

IDF Curve Projections for the Delaware River Basin

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Dave Robinson – Rutgers

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Bernice Rosenzweig – Sarah Lawrence College

Chris Castellano – Cornell

Harrison Tran – Cornell

Ben Eck – Cornell

Adrien Zheng – Cornell

Colin Evans – Cornell



Cornell University

Presented to an advisory committee of the DRBC on December 20, 2023. Contents should not be published or re-posted in whole or in part without the permission of the author or the DRBC.



Co-Production

Methods

Multi-model / downscaling
Atlas-14

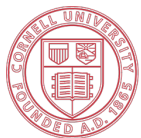
Spatial Scale

Grid, municipality, basin, county

Uncertainty

Scenarios
Ensemble spread

Website design and specifications

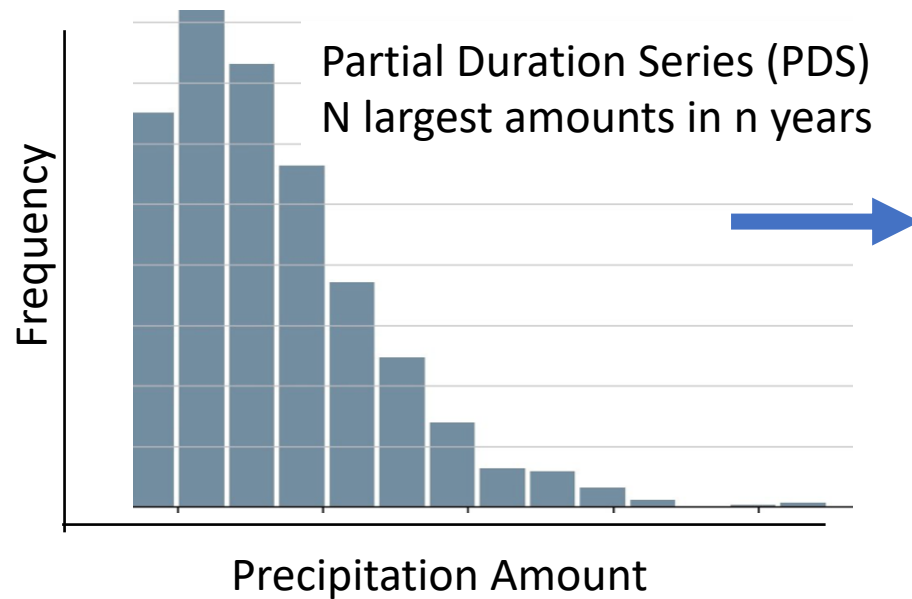


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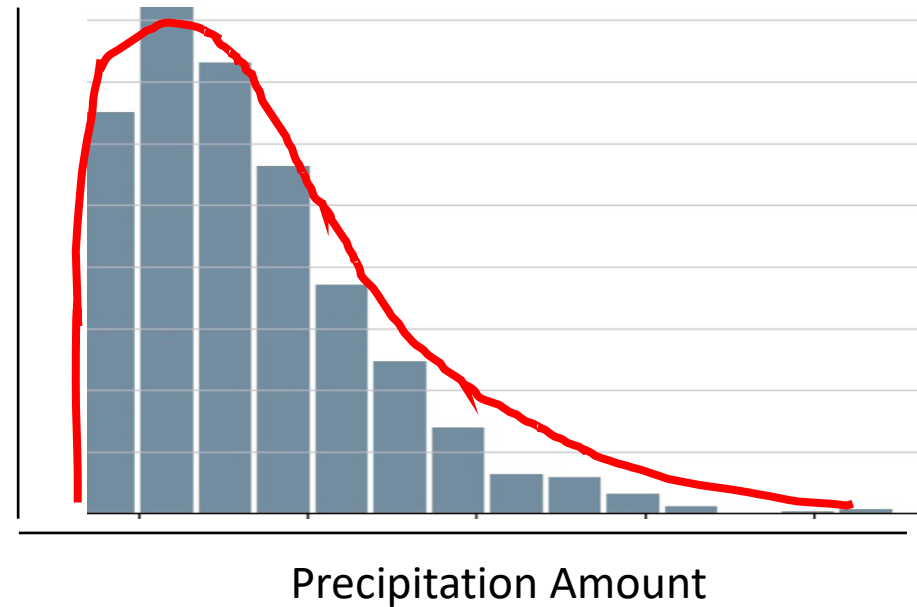


Methods: Partial Duration Series Fit

Sample (obs)



