Working from a Faint Signal Towards Climate-Informed Decision Support

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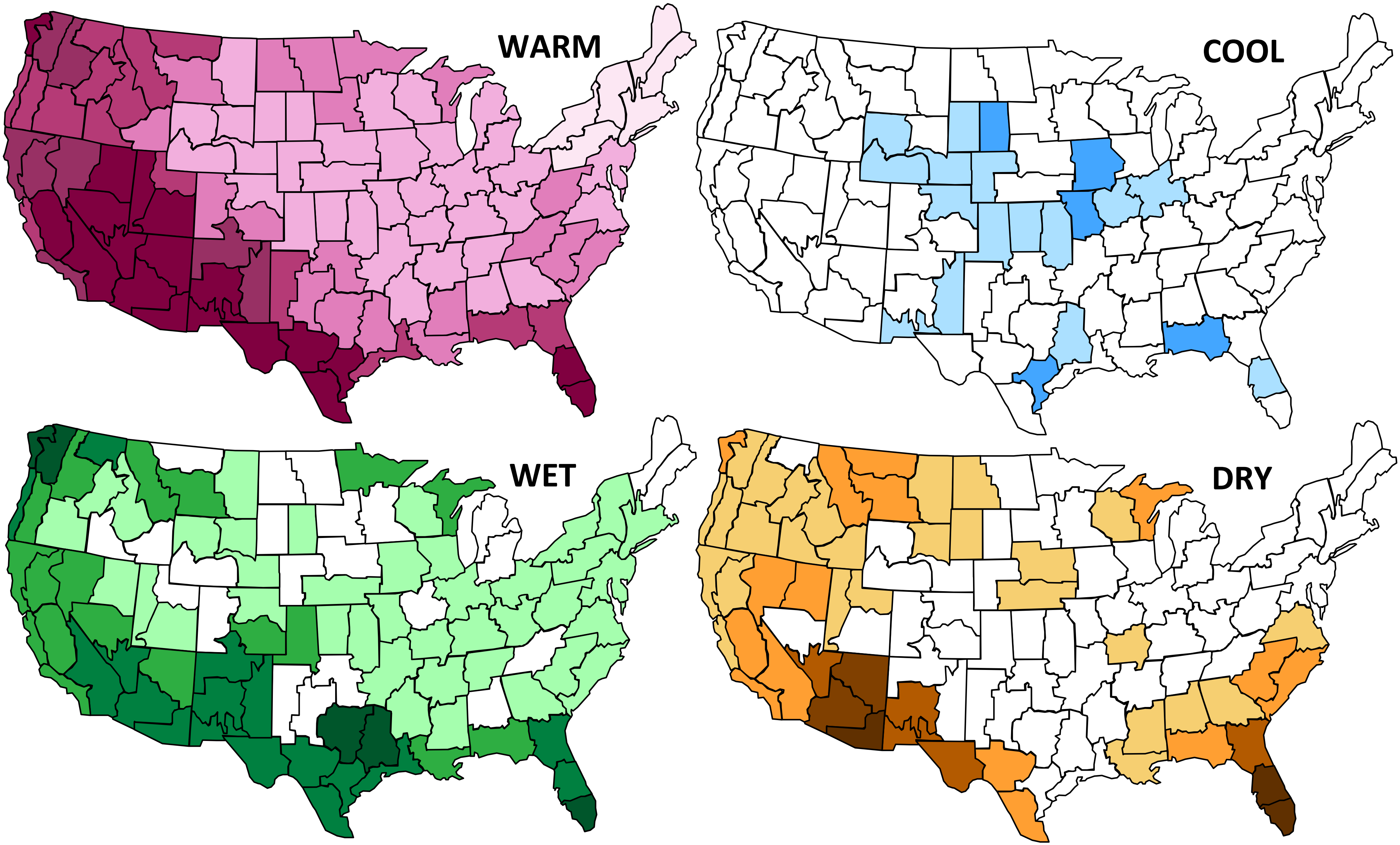
Do the NOAA/CPC Seasonal Climate Forecasts Have Useful Skill?

Yes, for average temperature forecasts for warmer-than-average conditions for most of the U.S.;
but precipitation forecasts are less skillful, limited to specific regions, seasons, and ENSO conditions.

Assessment of Utility of CPC Seasonal Forecasts

(at forecast scales: large areas and 3-month periods)



Seasonal forecast skill is derived from either ENSO teleconnections or strong trends.

For much of the U.S., teleconnection signals are weak, while the trends are modest by comparison to actual variations.

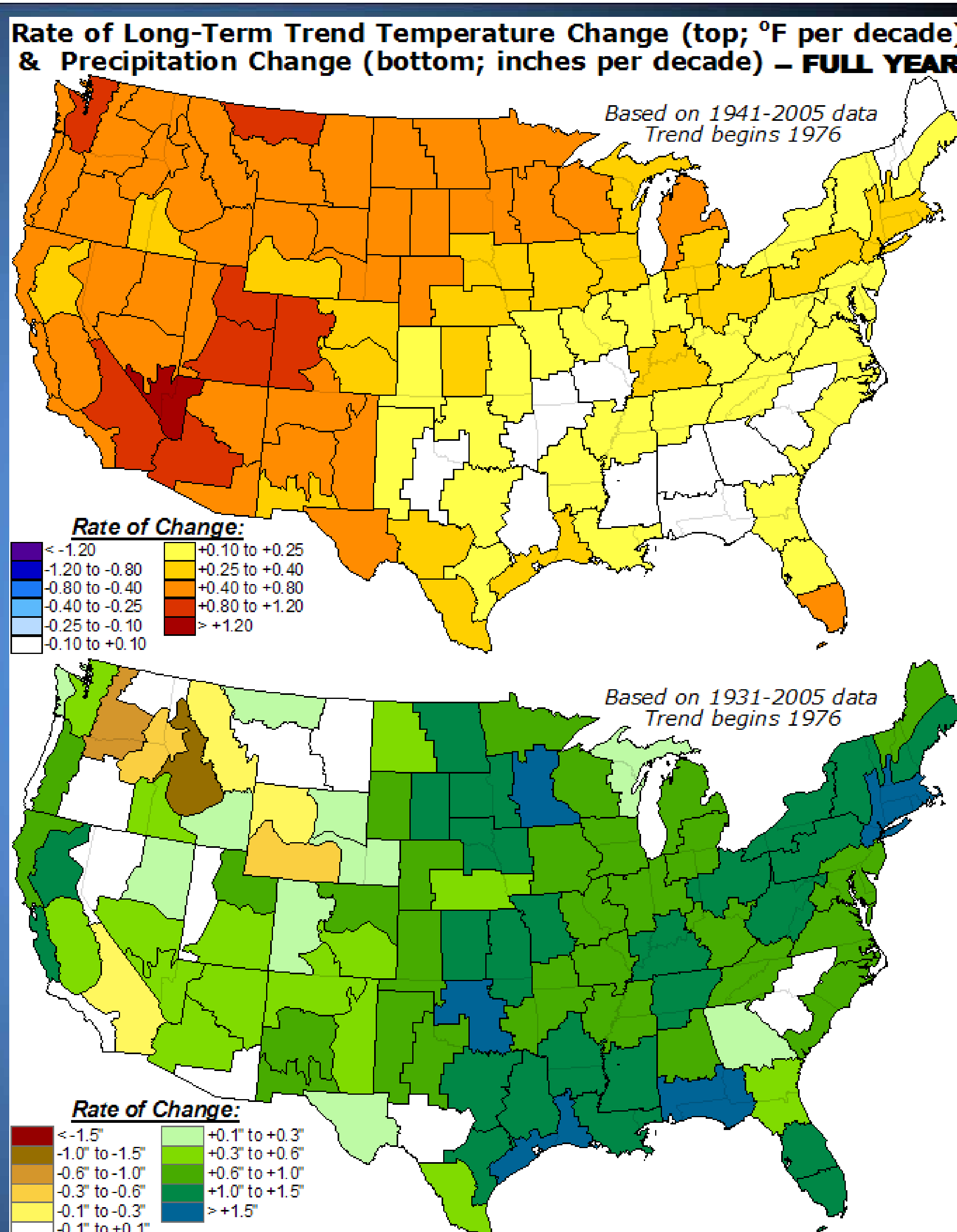
Many of the important seasonal variations are NOT forecast, especially for precipitation.

