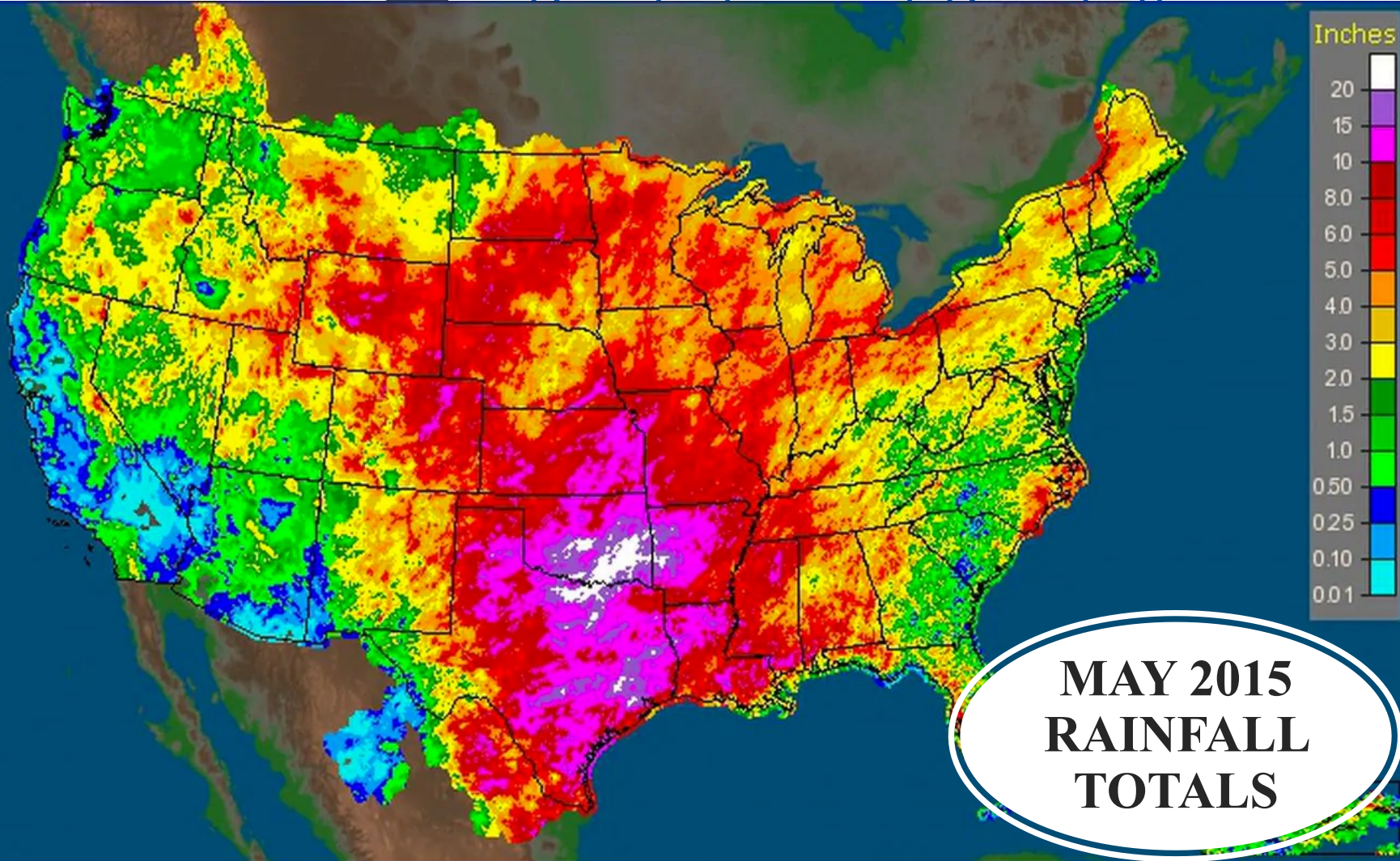


Lessons from the

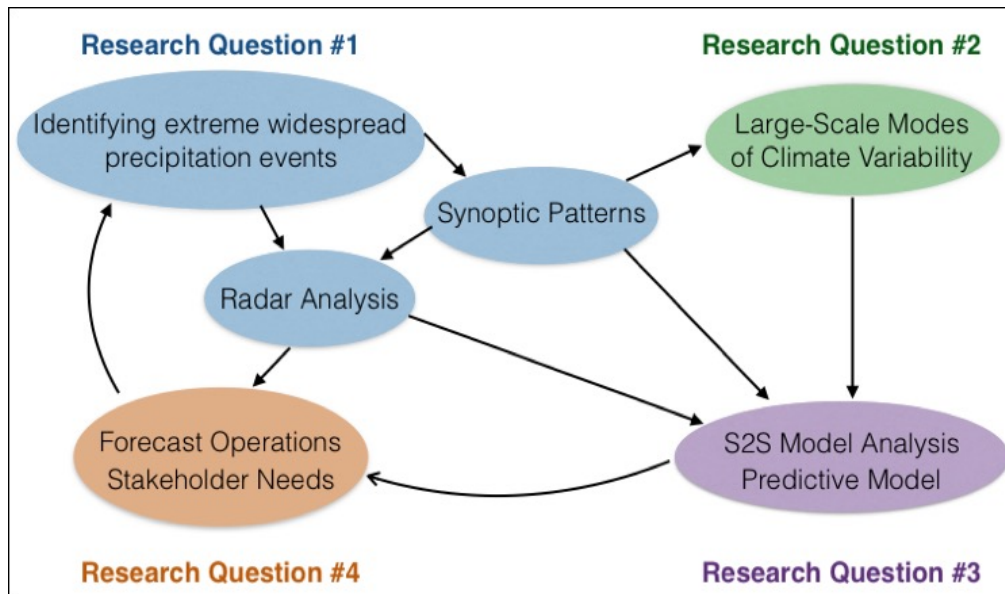
Distribution of Precipitation



<http://meszip.com>

Prediction of Rainfall Extremes at Sub-Seasonal to Seasonal Periods

