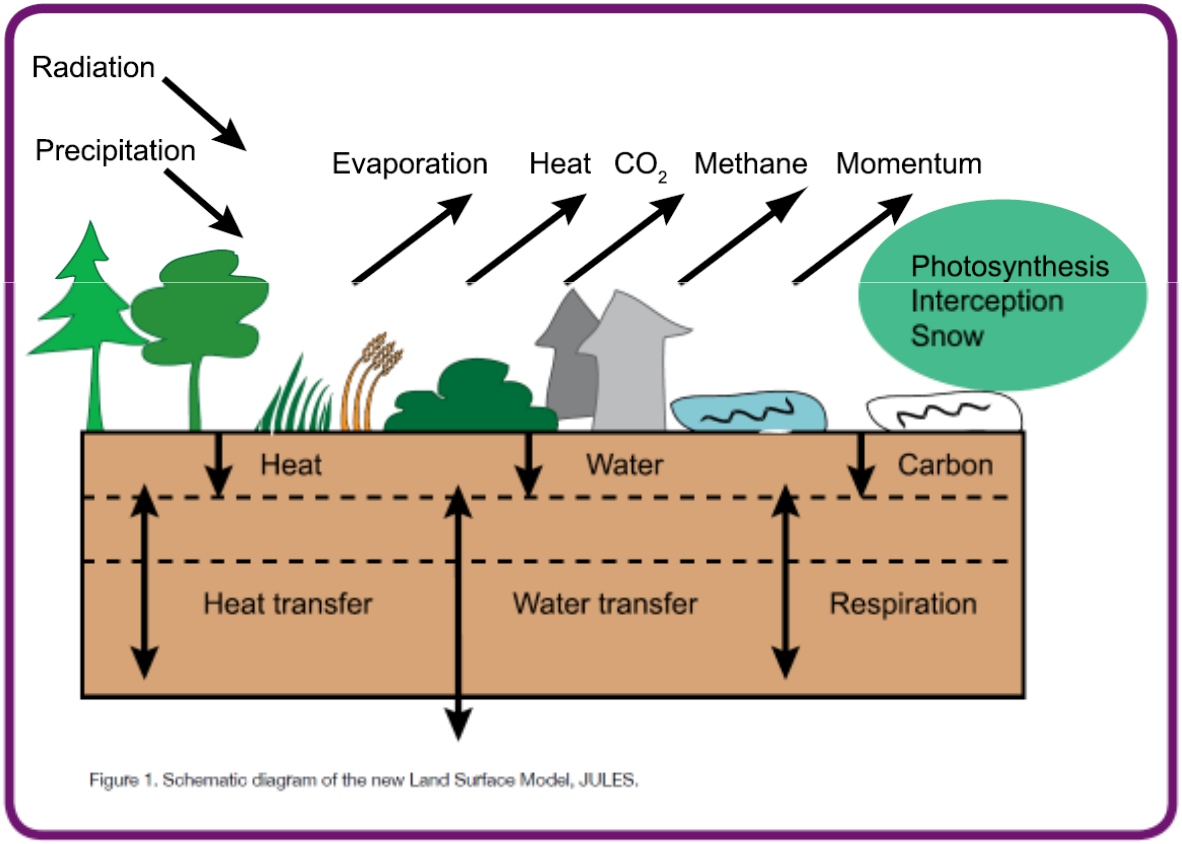

Figure 1. Schematic diagram of the new Land Surface Model, JULES.

4 layers of depths:

- 0.1 m
- 0.25 m
- 0.65 m
- 2 m

Free drainage lower boundary

1km^2 grid

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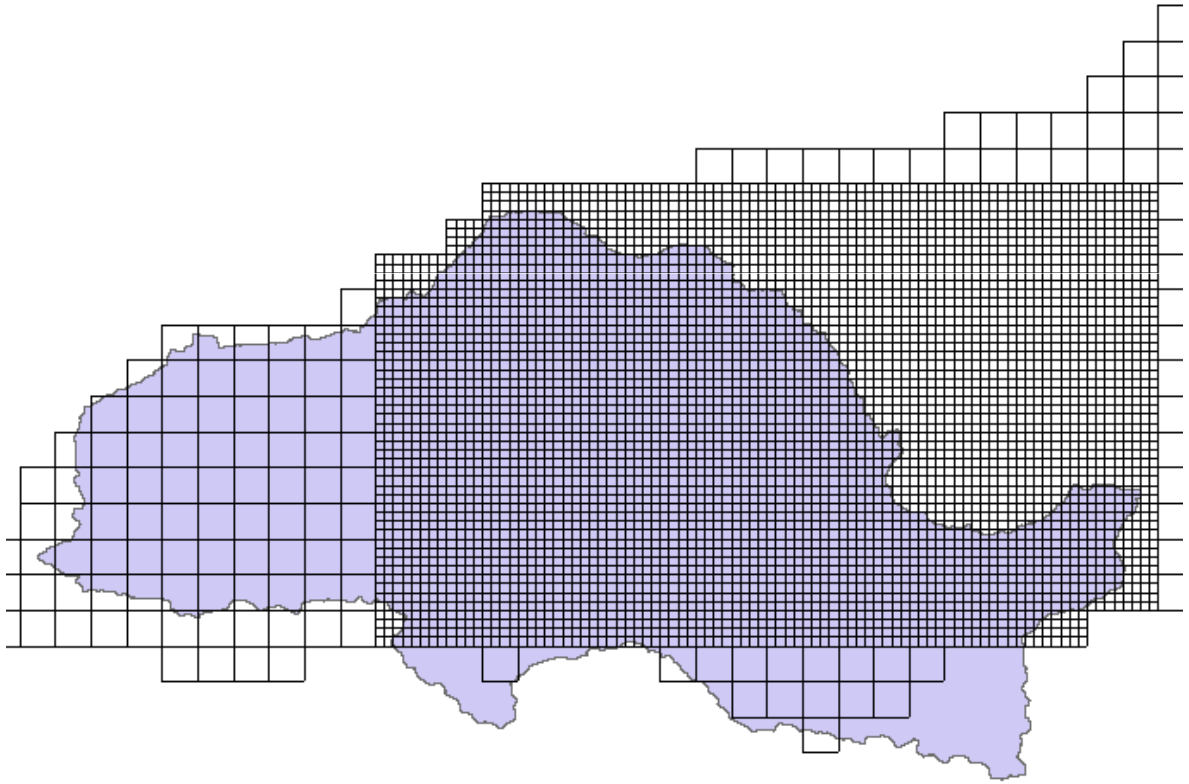
ZOOM