So what do we do whenever or wherever the CPC forecasts are insufficient?

This is a significant challenge because we know that traditional climatological approaches are of questionable utility given a changing climate.

One expression of climate change: significant trends since 1975.

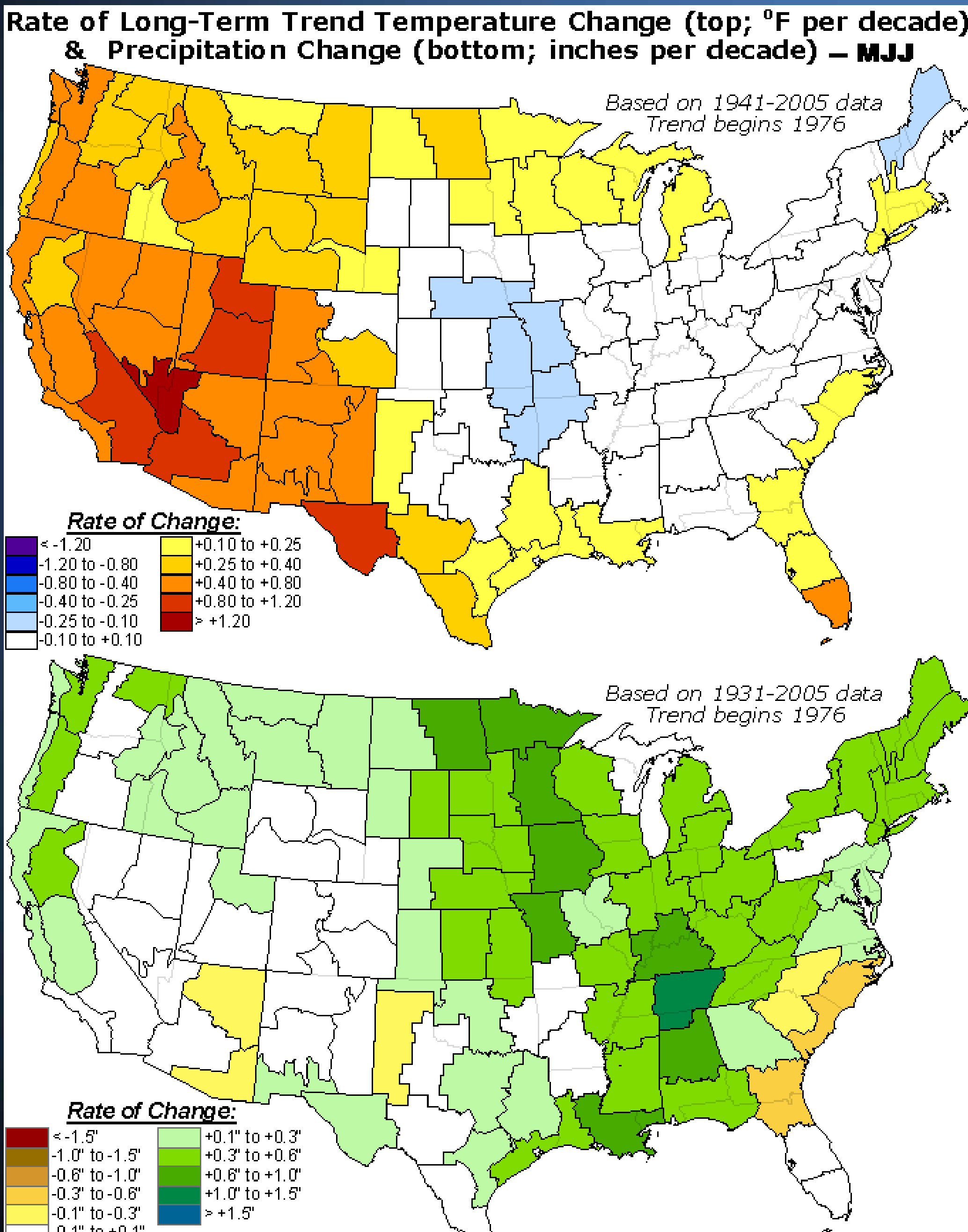
This example shows annual trends; largest temperature trends > 1.2 °F per decade, largest precipitation trend > 1.5” per decade.

