

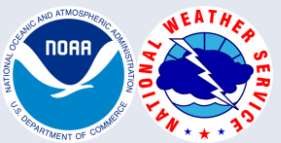
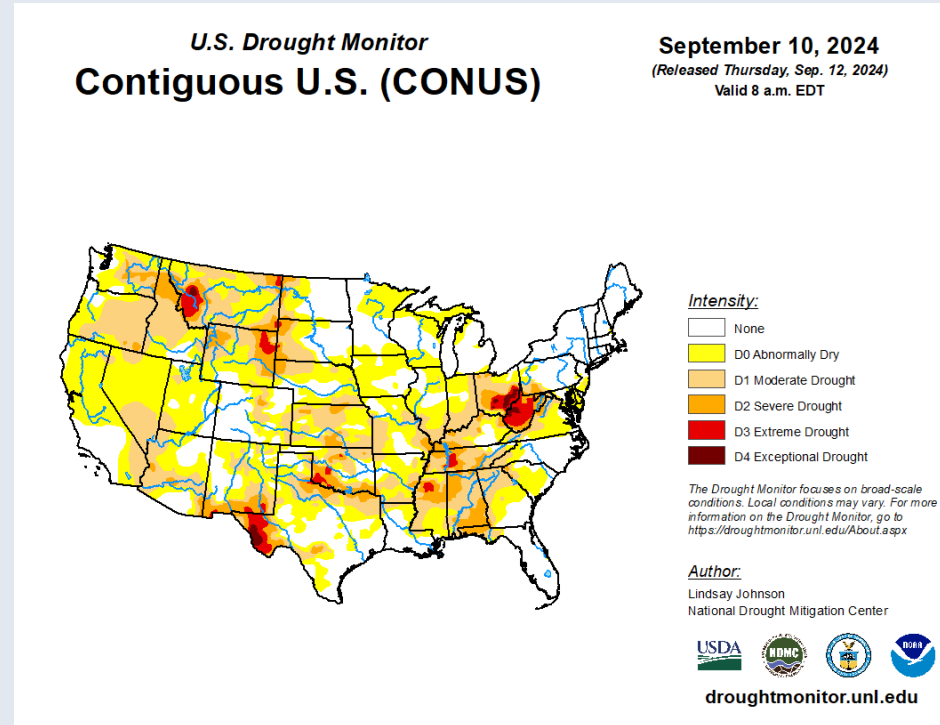
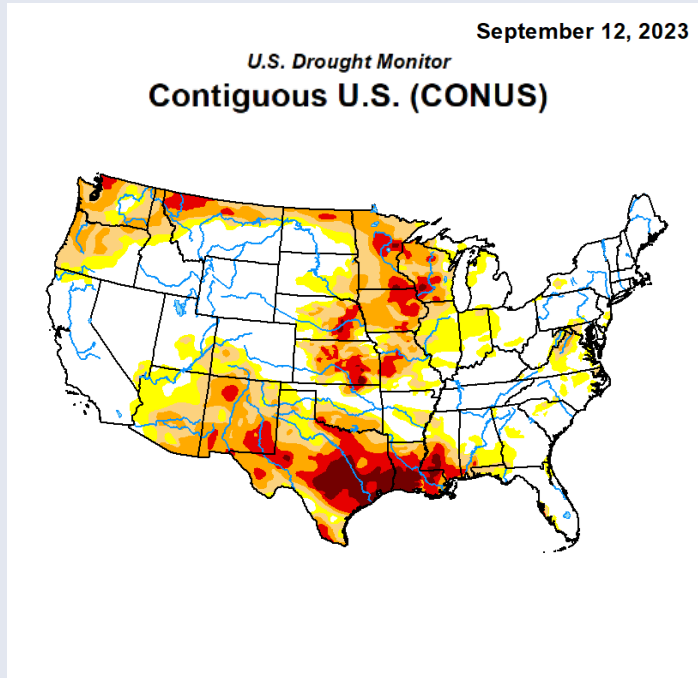
Too Much, Yet Not Enough: How Changing a Climate Impacts Hydrology

Matt Wilson
Service Coordination Hydrologist
Lower Mississippi River Forecast Center



