

Washington County Water Consortium

February 4, 2026

2 to 3 pm

Remote meeting - Zoom

(If you are not on the Consortium listserv, please email

Adriana.Atcheson@washingtoncountymn.gov for the Zoom link and access code)

Agenda

2:00 - 2:05

Welcome

Introductions, Announcements

2:05 - 2:30

Precipitation Extremes: From Past Patterns to Future Floods

Topic: This presentation shares an analysis of historical precipitation extremes which reveals significant upward trends in the frequency and intensity of large storms across the Upper Midwest, with important implications for future flood risk.

Presenter: Noah Gallagher, Ph.D., St. Anthony Falls Laboratory/UMN

2:30 - 3:00

Aquatic Invasive Species Programming in Washington County

Topic: Update on county-wide AIS programming, including watercraft inspections, early detection and rapid responses, and education efforts.

Presenter: Matt Oldenburg-Downing, Senior Water Resource Specialist, WCD

Precipitation Extremes: From Past Patterns to Future Floods

Presented by: Noah Gallagher, Ph.D.

Postdoctoral Researcher, St. Anthony Falls Lab, UMN

February 4th 2026



UNIVERSITY OF MINNESOTA
Driven to Discover[®]



Civil, Env. &
Geo - Eng.

Acknowledgments

- Based on work funded by the LRRRB and MnDOT

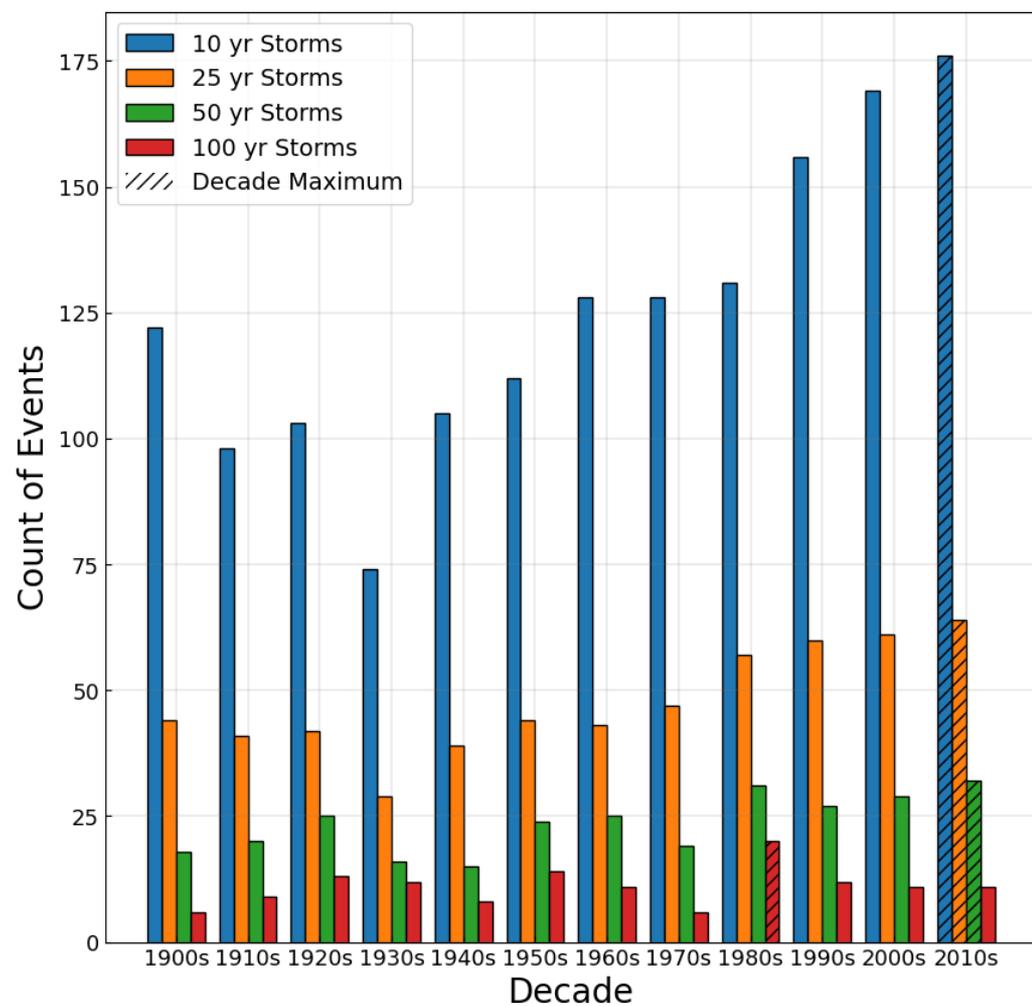


- Project Contributors: Dr. John Gulliver, Dr. Andy Erickson, Dr. Bill Herb and Dr. Bruce Wilson



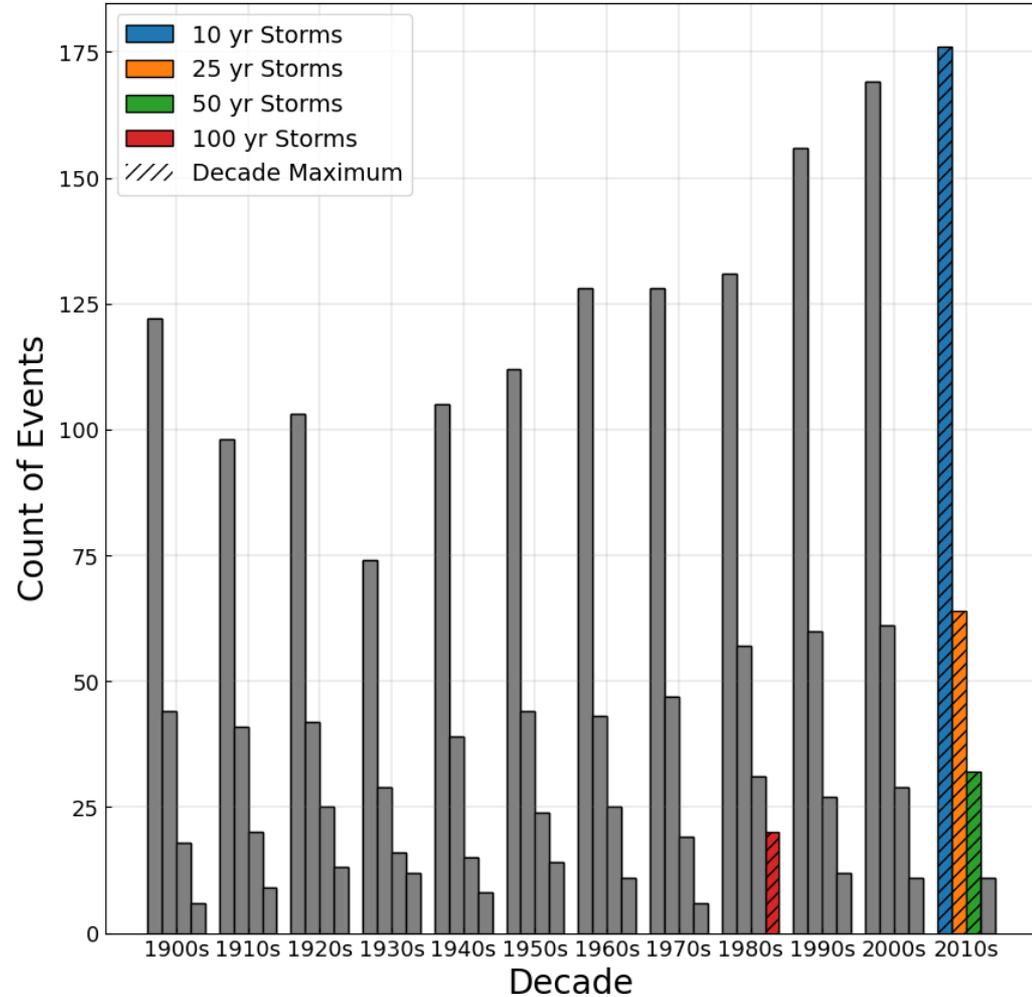
Background

- Large Storms pose Flood Risks for Urban Areas
 - Impervious Cover
 - Concentrated Population
- More Frequent Large Storm Events



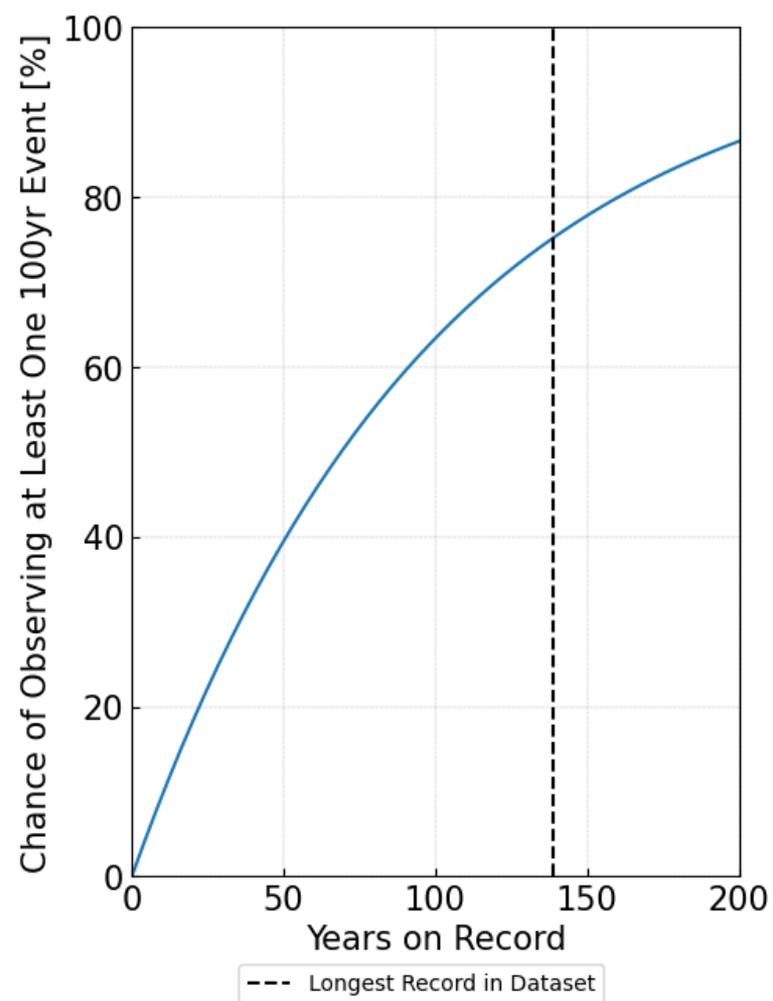
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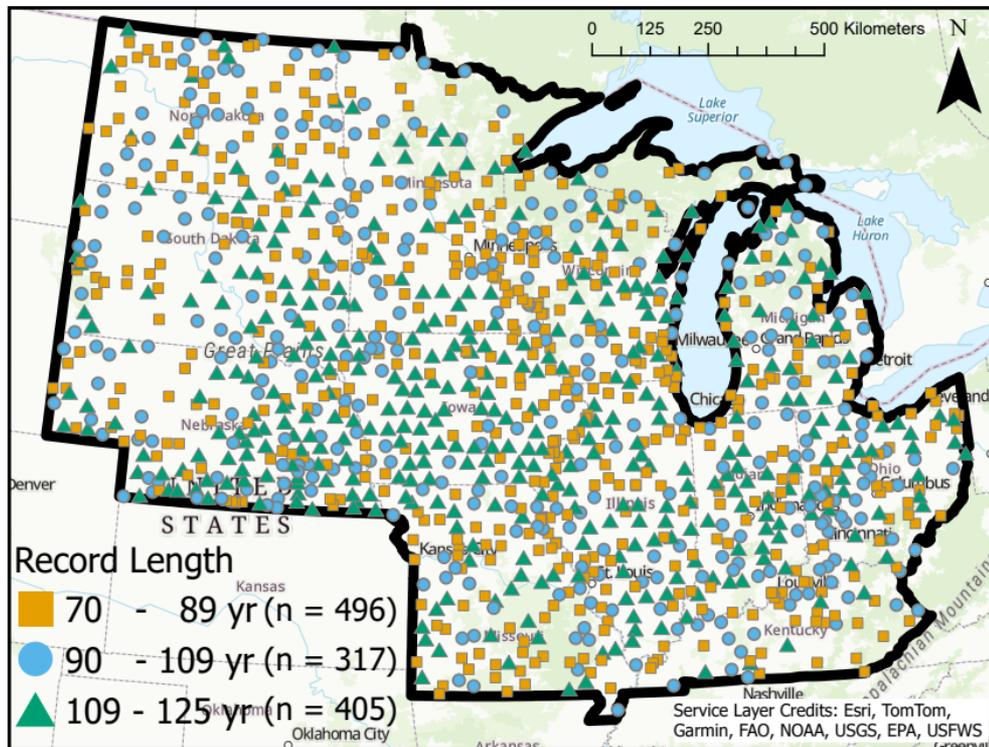
Rare Event Challenges