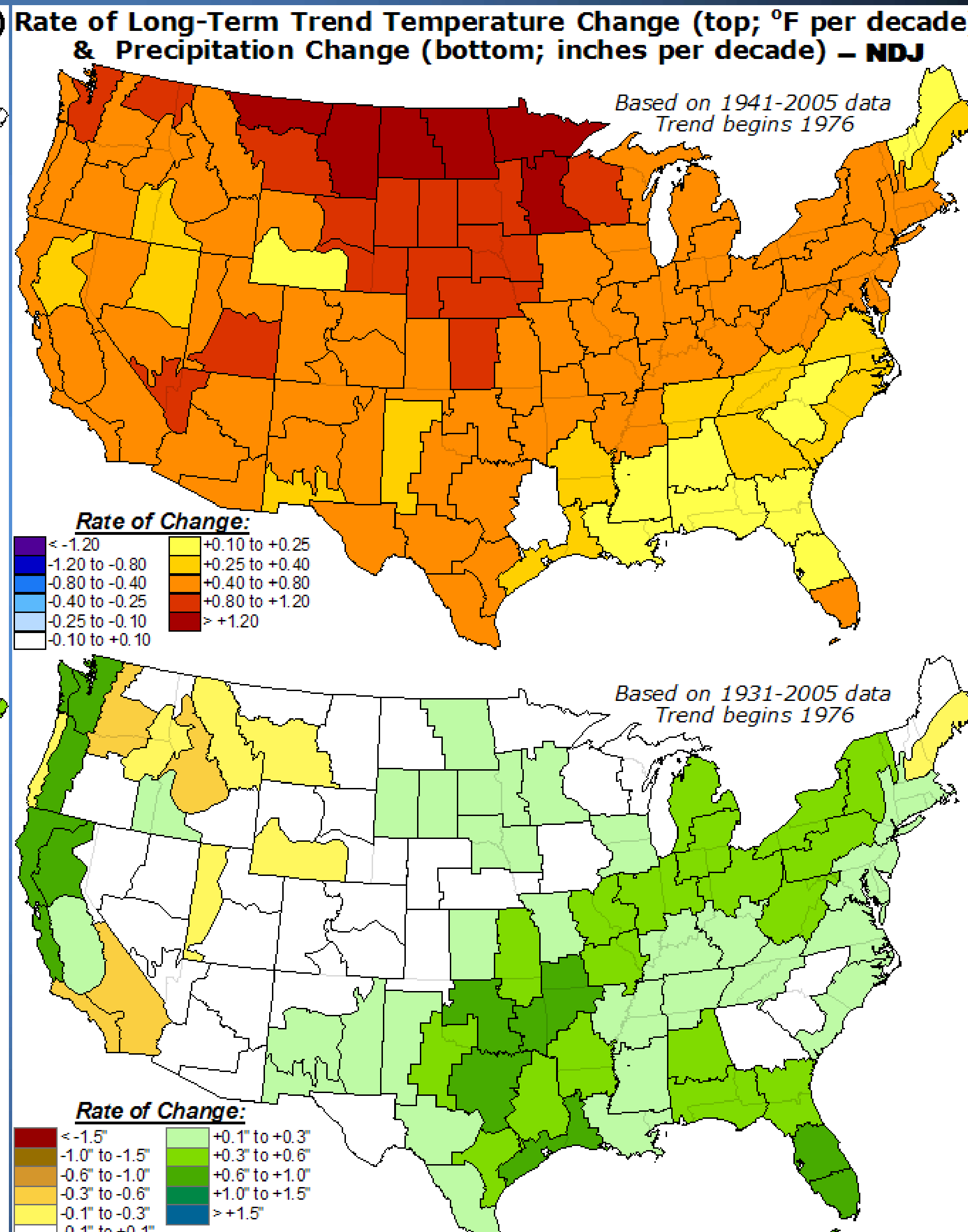


Seasonal trends

May-June-July

November-December-January



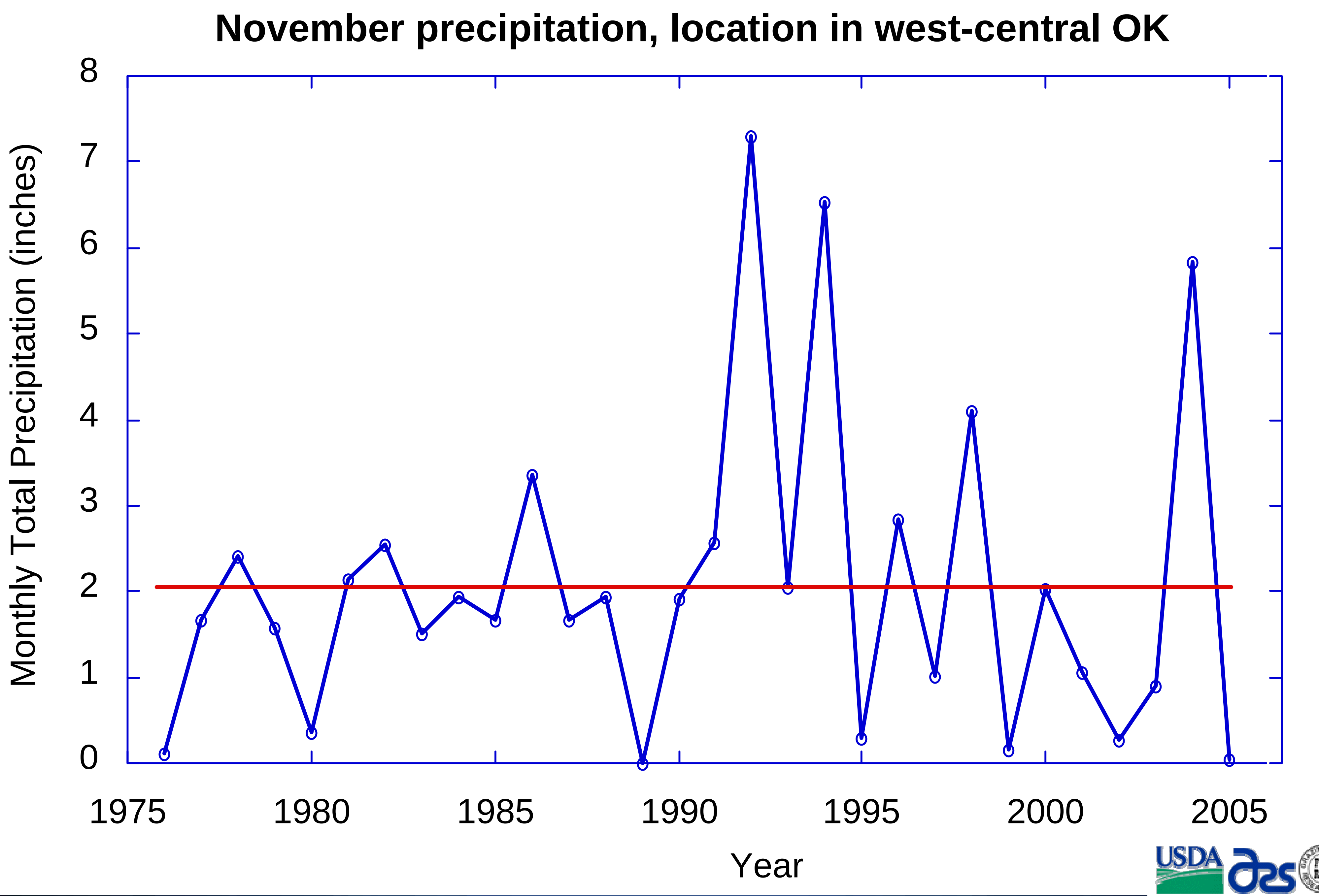


This means that a standard 30-year average over 1971-2000 (also called “normal”) , is *not* going to be a useful indication of what we should expect.

