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## A global assessment of heatwaves since 1850 in different datasets

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Over the past century there was a significant increase in heatwaves in several regions around the globe. This increase is projected to continue with ongoing global warming and forms a serious risk for various ecosystems as well as human health. Changes in the occurrence and the characteristics of heatwaves since the middle of the 20<sup>th</sup> century are extensively studied in observational datasets and model simulations. However, there is a research gap concerning preindustrial (1850-1900) heatwaves and heatwaves in the early 20<sup>th</sup> century and their relation to forcings and large-scale variability modes.

In this study we analyse the occurrence of heatwaves and the spatial and temporal distribution of different heatwave characteristics since 1850 using different observational datasets (20CRv3 reanalysis, EUSTACE gridded temperature, HadEX3 and station data) and a 36-member ensemble of atmospheric model simulations. We compare preindustrial heatwaves to recent and projected heatwaves and analyse how global or local heatwave hotspots change over time.

We use a new approach, a 30-year running baseline climatology, which allows us to analyse heatwave characteristics across different centuries. Our analysis shows that the different observational datasets show a comparable distribution of heatwave characteristics. Furthermore, the atmospheric model based on observed volcanic forcings can also be used to analyse preindustrial and early 20<sup>th</sup> century heatwaves. The agreement of the model simulations with the observational datasets allows to use the atmospheric model to analyse earlier preindustrial time periods that are not covered by observations. With our on-going analysis of preindustrial heatwaves, we consequently contribute to a better understanding of past climate extremes.