

NYC Extreme Precipitation: Interannual and Seasonal Variability

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INTRODUCTION

Extreme precipitation events are predicted to become more intense in many regions (Pachauri et al., 2014). However, the total precipitation for the Northeast US has shown a very weak trend from 1977 to 2007, but there was an increase in tropical cyclone contribution to extremes (Knight & Davis, 2009). The synoptic classification of storms in the region suggest that other storms may also be important (Fig. 1). This project studied the extreme rainfall in the greater New York City region from 1979 to 2012 through the classification of the interannual and seasonal precipitation variability. In looking at this, the events of precipitation are analyzed and calculated. The study may provide noticeable insights into the variability that create the rainfall measured.

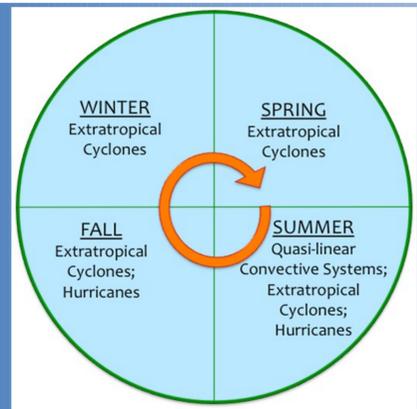


Fig. 1. Synoptic classification of storms in NYC

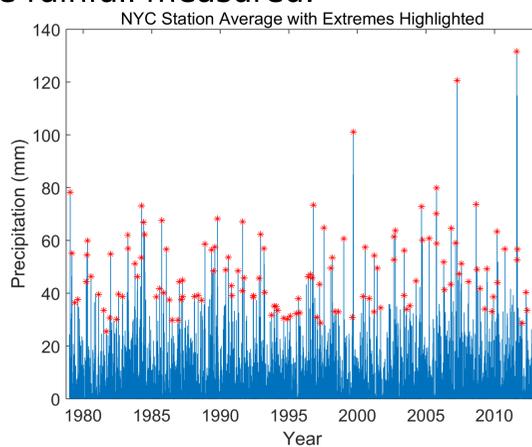


Fig. 2. NYC precipitation station average (blue) from 1979 to 2012 with extreme events highlighted with red

METHODS

Daily precipitation data for 12 weather stations from the Global Historical Climatology Network were averaged to obtain a station average for the NYC region. Annual average values were calculated for both overall and extreme precipitation, the latter which was done by identifying the 99th percentile for each year and averaging them (Fig. 2). These two values were divided to obtain the ratio. The annual average extreme precipitation events were also used to create a histogram of the annual distribution. The number of extremes was recorded to display the frequency of heavy rainfall among the overall rainfall data throughout the 34 year range. Among that data, the day with the most precipitation best illustrated its corresponding weather

RESULTS

The NYC area average from 1979-2012 (Fig. 2) shows the interannual and seasonal variability for both extreme and total averaged events. The average extreme precipitation was approximately 48 mm with the three largest events occurring within the last 15 years. The average annual precipitation (Fig. 3) shows an overall synchronous but not identical pattern in variability with large changes in extreme precipitation occurring over several years. The average annual extreme is shown to have a ratio of 15 times larger than the average overall precipitation (Fig. 4), most of which occur in Fall and Spring (Fig. 4). The largest extreme precipitation event was found in each season and the events are shown on the sea level pressure and precipitation maps (Fig. 6 - 9). The Fall storm shows the most precipitation most likely due to its slow speed and direct pathway across the North American region. The summer storm shows the least precipitation most likely due to its fast traveling speed and its non direct pathway that briefly passes the North American region.

extreme precipitation (orange)

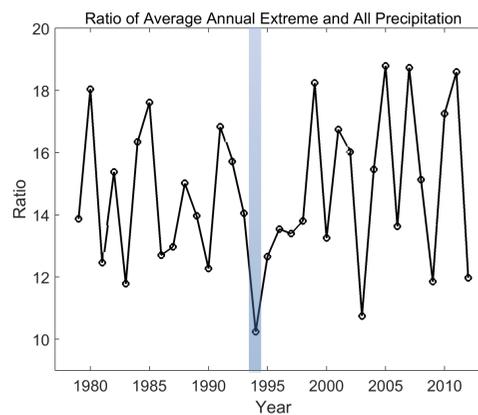
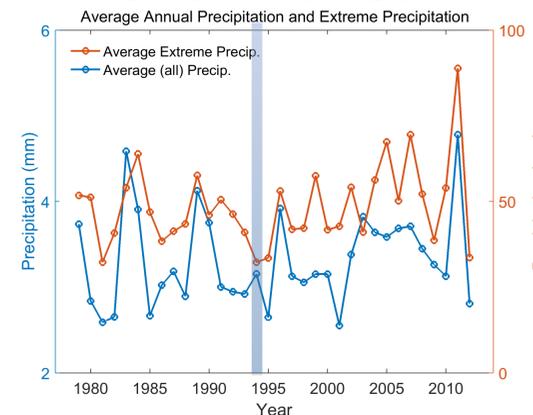


