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Historical and future changes in maximum and minimum temperature records over Europe

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Recent studies examining changes in temperature record frequency over the continental United States have reported that the number of Tmax records has been increasing over the past 50 years and occurring at twice the frequency of Tmin records. In a stationary climate, the number of records should decrease with time as1/n, where n is the number of years of record-keeping. Here we seek to understand how European temperature records have changed during the late 20th century and how they are expected to change under as greenhouse gases increase during the 21st century, using a new ensemble method to filter out the effect of the starting year in the calculation of the records. We find that until 1980, the ratio of Tmax to Tmin records remains close to one, indicating that the climate was relatively stationary. After 1980, there is a distinct positive trend where the observed ratio averages around four during the early part of the 21st century, indicative of a warming trend. Further, the ratio of Tmax to Tmin records set by the year 2100 as simulated by five RCM simulations reaches values of up to several hundred by the end of the 21st century. Spatial changes in record frequency over Europe are also examined. The models project the highest numbers of Tmax records over the Mediterranean during summer, and Scandinavia during the spring and fall. Tmin records decrease most substantially over eastern Europe and western Russia, and the Mediterranean. Our analysis confirms the usefulness of the use of maximum and minimum temperature records in regional warming detection and attribution studies.