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

Vladimir Kossobokov (1,2), Jean-Louis Le Mouël (1), and Vincent Courtillot (1)
(1) Geomagnetism and Paleomagnetism, Institut de Physique du Globe de Paris, Place Jussieu, Paris, France [courtil@ipgp.fr],
(2) International Institute of Earthquake Prediction Theory and Mathematical Geophysics, Moscow, Russia

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 (∼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.