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Changes in Intense Precipitation over the Conterminous U.S.: Effects of the global change and/or a feedback of the land use changes?

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In the United States during the past 62 years (1948-2009), the climatology of intense precipitation events, their regional distribution, internal structure (mean and peak hourly intensity and duration) and changes can be analyzed using the long-term time series of dense networks of daily and hourly precipitation gauges. After a major data rescue effort in 2000, daily precipitation data set can be analyzed on a century time scale. Hourly precipitation measurements, HPD (while being conducted for more than 100 years at a dense network of U.S. stations) are in digital form only since 1948. When the data rescue efforts of the HPD network will be completed for the pre-1948 period, analyses of the hourly data can also be expanded to the century time span.

On average over the conterminous United States (CONUS), two thirds of annual precipitation falls during $\sim$20% of rain days with totals above 12.7 mm (or 0.5 inch; intense precipitation). We focus only on these precipitation days and multi-day events constructed from consequent intense precipitation days. We also define extreme daily and multi-day rain events that may be loosely attributed to floods, property damage, or worse and in the following discussion are associated with rare events that are above 155 mm (6 inches).

Our analyses show that over the eastern two-thirds of CONUS, a statistically significant redistribution in the spectra of intense precipitation days/events during the past decades has occurred. Moderately heavy events (those with daily totals between 12.7 mm and 25.4 mm) became less frequent compared to days and events with precipitation totals above 25.4 mm. During the past 3 decades (compared to the previous 3 decades), significant increases occurred in the frequency of "very heavy" (above 76.2 mm) and extreme precipitation events in the central region of the CONUS ($\sim$35% of CONUS from the Great Lakes and Midwest to the Gulf Coast), with up to 40% increases in the frequency of days and multi-day rain events with precipitation totals above 155 mm. These changes coincided with a significant (two- or threefold) increase in the total yield of agriculture production in the Central U.S. (soybeans and corn yield). Keeping in mind that evapotranspiration from the agriculture fields is linearly proportional to their yield, we speculate that the observed dramatic changes in extreme precipitation in the Central U.S. (at least partially) can be a result of the local anthropogenic factor, the change in land use that intensified recycling of local precipitation during the warm season. The "usual suspects" associated with extreme precipitation (tropical cyclones) do not significantly contribute to the changes that we found for the Central U.S. Over time in each large region of CONUS, the internal precipitation structure (e.g., mean and maximum hourly precipitation rates within each preselected range of daily or multi-day event totals) did not noticeably change.