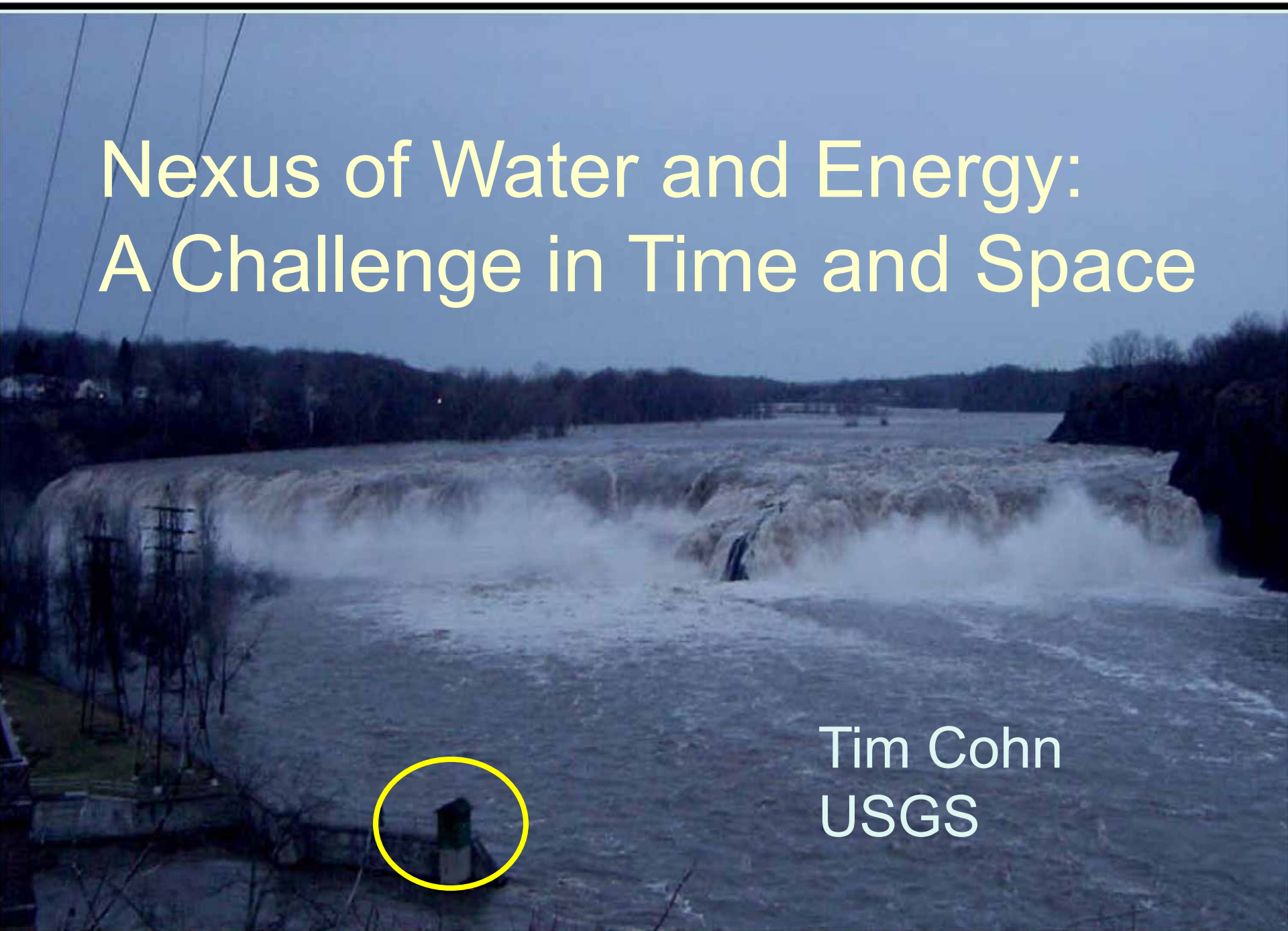
Earthquakes ★ Floods ★ Hurricanes ★ Landslides ★ Tsunamis ★ Volcanoes ★ Wildfires

