Assessing the fidelity of the water balance of the JULES model at a 1km gridded scale across the UK

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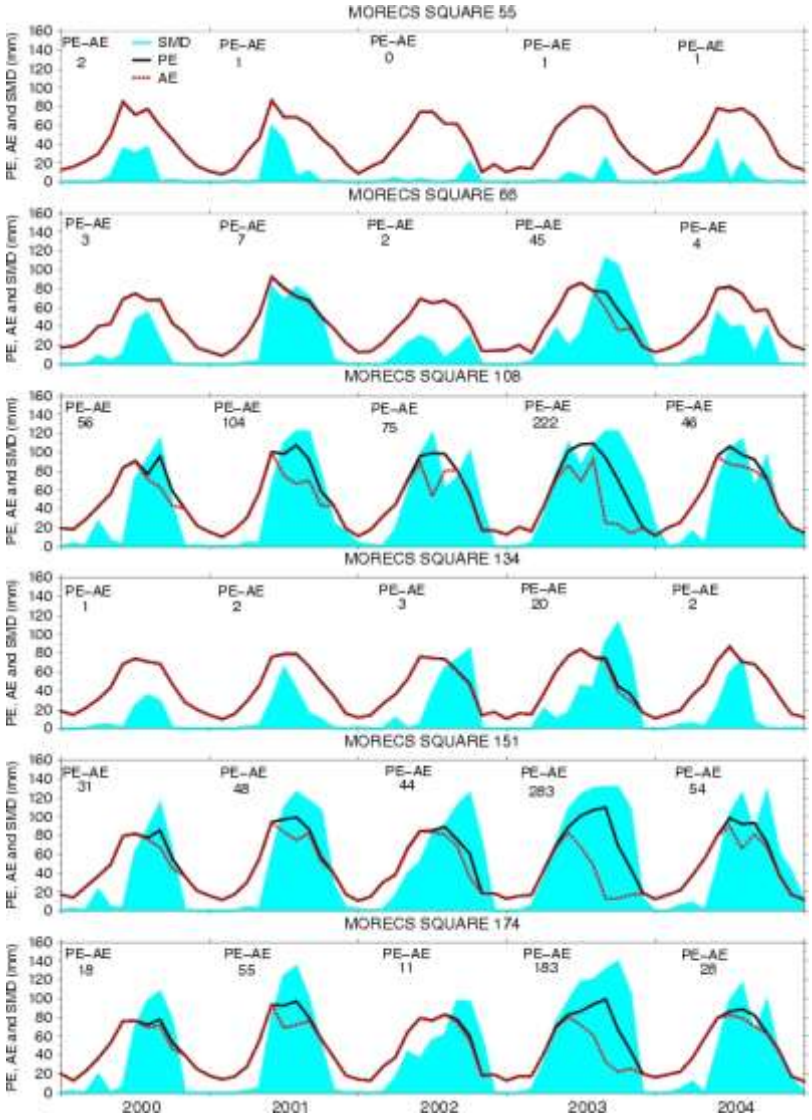
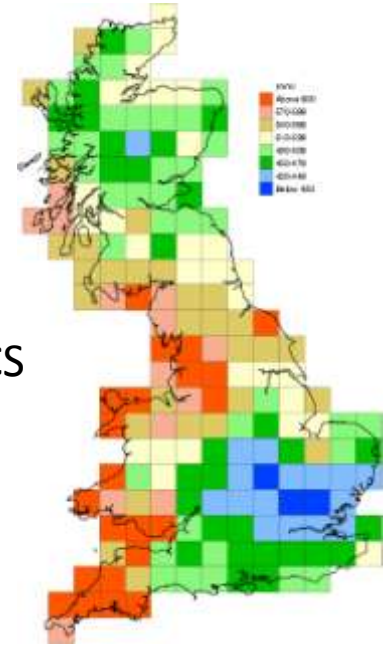
Water balance assessments



Currently, an assessment of the UK Water balance is made using the MORECS Model at a grid-square of 40km

Published by NRFA

MORECS



Hydrological Summary from NRWA:
http://www.ceh.ac.uk/data/nrfa/nhmp/annual_review.html