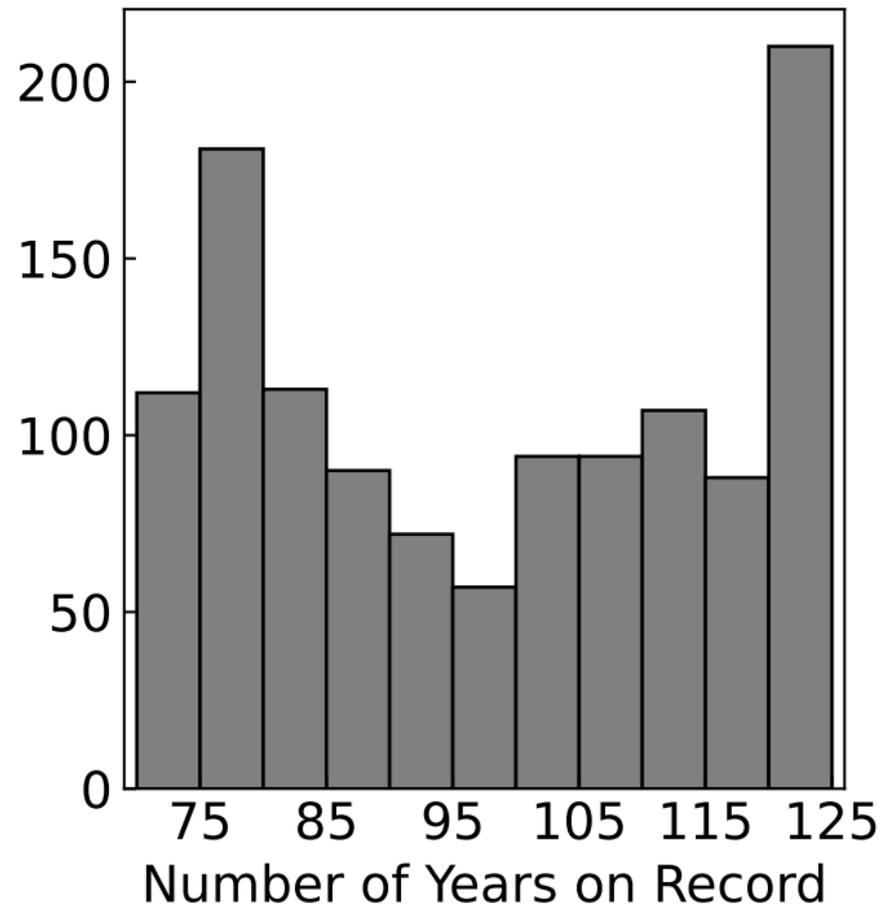
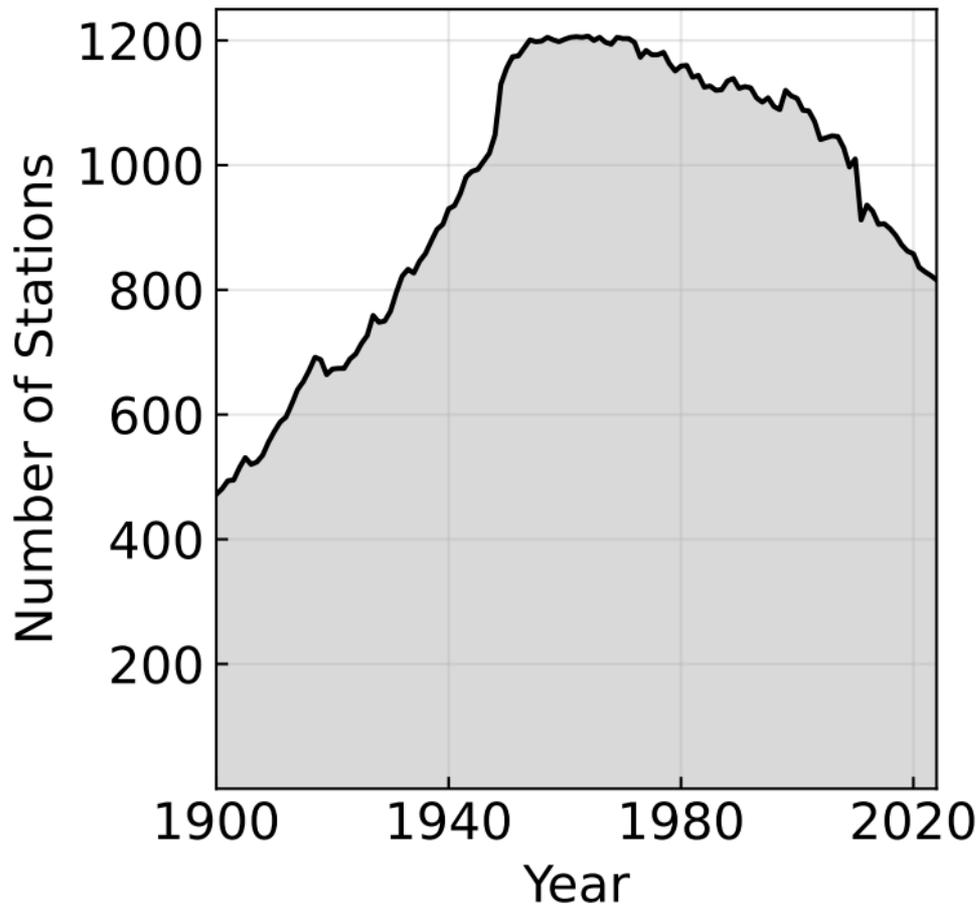
- Data Limitations
 - Quality
 - Quantity
- Locality
 - Different Rains in Different Plains



Data

- NCEI Global Historical Climatology Network
 - Daily Records
- 1,218 Stations
 - Minimum 70 yr Record
 - Avg. 98 yr Record





Methods

- Large Dataset → General Trends
 - 12 States
- Normalization
 - Rank **Annual Maximum** Storm within each Station
 - Divide by **# of Stations** with Data each Year
- Observe **Changes** in Different Percentile Storms:

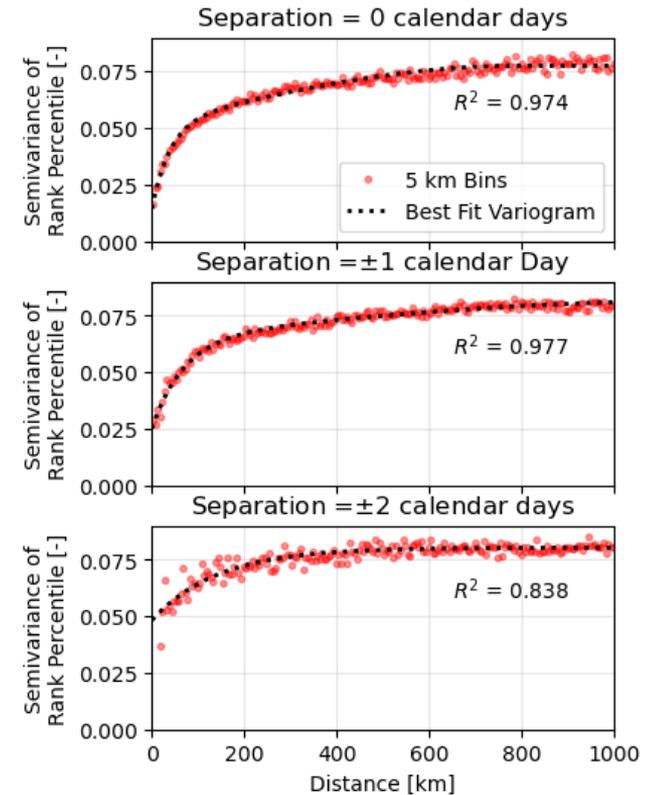
of Stations Observing n_{th} Percentile Event

Total # of Stations Observing that Year



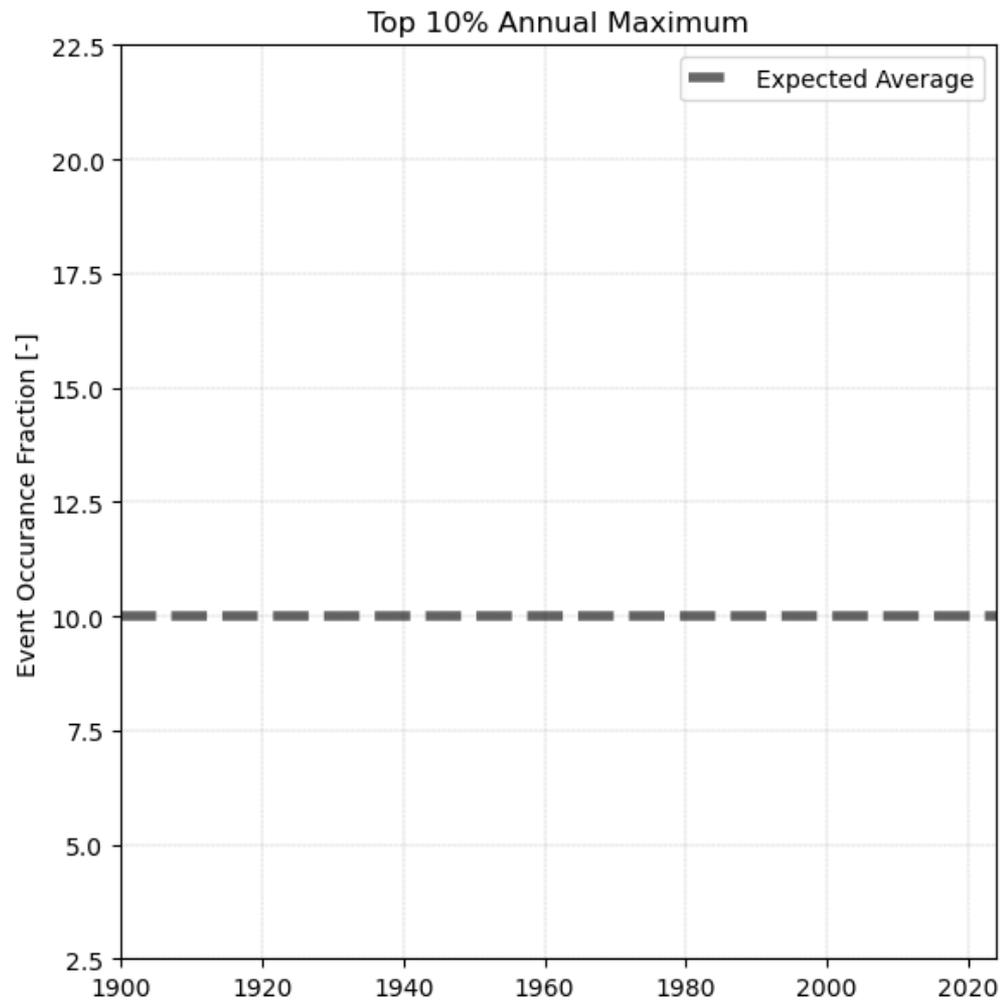
What about Storm Clustering?

- Measure Spatial Correlations
 - Events occurring same day, +/- 1 day, +/- 2 days ect.
- Correction Factor based on Variograms