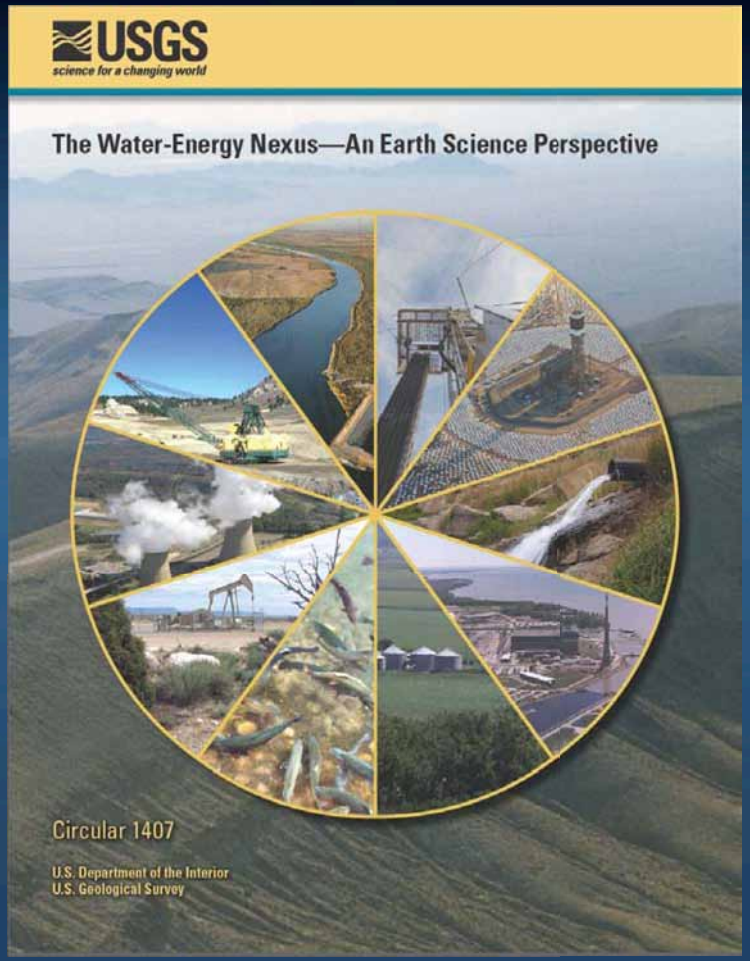
# Nexus of Water and Energy: A Challenge in Time and Space



Tim Cohn
USGS

# 2015 USGS Study

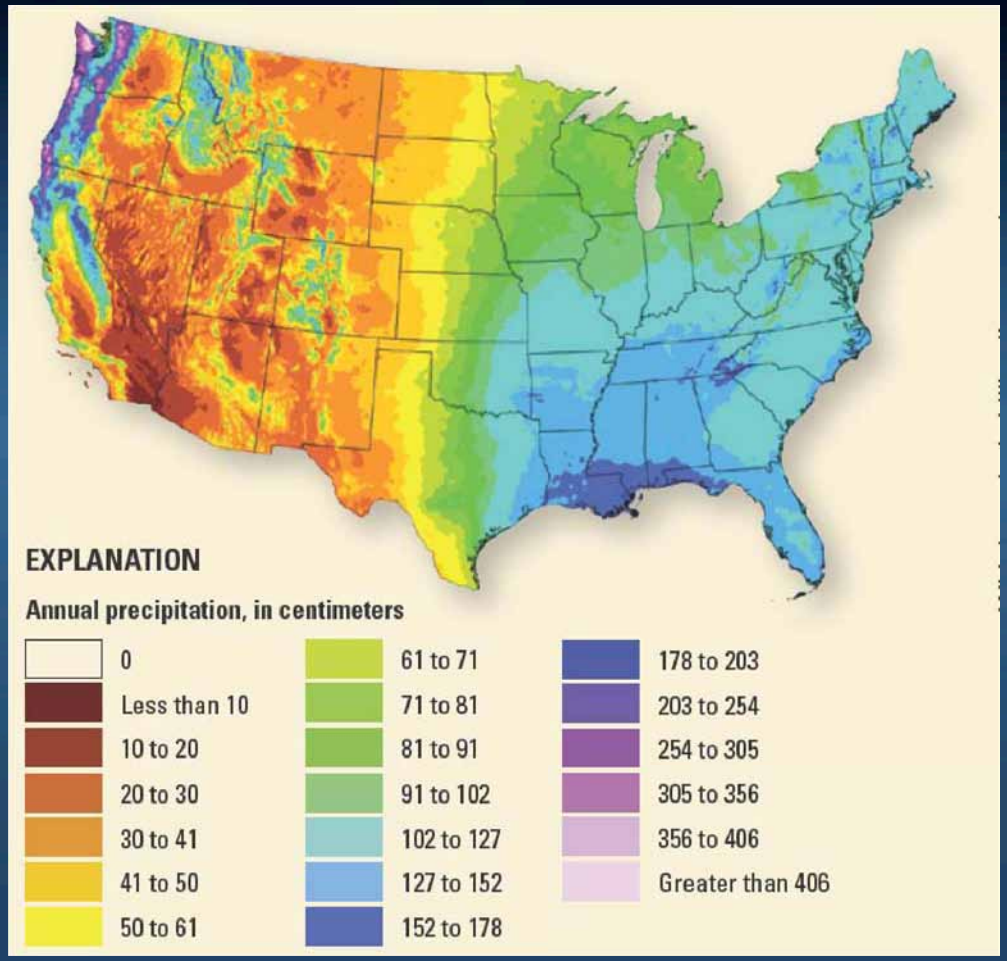
## [Healy *et al.*]




