Evaluating the accuracy of Atlas 14's sub-hourly rainfall rate estimates based on 20th century statistical analysis in comparison to 21st century high-temporal observations, and its implications for Maryland

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Introduction

Motivation: Global warming is affecting the hydrologic cycle by increasing the atmosphere's capacity to hold water vapor, leading to heavier rainfall and more frequent, catastrophic floods

	Ellicott City, MD Flood 2016	Ellicott City, MD Flood 2018
Rainfall Rate	6.60in/3hr **4.56in/1hr**	6.56in/3hr **5in/2hr**
Economic Damage	$67.2 million	$40 million
Fatalities	2	1

- If we reference Atlas 14, both events are categorized as 1-in-1,000-year events

What is Atlas 14?

- Atlas 14 is the nations standard for estimating the magnitude and frequency of extreme precipitation events
  - Atlas 14 limitations include inconsistent observational record and station distribution, bases sub-hourly estimates solely on statistical analysis, does not fully account for a changing climate

This research emphasizes the **critical role** of **accurate** rainfall data for **public safety** and **economic resilience**

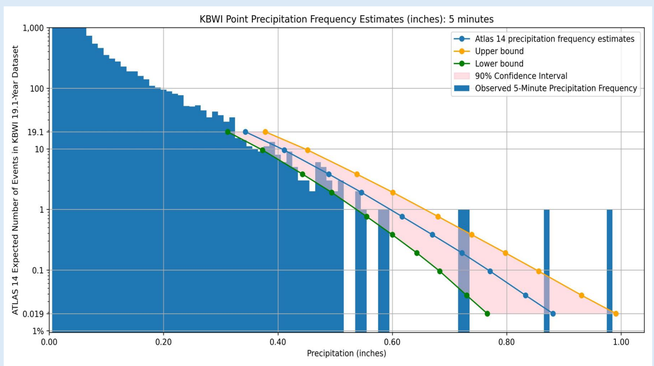
Data/ Methods

- **Where:** DC/ Metro Area
- **When:** Focuses on sub-hourly durations (5-min, 10-min, 15-min, 30-min, 60-min)
- **Data:** Using 1-minute data from the Maryland Mesonet (2023–2024), ASOS stations (2001–2024), and CoCoRaHS significant rainfall reports (2001–2024)
- **Methods:** Python scripts were developed to create frequency graphs for Atlas 14 precipitation frequency estimates and observed precipitation frequencies
  - The Atlas 14 script processes raw CSV data, extracts precipitation estimates, and converts recurrence intervals to expected frequencies, generating plots with confidence intervals
  - The observed data script calculates running precipitation sums and counts frequency distributions for various durations, overlaying results with Atlas 14 estimates for station-specific comparisons

Future Work

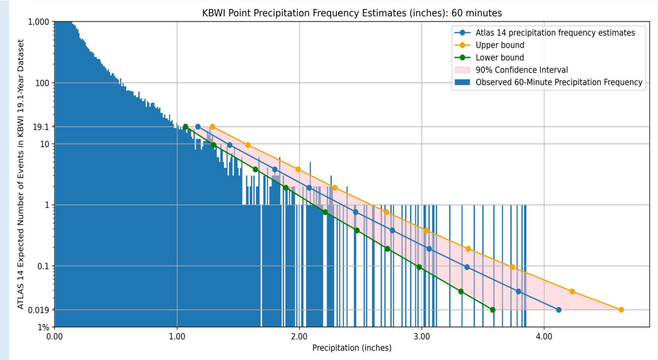
- Generate frequency graphs for all stations at sub-hourly intervals to compare slopes and y-intercepts with Atlas 14 estimates
- Combine Maryland Mesonet and ASOS data to create one frequency graph per sub-hourly duration
- Perform frequency interval statistics for quantitative analysis

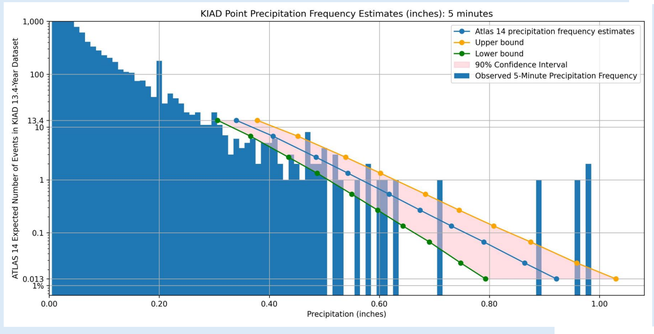
Results



BWI ASOS station at 5-minute duration

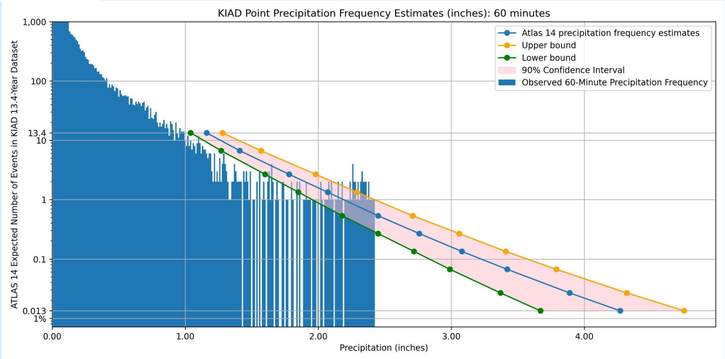
BWI ASOS station at 60-minute duration

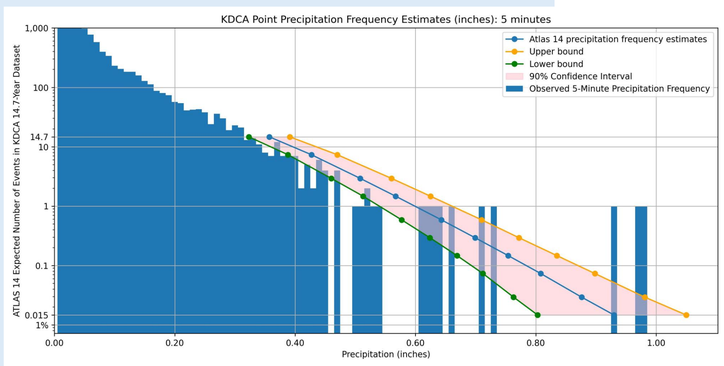




IAD ASOS station at 5-minute duration

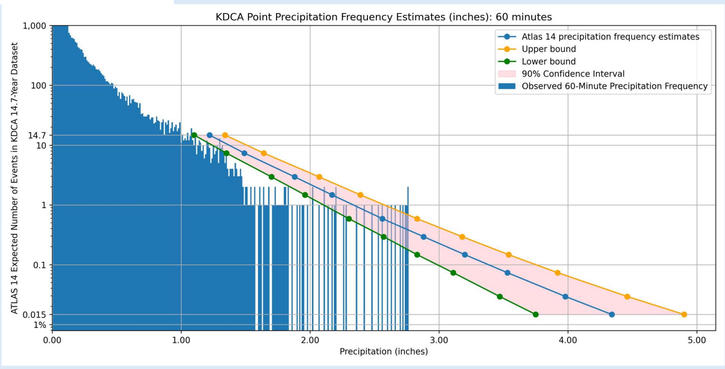
IAD ASOS station at 60-minute duration





DCA ASOS station at 5-minute duration

DCA ASOS station at 60-minute duration



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