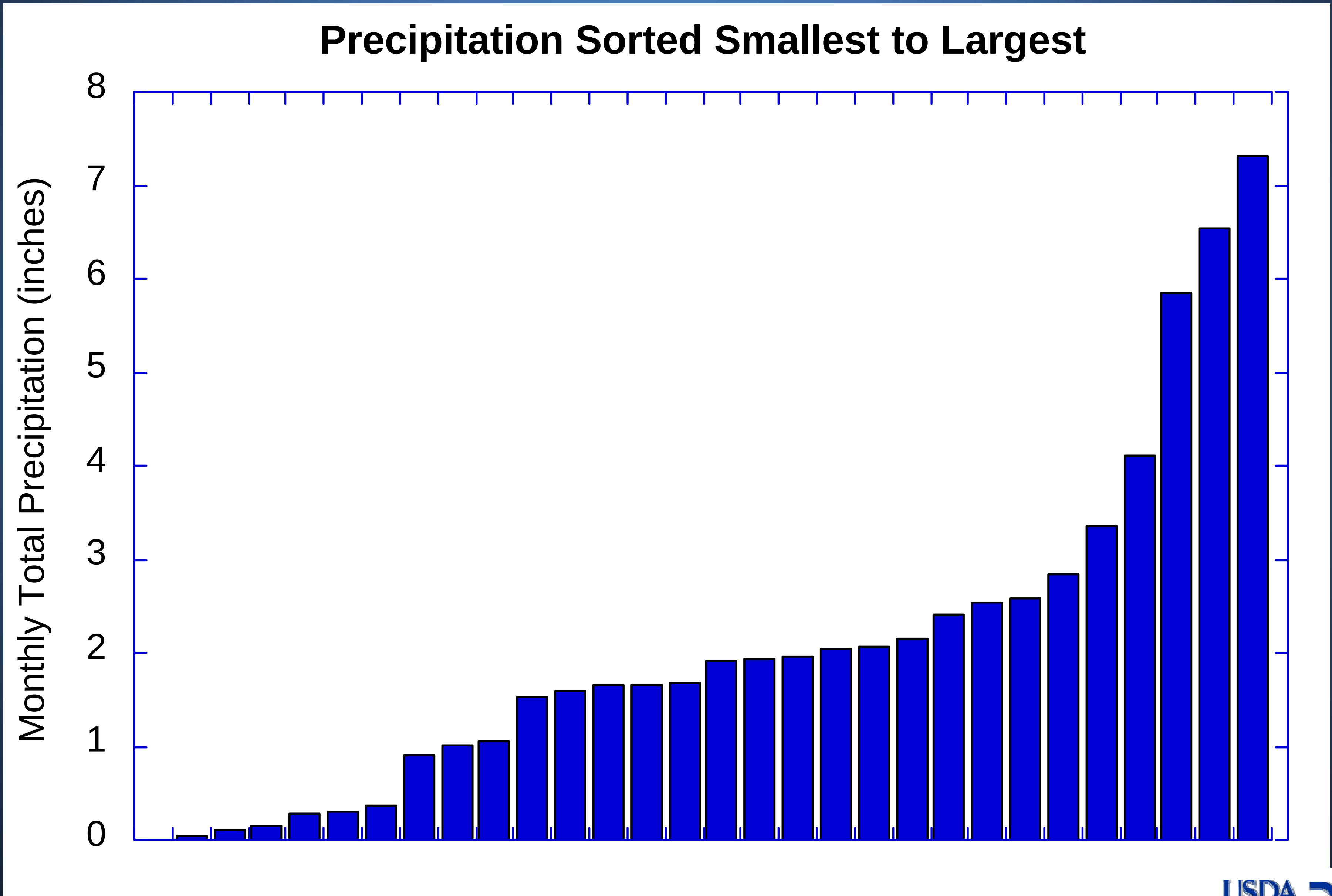
One option would be to focus on the most recent 30 years, and use those years to define the odds for what we might expect.

This is similar to what CPC and other climate forecast groups are already doing: climate forecasts are statements of shifts in odds compared to some base 30 year period.

