

# Precipitation Extremes and Flood Potential Under Climate Change in the Northeastern U.S.

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## Background

### INTRODUCTION

Extremes can have significant effects on the lives of people in New York City<sup>(1)</sup>:

- more frequent street, basement and sewer flooding
- reduction in water supply
- biological and chemical changes in potable water quality
- longer drought spans



### PROJECT OBJECTIVES

- to determine the distribution of precipitation extremes and their link to large scale climate indices
- to evaluate the simulation of precipitation extremes by IPCC models and assess the feasibility of projecting changes in extremes during the 21st century.
- to explore local impacts of changes in extreme event distribution on the New York metropolitan area

### DATA SOURCES

**Observations:** Utah State University Climate Center. provides daily data for U.S. meteorological station, forming the basis for calculation of extremes (<http://climate.usurf.usu.edu/products/data.php>).

**Model output:** Output from the IPCC AR4 coupled models for the 20<sup>th</sup> and 21<sup>st</sup> centuries. 9 models provide a subset of the output based on post processed compilation of climate extremes ([http://www-pcmdi.lln.gov/ipcc/standard\\_output.html#Table A4](http://www-pcmdi.lln.gov/ipcc/standard_output.html#Table A4)).

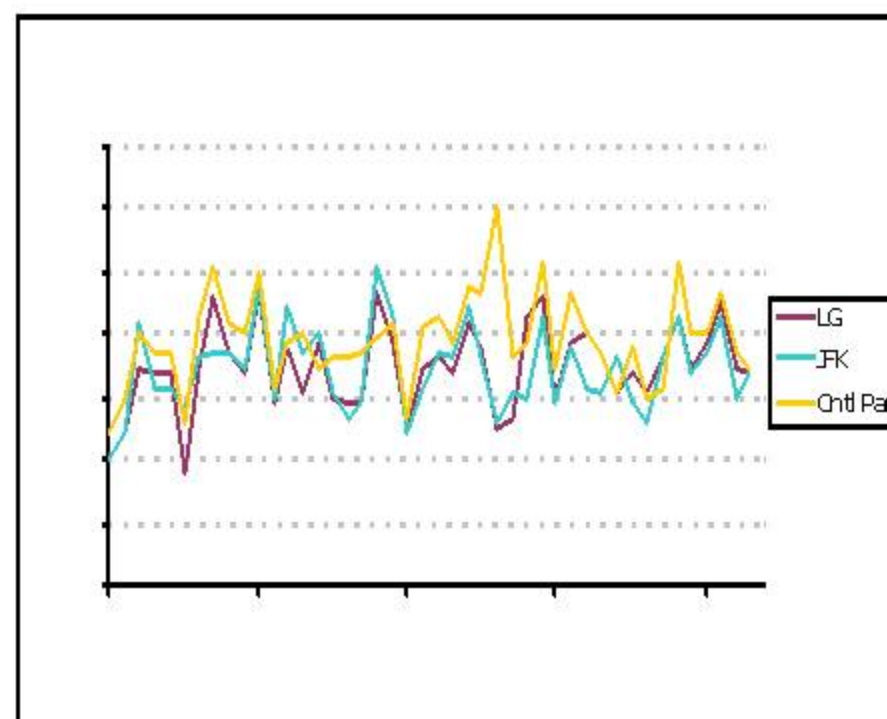


### METHODS:

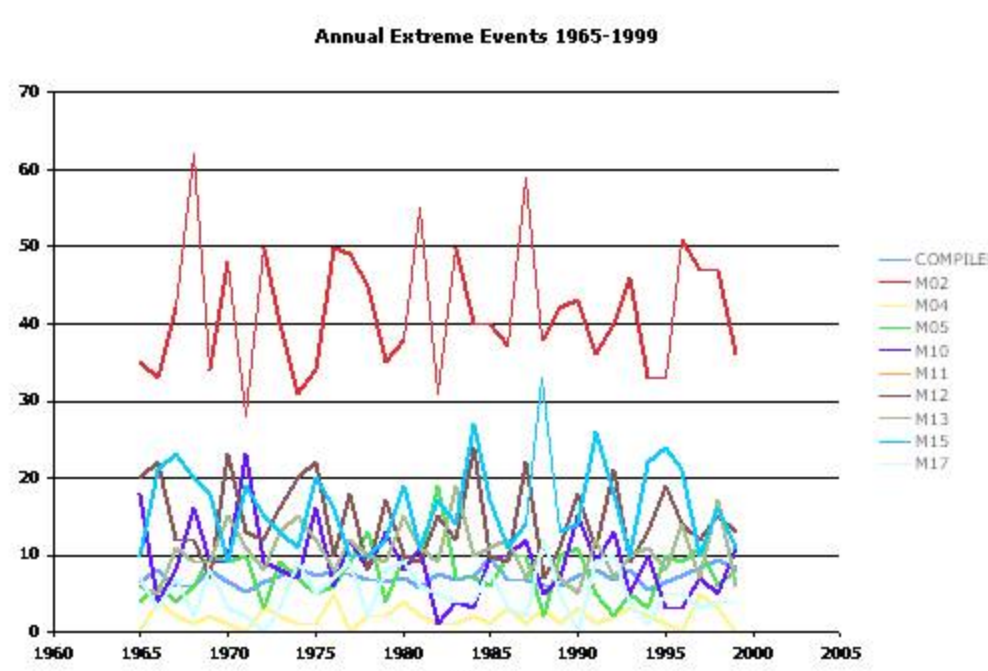
- Compare precipitation data from different stations across New York state to determine coherence
- Compare historical precipitation data to climate models simulations of the 20<sup>th</sup> century
- Based on 20<sup>th</sup> century simulation assess model projection capability

## Results

The results below are preliminary and are meant to indicate the directions we are following. Only nine of the IPCC models\* provide measures for precipitation and temperature extremes on an annual basis. We have used only one measure below, namely: the annual number of days with precipitation greater than or equal to 10 mm per day. Other measures will be studied in the upcoming weeks.