http://pubs.usgs.gov/circ/1407/

USGS

# Hydrologic Variability in Space

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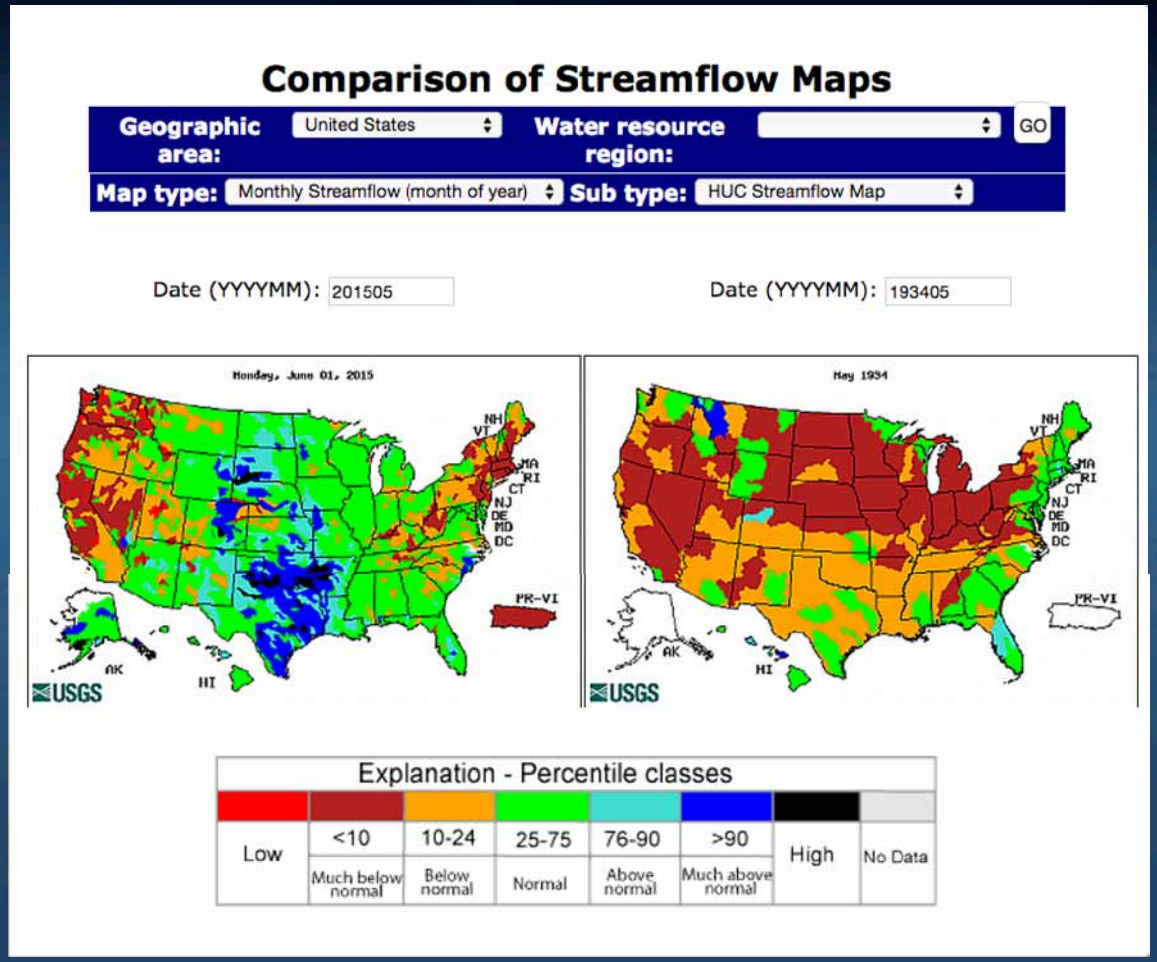
# Hydrologic Variability in Time (May 2015 vs May 1934)