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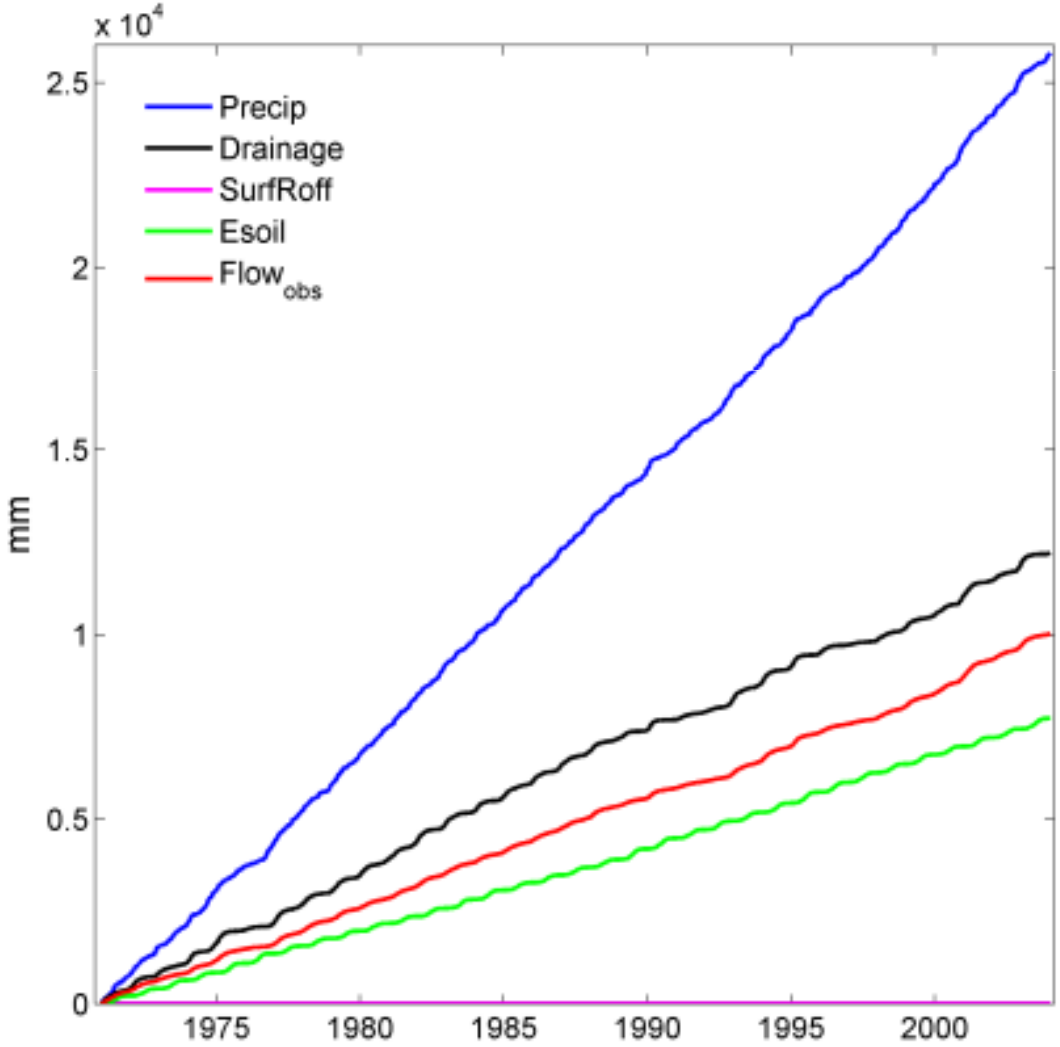
JULES: elements of mass balance in the Kennet



1) Almost no surface runoff
2) Drainage/Precip =0.47
3) AE/Precip ≈ 0.3
4) Drainage is 22% higher than observed flow

