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Evaluation of observational data sources and attribution studies of precipitation extreme indices in Ireland

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The warming of the climate system due to anthropogenic climate change not only leads to slow changing events such as the increase in the mean sea surface temperature (SST), but is also expected to cause changes in the magnitude and/or frequency of extreme weather extreme events, e.g. precipitation, floods, heatwaves. Many of these changes have, to some extent, been attributed to human influence in terms of probabilities.

Different studies have analysed the variations in indices of extreme temperature and precipitation between historical and simulated future datasets under different IPCC carbon emission scenarios. However, to the best of our knowledge, no previous study has investigated possible changes of such indices in Ireland between the actual world (factual) and the counterfactual world (i.e a world without the anthropogenic human influence).

Extreme precipitation indices were obtained from daily observational time series of precipitation provided by Met Éireann, the Irish Meteorological Service. Sources such as GPCC, GHCNDEX or HadGHCND were also considered. The RClimDex package, from the Expert Team on Climate Change Detection and Indices (ETCCDI), was used to verify the quality and homogeneity of the time series and the calculation of extreme indices related to precipitation.

The evaluation of the performance of the different datasets for the extreme precipitation indices over Ireland resulted in the selection of a cluster of best-suited data for attribution studies of extreme weather events with the biggest impacts on Ireland, namely long duration precipitation (typically greater than 24 hours) and associated flooding.

Extreme indices of precipitation were then used to validate outputs of climate models such as HadGEM3 for the actual world. Indices for the counterfactual world are also obtained using the climate models. Finally, changes in extreme precipitation between the two scenarios were studied.

The results will be further used for an attribution study from a dynamic point of view, analysing the changes in the synoptic patterns associated with those extreme indices of precipitation between both worlds.

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