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Wetter winters and drier summers in the UK explained by data errors and biases

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Long-term, quality assured records underpin our understanding of climate variability and change. Globally, few such records extend to the 18th Century, particularly for precipitation. The England Wales Precipitation (EWP) series is a notable exception that provides a continuous monthly record from 1766. EWP has found widespread use across diverse fields of research including; trend detection, evaluation of climate model simulations, as a proxy for mid-latitude atmospheric circulation, a predictor in long-term European gridded precipitation datasets, the assessment of drought and extremes, tree-ring reconstructions and as a benchmark for other regional series. A key finding from EWP has been the trends towards wetter winters and drier summers. We statistically reconstruct winter and summer EWP using independent, quality-assured temperature, pressure and circulation indices. Using a sleet and snow series for the UK derived by Prof. Gordon Manley and Prof. Elizabeth Shaw to examine reconstructions, we show that precipitation totals for pre-1870 winters are biased low due to gauge under-catch of snowfall and a higher incidence of snowfall during this period. When these factors are accounted for the trend to wetter winters in EWP is no longer evident. For summer, we find that pre-1820 precipitation totals are too high due to decreasing network density and uncertain data at key stations. A significant trend to drier summers is not robustly present in our reconstructions of the EWP series, with significance depending on start/end year and predictors used in model reconstructions. Our findings challenge current assumptions about historic climate variability and change in north-western Europe. It is also likely that the identified biases in EWP have distorted many other long-term European precipitation series.