

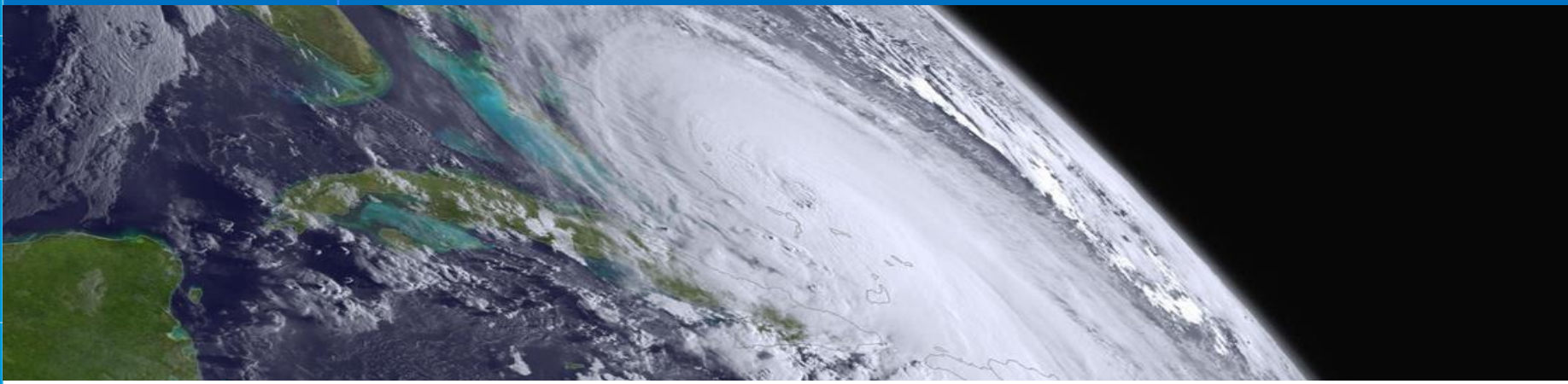
NOAA

**National Weather
Service**

The Next-Generation Local Climate Analysis Tool

Stephen Baxter, Marina Timofeyeva-Livezey,
Jenna Meyers, Michael Churma, and
Margaret Hurwitz

CPASW-CDPW - March 2024, Tallahassee, FL





Take Away Messages



- Experimental Local Climate Analysis Tool v2 (LCATv2) is a new generation LCAT that provides the following:
 - New interface including embedded map with progressive disclosure
 - Faster operating processes
 - Improved interactive “Plotly” graphics and dynamic interpretation statements
 - Added data and analytical methods
 - Added templates for various decision support applications
- LCATv2 features data, methods, templates, and communication support needed for climate sensitive decisions
- Evaluation process is based on social sciences principles and is leading to LCATv2 performance measures

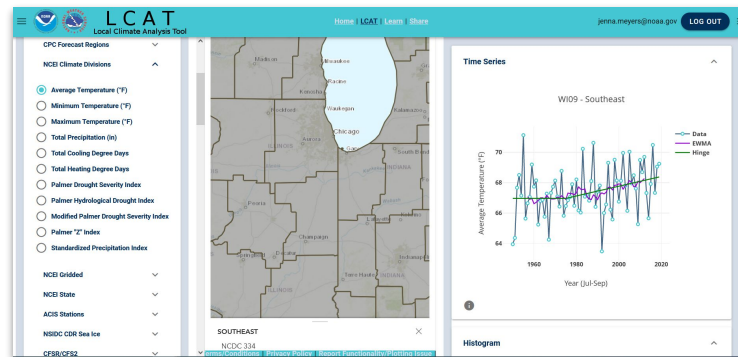




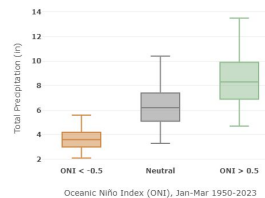
Next Generation LCAT



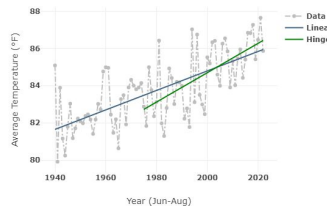
- Provides access to reliable climate data and analysis methods
- Shares best practices for decision support
- Provides data, methods, templates for studies of extreme events, Arctic, coastal challenges, drought, water resources, etc.
- Fosters user applications of climate information
- Retains dynamic interpretation statements and adds dynamic figures
- Allows users to assess the observed rate of climate changes compared to climate variability (signal-to-noise)