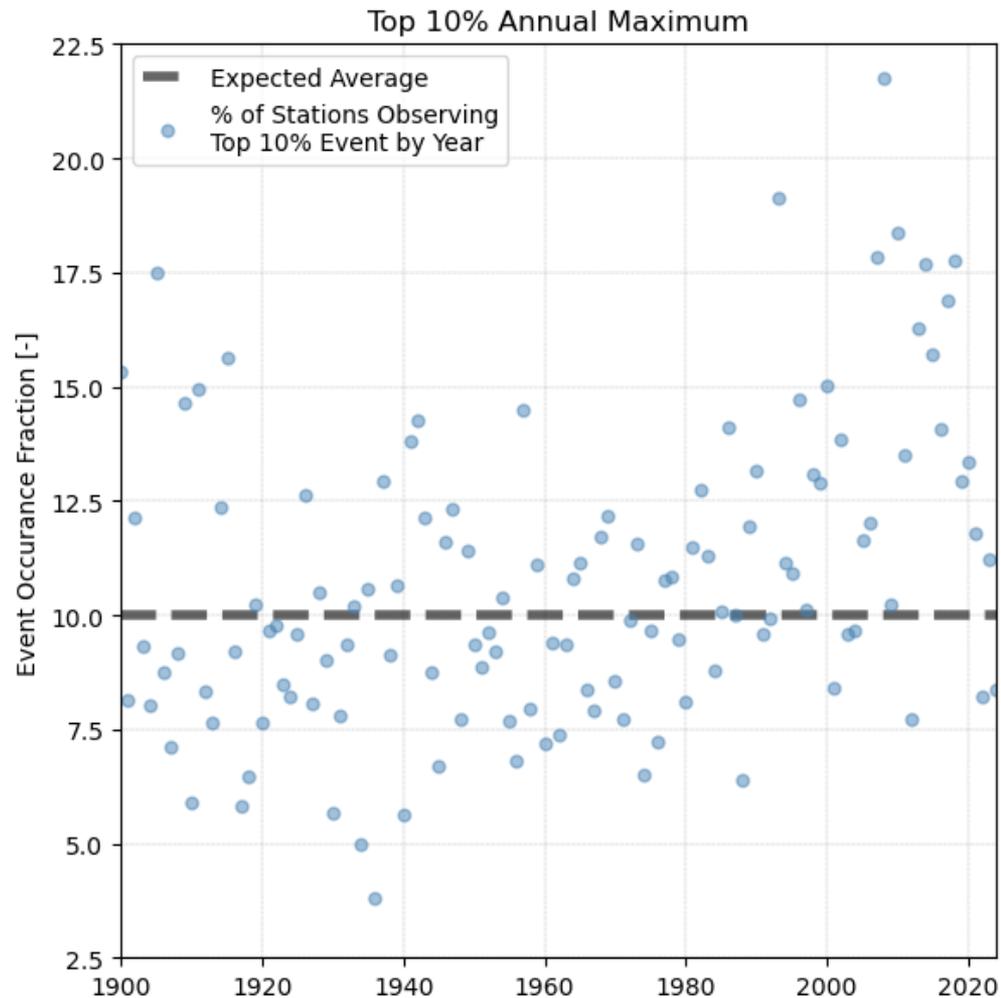
Results

- In a Stationary Climate ~10% of Stations Experience a Top 10% Event each Year



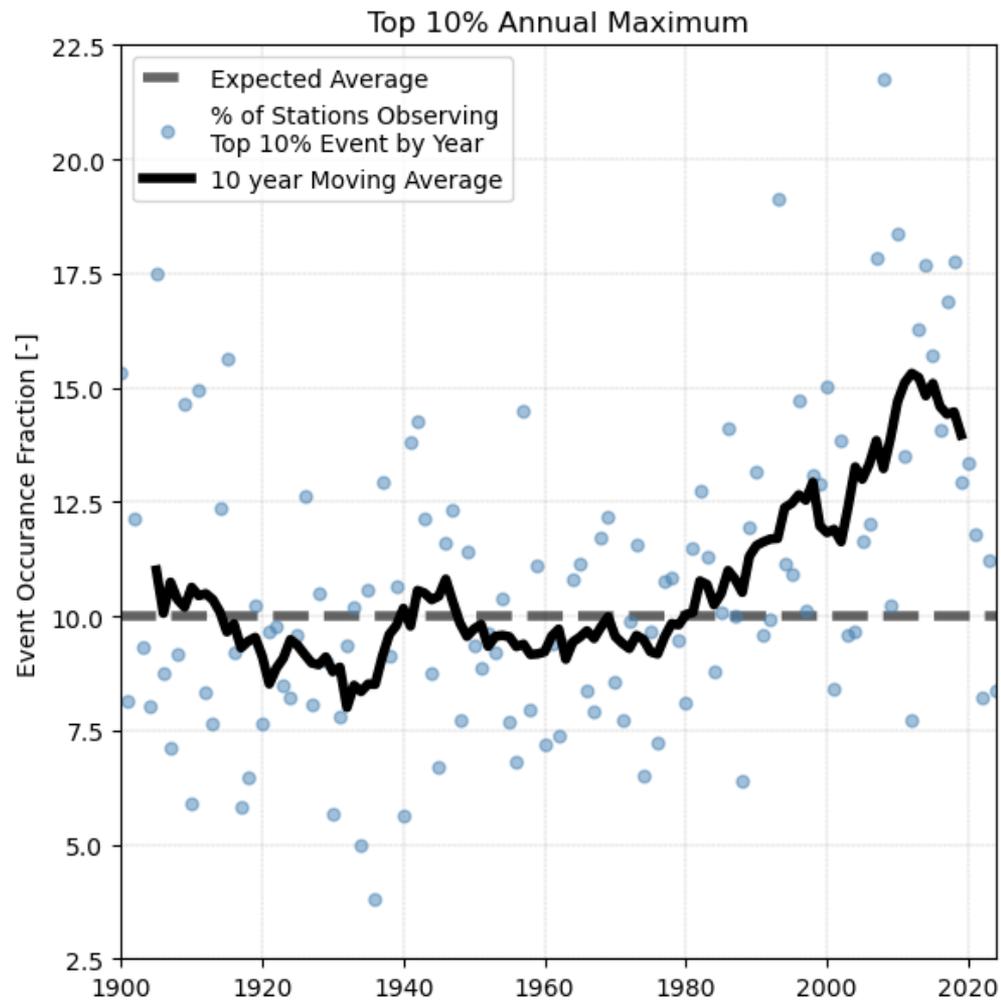
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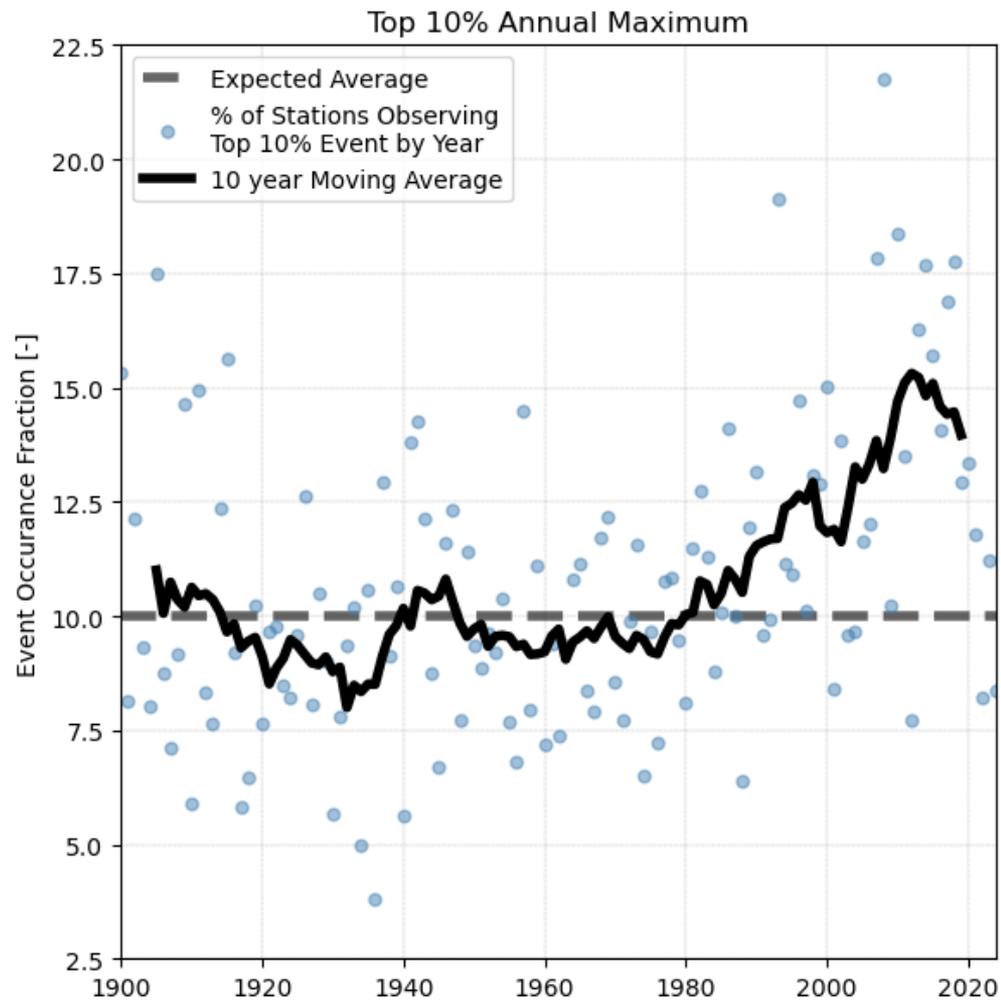
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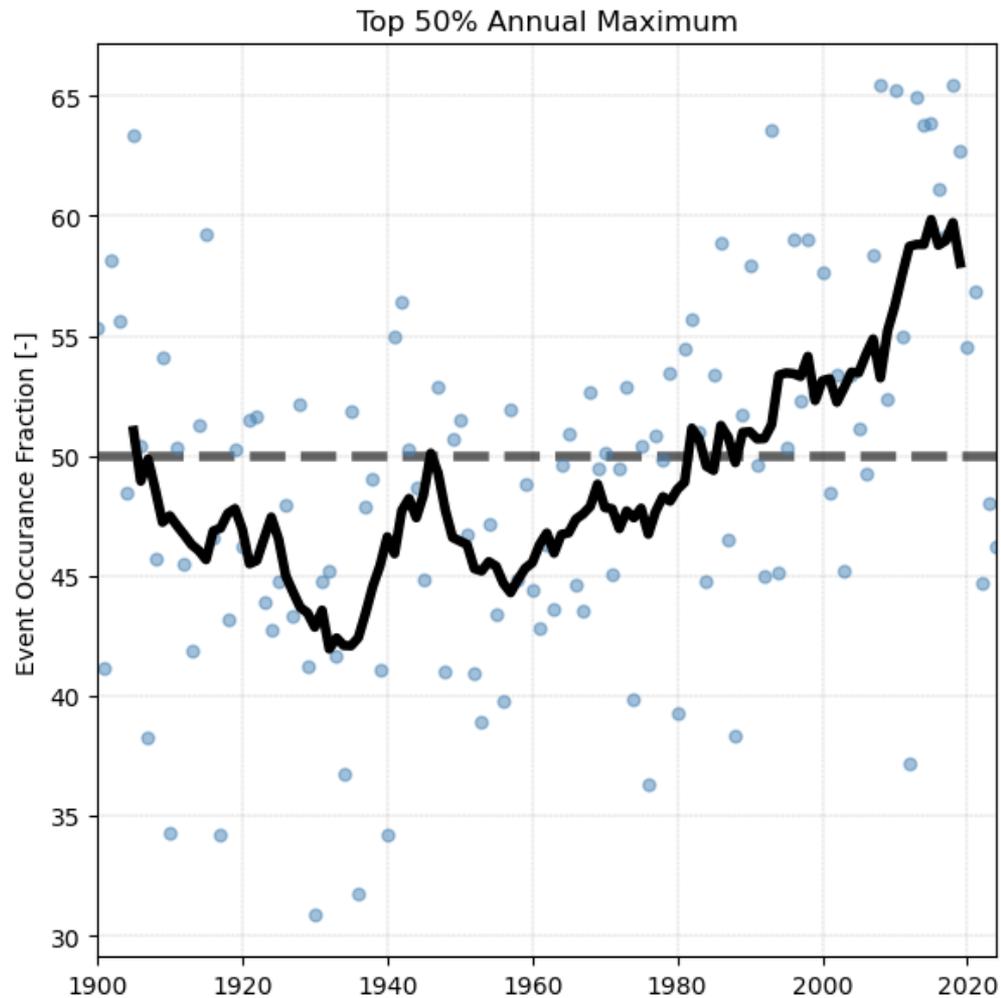
Results

- In a Stationary Climate ~10% of Stations Experience a Top 10% Event each Year
- Mann-Kendall Test For Monotonic Trend
 - Positive Trend
 - $p = 1.27 \cdot 10^{-5}$



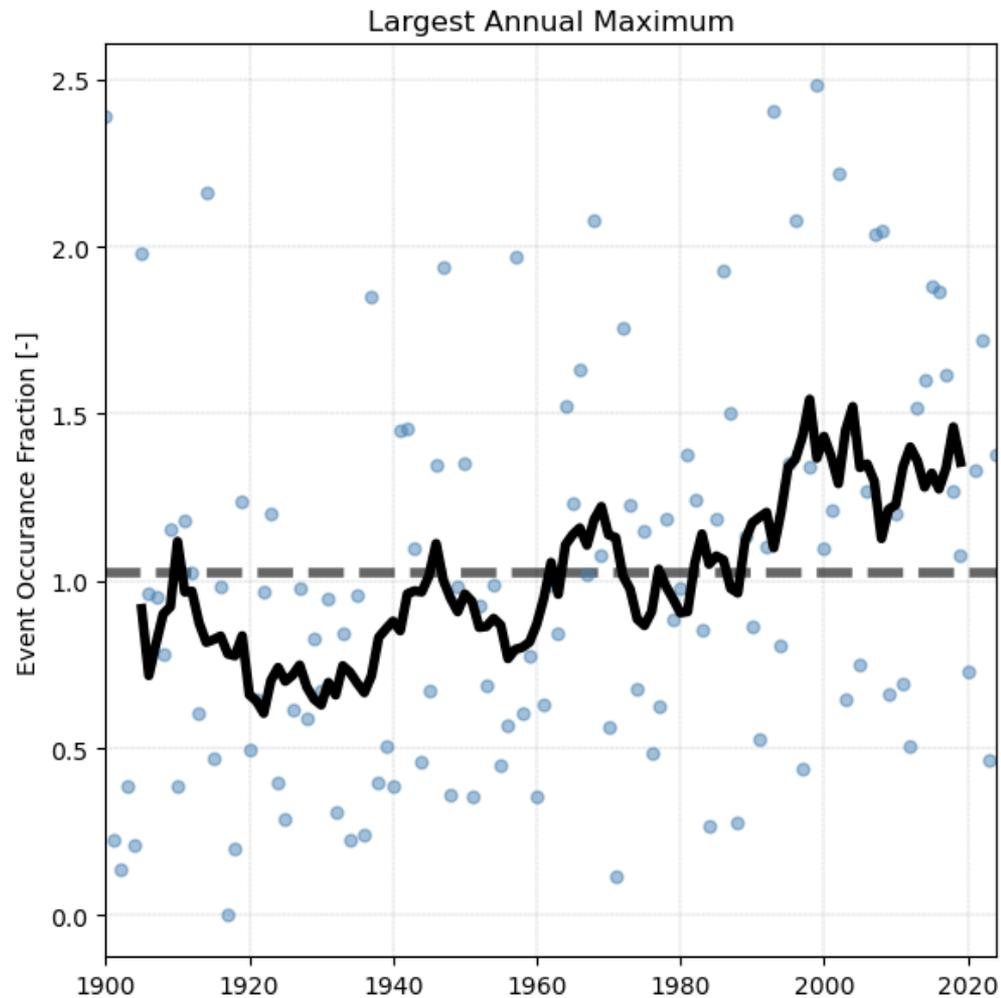
Results

- 2 Year Storm is also Becoming **More Frequent**
- Mann-Kendall Test For Monotonic Trend
 - Positive Trend
 - $p = 6.12 \times 10^{-6}$