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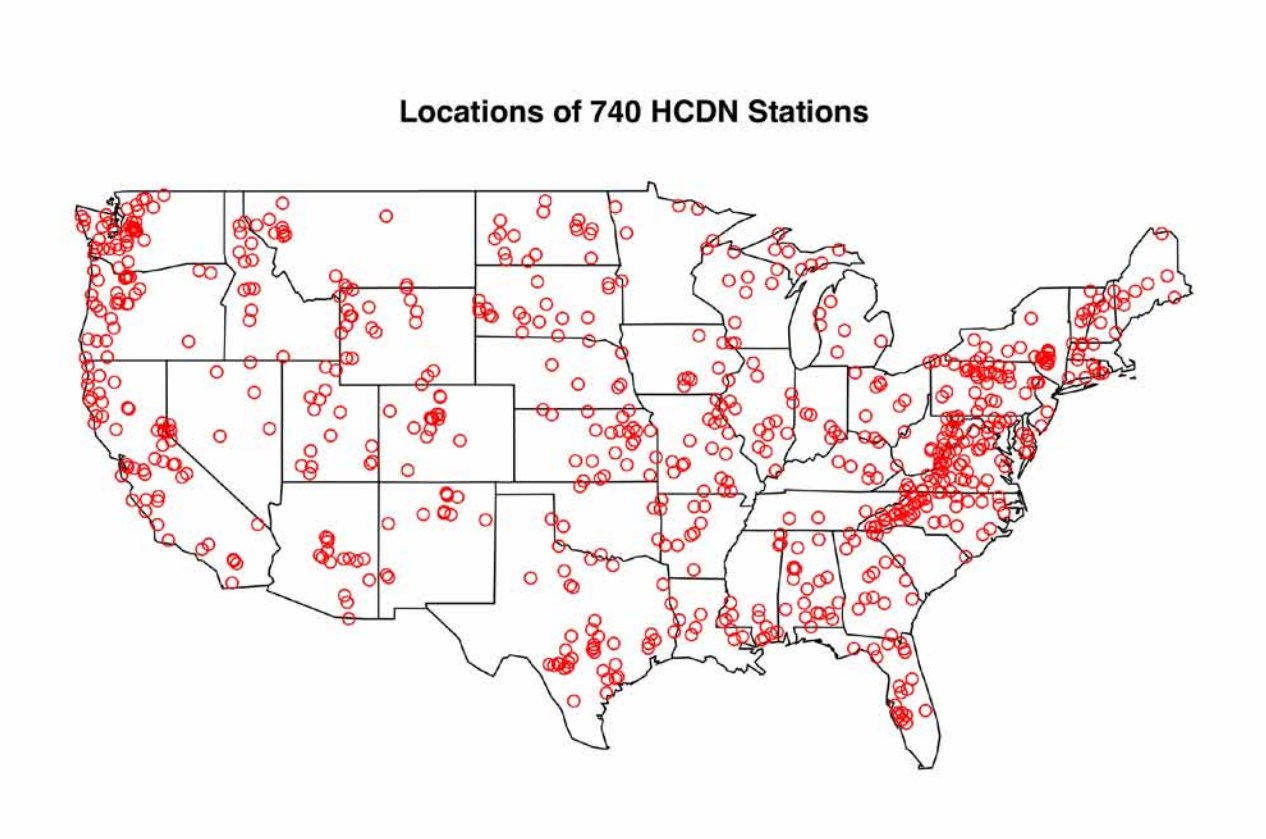
# Observed Trends
## (The Gages-II HydroClimatic Data Network)

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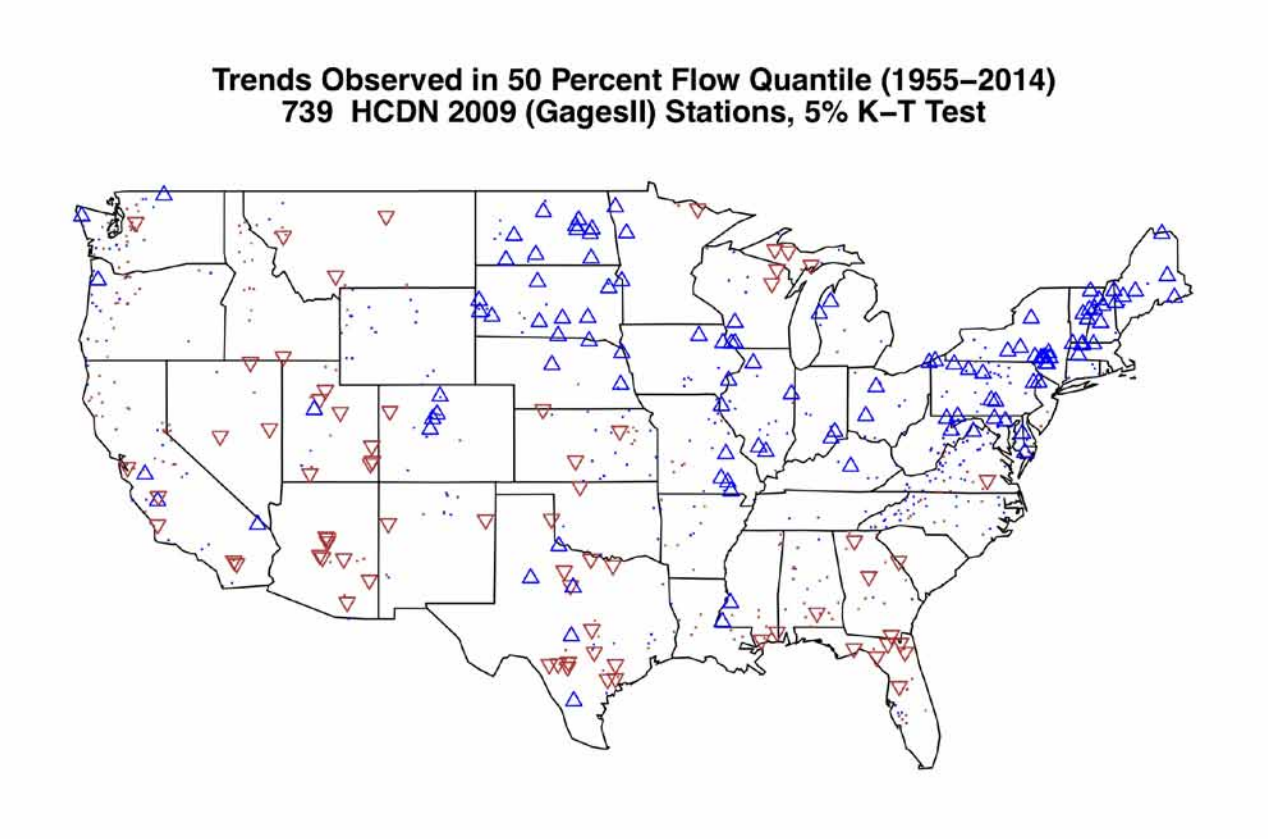
# Median-Flow Trends (1955-2014)