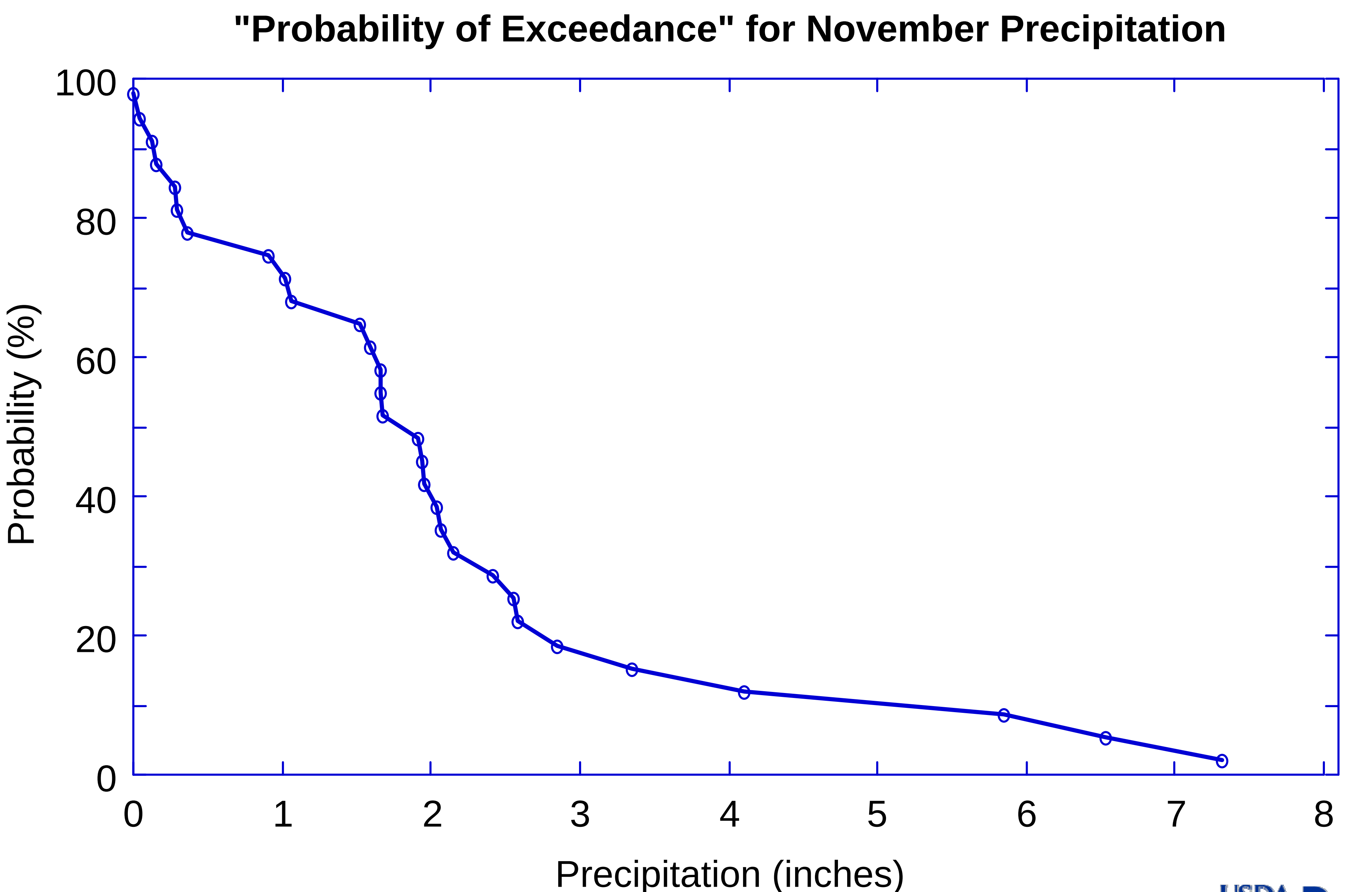
Time series 1976-2005



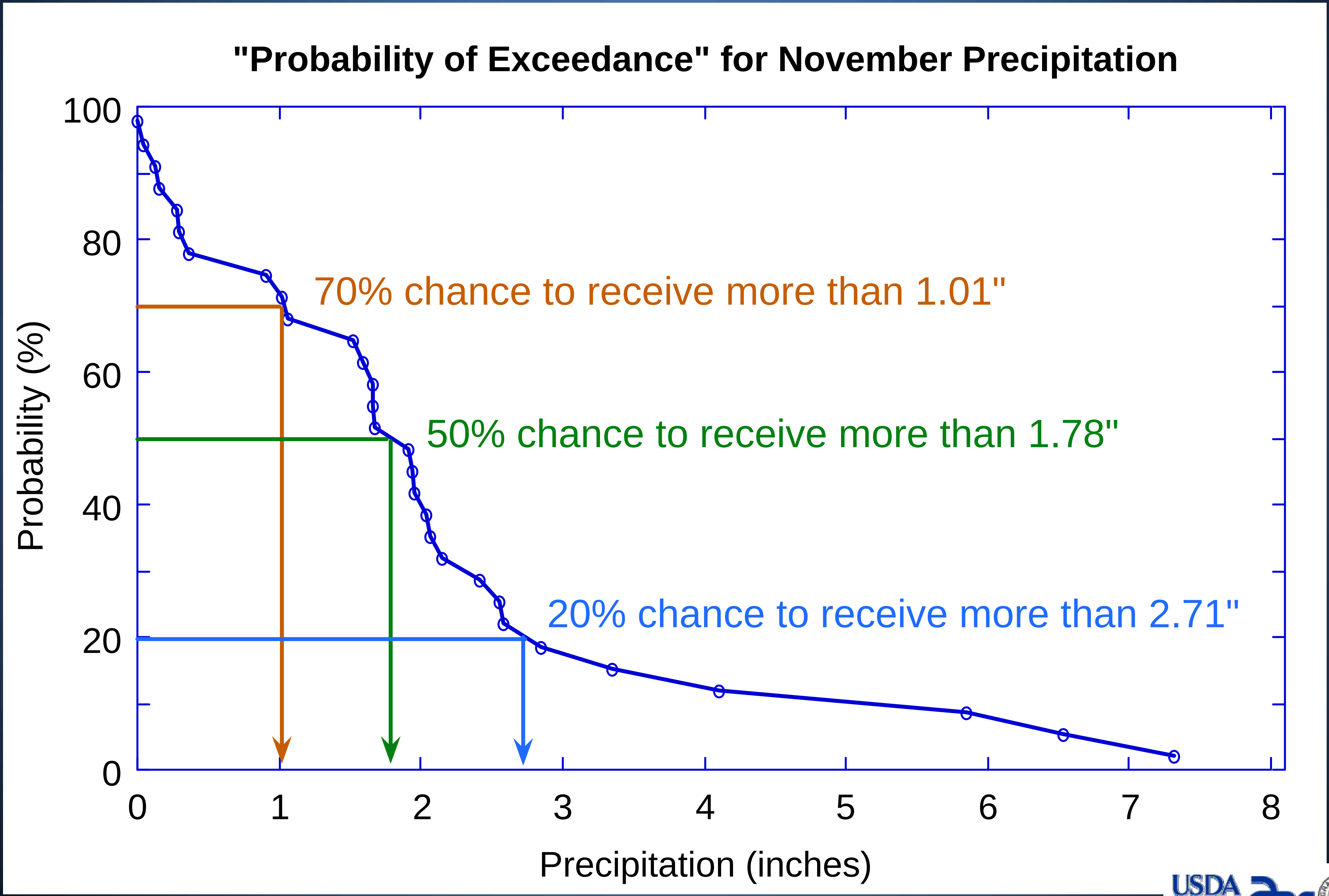
There is a better way to look at the data. First, sort smallest to largest:



Next, assign the matching probability to each amount:



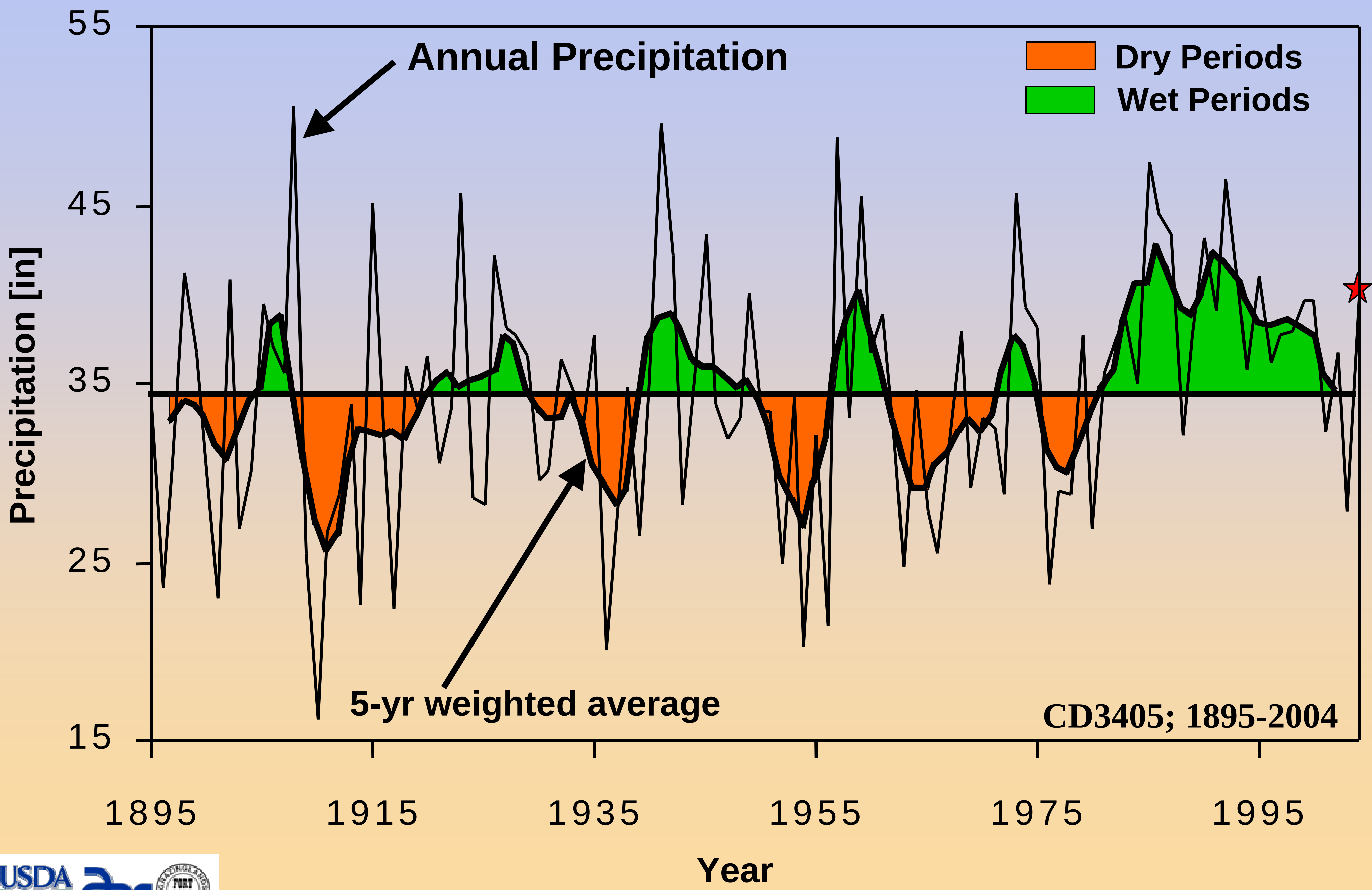
Why do this? So you can read the odds.....



