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Hourly rainfall changes in response to surface air temperature over eastern contiguous China

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In this study, late-summer rainfall over eastern contiguous China is classified according to hourly intensity and the changes of moderate, intense and extreme precipitation in response to variation of surface air temperature are analyzed. The e-folding decay intensity (I_{mi}) derived from the exponential distribution of rainfall amount is defined as the threshold which partitions rainfall into moderate and intense rainfall, and the double e-folding decay intensity (I_e) is used as the threshold to pick out extreme cases. The mean values of I_{mi} and I_e are about 12 mm h^{-1} and 24 mm h^{-1} respectively. Between the two periods, 1966-1985 and 1986-2005, the ratio between moderate and intense rainfall has experienced significant changes. And the spatial pattern of changes in the percentage of moderate rainfall presents a direct relation with that of the surface air temperature. Based on temperature changes, three regimes, Regime N (North China), Regime C (central eastern China) and Regime S (southeastern coastal area of China), are defined. In warming regimes (Regime N and S), the percentage of moderate rainfall exhibits a decreasing trend. In Regime C, where the temperature has fallen, the percentage of moderate rainfall increased prominently. In all three regimes, there are significant negative (positive) correlations between the percentage of moderate (intense) rainfall and the temperature. The relation between the extreme rainfall and the surface air temperature is far more regional dependant. With plenty water supply and little change in relative humidity, the extreme rainfall increased in Regime S. Although Regime N also shows strong warming trends, there is no significant trend in extreme precipitation due to the lack of water vapor transportation.