Southeast Climate
EXTENSION | Advancing Climate Extension in Agriculture

Rainfall Intensity Changes in the Southeastern U.S.

Historical Trends and Climate Change Projections

Key points

- High-intensity rainfall events have become more common in the Southeastern U.S. in recent decades
- Extreme rain events can be costly for producers due to erosion, crop damage, nutrient losses, and reduced days for fieldwork
- Management solutions that can make production more resilient to intense rainfall are being implemented, including conservation tillage, high-residue cover crops, and sod-based rotation

Introduction Rainfall intensity is the depth of rainfall observed during some time; it could be expressed in terms of inches/day, inches/hour, or some other units. The intensity of rainfall affects the balance of infiltration and runoff at the soil surface.

There are a variety of ways to define a measure of rainfall intensity. One relatively common measure uses a fixed-thresholds approach. The way this works is that the number of rain events above a certain threshold (i.e. greater than or equal to 6 inches/day) is counted each year at each monitoring location. An example of the fixed-thresholds approach is shown in Figure 1. Four rainfall categories (moderate, heavy, very heavy, and extreme) were defined, and the numbers of events in those categories were calculated for the last 30 year years (1984-2013) and were compared to previous 30 years (1954-1983).

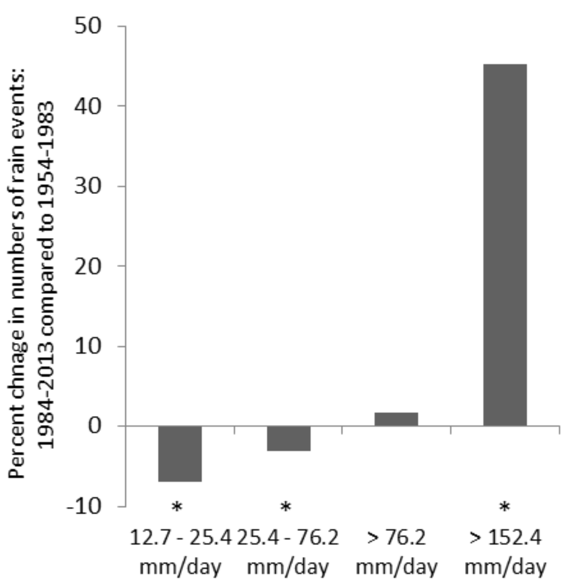

Figure 1. Southeast U.S. region-wide percent change in numbers of rain events in 4 fixed-threshold categories: percent change show difference in numbers of rain events in the most recent 30 years (1984-2013) compared to previous 30 years (1954-1983). Changes are statistically significant for the >152.4 mm/day category (increases) and for the 12.7 – 25.4 mm/day and 25.4 – 76.2 mm/day categories (decreases), designated by asterisks in the figure. Based on a study of AL, FL, GA, NC, SC rain intensity by Dourte, Fraisse, and Bartels.

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NIFA National Institute of Food and Agriculture
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Cover photo: Lynn Betts, USDA-NRCS

Alternatively, another way to do this is to calculate the percent of annual total rainfall that falls in the top 1% of daily rain events. So for each year at each weather station measuring rainfall, you calculate the total annual rainfall by adding up all the daily rain events. Next, you sort all those rain events and look at only the top (highest daily intensity) 1%. Adding up the rainfall depth in the heaviest 1% of rain days and dividing that by the total annual rainfall gives the fraction of rainfall received in the top 1% of rain events.

Testing for historical changes in rain intensity can be done by looking at averages in recent periods compared to averages in a longer period. For example, decadal averages compared to longer-team averages. Or simple trendlines can be fitted to the annual data (percentile-based or fixed-threshold or some other approached).

Regardless of the approach used to test for changes in rainfall intensity, the goal in Climate Extension is to focus on management solutions that increase the resilience of production systems to climate risks. So it is important to engage stakeholders across the food system to learn together about strategies for reducing any potential risks of increasingly common extreme rain events.