Improve our capability to predict, and increase resilience to, sub-seasonal to seasonal (S2S; i.e., 14 to 90 days) extreme rainfall events



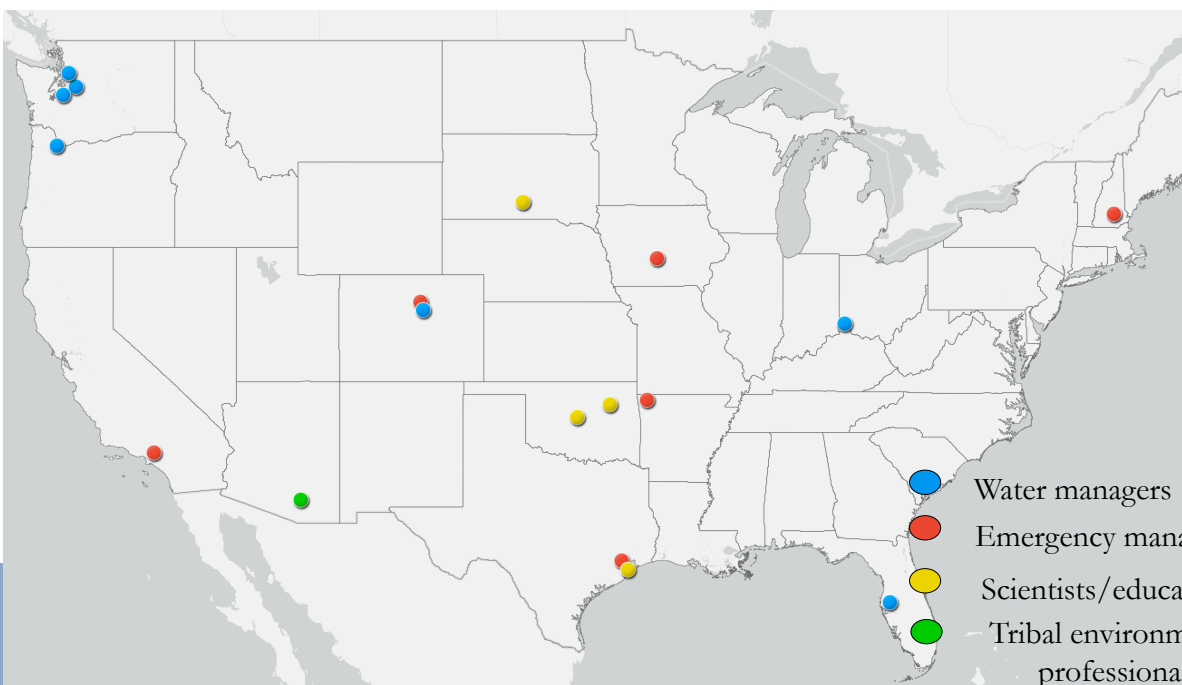
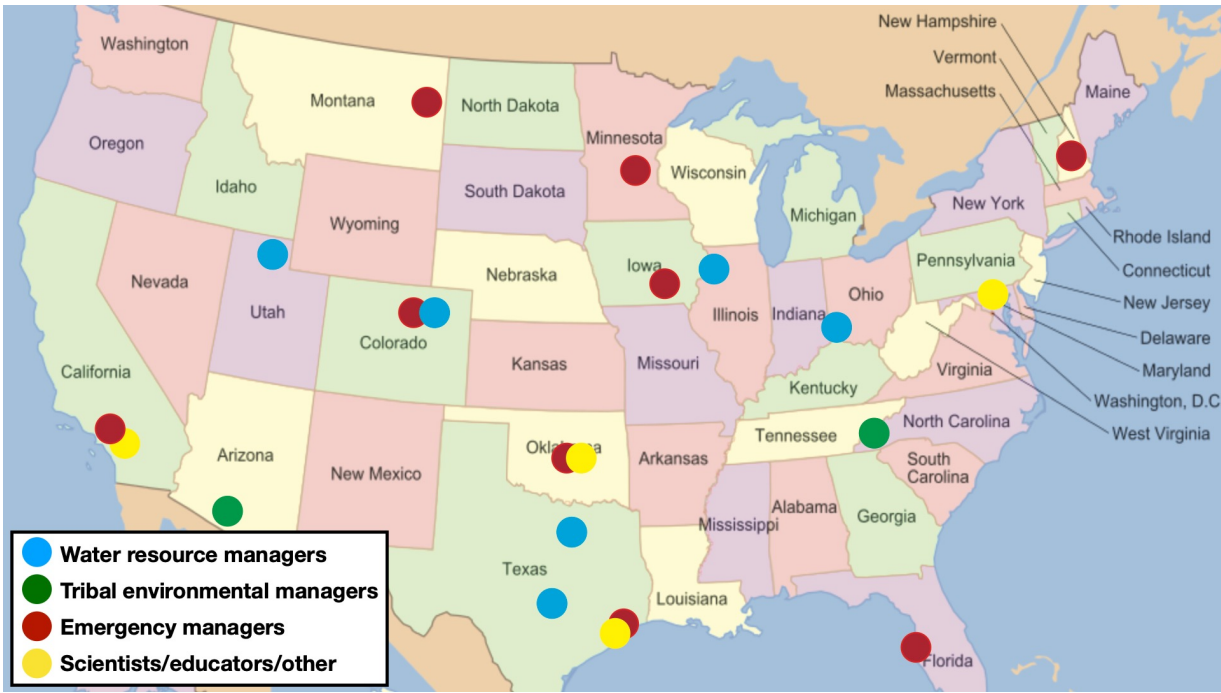
Co-Production of Knowledge