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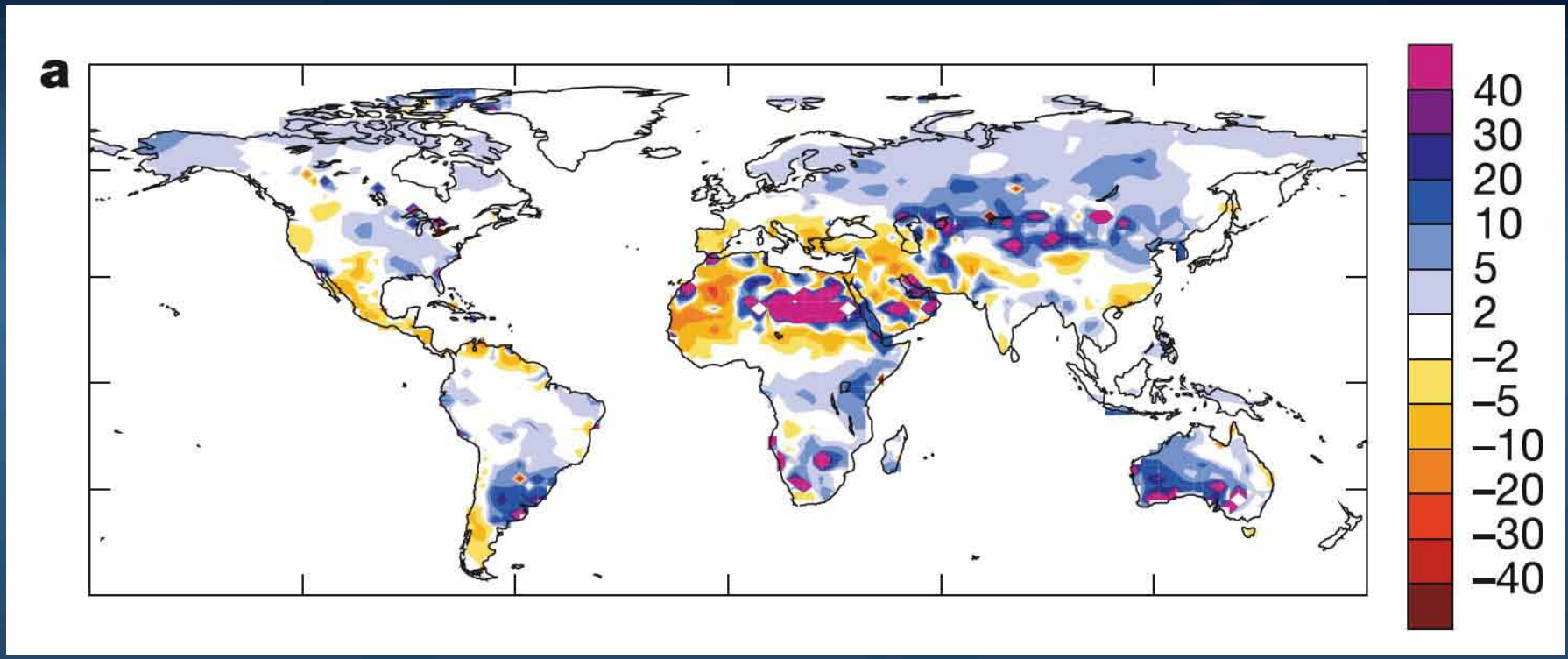
# Observed Changes in 20th Century Runoff

