



# Introduction

- The Lake Champlain watershed is vulnerable to changes in patterns of extreme climate events
- Global Climate Models (GCM) can simulate climate change but resolution is too low
  - Regional climate models (RCMs) can simulate at a finer resolution and take into account topography and orography
  - The Weather Research and Forecasting Model (WRF) is a commonly assessed RCM
- Distributional Biases are a common byproduct of climate models
  - Bias correction adjusts models simulations to match observed data
    - Quantile Mapping



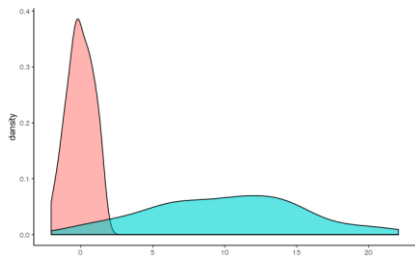
# Objectives

1. Examine spatial and temporal patterns of extreme distributions of maximum temperature from WRF and station data
2. Evaluate the performance of three implementations of a bias correction technique on extreme temperature projections from WRF



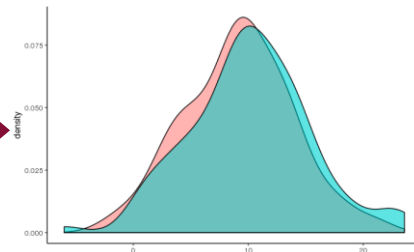
# Methods and Data

- Model Data: WRF projections
  - Station Data: daily observations from Global Historical Climate Network
  - Time period: **1980-2014**
  - Extreme Event: upper **90th percentile** distribution of TMAX
  - **73** stations paired to nearest WRF point
- Quantifying the accuracy of WRF through **Perkins Skills Scores** a measure of overlap between two distributions
  - Quantifying the accuracy of WRF through **Annual Correction, Monthly Correction, and Train/Test Correction**