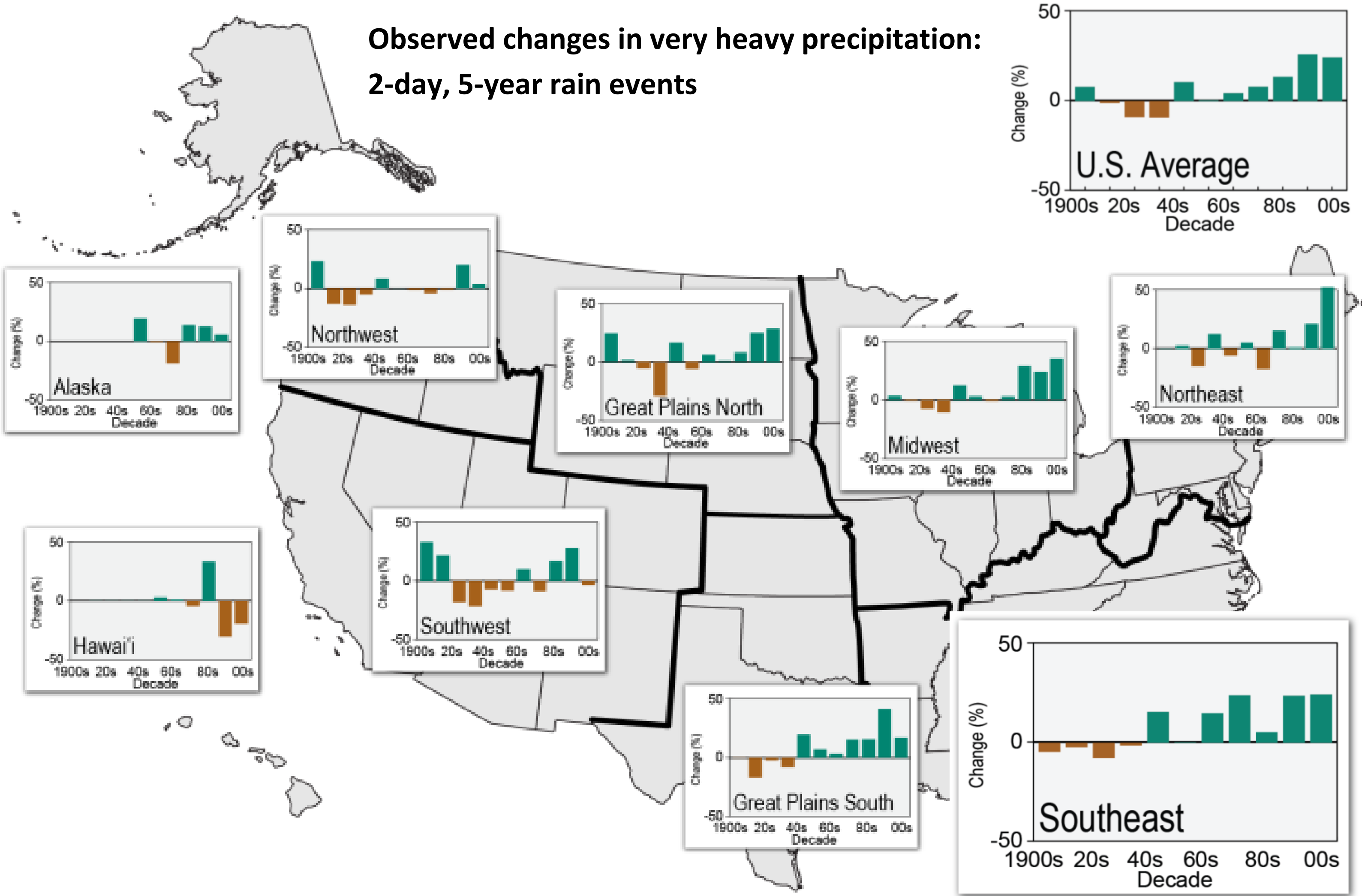

Figure 2. Another measure of rainfall intensity is a 2-day precipitation amount that is exceeded on average only once in a 5-year period; this can be called the "once-in-five-year event". The figure above shows that in recent decades the 5-year rain events are being more commonly observed (based on data from 1901-2012 and changes compared to the 1901-1960 period). Figure adapted from "[Monitoring and understanding trends in extreme storms: State of knowledge]" by Kunkel et al. 2013; included in the [National Climate Assessment 2014] at [http://nca2014.globalchange.gov/].