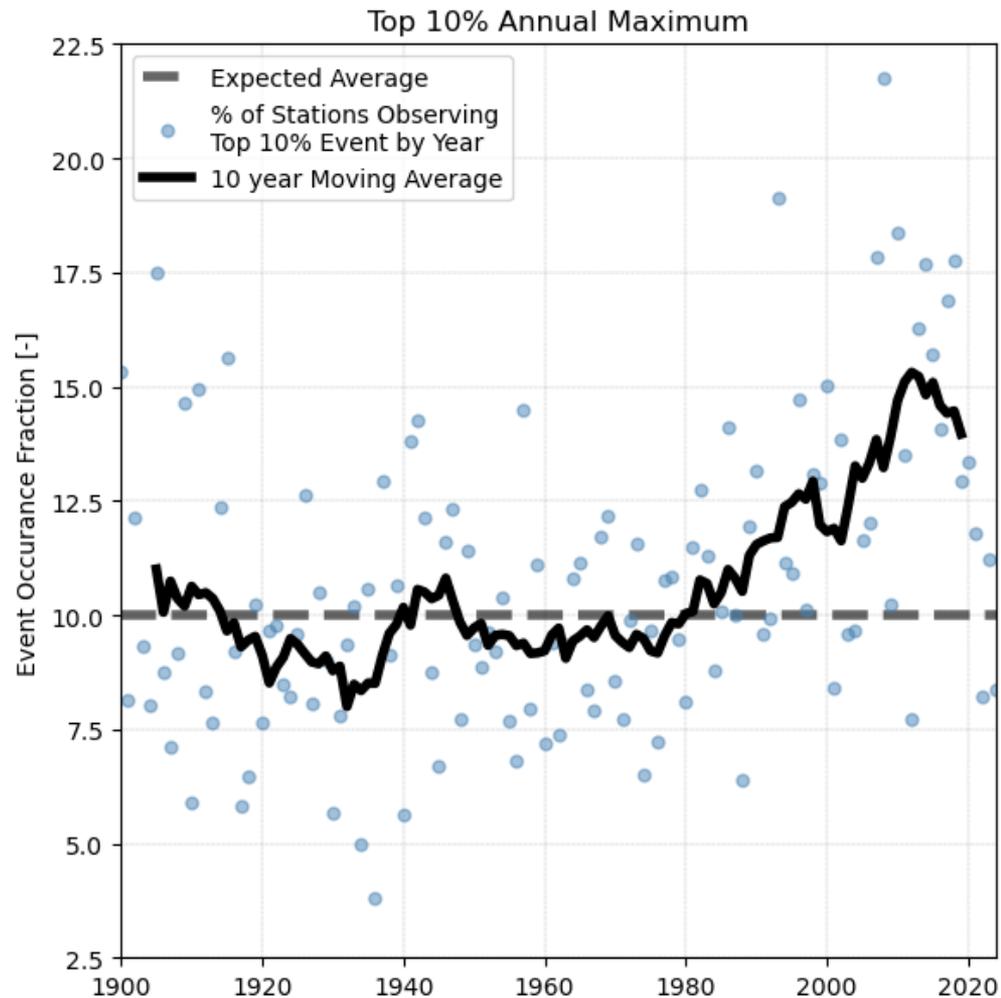
Results

- Applied to “Largest Storm on Record”
 - Approximates 100yr Event
- Mann-Kendall Test For Monotonic Trend
 - Positive Trend
 - $p = 4.53 \times 10^{-5}$



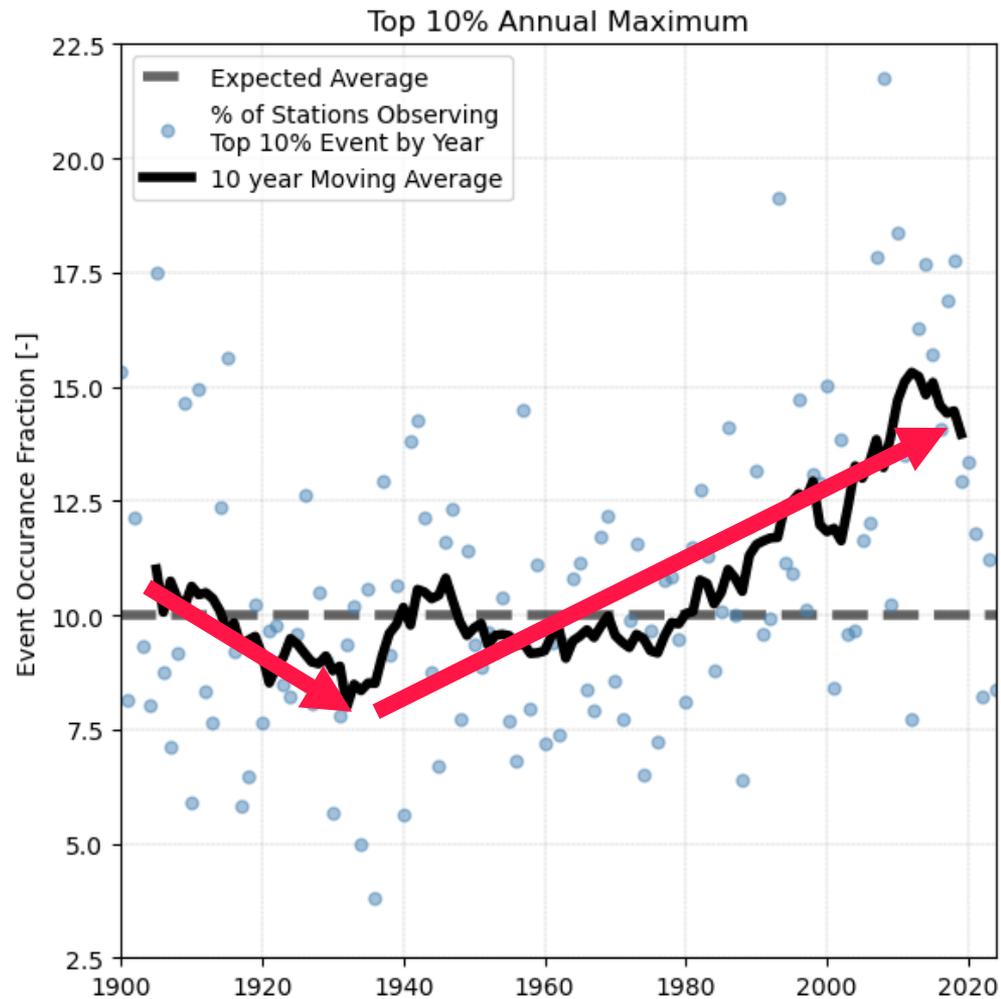
Future Analysis

- Fitting for Best Predictions
- Does the trend have a starting point?
 - If so, when?



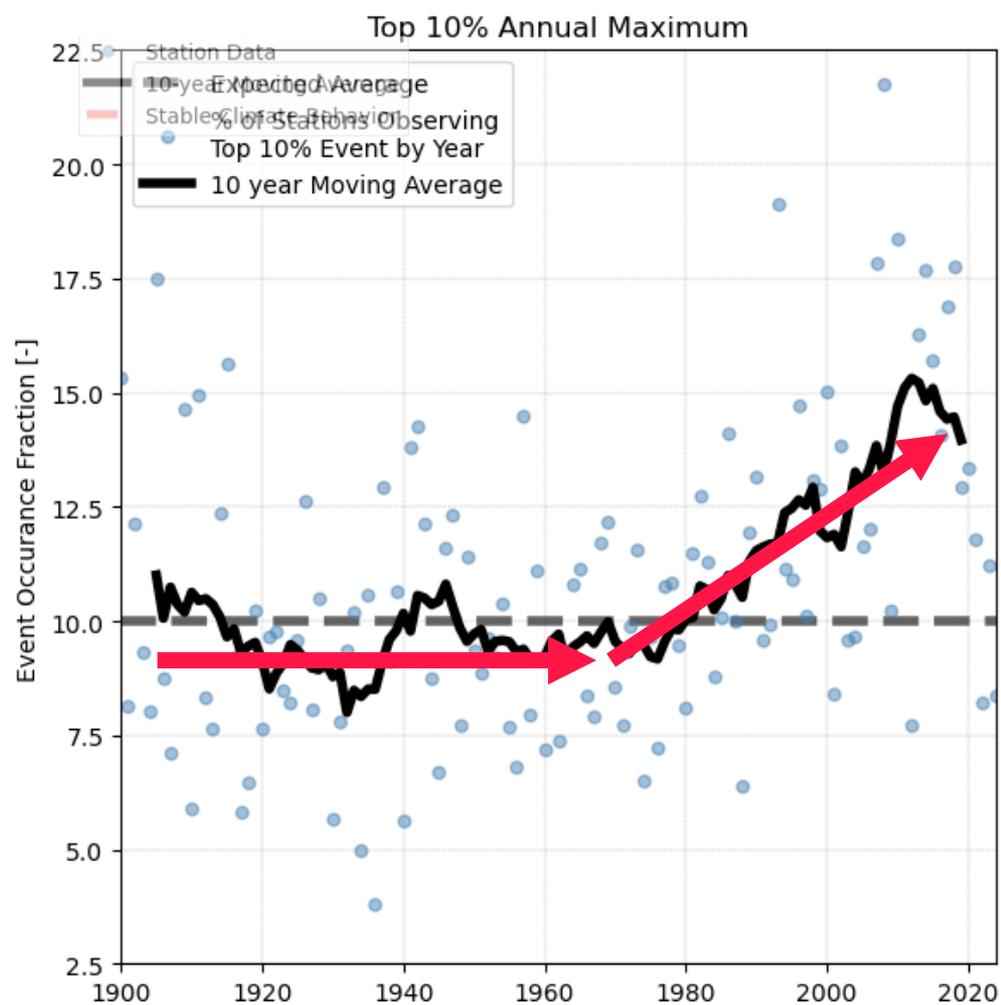
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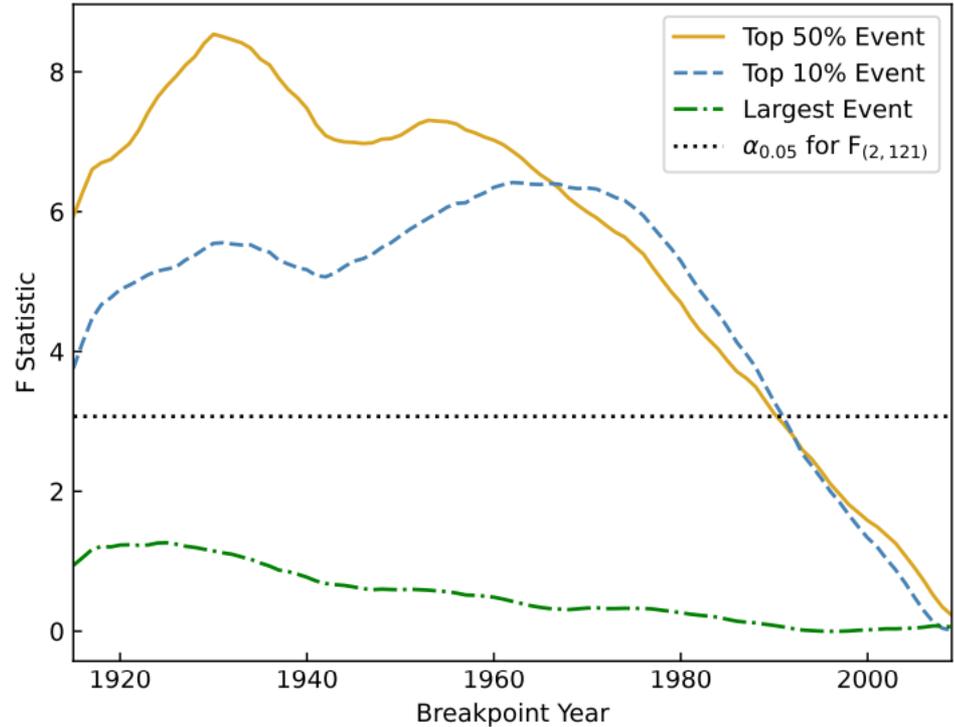
Future Analysis

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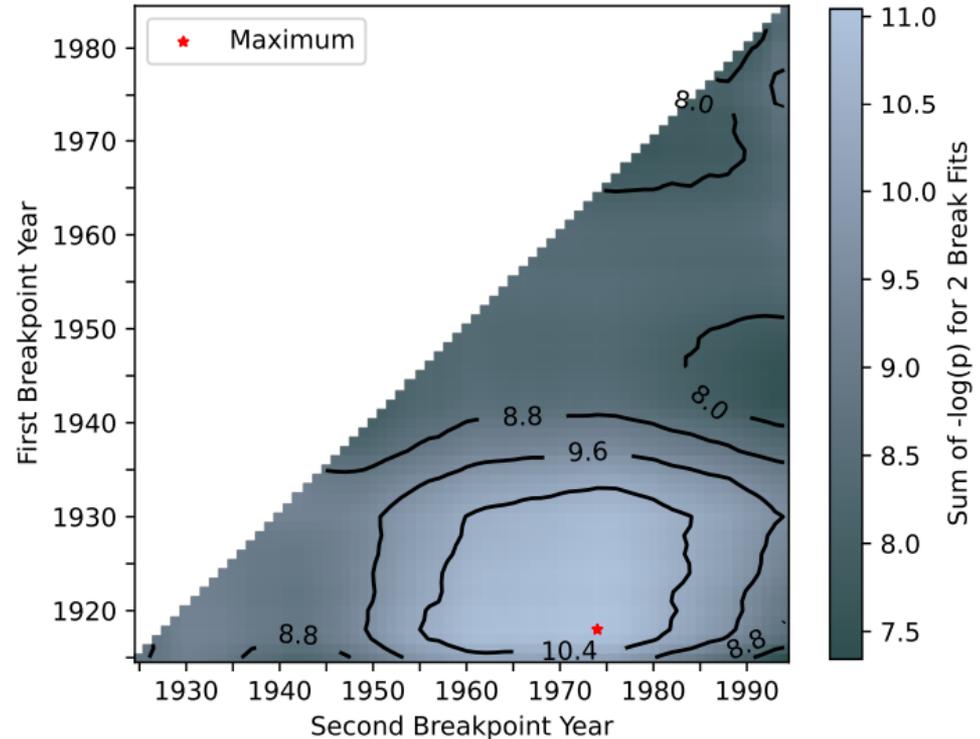
Finding a Breakpoint