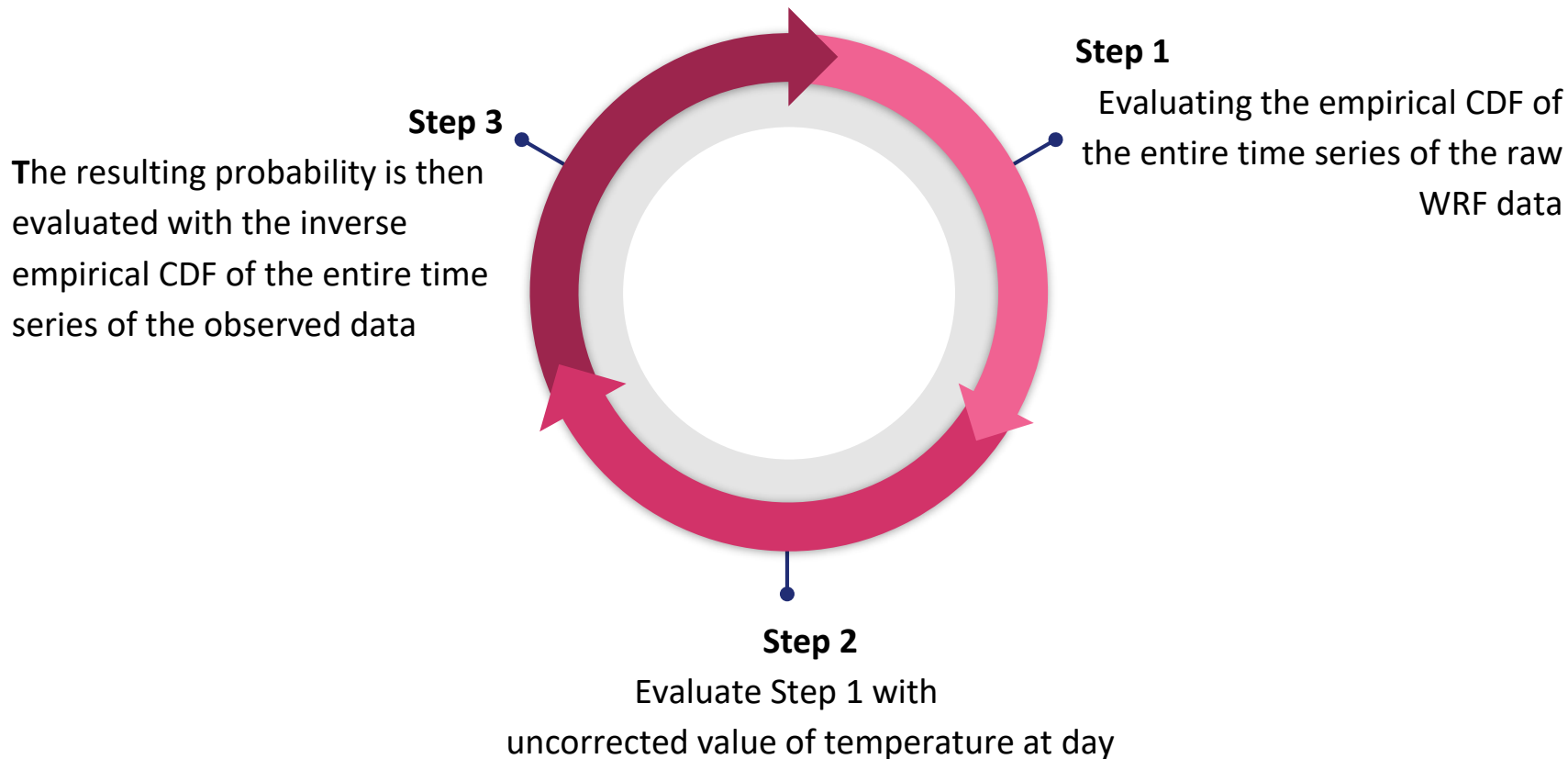


**Perkins Score of 0**  
Overlapping PDF  
distributions illustrating  
the total skill score in a  
a very poor skill score  
(0.02)

