Assessing climate change risk in Yorkshire

Piloting new climate change projections with regional stakeholders in Yorkshire catchments

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iCASP
Integrated Catchment Solutions Programme

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- Explored ways organisations in Yorkshire could make use of UKCP18 to manage flood and drought risk.

- One case study showed how UKCP18 could be used to update surface water flood maps using high resolution (2.2km) data.

- A second case study developed a drought risk assessment method based on a relatively simple rainfall index using coarse (60km) and high resolution data (12km, 2.2km) data.

Yorkshire Integrated Catchment Solutions Programme (iCASP)

This UKCP18 demonstration project involved a group of six stakeholders from the Yorkshire Integrated Catchment Solutions Programme (iCASP) who represented local government, major infrastructure owners and technical specialists. They developed two case studies, one on surface water flooding and the other on drought, to consider how they might use UKCP18.

Surface water flooding from heavy downpours is a significant risk in Yorkshire. UKCP09 had been used to assess future changes in flood risk by two of the partners in this case study – JBA Consulting and Leeds City Council. However, the group agreed that the information couldn't provide robust estimates of changes in intense rainfall and wanted to understand how UKCP18 could.

At the other extreme, although prolonged drought is a relatively infrequent hazard in Yorkshire, the consequences are costly. Partners for this case study – The National Farmers' Union (NFU), Environment Agency (EA) and Yorkshire Water had all used information derived from UKCP09 in their own way to assess and communicate future risks of drought in the region. They wanted to understand how UKCP18 might change those assessments.

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Exploiting UKCP18 data

The table below summarises the data products suggested for use in the two case studies and the key benefits in each context. The stakeholders will need continuing practical support and guidance (e.g. from the Met Office and other 'boundary organisations') to prepare and interpret projections for their specific contexts. See case study reports at iCASP project website for further details.

https://icasp.org.uk/resources/uk-climate-projections/

Case Study	UKCP18 products	Benefits of product
Case Study 1: Rainfall Depth Duration Curves for Surface Water Flood Risk Mapping in Yorkshire	High resolution models ~ 10 models at 2.2km	This approach would exploit the improved representation of storm physics in the new regional model and provide greater spatial and detail than past guidance on high-intensity rainfall which was based on UKCP09 data.
Case Study 2: Yorkshire Water Drought Index	Global models ~ 15 global HadGEM models and an additional ~ 13 CMIP5 models	Global and local, finer scale weather and climate processes that influence long-term drought conditions in the UK can be accounted for by looking at both the global general circulation model and high-resolution regional climate model projections in UKCP18.
	High resolution models ~ 12 models at 12km	
	High resolution models ~ 10 models at 2.2km	

Find out more

This project is part of a portfolio of demonstration projects that have worked with the UKCP18 team to understand the implications of the next set of UK Climate Projections for their sector.

To find out more about the UKCP18 project and other demonstration projects, please visit
https://www.metoffice.gov.uk/research/collaboration/ukcp

The case studies

Both case studies developed a set of actions for organisations to take, some to do soon after UKCP18 release and others that would require longer-term co-ordination and investment. More specifically, each case study looked in detail (examples below) at how UKCP18 could be used to reproduce existing assessments of flood and drought, enabling a quick comparison with previous results.

Case Study 1: JBA developed the methodology behind the EA's Flood Map for Surface Water (FMfSW); a key reference for Local Authorities when conducting surface flooding preparedness and response planning. Underlying the FMfSW analysis is the specification of total rainfall for different durations and probabilities – called 'Depth Duration Curves' (spanning 1, 3 and 6-hour events for 3.3%, 1% and 0.1% annual probability). This first case study outlined how a user could recreate these curves for present-day and future periods using UKCP18 projections of hourly rainfall from the high-resolution (2.2 km) climate model.

Case Study 2: In 2012, Yorkshire Water commissioned a study into multi-year drought by applying a relatively simple hydrological drought index (DSI6) to observed precipitation records from a selection of rain gauge stations across Yorkshire. A weather generator was used to supplement the observational record by providing an ensemble of 200 time series for the same baseline period at each location. UKCP09 change factors from precipitation projections were applied to the baseline time series - resulting in drought risk (duration / frequency) charts for current and future time periods. This second case study showed how a user might recreate these charts using monthly precipitation time series from a variety of UKCP18 data products.

What to be aware of with UKCP18

Both cases advocated sense-checking UKCP18 outputs, which would involve three steps (technical advice and guidance may be required for these):

1. **Evaluate projections against observations** – how well do the models recreate the observed climate? The UKCP18 project team will provide evidence and guidance to assist with this step.

2. **Bias correct** – models may do a satisfactory job of representing weather patterns and changes over time but 'absolute' levels of various parameters may be inaccurate. It is common for statistical 'corrections' to be applied to account for these systematic biases but they have their limitations. See the case study reports on the iCASP project website for further details.

3. **Check model projections represent the "full range of future climate uncertainty" as sampled by PDFs** - UKCP18 provides Probability Density Functions (PDFs) for 25 km grid cells across the UK. These show a 'range of known uncertainty' in the climate model and provide a useful context for comparing the 'plausible realisations' of climate produced by the global and regional models.

Stakeholders require continuing practical support from the Met Office and other intermediary organisations to interpret and prepare projections for their specific contexts e.g. guidance or tools for completing the sense-checking steps above. The group welcomes ongoing regional technical assistance from the Met Office leading up to the release of UKCP18.

Further information

You can find detailed information about these case studies and the iCASP project at http://icasp.org.uk/resources/uk-climate-projections/.

Barden Upper Reservoir dried up completely in the 1995 drought (www.geograph.org.uk/photo/235848) © Stephen Craven