Equinoctial Extreme Precipitation Variability

Yelitza Ramirez[#], Stanley Ko[&], Amana Hosten[&], James F. Booth[&]
[#] City College Academy of the Arts, [&]Earth and Atmospheric Science Department, CCNY

This research was supported by NOAA CREST (NOAA CREST-Cooperative Agreement No: NA11SEC4810004) and funded by The Pinkerton Foundation.

The City College of New York

J. F. Booth Climate & Weather Research Group

INTRODUCTION

Strong precipitation events in New York City can generate hazardous flooding conditions, which makes it imperative that we understand and classify the variability of extreme precipitation. Recent work from our group found that extreme precipitation events tend to occur more often in late spring and early fall, as compared to other parts of the year. In this project, we analyzed precipitation by classifying the variability of equinoctial (Spring and Fall) extreme precipitation in the greater New York City region (Fig. 1) future changes.

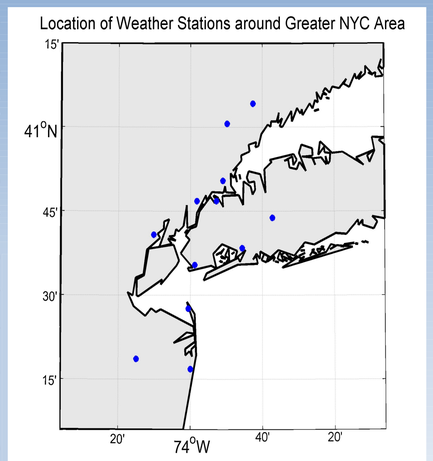

Fig. 1. Locations of GHCN land weather stations; precipitation data source

METHODS

Precipitation data for 12 weather stations from the Global Historical Climatology Network was used to statistically compare the Spring (MAM=March, April, May) and Fall (SON=September, October, November). Comparisons included the frequency, distribution, and accumulation among two different extreme precipitation metrics, 99th percentile and consecutive (events greater than 4 days of continuous duration). The data were averaged to a station average. Subsequently, MAM and SON were separated to obtain the distribution of all precipitation events, consecutive events, and to calculate the 99th percentile. ECMWF ERA-Interim reanalysis

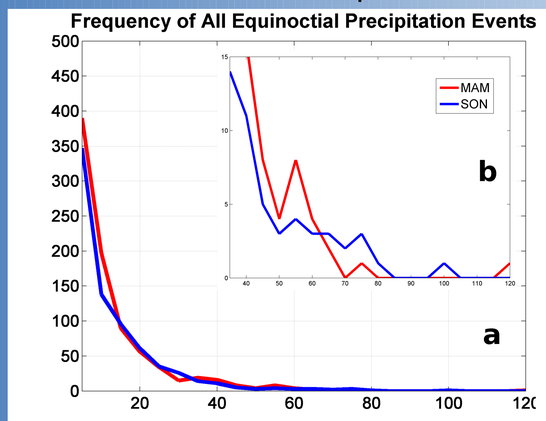

Fig. 2. (a) Frequency of all precipitation events of Spring and Fall from 1979 to 2012. (b) Magnified view of the tail from 2a.

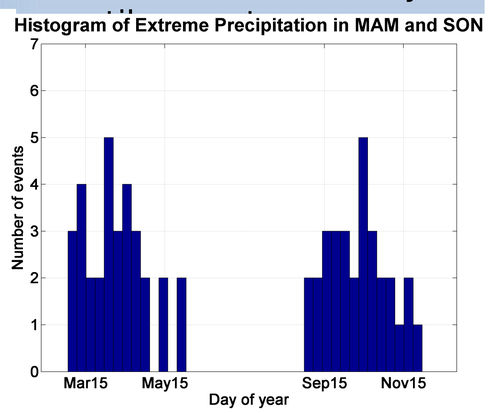

Fig.3. Seasonal distribution of precipitation events: shows that extreme precipitation occurs at nearly the same rate in Mar, Apr, Sep and Oct, and less often in May and Nov.