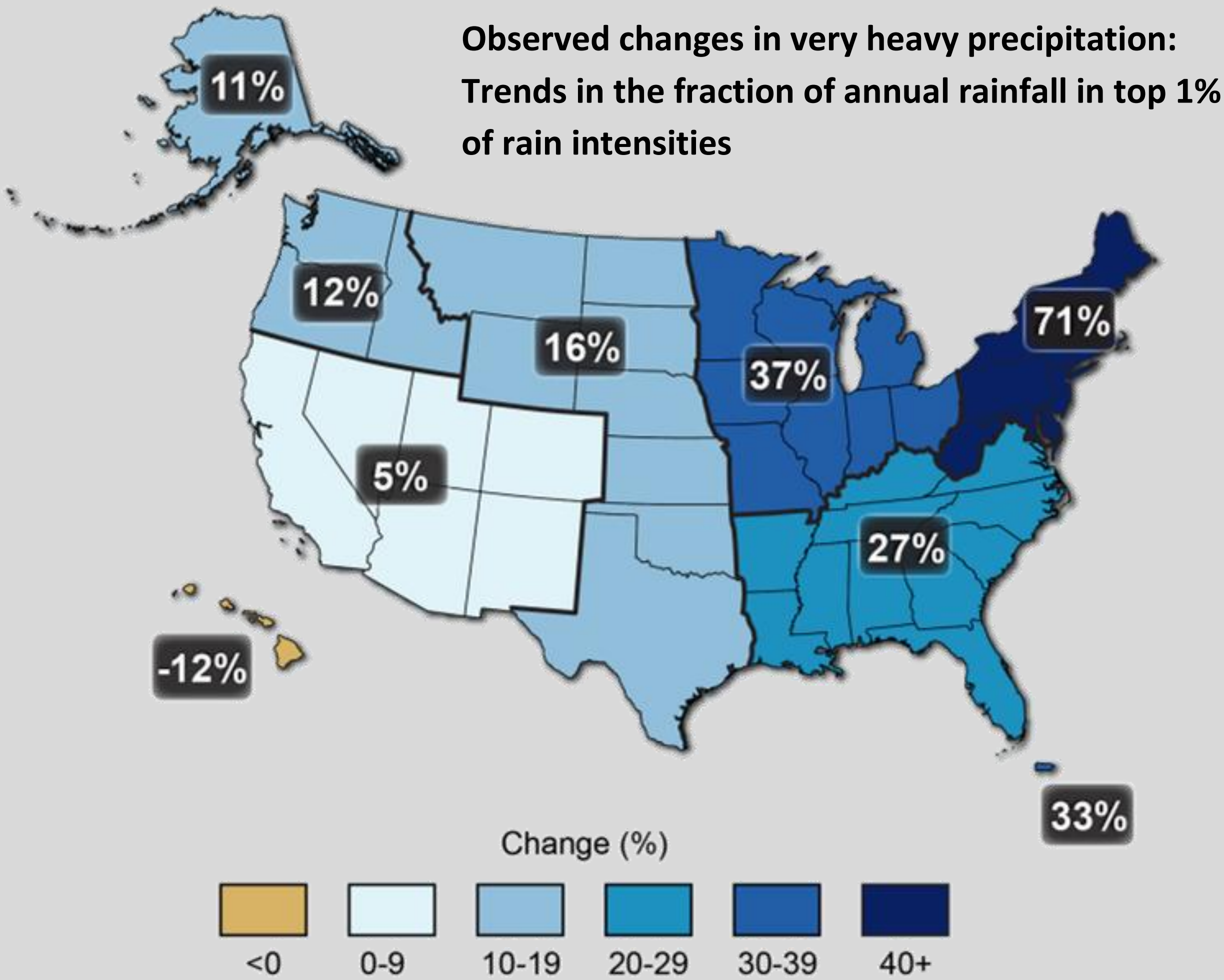

Figure 3. The map above shows the percent increases in the amount of precipitation falling in the heaviest 1% of all daily events from 1958 to 2012. These trends, based on the beginning and ending points of trendlines for the 1958-2012 data, are statistically significant for the Southeast, Great Plains, Midwest, and Northeast. Figure source: updated from [Global Change Impacts in the United States](#) by Karl et al. 2009, included in the [National Climate Assessment 2014](#) at http://nca2014.globalchange.gov/

Photo: 2014 National Climate Assessment

Climate Change Projections

Warmer air can hold more water vapor, and if temperatures continue to rise, the projections of future climate suggest there will be continued increases in high-intensity rain events.

Management Solutions

A major goal in Climate Extension is to highlight emerging and established management options that can reduce climate risks and make agricultural systems more efficient. There have been some increases in high-intensity rain events in recent decades; also during this time there have been changes in management practices by producers that have made their systems less vulnerable to climate risks. In recent years there has been an increase in the area planted in winter cover