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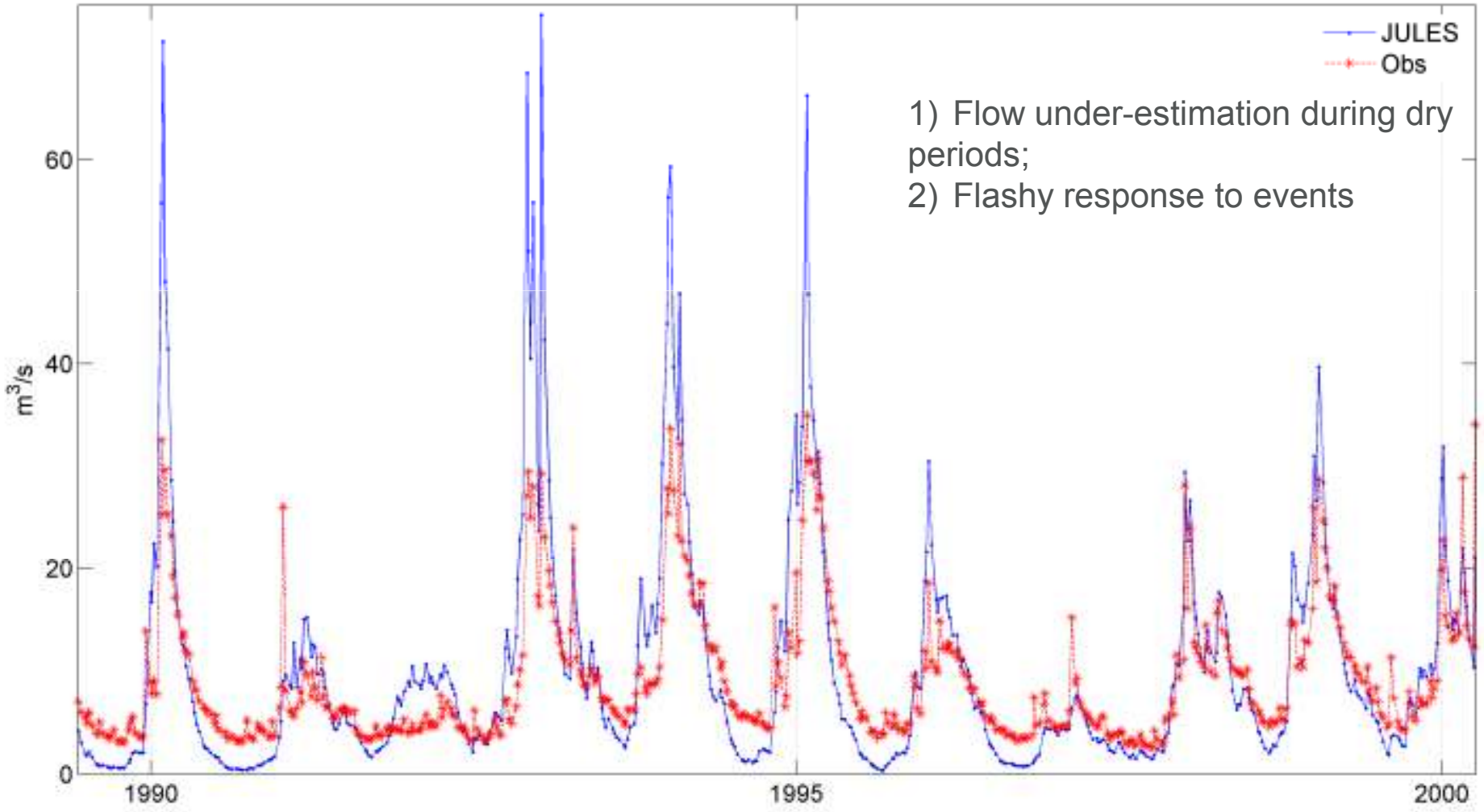
Flows – no groundwater routing



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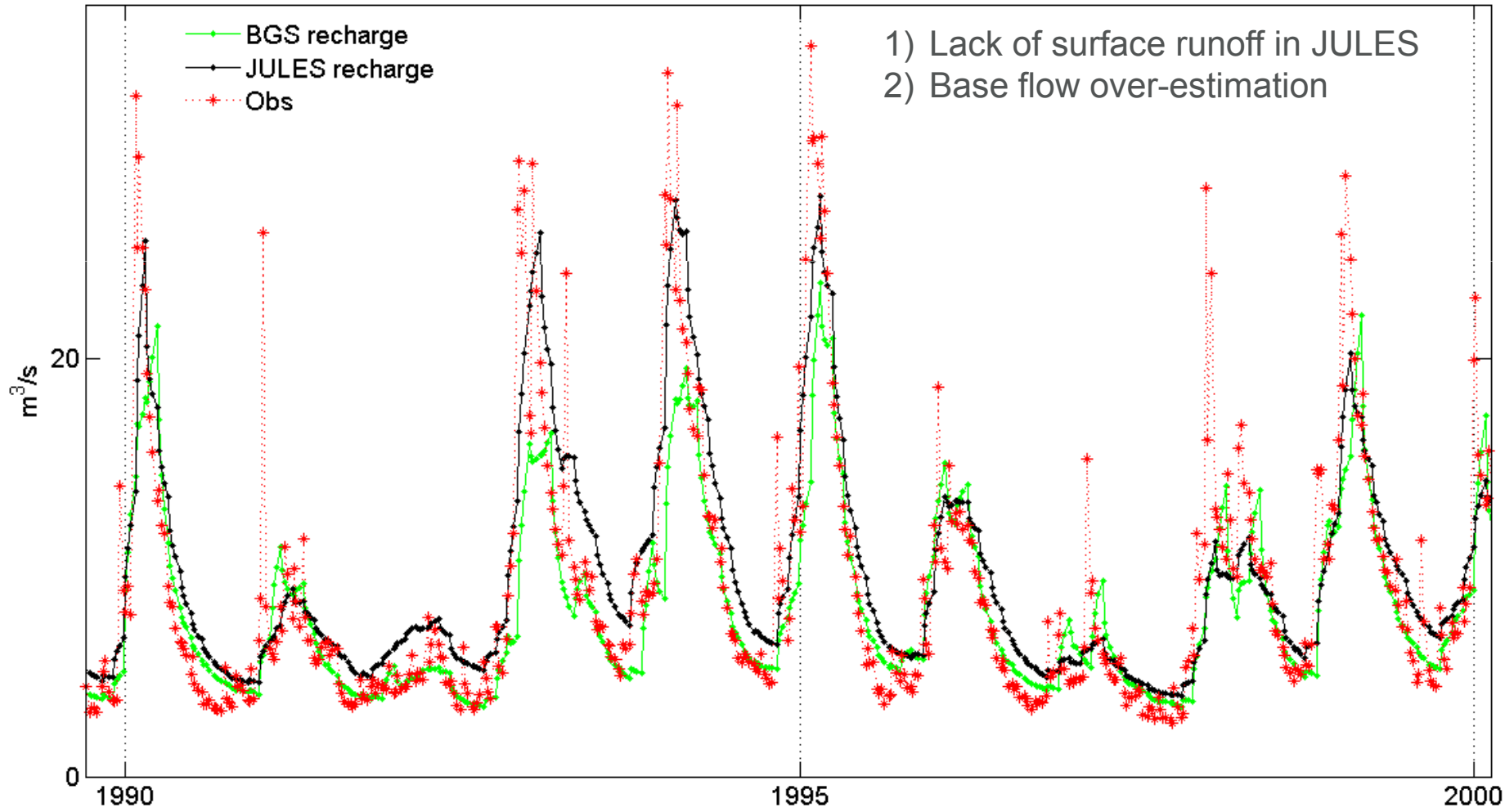
Flows – ZOOMQ3D groundwater routing