FL05 - Everglades and Southwest Co

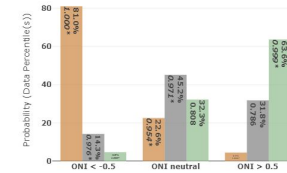


NV04 - Extreme Southern



FL05 - Everglades and Southwest Co

Total Precipitation (in)



Jan-Mar, 1950-2023 (Period of Analysis Climo Ref)
*90% Significance Level (1- α > 0.9)



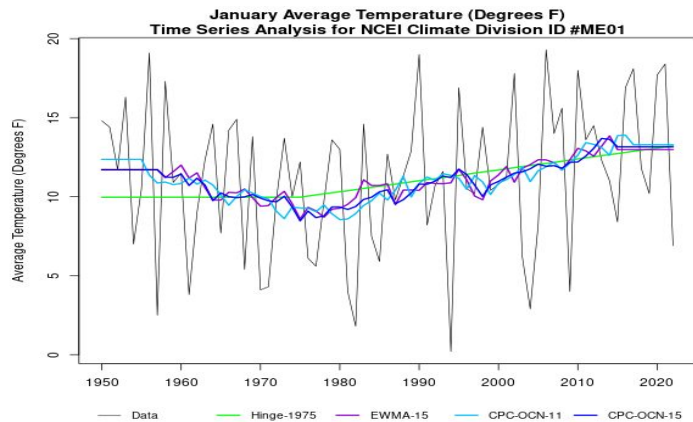
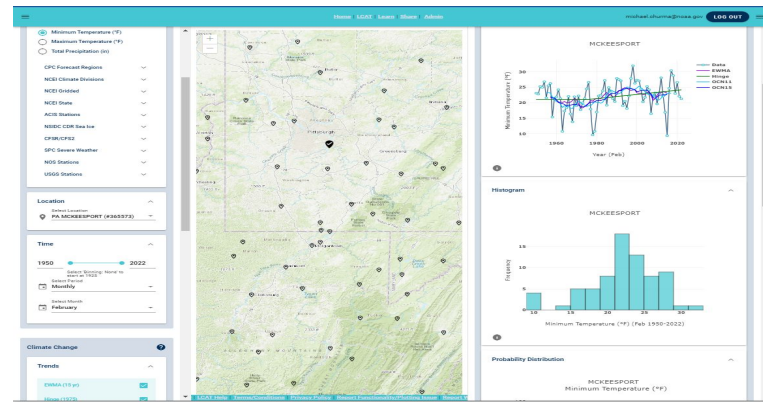
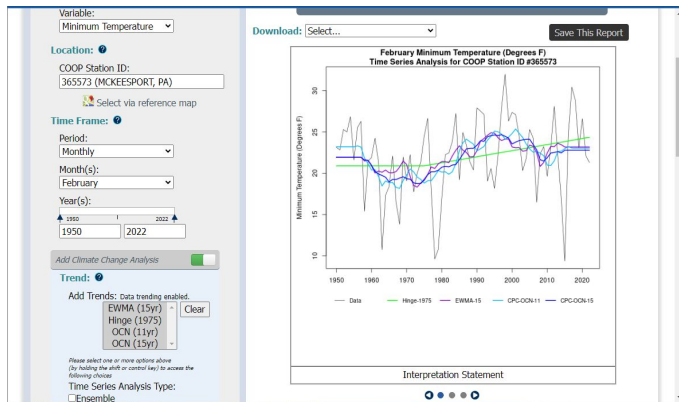
**Experimental
implementation coming
in 2024!**