- Two slope Piecewise Function
- Compared to Linear Fit (Jones and Molitoris 1984)
- Two Candidates
 - ~1930 Breakpoint
 - ~1970 Breakpoint



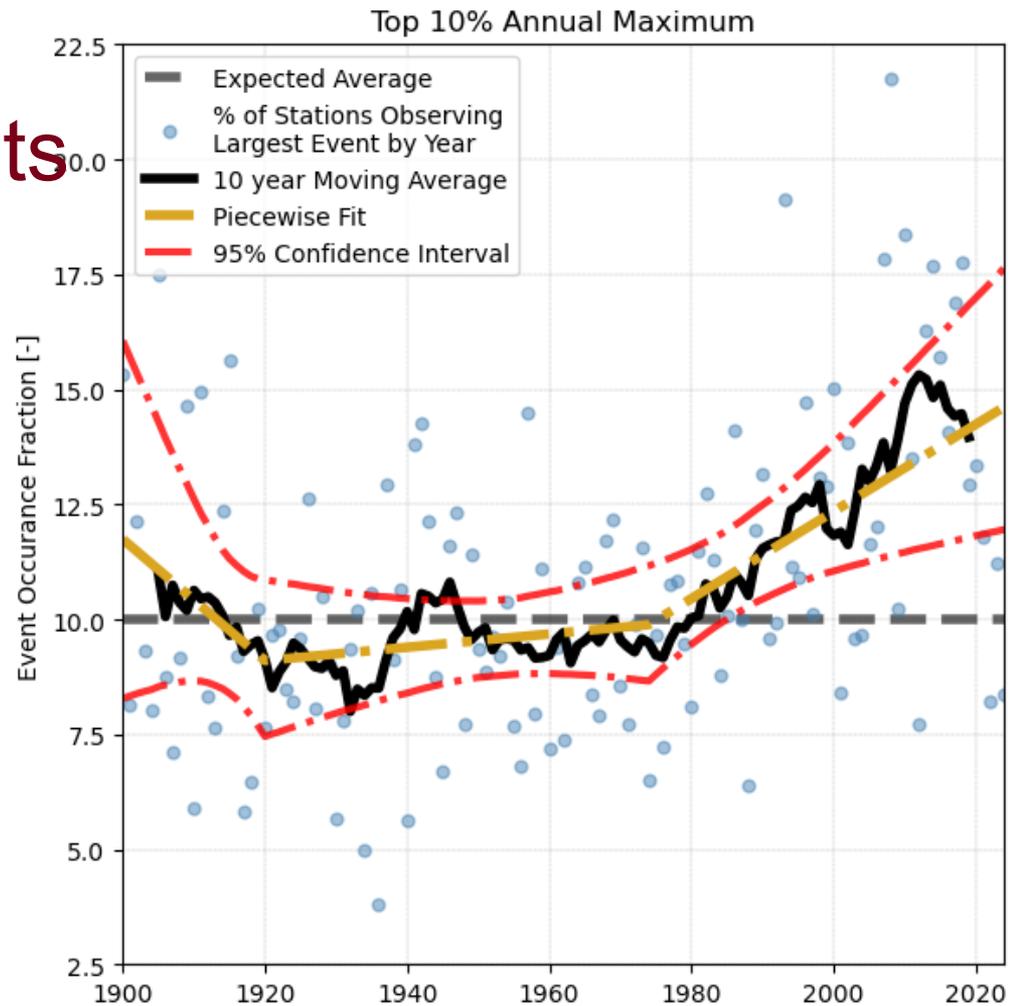
Finding the Breakpoint(s)

- Two Breakpoint Piecewise Function
- 1920 Breakpoint
 - Reversal of Downwards Trend
- 1974 Breakpoint
 - Acceleration of Frequency Increase



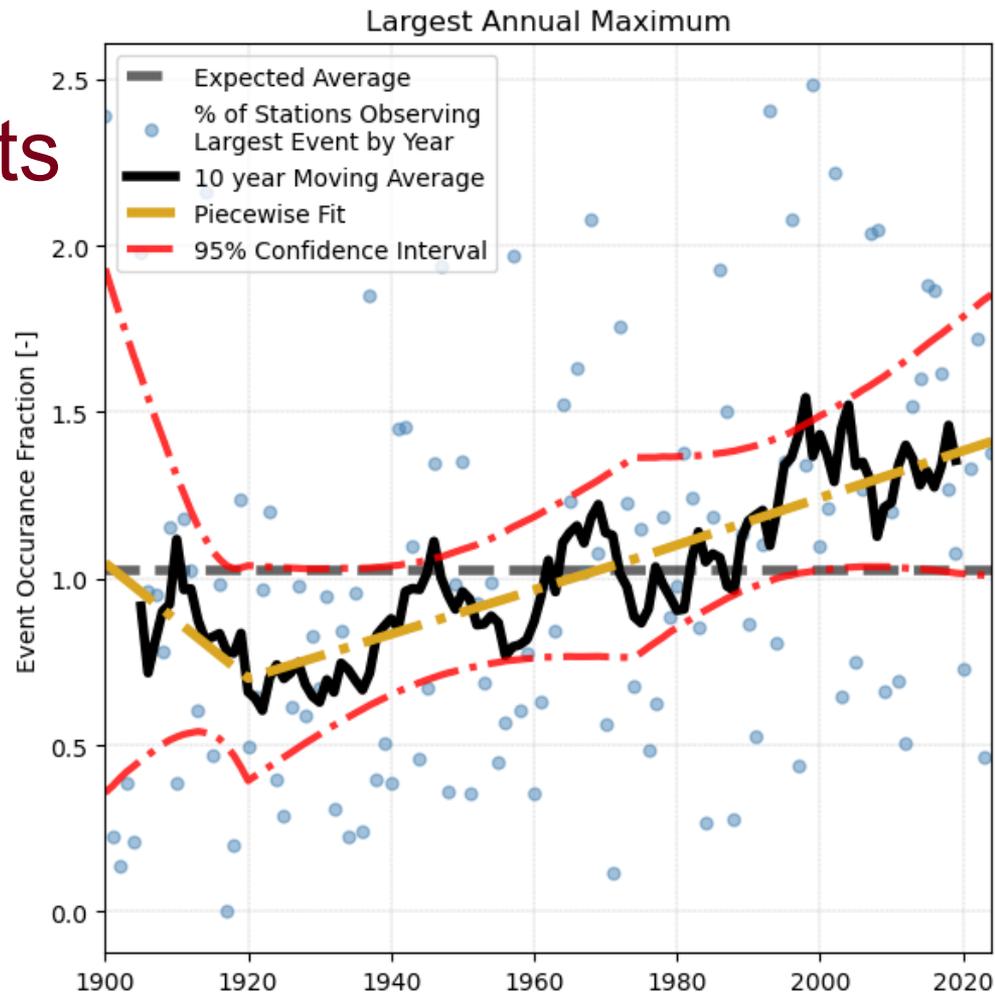
Interpreting the Results

- 10th Percentile Events
Approximates the 10yr Storm
- '10yr depth' occurring ~15%
of stations in 2024 → 7yr
Storm



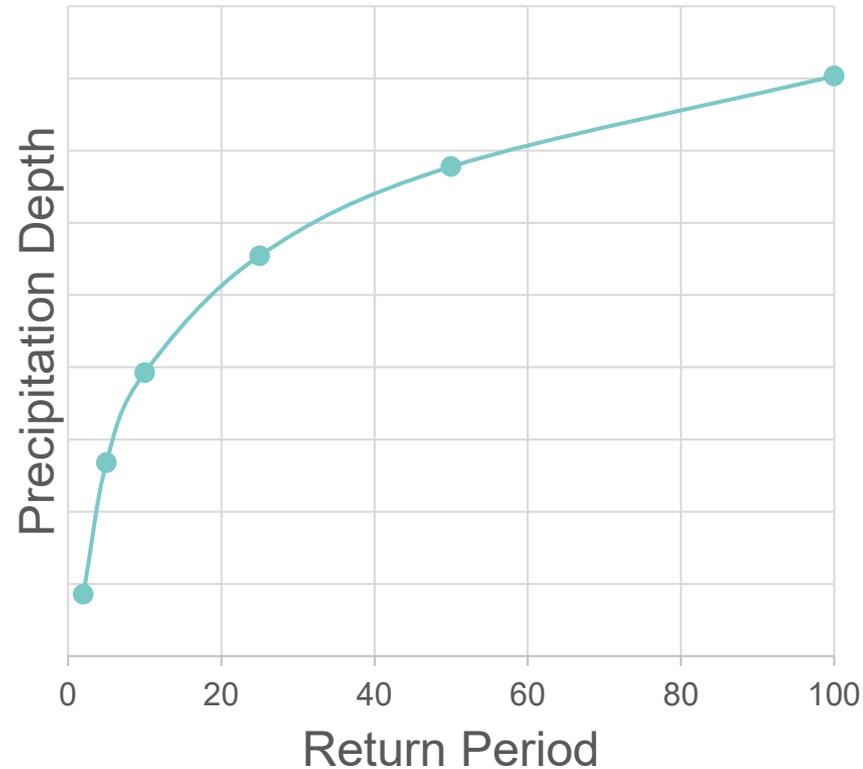
Interpreting the Results

- Largest Events Approximate the 98yr Storm
- Largest Event on Record occurring ~1.4% of stations in 2024
- 98yr \rightarrow 71yr Storm



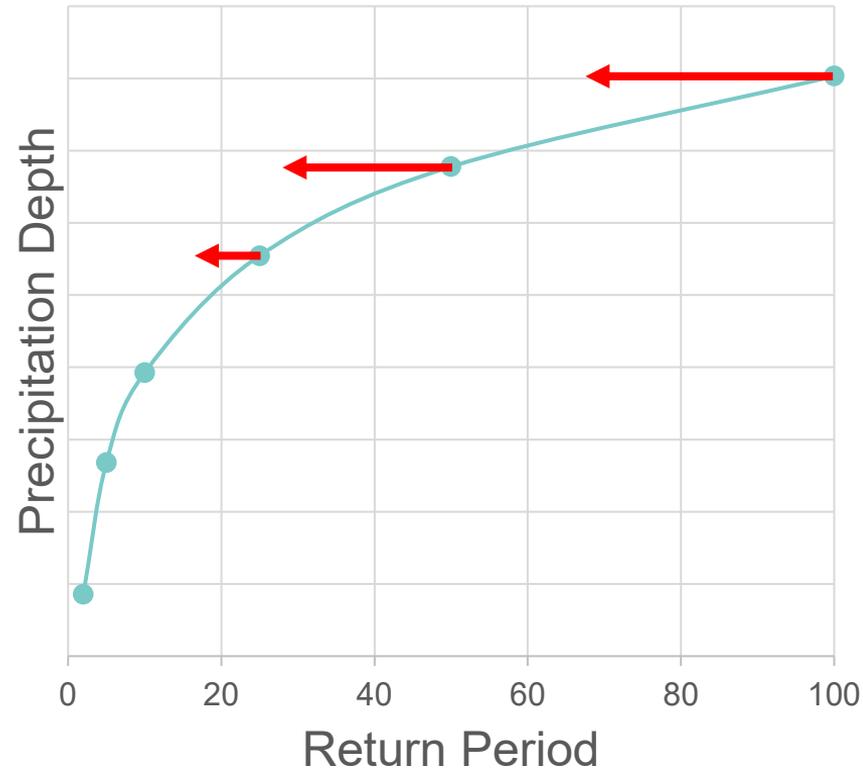
Interpreting the Results

- Intensity – Duration – Frequency Curves
- **Greater Frequency** results in **Greater Depths** for smaller return period storms



