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Sub-seasonal UK winter precipitation intensifies in-line with expected temperature scaling

James Carruthers[1], Selma Guerreiro[1], Hayley Fowler[1], and Daniel Bannister[2]
[1]Newcastle University, Water Group, School of Engineering, Newcastle upon Tyne, United Kingdom of Great Britain – England, Scotland, Wales (j.carruthers2@newcastle.ac.uk)
[2]Willis Research Network, Willis Towers Watson, London, United Kingdom of Great Britain – England, Scotland, Wales

Interannual to multi-decadal variability in large-scale dynamics such as atmospheric and oceanic circulation results in significant noise and temporary trends in regional climate. Attempting to understand longer term trends as a result of anthropogenic climate change requires disentangling internal variability and climate change signals. One of these climate signals is the Clausius-Clapeyron (CC) scaling in precipitation resulting from temperature increases. In this work, we characterise and constrain variability in sub-seasonal winter rainfall in the UK resulting from synoptic scale-conditions. The UK experiences periods of sustained precipitation in some winters which result in widespread flooding due to extreme accumulation, such as the winter of 2013/2014. Using categorised sea-level pressure fields and gridded precipitation between 1900-2020, we simulate 'expected' precipitation resulting from North Atlantic synoptic conditions. We find a rising trend since the 1980s in observed monthly accumulation which is not reflected in the simulated precipitation timeseries, indicating that recent wet winters in the UK have been wetter than expected given the synoptic conditions. The rising trend in the residual (observed - simulated) mean monthly precipitation is in line with expected CC scaling rate of ~6-7% per degree warming according to changes in UK annual mean temperature. However, the residual in extreme monthly precipitation has scaled at approximately twice that rate. To better understand differences in changes for average and extreme precipitation accumulation, we explore the influence of dynamical feedbacks which may increase precipitation at higher intensities. We find that residual precipitation is influenced by the persistence of synoptic conditions and exhibits remote teleconnections to sea surface temperature and atmospheric conditions in the tropics and sub-tropics. This work highlights the importance of considering variability in large-scale dynamics when identifying climate change signals and sheds light on influences on sub-seasonal to seasonal winter precipitation in the UK.ences on sub-seasonal to seasonal winter precipitation in the UK.