<https://lcat.nws.noaa.gov>

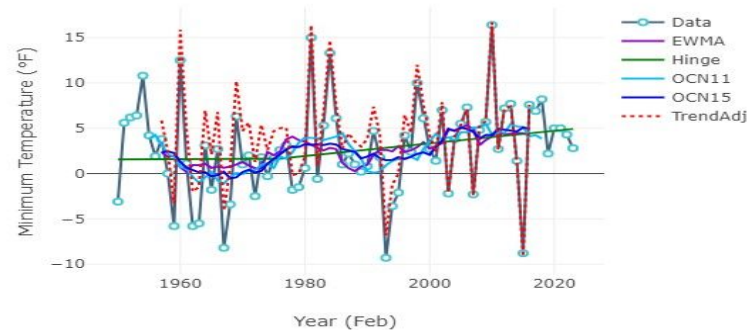




LCATv2 new interface



ME01 - North





LCAT Data

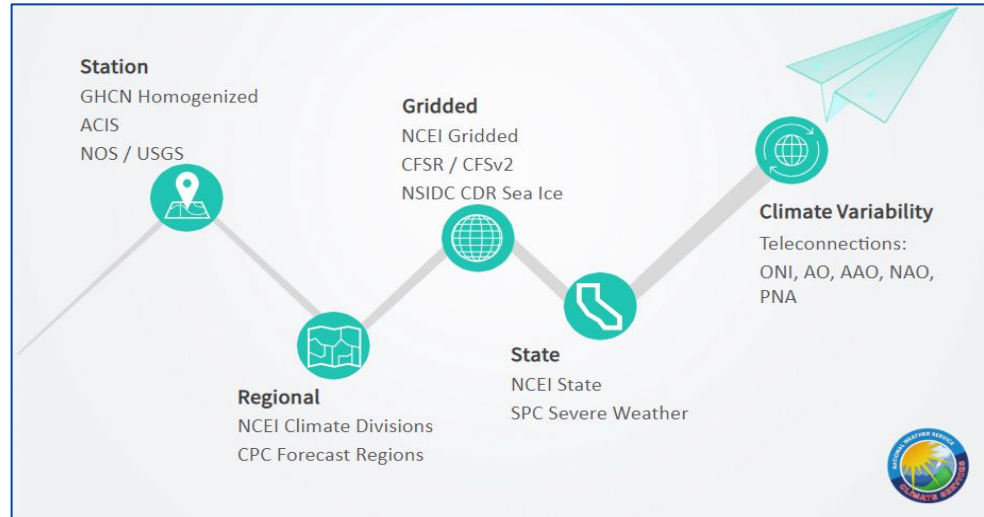


Variables

- Average, maximum, & minimum temperature
- Total precipitation
- Heating & cooling degree days
- Drought indices
- Snow depth & snowfall
- Gridded sea and water variables (sea ice, etc)
- Extremes
- Tornado days & total tornadoes
- Flood days & water levels
- Mean flow rate
- Teleconnection indices
- And many more!



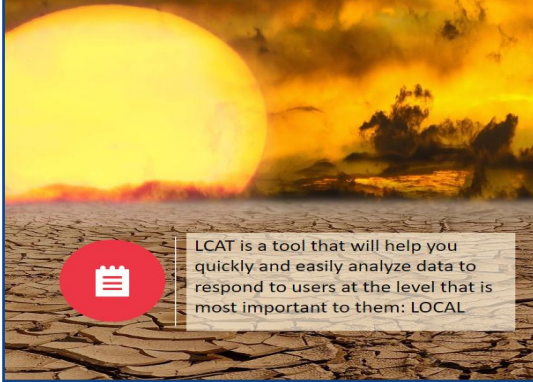
- Environmental variables for decisions related to main climate-sensitive decisions (extremes, water resources, coasts, Arctic, etc.)
- Various spatial options for site-, region-, or state-focused decisions





LCAT Climate Change Studies

Significance of Climate Change Information at Local Level



LCAT is a tool that will help you quickly and easily analyze data to respond to users at the level that is most important to them: LOCAL