Statistical Distribution

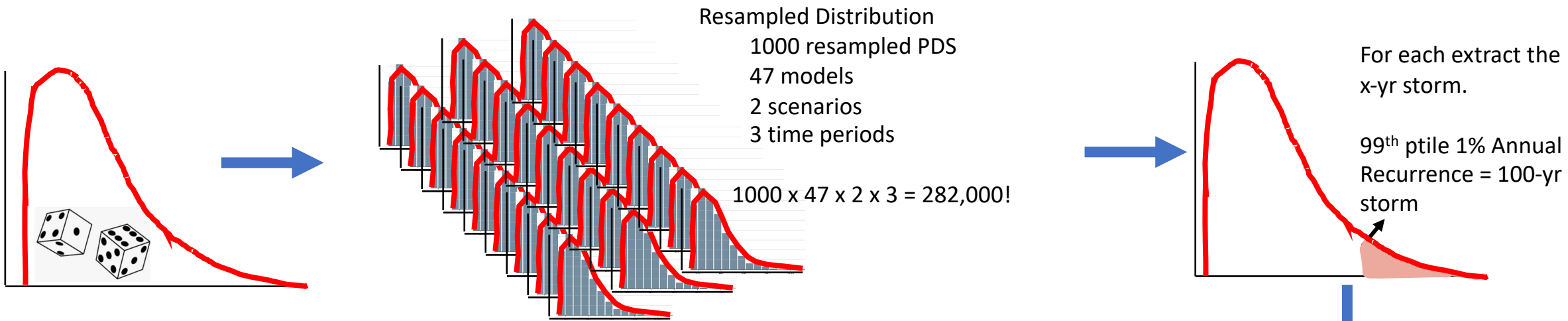


3 time periods x 47 model-downscaling combinations x 2 Scenarios

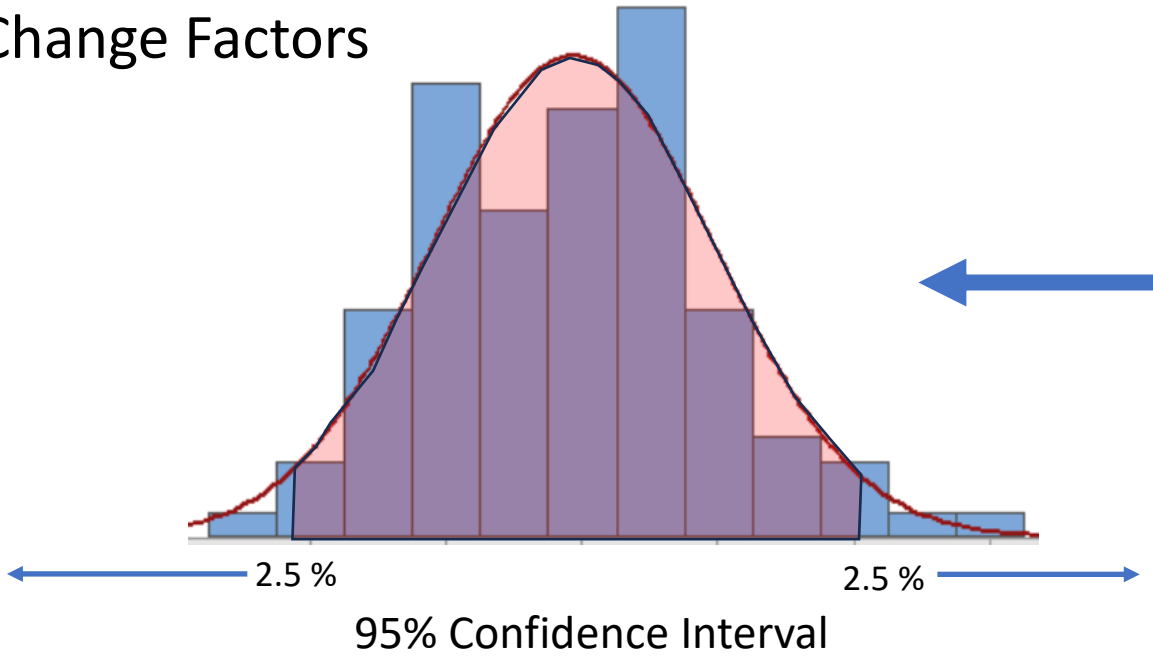
- 1950-1999 (model hist)
- 2020-2069
- 2050-2099
- 31 statistically downscaled LOCA (NCA method)
- 16 Dynamically downscaled
- RCP 8.5
- RCP 4.5



Methods: Resampled Confidence Intervals



47,000 x-yr Change Factors

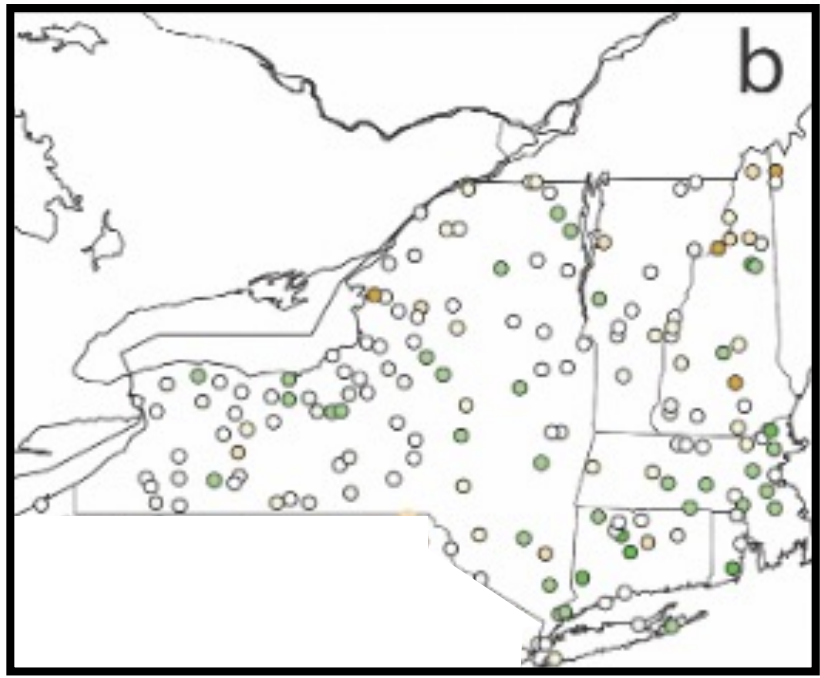


Change Factor

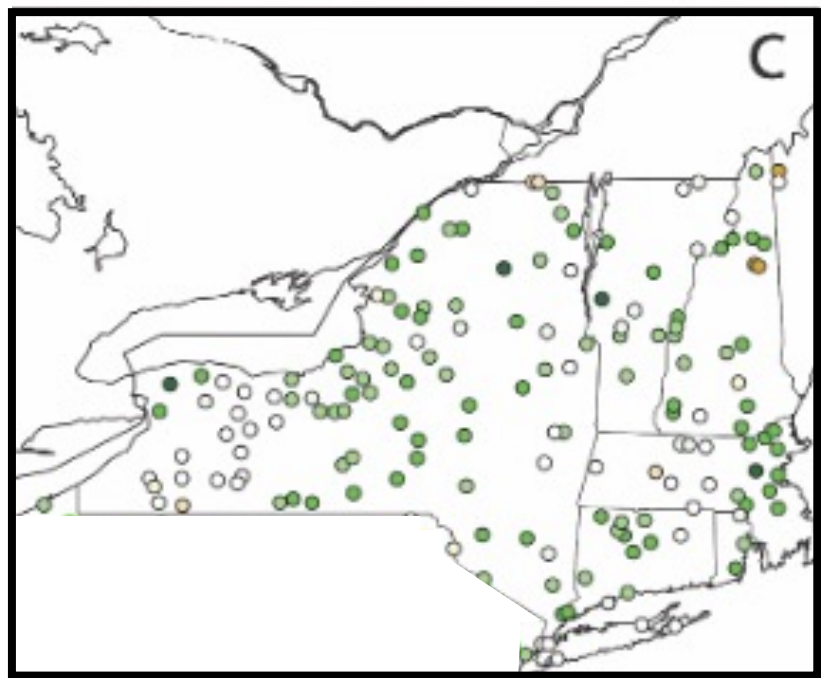
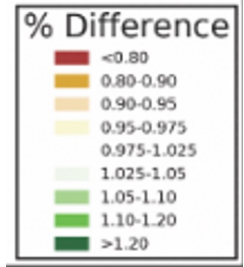
ARI Future

ARI Historical

How well Does Method Replicate Atlas 14?