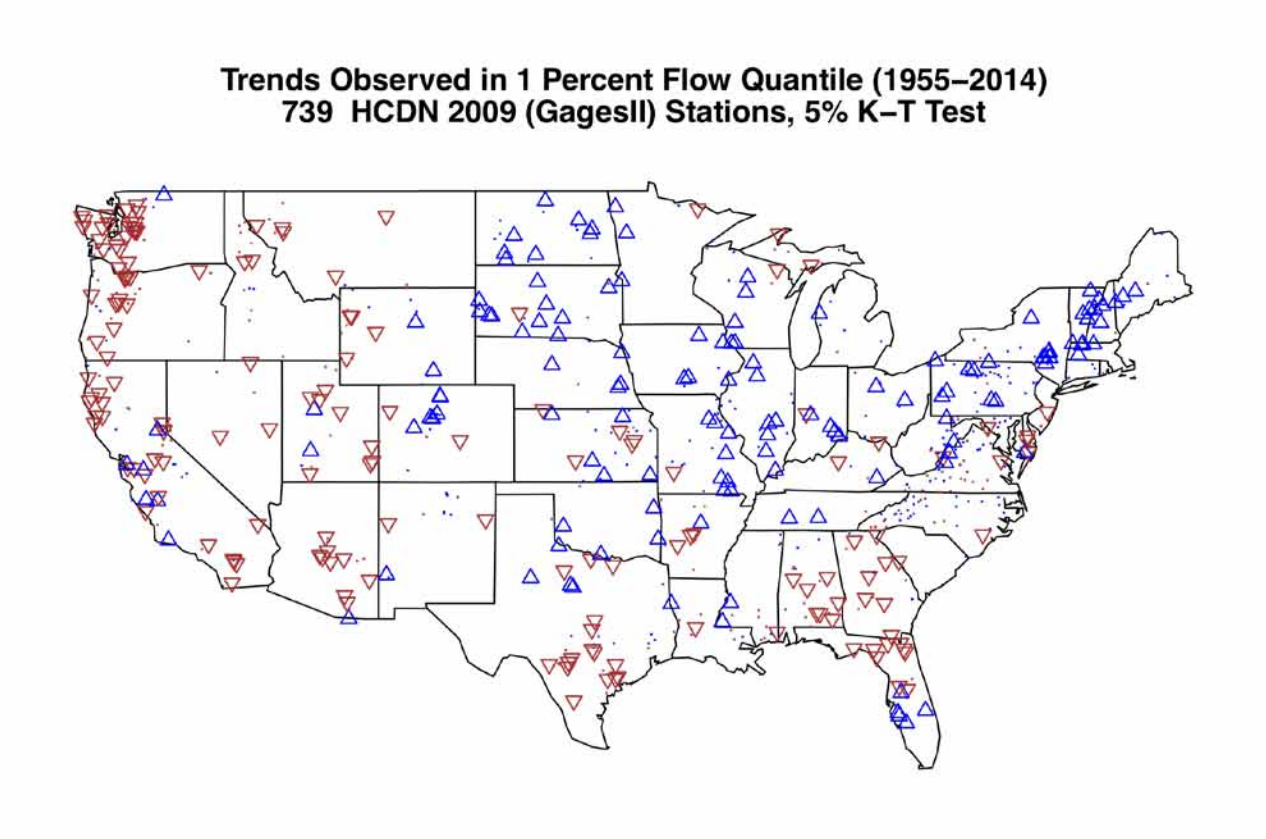
## 100*(mean[1971-1998]-mean[1900-1970])/mean[1900-1970]




Milly et al., 2005

USGS

# Low-Flow Trends (1955-2014)

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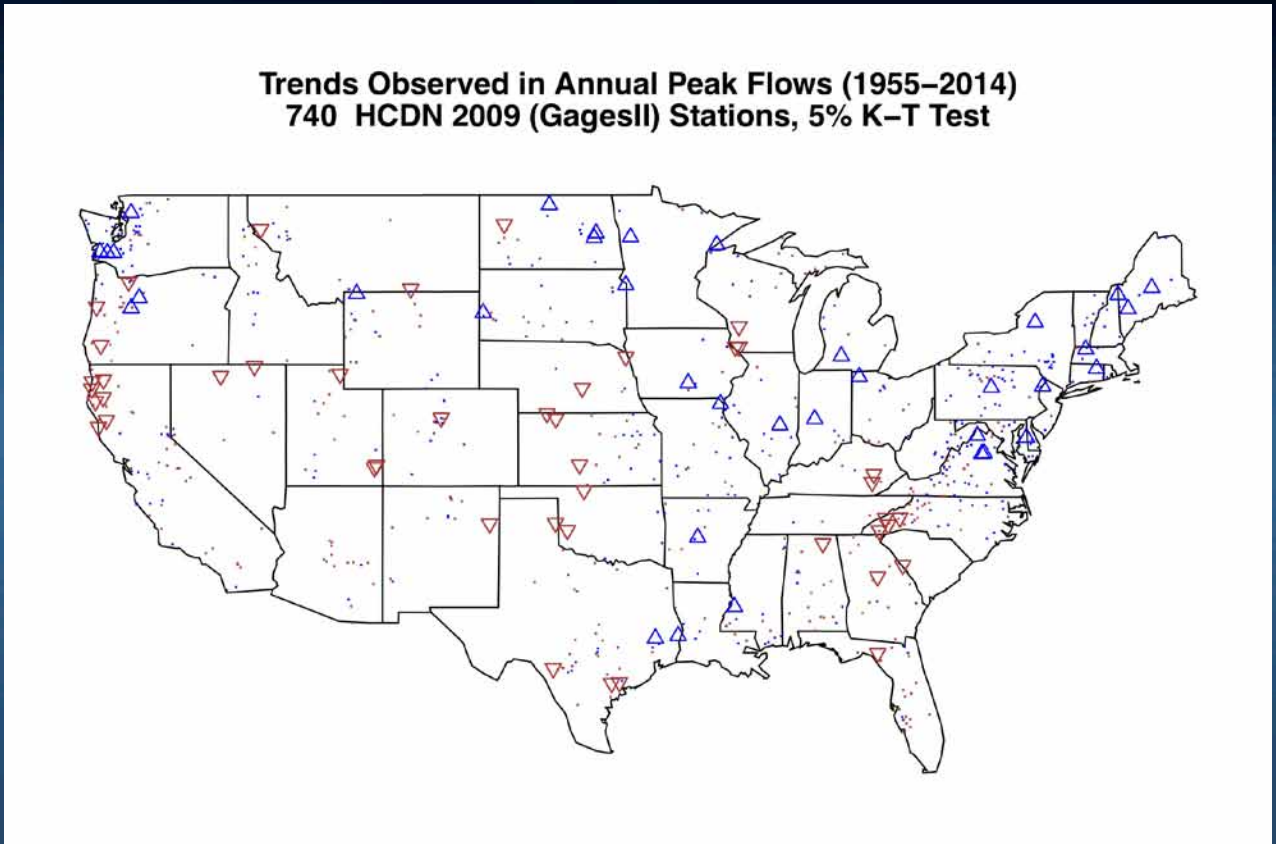
# Flood Trends (1955-2014)