Climate Change is not global

- Many resources and reports offer global and/or continental scale information
- Most decisions are made at local level where they are relevant

Local Information is valuable

- Site-specific information for partners
- Sector-based information for agriculture, energy, transportation, etc
- Special interests for coastal, rural, and arctic communities, etc



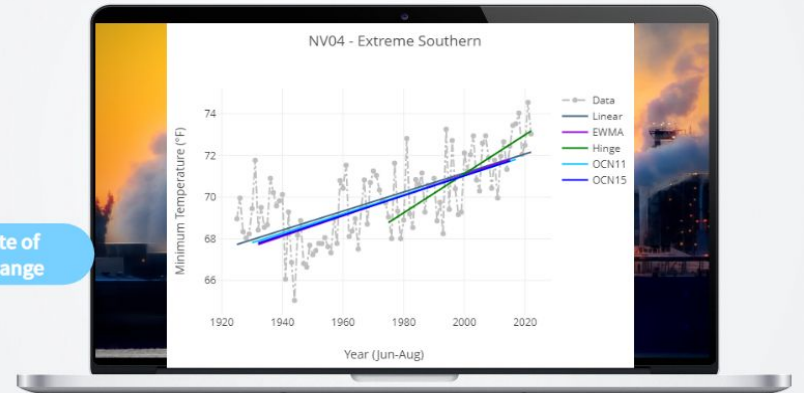
- Using NOAA-recommended trend-fitting methods
- Analysing changes in both data and optimal normals
- Providing dynamic graphics and interpretation statements

Rate of Change Studies

- Time to climate change signal equals or exceeds climate variability
- Trend comparison among different variables using standard normal metrics



Rate of Change



Rate of Change: explains how much is a climate variable changing over a period of time and allows you to understand how fast a change is occurring.





LCAT Climate Variability Studies



Composites Methodology

Composite analysis is a study of **conditional probability** of a climate variable. The condition is the occurrence of a climate variability event (ENSO, NAO, others).

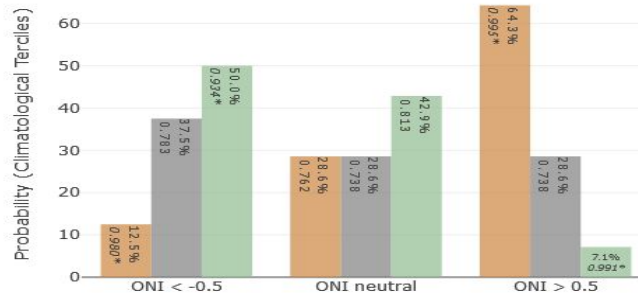
	Powerball	Composite Analysis
Population	30 balls	30 years of observations
Sample	9 balls drawn	9 El Niño years
Event	Outcome of red balls	Above normal observations in El Niño sample
Conditional Probability	Chance of 7 red balls in sample of 9	Chance of 7 above normal years in sample of 9



Existing relationship between ENSO event and local climate alters its PDF

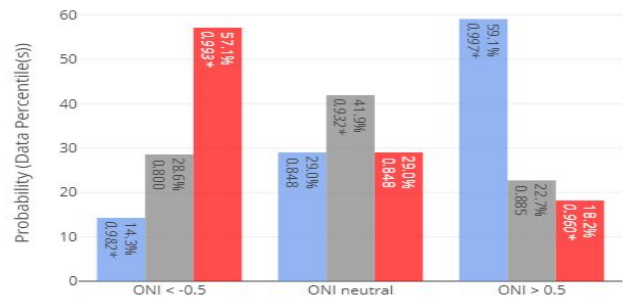


Honolii Stream nr Papaikou, HI
Mean Flow Rate (cubic ft/s)



Dec-Feb, 1979-2022 (Period of Analysis Climo Ref)

GA05 - Central
Maximum Temperature (°F)



Jan-Mar, 1950-2023 (Period of Analysis Climo Ref)
*90% Significance Level (1- α > 0.9)