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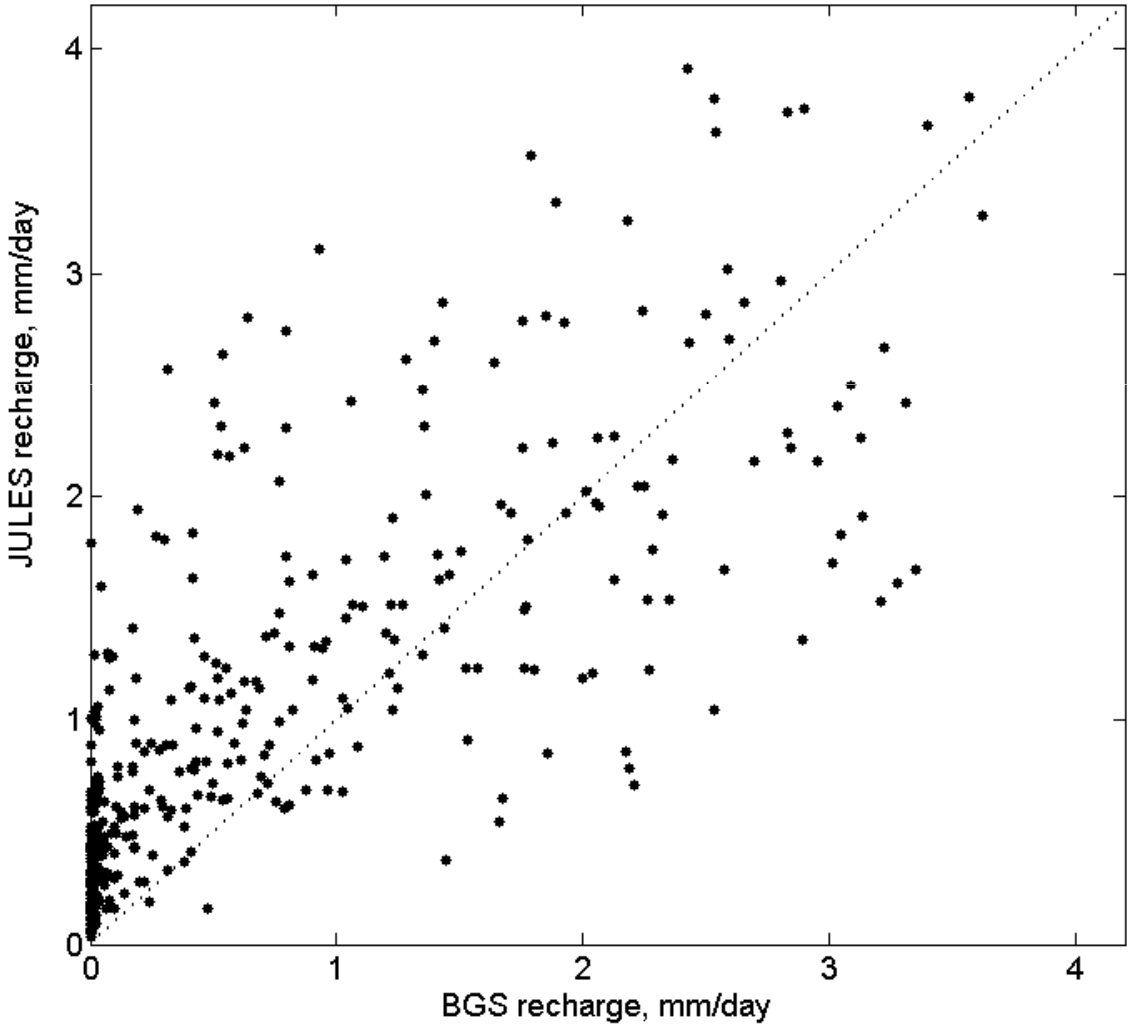
Recharge – comparison of BGS model and JULES



