

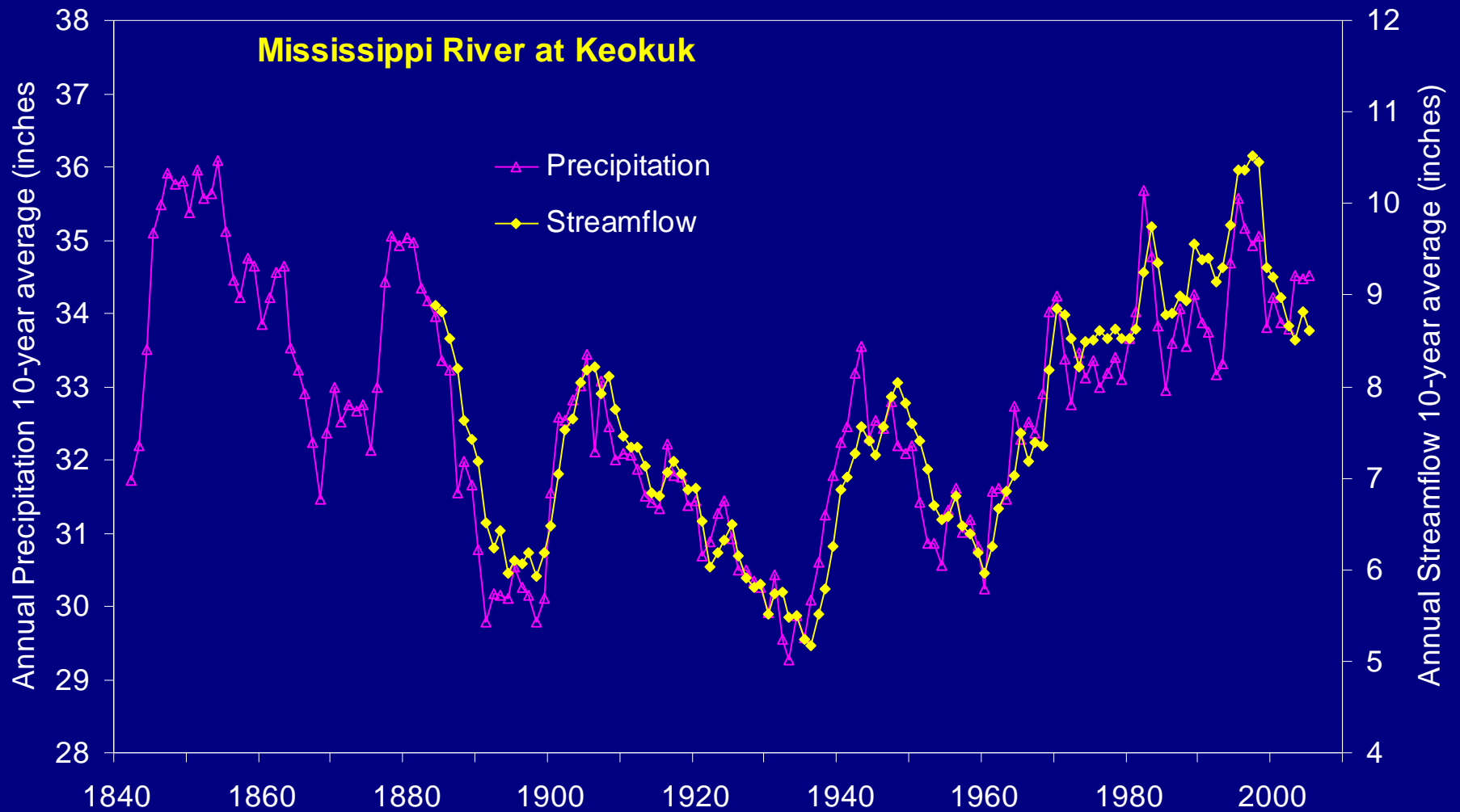
Impacts of Climate Variability & Change on Streamflows in the Upper Midwest