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# Changing Demand for Water

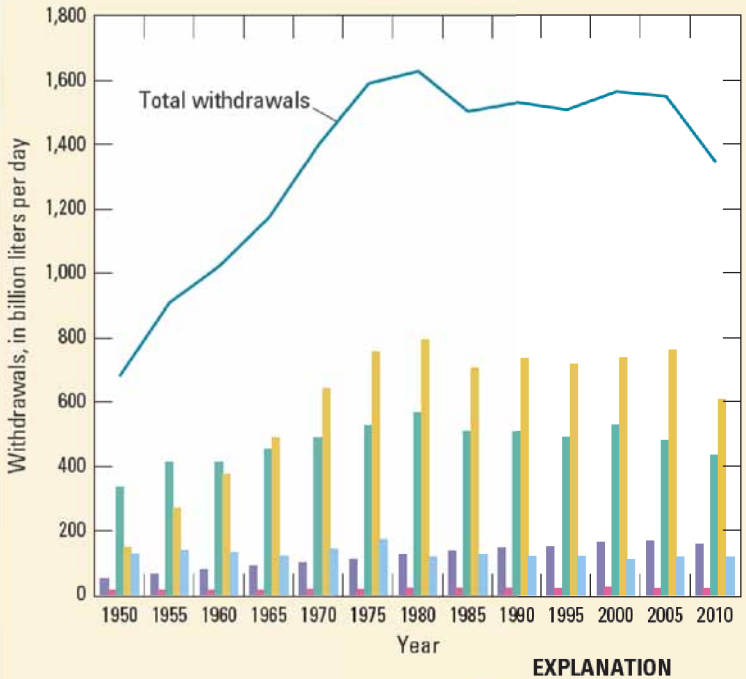


**Figure B–3.** Trends in water withdrawal by water-use category, 1950–2010. "Other" includes industrial, aquaculture, and mining. (Maupin and others, 2014)