Fig. 4. Ratio between the average extreme precipitation and the average overall precipitation. Large values indicate that the top 99th percentile was large compared to the average for all rain events. Small values (e.g. 1994) indicate that the 99th percentile was small compared to the overall

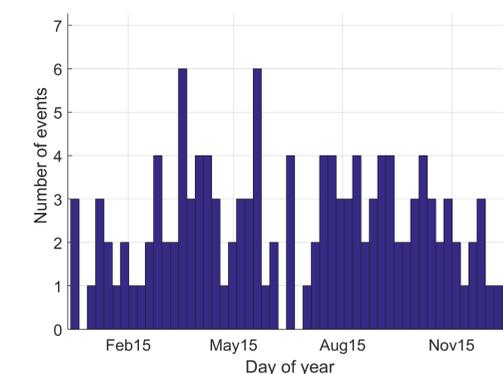


Fig. 5. Distribution of extreme precipitation throughout the year from 1979-2012

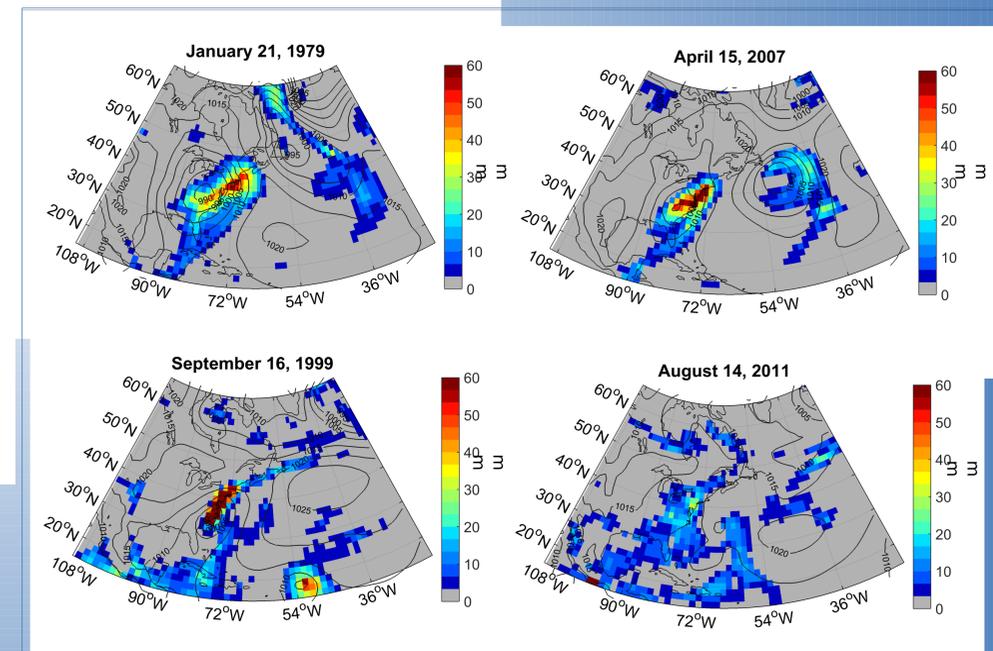


Fig. 6 Precipitation (color) and sea level pressure (contours) maps on the day with the most precipitation in NYC region for each season (units: precip: mm; sea level pressure: hPa)

CONCLUSIONS

Data collected from the 12 weather stations over a span of 34 years show patterns of extreme rainfall. The top 3 extremes occurred during the last 15 years. However, there is no discernable signal for interannual variability. The average of extreme precipitation shows a ratio 15 times larger than the average overall precipitation. Fall and Spring both show large quantities of extreme weather events while the Summer and Winter shows the least extremes.

References

- Knight, D. B., & Davis, R. E. (2009). Contribution of tropical cyclones to extreme rainfall events in the southeastern United States. *Journal of Geophysical Research*, 114(D23).
- Pachauri, Rajendra K. et al. "Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." (2014).