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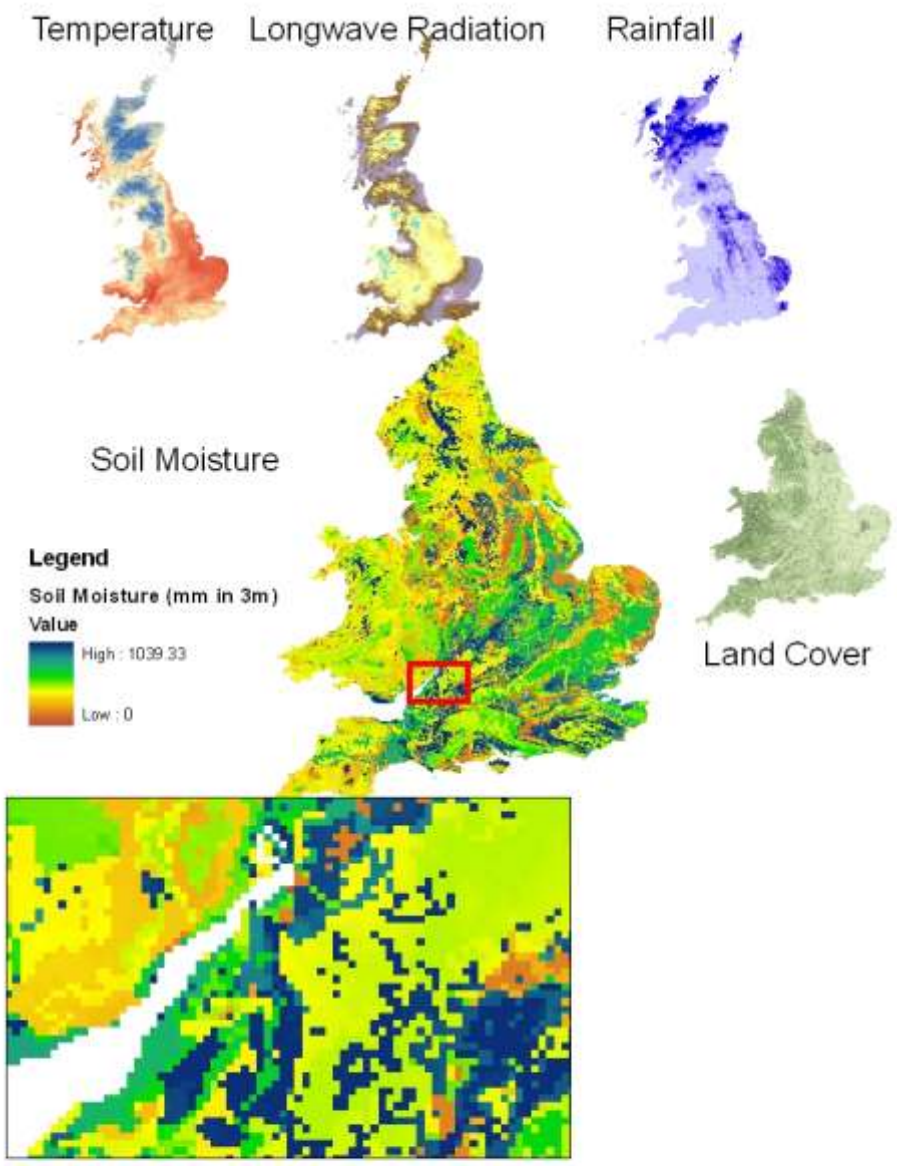
CHESS = Climate Hydrology Ecology Support System

- Evaporation, soil temperature and moisture and runoff
- Daily, 1km, 30 years
- Diagnosed from JULES

Address the issue of multiple environmental drivers of change on UK resources

- Climate Change
- Land cover change
- Nitrogen loading



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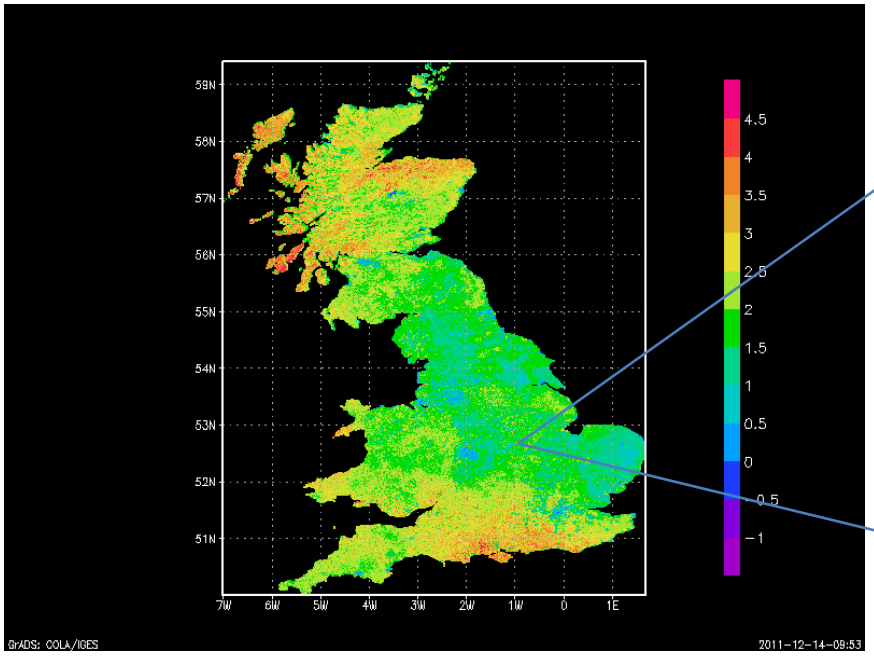
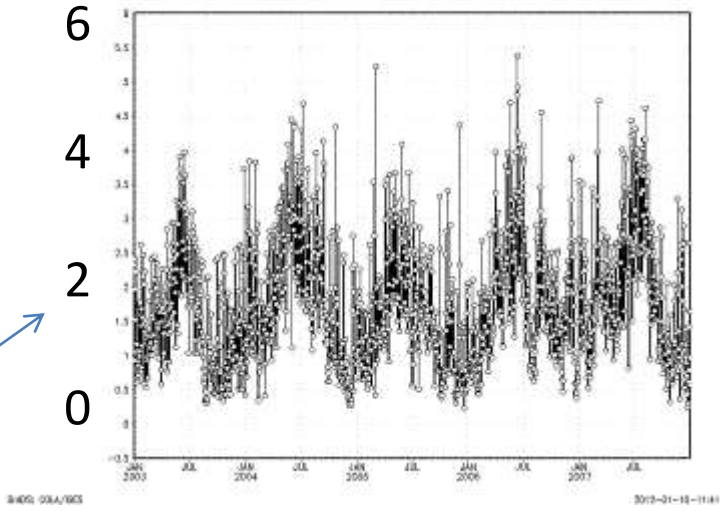
Time series at a point

