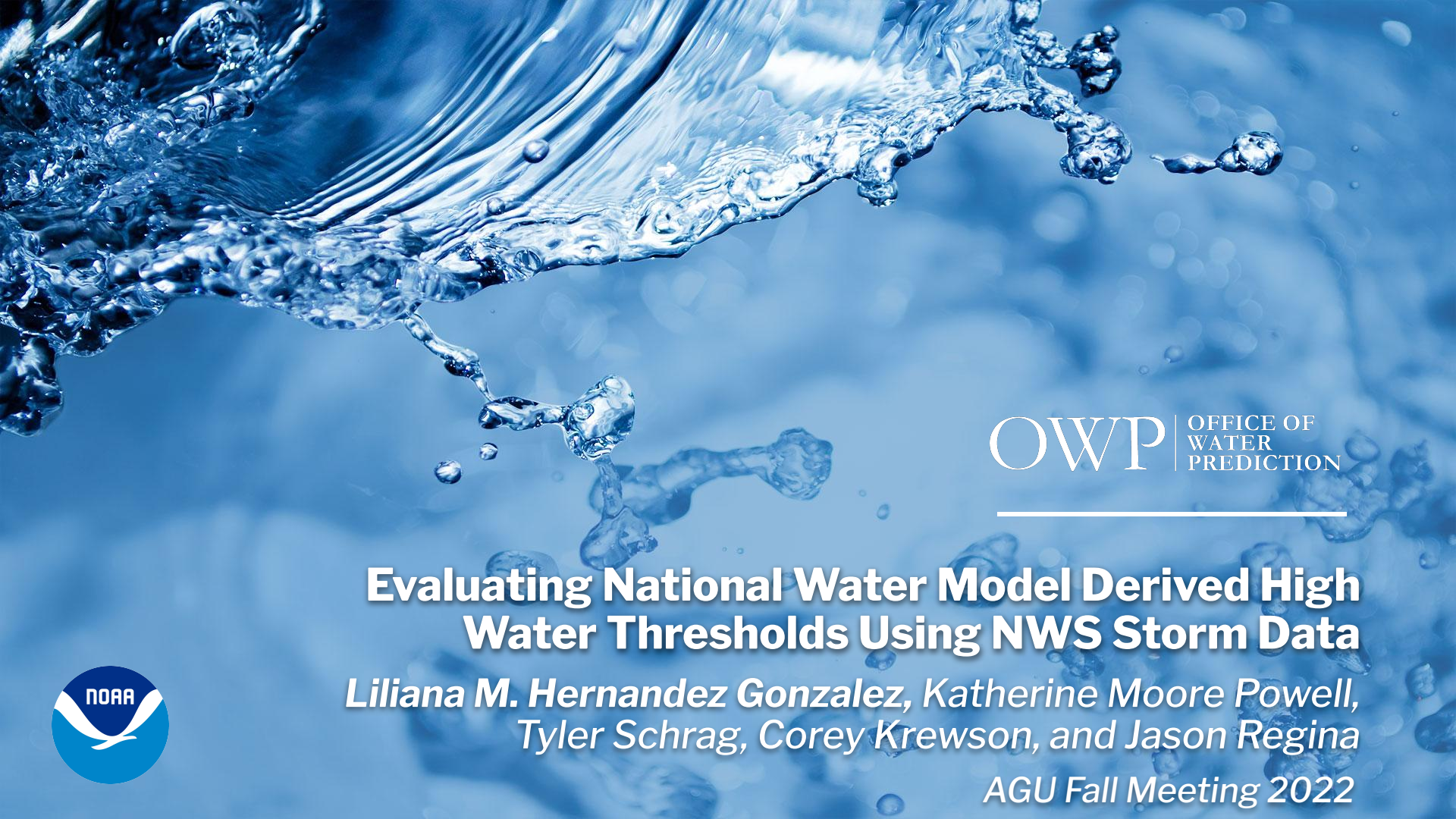


OWP | OFFICE OF WATER PREDICTION

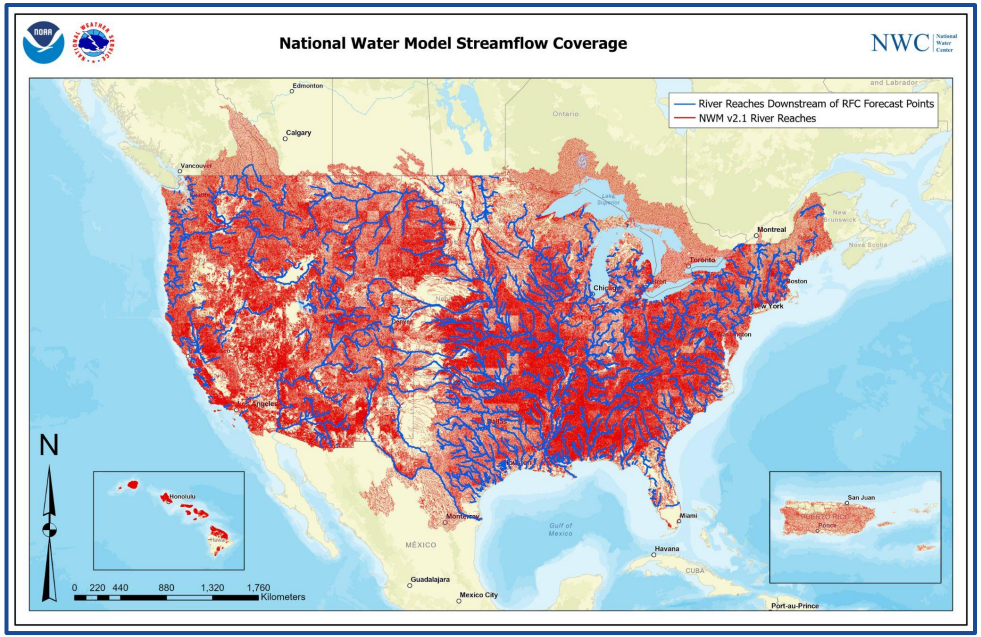
Evaluating National Water Model Derived High Water Thresholds Using NWS Storm Data