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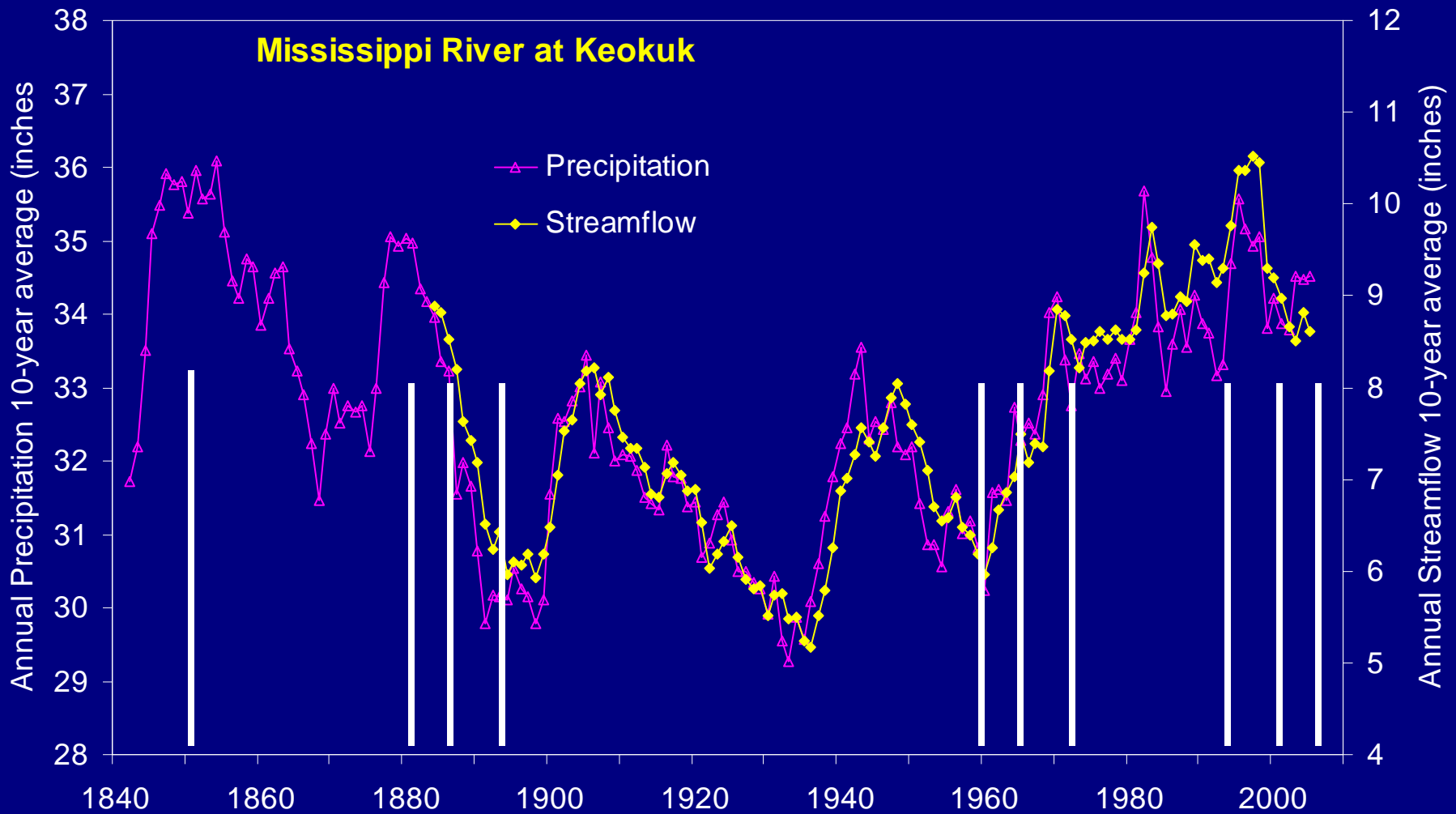
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