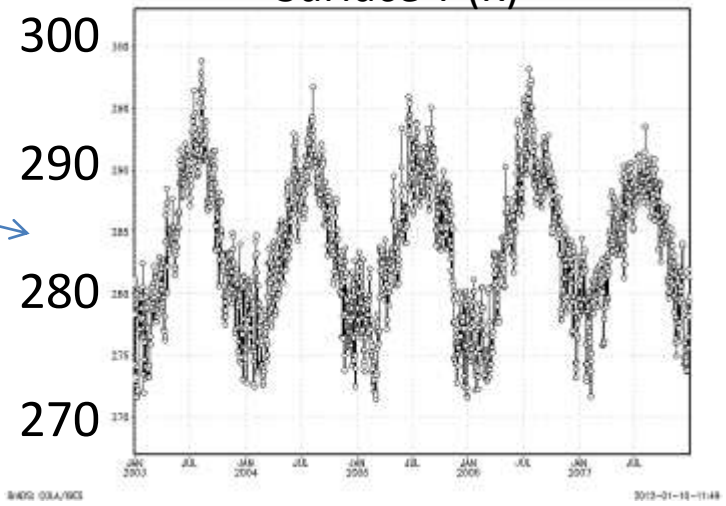
Possible to look at daily time series anywhere in the UK
Represents mean over 1km square



Evaporation (mm/day)



Surface T (K)



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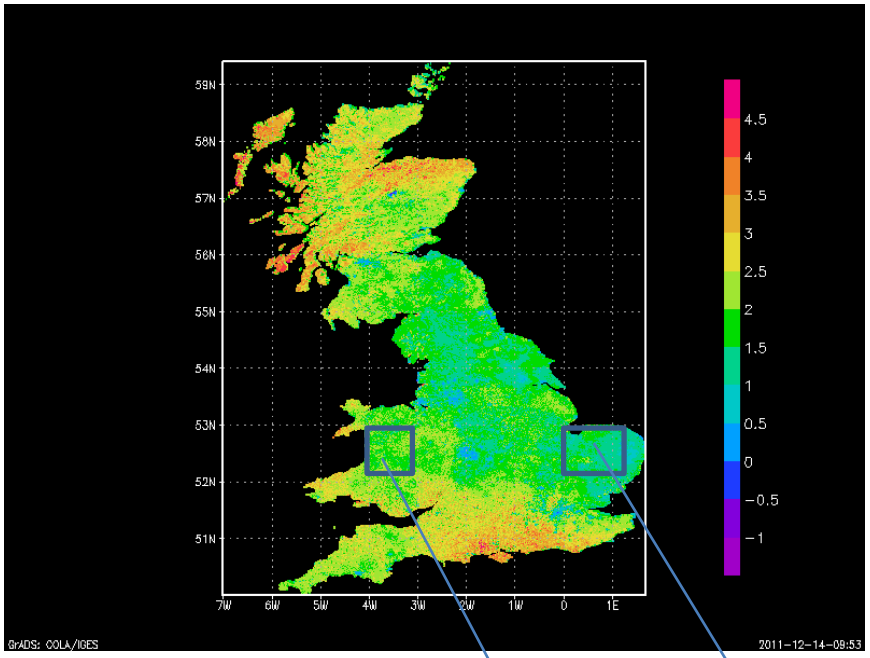
Time series at regional scale

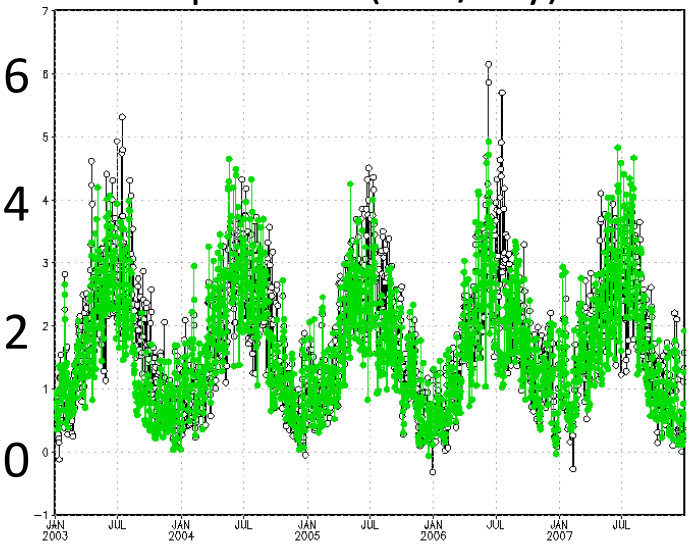
Possible to look at mean over 100km square