If you can associate a consequence with the different amounts or ranges of precipitation (e.g., streamflow or crop yield), you have a definition of risk. This makes such a probability assessment useful in a decision support context. This approach is new only in the sense of focusing on recent years, rather than the 30 years associated with full decades per current practice (e.g., 1971-2000).

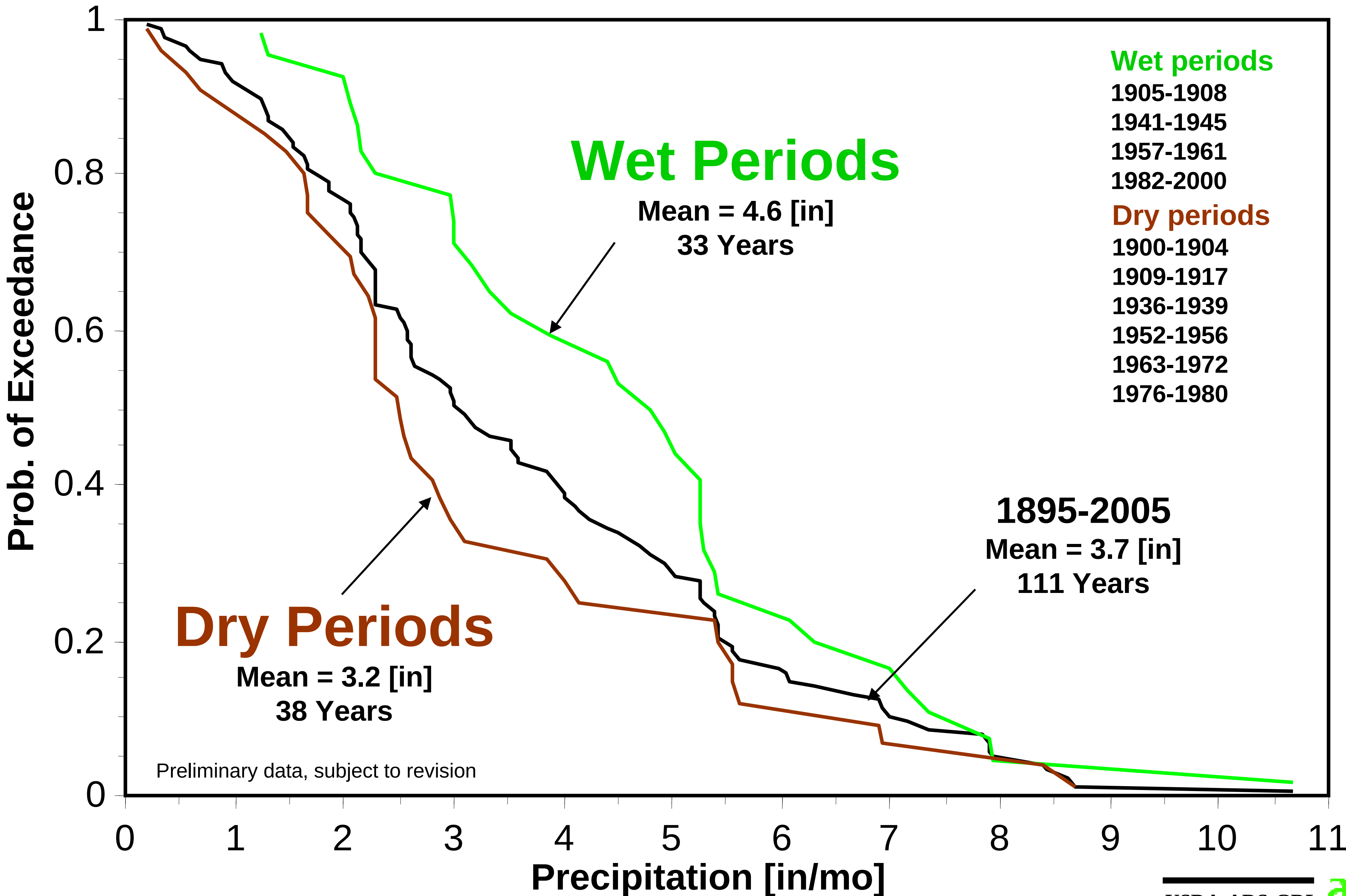
However, there is probably more that we can do to develop probabilistic guidance. This is a continuing research focus for our group and many others.
My current effort is investigating possible uses of the decadal persistence of precipitation variations.

Annual Precipitation in Central Oklahoma



Probability of Exceedance of September Precipitation

Climate Division 3405; Central Oklahoma; 1895-2005



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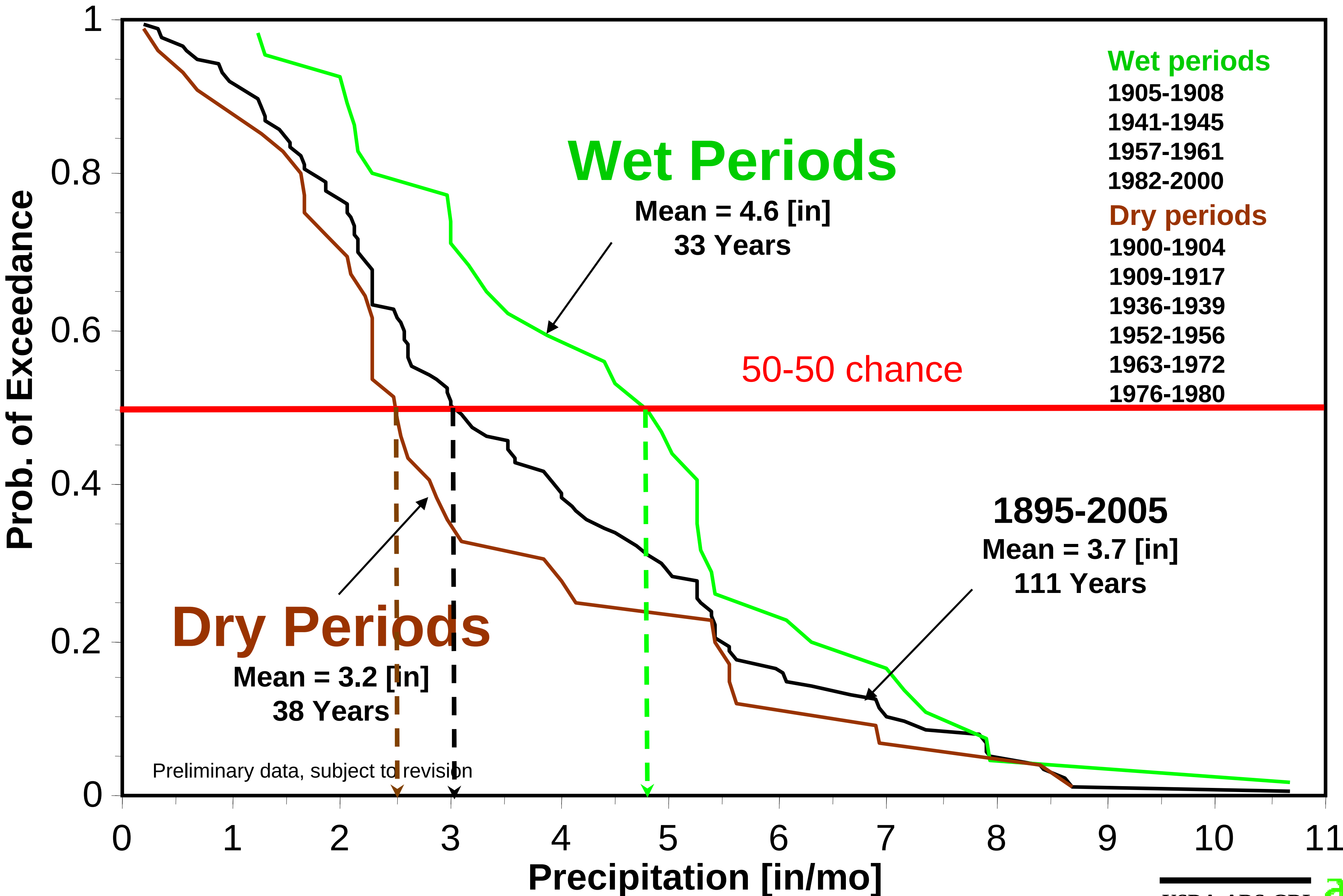