Liliana M. Hernandez Gonzalez, *Katherine Moore Powell, Tyler Schrag, Corey Krewson, and Jason Regina*

AGU Fall Meeting 2022

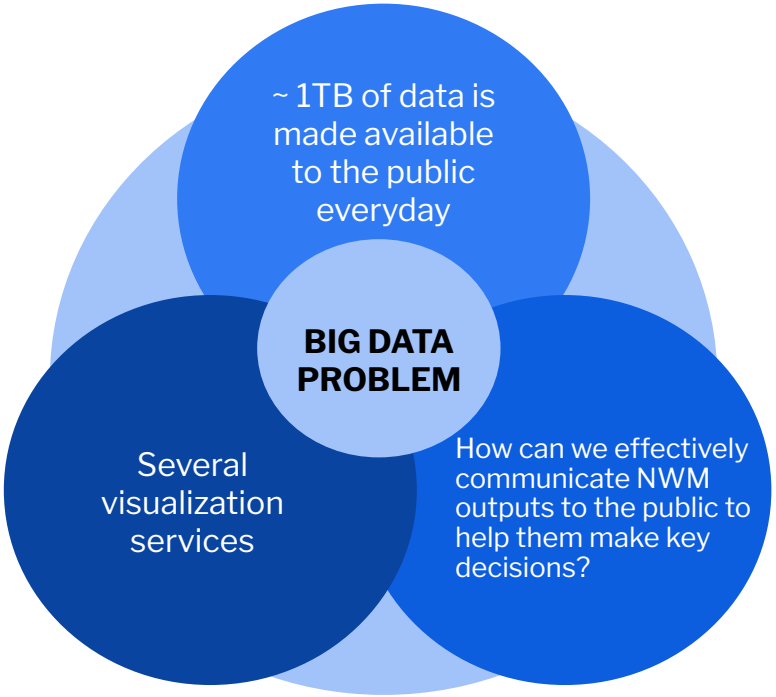
National Water Model (NWM)

The NWM forecasts streamflow along 3.4 million river miles across USA and its territories to minimize flood impacts and provide hydrologic guidance for areas without traditional NWS river forecasts.

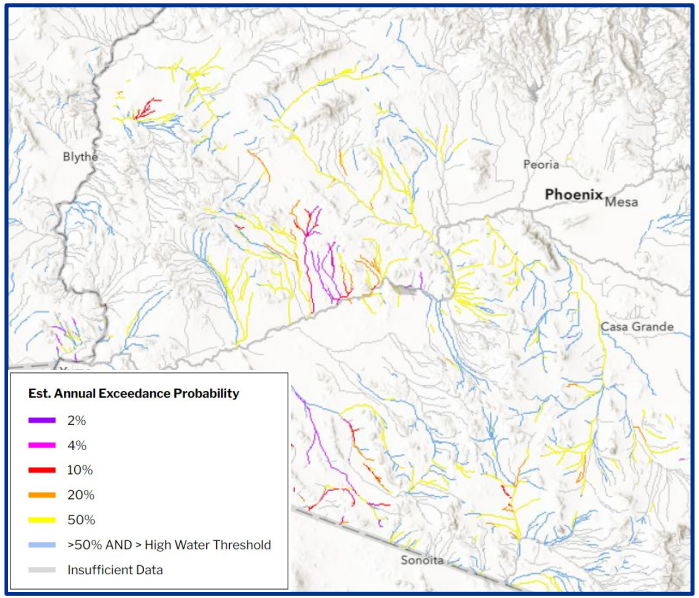


NWS: National Weather Service
RFC: River Forecast Centers

Big Data Problem & High Water Thresholds



Filtering on flows that are greater than or equal to the **"high water" threshold** allows NWM visualization services to focus on areas where there is potential for flooding.