LCAT Climate Variability Studies

Composites Methodology: Significance Testing

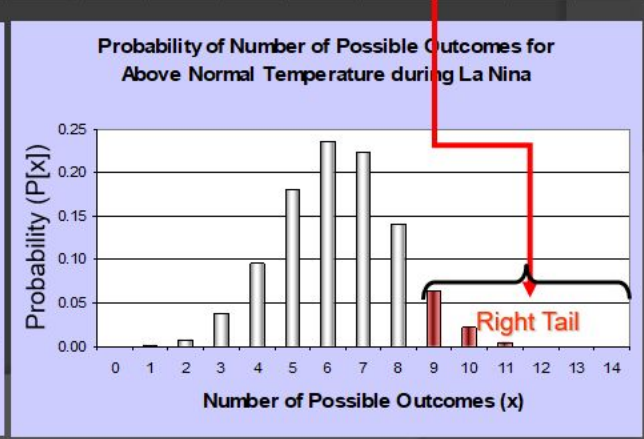
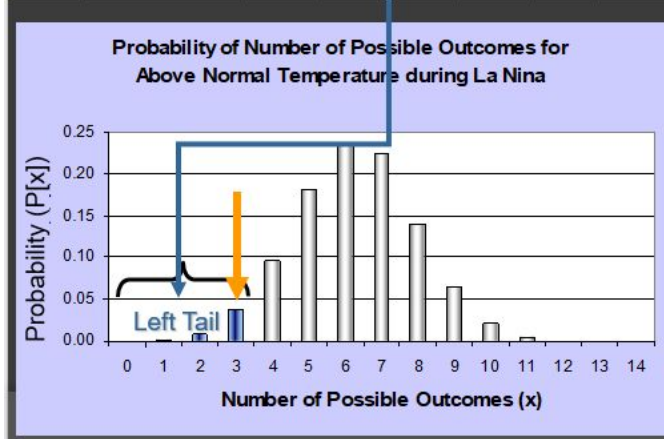
Hyper-geometric Distribution:

- Applies Sampling without replacement from finite population
- Random selection made, decreasing population with each draw - changing probability of success each time

Applied in LCAT Composites

- Identify relationship between CV event and the category
- One-tail test conducted at 90% confidence level for each tail

Outcome of Above	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
LaNina P(x)	0.000	0.001	0.008	0.034	0.095	0.180	0.235	0.224	0.140	0.065	0.018	0.000	0.000	0.000	0.000
Sum(P[x])	0.000	0.001	0.008	0.042	0.138	0.318	0.553	0.777	0.917	0.982	1.000	1.000	1.000	1.000	1.000
1-Sum(P[x-1])	1.000	1.000	0.999	0.992	0.958	0.863	0.682	0.447	0.223	0.083	0.018	0.000	0.000	0.000	0.000



