

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⁽¹⁾:

- 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 20th and 21st 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).



METHODS:

- Compare precipitation data from different stations across New York state to determine coherence
- Compare historical precipitation data to climate models simulations of the 20th century
- Based on 20th 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.

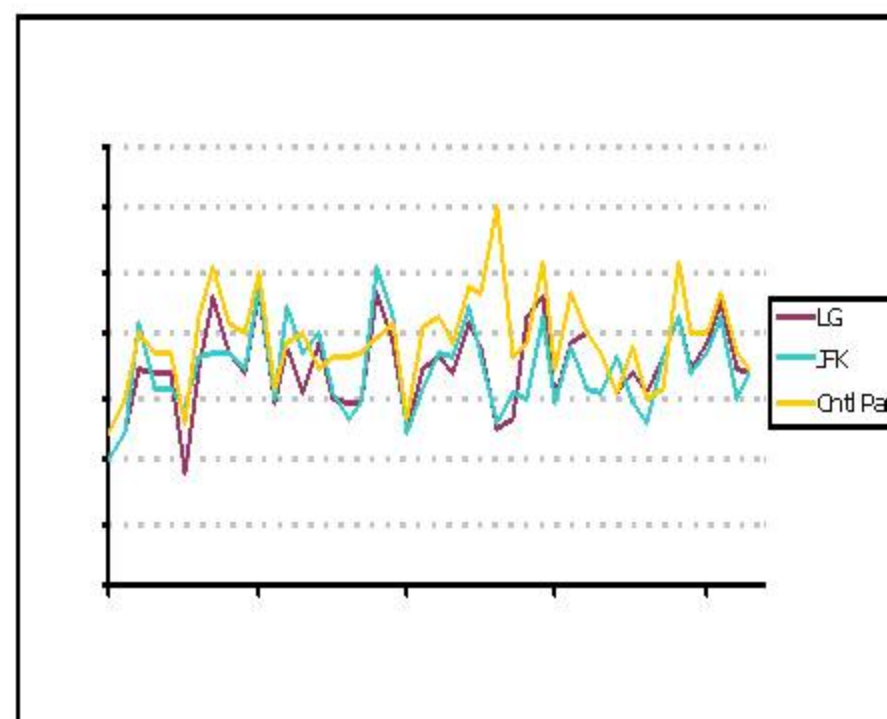


FIGURE 1, Observations: The number of days per year with daily precipitation greater than 10 mm at JFK, and LaGuardia Airports, and in Central Park, New York City. Shows year-to-year change in occurrence of extreme precipitation events. High correlation (~0.8) between stations reflects coherence in data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