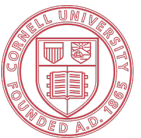


2-yr Storm

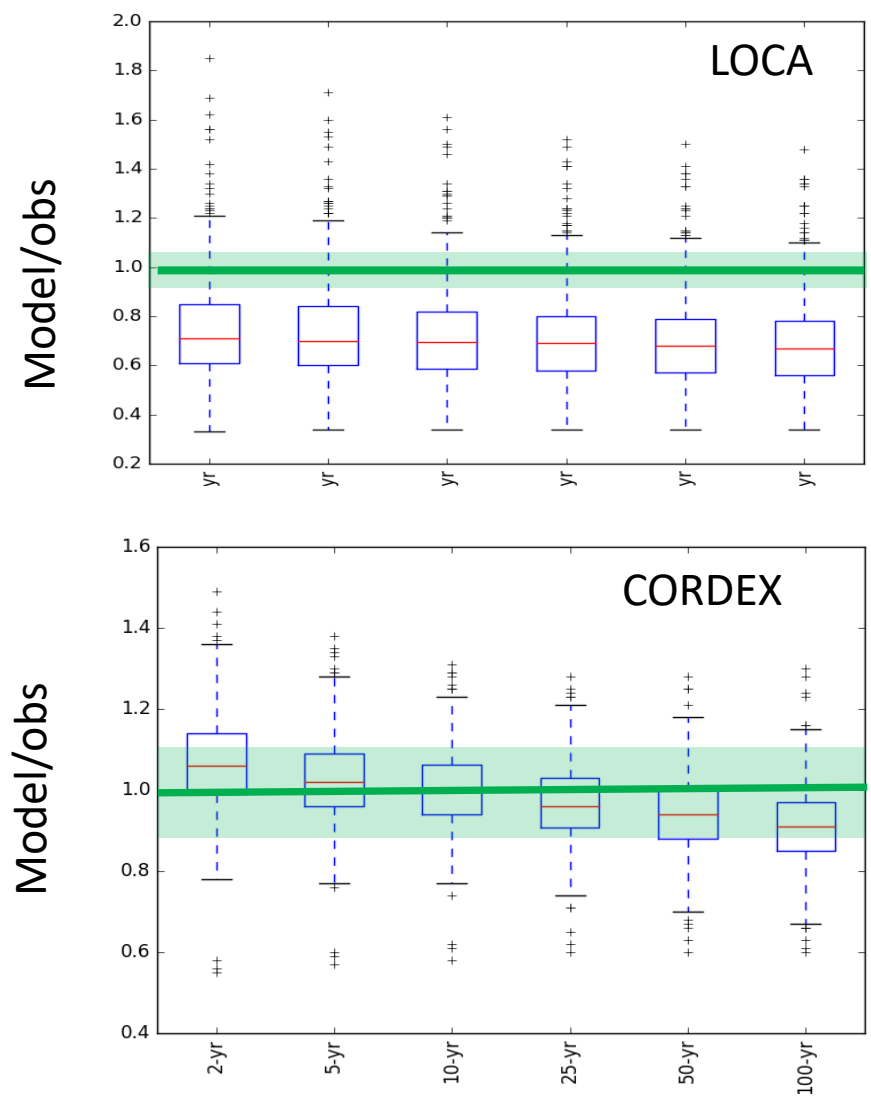


100-yr Storm

Needed to demonstrate that our base methods matched what the industry was accustomed to using



Why a Change Factor ?



NOAA Atlas 14 POINT PRECIPITATION FREQUENCY ESTIMATES: NJ

Data type: Units: Time series type:

1) Manually:

a) By location (decimal degrees, use "*" for S and W): Latitude: Longitude: Submit

b) By station (list of NJ stations):

c) By address Search

2) Use map:

a) Select location
Move crosshair or double click

b) Click on station icon
Show stations on map

Location information:
Name: Columbus, New Jersey, USA*
Latitude: 40.1000°
Longitude: -74.7000°
Elevation: 95 ft **

* Source: ESRI Maps
** Source: USGS

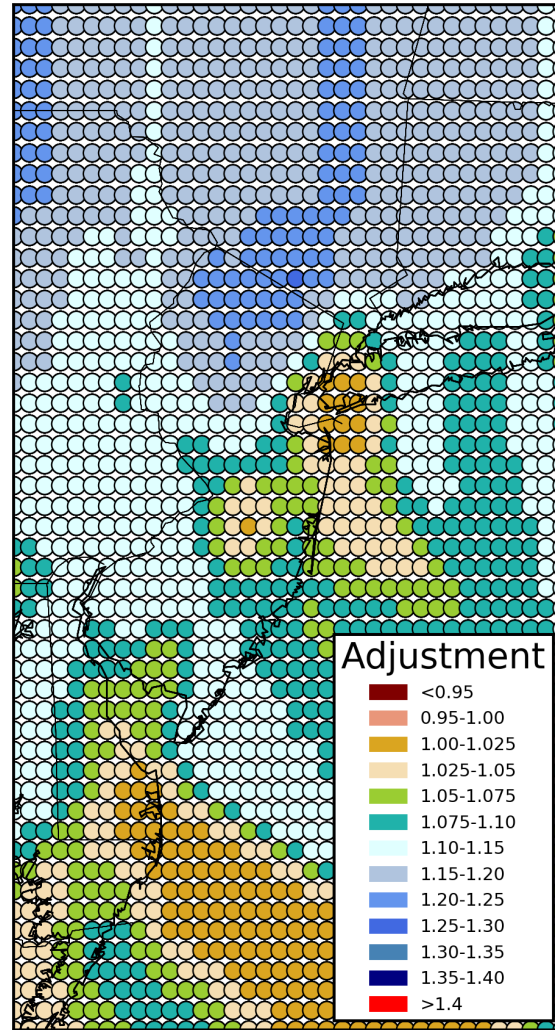
POINT PRECIPITATION FREQUENCY (PF) ESTIMATES
WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 2, Version 3

Models Have a Bias
Bias is a function of return period

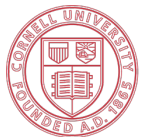
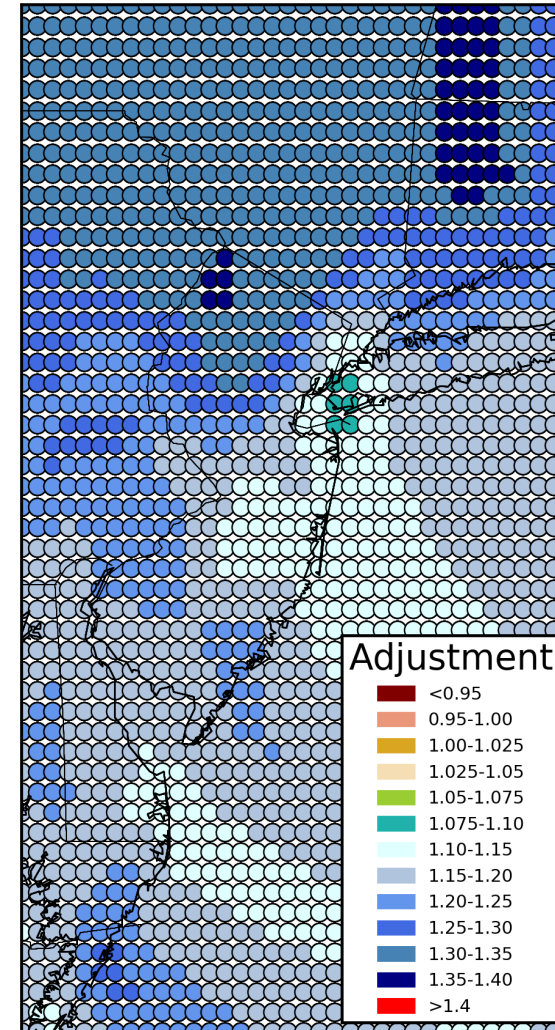
NOAA Atlas 14 is the go too data set