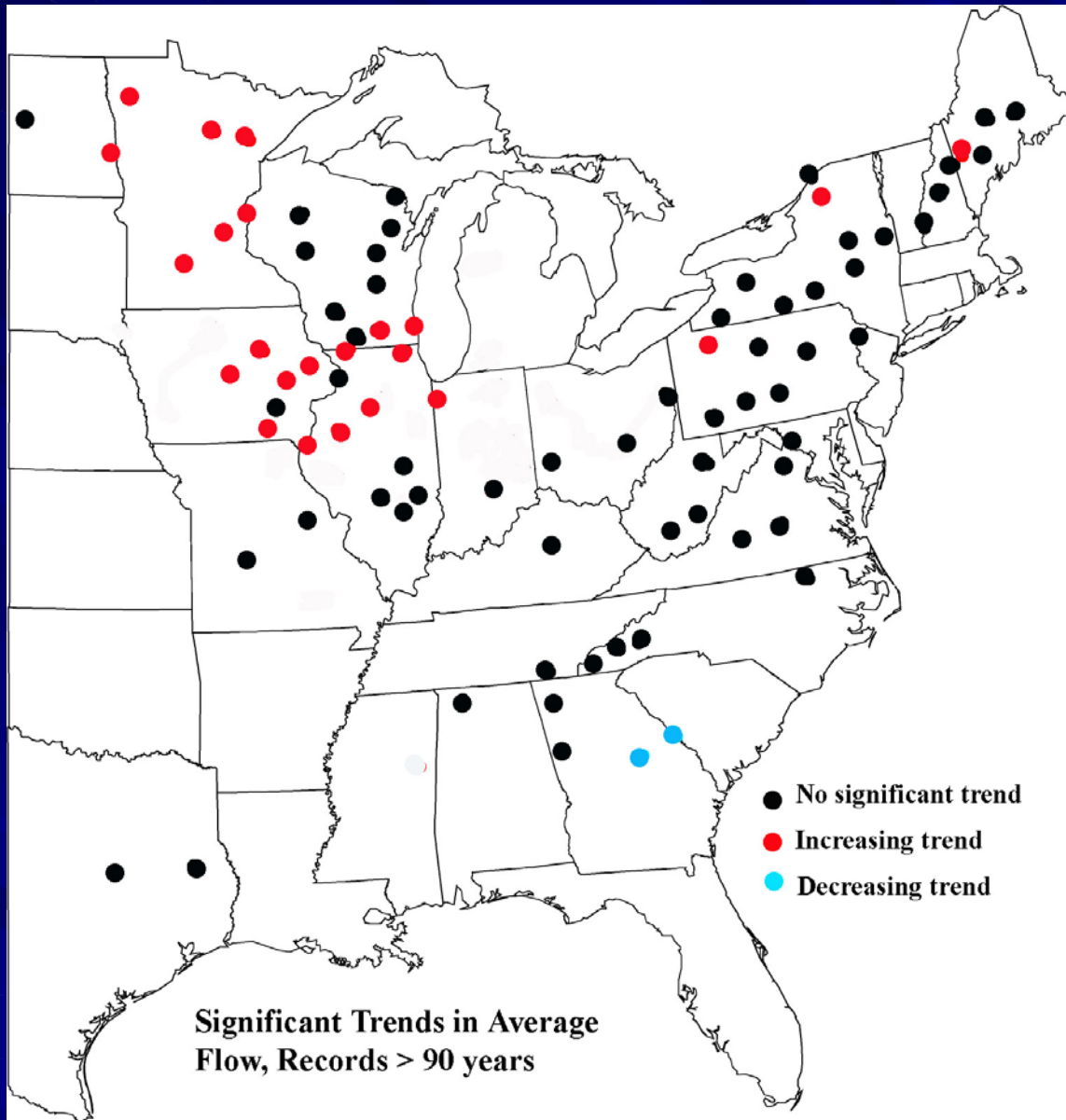
What's the cause of average flow increases? Precipitation.



