EGU General Assembly 2024

EGU24-20081, updated on 12 May 2024
https://doi.org/10.5194/egusphere-egu24-20081
EGU General Assembly 2024

Towards an operational forecast-based attribution system - *beyond isolated events*

Nicholas Leach[1,2], **Shirin Ermis**[1], Olivia Vashti Ayim[1], Sarah Sparrow[3], Fraser Lott[4], Linjing Zhou[9], Pandora Hope[9], Dann Mitchell[5], Antje Weisheimer[6,7], and Myles Allen[1,8]

[1]Atmospheric, Oceanic and Planetary Physics, University of Oxford, Oxford, UK (nicholas.leach@physics.ox.ac.uk)
[2]Climate X Ltd., London, UK (nicholas.leach@climate-x.com)
[3]Oxford e-Research Centre, University of Oxford, Oxford, UK
[4]Met Office Hadley Centre, Exeter, United Kingdom
[5]University of Bristol, Bristol, UK
[6]National Centre for Atmospheric Science, University of Oxford, Oxford, United Kingdom
[7]European Centre for Medium-range Weather Forecasts, Reading, United Kingdom
[8]Environmental Change Institute, University of Oxford, Oxford, UK
[9]Bureau of Meteorology, Australia

Interest in the question of how anthropogenic climate change is affecting extreme weather has grown considerably over the past few years - and 2023 has been no exception. This increase in interest has brought a need for robust approaches that are able to quantitatively answer this question rapidly after an event occurs. However, conventional attribution frameworks using statistical or dynamical climate models have been challenged by several recent events that lay well beyond the historical record.

While such events have proven difficult to attribute using conventional methodologies, many were surprisingly well forecast by high-resolution numerical weather prediction systems. These systems generally lie at the state-of-the-art in the spectrum of earth system modelling, and their deficiencies are well documented and understood. We suggest that they therefore represent an opportunity for answering attribution — and other weather and climate risk-related — questions, based on models that are demonstrably able to simulate the often non-linear physics of the extremes that we are most interested in. This can increase the confidence in any attributable changes assessed since such changes can be explained in terms of the underlying physical processes. Further, as attribution science extends beyond purely physical assessments and into socioeconomic impacts, this opportunity will grow: weather models are already widely used by risk and emergency management professionals as inputs to hazard models. A final advantage of basing attribution statements on weather forecast models is that it is not only apparent when a forecast model can be used — but also when the model has a crucial deficiency as indicated by a forecast bust. In this case it would be clear that making a quantitative attribution statement would not be appropriate.

We have previously used a global high-resolution and coupled ensemble prediction system to

quantify human influence on the Pacific Northwest Heatwave and Storm Eunice. Here, we move from event-centric to pseudo-operational experiments. We present a season of perturbed forecasts for attribution, initialised twice per week during the 2022-23 winter in both pre-industrial and future climates, using the same operational ECMWF model as before. A number of high-impact extreme events took place during this winter, and we will present preliminary results from some of these.

We suggest that this large set of simulations may be of interest to a wide range of users both inside and outside the attribution community, and we therefore aim to make them publicly available. In addition, we are keen to overcome the limitation imposed by our use of a single model within these experiments, and therefore invite other weather forecasting groups to run comparable experiments.