- 2018: Research Priorities Workshop

What characteristics matter most to those who rely on predictions of extreme rainfall?

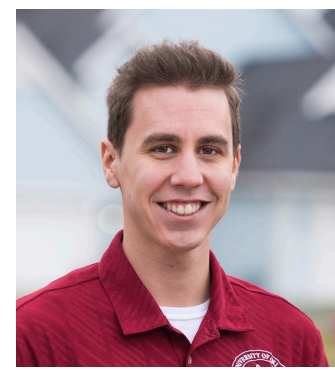
- 2021: “Product Definition” Workshop

Research requires **discussion among researchers, forecasters, & decision makers** to develop usable products

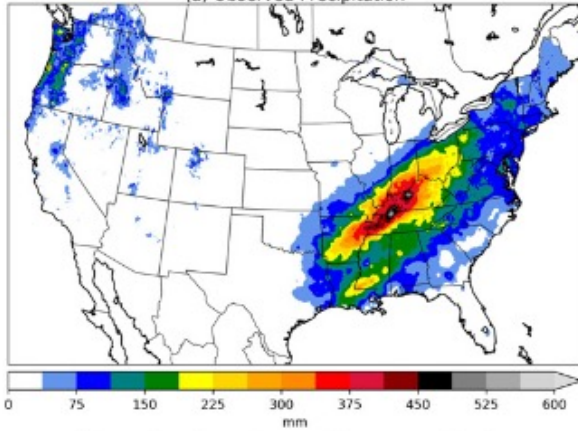


14-day Extreme Precipitation Definition

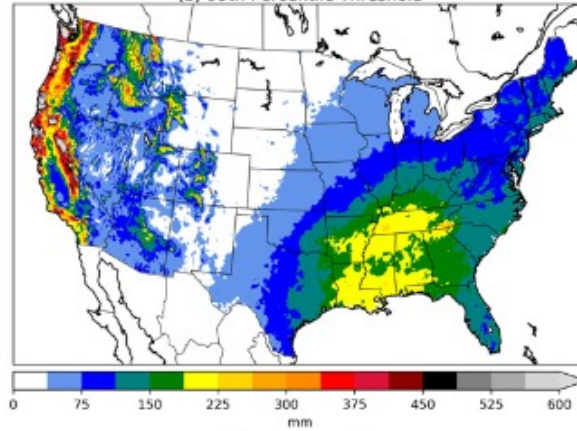
Ty Dickinson



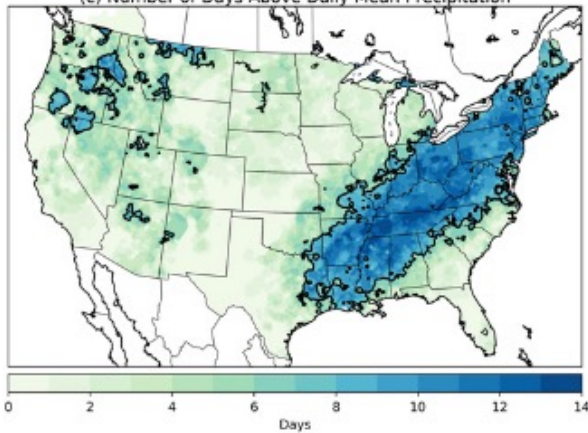
(a) Observed Precipitation



(b) 99th Percentile Threshold



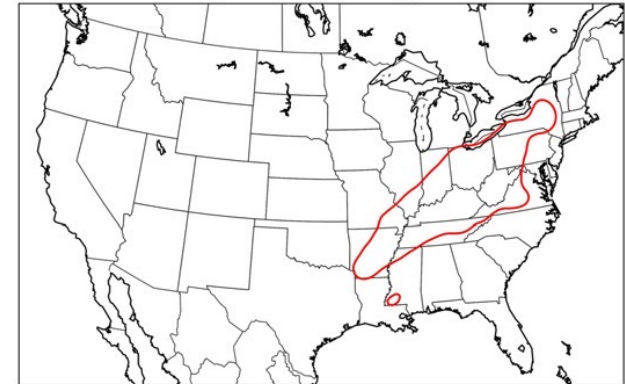
(c) Number of Days Above Daily Mean Precipitation



