Issues relating to use of the BETWIXT scenario data/software

- **Consistency with UKCIP02**
- **Perturbing NSRP (changes in mean, PD, var., skew.)**
- **Consistency of the CRU/Newcastle scenarios**
- **Representativeness of station data : Manchester temperature transect/urban heat island study**

BETWIXT maintains consistency with UKCIP02

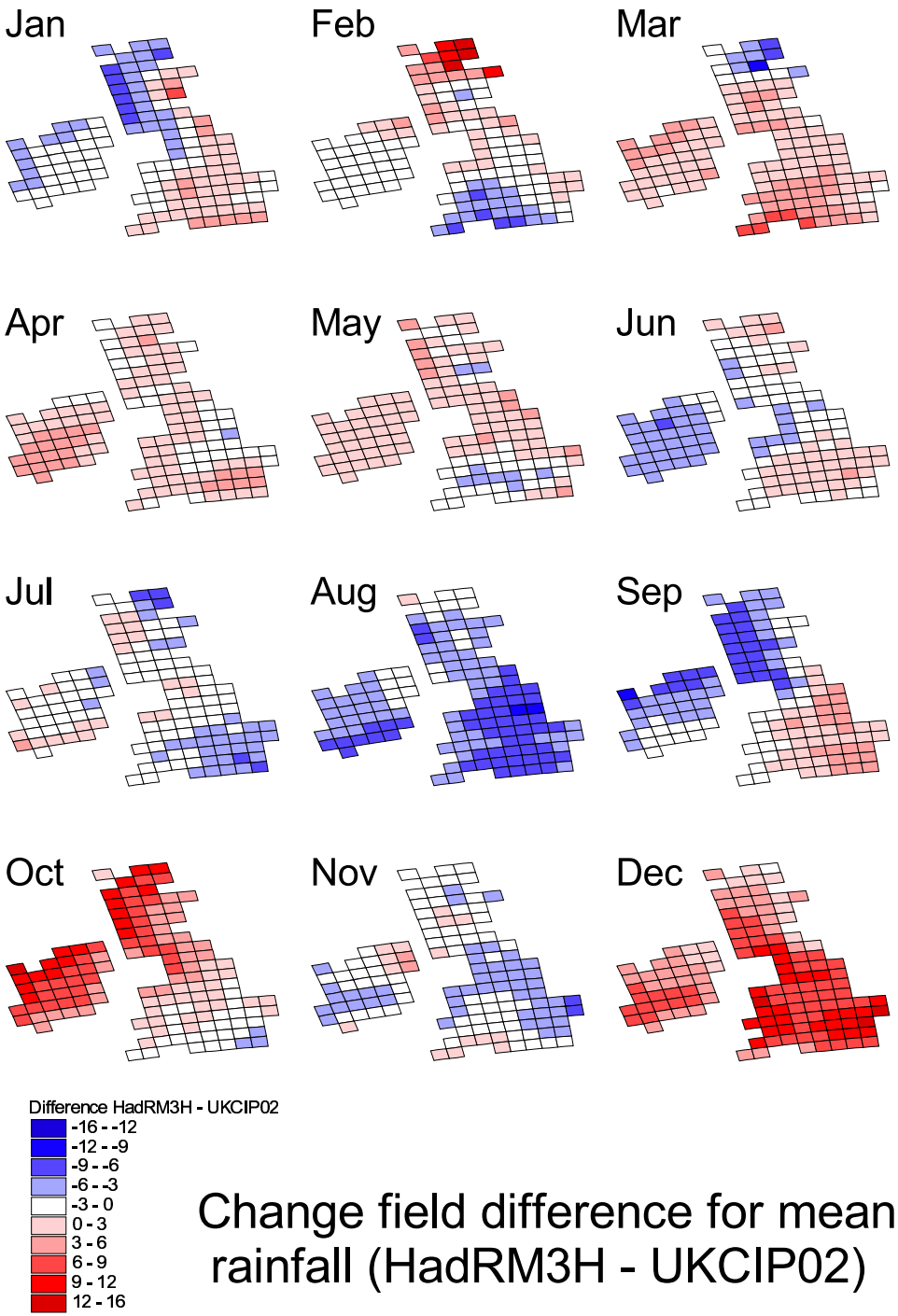
- By using ‘change factors’ calculated from the same HadRM3H simulations as used to produce the UKCIP02 spatial patterns
- By using UKCIP02 multiplying factors

Time-slice	Low Emissions	Medium-Low Emissions	Medium-High Emissions	High Emissions
2020s	0.24	0.27	0.27	0.29
2050s	0.43	0.50	0.57	0.68
2080s	0.61	0.71	1.00	1.18

However, according to

http://www.ukcip.org.uk/scenarios/production/production.html:

It should also be noted that *temporal interpolation* has been applied to the monthly data. The interpolation was applied to the Medium-High Scenario change fields (from which the other scenarios are then derived by pattern-scaling). By using a 1-2-1 filter any step changes produced by the model between adjacent months have therefore been smoothed.



Change field difference for mean rainfall (HadRM3H - UKCIP02)

Difference in monthly change fields for mean rainfall produced using daily HadRM3H data and by UKCIP02 with temporal smoothing using a 1-2-1 filter. Difference field is produced by subtracting the UKCIP02 change fields from those produced using HadRM3H.

