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North-Atlantic SST amplified recent European land temperature extremes and trends

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Europe has been warming over the past 30 years. In particular all seasonal temperature records have been broken since 2003, which altered socio-economic and environmental systems. Since we expect this trend in both mean and extreme temperatures to continue along the 21st century under enhanced radiative forcing, it is crucial to understand the underlying mechanisms of such climate variations to help in considering adaptation or mitigation strategies to reduce the impacts of a warmer climate. In this study we show that North-Atlantic atmospheric dynamics mostly explains the interannual variability of the European seasonal temperatures but not their trends and extreme seasons. From a statistical regression analysis we show that temperature trends are only obtained when taking into account sea-surface temperature (SST) evolution, which has warmed under both influences of the man-induced radiative forcing and the Atlantic Multidecadal Oscillation. Then we perform a set of sensitivity experiments with the MM5 regional mesoscale model, which confirm the influence of Atlantic SSTs in shifting the recent land temperatures towards higher values, as found from statistical methods. We also find that this oceanic contribution is stronger in fall and winter, which are seasons of strong westerlies, than in spring and summer, where local dynamics and feedbacks are the main amplifiers.