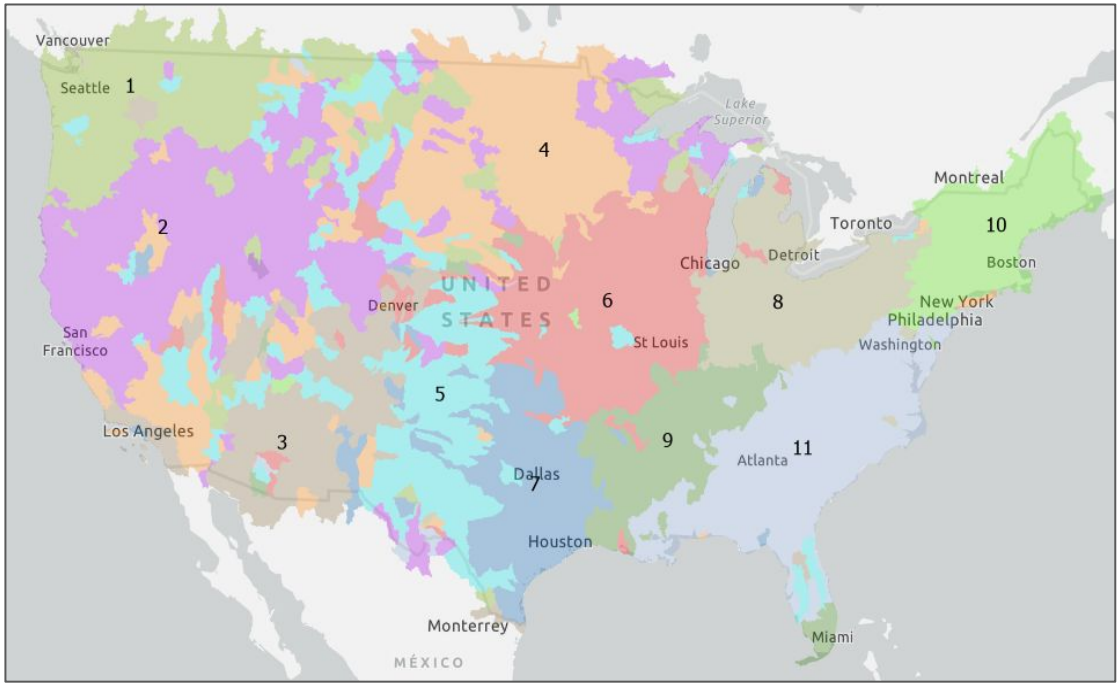


NWM High Flow Magnitude Analysis Service

Deadman Wash	
NWM Feature ID	20376363
USGS HUC6	150702
Valid Time (UTC)	10/27/2022 14:00
Streamflow (cfs)	43.44
Annual Exceed Prob (%)	4
High Water Threshold	8.48
2% Streamflow (cfs)	60.46
4% Streamflow (cfs)	43.38
10% Streamflow (cfs)	27.01
20% Streamflow (cfs)	18.08
50% Streamflow (cfs)	9.36

High Water Thresholds and HUC8 Runoff Clusters

We established “high water” thresholds for **eleven clusters** with similar variability in water-year runoff efficiency across CONUS

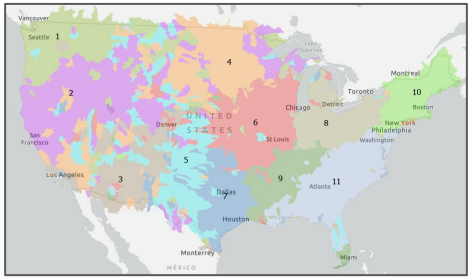


Adapted from McCabe and Wolock, 2016

Cluster	Recurrence Interval (Yr)
1	2.9
2	1.6
3	1.6
4	1.5
5	1.6
6	1.1
7	3.2
8	1.0
9	1.1
10	1.3
11	1.3

HUC8: Hydrologic Unit Code 8; CONUS: Contiguous United States

Computing High Water Thresholds

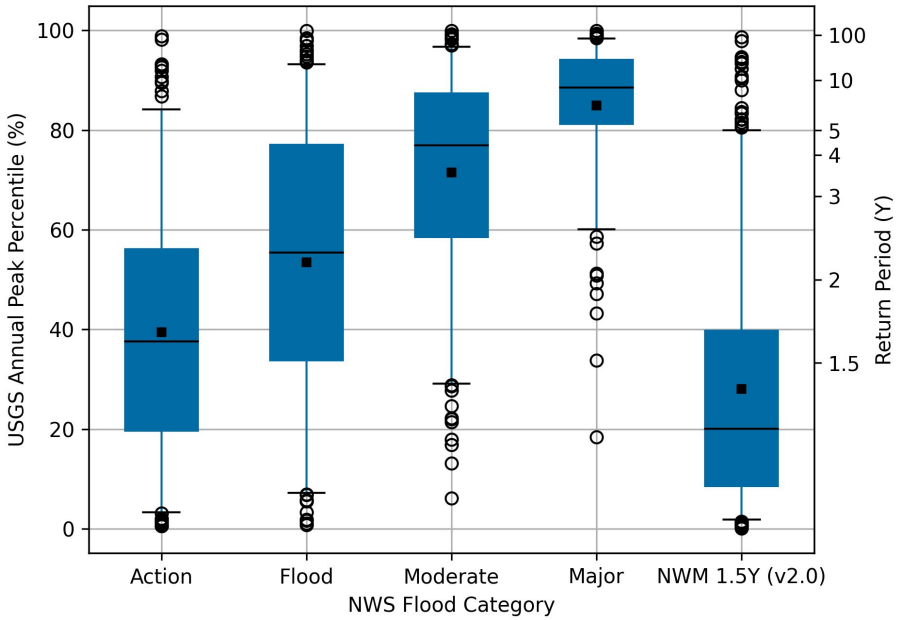


Identified “high water” thresholds from a statistical analysis of peak flow outputs from a NWM 40-year retrospective simulation (1979 - 2019).