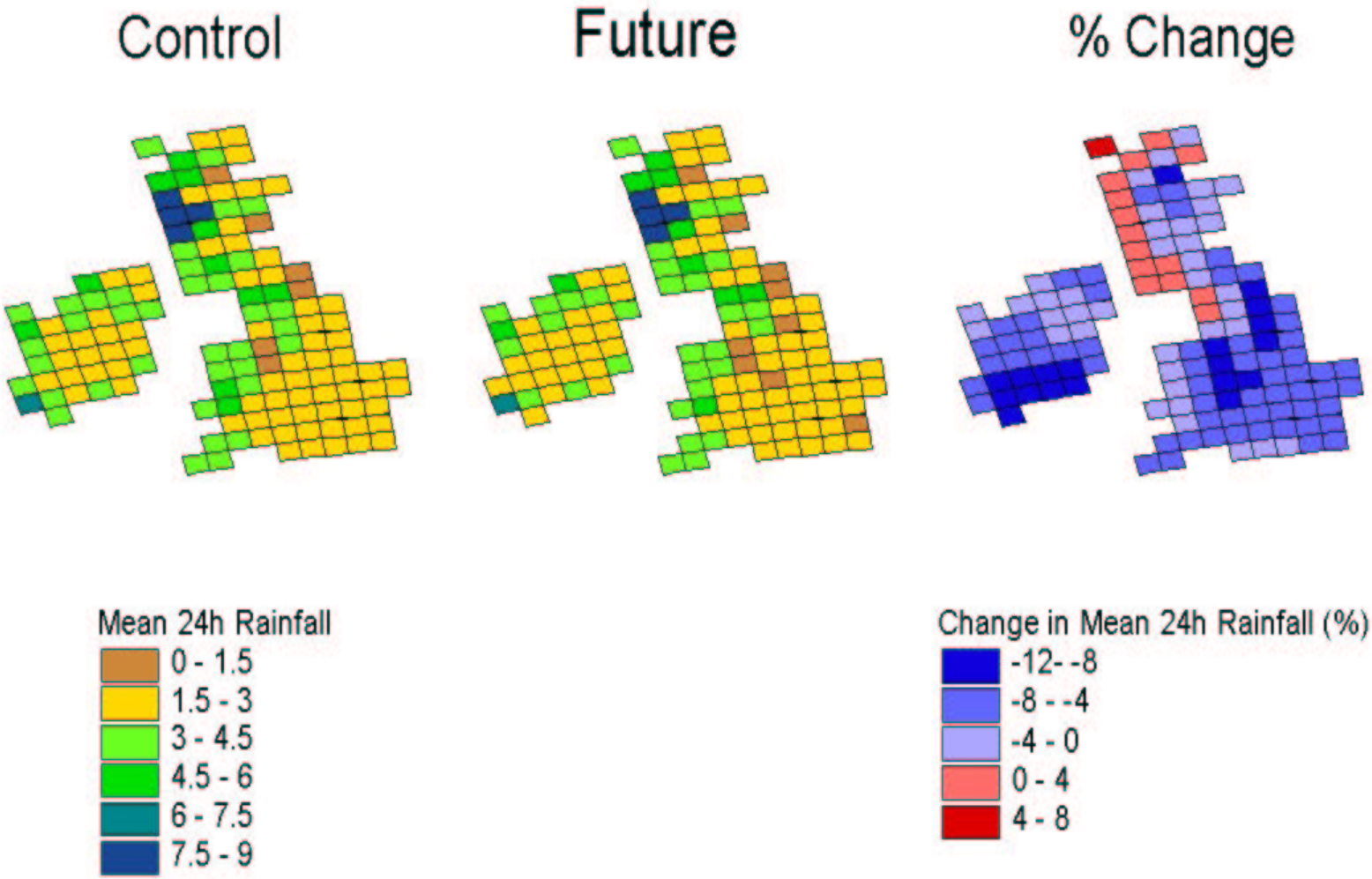
For BETWIXT it is not appropriate to apply seasonal or spatial smoothing

- **But we will avoid any ‘anomalous’ HadRM3H grid squares**
- **And justify this decision in the technical briefing note on UKCIP02 change fields and scaling factors**