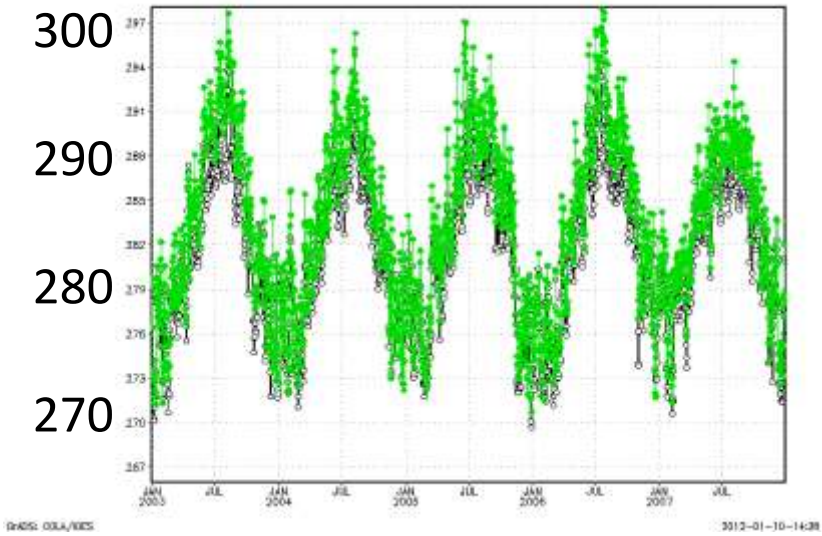
Black

Green

Evaporation (mm/day)



2003 2004 2005 2006 2007



2003 2004 2005 2006 2007

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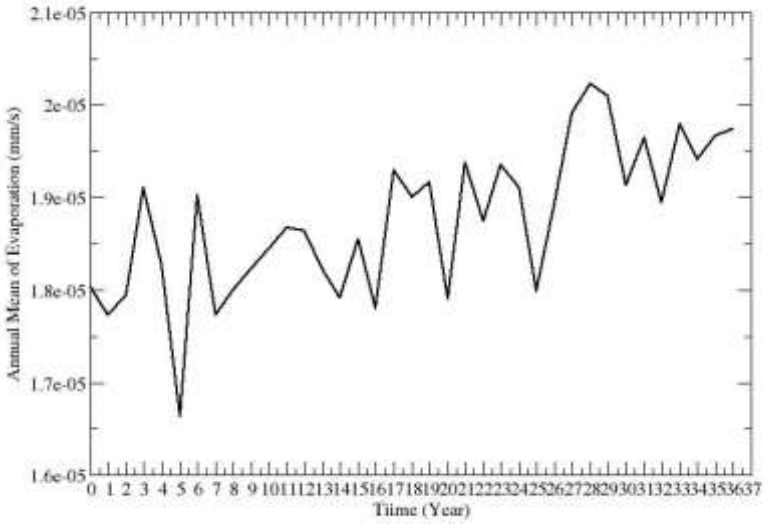
Time series across the UK

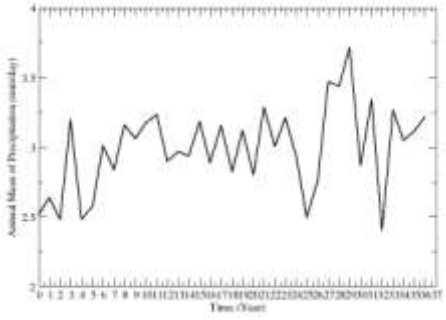
UK-wide annual average water balance: 1971 to 2006

Possible upward trend in evaporation?

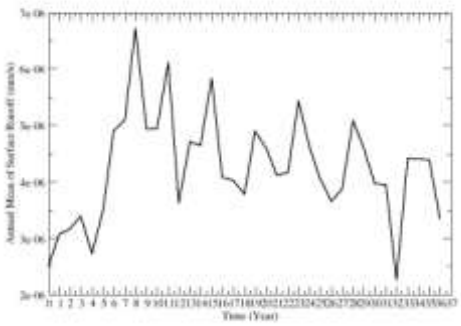
Evaporation



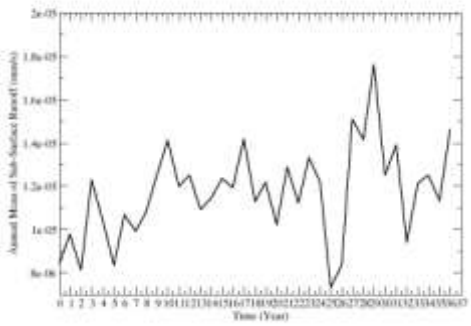
Rainfall



Surface runoff



Sub-surface runoff



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But is it right?