Table 1. 99th percentile events and consecutive

	Mar	Apr	May	Sept	Oct	Nov
99th count	15	13	4	12	13	6
99th accum. (mm)	764.19	744.83	213.23	711.64	741.48	287.82
99th avg. (mm)	50.95	57.29	53.31	59.30	57.04	47.97
99th sum (mm)	1722.25			1740.94		
consec. count	16	25	22	20	20	6
consec. accum. (mm)	791.98	1014.68	1024.62	772.71	1403.17	202.33
consec. avg. (mm)	49.50	40.59	46.57	38.64	70.16	33.72
consec. sum (mm)	2831.28			2378.20		
# of zero precip. days	478	400	408	508	538	494

COMPOSITE ANALYSIS FIGURES
Precipitation and Sea level pressure averages for the top 32 events in spring (MAM) and fall (SON).

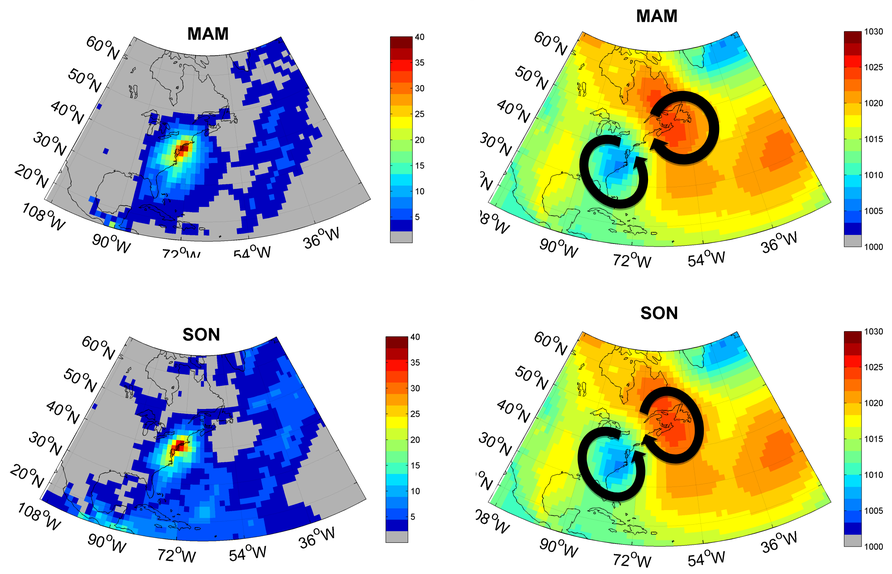

Fig.4, 5. Composite Averages (a) Precipitation (units: mm) and (b) sea level pressure (SLP) (units: hPa). Precipitation maximum over NYC is similar for both seasons. However, in the fall there is more precipitation in the southern part of the N. Atlantic ocean. Lines of constant SLP approximate the wind direction.

RESULTS

The frequency of all precipitation events (Fig. 2a) is approximately the same for both seasons, including the extremes (Fig 2b). A minor difference can be seen in the Spring which has more events with 10-15 mm of rain. Table 1 shows the extreme metric comparison. For the 99th percentile metric, the number of events, monthly accumulation of precipitation, average and seasonal totals are similar. The seasonal distribution also show similar patterns of more events and larger monthly accumulation for the first two months, which is also seen in seasonal histogram of 99th percentile events (Fig. 3). Consecutive events occur more frequently in spring than the fall. Fall has more days without rain, but the total precipitation is almost the same as spring; telling us that even though fall has less days of rain, the rain it receives is stronger and heavier. The composites (Fig. 4 and 5) represent the typical extreme precipitation event (99th percentile) in the two seasons. They both show similar SLP patterns, which are a low pressure system close to NY and a high pressure system to the northeast.

CONCLUSIONS

This project supports findings from our previous work which showed precipitation totals were similar for Spring and Fall. It also better characterizes the variability of equinoctial extreme precipitation. Both seasons receive similar amounts of total and extreme precipitation and have more extreme precipitation events in the first two months. However, there are more consecutive events in the spring and more days of no precipitation in the fall. This research project could help in determining future changes in the precipitation and could prevent flooding form unexpected extreme precipitation.