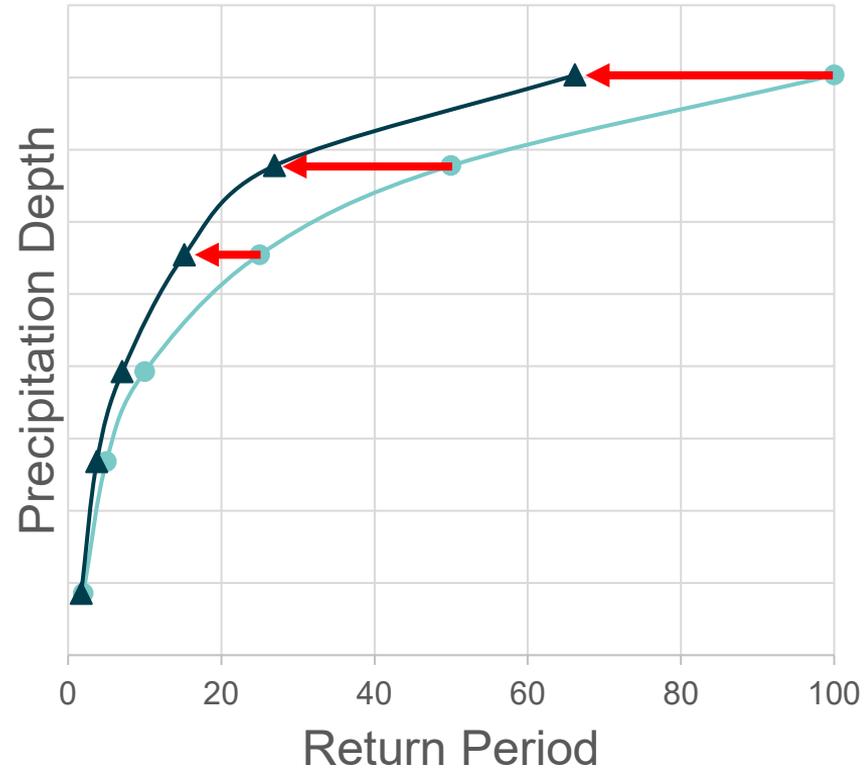
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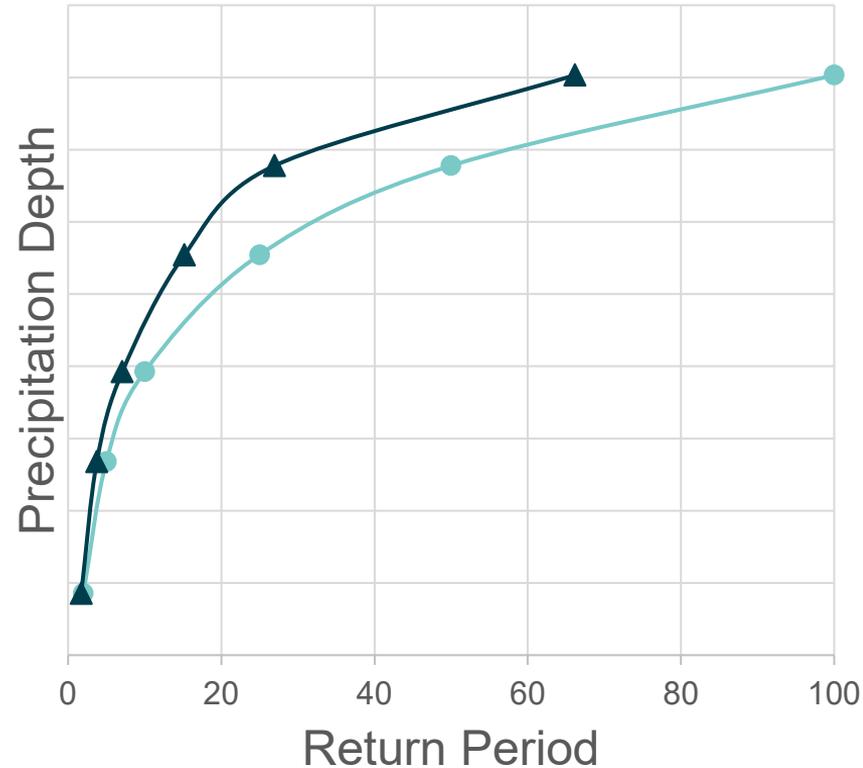
Interpreting the Results

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Interpreting the Results

- Intensity – Duration – Frequency Curves
- **Greater Frequency** results in **Greater Depths** for smaller return period storms
- **No New 100yr Depth**



Interpreting the Results

- Intensity – Duration – Frequency Curves
- **Greater Frequency** results in **Greater Depths** for smaller return period storms
- **No New 100yr Depth**
- **Often Larger than A14**

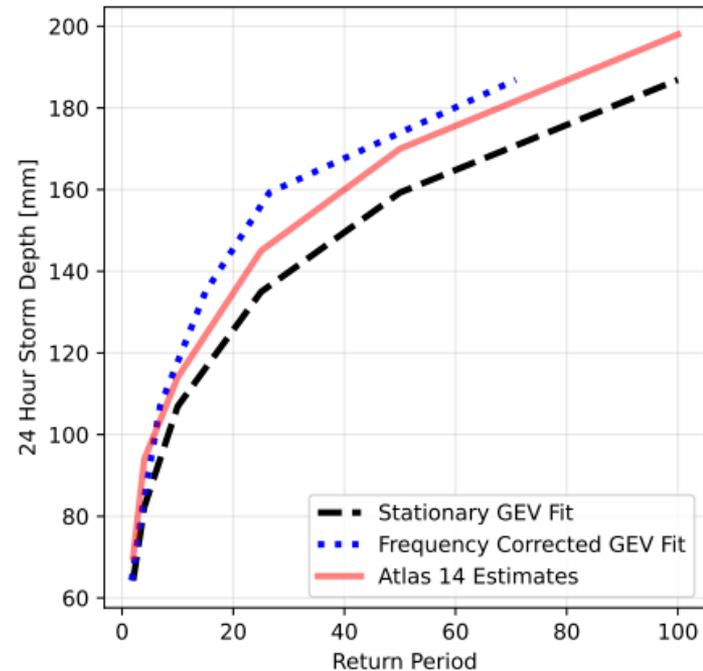
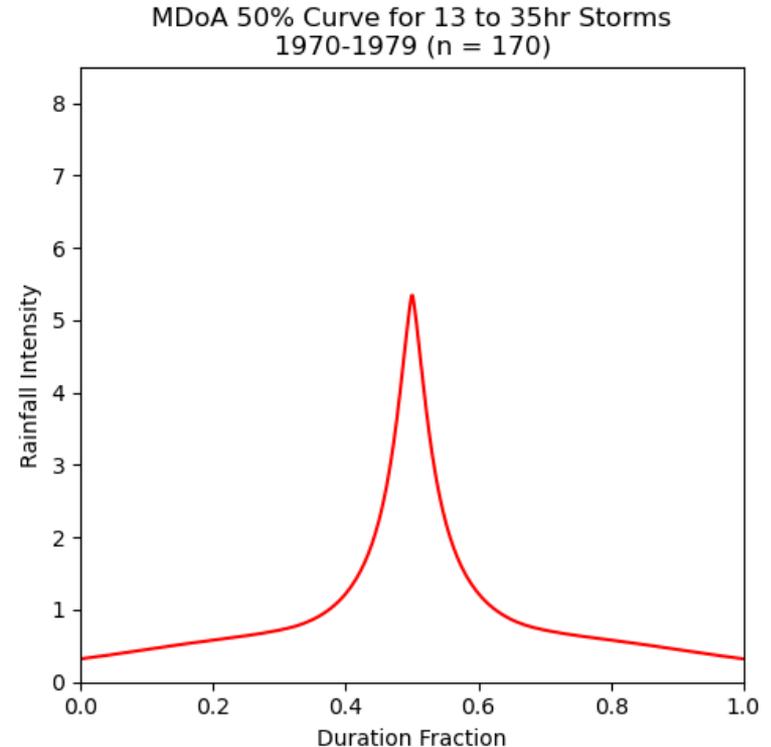


Fig. 7. A comparison of the estimates from a generalized extreme value (GEV) fit of annual maximum series data (Stationary GEV Fit), the frequency adjusted GEV fit, and estimates from Atlas 14, Volume 8 from the Grand Meadow station in Minnesota, USA (ID: USC00213290).

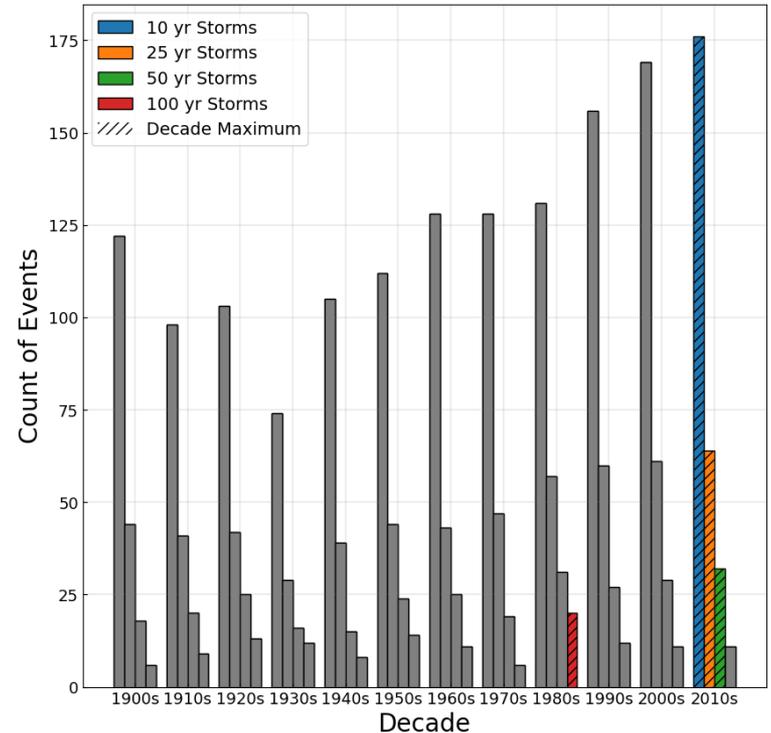
Larger and More Intense

- New method for quantifying intra-storm intensity
- Peak 1-hour intensity growing faster than total (24-hour) depth



Applications and Future Work

- Applying to Atlas 14 Estimates
 - Weighted Station Age
- GCM Evaluation
 - Reproduction of Historical Trends



Thank You



Updates Newsletter: stormwater.safl.umn.edu

Gallagher et al. Forthcoming. "Non-Stationarity in Records of Extreme Precipitation Frequency for the Upper Midwest " Journal of Hydrologic Engineering. DOI: 10.1061/JHYEFF/HEENG-6830

Contact Me: galla444@umn.edu



Washington County 2016-2025 AIS Plan Overview

Washington Conservation District

What are AIS?

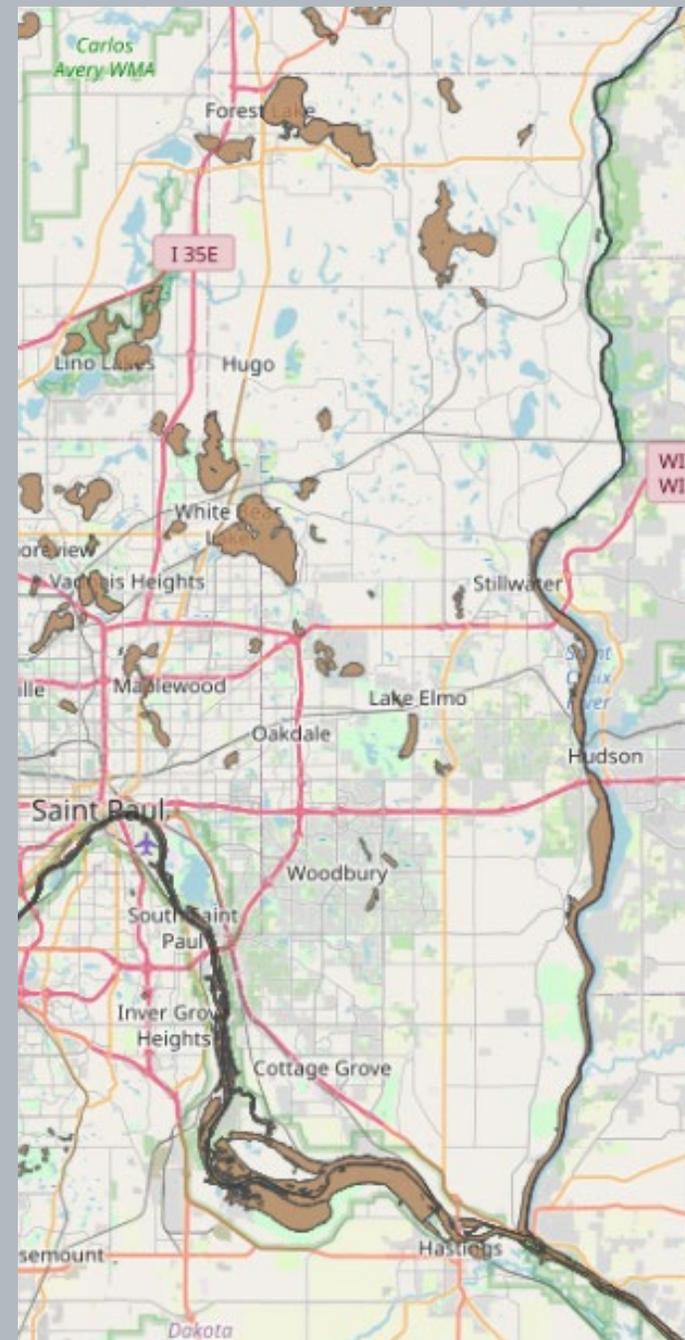
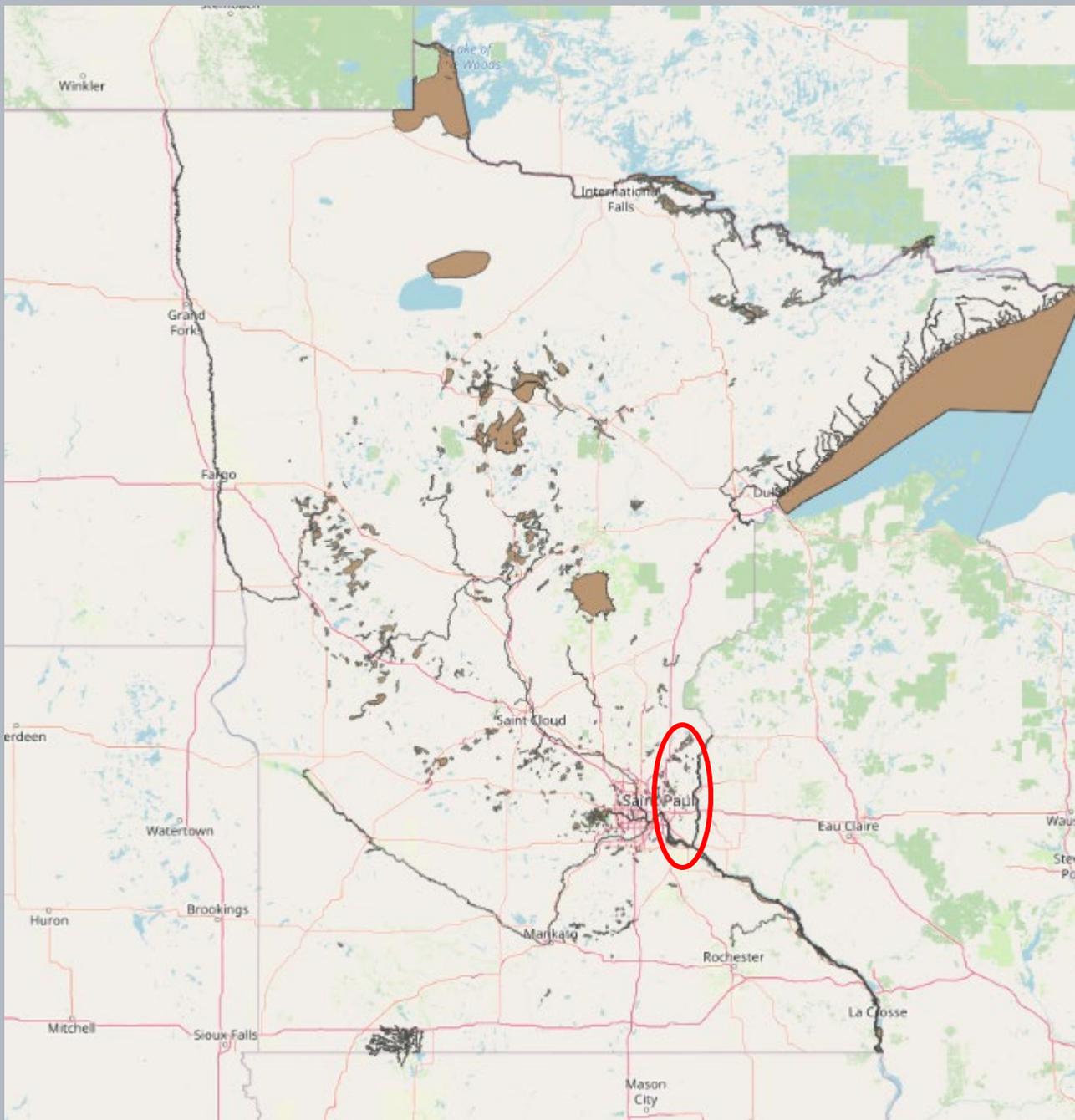
Invasive Species in Minnesota

