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Wet - wetter - weather: Attributing Global Precipitation to weather features

Kjersti Konstali¹, Asgeir Sorteberg¹, Clemens Spensberger¹, Chris Weijenborg², Johannes Lutzmann¹, and Thomas Spengler¹

¹Geophysical Institute, University of Bergen, Bergen, Norway

²Department of Meteorology and Air Quality, Wageningen University & Research, Netherlands

Precipitation has increased globally in the mean during the past century and is expected to continue to increase with rising temperatures. In the mid- to high latitudes, extratropical cyclones, fronts, atmospheric rivers, and cold air outbreaks are associated with a substantial fraction of the total precipitation. As these weather features might respond differently to a changing climate, investigating precipitation changes in the context of weather systems provides further insight into the observed changes in precipitation. Therefore, we introduce a new method for attributing precipitation to weather features. The method allows us to decompose total precipitation into the respective contributions by extratropical cyclones, fronts, atmospheric rivers, cold air outbreaks, and their combinations.

We have classified precipitation between 1930-2010 in the ECMWF's twentieth century reanalyses project, ERA-20C. Our method assigns 70% of the total precipitation poleward of 30° to the aforementioned categories, allowing us to assess the relative importance of these weather features for total precipitation and for precipitation extremes. We find that the combination of extratropical cyclones, fronts, and atmospheric rivers accounts for more than 50% of the total precipitation and for 90% of the extreme events in the northern hemisphere storm-track regions, despite these precipitation events occurring less than 20% of the time.