BGS recharge is 69% of JULES recharge

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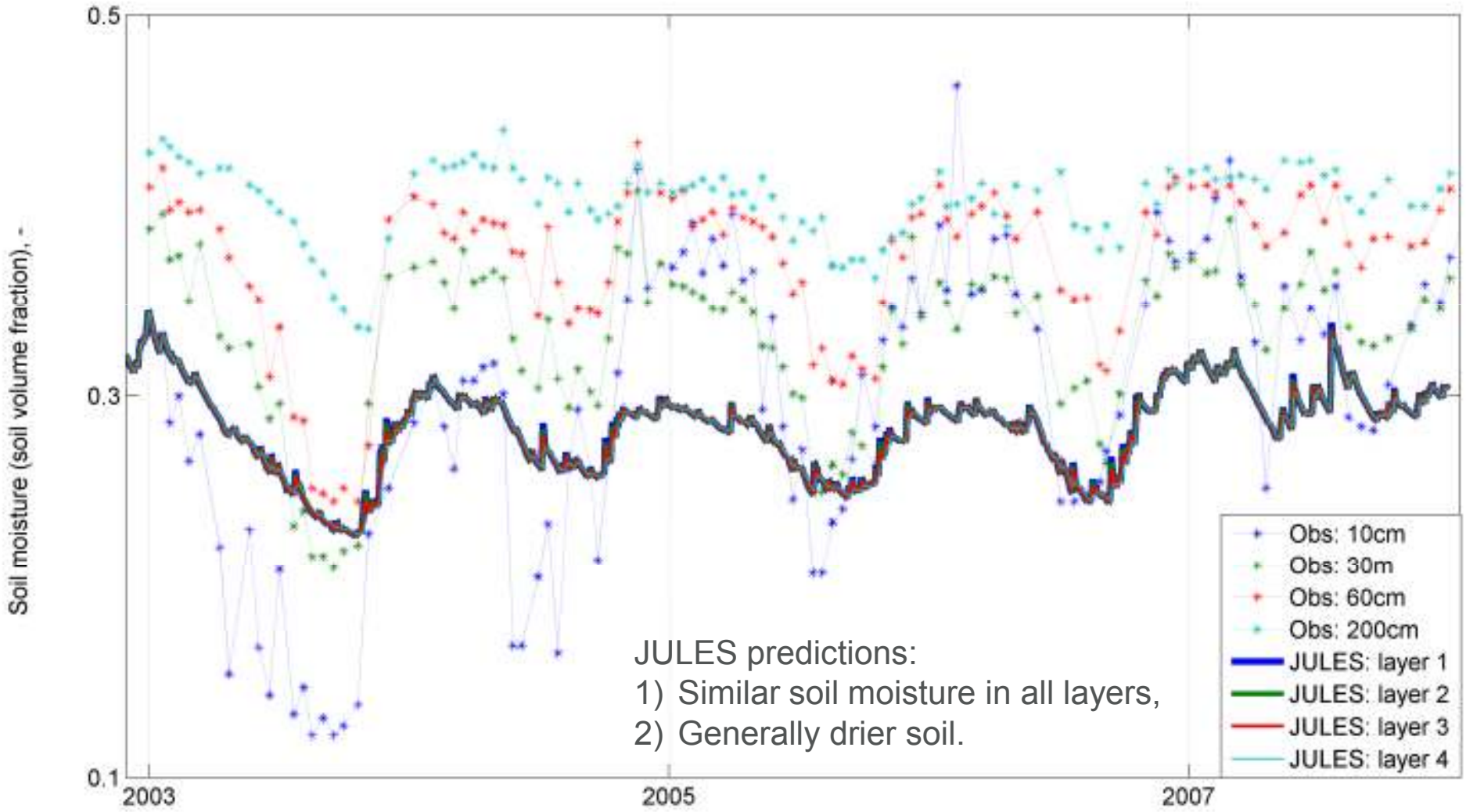
Soil moisture: Warren Farm