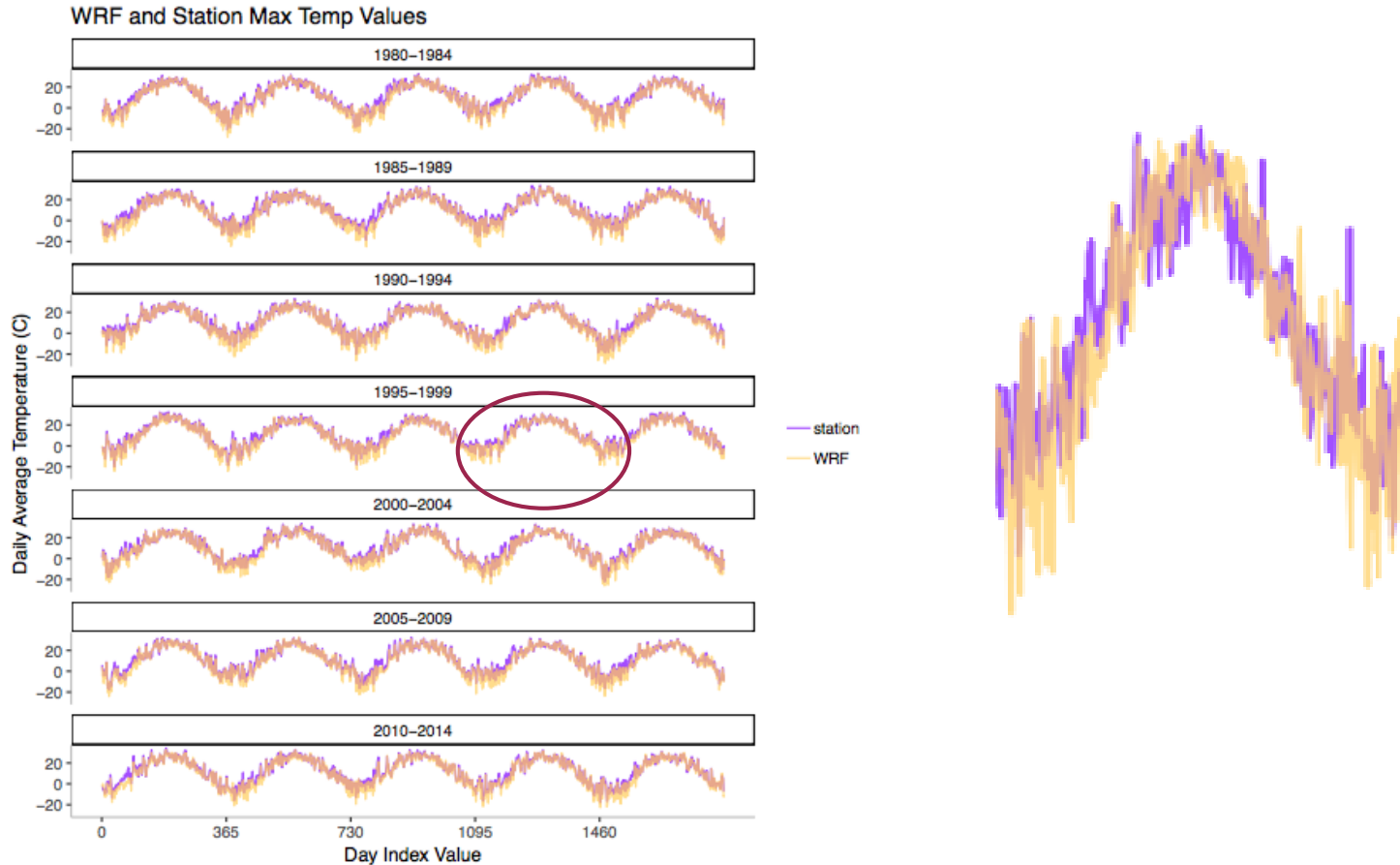
**Perkins Score of 1**  
Overlapping PDF  
distributions illustrating  
the total skill score in a  
near-perfect skill score  
test (0.9)



