



Asymmetric trends in seasonal temperature variability based on long instrumental records

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While the increase in global mean temperature over the past several decades is widely accepted, the issue as to whether and to what extent temperature variability is changing has not been solved yet. Temperature variability as the width of the temperature distribution measures the likelihood of temperature extremes. Those changes can amplify, nullify or reduce the effect a gradual warming has on extremes. Since climatic extremes exert large impacts on society and ecology, effects of altered temperature variability must be considered in tandem with effects of a gradually increasing temperature mean. Previous studies of trends in mean temperature and its associated variability have produced conflicting results. Here we investigate 10 selected long-term climate records of minimum, mean and maximum temperatures in Switzerland, Germany and the UK. In detail, we analysed trends in seasonal, annual and decadal measures of variability (standard deviation and various quantile ranges) as well as asymmetries in the trends of extreme vs mean temperatures via quantile regression. Besides accelerated mean warming during 1864-2012, we found higher trends for Tmax than for Tmin in the last 40 years (1973-2012), amounting to up to $0.08^{\circ}\text{C yr}^{-1}$ in spring. In contrast, variability trends were not as uniform: significant changes occurred in opposing directions depending on the season, as well as when comparing 1864-2012 trends to those of 1973-2012. Often, variability changed asymmetrically and consequently, trends in high and low extremes differed. More patterns were detected for spatial and seasonal variation in these changes of variability.