



## **Changing trend of percentile–based temperature indices over Pakistan**

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This study evaluates the annual to interannual trends of percentile-indices temperature extremes during 1981–2010 for 27 synoptic stations spatially distributed over Pakistan. The indices were estimated using homogenized daily minimum (Tmin) and maximum (Tmax) temperatures. Indices defining the cold and hot extremes were calculated with the help of RCLimDex software. A nonparametric Mann–Kendall test and Sen’s slope estimates were used to determine the statistical significance and magnitude of a trend, respectively. The magnitude of trend was determined for various agro-ecological zones across Pakistan. We found that spatially averaged trends of cool nights (TN10p) and hot nights (TN90p) are more pronounced for the Northern Irrigated Plains during winter and spring. The zone of Sandy Deserts experienced the largest decrease in the frequency of cool days (TX10p) while, hot days (TX90p) frequency index was found to be more pronounced and significant for the Wet Mountains zone during spring. On an annual timescale, the magnitude of trend in hot nights was found to be larger than for hot days. The rate of change of warming in cool nights and cool days was found to be higher during spring and fall when compared to that of winter and summer. Overall, we found significant differences within the spatial distribution of day and night temperature extremes, indicating a trend of regional warming across Pakistan.