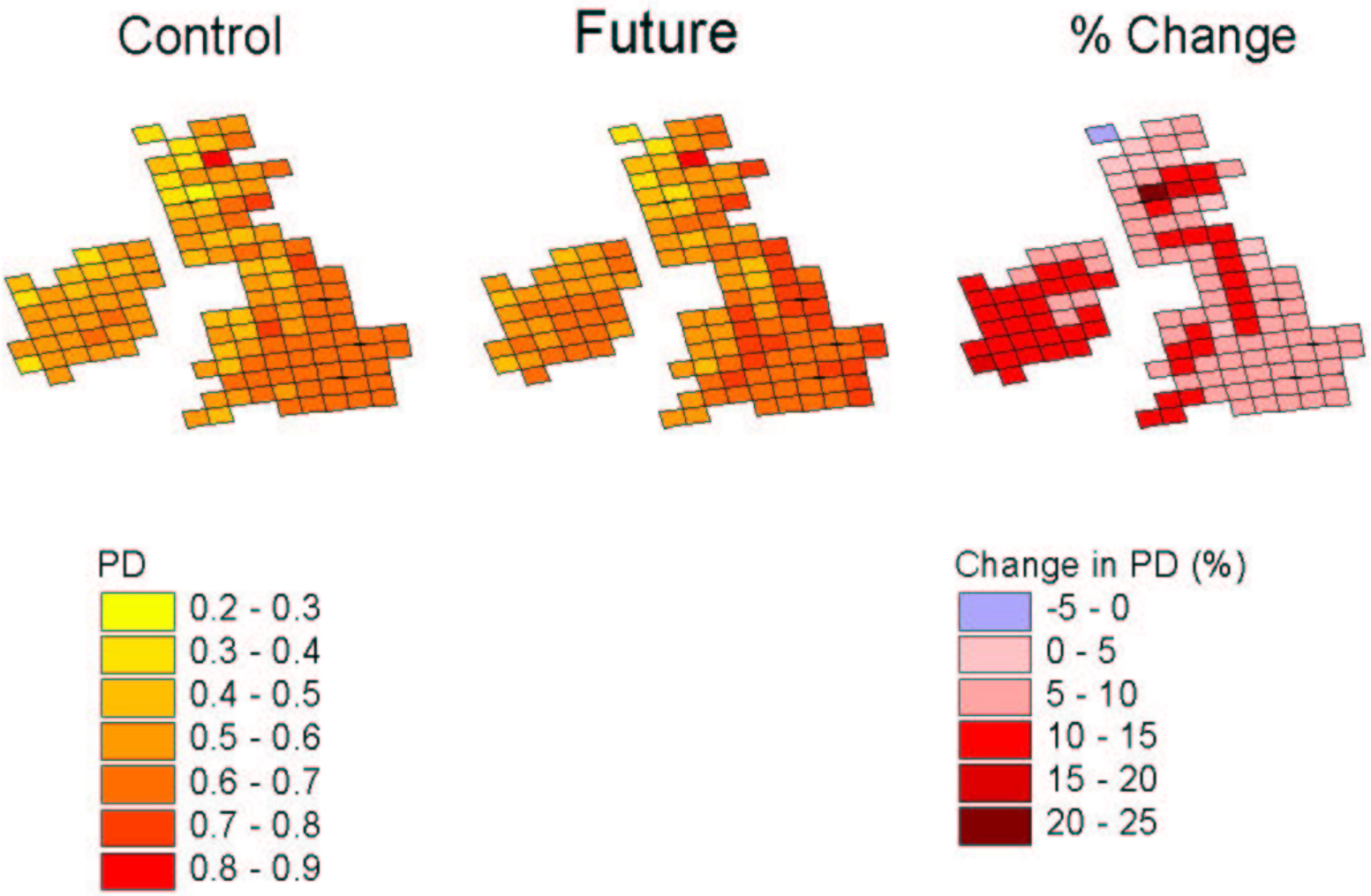
Perturbing NSRP

HadRM3H changes in:

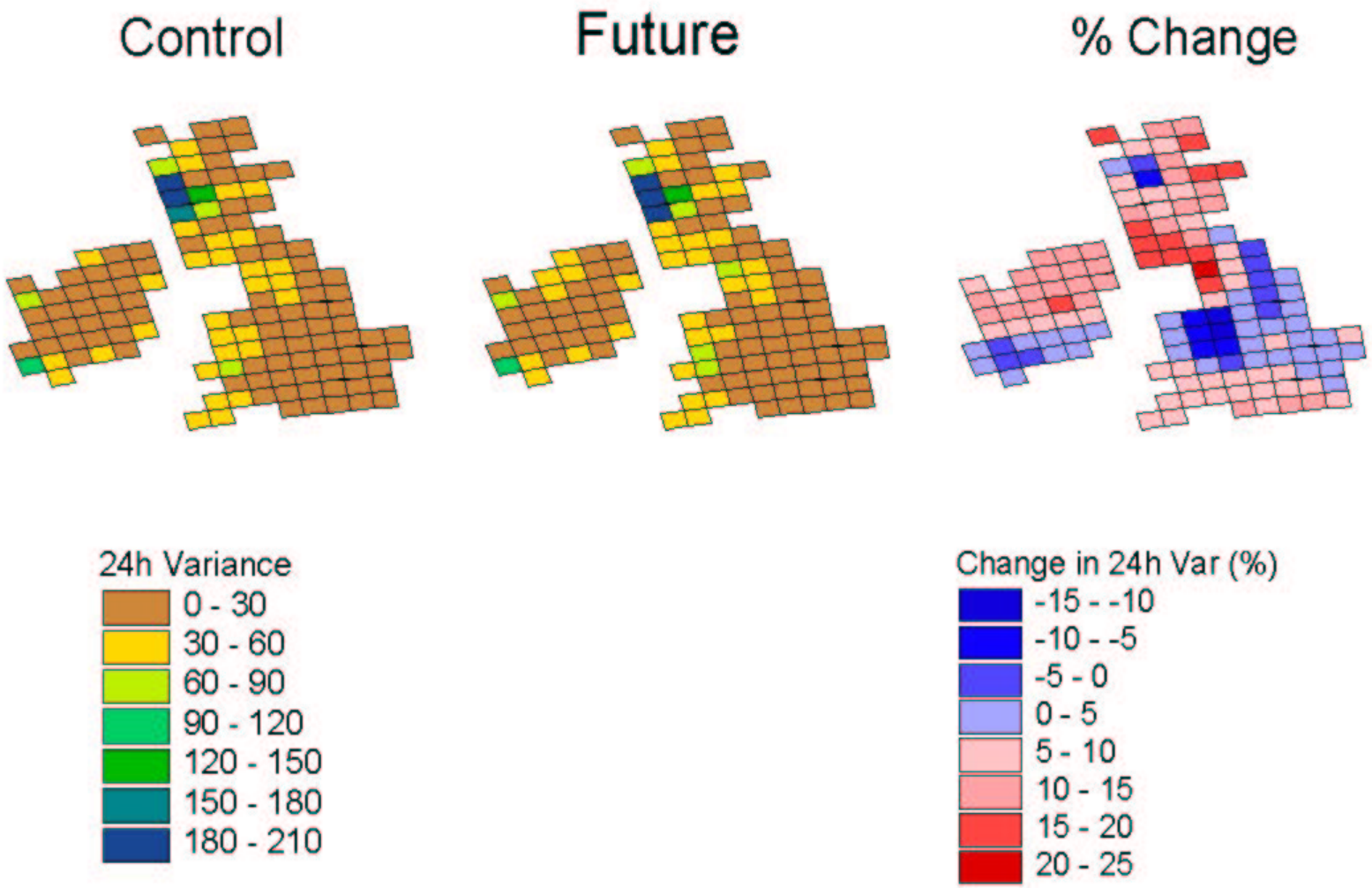
- **Mean daily rainfall**
- **Proportion of dry days**
- **Daily variance**
- **Daily coefficient of skewness**



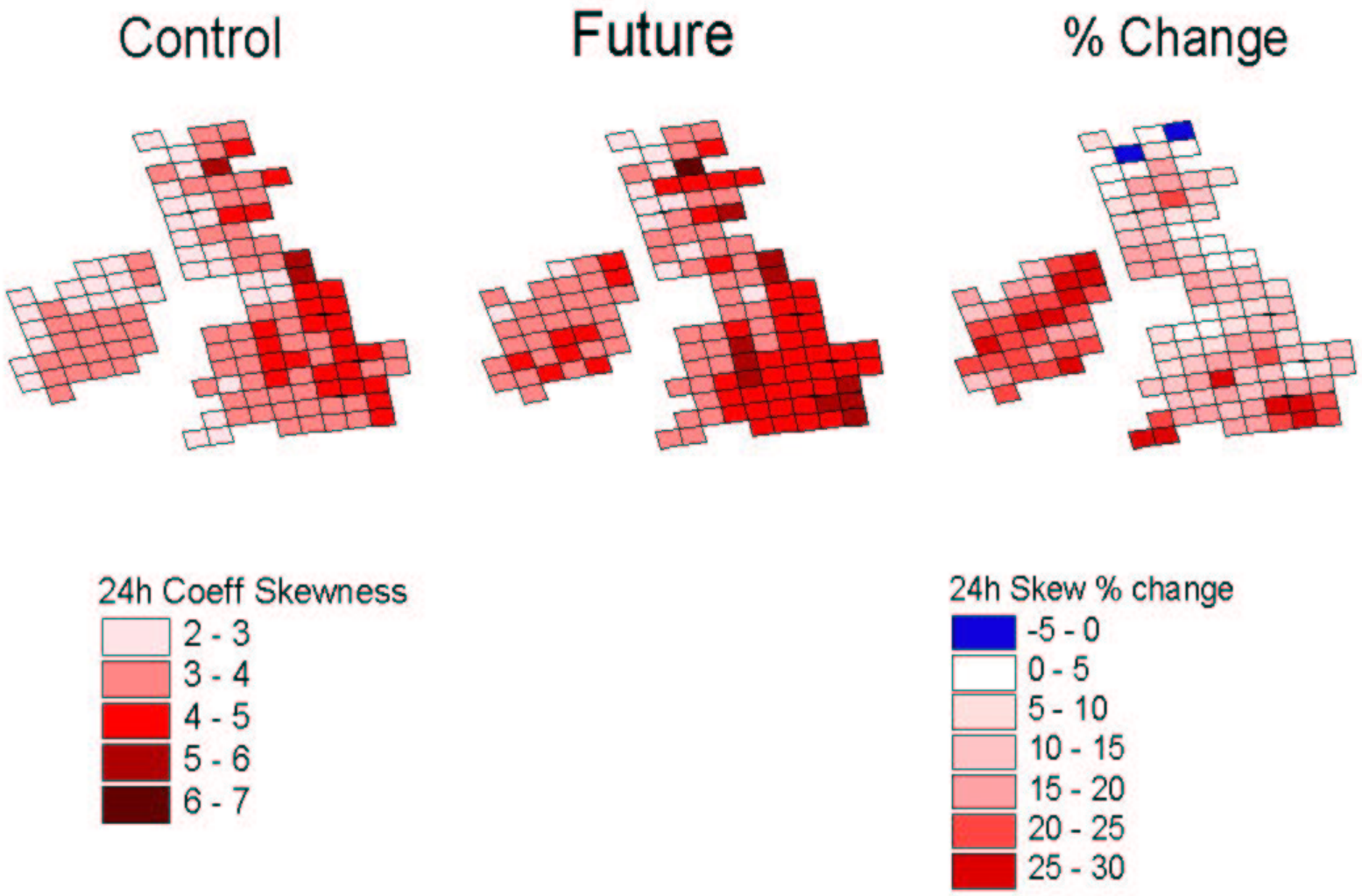
Mean daily rainfall for Control Scenario 1961-1990, Future Scenario UKCIP02 Medium-High 2071-2100 (SRES A2 Scenario) and percentage change between Control and Future Scenarios, produced using daily HadRM3H data.