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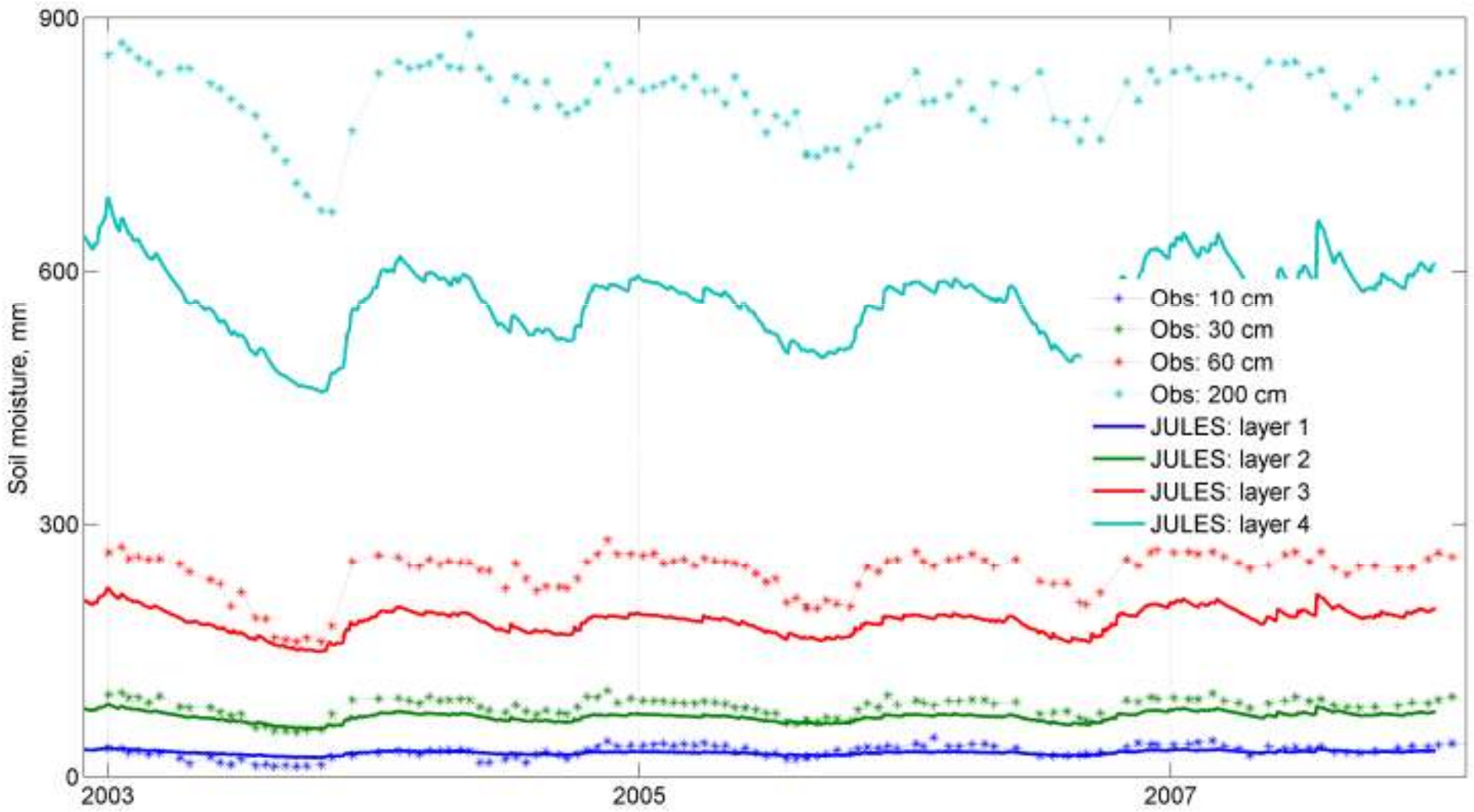
Soil moisture: Warren Farm



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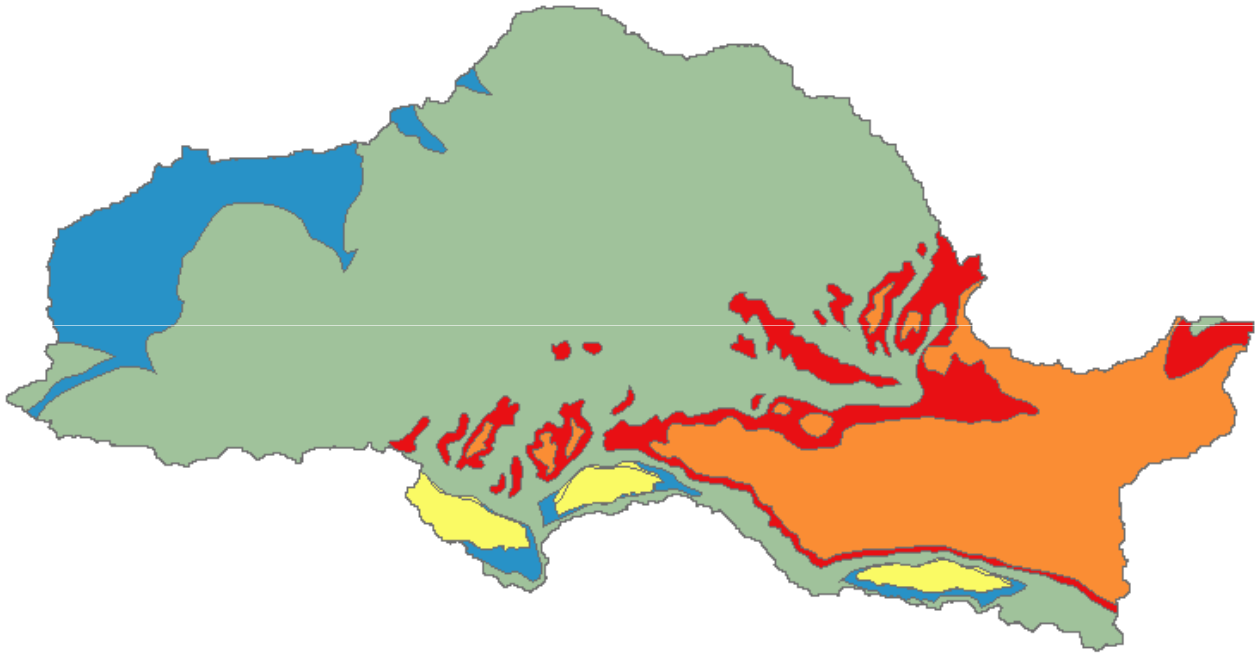
Kennet Geology



