Texas Drought Issues and Nonstationarity

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https://climatexas.tamu.edu
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Chacterizing and Analyzing Drought

- Severity?
- Rarity?

Chacterizing and Analyzing Drought

- Severity
  - Impact magnitude?
  - Impact relative magnitude?
- Rarity

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  - Historical return frequency?
  - Expected present-day return frequency?

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- The US Drought Monitor says:
  - "The U.S. Drought Monitor (USDM) is a map released every Thursday, showing where drought is and **how bad it is** across the U.S. and its territories."

Source: https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx

Chacterizing and Analyzing Drought

- The US Drought Monitor says:

Category	Description	Example Percentile Range for Most Indicators
None	Normal or wet conditions	30.01 or Above
D0	Abnormally Dry	20.01 to 30.00
D1	Moderate Drought	10.01 to 20.00
D2	Severe Drought	5.01 to 10.00
D3	Extreme Drought	2.01 to 5.00
D4	Exceptional Drought	0.00 to 2.00

- Rarity
  - Historical return frequency?
  - Expected present-day return frequency?

Source: https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx

While you're at it, please fix this!

Category	Description	Example Percentile Range for Most Indicators	Values for Standard Precipitation Index and Standardized Precipitation-Evapotranspiration Index
None	Normal or wet conditions	30.01 or Above	~~-0.49 or above~~ **-0.52 or above**
D0	Abnormally Dry	20.01 to 30.00	~~-0.5 to -0.79~~ **-0.53 to -0.84**
D1	Moderate Drought	10.01 to 20.00	~~-0.8 to -1.29~~ **-0.85 to -1.28**
D2	Severe Drought	5.01 to 10.00	~~-1.3 to -1.59~~ **-1.29 to -1.64**
D3	Extreme Drought	2.01 to 5.00	~~-1.6 to -1.99~~ **-1.65 to -2.05**
D4	Exceptional Drought	0.00 to 2.00	~~-2.0 or less~~ **-2.06 or less**

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  - Impact relative magnitude, given present-day human systems
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  - Return frequency based on period of record (which one?) PDF, stationary
  - Return frequency based on recent period PDF, stationary
  - Return frequency based on period of record PDF, nonstationary

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Should the PDF be fitted (MLE) or empirical?

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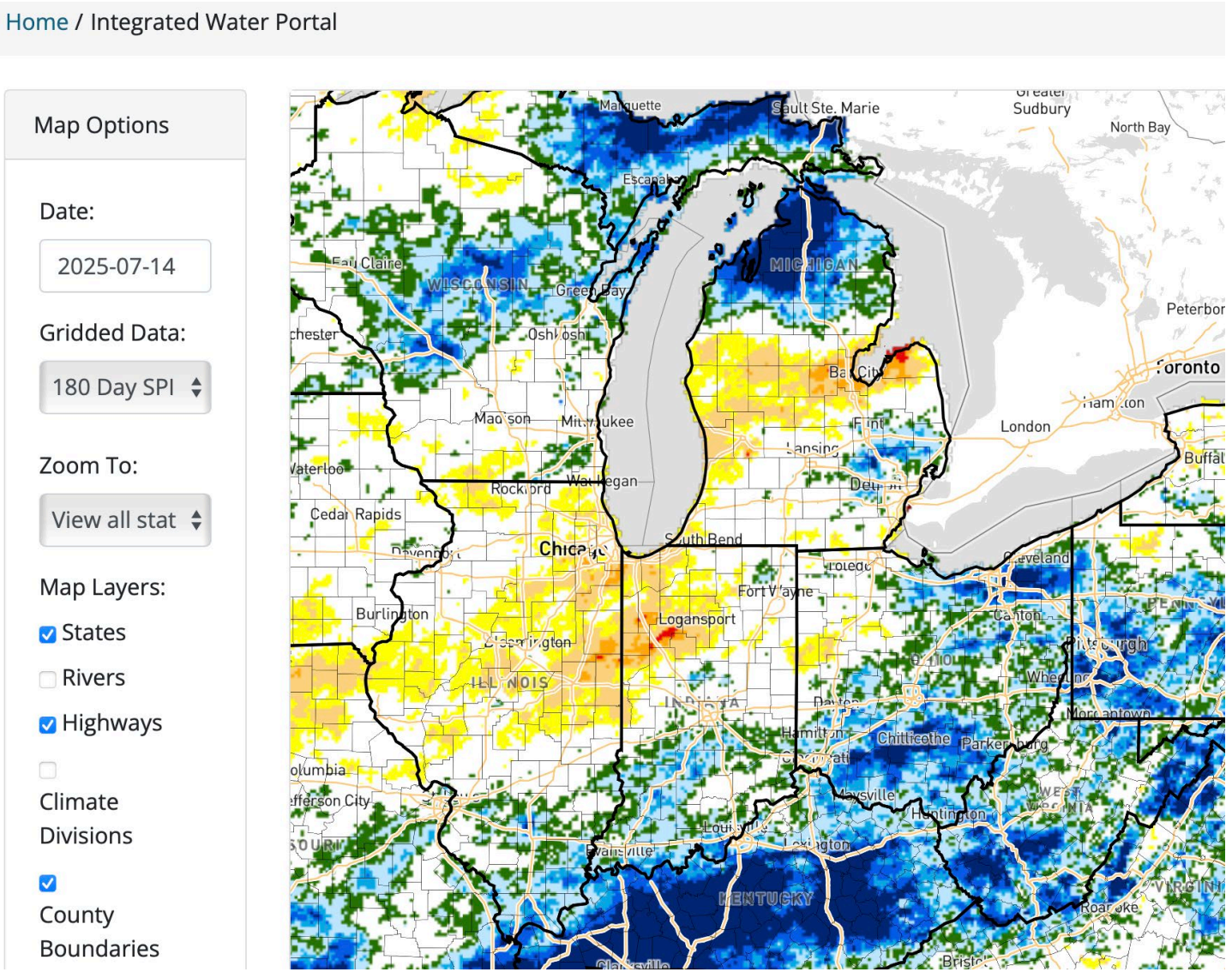
The "correct" answer depends on the application!

Should the PDF be fitted (MLE) or empirical?

Example: Southern Regional Climate Center's Integrated Water Portal

- Input data: **RFC Stage IV**
- Intended to represent "expected rarity"
- Based on fitted PDF
  - (Empirical PDF version in beta testing)
- Uses period of record for PDF moments
  - Data source: **GHCN-Daily precip**
  - Working on precip/PET version
  - "Pooling" compensates for variable station periods of record
- Uses 1991-2020 period to replace first moment
  - Data source: **PRISM**
  - Assumes severity of event will depend on rarity relative to recent climate conditions (agricultural adaptation)
- *https://www.srcc.tamu.edu/water_portal/*
- Proper interpretation of drought products requires at least this much metadata



Summary of answers

- Issue: Accuracy of precipitation obs/analyses
- Local concerns: USDM doesn't represent impact severity
  - (but it shouldn't!)
- Sources and inputs:
  - IWP, hydrologic observations
  - Agricultural/ecological cycle + local reports
- Users: USDM inputters, ranchers (indirectly), water managers (messaging)
- Nonstationarity: effect of changing temperature, CO2?