(d) Extreme Points



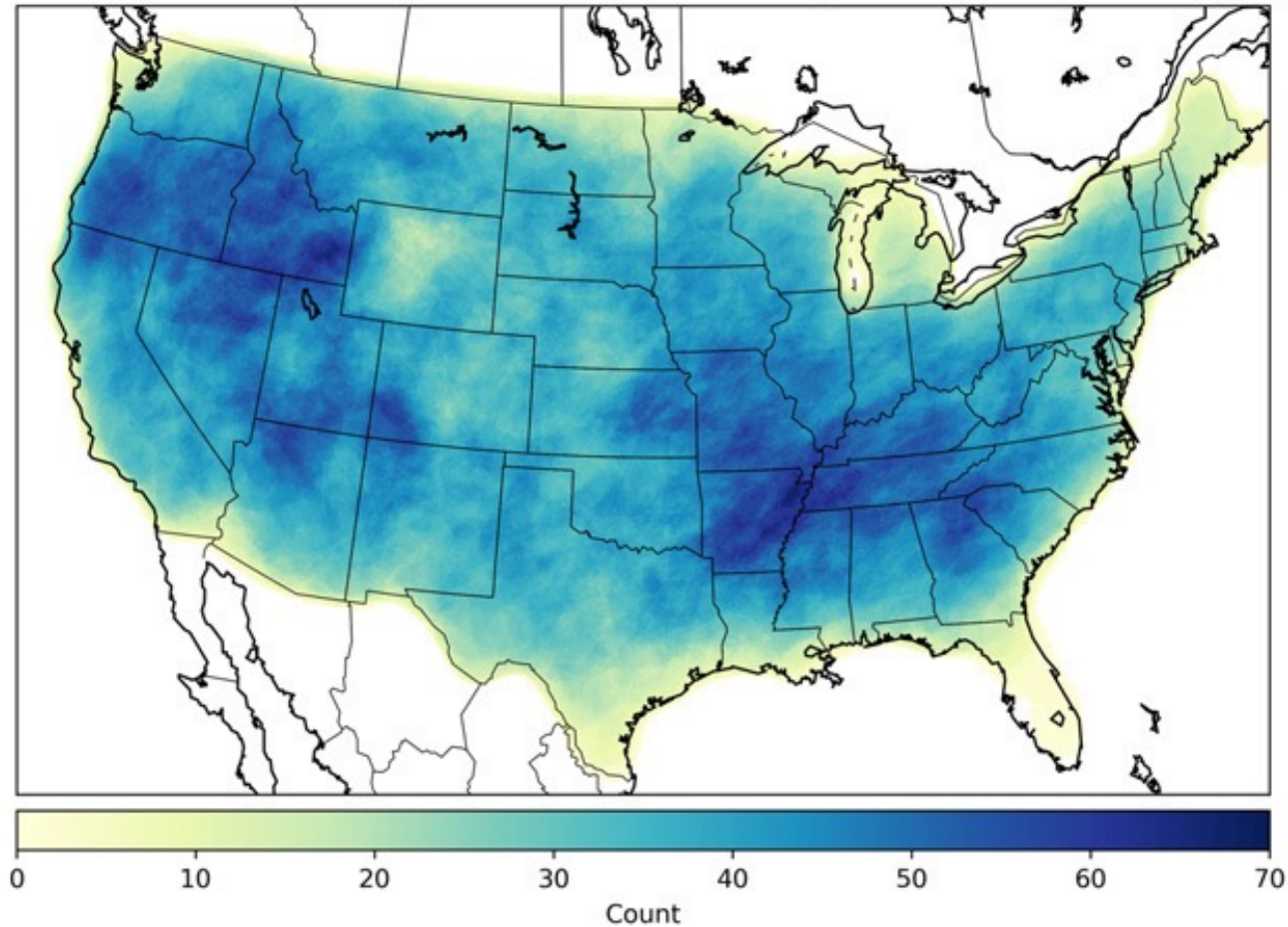
(e) Extreme Event Polygon



An extreme region \rightarrow extreme event if area \geq 200,000 km².