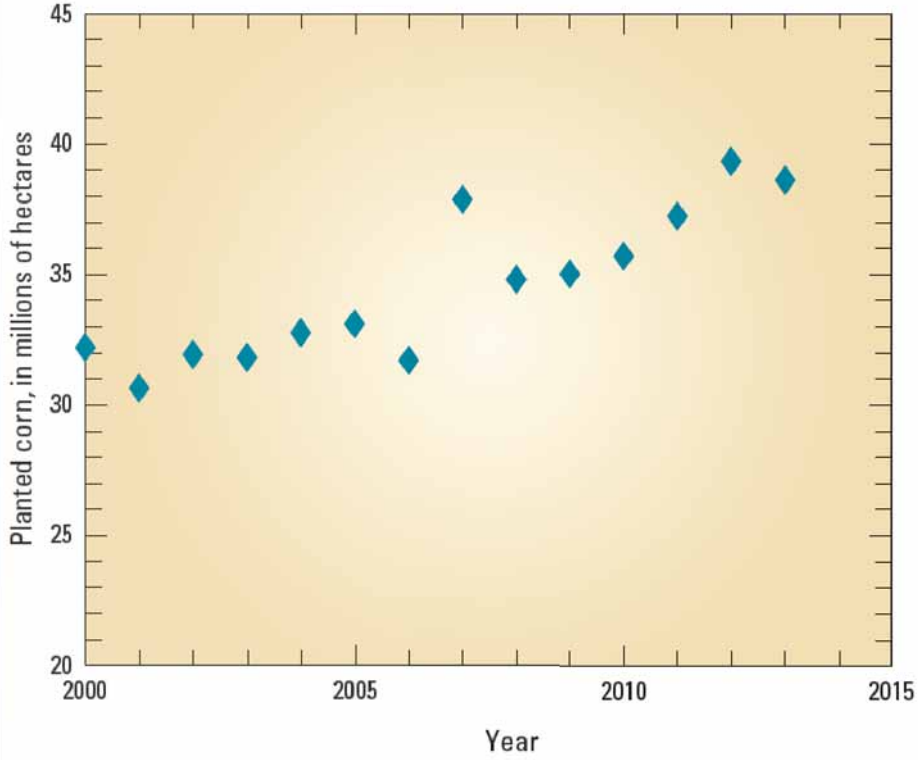


**Figure 11.** Annual hectares of planted corn in the United States, 2000–2013. (From U.S. Department of Agriculture, National Agricultural Statistics Service, 2014)

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# Is There Something to Worry About?

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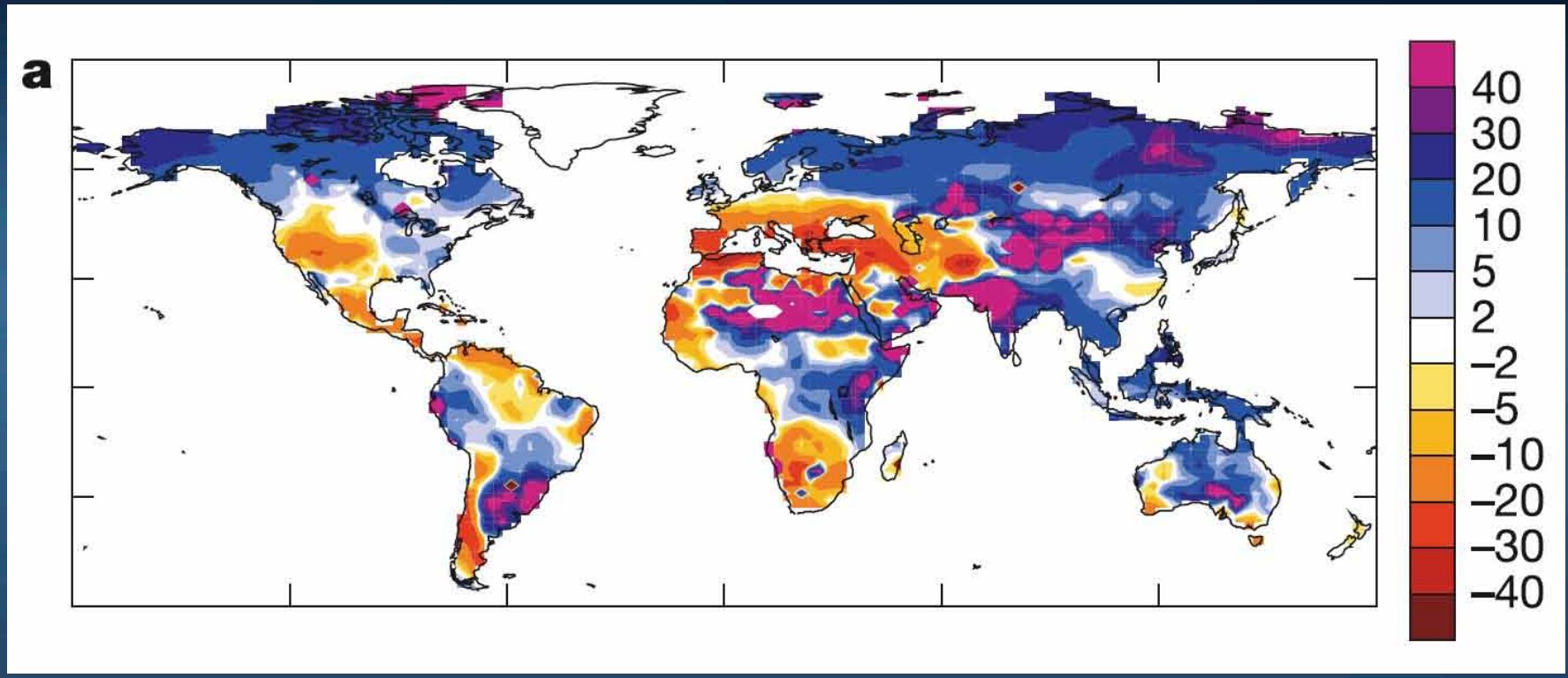
# Projected Changes in 21st Century Runoff

## 100*(projected[2041-2060]-mean[1900-1970])/mean[1900-1970]




[Milly et al., 2005]

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# National Climate Assessment [2014]

"Average U.S. precipitation has increased since 1900, but some areas have had increases greater than the national average, and some areas have had decreases. More winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century."

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# Conclusions

- Water supply and demand vary over time and space
- Current models provide limited information about future conditions
- There is substantial uncertainty about what to expect in the future