Scenarios Give a Very Different Picture of the Future

100-yr RCP 4.5. 2050-2099



100-yr RCP 8.5. 2050-2099

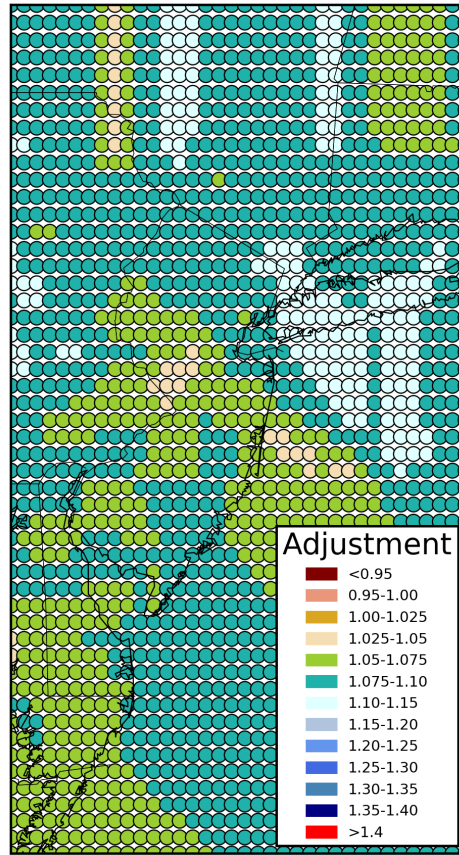


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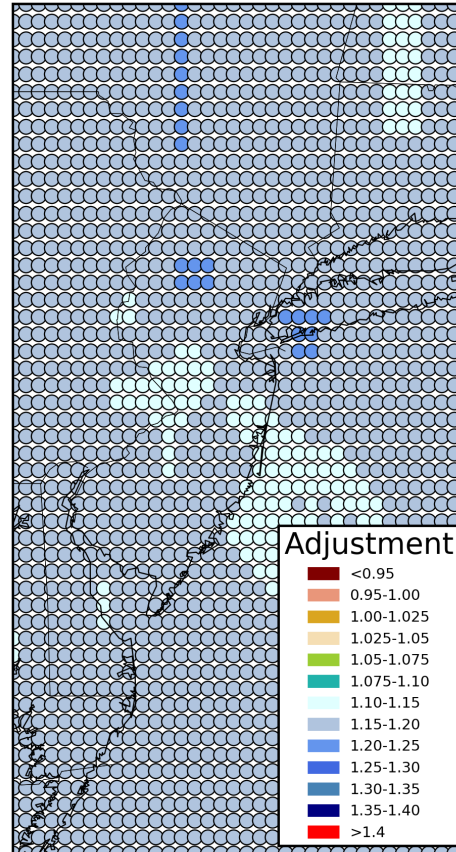
Not my decision category!



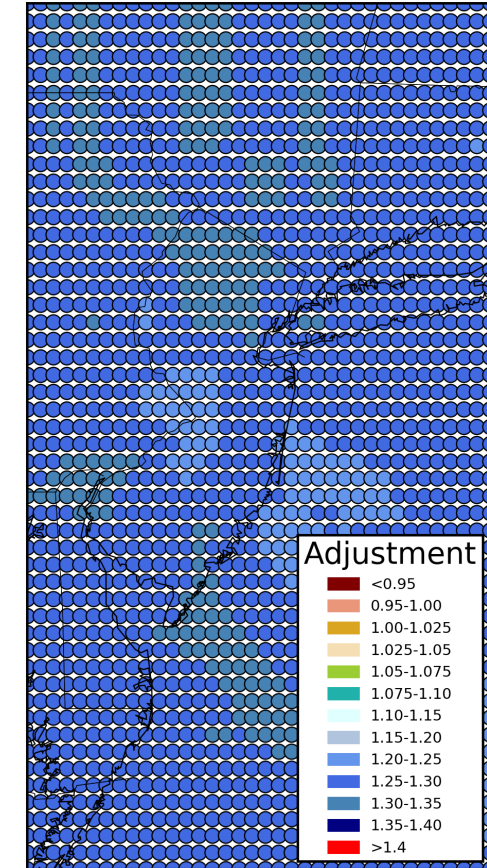
Ensemble Change Factor 17th-83rd percentile range 2-year ARI



17th

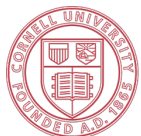


median

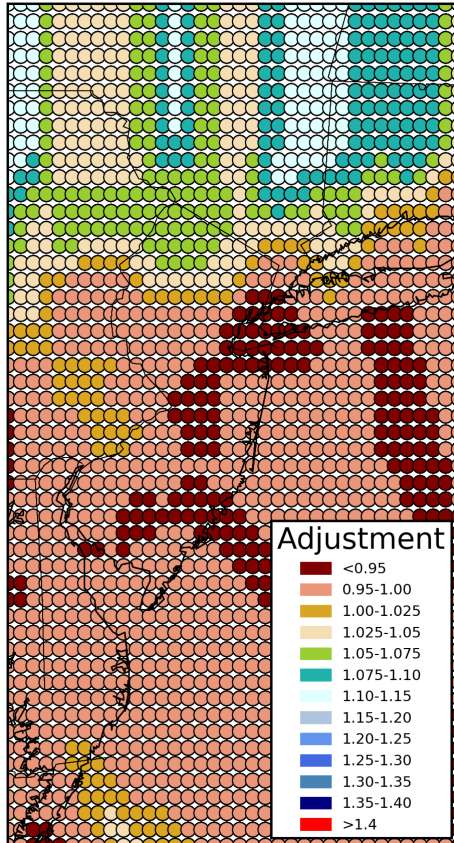


83rd

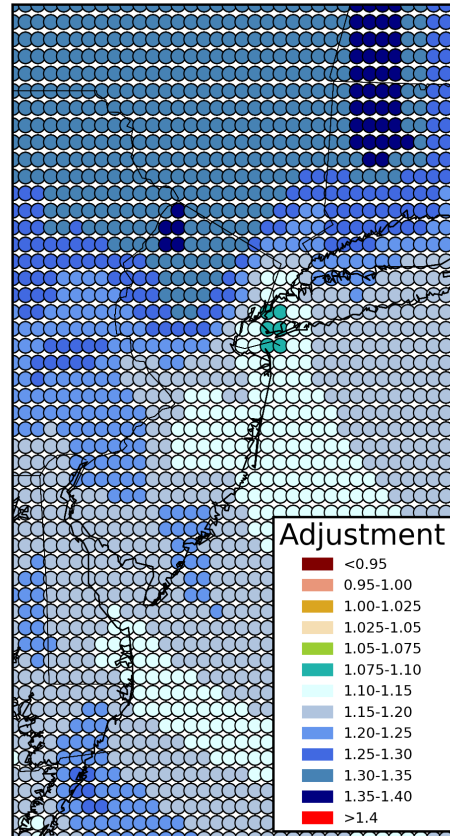
All show an INCREASE, but....there is a large spread in the ensemble!



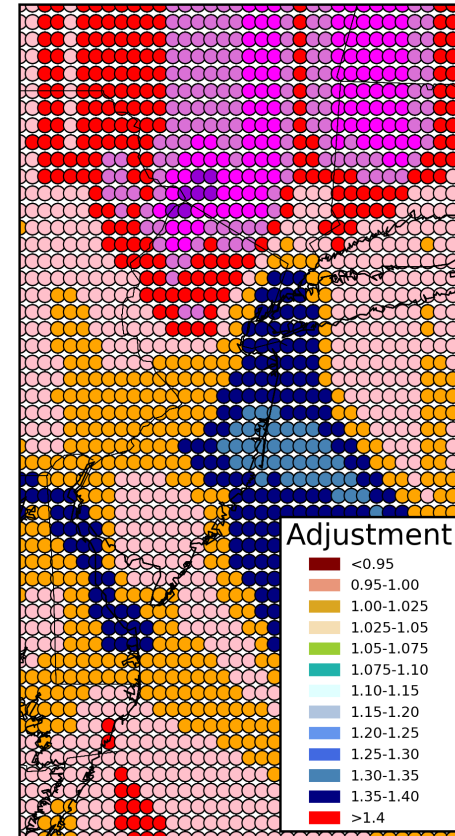
Ensemble Change Factor 17th-83rd percentile range 100-year ARI



17th



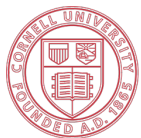
median



83rd

Orange 1.40-1.45
Pink 1.45-1.5
Red 1.5-1.55

NOT ALL show an increase, and the spread is even larger!!