Extreme Periods

Total Number of Times in a 14-Day Extreme Precipitation Event (1915 - 2018)

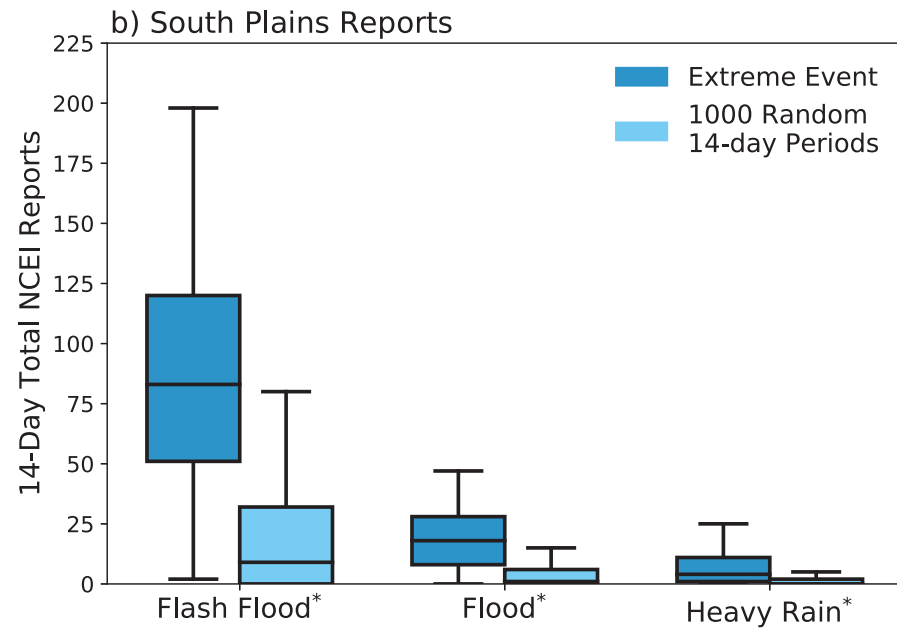
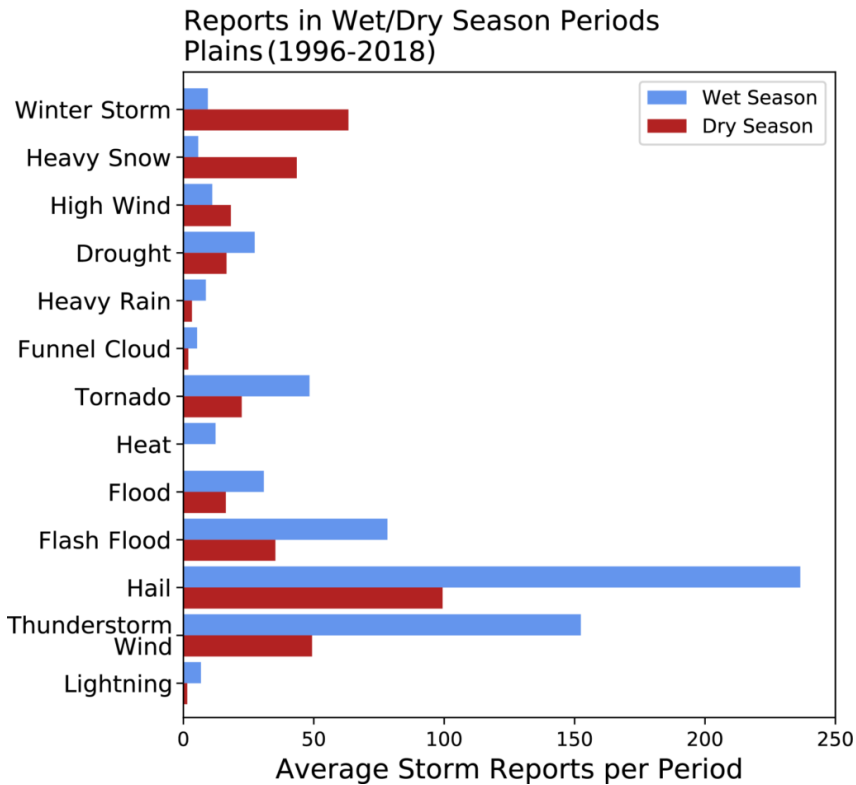


“Extreme rainfall does not equal an extreme event.”

–PRES2iP participant



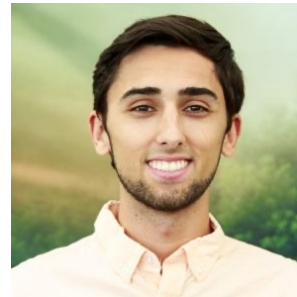
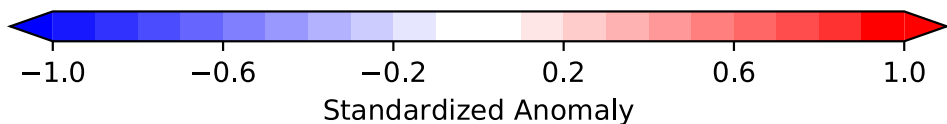
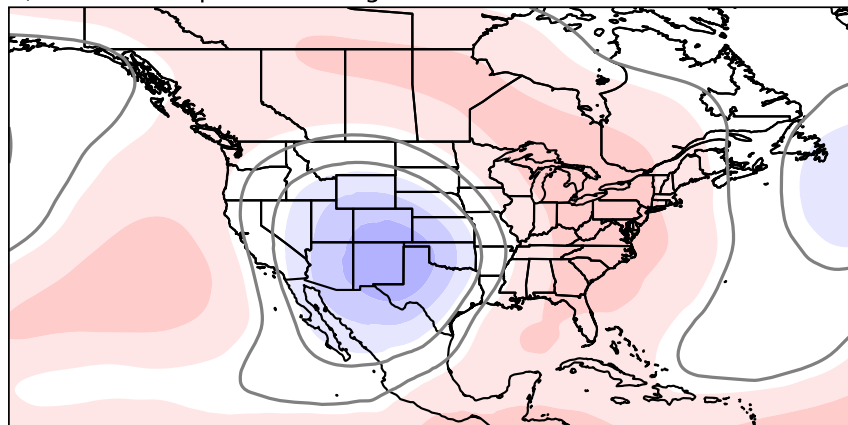
Impacts: NCEI Storm Reports Database