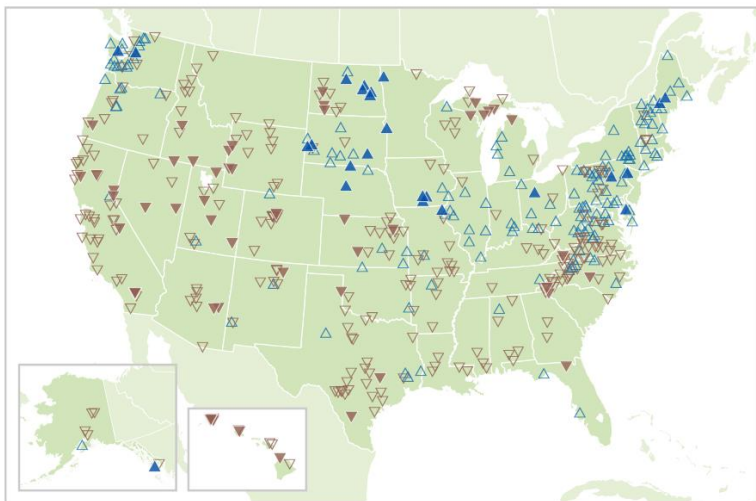
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Drought Map: Last Year and Present



Changes in Flood Frequency and Magnitude

Change in the Frequency of River Flooding in the United States, 1965–2015

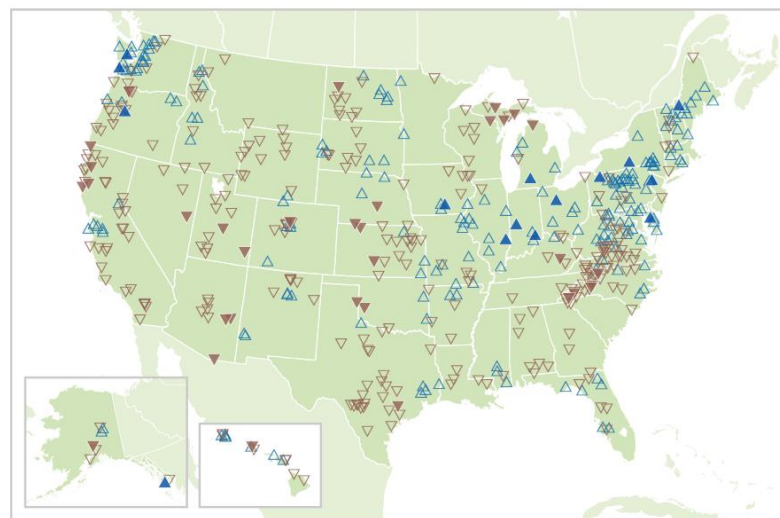


▼ Significant decrease ▽ Insignificant decrease ▲ Insignificant increase ▲ Significant increase

Data source: Slater, L., and G. Villarini. 2016 update and expansion to data originally published in: Mallakpour, I., G. Villarini. 2015. The changing nature of flooding across the central United States. *Nature Climate Change* 5:250–254.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

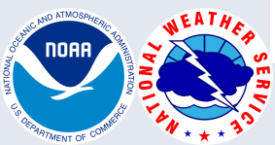
Change in the Magnitude of River Flooding in the United States, 1965–2015



