Improved understanding of current weather-related risks to the UK

Why this is important: Extreme weather and climate events already cause significant impact on the UK. Heavy rainfall events can have severe impacts on infrastructure and businesses while high temperatures can lead to increases in air pollutants, heat related deaths, crop failure and severity of wildfire. A better understanding of the current likelihood of extreme and unprecedented weather-related events in the UK and how they have been influenced by manmade climate change will enable vulnerable communities to take steps to become more prepared and resilient. It feeds into improved understanding of risk, which is highly relevant for policy and contingency planning and helping support on-going efforts to mitigate future emissions.

Buckled rails at Wishaw near Glasgow June 2018 (credit: Network Rail)

What the UKCR programme is doing: A suite of tools is now available which, when combined in an integrated way, can provide a more comprehensive picture to better quantify the current and future likelihood of extreme events. Work under the UKCR programme to date has focussed on attribution analysis of the 2018 summer heatwave to quantify the influence of manmade climate change, and assessing climate model simulations alongside observations to quantify the current likelihood of seeing a summer warmer than summer of 2018. The attribution analysis used a multi-model ensemble of 20 CMIP5 models which when compared against observations were found to reproduce well the historical summer temperature trends and variability. Distributions of the summer mean temperatures with and without the effect of human influence on the climate were then constructed from anomalies over the 15-year period centred on 2018 (2011-2025).

To understand current heatwave risk in the UK the UNprecedented Simulated Extremes using ENsembles (UNSEEN) methodology has been applied. Extreme events in the historical observational record are very few making it difficult to generate robust estimates of likelihood using observations alone. To overcome this UNSEEN uses Met Office computer model simulations to create virtual observations of the current climate, increasing available data by one hundredfold and thus demonstrating many more plausible extreme events that haven't been recorded yet but could occur. Statistical testing of the model against the observed climate has found the UNSEEN methodology suitable for applying to UK summer temperature as well as the data being used for modelling pest indicators to estimate their plausible current range in the UK.

Results so far: Applying these tools has shown that the present-day chances of exceeding the 2018 UK summer temperature is approximately 30 times larger due to man-made greenhouse gas emissions. The current risk of an event similar to the UK summer 2018 heatwave is approximately 1 in 10, suggesting that without further climate change we could already expect a summer as hot as 2018 on average once per decade. Results also show that temperatures much higher than 2018 are possible today: in the current climate there is a 1% chance of a summer approximately 1°C warmer than 2018. Although climate change has led to an increased chance of hot summers, whether a hot summer occurs in any particular year still also depends on natural climate variability, especially that associated with the circulation of the atmosphere. The summer of 2018 was characterised by persistent anticyclonic circulation patterns, which have been found to facilitate warm extremes within the UK.

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What is next? Event attribution and the UNSEEN methodology will be applied to further extreme events as/when they occur to understand how likely they are to happen again in today's climate and assess how much more severe they could be. Additionally, the research team is working beyond the UKCR programme with colleagues at Defra on applying the UNSEEN method to UK plant pest indicators with a methodology developed for applying to five plant pests; Asian longhorn beetle, Peach potato aphid, Turnip moth, Diamondback moth and midges. Additionally, work within the UKCR programme is comparing the UNSEEN method with other approaches to characterise present day climate in order to provide advice to researchers on good practice.

References:

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