Examining Precipitation Across the Garden State From 1900 to 2020

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NJ Department of Environmental Protection

Division of Science and Research

Authors and affiliations:
David Robinson, Natalie Teale, and Logan Soldo

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What was the purpose of the study?

This study provides a comprehensive overview of precipitation within New Jersey from 1900 to 2020 using daily observations from National Weather Service Cooperative Stations. In addition to summarizing "traditional" annual and seasonal values and variability, this study uses novel approaches to help explore changing precipitation patterns in the State at different spatial and temporal scales. This report provides a more complete understanding of precipitation means and extremes in New Jersey.

Overall, what did the studies show?

New Jersey is becoming increasingly wetter over time, particularly in the warm season. This trend is most pronounced in recent decades in southern and coastal regions of the State. Additionally, there appears to be a shift towards moderate and heavy daily events contributing more to annual precipitation totals. In the last 20 years, it takes fewer days to reach totals of 10 and 20 inches of precipitation than in the last half century.

How will DEP use the data?

This study provides an up-to-date historical baseline, which can be used for comparisons to future changes in precipitation patterns that are projected for New Jersey due to climate change. The comprehensive analyses in this study will also allow more informed decisions to be made with regard to planning and responses to flooding, including flash and riverine events, as well as for drought monitoring and associated water management.

What were some key findings of the study?

Precipitation patterns generally are increasing Statewide. More specific patterns are complex and riddled with high variability and limitations in data availability. Key findings include the following:

- From 1900-2020, Statewide annual precipitation averaged 45.6" and has increased significantly at about 7% per century (3.3 inches per century), driven by spring and fall seasonal increases (Figure 1).
- 2011 and 2018 were the wettest years on record. Four of the ten wettest years have occurred in the last 30 years, while only one of the ten driest occurred during this period.
- All weather stations representing New Jersey's six drought regions have increasing linear trends from 1900-2019. The northernmost four drought regions (Northwest, Central, Coastal North, and Northeast) significantly increased in annual precipitation over this time.
- Contributions of annual precipitation have also changed in some of the drought regions from 1900-2019, but vary considerably and do not indicate any clear patterns in distribution.
    - In the coastal south, less than 1-inch daily precipitation events have significantly decreased in their percent of annual precipitation, while daily events with 1 to 2 inches have significantly increased.
    - In the southwest and northeast regions, less than 1-inch daily precipitation events have significantly decreased in contributions to annual precipitation.
    - The northwest region has had a significant increase in daily precipitation events exceeding 2 inches of annual precipitation.
    - All regions on average had 0.1 inches or more of precipitation fall about one to two times per week throughout the year.
- Additional weather stations became available by 1950 and were used for further analyses. Again, precipitation has increased significantly Statewide from 1950-2020. Using this time series (rather than 1900-2020), linear trends increased in all seasons, but summer had the greatest increase. This shift is partially explained by greater interannual variability for summer and fall in recent decades, driven by extreme events, including when Hurricane Irene caused the wettest month on record (August 2011).
- A comparison of the 1981-2010 and recent 1991-2020 climate normals, or averages, indicates that NJ has gotten wetter Statewide (Figure 2). The coast had the greatest increase in annual precipitation, followed closely by the south, while the north had only a slight increase.
- From 2000-2020, the warm season has experienced a faster pace for accumulating multi-month precipitation totals of 10 and 20 inches than the last half of the 20th century.

Table 1. Ten wettest (left) and ten driest (right) years observed in New Jersey from 1900-2020.

Rank	Precip.	Year
1	67.76	2018
2	63.95	2011
3	59.18	1996
4	58.50	1983
5	57.66	1975
6	56.95	1972
7	56.49	1979
8	56.48	2003
9	55.64	1902
10	54.54	1989

Rank	Precip.	Year
1	29.27	1965
2	34.48	1930
3	34.53	1963
4	35.55	2001
5	36.04	1957
6	36.43	1964
7	36.60	1931
8	36.79	1941
9	37.88	1921
10	37.96	1916