Proportion dry days (PD) for Control Scenario 1961-1990, Future Scenario UKCIP02 Medium-High 2071-2100 (SRES A2 Scenario) and percentage change between Control and Future Scenarios, produced using daily HadRM3H data.



Daily variance for Control Scenario 1961-1990, Future Scenario UKCIP02 Medium-High 2071-2100 (SRES A2 Scenario) and percentage change between Control and Future Scenarios, produced using daily HadRM3H data.



Daily coefficient of skewness for Control Scenario 1961-1990, Future Scenario UKCIP02 Medium-High 2071-2100 (SRES A2 Scenario) and percentage change between Control and Future Scenarios, produced using daily HadRM3H data.

Consistency of the CRU and Newcastle scenarios

- We are using the same change fields and scaling factors (hence these are described in a jointly-produced technical briefing note)

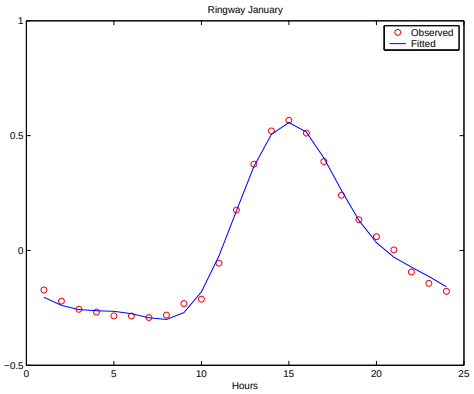
- We can compare scenarios for common stations, e.g., do different models produce different changes in extremes? (downscaling uncertainty)

NSRP hourly rainfall output will be used to drive the CRU hourly weather generator

- **Vapour pressure, wind speed and sunshine duration, are calculated from regression equations (for each hour/half month) with hourly temperature as the predictand**

- **Hence we need to calculate the diurnal temperature cycle for each day, so that it is consistent with the NSRP hourly precipitation….**

- So we aggregate the hourly rainfall to give a daily total
- Which is used as the primary variable to run the CRU daily weather generator, to give consistent daily temperature
- From which we then calculate the diurnal temperature cycle using a fitted sine curve to give us the predictands for the other variables



Primary generated hourly variable:

From NSRP -

Precipitation (mm)

Secondary generated hourly variables:

From generated daily temperature (fitted sine curve) -

Mean temperature (degrees C)

From regression equations with hourly T as predictand -

Vapour pressure (hPa)

Wind speed (ms^{-1})

Sunshine duration (hours)

Calculated hourly variables:

Relative humidity (%)

Wind gust speed (ms^{-1}) *from ratios of mean hourly/gust speeds calculated by Clair Hanson*