Converted NWS “Action” flood stage to an “Action” discharge, which is then converted to a percentile using the empirical distribution of annual peak flows.

Used the median value of NWS “Action” recurrence intervals for all locations in the cluster as starting point to determine the “high water threshold” for that cluster.

Adjusted the “high water thresholds” in some areas based on observations made through several flood events.



Courtesy of Jason Regina

What Datasets Can Be Used to Evaluate the Computed High Water Thresholds?

Storm Data is an observational database and NOAA's **official record** for the occurrence of storms and other significant and high-impact weather events.

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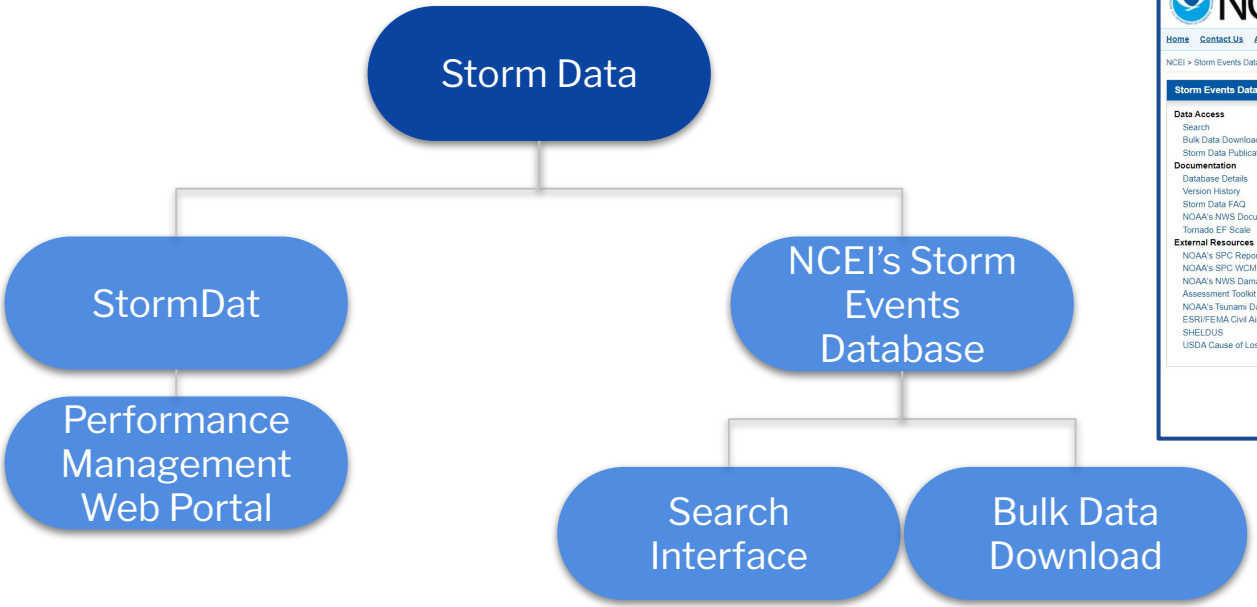
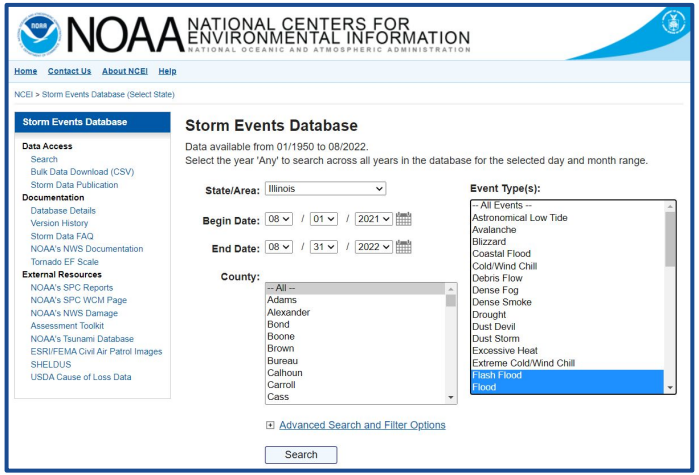
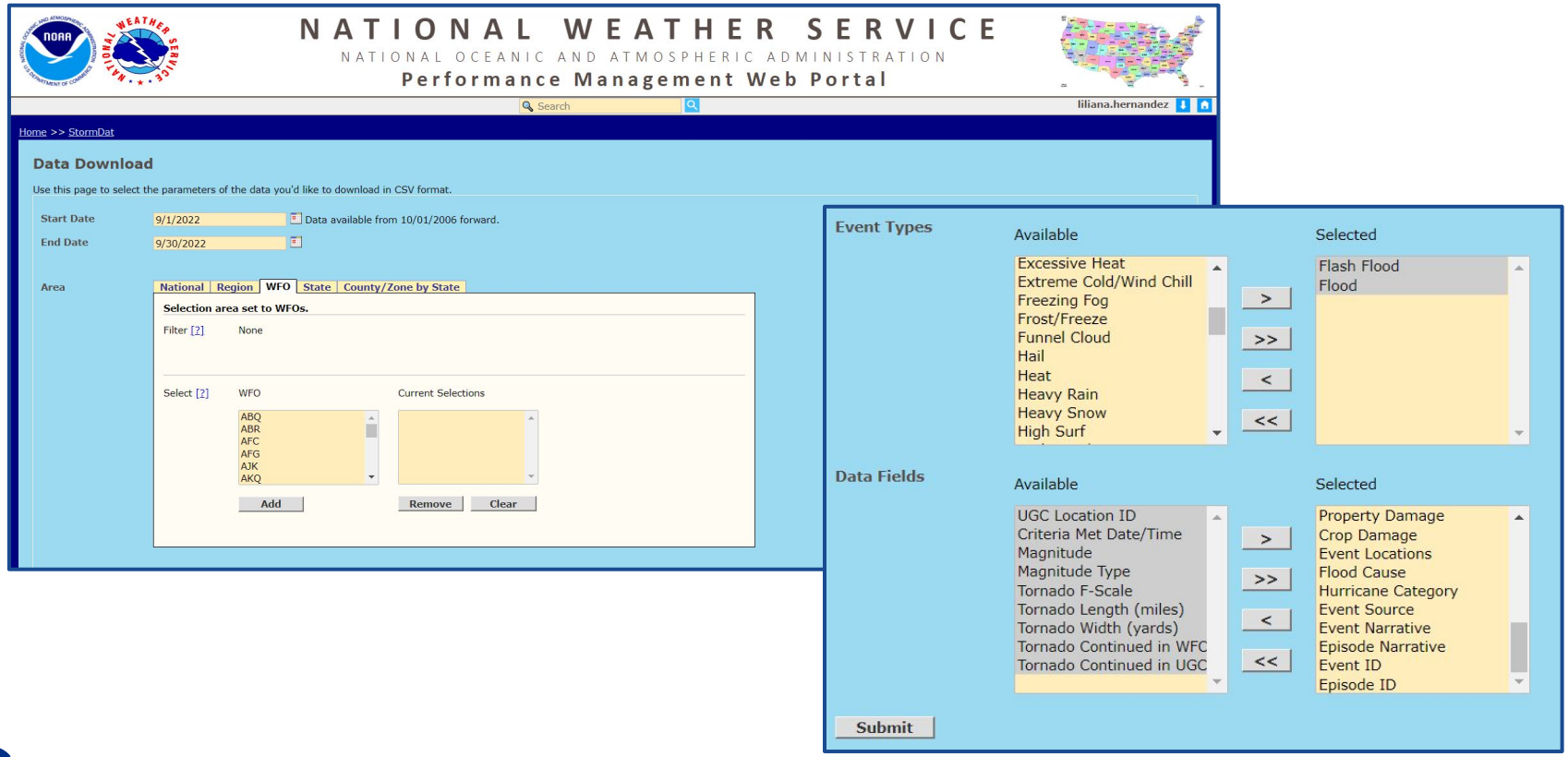