14-day Extreme Period Total Composites

South Plains

South Plains Standardized Anomalies
a) 500hPa Geopotential Height



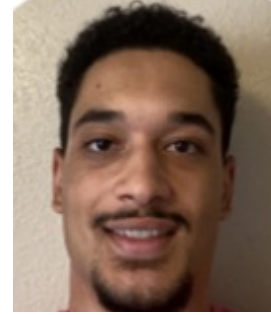
Greg
Jennrich



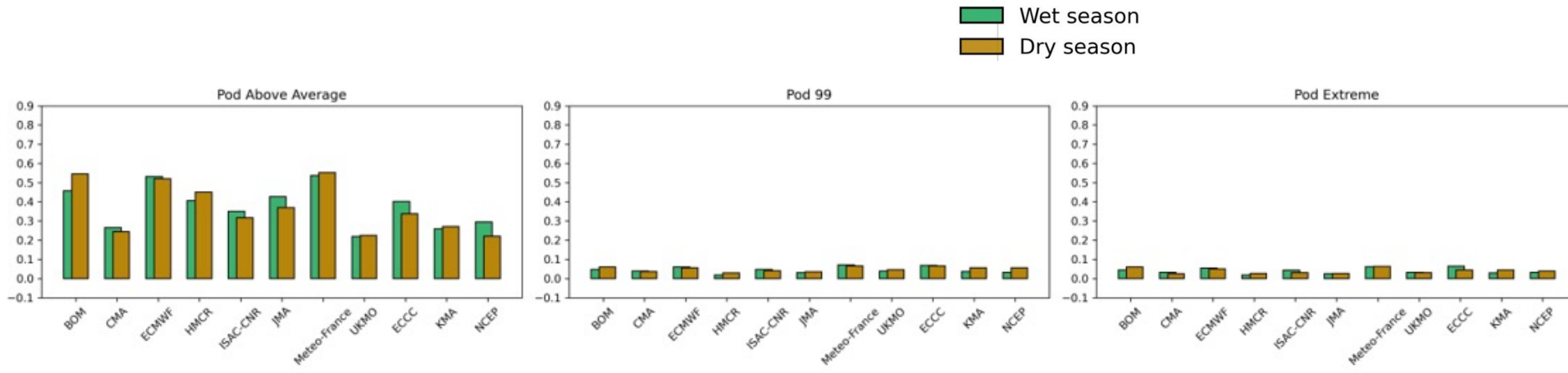
Melanie
Schroers

	similar	dis-similar
	P(event above)	P(event below)
NE	9.7%	3.1%
SE	10.0%	3.9%
GL	13.7%	3.8%
NP	6.6%	1.1%
SP	11.5%	5.1%
MW	11.7%	4.1%
WC	19.9%	3.1%

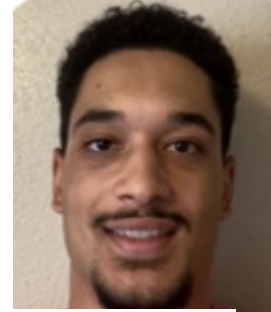
Conditional Probabilities of an period given a similar (above) or dis-similar (below) pattern



Prediction: S2S Models

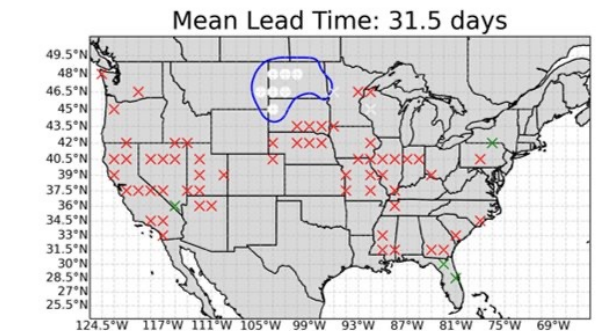
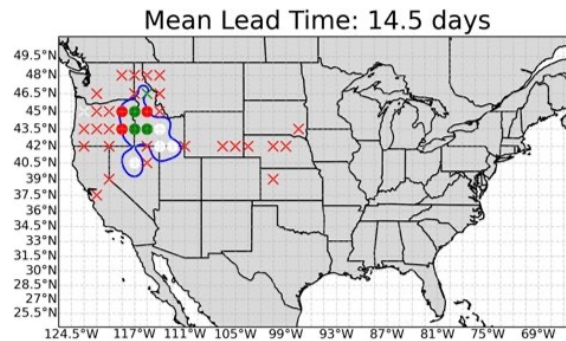
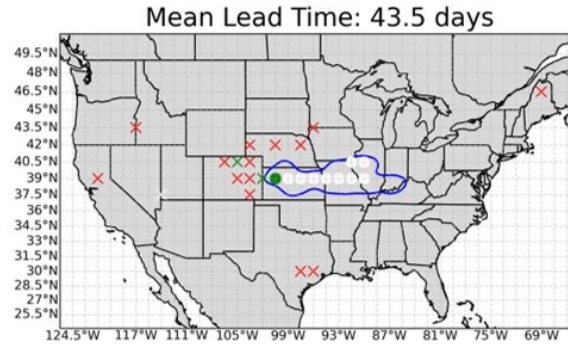