Need orthogonal datasets to check the model output:

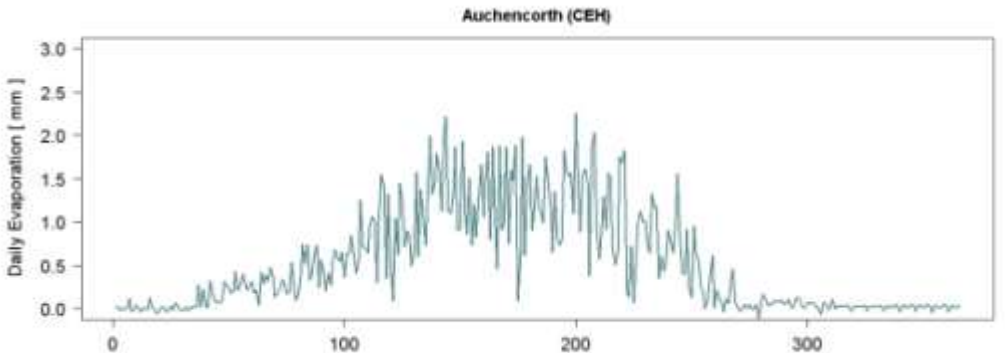
River flow: National River Flow Archive at CEH

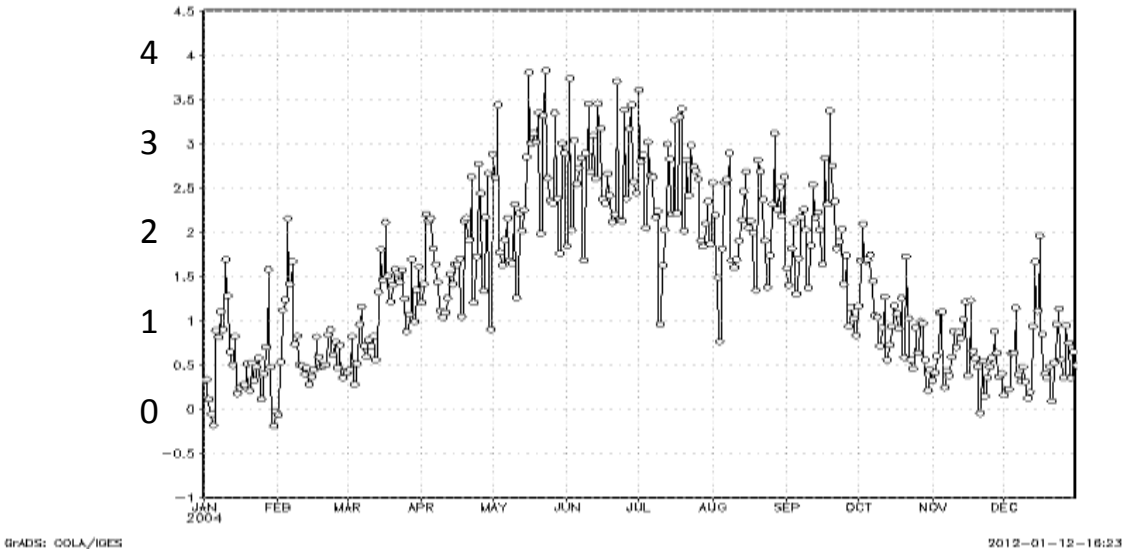
Direct Evaporation (EC): CEH data at Tadham Moor, Sheepdrove, Wytham, Edinburgh

Soil Moisture: Data records held at CEH

Satellite data of LST (see next slides)

EC data from site near Edinburgh





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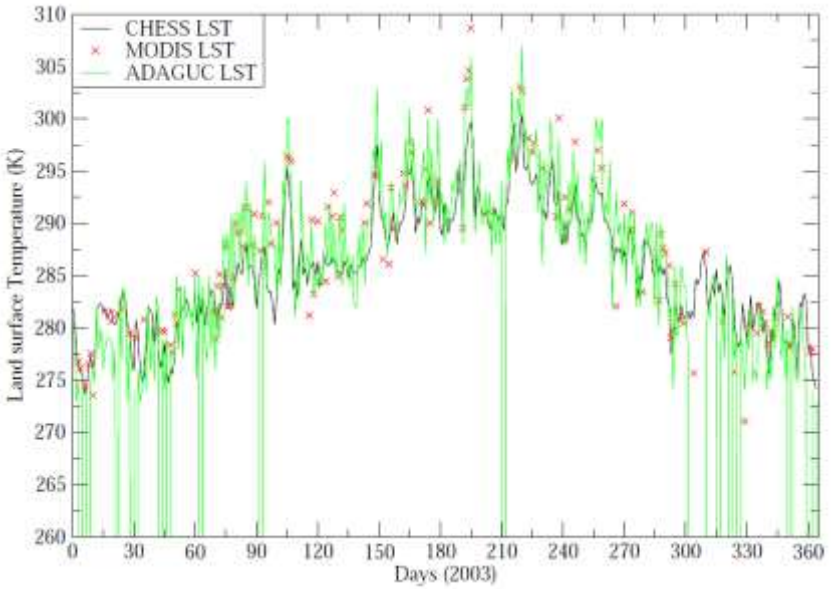
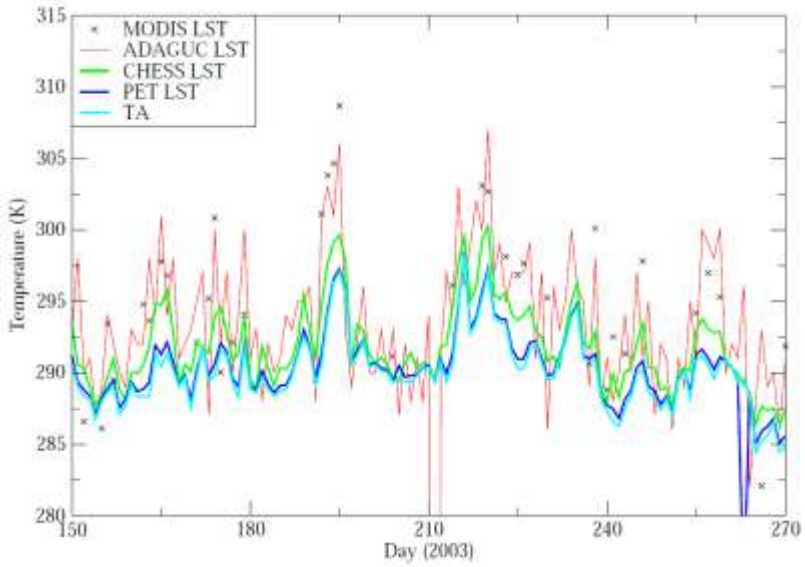
Daily time series of LST