Website

<https://DRBC-idf.rcc-acis.org>

The screenshot shows the DRBC website interface. At the top left is the DRBC logo with the text "Delaware River Basin Commission" and "DELAWARE • NEW JERSEY PENNSYLVANIA • NEW YORK UNITED STATES OF AMERICA". The main title is "Projecting Extreme Precipitation in the Delaware River Basin" with the subtitle "An Interactive Tool Supporting Regional Resilience". Below the title are four selection controls: "Select By:" with buttons for "County", "Municipality", and "HUC 12"; "Emission Scenario:" with buttons for "Low RCP 4.5" and "High RCP 8.5"; "Time Period:" with buttons for "2020-2069" and "2050-2099"; and "Annual Exceedance Probability:" with buttons for "50%", "20%", "10%", "4%", "2%", and "1%". A color scale legend for "Change Factor (Percentile)" ranges from 0.90 to 1.50. Below the legend are three tabs: "User Guide", "IDF Curve", and "About the Data". The "User Guide" tab is active, showing a map of the Delaware River Basin and a text box with instructions. The map shows the basin boundary in black and various municipalities in green. The text box contains sections for "Choosing Options", "Changing Tabs", and "Selecting Location".

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Select By:

Emission Scenario:

Time Period:

Annual Exceedance Probability:

Change Factor (Percentile)
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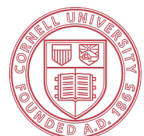
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Time Period: 2020-2069 2050-2099

Annual Exceedance Probability: 50% 20% 10% 4% 2% 1%

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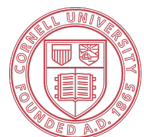
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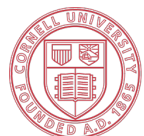
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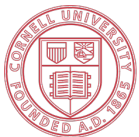
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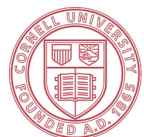
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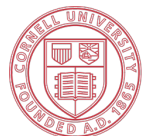
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The tab will automatically change to 'IDF Curve' and will display the IDF curve chart for the area that you selected.