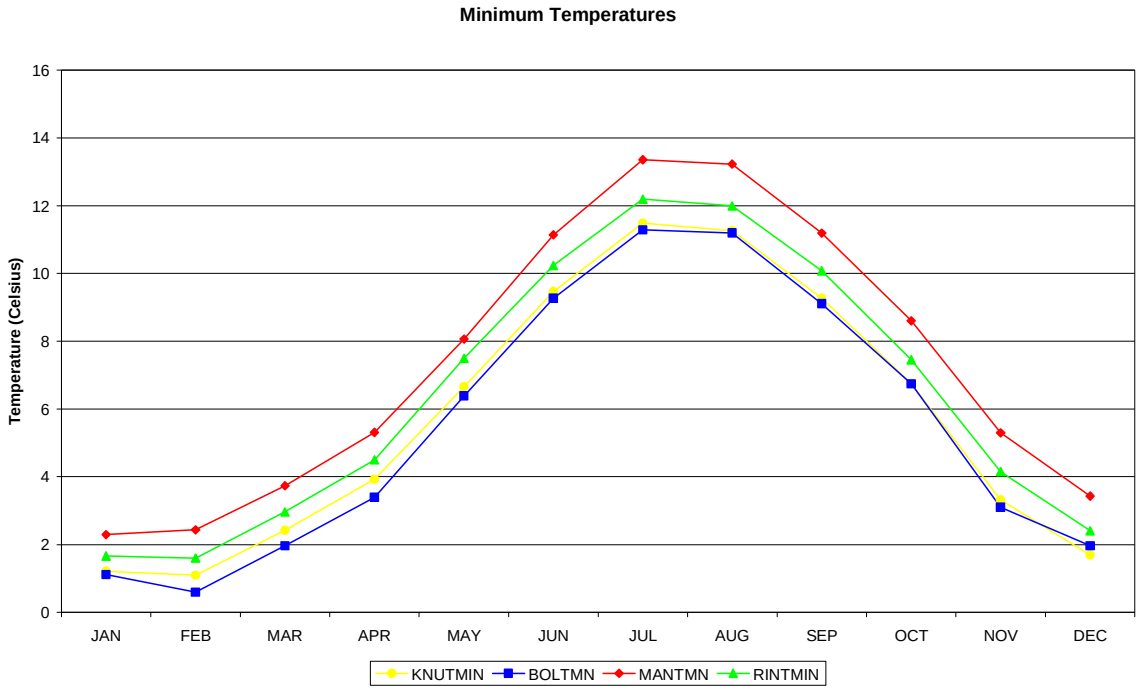
Representativenesss of station data

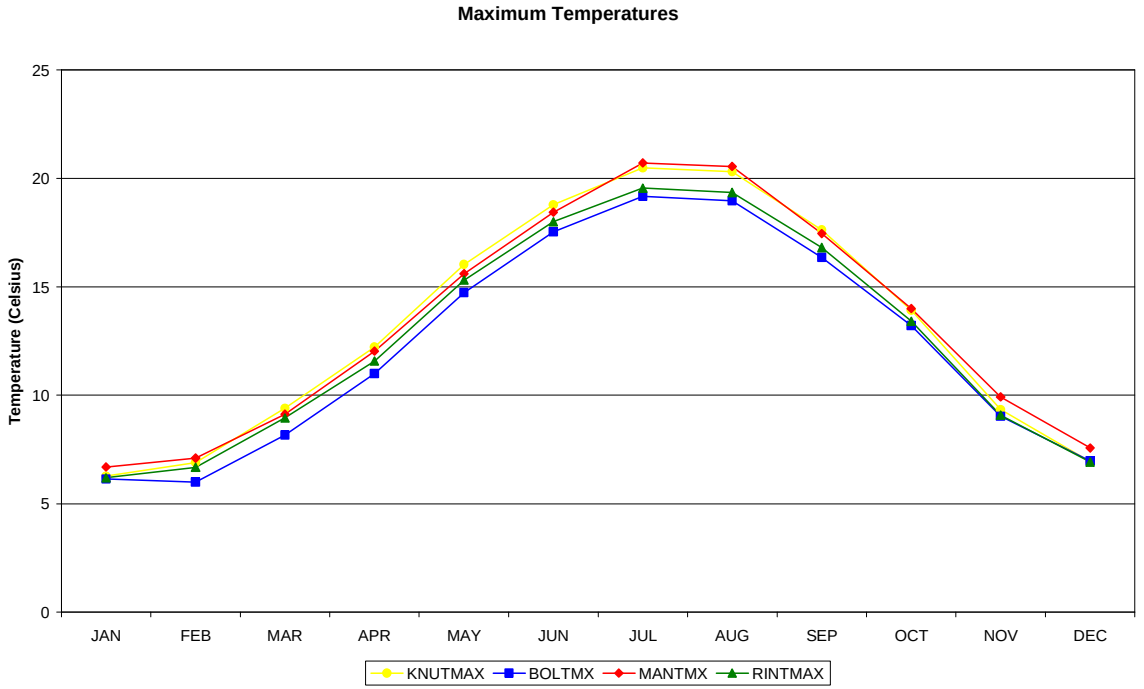
- **Manchester case study**
  - **transect:**
    - **Knutsford**
    - **Ringway**
    - **Manchester weather centre**
    - **Bolton**
  - **repeat of Rob Wilby's London study**

Theo Chineke and Clare Goodess

Minimum temperature seasonal cycle

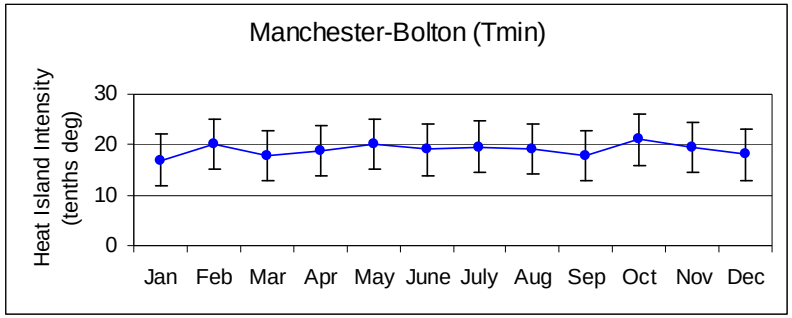
Knutsford – yellow
Ringway – green
Weather C. – red
Bolton - blue