Invasive species are species that are not native to Minnesota *and* cause economic, social, or environmental harm, or harm to human health.

Minnesota's natural resources are threatened by a number of invasive species such as zebra mussels, Eurasian watermilfoil, common buckthorn, and emerald ash borer. Invasive species can occur on land or in the water.

Minnesota Aquatic Invasive Species Research Center (MAISRC)

At the most basic level, aquatic invasive species are water-dwelling organisms that are not native to Minnesota. The impacts of aquatic invasive species vary. While some invasive species cause damage to ecosystems, others can cause human or economic harm.



Water body name	County or counties	Listed for aquatic invasive species	Year listed as infested	Year species was first confirmed, or connected water body	DOW number
Alice	Washington	Eurasian watermilfoil	2013	2012	82-0287
Big Marine	Washington	Eurasian watermilfoil	2005	2004	82-0052
Bone	Washington	Eurasian watermilfoil	2007	2006	82-0054
Bone	Washington	zebra mussel	2019	2019	82-0054
Camp Galilee	Washington	Eurasian watermilfoil	2007	2006	82-0502
Clear	Washington	Eurasian watermilfoil	2007	2006	82-0163
Colby	Washington	Eurasian watermilfoil	2012	2011	82-0094
DeMontreville	Washington	Eurasian watermilfoil	2009	2008	82-0101
Elmo	Washington	Eurasian watermilfoil	2006	2005	82-0106
Forest	Washington	flowering rush	2007	1998	82-0159
Forest	Washington	Eurasian watermilfoil	2015	2015	82-0159
Forest	Washington	zebra mussel	2015	2015	82-0159
Goose	Washington	Eurasian watermilfoil	2018	2018	82-0059
Horseshoe	Washington	Eurasian watermilfoil	2013	2012	82-0074
Jane	Washington	Eurasian watermilfoil	2012	2012	82-0104
Long	Washington	Eurasian watermilfoil	2009	2009	82-0021
Long	Washington	Eurasian watermilfoil	2016	2016	82-0030
Long	Washington	Eurasian watermilfoil	2006	2005	82-0118
Long	Washington	Eurasian watermilfoil	2008	2007	82-0130
Mud	Washington	Eurasian watermilfoil	2007	2006	82-0168
Olson	Washington	Eurasian watermilfoil	2009	connected to DeMontreville (82-0101)	82-0103
Pine Tree	Washington	Eurasian watermilfoil	2021	2021	82-0122
Powers	Washington	Eurasian watermilfoil	1998	1998	82-0092
St. Croix River	Washington	Eurasian watermilfoil	1995	1992	82-0001
St. Croix River downstream of the St. Croix Boomsite Recreation Area at river mile 25.4	Washington	zebra mussel	2001	2000	NA
Sunfish	Washington	Eurasian watermilfoil	2019	2018	82-0107
Sunnybrook	Washington	Eurasian watermilfoil	2019	2019	82-0133
Sunset	Washington	Eurasian watermilfoil	2001	2001	82-0153
White Bear	Washington	zebra mussel	2014	2014	82-0167
White Bear	Washington	Eurasian watermilfoil	1995	1988	82-0167
Wilmes	Washington	Eurasian watermilfoil	2007	2007	82-0090

**Minnesota Department of
Natural Resources (DNR)
List of Infested Waters -
November 9, 2022**



Water body name	County or counties	Listed for aquatic invasive species	Year listed as infested	Year species was first confirmed, or connected water body	DOW number
Alice	Washington	Eurasian watermilfoil	2013	2012	82-0287
Big Carnelian	Washington	zebra mussel	2024	2024	82-0049
Big Marine	Washington	Eurasian watermilfoil	2005	2004	82-0052
Big Marine	Washington	zebra mussel	2025	2025	82-0052
Bone	Washington	Eurasian watermilfoil	2007	2006	82-0054
Bone	Washington	zebra mussel	2019	2019	82-0054
Camp Galilee	Washington	Eurasian watermilfoil	2007	2006	82-0502
Clear	Washington	Eurasian watermilfoil	2007	2006	82-0163
Clear	Washington	zebra mussel	2024	2024	82-0163
Colby	Washington	Eurasian watermilfoil	2012	2011	82-0094
DeMontreville	Washington	Eurasian watermilfoil	2009	2008	82-0101
Elmo	Washington	Eurasian watermilfoil	2006	2005	82-0106
Forest	Washington	flowering rush	2007	1998	82-0159
Forest	Washington	Eurasian watermilfoil	2015	2015	82-0159
Forest	Washington	zebra mussel	2015	2015	82-0159
Goose	Washington	Eurasian watermilfoil	2018	2018	82-0059
Horseshoe	Washington	Eurasian watermilfoil	2013	2012	82-0074
Jane	Washington	Eurasian watermilfoil	2012	2012	82-0104
Long	Washington	Eurasian watermilfoil	2009	2009	82-0021
Long	Washington	Eurasian watermilfoil	2016	2016	82-0030
Long	Washington	Eurasian watermilfoil	2006	2005	82-0118
Long	Washington	Eurasian watermilfoil	2008	2007	82-0130
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Minnesota Department of
Natural Resources (DNR) List
of Infested Waters -
September 24, 2025



AIS in Washington County



Eurasian Watermilfoil: 26+ lakes in Washington County



Zebra Mussels: Forest Lake, White Bear, Bald Eagle, St. Croix, Big Carnelian, Big Marine, Clear, Long, Demontreville, Olson, Jane, Elmo



Curly-leaf Pondweed: Ubiquitous



Common Carp: Ubiquitous



Rusty Crayfish: 2 lakes in Washington County, St. Croix



Chinese Mystery Snail: Ubiquitous



Invasive Phragmites (*Phragmites australis* subsp. *Australis*): Elmo, Big Marine, ?



Flowering Rush: Forest Lake

AIS Future Concerns



- Spiny Waterflea
 - Approximately 70 Minnesota water bodies listed as infested, mostly in the northern part of the state
 - Competes with planktivorous fish for same food resource
- Starry Stonewort
 - 35 water bodies listed as infested, including Medicine Lake in Hennepin County
 - 4 new infestations found during 2025 Starry Trek
 - Forms dense mats that impede lake use

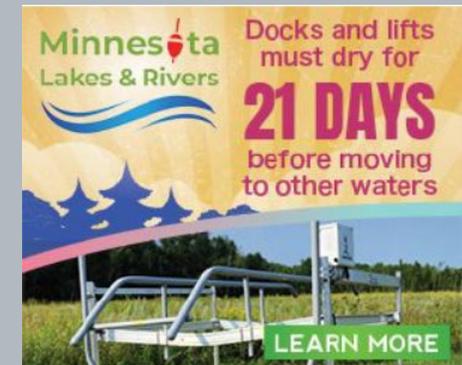
Program Activities

- 1 – Public Awareness and Education
- 2 – Watercraft Inspections
- 3 – Early Detection and Rapid Response (EDRR)
- 4 – Enhanced AIS Enforcement
- 5 – Access Improvements



Public Awareness and Education

- Partnership with EMWREP
 - Flyers, mailers, and other print materials
 - Workshops and community events
 - Newspaper articles, social media content & videos
 - East Metro Lakes e-newsletter (190 recipients)
- Partnership with Wild Rivers
- Partnership with Leighton Media
 - Targeted ads on news sites and video apps (1 million impressions in 2024)





Zebra mussels and starry stonewort spread to more Minnesota lakes

By: angiehongmn, August 29, 2025
Aquatic Biology, Wildlife

This summer, the Minnesota Department of Natural Resources has reported new infestations of aquatic invasive species – zebra mussels and starry stonewort – at a dozen lakes across the state. The discoveries underscore the inherent challenge of protecting Minnesota waterways in a state with more than 11,000 lakes, thousands of natural and manmade connections, and countless ways to access the water from public and private lands.

[READ MORE](#)



mnnature_awesome
Original audio

mnnature_awesome I regret to inform y'all that zebra mussels have been confirmed in Big Carnelian Lake (Washington County). New infestations found this year include Buffalo Lake (Becker Co), Marion Lake (Otter Tail Co), and East Croix.

Staff from the @minnesotadnr, @wcd_mn and Croix Watershed District did a thorough survey of numerous adult and larval mussels, concluding that they have been in Big Carnelian for three years now. Unfortunately, no treatment options are available.

Roughly 4% of Minnesota Lakes (about 320) have zebra mussels but it is NOT too late to protect the other 96% of lakes.

In addition to CLEAN, DRAIN, DRY your boat and dock for the season. They should be on the DNR water service providers and should be taking steps to prevent contamination from other nearby lakes.

#minnesota #bigcarnelianlake #zebramussels #ais #mnlakes

56w

sivertsoneric Fresh from Illinois I bet

56w Reply

View replies (1)

[View insights](#)

[Boost reel](#)



Liked by mundobarajas and 523 others
September 9, 2024

Add a comment...

[Post](#)

Hiring a contractor to remove your boat, dock, or lift?



Make sure that contractors and lake service providers take the necessary precautions to avoid spreading zebra mussels and other invasive species!



ASK THEM IF THEY HAVE COMPLETED AQUATIC INVASIVE SPECIES (AIS) TRAINING.

Only hire contractors that are on the Minnesota DNR's list of permitted service providers: bit.ly/MNDNR_LSP



ASK THEM WHAT STEPS THEY TAKE TO AVOID TRANSPORTING INVASIVE SPECIES FROM NEARBY INFESTED LAKES

It is illegal to transport any equipment with zebra mussels or other prohibited invasive species away from a water access or shoreland property.

Docks, boat lifts, and swimming platforms must dry for 21 days before entering another waterbody.

Lake service providers should have a protocol in place to clean, inspect, and decontaminate their equipment after leaving a lake or river and be extra cautious when working on water bodies with known infestations.



HOW CAN YOU AS AN ASSOCIATION, NEIGHBORHOOD, OR LAKESHORE COMMUNITY HELP YOUR DOCK SERVICE PROVIDER?

Collectively seek to use a single service provider and coordinate a schedule that all dock services are provided on your lake in a single period. Reducing the number of trips to your lake will significantly reduce the risk of new AIS.