- Analyzed model performance across 185 periods from 1993 to 2012.
- S2S Prediction Project reforecast ensemble has low skill in discriminating extreme grid points in the S2S timescale.



Prediction: S2S Models

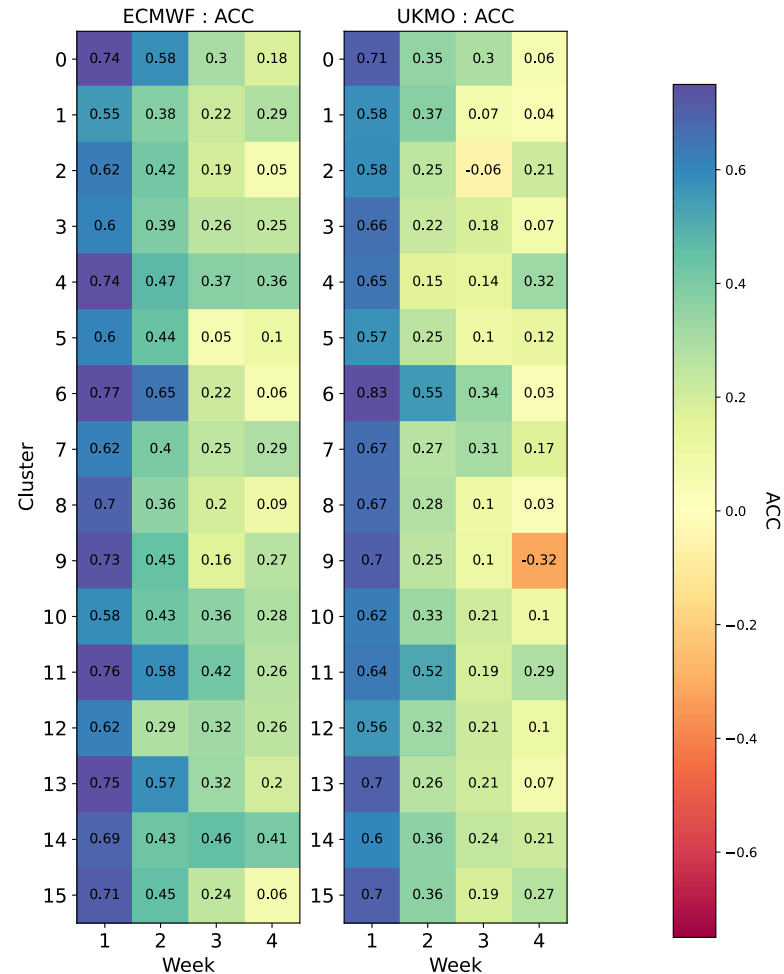
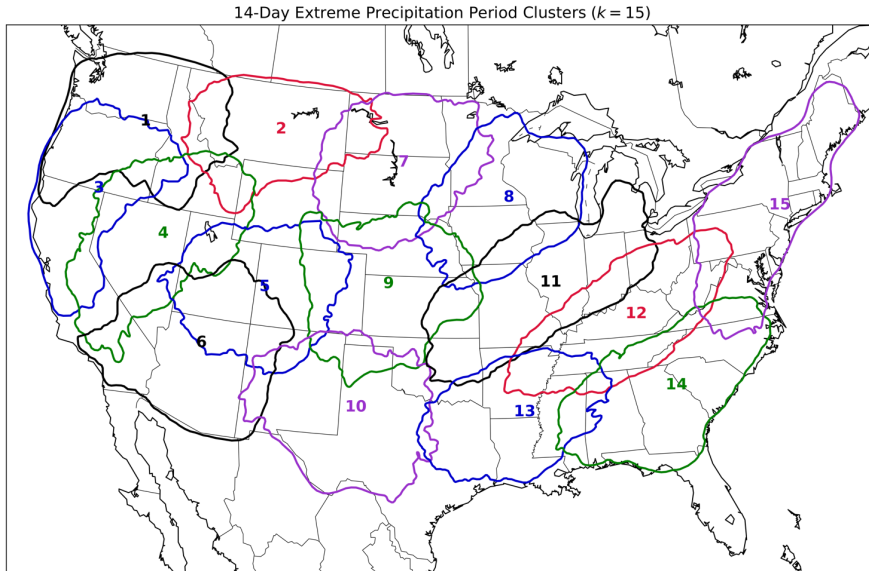
- S2S-range ensemble-mean two-week precipitation is most skillful for periods in western clusters and during meteorological winter.