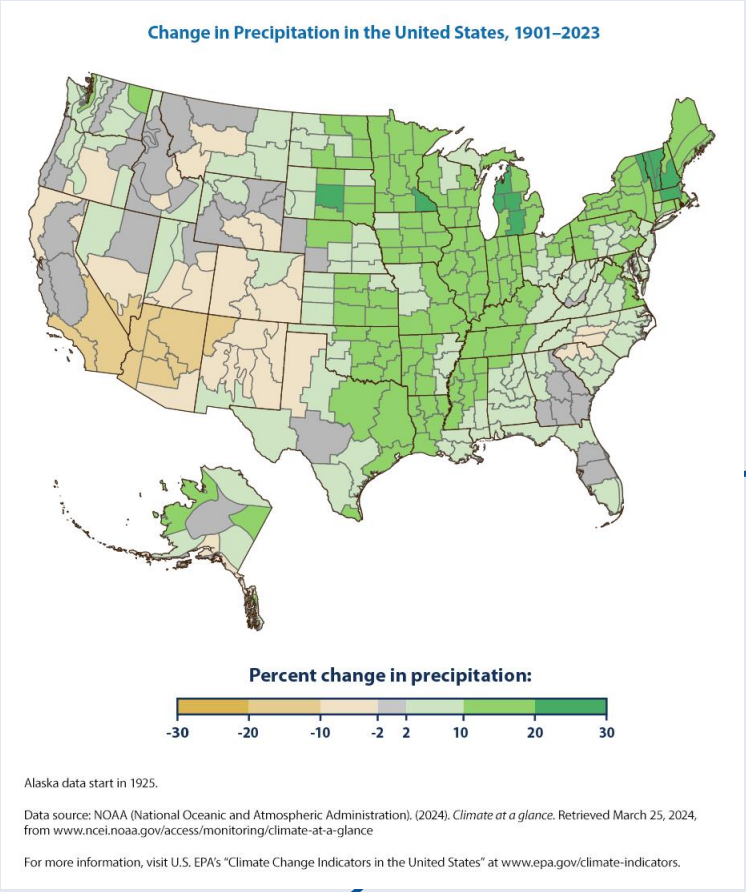
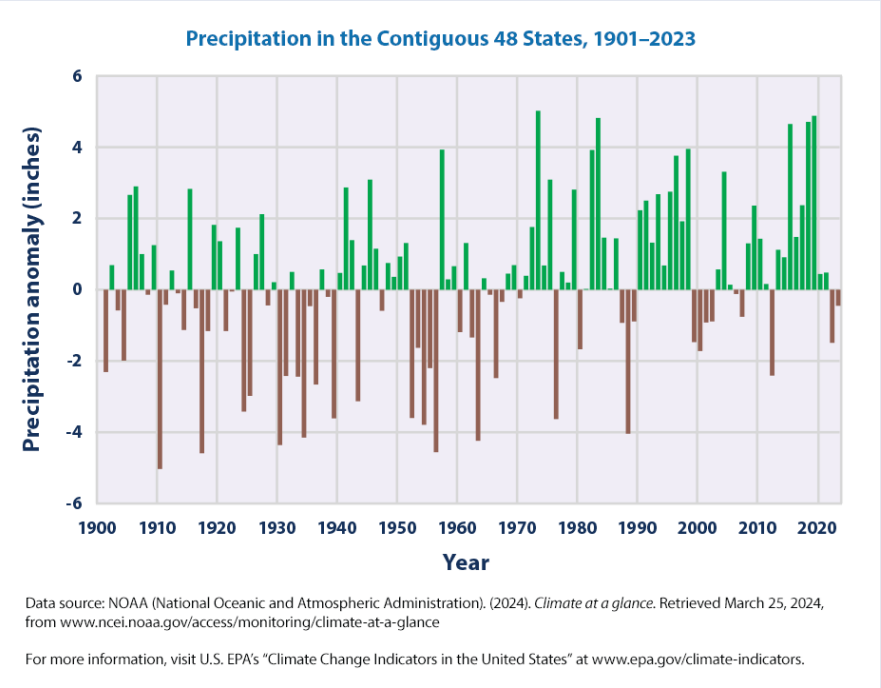
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Data source: Slater, L., and G. Villarini. 2016 update and expansion to data originally published in: Mallakpour, I., G. Villarini. 2015. The changing nature of flooding across the central United States. *Nature Climate Change* 5:250–254.

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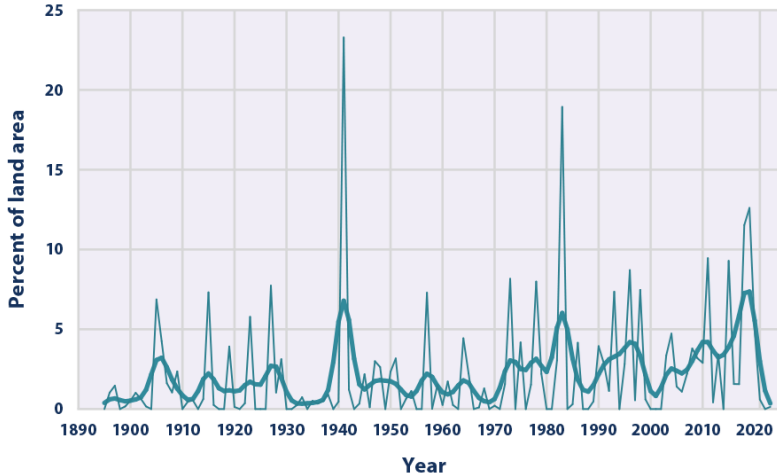