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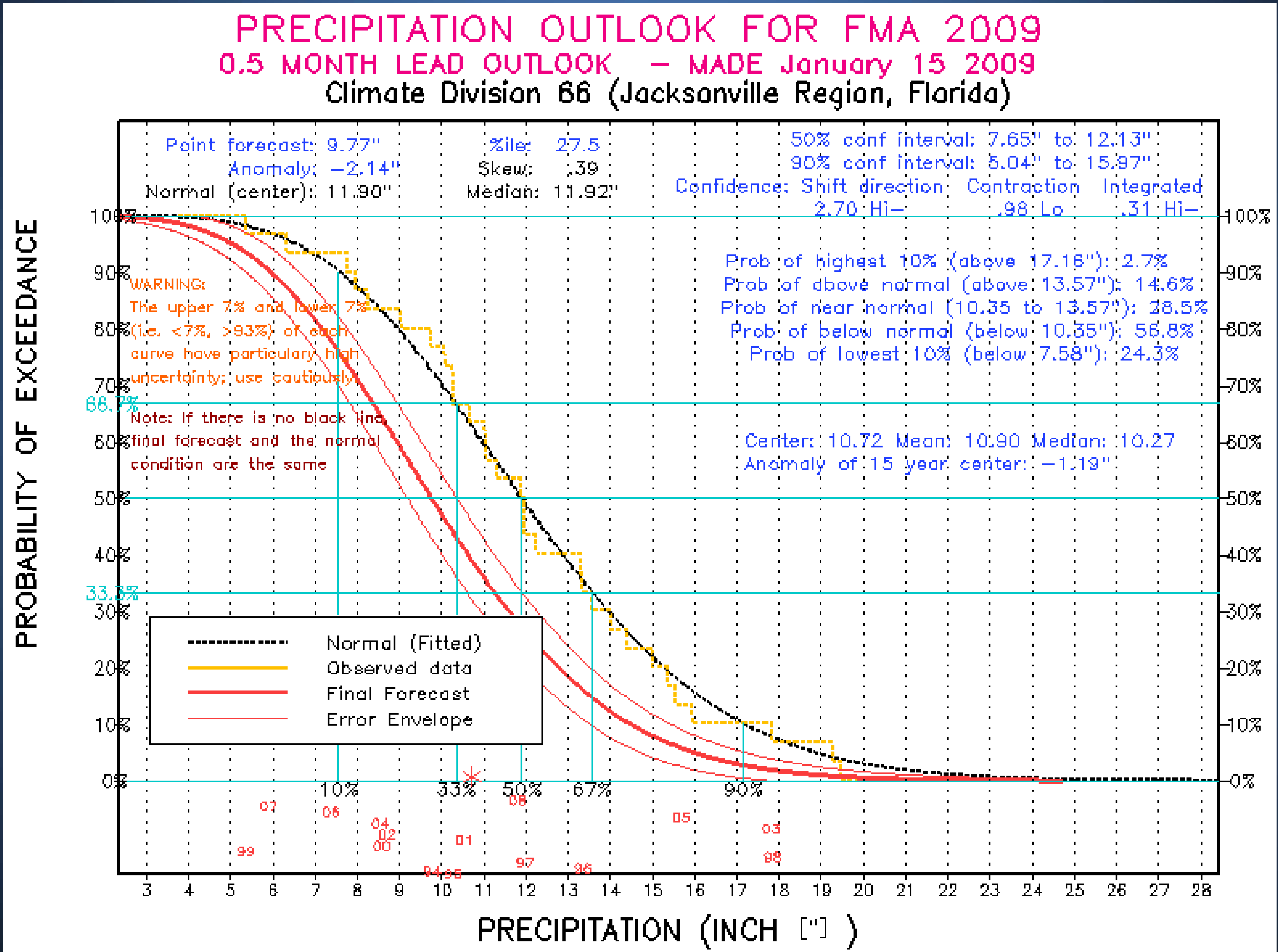
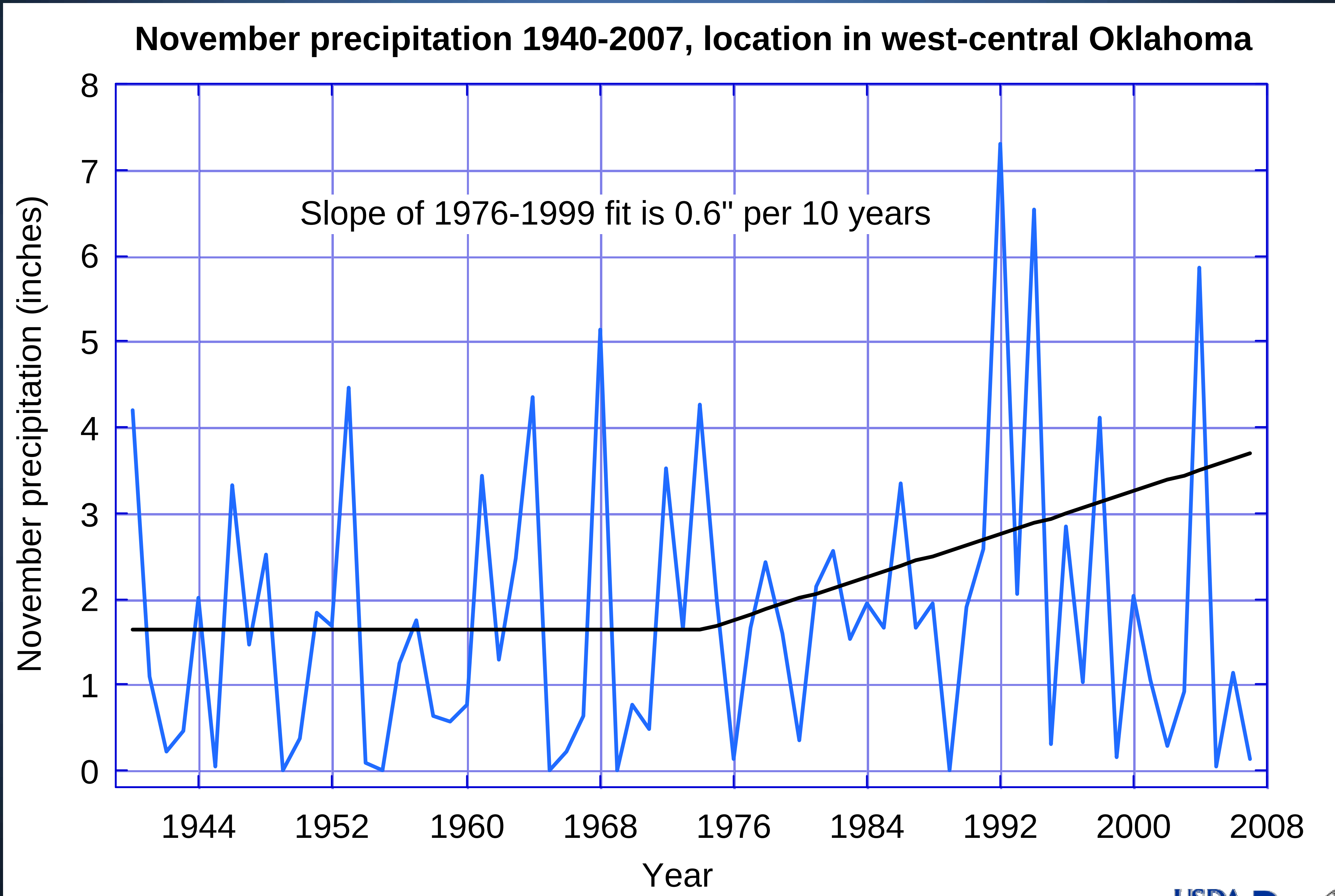
Example CPC Forecast