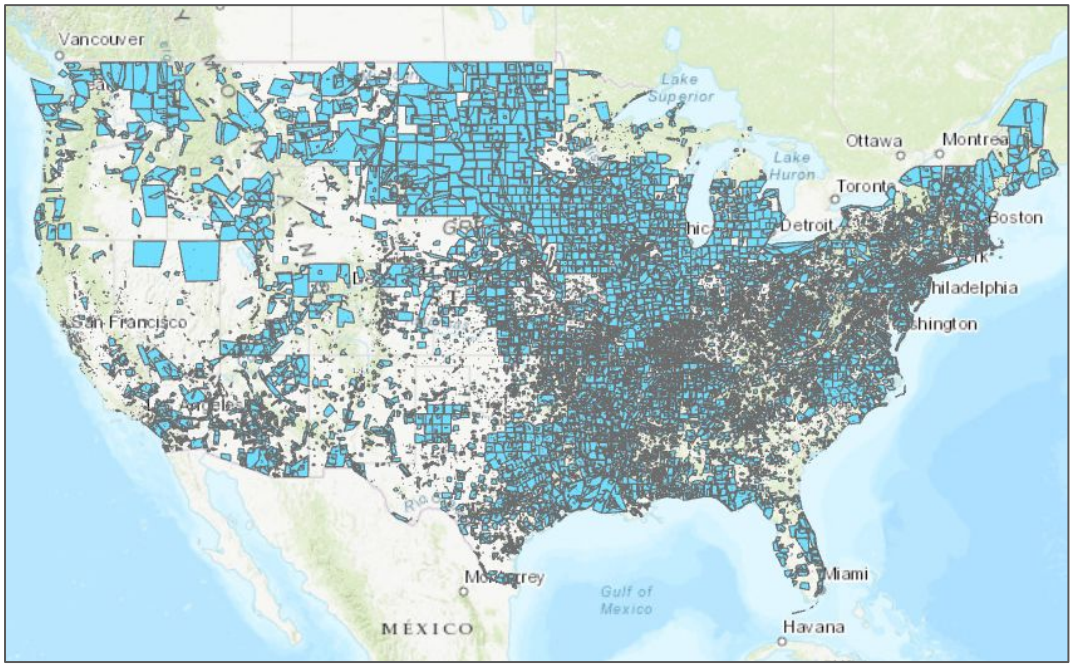
NCEI: National Centers for Environmental Information

How to Download Storm Data?



