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Climate Central World Weather Attribution (WWA) project: Real-time extreme weather event attribution analysis

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Extreme weather detection and attribution analysis has emerged as a core theme in climate science over the last decade or so. By using a combination of observational data and climate models it is possible to identify the role of climate change in certain types of extreme weather events such as sea level rise and its contribution to storm surges, extreme heat events and droughts or heavy rainfall and flood events. These analyses are usually carried out after an extreme event has occurred when reanalysis and observational data become available.

The Climate Central WWA project will exploit the increasing forecast skill of seasonal forecast prediction systems such as the UK MetOffice GloSea5 (Global seasonal forecasting system) ensemble forecasting method. This way, the current weather can be fed into climate models to simulate large ensembles of possible weather scenarios before an event has fully emerged yet. This effort runs along parallel and intersecting tracks of science and communications that involve research, message development and testing, staged socialization of attribution science with key audiences, and dissemination.

The method we employ uses a very large ensemble of simulations of regional climate models to run two different analyses: one to represent the current climate as it was observed, and one to represent the same events in the world that might have been without human-induced climate change. For the weather "as observed" experiment, the atmospheric model uses observed sea surface temperature (SST) data from GloSea5 (currently) and present-day atmospheric gas concentrations to simulate weather events that are possible given the observed climate conditions. The weather in the "world that might have been" experiments is obtained by removing the anthropogenic forcing from the observed SSTs, thereby simulating a counterfactual world without human activity. The anthropogenic forcing is obtained by comparing the CMIP5 historical and natural simulations from a variety of CMIP5 model ensembles.

Here, we present results for the UK 2013/14 winter floods as proof of concept and we show validation and testing results that demonstrate the robustness of our method. We also revisit the record temperatures over Europe in 2014 and present a detailed analysis of this attribution exercise as it is one of the events to demonstrate that we can make a sensible statement of how the odds for such a year to occur have changed while it still unfolds.