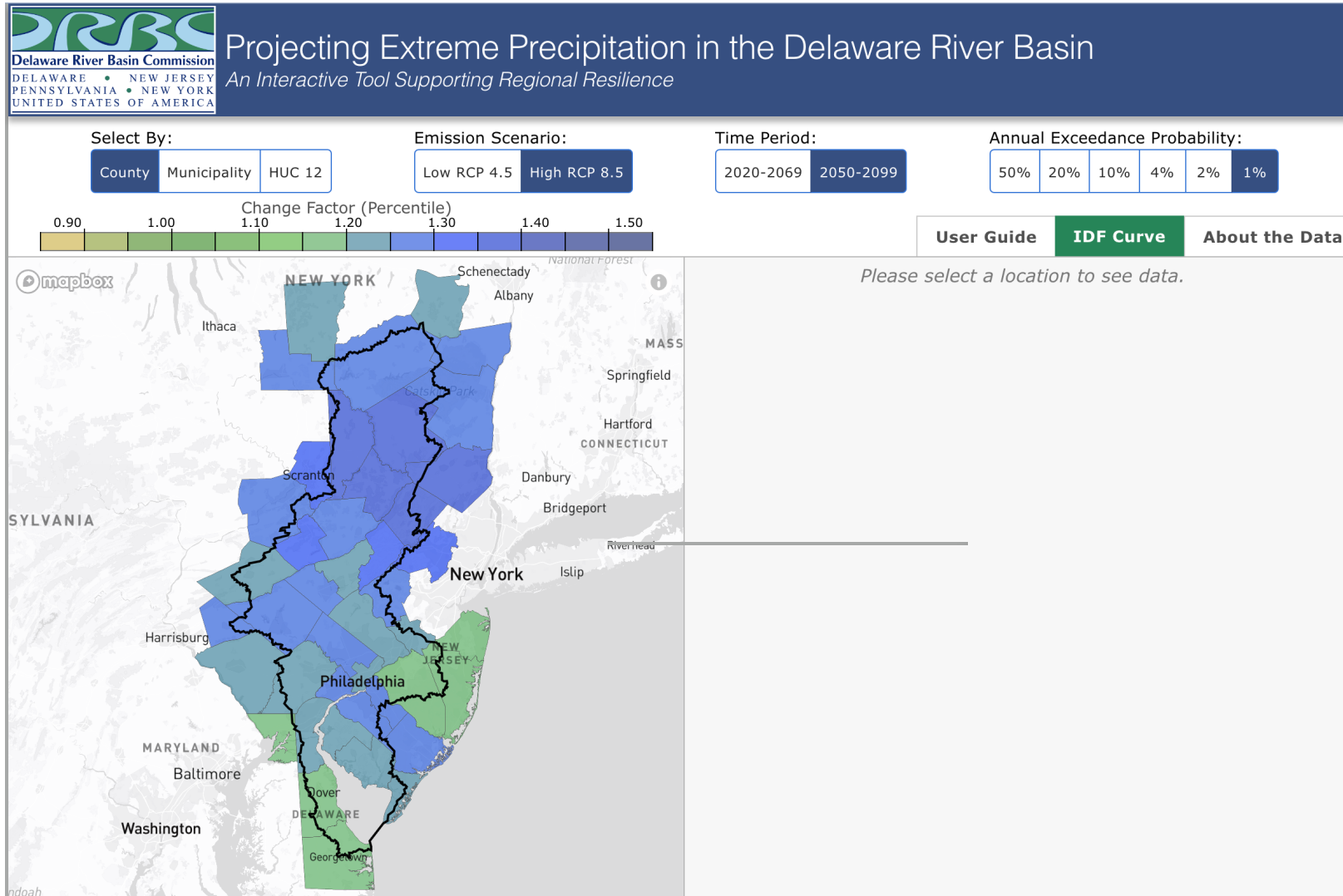


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Website

<https://DRBC-idf.rcc-acis.org>

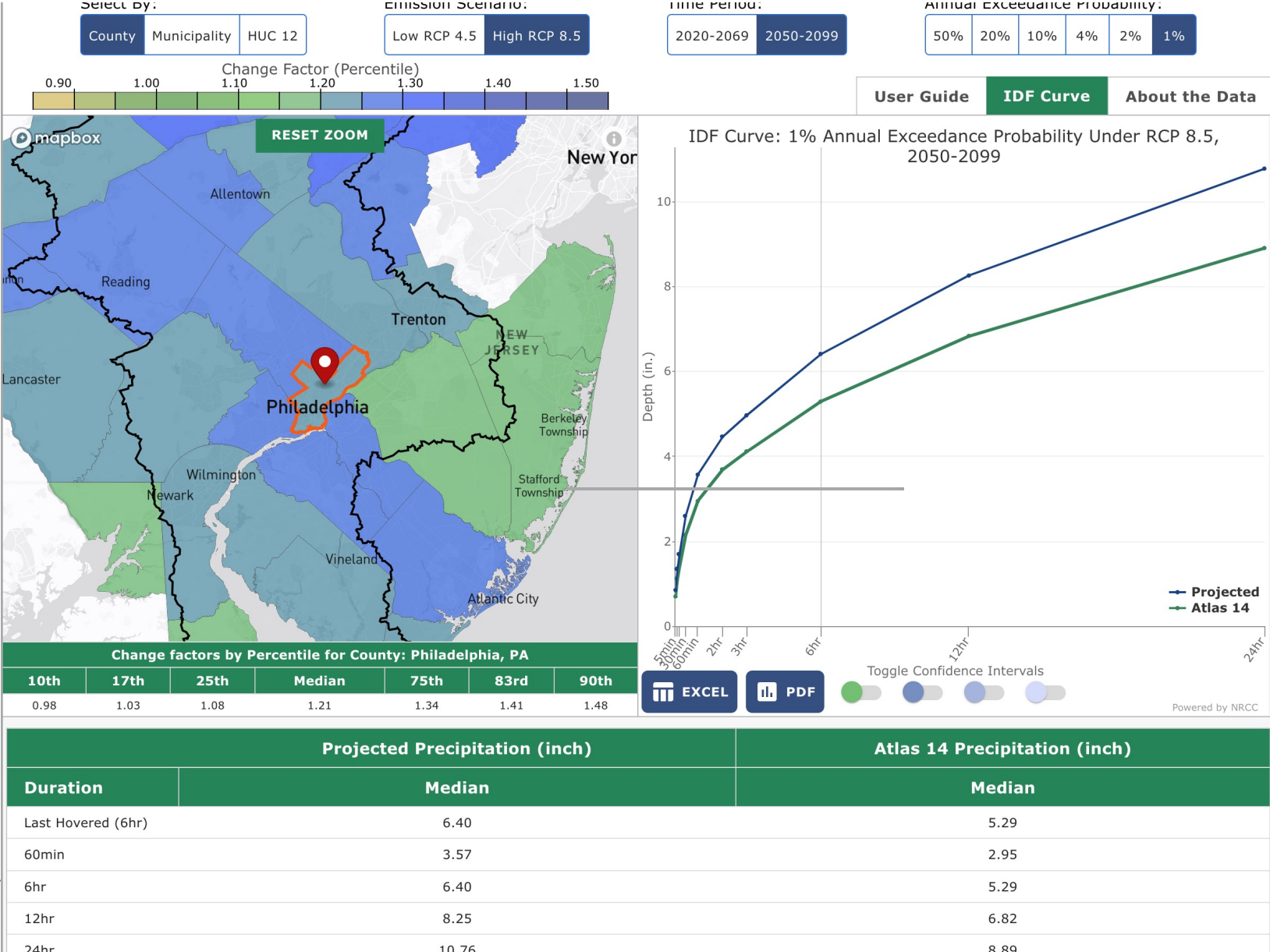


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Website

<https://DRBC-idf.rcc-acis.org>