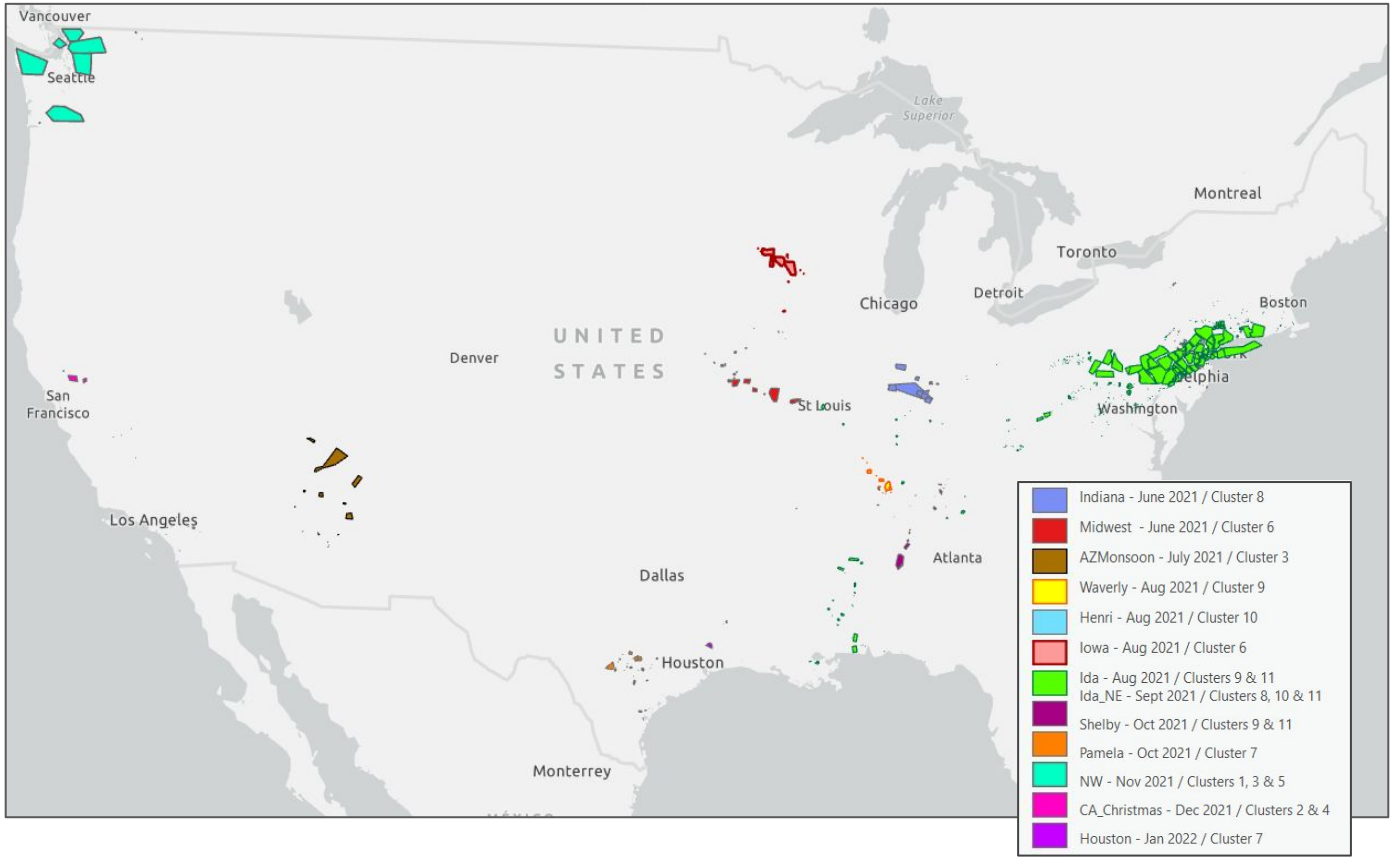
NWS Storm Data

- **StormDat**
  - Period of Record: 1996 to present
- **Years collected for Test Dataset**
  - 2008 - 2022
- **Number of events**
  - >90,000 events!
- **Types of events**
  - flood and flash flood*
- **Attributes**
  - ~40 attributes in total
- **Limitations:**
  - reported Storm Data flooding might be caused by non-riverine flooding

