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Attributing the wet Winter season 2013/14 in Southern UK and Northern France using circulation analogues statistics

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The Winter season 2013/14 was characterised by frequent storms and record breaking seasonal precipitation sums in Southern UK, causing severe flooding. High precipitation anomalies were likewise observed in Northwestern France and Slovenia for example.
Assuming that such high impact events occur under specific atmospheric circulation configurations, circulation analogues are studied here. We present a method that consists of analysing distance statistics from the circulation analogue computation and precipitation simulations using observed precipitation (gridded EOBS data and station observations) on analogue days. This method allows to compare the probabilities of finding good circulation analogues for days with heavy precipitation or strong winds during different historic periods using reanalysis data. An increasing probability of finding good analogues for those days over time can then be interpreted as an increase in the probability of occurrence of such events in terms of circulation, whereas a change in precipitation drawn from different historic periods, given a constant probability of finding good circulation analogues, can be attributed to changes in the thermodynamics.
The Winter season 2013/14 had an unusually high number of days with high zonal index over the North Atlantic, but no significant trend in the zonal index or its persistence was detected in the reanalysis data. We found no change in the probability of finding good analogues for the winter days 2013/14 over different historic periods. Despite high uncertainties related to the choice of the distance metric and the precipitation resampling methodology, we found consistently higher simulated precipitation when analogues were drawn from more recent years. We found further an increase of precipitation return level for same return times in an ensemble of bias corrected EURO-CORDEX projections for the 21st century under RCPs 4.5 and 8.5. We conclude that it is likely that this precipitation event was linked to climate change, and that it is likely to increase in the future.