crops. The substantial amount surface residue of a cover crop can reduce many of the negative impacts of intense rainfall, reducing runoff of soil, water and nutrients. This could be a big economic and environmental benefit in some seasons. Learn more about strategies being used by producers to make their production systems more resilient – click the image or link below to find our management factsheets and videos.
http://agroclimate.org/fact-sheets-management.php

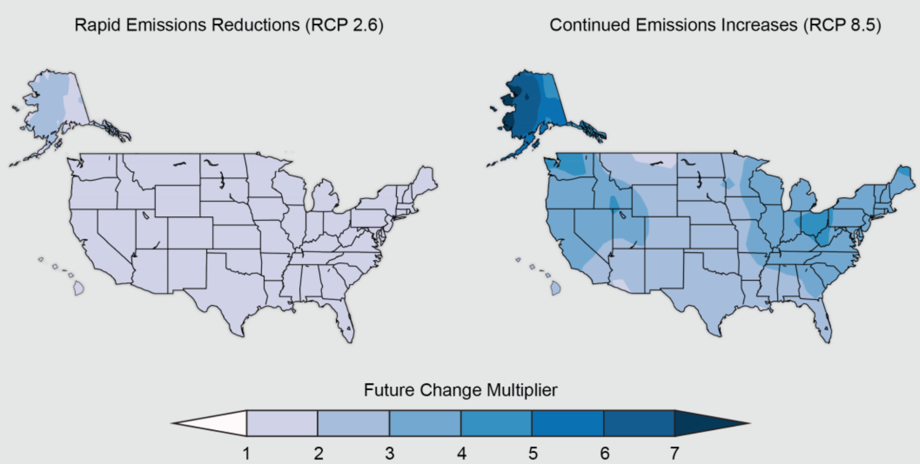

Figure 4. These maps show the increase in the frequency of a 1-in-20-year rain event between the 20 year periods of 2081-2100 and1981-2000. Assuming rapid emission reductions these events might occur almost 2 times as often, and assuming continued emissions increases these events could occur nearly 3 times as often in parts of the Southeast.

Management Fact Sheets: Reducing Climate Risks and Improving Resource-use Efficiency

High-residue Cover Crops

High-biomass cover crops to reduce yield variability and improve soil quality

Sod-based Rotation

Perennial grass in a conventional rotation to improve soil organic matter and increase root zone depth

Conservation Tillage

Reducing tillage to decrease runoff and save time on field operations

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