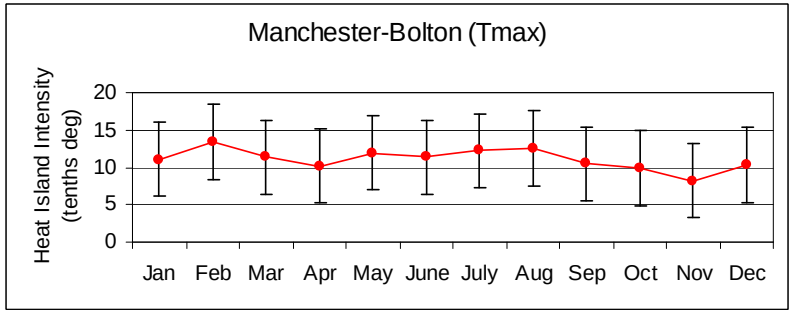


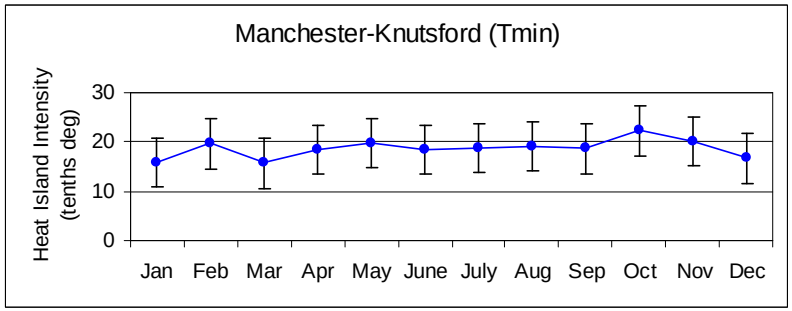


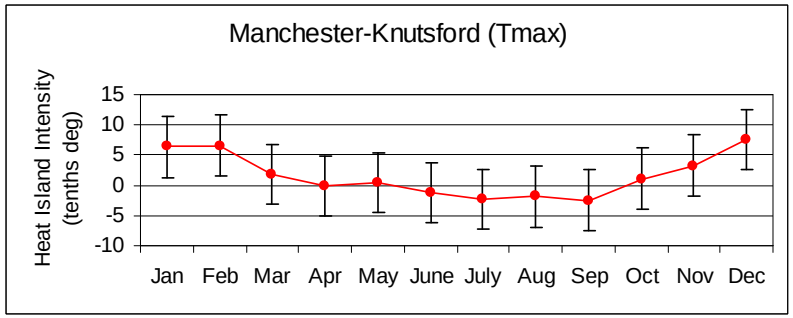
Maximum temperature seasonal cycle

‘Urban heat island’ seasonal cycle



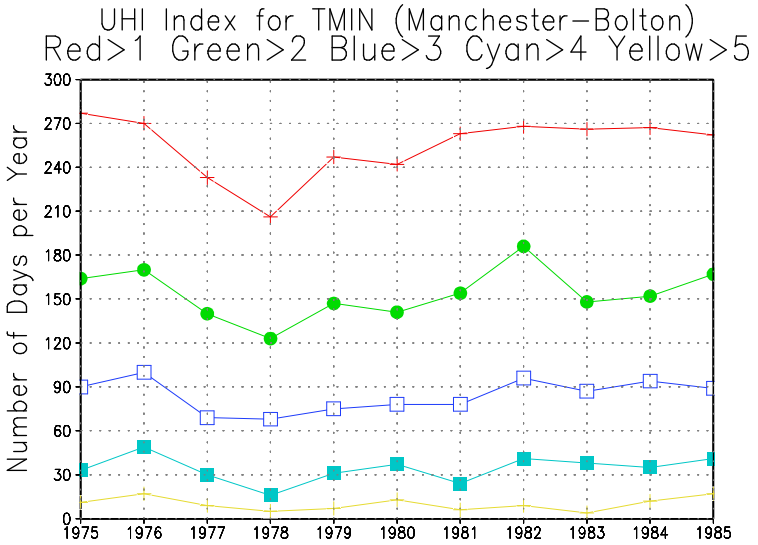




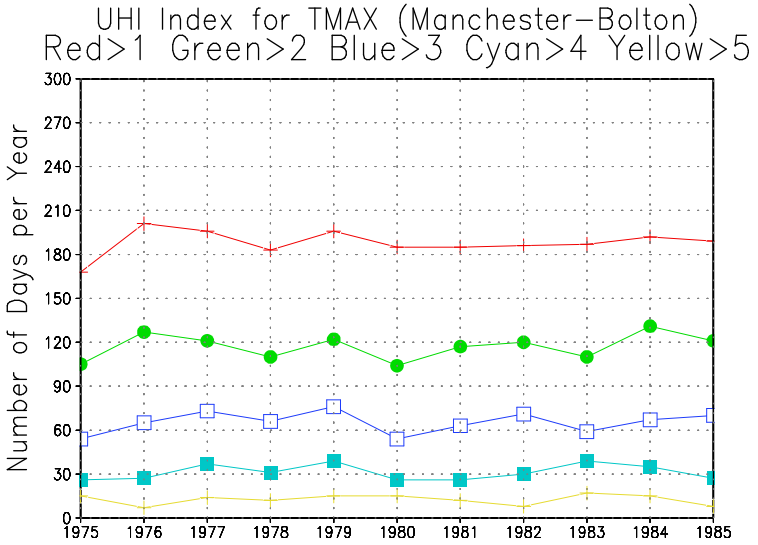


‘Urban heat island’ time series, 1975-1985

Minimum temperature
Manchester-Bolton

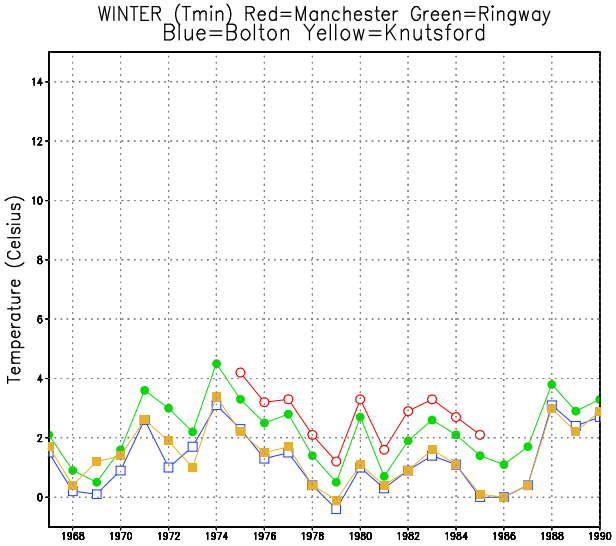