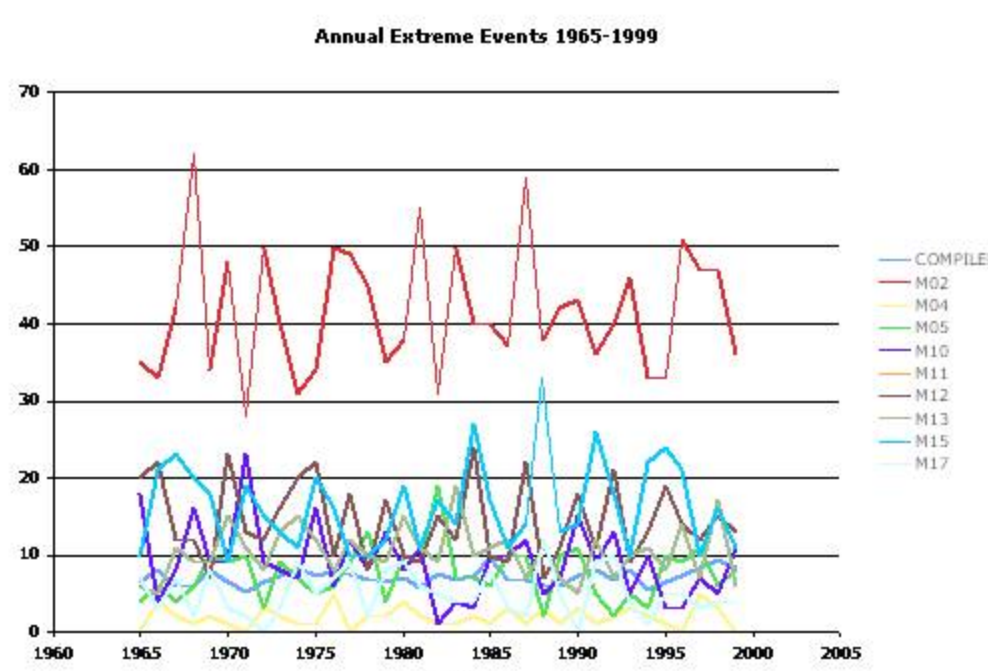


FIGURE 2, Models: The number of days per year with daily precipitation greater than 10 mm. Compared to observations the majority of model under-represent large precipitation events (by this measure). The smooth, multi-model average (light blue line), provides clear indication of the existence of a long-term 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);
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m11=ipsl_cm4(France);
m12=miroc3_2_hires(Japan);

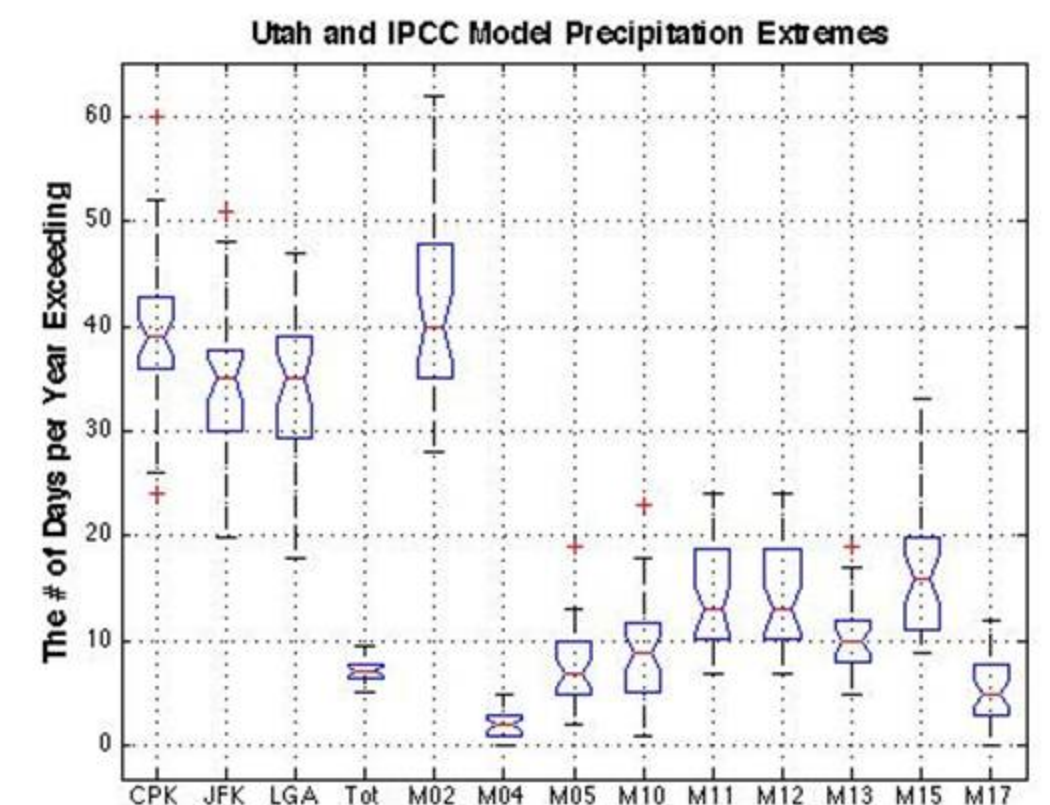


FIGURE 3: Box plots for observational data and IPCC models for the common period 1965-1999. We do not expect individual events between observational data and models to be correlated. We use box plots as a measure of the distribution of extreme events and to compare the models and observational data. 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).⁽²⁾

Examine model projections for the 21st 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.