



Changing Temperature Extremes Based on CMIP5 Output via Semi-Parametric Quantile Regression Approach

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The Expert Team on Climate Change Detection and Indices (ETCCDI) proposed a set of 27 core indices, describing extreme weather and climate events based on daily temperature and precipitation data. There are six percentile-based temperature extreme indices: four exceedance rates (ERs) (TN10p, TN90p, TX10p and TX90p) and two durations (cold spell duration [CSDI] and warm spell duration [WSDI]), derived by using percentiles for calendar days during the base period 1961–1990 as thresholds. The widely used empirical quantile (percentile) estimator or its bootstrap resampling adjustment may result in inhomogeneity in the derived annual ER series or in their linear trends, as well as seasonally varying biases in the monthly ER series. We present a new data set of the six indices for the historical and three representative concentration pathways (RCP2.6, RCP4.5 and RCP8.5) scenarios simulated by 19 global climate models participating the Coupled Model Intercomparison Project Phase 5, generated via the semiparametric quantile regression approach. Percentiles estimated upon the independence condition, inhomogeneity and seasonal biases are removed from the new data set, so that the changes in temperature extremes can be authentically revealed from the climatological distribution point of view. Compared with its counterpart produced by the CLIMDEX project, the new data set shows similar spatial and temporal change patterns under the RCP scenarios, but with much smaller magnitudes. By the end of 21st century, TN90p increases to 17.3, 24.5 and 40.0%, and TX90p increases to 16.9, 22.1 and 35.3%, under RCP2.6, RCP4.5 and RCP8.5, respectively. WSDI increases to 35 days under RCP8.5. For the three increasing indices, the most significant changes occur in tropical and extratropical regions. The greatest increases in TN90p and TX90p occur in southeast Asia and Amazon Basin, up to 85 and 68% in the summer under RCP8.5; that in WSDI occurs in Amazon Basin up to 120 days under RCP8.5.