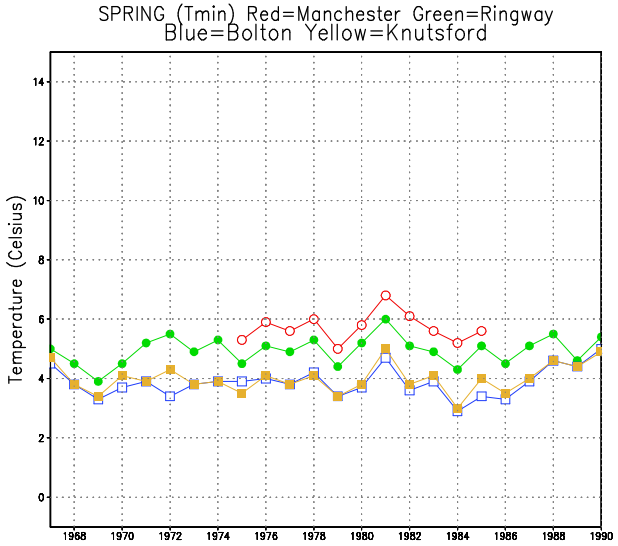
Maximum temperature
Manchester-Bolton

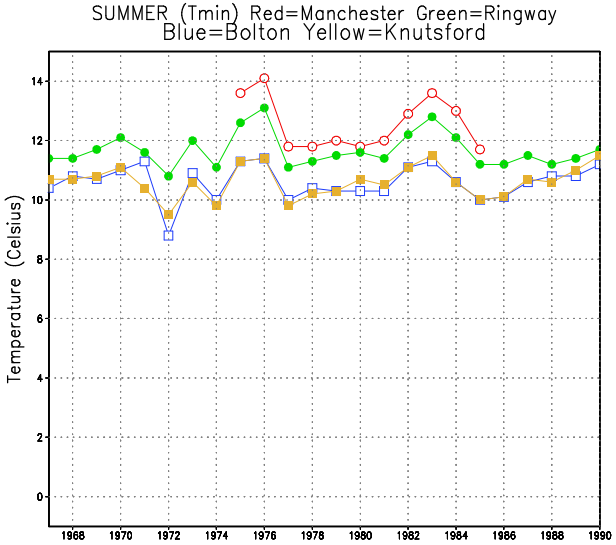


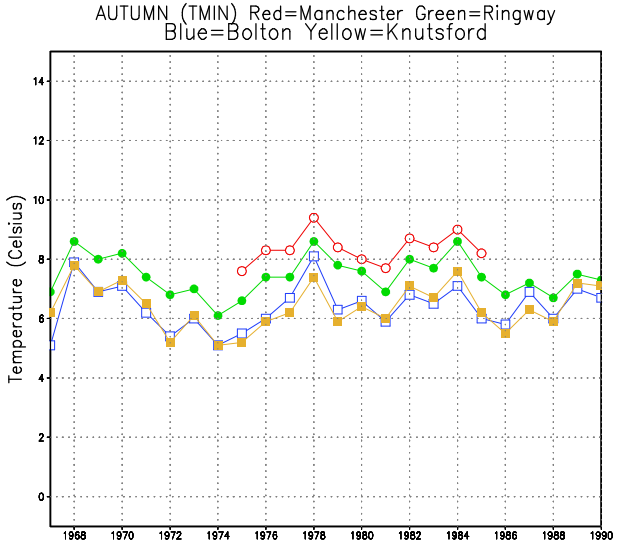
Minimum temperature time series, 1967-1990

Knutsford – yellow
Ringway – green
Weather C. – red
Bolton - blue









We hope to use SDSM to estimate future changes in the 'urban heat island' using Hadley Centre model output:

- Winter maximum temperature
- Summer minimum temperature