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# Observed changes of the precipitation spectrum structure over China in a warming climate

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In this study, the changes in the spectrum structure of the precipitation (the probability distribution function of precipitation frequency and accumulated amount as a function of precipitation intensity category) over China and its six sub-regions during 1960-2013 are analyzed using homogenized daily rain gauge data from 632 stations. The spectrum structure of the precipitation has shifted from less light precipitation events to more very heavy precipitation events in the past half century over China. For whole China area weighted mean, very heavy precipitation events increased significantly with the rate 1.51% per decade. Meanwhile, the decrease of light (-1.25% per decade) and moderate (-1.14% per decade) precipitation events is also significant. Moreover, dry days and trace days showed increase of 3.78% per decade and decrease of -8.22% per decade, both trend are statistically significant at the 0.001 level. The above shifts of precipitation spectrum structure imply an increase of the risk of drought and flood over China in the past half century. Although the consistently significant increase of dry days and decrease of light precipitation, trace days and total precipitation days are almost throughout whole China, changes in other precipitation intensity grades exhibited obvious regional characteristics. Over Yangtze River valley (YZ) and South China (SC), very heavy precipitation events also increased at the expense of light precipitation. However, positive trends dominated the changes in precipitation spectrum structure of Northwest China (NC); precipitation spectrum structure showed an overall weakening over Southwest China (SC) and North China (NC), and an overall strengthening in Northeast China (NE). We examined the dependence of the precipitation spectrum structure change over China on global temperature based on method proposed by Liu et al., (2009), results showed that extreme weak and extreme high precipitation events are more easily affected by global warming than medium intensity precipitation events. For a 1K increase of global temperature, national averaged dry days increase 20.63%; trace days and total precipitation events decrease 46.53% and 22.89%, respectively; the extreme weak (lowest 10% bin) and high (top 10% bin) precipitation showed large decrease and increase of -27.12% and 24.21%, separately.