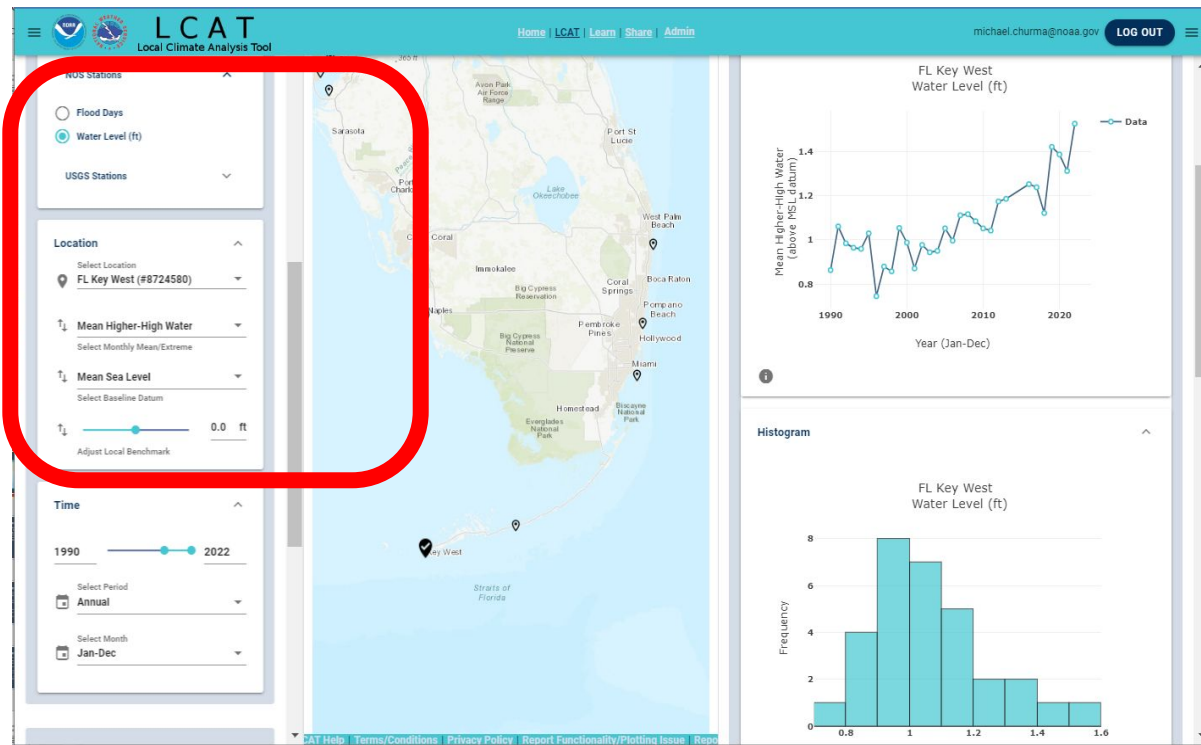


LCAT2 Features – NOS Gages



National Ocean Service gages

- Flood Days and Water Level
- Datum selections
- “Benchmark” slide bar to allow users to set water levels for local benchmarks
- Using API from [NOAA Tides and Currents](#)





LCAT2 Features – USGS Stream Gages



- USGS Stream Gage Monthly Mean Flow Rate incorporated into LCAT-2.
- Hydro-Climatic Data Network (HDCN) gages with unimpaired long climatological data

The screenshot displays the LCAT2 (Local Climate Analysis Tool) interface. On the left, the 'Climate Variables' panel is open, and 'USGS Stations' is selected. Under 'USGS Stations', the option 'Mean Flow Rate (cubic ft/s)' is highlighted with a red circle. Below this, the 'Location' is set to 'PA Monongahela River at Elizal' and the 'Time' range is from 1970 to 2020. The central map shows the Monongahela River basin in Pennsylvania. On the right, the 'Analysis Results' section shows a 'Time Series' graph for 'Monongahela River at Elizabeth, PA'. The graph plots 'Mean Flow Rate (cubic ft/s)' on the y-axis (ranging from 5k to 25k) against 'Year (Apr)' on the x-axis (ranging from 1980 to 2020). Three data series are shown: 'Data' (light blue line with markers), 'EWMA' (purple line), and 'OCN15' (dark blue line). A 'Histogram' section is visible below the graph.





