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Doing more with what we have: adding narrative and skill to NWP output through automated event-precursor analysis

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Advances in numerical weather prediction regularly produce more skilful and far-ranging predictions of the atmospheric state –but at the cost of increased complexity. As resolution becomes finer and ensemble sizes grow, it becomes ever-more difficult to track why a forecast system predicts a certain outcome: despite their basis in theory, our NWP systems often end up being treated simply as black-box models. Here, we report on the development of a new tool that aims to simplify the process of cracking open the black box, by automatically tracing the chains of large-scale precursors that lead to increased risk of a particular extreme weather event.

The potential for such a tool to add value to existing NWP output is twofold. Firstly, by automatically identifying the causal factors –wave-breakings, extratropical transitions, etc. –leading to a weather event, interpretability is reintroduced to the forecast. Understanding the narrative of a weather event, in a way reminiscent of the use of storylines in climate projections, makes it easier to weight contradictory or ‘jumpy’ forecasts, and to identify where known model biases may be impacting the prediction. Secondly, there is the promise of quantitative improvements in forecast skill, through process-oriented bias correction. Where remote drivers alter the probability of a weather event via teleconnections, models may capture the driver but not successfully propagate its influence, leading to an absence of an event in the forecast. By spotting and flagging the presence of such a driver in the NWP output, a valuable long-range warning could nonetheless be provided.

We demonstrate this tool with a motivational example from European extreme rainfall. Still in a prototype phase, we particularly aim to elicit feedback and insight from end-users into what functionality and visualisation methods would be of most value to them, in order to maximise the downstream impact of the project.

Primary author: DORRINGTON, Joshua (Karlsruher Institute of Technology)

Co-authors: GRAMS, Christian M. (IMK-TRO, Karlsruhe Institute of Technology (KIT)); VITART, Frederic (ECMWF); MAGNUSSON, Linus (ECMWF); GRAZZINI, Federico (LMU Muenchen/ARPAE-SIMC); FERRANTI, Laura (ECMWF)

Presenter: DORRINGTON, Joshua (Karlsruher Institute of Technology)

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