Look at daily time series of LST from MODIS and ADAGUC

11am – outputs from JULES

Initial assessment looks good
Note: lower limit to TS can be calculated with Potential Evaporation





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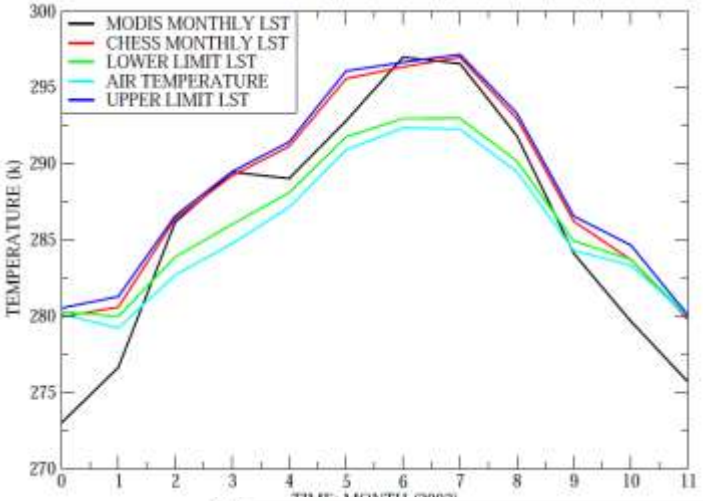
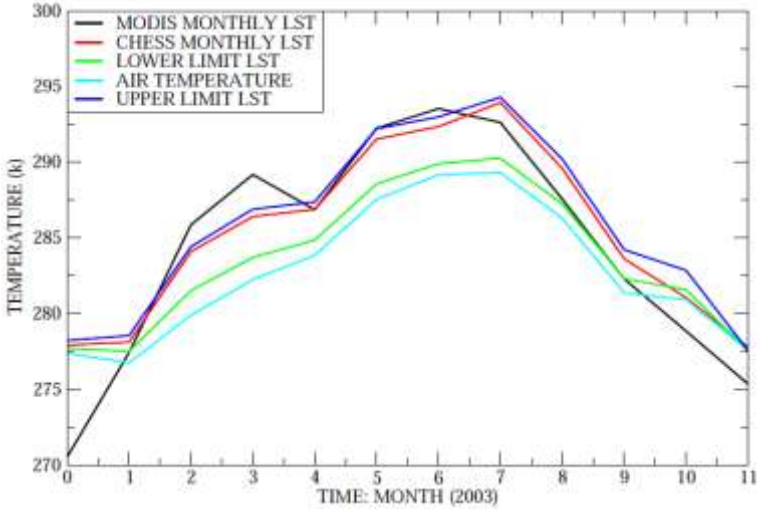
Seasonal average LST

Average up to seasonal mean: Now showing upper limit (evaporation is zero) and lower limit (evaporation at potential).

MODIS has a different seasonal pattern in winter.