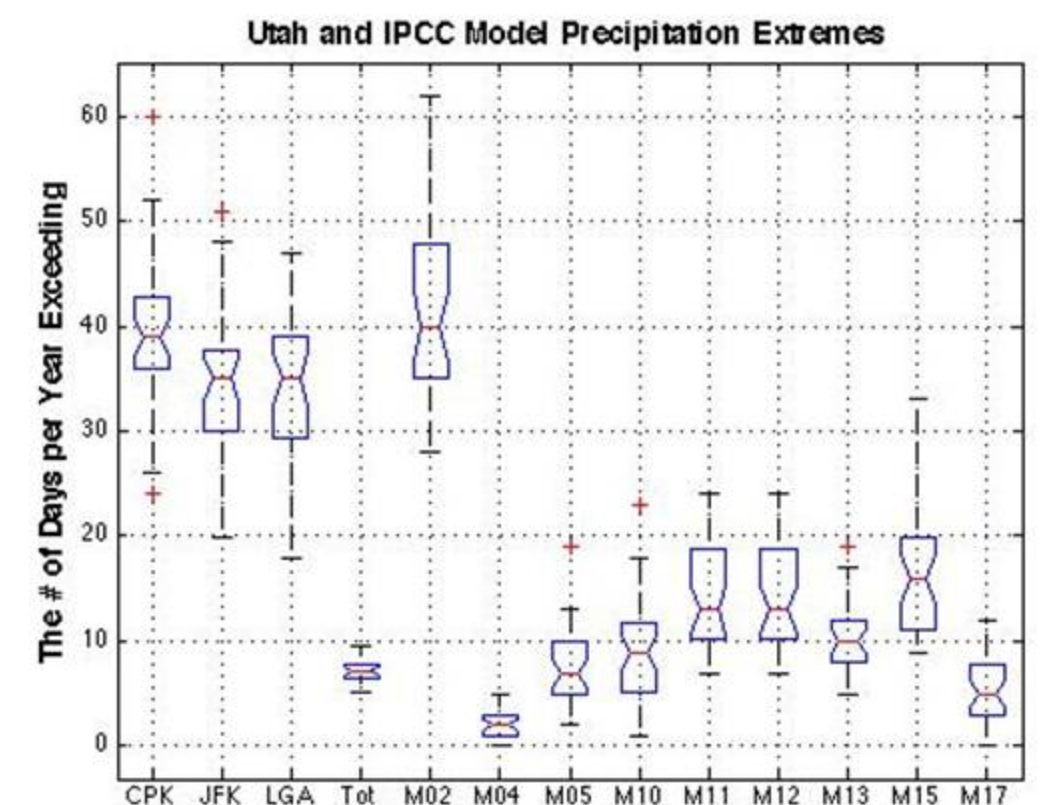
**FIGURE 1, Observations:** The number of days per year with daily precipitation greater than 10 mm at JFK, and LaGuardia Airports, and in Central Park, New York City. Shows year-to-year change in occurrence of extreme precipitation events. High correlation (~0.8) between stations reflects coherence in data across New York Metropolitan Area.



**FIGURE 2, Models:** The number of days per year with daily precipitation greater than 10 mm. Compared to observations the majority of model under-represent large precipitation events (by this measure). The smooth, multi-model average (light blue line), provides clear indication of the existence of a long-term trend (or non-thereof).

### \* IPCC Models participating in this study

m02=cnrm\_cm3(France); m13=miroc3\_2\_medres(Japan);  
m04=gfdl\_cm2\_0(USA); m15=mri\_cgcm2\_3\_2a(Japan);  
m05=gfdl\_cm2\_1(USA); m17=ncar\_pcm1(USA);  
m10=inmcm3\_0(Russia);  
m11=ipsl\_cm4(France);  
m12=miroc3\_2\_hires(Japan);



**FIGURE 3: Box plots for observational data and IPCC models for the common period 1965-1999. We do not expect individual events between observational data and models to be correlated. We use box plots as a measure of the distribution of extreme events and to compare the models and observational data. The plot displays the upper quartile, lower quartile, median and range of extreme data values.**

The figure highlights the difference between model simulations and observational data in the distribution of extreme events

## Summary



There is coherence in the occurrence of extreme events across the New York City region.

IPCC models underestimate the number of large precipitation events.

### NEXT STEPS...

Compare other measures of precipitation extremes such as the 95th percentile, maximum 5-day precipitation total and maximum number of total dry days (<1 mm total rainfall).<sup>(2)</sup>

Examine model projections for the 21<sup>st</sup> century.

### REFERENCES

- (1) NYC DEP Climate Change Program Assessment & Action Plan, May 2008.
- (2) Frich, P. et al. (2002) Observed coherent changes in climatic extremes during the second half of the twentieth century. *Climate Research*, 19: 193-212.