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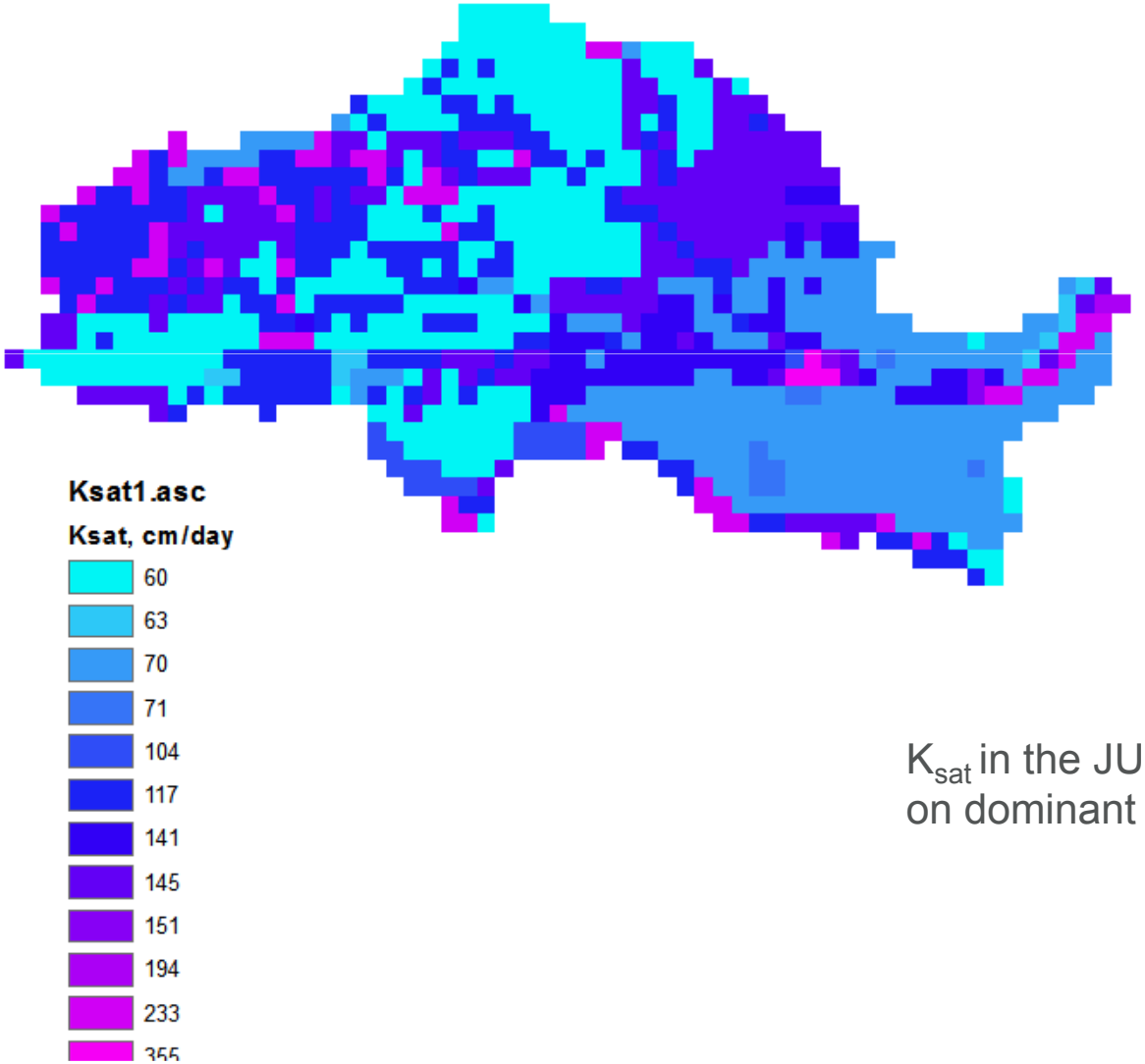
Grid to grid variability in permeability



