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A statistically significant signature of multi-decadal solar activity changes in atmospheric temperatures at three European stations

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We study the effect of solar variability on temperatures recorded in three European stations with the longest gapless series available (Prague, Bologna and Uccle). Following a pattern recognition approach, we partition daily temperature "indices" (minimum, maximum, and range) in two separate classes with respect to the level of solar activity (high H versus low L 11-yr cycles). Using the two-sample Kolmogorov-Smirnov statistics, multiple shuffles of data, and other partitions, we demonstrate that the separation between H and L probability distribution functions of temperatures is statistically significant and robust. We also find that average annual variations for the H and L classes display both common and site-specific patterns. For practically all series considered, differences between graphs of annual change for the two classes H and L are large ($\sim$1°C). Solar activity may account for a significant part of the multi-decadal variations in temperature observed at these European sites in the past two centuries.