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The role of human influence on climate in recent UK winter floods and their impacts

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The whole winter of 2013/2014 was characterized by a near-continuous succession of westerly storms. Accumulated rainfall during January 2014 was the largest ever recorded for that month across much of southern England, including the Radcliffe Observatory record in Oxford that begins in 1767. Severe floods resulted, causing major disruption.

So far, quantifying any contribution from human influence on climate to such weather events and resulting floods has been difficult due to the large natural variability of winter precipitation in the North Atlantic and European regions. The emerging science of probabilistic event attribution however increasingly allows us to evaluate the extent to which human-induced climate change is affecting localised weather events.

Under the project "EUropean CLimate and weather Events: Interpretation and Attribution" (EUCLEIA), an end-to-end attribution study is performed for the first time. An ensemble of 134,354 general circulation model simulations is run using the citizen science project weather@home. We find that the frequency of days in January in zonal flows increases jointly with increases in precipitation as a result of anthropogenic climate change. The best estimate of the change in risk of extreme (1-in-100-year in pre-industrial conditions) precipitation for January in southern England is an increase by around 40%, but the uncertainty range includes no change or an increase by over 150% due to uncertainty in the pattern of anthropogenic warming. A hydrological model driven by the model-simulated precipitation gives similar increases in risk compared to precipitation for 30-day peak river flows for the Thames at Kingston. Given these river flows we estimate that anthropogenic climate change has placed an additional 3,500 properties in the Thames catchment (upstream of the tidal reach through London) at risk of flooding from rivers over a broad range of return-times. Our study provides for the first time an estimate of the scale of precipitation-related damages in a specific region due to the effects of anthropogenic changes in the composition of the atmosphere on climate.