THE FOLLOWING EAST METRO WATER BODIES ARE LISTED AS INFESTED WITH ZEBRA MUSSELS:

Ramsey County:
Bald Eagle, Charley, Johanna, Long, McCarron, Owasso, Pleasant, Sucker, and Vadnaia Lakes

Chisago County:
Comfort and Little Comfort Lake

Washington County:
Big Carnelian, Bone, Demontreville, Forest, Long, Olson, and White Bear Lakes, and the St. Croix River, downstream of the Boom Site (River Mile 25.4)

Isanti County:
Spectacle Lake



LEARN MORE AT:
www.dnr.state.mn.us/invasives/ais

Education Activities

Sign design

Newspaper ads

Social media ads

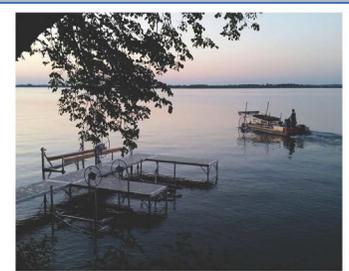
Video app ads

Boat cleaning kits promotion

AIS ID workshops

Reporting and reminders in newsletters

Postcard creation and distribution



TIPS FOR HIRING A BUSINESS TO INSTALL OR REMOVE YOUR BOAT, DOCK, LIFT, OR OTHER EQUIPMENT



WHEN HIRING A LAKE SERVICE PROVIDER MAKE SURE TO:

- Ask if they have completed Aquatic Invasive Species (AIS) Training.
- Confirm that they are on the DNR's list of permitted service providers: bit.ly/MNDNR_LSP

WHEN REMOVING EQUIPMENT YOURSELF, REMEMBER:

- It is illegal to transport any equipment with zebra mussels or other prohibited invasive species away from a water access or shoreland property.
- Docks, boat lifts, and swimming platforms must dry for 21 days before entering another waterbody.

REMINDER: Minnesota invasive species laws regulate the transport of invasive species equipment, and water to help prevent the spread of AIS which threaten native species and aquatic ecosystems and impair recreational activities like boating and fishing.

Learn more: www.dnr.state.mn.us/invasives/ais/index.html

Thank you for protecting our lakes!

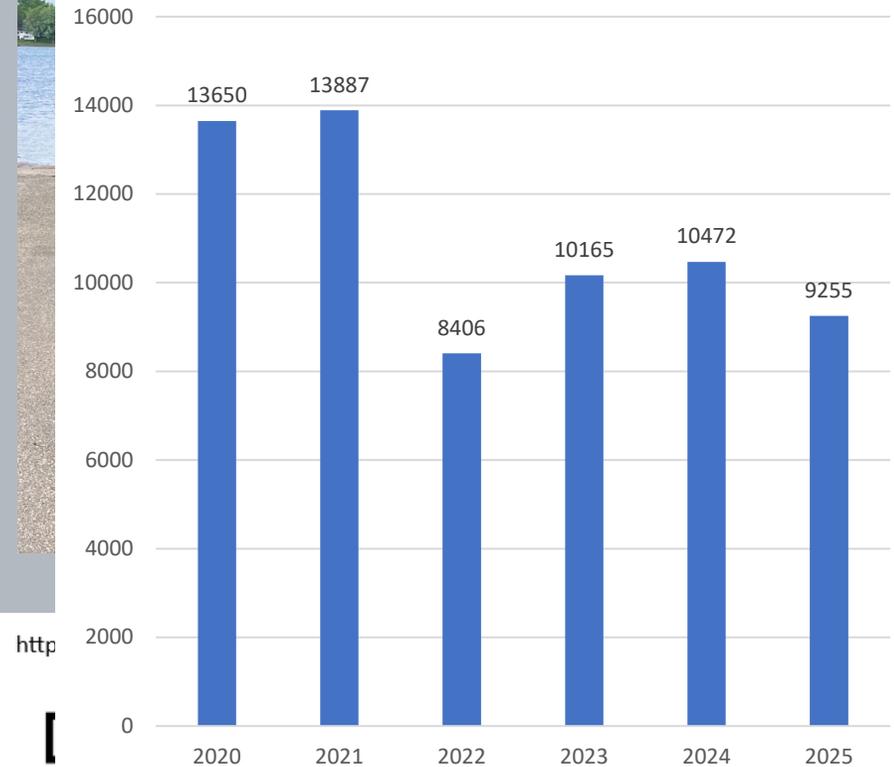


Watercraft Inspections

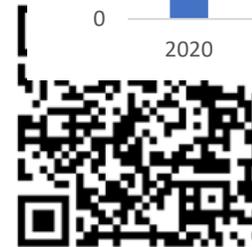
- Statewide program created in 1992
- WCD County-wide program using County funds since 2015
 - 938 inspections performed in 2015
 - 13,887 inspections performed in 2021
- CLFLWD and Chisago County programs



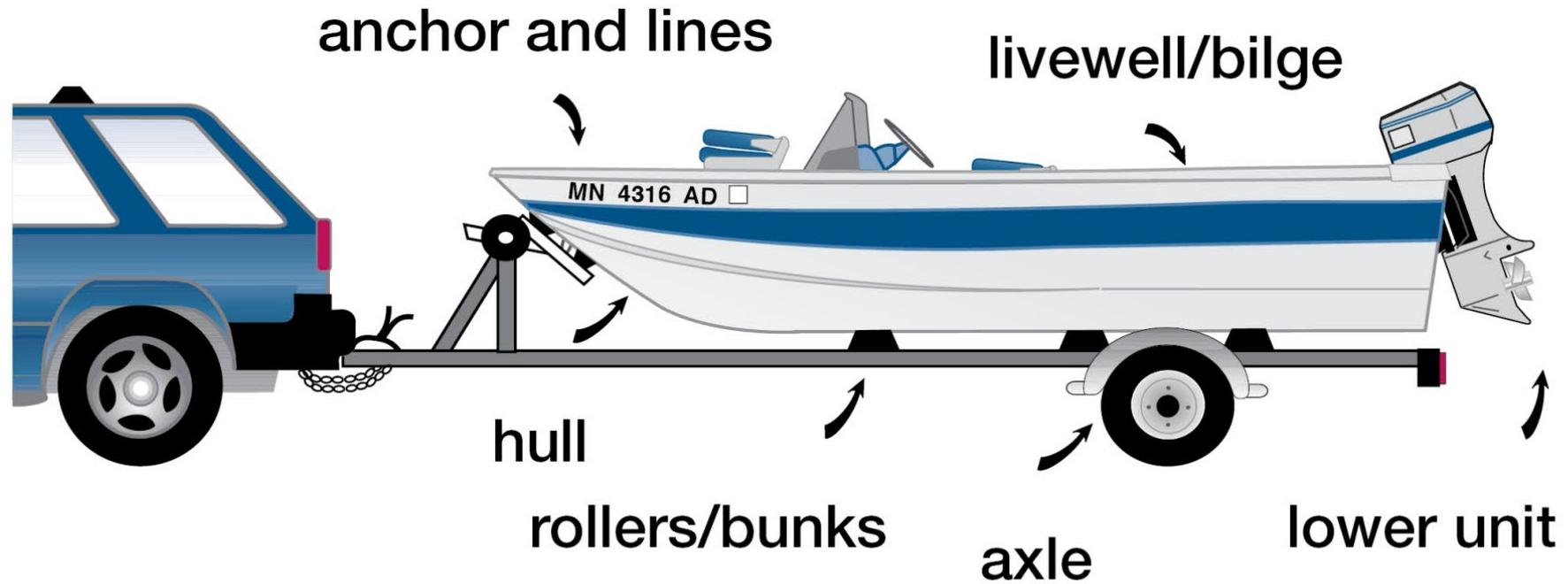
Watercraft Inspections Conducted per Year



http



Check these places on your boat and trailer for aquatic plants or animals:



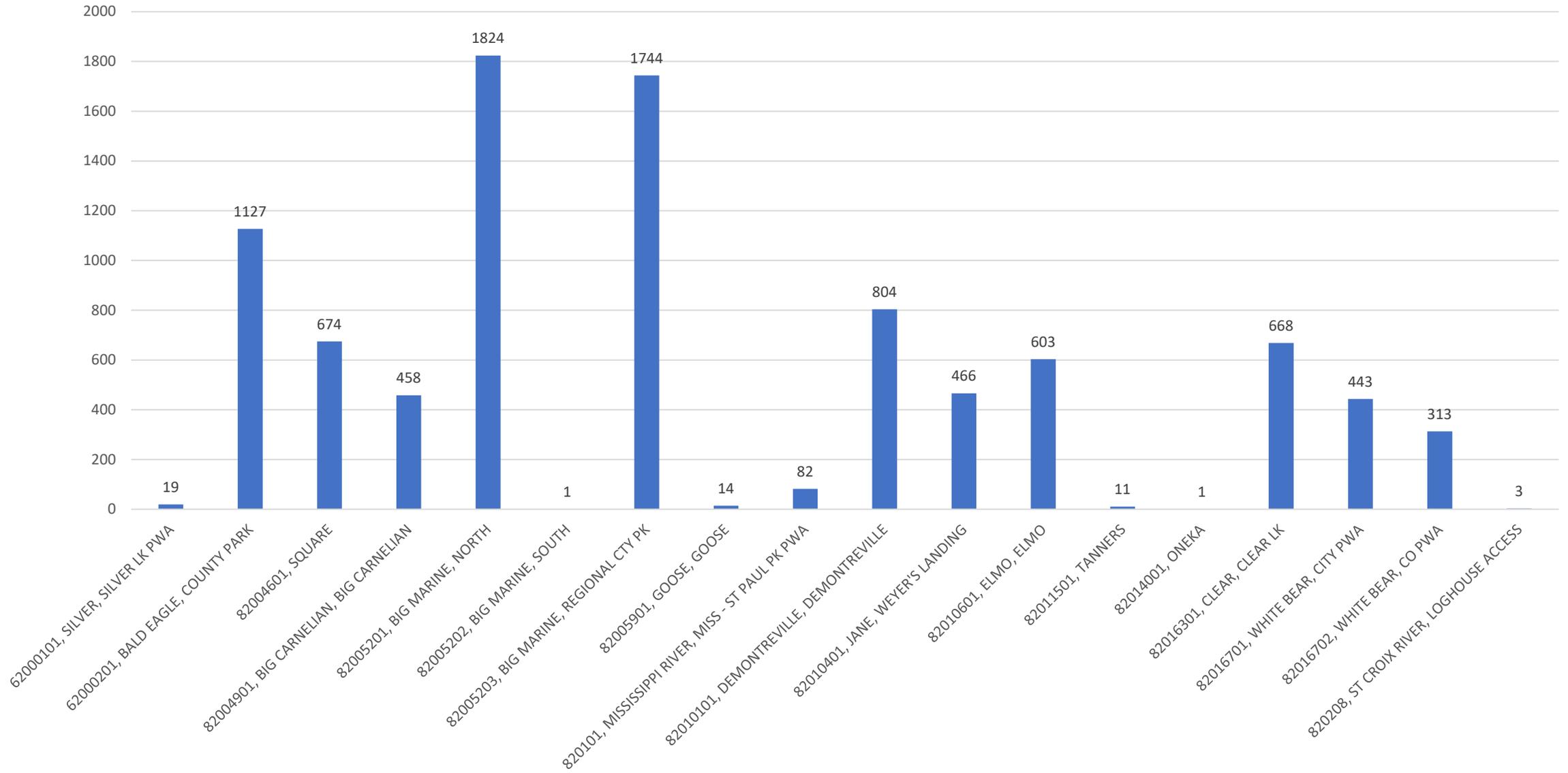
According to Minnesota DNR, 95% of incoming watercraft arriving at launches in 2024 were in compliance with state laws and 98% were free of plants, invasive animals, mud and water.

That's a major improvement since 2015, when only 86% of watercraft were in compliance with state laws.

2025 WCD Inspections

- 18 public accesses in Washington and Ramsey Counties
- 3,068.5 hours of inspections
- 9,255 inspections
 - 60% entering, 40% exiting
 - 94 drain plug violations (2%)
 - 54 plant/animal/water violations
 - Highest number of inspections performed at Big Marine followed by Bald Eagle, DeMontreville, White Bear

Total Inspections by Landing 2025



Early Detection

- Weekly early detection conducted by staff April-September
- Additional full lake meander surveys conducted 1-2x per year on rotating lakes
- Rapid Response protocols initiated when new infestations are identified
- Allows for long term monitoring of known invasive species

Aquatic Invasive Species Early Detection: Shoreline Search



Introduction



of downloading the Great Lakes Early
equipment

Conduct

Searches a
completed

for any inv

the dock,

the perfect

surface in

the dock,

floating de

attach to

underwat

view the l

which can

should be

invasive sp



collected and brought to the office for further inspection. Additionally, when an infestation is found, a positive survey should be filled out on the GLEDN application.

ded areas, so the underside of the dock is
nds, the employee should feel any dock
ps or sharp shells. Following inspection of
the landing by picking up rocks, vegetation,
area. Remember that zebra mussels can

used to
ent,
eyes
on
be



Rapid Response

- Multiple Rapid response efforts undertaken since 2016
- Coordination with State and Local Partners
 - Goose Lake EWM - Identification
 - Bone Lake ZM – Treatment
 - Bone Lake Water Hyacinth – Treatment and Eradication
 - Big Car ZM – Identification
 - Big Marine ZM - Monitoring





Enhanced AIS Enforcement



- MNDNR Training of Local LEO's
- Coordination with CO's for ZM Violations
- Coordination with WaCo Sheriff and Level 1 Program
- More Needed!

Landing Improvements

Waterfowl Hunters

Future hunters are relying on you to prevent the spread of aquatic invasive species...do your part.



- CLEAN
- DRAIN
- DRY

Minnesota DEPARTMENT OF NATURAL RESOURCES

STOP AQUATIC HITCHHIKERS!

WASHINGTON OBSERVATION DISTRICT

Learn more at mndnr.gov/ais



You Can Help Protect These Waters



BEFORE launching, please make sure your watercraft is clean, drained, and plug is restored.

Landing Improvements



CD3 Roadside Tool Station: Two tools on lockable reels

Aqua Weed Stick Landing Station Dual Reel: Two tools on lockable reels



Thank you Partners!



& so many others!



Thank you!