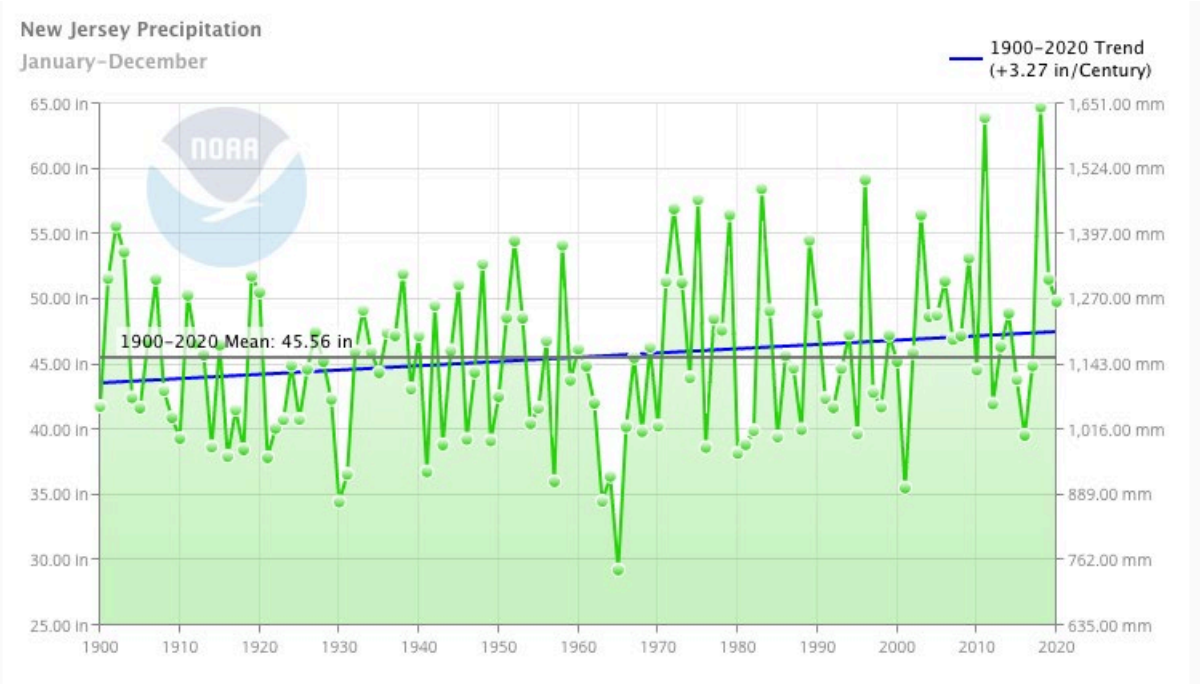

Figure 1. *New Jersey annual precipitation from 1900-2020 and a linear regression for the period of record (blue line). The trend per century is shown in the top right. Data and graph from [Climate at a Glance (NCEI).]*

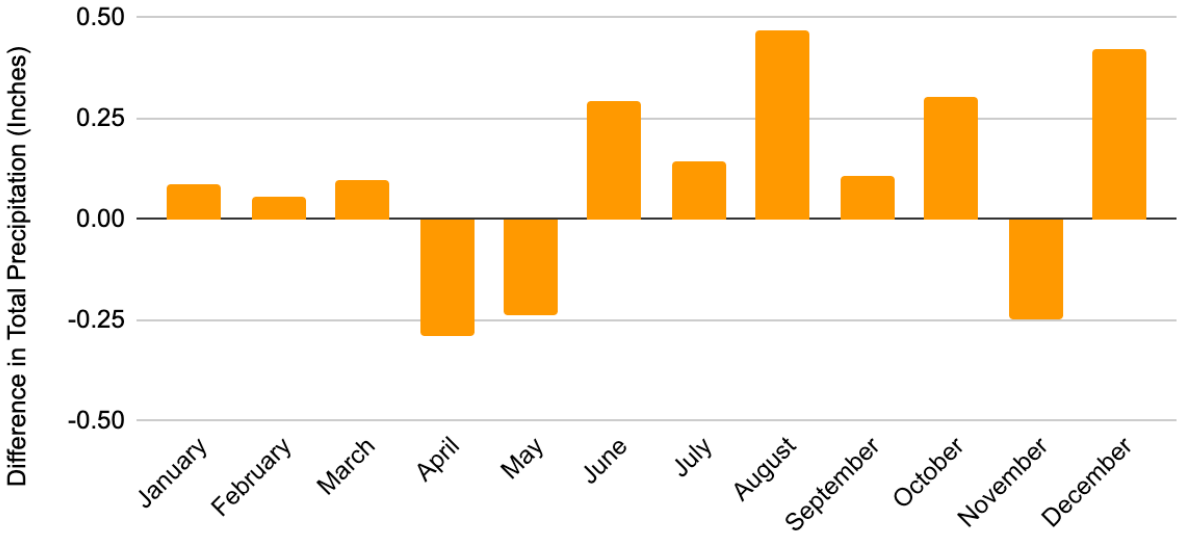

***Figure 2**. New Jersey monthly differences in precipitation normal (averages) between the 1981-2010 and 1991-2020 periods. Positive values indicate the more recent 30-year interval is wetter.*

Please review the full report for more detailed information at
https://dep.nj.gov/wp-content/uploads/dsr/precipitation-1900-2020.pdf

Who to contact with further questions.

Kirk Raper, NJDEP – kirk.raper@dep.nj.gov

David Robinson, NJ State Climatologist – David.robinson@rutgers.edu

State of New Jersey
Phil Murphy, Governor

Department of Environmental Protection
Shawn M. LaTourette, Commissioner

Division of Science & Research
Nicholas A. Procopio, Ph.D., Director

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