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Simulation and projection of summer surface air temperature over China: a comparison between a RCM and the driving global model

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ABSTRACT: The regional climate model (version 3, RegCM3) with the horizontal resolution of 50 km was employed to downscale the historical and projected climate changes over CORDEX East Asia domain, nested within the global climate system model FGOALS-g2 (Flexible Global Ocean-Atmosphere-Land System Model: Grid-point Version 2). The simulated (1986-2005) and projected (2046-2065) summer surface air temperature changes under RCP8.5 scenario over China were compared between the RegCM3 and FGOALS-g2. The air temperature indices used in this study included tmx (daily maximum temperature), t2m (daily average temperature) and tmn (daily minimum temperature), and extreme high-temperature events included TXx (max tmx), TX90p (warm days) and WSDI (warm spell duration). Results indicated that both models could reasonably reproduce the climatological distribution of surface air temperature and extreme high-temperature events. Compared to the driving global climate model, the detailed characteristics of summer surface air temperature were better simulated in RegCM3 due to its higher horizontal resolution. Under the RCP8.5 scenario, summer surface air temperature over China will increase significantly during the middle of 21st century. RegCM3 projected larger increase of tmx than tmn over most regions of China, but in the western Tibet Plateau, the increase of tmn was larger. In the projection of FGOALS-g2, the projected changes of the three temperature indices (t2m, tmn, and tmx) were similar with larger increases over northeastern China and Tibet Plateau. Extreme high-temperature events were projected to increase significantly in both models. TX90p will increase more than 60% compared to present day, while WSDI will become twice of present day.

Key words: Summer surface air temperature; Extreme high-temperature events; Regional climate model; Climate change