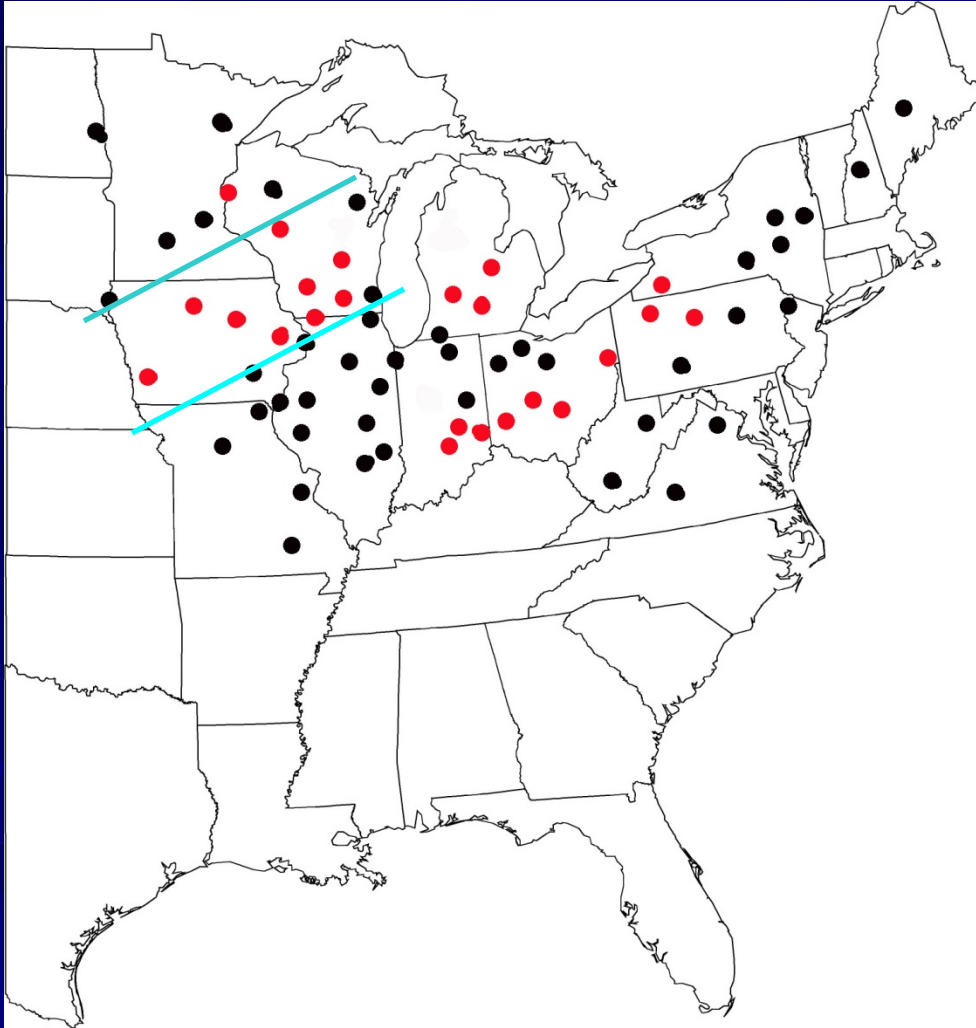
When did the worst floods (greatest flow amount) occur?