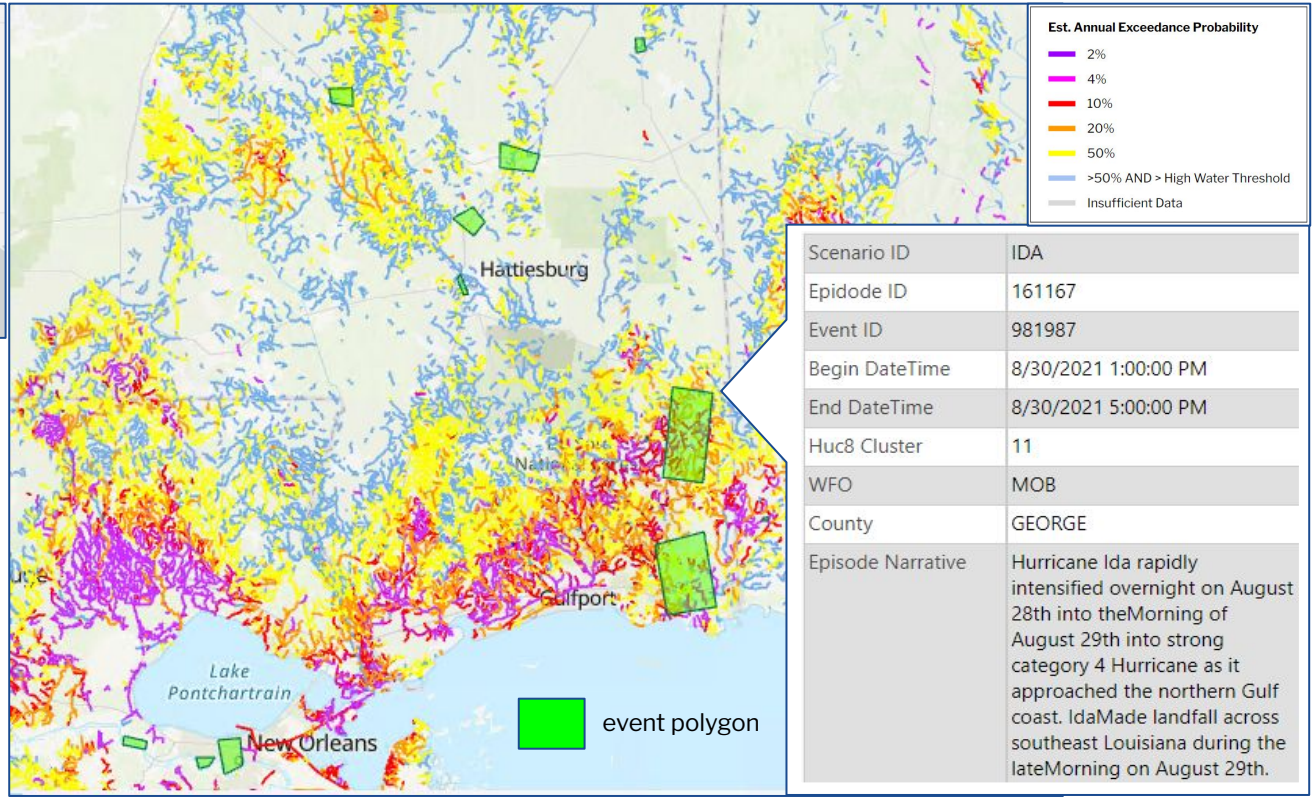


*not including coastal floods

Storm Data Event Polygons for Selected Scenarios (NWM v2.1)



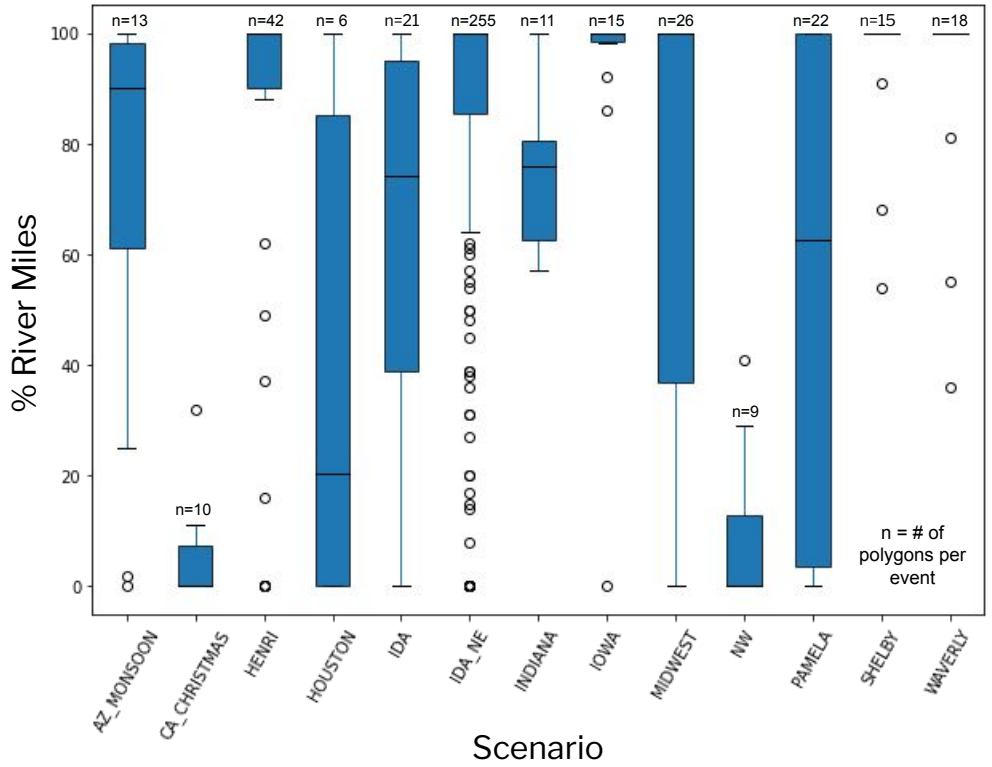
Selected Scenario: Hurricane Ida (8/29 - 8/31/2021)



