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Assessment of Temperature Extremes in China Using RegCM4 and WRF

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This study validates temperature extremes over China in two regional climate models (RCMs), RegCM4 and WRF, driven by the ECMWF's 20th century reanalysis. Based on the advice of the Expert Team on Climate Change Detection and Indices, 12 extreme temperature indices (i.e. TXx, TXn, TNx, TNn, TX90p, TN90p, TX10p, TN10p WSDI, ID, FD, and CSDI) are derived from the simulations of two RCMs and compared with those from observational data during 1981–2010. Overall, the two RCMs demonstrate satisfactory capability in representing the spatiotemporal distribution of the extreme indices over most regions. RegCM performs better than WRF in reproducing the mean temperature extremes, especially over the Tibetan Plateau (TP). Moreover, both models capture well the decreasing trends in ID, FD, CSDI, TX10p, and TN10p, and the increasing trends in TXx, TXn, TNx, TNn, WSDI, TX90p, and TN90p, over China. Compared with observation, RegCM tends to underestimate the trends of temperature extremes, while WRF tends to overestimate them, over the TP. For instance, the linear trends of TXx over the TP from observation, RegCM, and WRF are 0.53°C (10 yr)$^{-1}$, 0.44°C (10 yr)$^{-1}$, and 0.75°C (10 yr)$^{-1}$, respectively. However, WRF performs better than RegCM in reproducing the interannual variability of the extreme-temperature indices. Our findings are helpful towards improving our understanding of the physical realism of RCMs in terms of different time scales, thus enabling us in future work to address the sources of model biases.