Trends in Average Flow

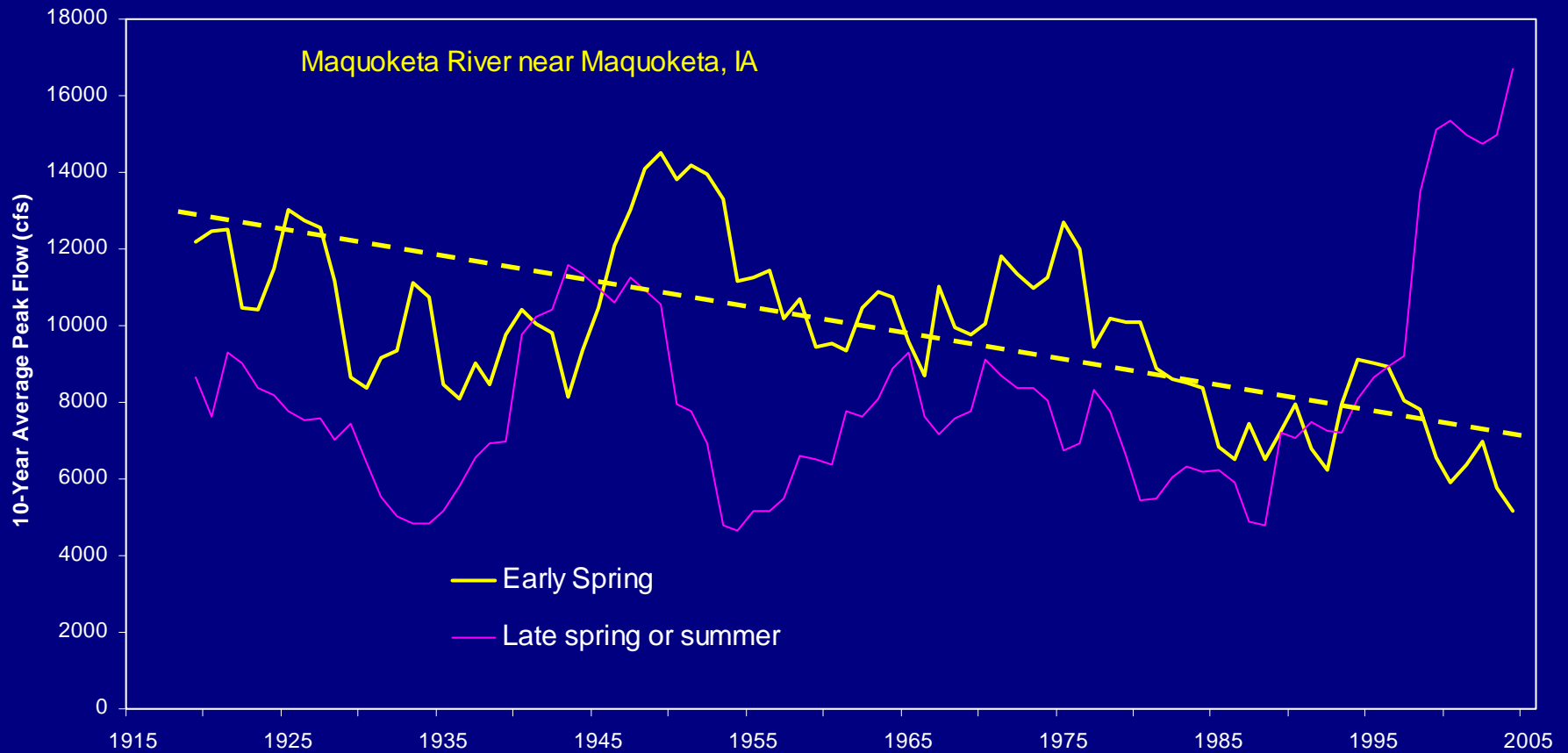


Trends in High Flows

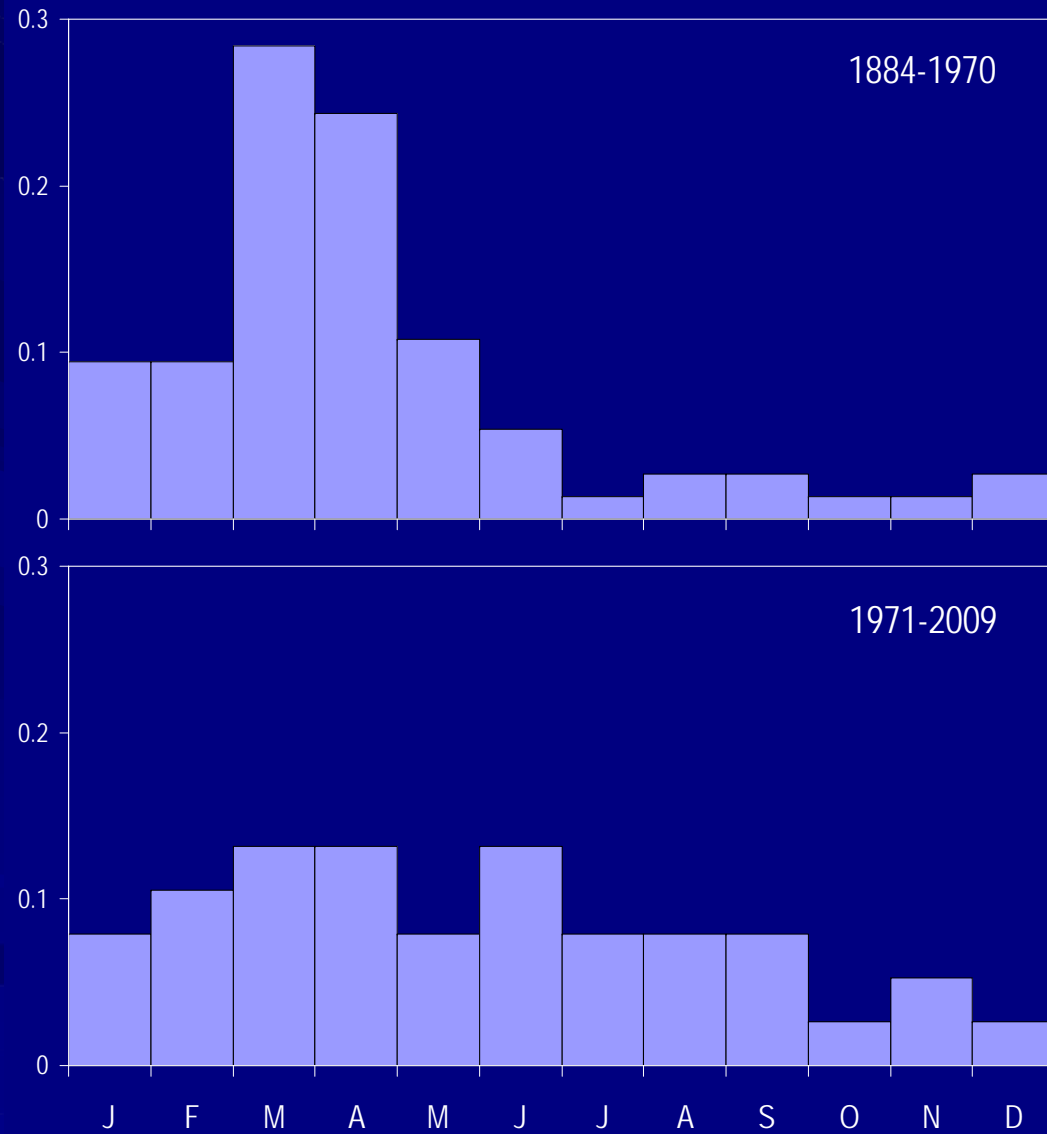


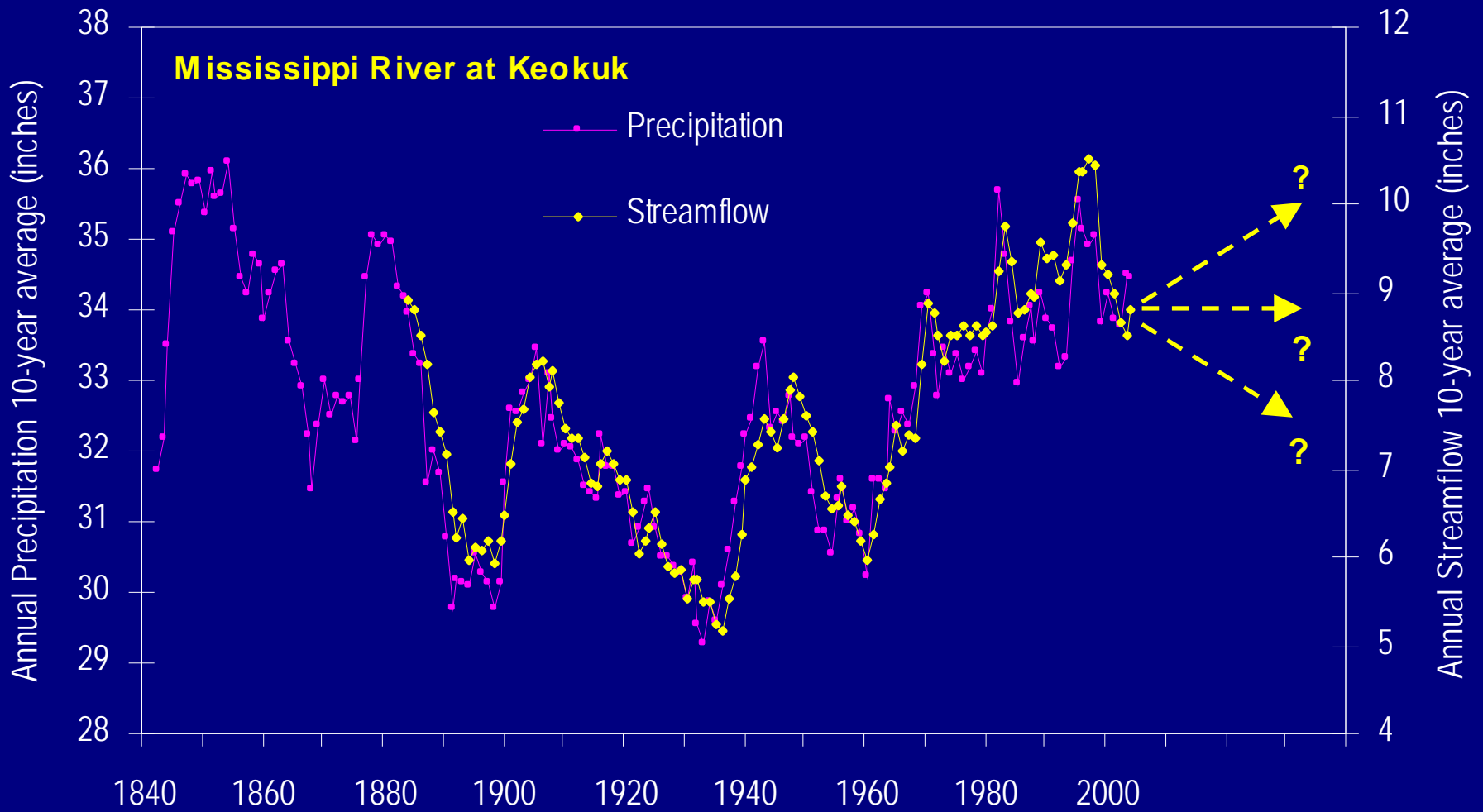
- High flow trend is decreasing with respect to average flow trend
- High flow trends are similar to changes in average flow

Decrease in flood peaks during early spring (attributed to warmer winters)



Illinois River - change in flooding season





Climate Change

Impacts on Water Resources

Certain climate change literature has projected the following for the Great Lakes and Midwest:

- Heavy precipitation events in the spring months will increase in magnitude and frequency – causing more flooding
- Average streamflow and lake levels will decrease, primarily from influence of increased temperatures
- There will be extended periods of precipitation deficit and low flows during the summer season
