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Variability of Temperature Extremes in Northwest Himalayas during Early 21st Century.

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In recent years, extreme events and their severe damage have become more common around the world. It is widely known that atmospheric greenhouse gases have contributed to global warming. A set of appropriate indicators describing the extremes of climate change can be used to study the extent of climate change. This study reveals the trends of temperature extreme indices on the spatial scale in the western part of Northwest Himalayas. The study is conducted at 13 climate stations lies at a different altitude of the study area. The Daily maximum and minimum temperature data during 2000--2018 of stations obtained from the Pakistan Meteorological Department (PMD) and Water and Power Development Authority (WAPDA). The 12 extreme temperature indices (FD, SU, TXx, TXn., TNx, TNn, TN10p, TN90p, TX10p, TX90p, CSDI, WSDI) recommended by ETCCDI (Expert Team on Climate Change Detection and Indices) are used to study the variabilities in temperature extremes. These indices are characterized based on amplitude, persistence, and frequency. The analysis is performed by using R package of extremes "RCLimDEX". The analysis shows the frequency of summer days (Su) and warm spells (WSDI) have increasing trends in the Southwest region, whereas the frequency of cold spells and frost days have decreasing trends observed in the Northern region of the study areas. The maximum and minimum values of daily maximum temperature (TXX, TXN) increase in the foothill area of the region and decreasing trends in the high elevation region. The day and night get cool in the Northwest region, whereas the days and nights are showing warmer trends in low elevation regions of the study area. Overall, the study concludes that the Northwestern parts have cool trends while South West and South eastern parts have warm trends during the early 21st century.

Key words: Temperature Extremes, Northwest Himalayas, Trends, R-Climdex, Climate Change