Precipitation Amount Changes

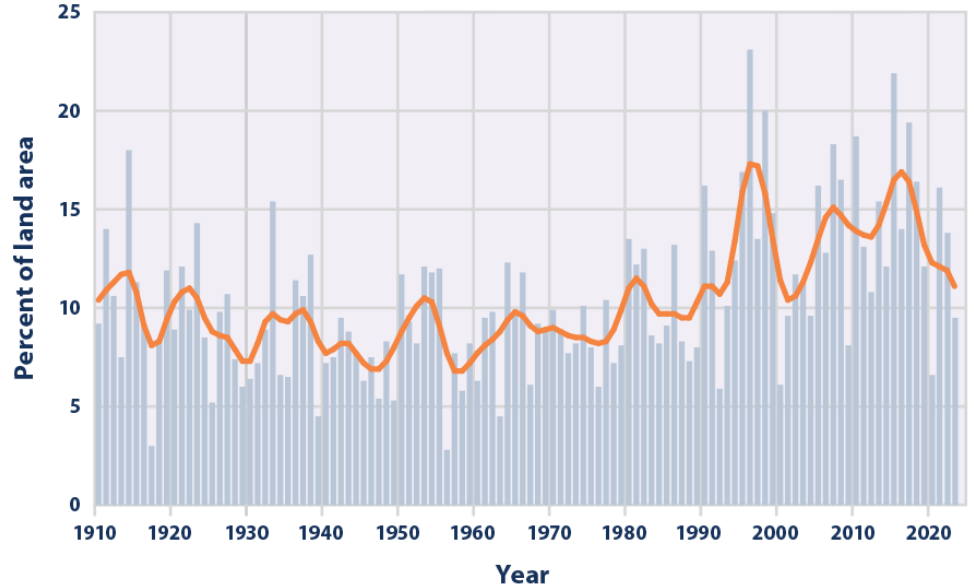


Changes in Precipitation Events

Unusually High Annual Precipitation in the Contiguous 48 States, 1895–2023



Extreme One-Day Precipitation Events in the Contiguous 48 States, 1910–2023



Data source: NOAA (National Oceanic and Atmospheric Administration). (2024). *U.S. Climate Extremes Index*. Retrieved April 18, 2024, from www.ncei.noaa.gov/access/monitoring/cei

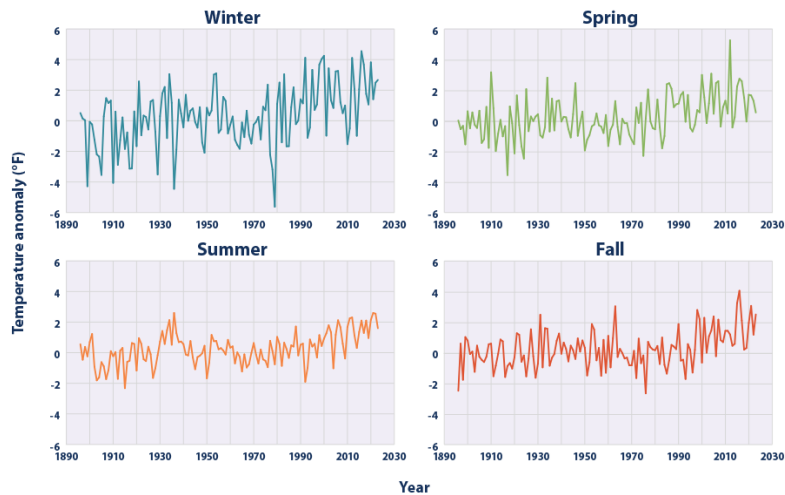
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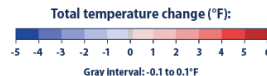
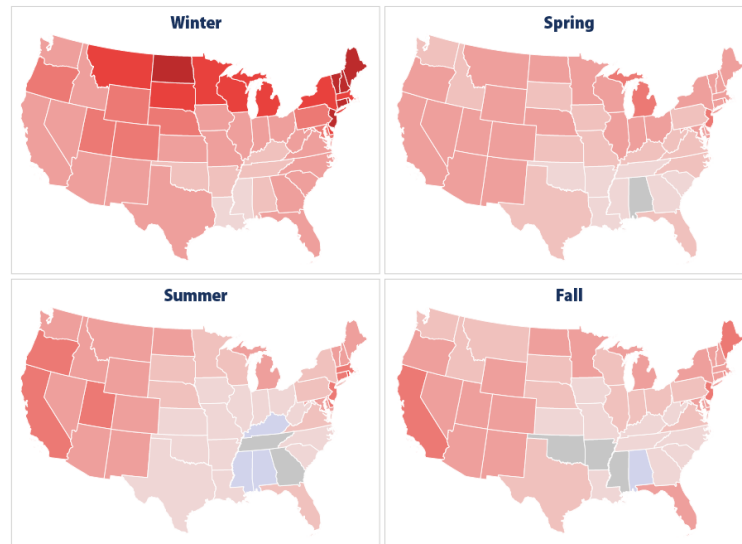
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Seasonal Temperature Changes