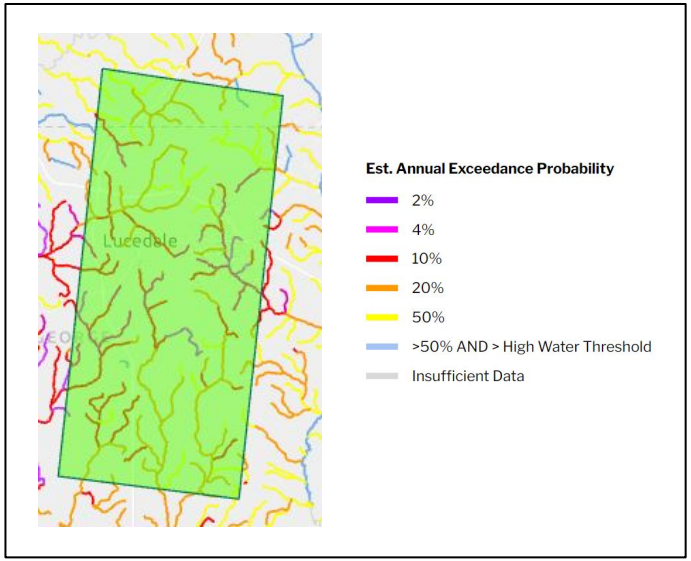
Scenario ID	IDA
Epidode ID	161167
Event ID	981987
Begin DateTime	8/30/2021 1:00:00 PM
End DateTime	8/30/2021 5:00:00 PM
Huc8 Cluster	11
WFO	MOB
County	GEORGE
Episode Narrative	Hurricane Ida rapidly intensified overnight on August 28th into theMorning of August 29th into strong category 4 Hurricane as it approached the northern Gulf coast. IdaMade landfall across southeast Louisiana during the lateMorning on August 29th.

% of River Miles With Streamflows Above High Water Threshold Within Storm Data Polygons

High Flow Magnitude Analysis Service



Hurricane Ida; Event ID: 981987

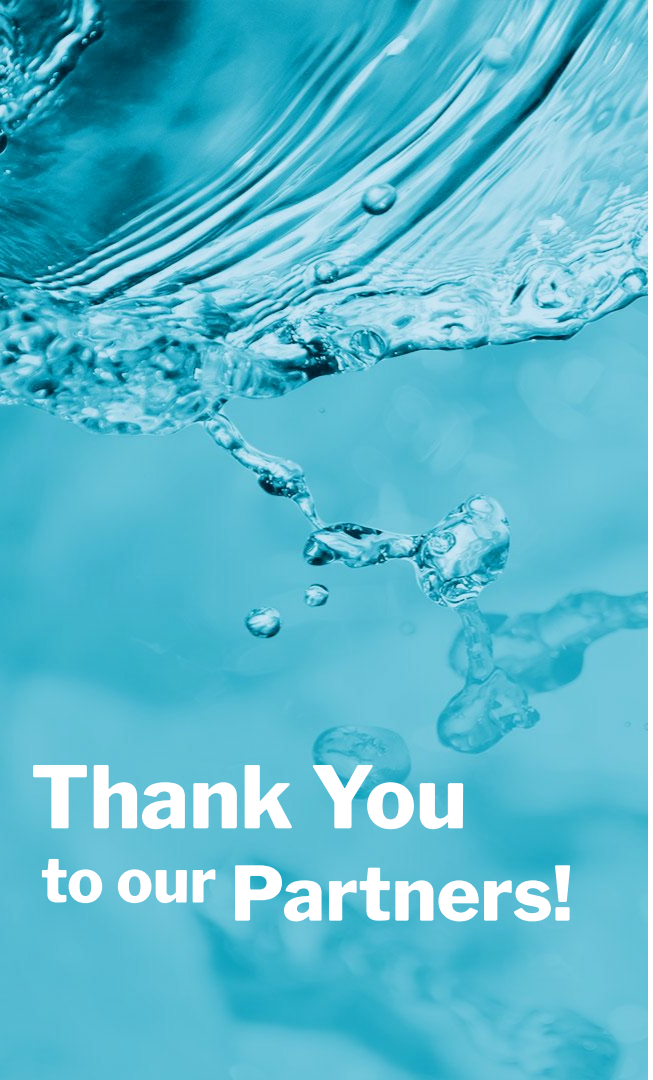


Limitations & Sources of Uncertainty

- polygon generation
- catchment morphology
- stream network derivation

Conclusions & Future Directions

- We provided details on NOAA's Storm Data database and how we are using it in the Geo-Intelligence Division (GID) to evaluate "high water" thresholds.
- Our evaluation of high water thresholds showed that, in general, the visualizations are focusing on areas where flooding was reported.
- Storm Data is the most comprehensive source for flood and flash flood reports and is widely used by the scientific community.
- Storm Data could be used to test visualization services for future releases of the NWM.



Thanks to Trey Flowers, Fernando R. Salas, Lauren Stewart, and Fred Ogden for their feedback. Also, thanks to Graeme Aggett and Lynker for their support.

Lynker

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Thank You!

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