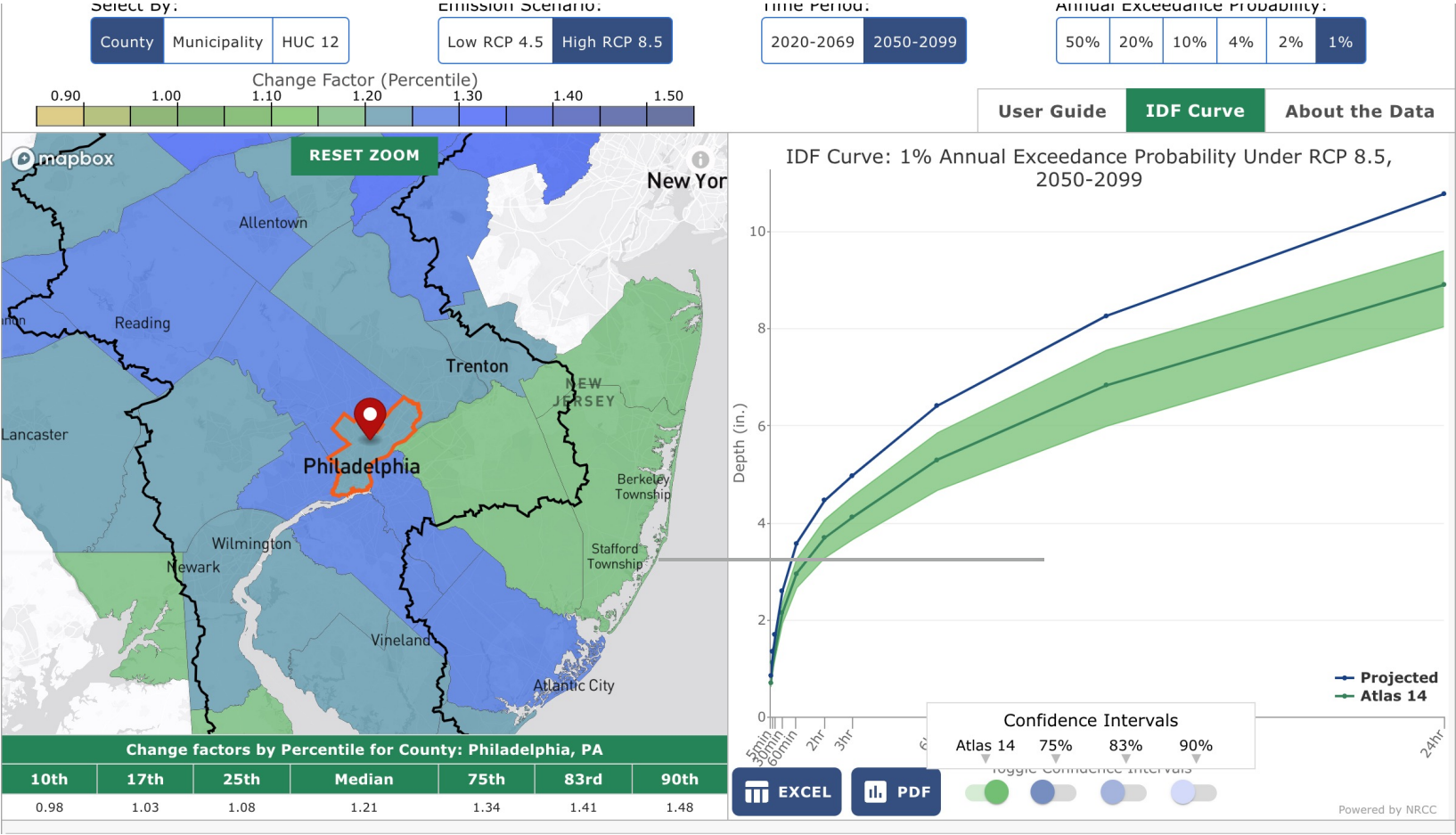


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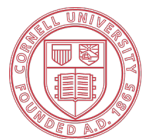
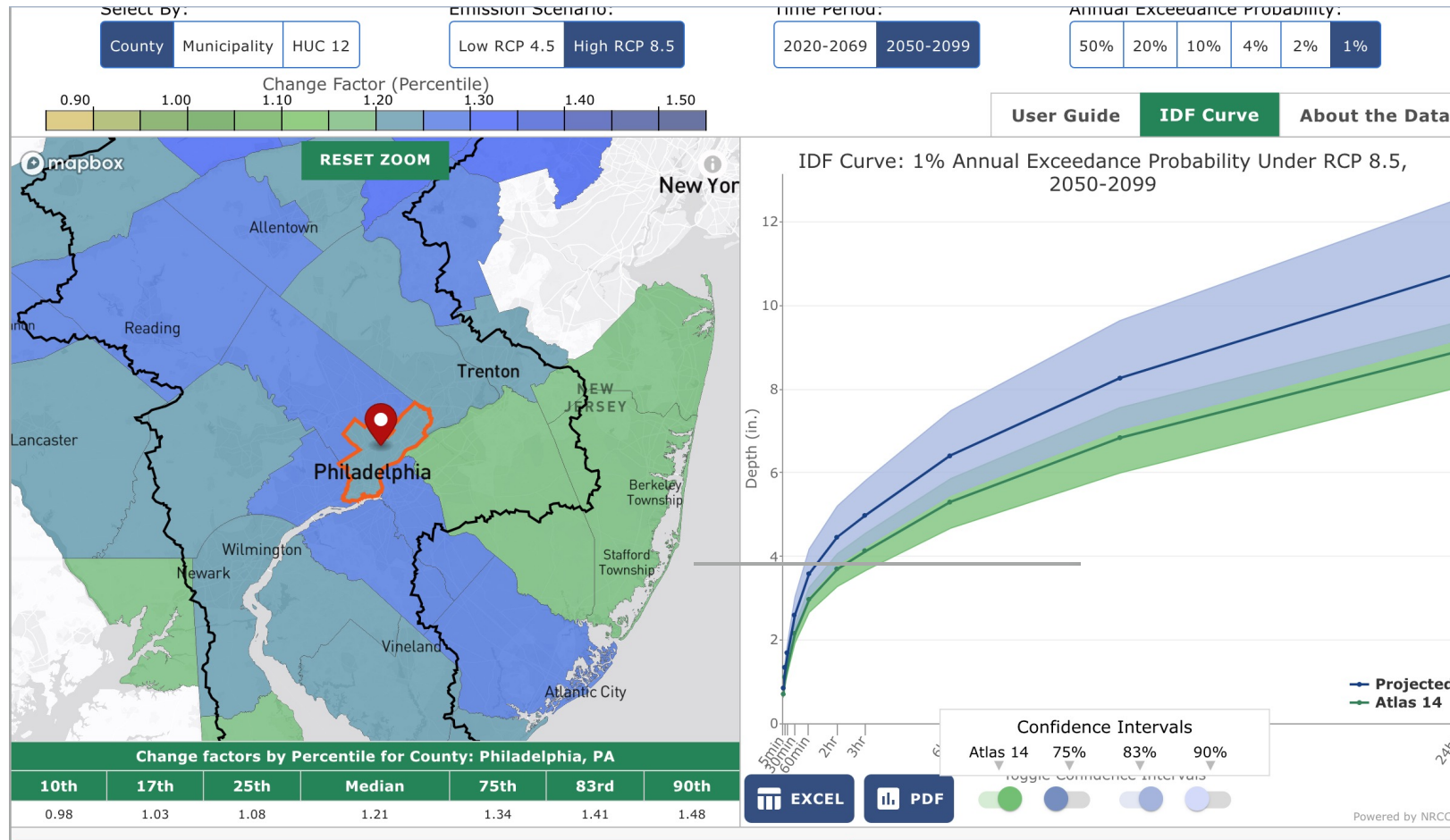


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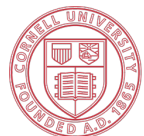
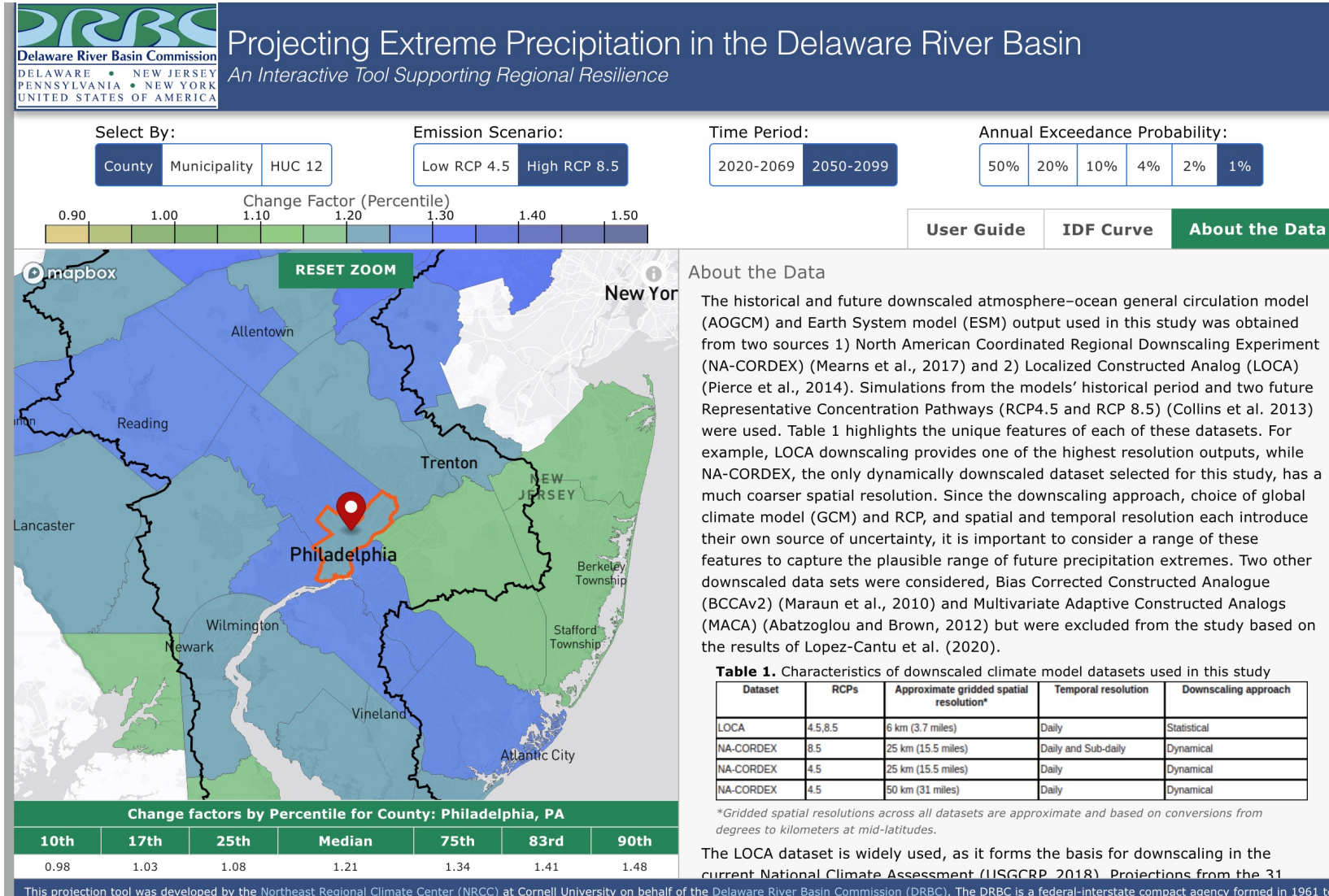