K_{sat} in the JULES top layer, based on dominant soil series

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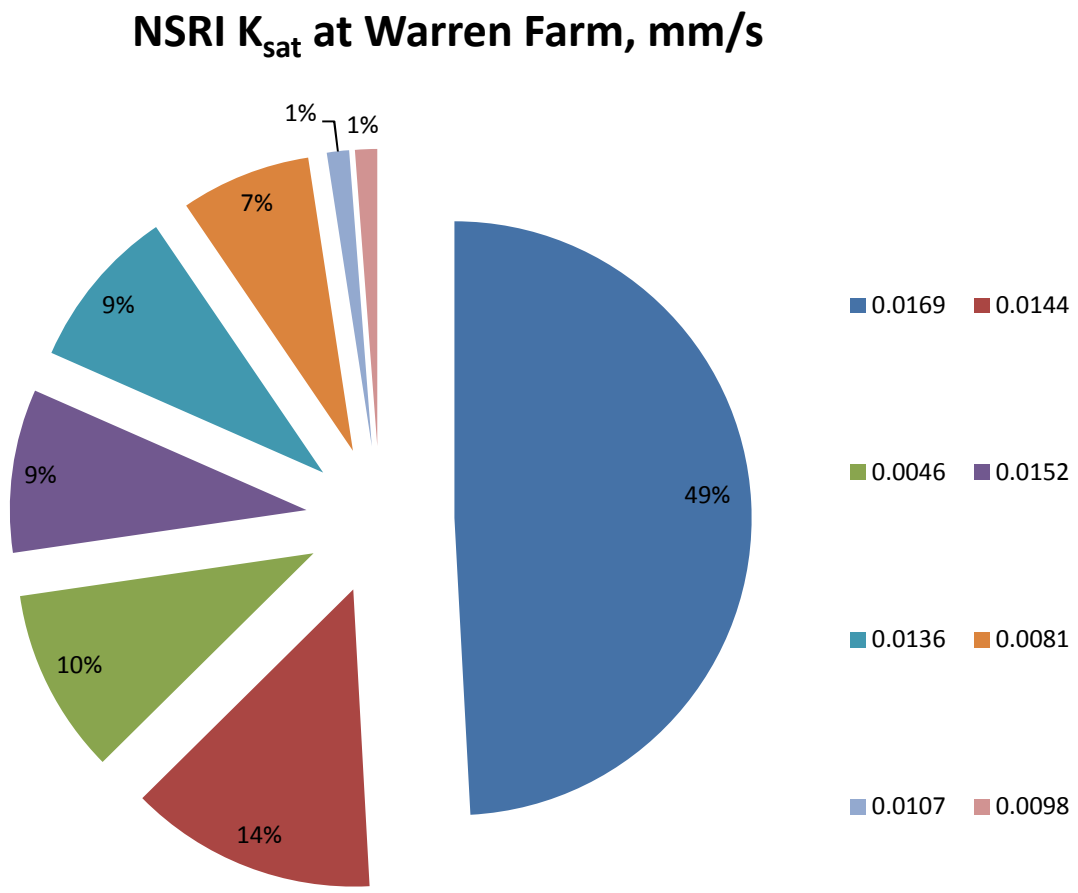
Sub-grid variability in permeability



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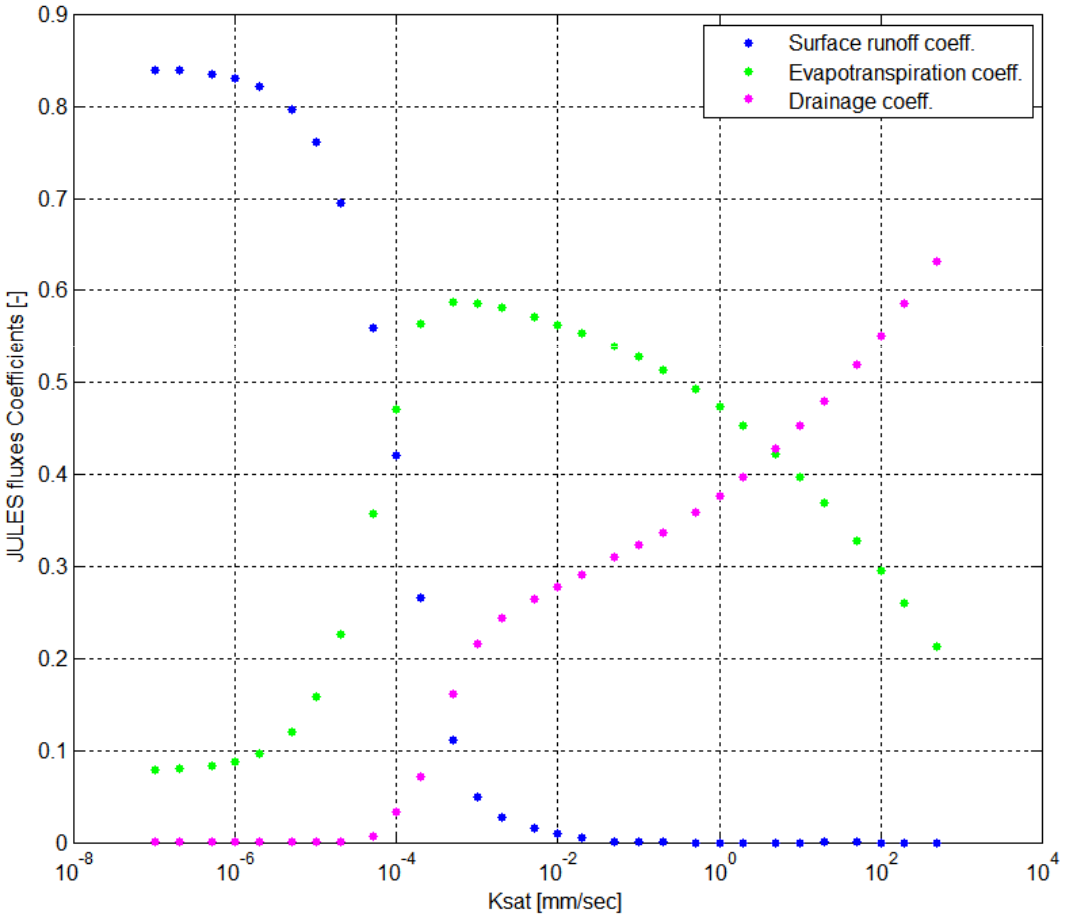
JULES: sensitivity to K_{sat}



Compare to: K_{sat} in the Kennet is 0.007 – 0.04 mm/s (top layer)

October, 2002 – December, 2008
Other soil parameters = "fine soil" parameters

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Summary and conclusions

New developments:

1) JULES was set up using a 1km NSRI soil database,
2) 1 km CHESS data was used as meteorological input, and
3) ZOOMQ3D was used for groundwater routing.
4) PDM or Topmodel options in JULES not used

Issues with results:

1) No surface runoff,
2) High drainage rate,
3) AE under-estimation,
4) Drier than observed soils.

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Possible next steps