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Multi-method attribution analysis of extreme precipitation in Boulder, Colorado

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Understanding and attributing the characteristics of extreme events that lead to societal impacts is a key challenge in climate science. Detailed analysis of individual case studies is particularly important in assessing how anthropogenic climate change is changing the likelihood of extreme events and their associated risk at relevant spatial scales. While climate model simulations provide an important basis for such analysis, reliable assessment of long term changes in extreme events is limited by models' inherent errors and biases.

Here, we conduct a comprehensive multi-method attribution analysis of the heavy precipitation that led to widespread flooding in Boulder, Colorado in September 2013. Using extreme value analysis of, first of all, historical observations, we assess the influence of anthropogenic climate change on the likelihood of one- and five-day precipitation events across the Boulder area. The same analysis is extended to the output of a 16-member coupled model ensemble, following rigorous evaluation of the model skill in representing the processes responsible for extreme precipitation events in this region. Preliminary analysis using both observation- and model-based methods suggests that an event of this magnitude is around 20% more likely as a result of anthropogenic climate change.

Recently, emphasis has been placed on the importance of model evaluation and bias correction in attribution studies. Further analysis will thus focus on sophisticated bias correction and downscaling techniques and their potential added value for application in attribution analysis. We also highlight the benefit of a multi-method approach in addressing event-specific attribution questions, particularly with regard to the quantification of uncertainty.