- Thus, the hydrologic cycle will intensify, resulting in **more extreme floods and more extreme droughts**

How does this compare to the historical record?

- There is no time in our hydrologic record where floods and droughts have both become noticeably worse during the same period.
- Instead, our experience has been that the hydrologic regime gets either collectively drier or collectively wetter. Hydrologic model simulation for most other climate scenarios confirm this.

Those outcomes are based on selected climate scenarios that have much wetter springs and drier summers

To put things in a broader perspective:

- There are 23 different Global Climate Models
- Over 150 different scenarios from these models
- Precipitation is one of the hardest variables to model and project in the future
- “It’s hard to place much confidence in any one characterization of future precipitation when the various models are all across the board”
– J. Angel (2009)

Simulated Impacts on Water Resources

- Low flows during extended drought conditions, such as would affect water supply reservoirs, appear to be most vulnerable to potential climate changes.
- Flooding seems to be somewhat less sensitive to projected climate scenarios. Potential flooding from precipitation increases may be offset by lower soil moisture from increased temperatures. Smaller watersheds and urban watersheds may be more sensitive and experience greater flood increases.
- Streamflow changes from climate change in the range of $\pm 10\%$ may not easily be statistically detectable when viewed within the context of the historical variability
- Only the driest GCM scenarios appear to substantially impact the normal range of flow conditions