# How Bias Correction Works



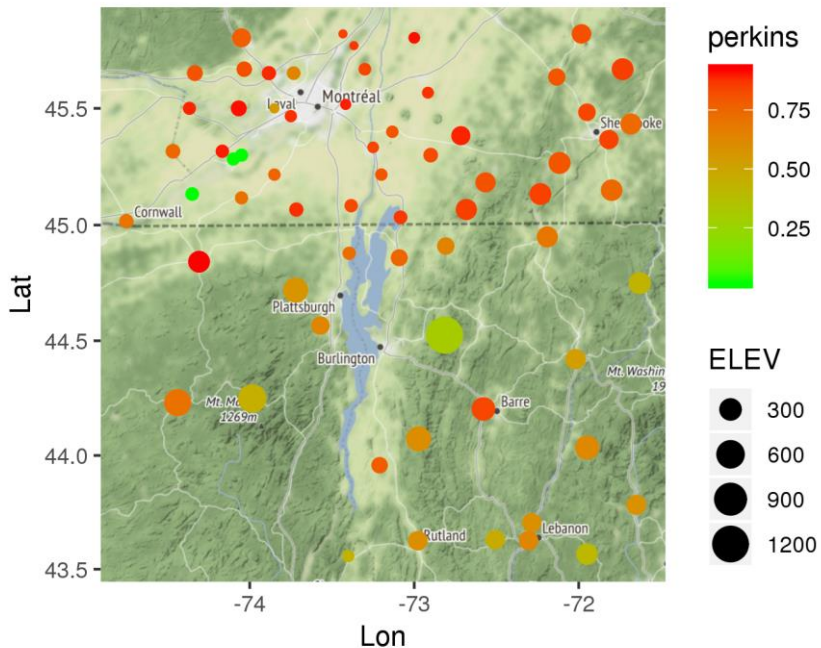
# Preliminary exploratory analysis



# Spatial patterns of Perkins skill scores

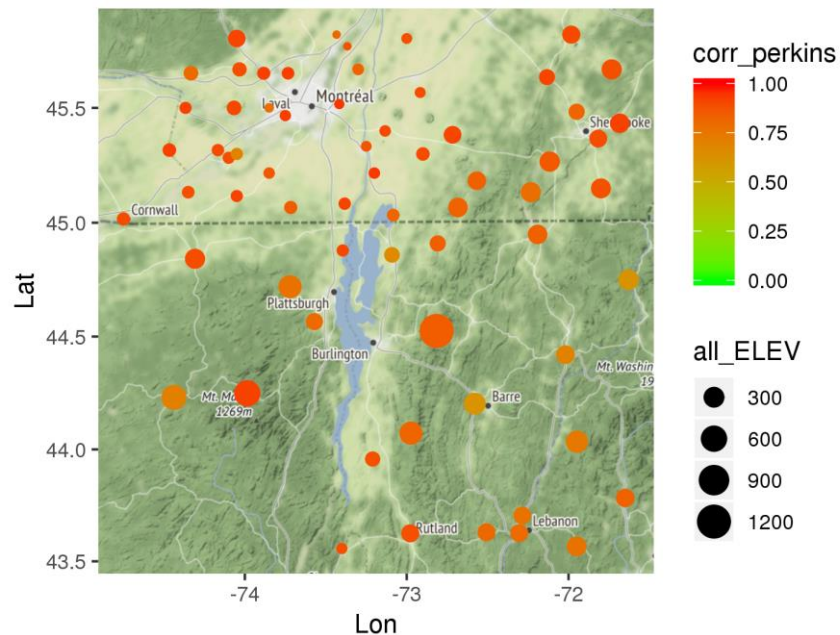
Before

Initial TMAX Perkins skill scores for 2000:2004 mean= 0.71



After

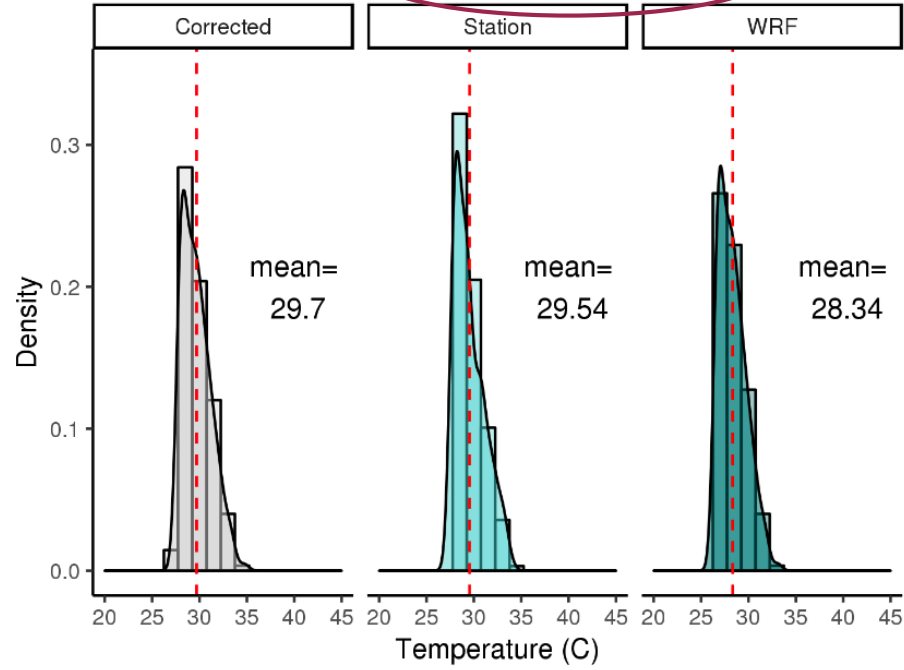
Bias corrected TMAX Perkins skill scores for 2000:2004 mean= 0.85





# Comparing raw WRF, bias corrected WRF, and station extreme temperature distributions


Corrected vs. Station vs. WRF Density for USC00436995  
original score= 0.6 corrected score= 0.88



# Average Perkins Scores Comparison

- Initial Perkins score: 0.62
- 1. Monthly Correction: 0.82
- 2. Annual Correction: 0.81
- 3. Train/Test: 0.78

# Discussion

- Variation of raw skill scores in the southeast quadrant of the study area
    - After bias correction, variability decreased, validating the effectiveness of the bias correction technique
  - Larger skill scores in southern Quebec compared to other regions of study area
    - Less complex topography in Canada
  - Monthly bias correction performed best
  - WRF consistently overestimated maximum daily temperatures during winter months
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# Conclusion

This study serves as a first step in aiding the scientific community's effort to better estimate, capture, and adapt to extreme weather events.



# References



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