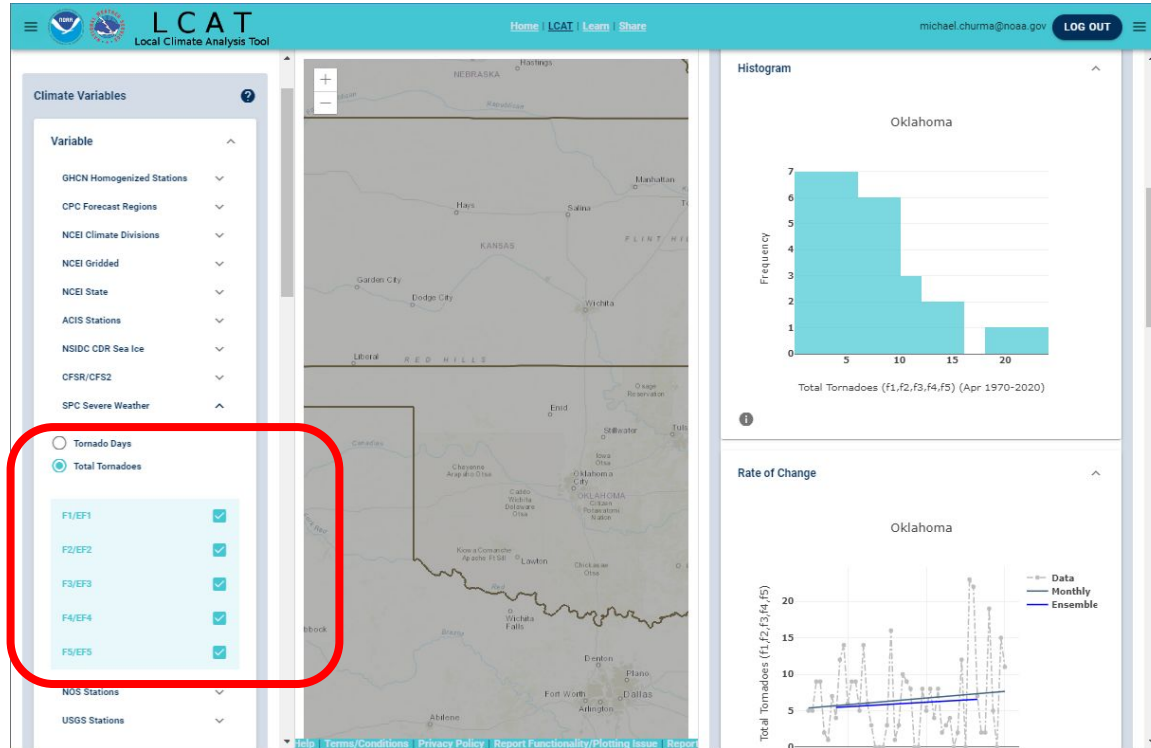
LCAT2 Features: SPC Tornado Record



Storm Prediction Center's tornado data set in LCAT-2 will allow users to analyze monthly tornado data state by state



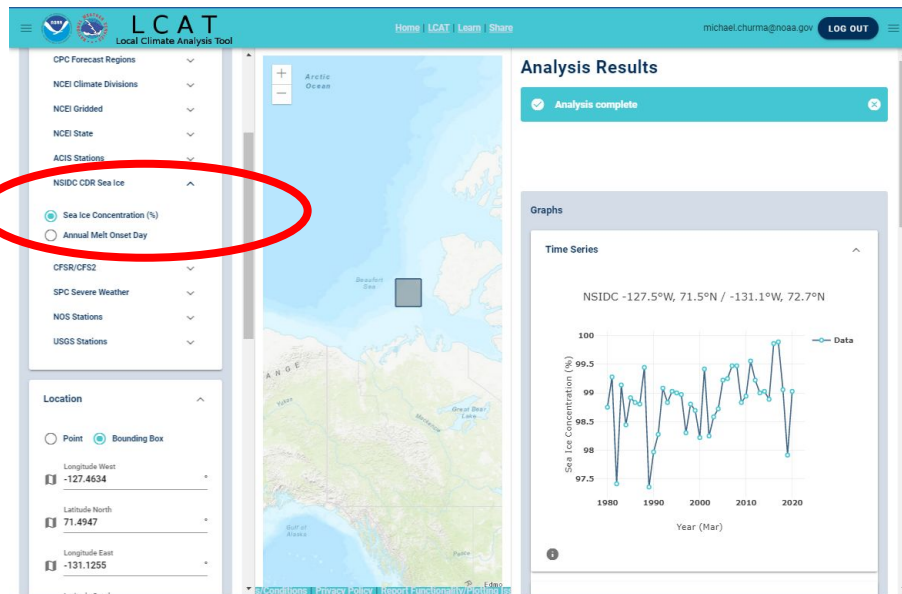
- Selectable by F/EF Scale and by State.
- F0/EF0 tornadoes not included to prevent false signal (i.e., more detections, not necessarily more tornadoes)