Several locations round the country show the same seasonal pattern





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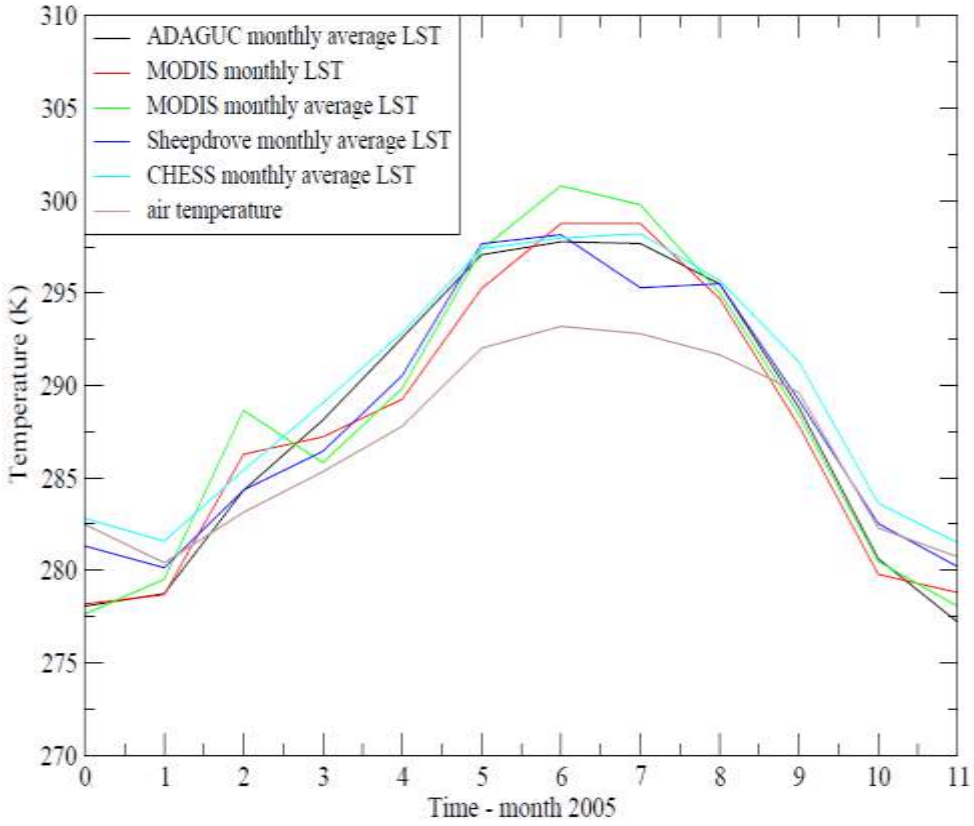
Site data: Sheepdrove

Checking against the best estimate we have of observed Land Surface Temperature

Conclusion: need to be cautious about data



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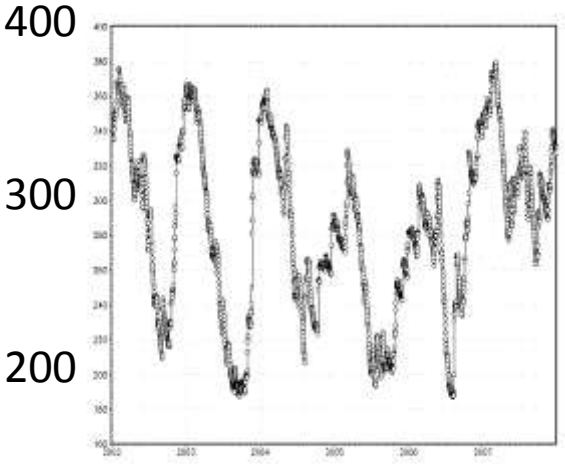
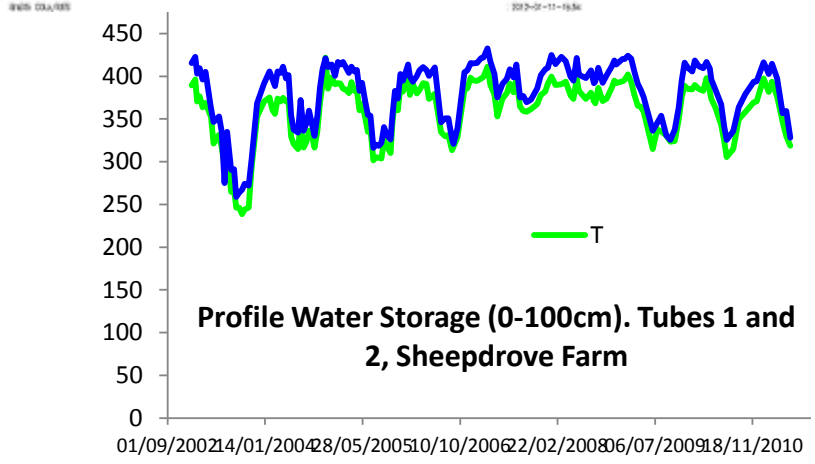
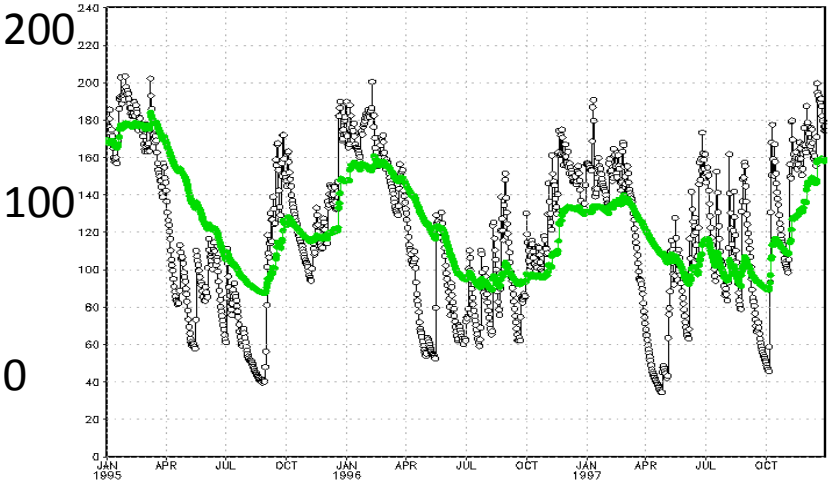
Soil moisture: site data