Green dot = hit
 white dot = miss inside polygon
 Red x = false alarm.
 White x = miss outside polygon

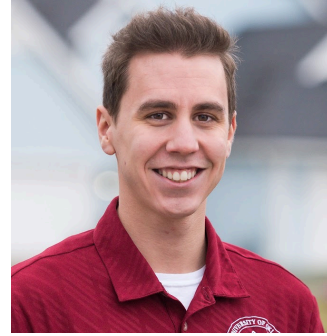


Cluster Based Verification – 500hPa GPH



Skill of GPH is high at week 1, but drops off quickly

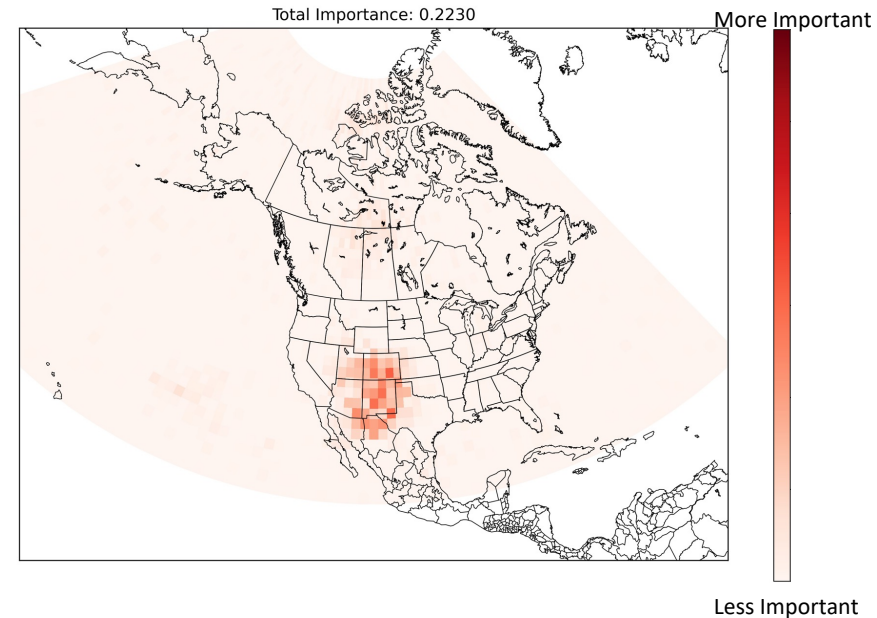
Correlation between skill of precip and heights drops away at Week 2



Prediction: Random Forests

- Random forest (RF) to predict days as being extreme/ not extreme.
- Major difference between hits and false alarms: false alarm days have similar pattern with deeper amplitudes but get position of trough/ridge axis wrong.

Southern Plains Z500 - Gini Importance



“Certainty can be even harder to deal with. If someone is certain that something is not going to happen then it is hard to change their mind.”

–PRES2iP participant

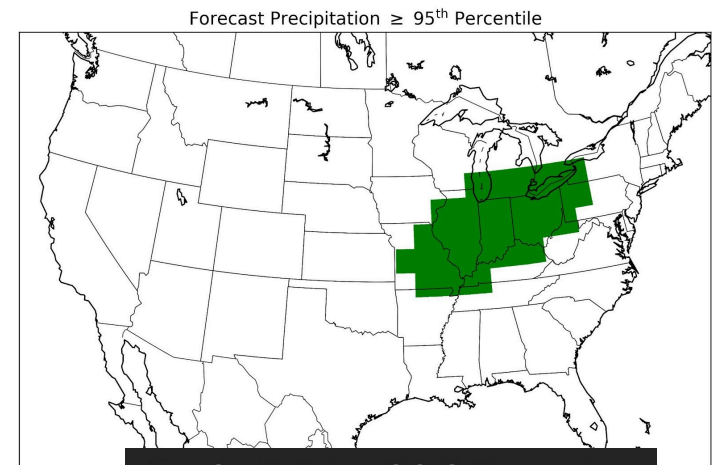


Uncertainty

- Most emergency managers planned for the worst-case scenario & **wanted products that included worst-case predictions**
- Other managers **focused on most-likely scenarios**, but still wanted to know worst-case in case they had to take a more aggressive decision mode

Key Takeaway

- Decision makers not very familiar with S2S time scale but they want to learn and understand



Session 4: Deterministic Forecast

00:00:53 | 1 question | 13 of 15 (86%) participated

1. Would this product cause you to take any actions 7 days before the event? (Single Choice)

13/13 (100%) answered

Yes (8/13) 62%

No (5/13) 38%

“This [workshop] built a huge bridge to help us understand your needs at the same time help you understand our needs.”

”Face to face engagement builds relationship & trust.”

“The Ivory tower opens its doors”

–PRES2iP participants

Take-Home Messages

- Subseasonal-to-seasonal prediction is a big challenge for scientists and stakeholders that crosses multiple spatial scales
- Community Partnerships:
 - Listen
 - Help – but don't dictate – the problem definition
 - Create useable and actionable science
 - Build a community of trust
 - 3rd HWT workshop in 2023

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<http://pres2ip.com/>
[@Pres2ip](#)