LCAT2 Features: Arctic Studies

NOAA National Snow and Ice Data Center Sea Ice Climate Data Record

- Concentration
- Annual Melt Onset Day
- Point or bounding box
- Augments CFSR/CFSv2 Sea Ice capabilities





LCAT2 Features - IDSS Presets



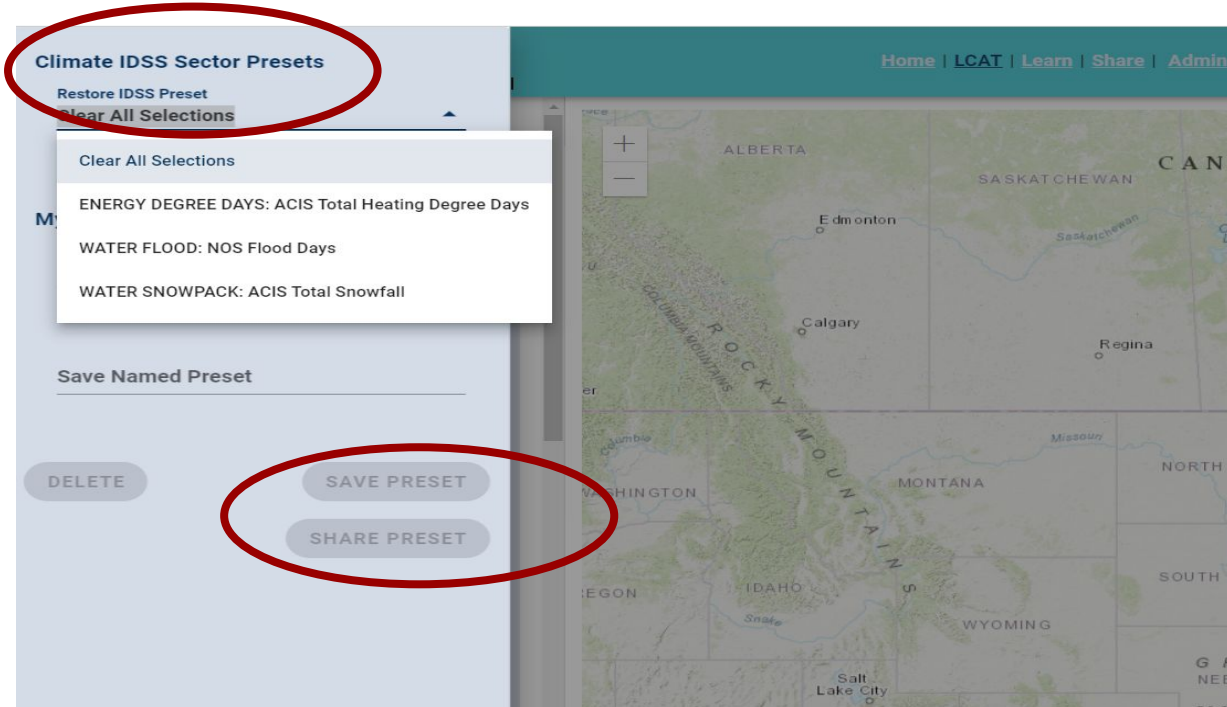
- Library of presets that will enable users to import detailed examples of LCAT applications relevant for IDSS delivery



- Process to submit examples to this library to share with all users



- Database that details the use cases, including a description of the decision support scenario and interpretation





LCATv2 Answers Important Questions



- LCAT plays a critical role in our [ENSO Communication Campaign](#):
 - What impact does ENSO have on the local climate? Is it statistically significant?
 - What impact does ENSO have on climate variables beyond average temperature and total precipitation? Examples: Coastal flood events; Tornado counts/days; Extremes
- What climatological guidance can I offer to my customers, especially when the NWS official forecast is calling for “Equal Chances”?
- How do leading teleconnection patterns related to monthly and seasonal climate variability in the local area?
- What are the long-term trends that have been observed?
- How do trends in extremes compare to trends in the mean?





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