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Multidecadal oscillations in rainfall extremes

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Many have anticipated a worldwide increase in the frequency and intensity of rainfall extremes and floods since the last decade(s). The relative importance of the two main contributing factors, climate change by global warming and natural variability by climate oscillations, is an issue of debate since many years. Based on a novel technique for the identification and analysis of changes in extremes, this paper affirms that rainfall extremes and other climate related variables in northwestern Europe have oscillatory behaviour at multidecadal time scales. Moreover, it is shown that the recent upward trend in these extremes is partly related to a positive phase of this oscillation, which coincided with the climate change influence.

The analysis is based on a worldwide unique dataset of 108 years of 10 minutes rainfall intensities at Uccle (Brussels), not affected by instrumental changes or measurement inhomogeneity. We also checked the consistency of the findings with long records in neighbouring regions of northwestern Europe. The past 100 years showed larger and more rainfall extremes for the 1910s-1920s, the 1960s, and more recently during both winter and summer of the past 15 years. These oscillation peaks are in part explained by persistence in atmospheric circulation patterns over the North Atlantic during periods of 10 to 15 years. During winter, the most recent oscillation peak was more enhanced suggesting that there was a global warming effect on the increase in rainfall extremes, and thus of river floods in this season. For the summer season, the oscillation peak and related cluster in rainfall extremes appears to be the main meteorological factor that explains the large number of recent urban drainage system floods in the region.