EMS Annual Meeting Abstracts
Vol. 15, EMS2018-777, 2018

Anthropogenic impacts on recent decadal change in temperature extremes over China

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Observational analysis indicates significant changes in some temperature extremes over China across the mid-1990s. The decadal changes in hot extremes are characterized as a rise in annual hottest day temperature (TXx) and warmest night temperature (TNx) and an increase in frequencies of summer days (SU) and tropical night (TR). The decadal changes in cold extremes are distinguished by a rise in annual coldest day temperature (TXn) and coldest night temperature (TNn), and a decrease in frequencies of ice days (ID) and frost days (FD). These decadal changes manifest not only over China as a whole, but also over individual climate sub-regions.
An atmosphere-ocean-mixed-layer coupled model forced by changes in greenhouse gases (GHG) concentrations and anthropogenic aerosol (AA) emissions realistically reproduces the general patterns and magnitudes of observed changes in both hot and cold extremes across the mid-1990s, suggesting a pronounced role of anthropogenic changes in these observed decadal changes. Separately, changes in GHG forcing lead to rise in TXx, TNx, TXn and TNn, increase in frequencies of SU and TR and decrease in frequencies of ID and FD over China through increased Greenhouse Effect with positive clear sky longwave radiation and play a dominant role in simulated changes of both hot and cold extremes over China. The AA forcing changes tend to cool Southern China and warm Northern China during summer via aerosol-radiation interaction and AA-induced atmosphere-cloud feedback and therefore lead to some weak increase in hot extremes over Northern China and decrease over Southeast China. Meanwhile, AA changes lead to warming over China during winter through cloud feedbacks related to aerosol induced cooling over tropical Indian Ocean and western tropical Pacific, and also induce changes in cold extremes the same sign as those induced by GHG, but with weak magnitude.