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Website

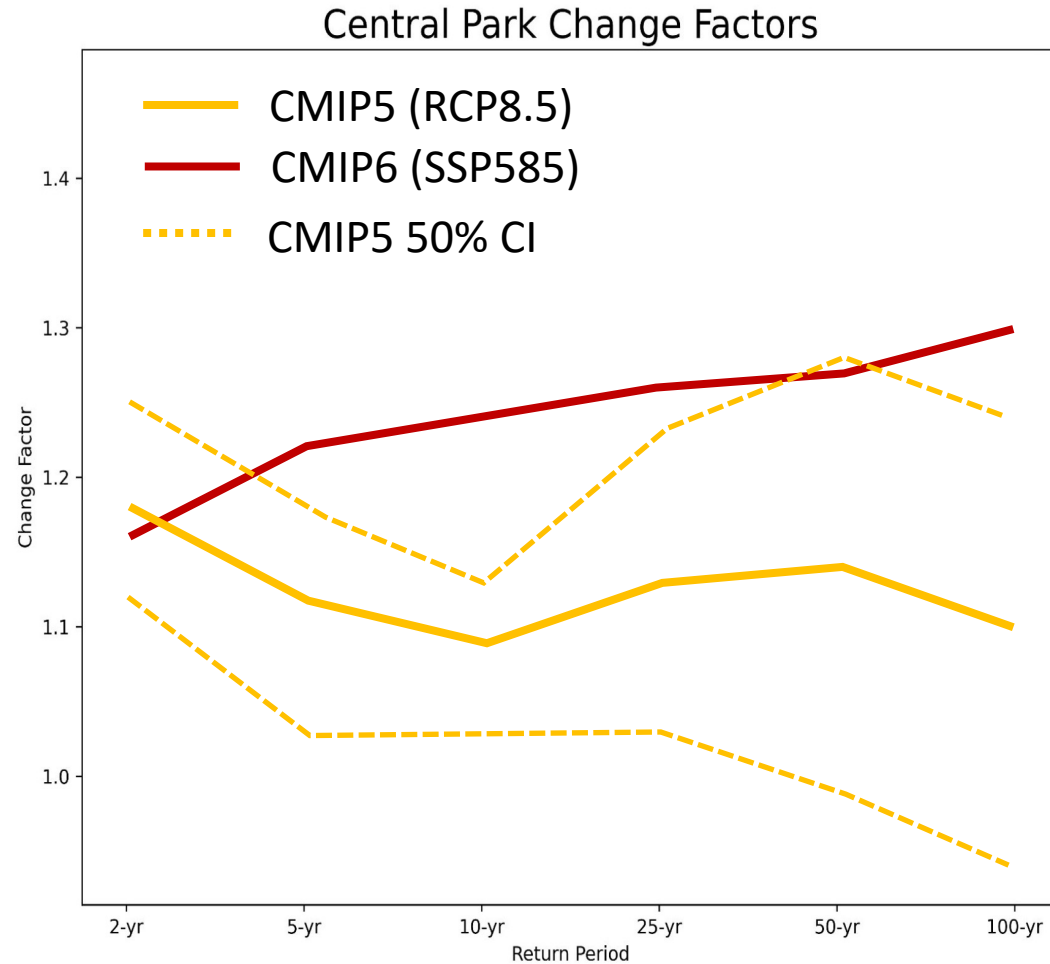
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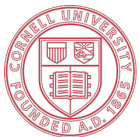
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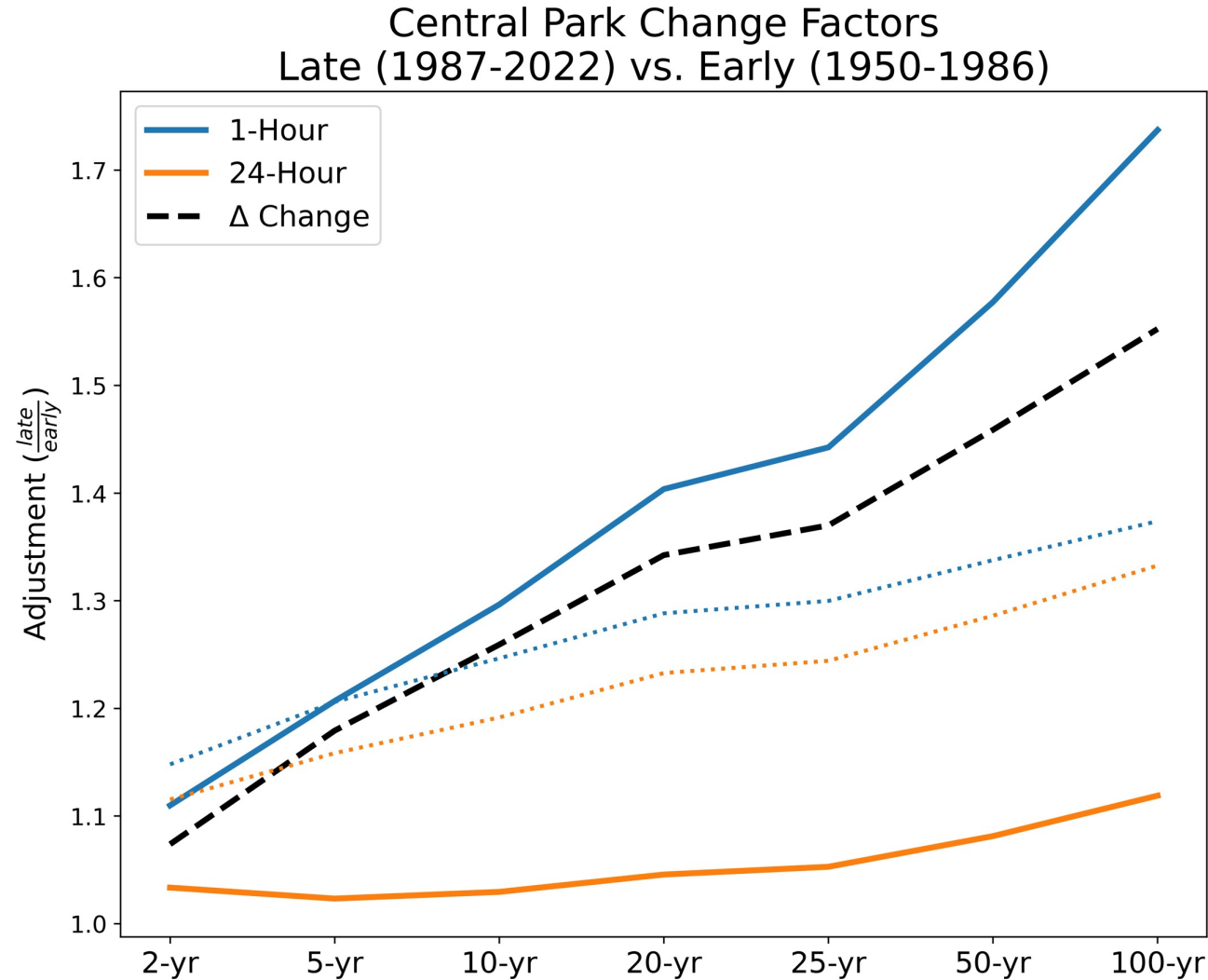
Results Need to be Updatable



Take Home Message: CMIP6 Extremes tend to be **LARGER** than CMIP5, especially at high return periods. Significance is Marginal



Results Should Evolve to Address Weaknesses and New Needs



Take Home Message: Since 1950 the change in extreme hourly rainfall has exceeded the rate of change of extreme daily rainfall. This is counter the assumption used in IDF development



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