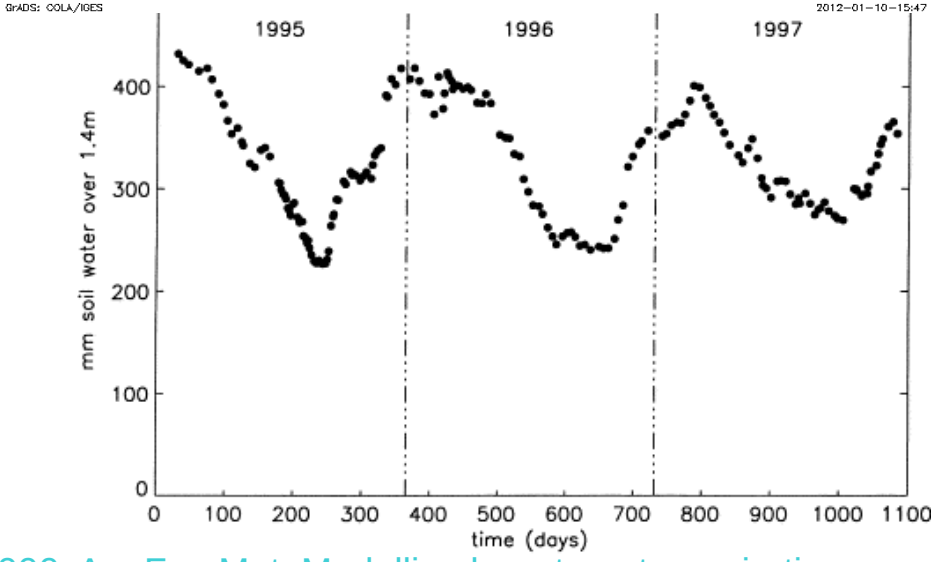
Ridgeway (Sheepdrove)





Howbery Park





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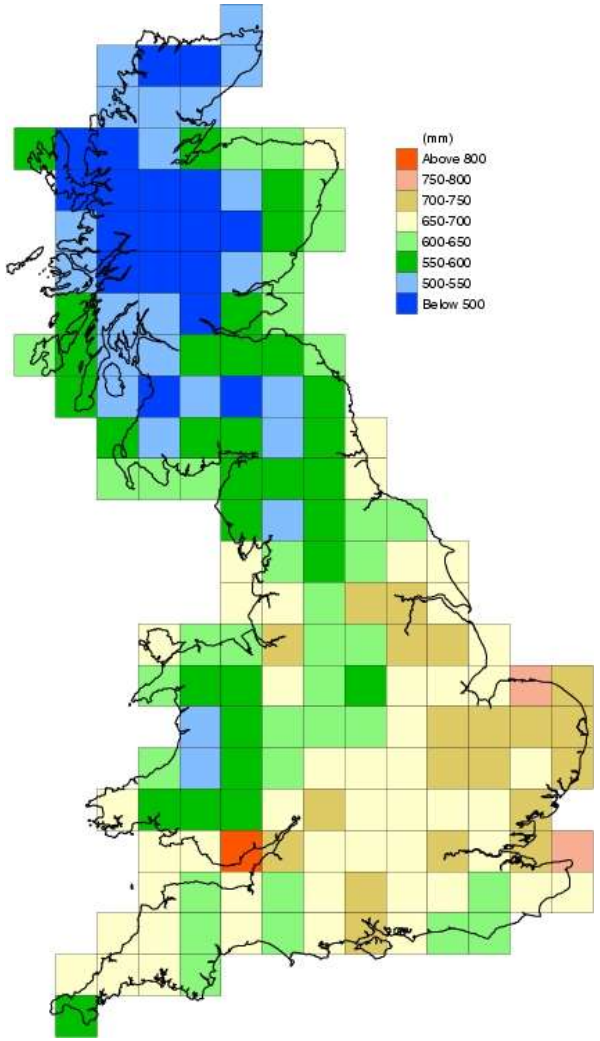
Harding et al, 2000, Ag. For. Met. Modelling long-term transpiration measurements from grassland in southern England

Licensing arrangements for the met data

The Meteorological data is downscaled from MORECS data

We cannot disseminate it (very restrictive license)

In communication with Met Office about this



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MORECS: Met Office Regional Evaporation Calculation System

Conclusions:

- New data assessments needed to ensure the fidelity of the UK water balance diagnosed by JULES
- Initial assessment using river flows and satellite LST look reasonable
- No metrics yet to assess how ‘good’ is ‘good enough’?
- Impacts of land use change and climate change will be possible

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