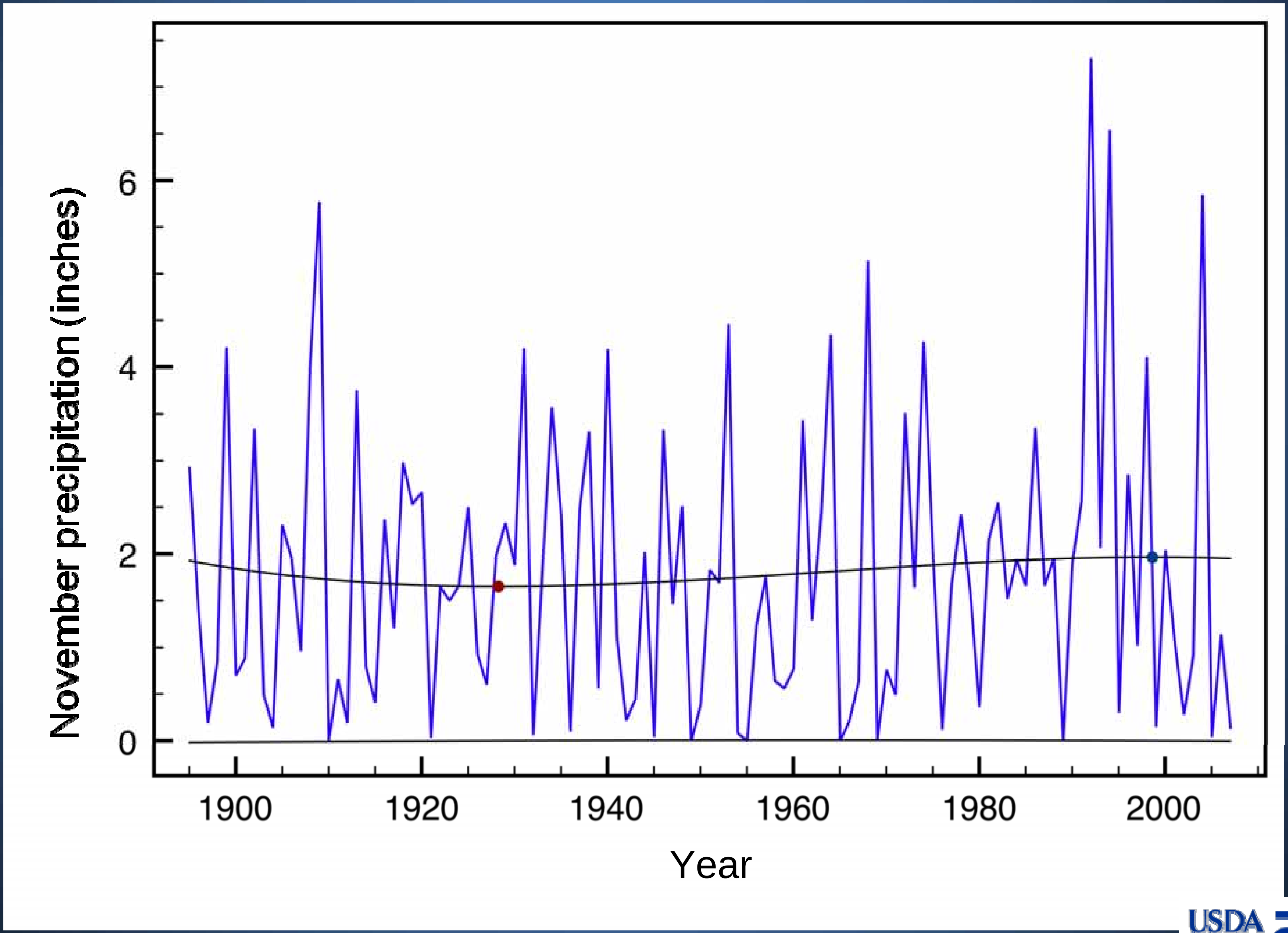


But given the strong trends in climate, is a 30-year or longer average the most useful way to define the “climate baseline” or the variations around it? What works best?

Instead of a simple average, use Livezey et al.'s hinge-fit?



How about a clever spline fit where we let the data determine the fit?



Summarizing My Main Points

- In places and times when official climate forecasts have little or no skill, we need to rethink how we use climatology to inform our decision support tools.
- Conservative approach:
  - o use the full probability distributions from the most recent 30 years to define climate/weather related risk for decision support applications.
- Exploratory approach:
  - o develop a new definition of "normal" to account for ongoing climate change;
  - o take advantage of decadal persistence in precipitation variations to provide potentially more accurate guidance.