Average Seasonal Temperatures in the Contiguous 48 States, 1896–2023



Change in Seasonal Temperatures by State, 1896–2023



Data source: NOAA (National Oceanic and Atmospheric Administration). (2024). *National Centers for Environmental Information*. Retrieved February 1, 2024, from www.ncei.noaa.gov

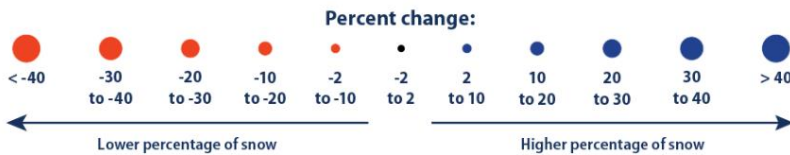
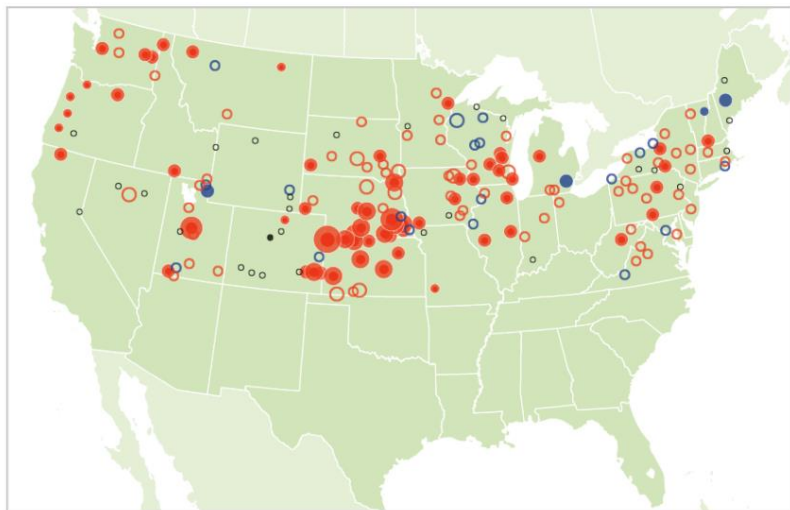
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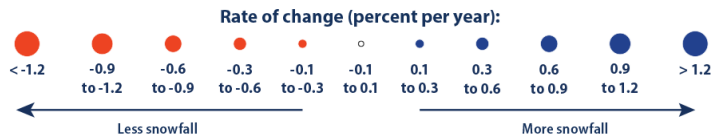
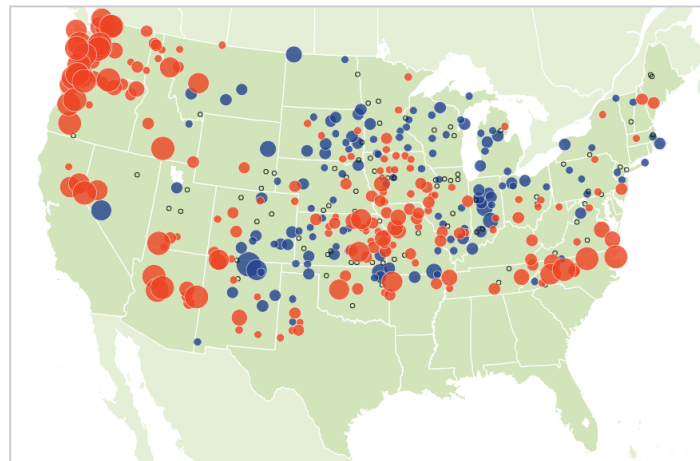
Changes in Winter Precipitation

Change in Snow-to-Precipitation Ratio in the Contiguous 48 States, 1949–2020



Filled circles represent statistically significant trends.
Open circles represent trends that are not statistically significant.

Change in Total Snowfall in the Contiguous 48 States, 1930–2007



Data source: Kunkel, K.E., M. Palecki, L. Ensor, K.G. Hubbard, D. Robinson, K. Redmond, and D. Easterling. 2009. Trends in twentieth-century U.S. snowfall using a quality-controlled dataset. *J. Atmos. Ocean. Tech.* 26:33–44.

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Important Takeaways

- In the Lower 48, precipitation averages have been increasing over the past 120 years, at an average rate of 0.18 inches per decade.
- Many regions have seen even faster rates of increasing precipitation, while certain areas have seen reductions in precipitation.
- There has been a trending uptick in extreme 1-day precip events since 1960s
- Average temperatures are on the rise in every season, but winter most significantly.
- Wetter winters and more extreme rain events are having some of the largest impacts on continental hydrologic systems.

