MAGNITUDE AND SIGNIFICANCE OF OBSERVED TRENDS IN PRECIPITATION FREQUENCY OVER THE U.S.

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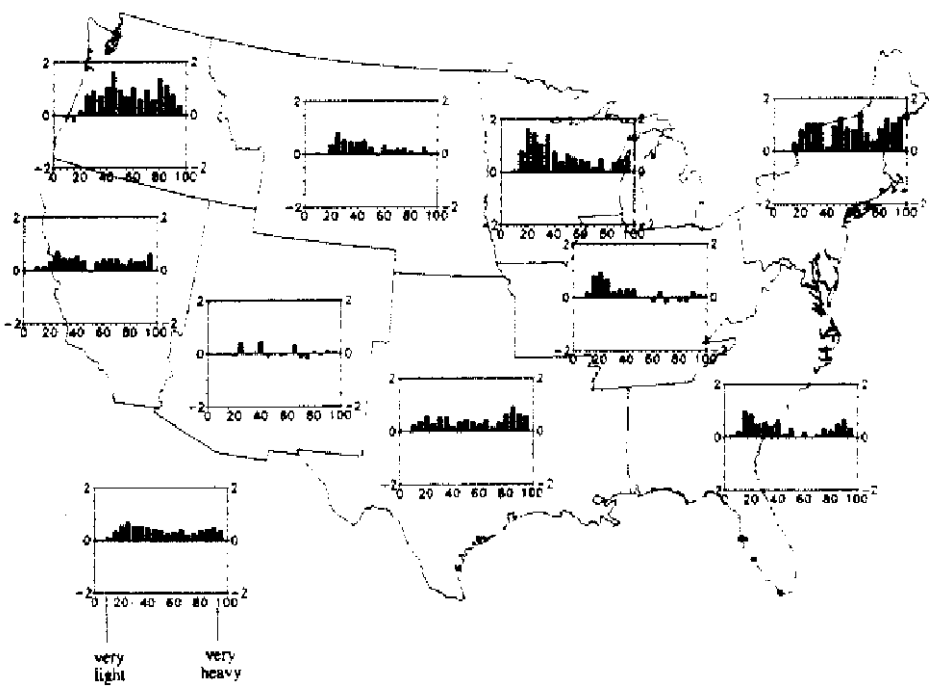
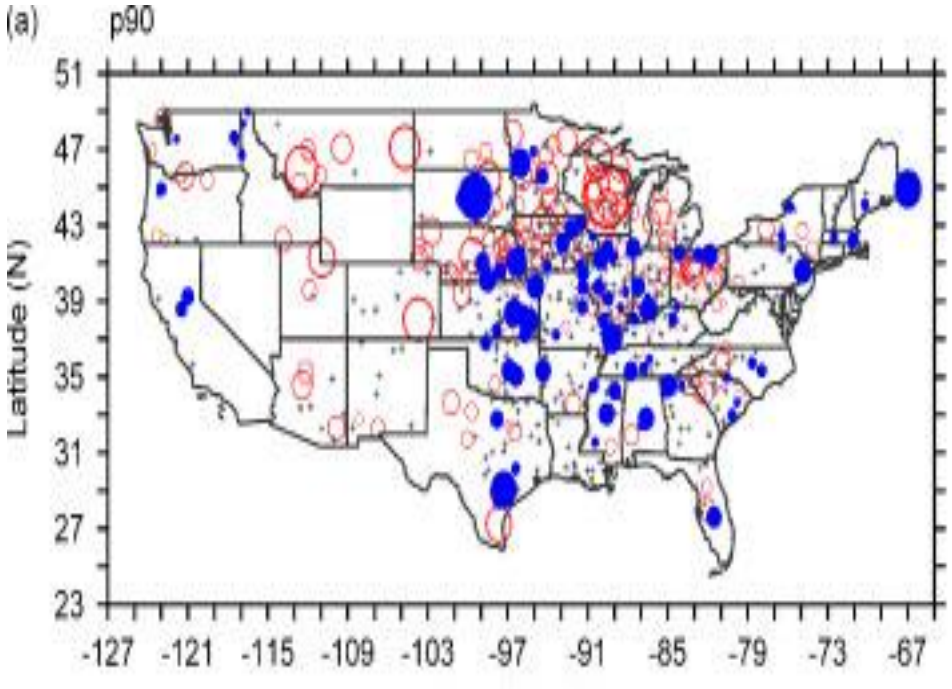
Motivation

- Changing behavior of how often it rains has widespread hydrologic implications
- Much progress has been made in documenting observed changes in mean and extreme precipitation characteristics (Karl et al.,1998; Easterling et al., 2000; Frich et al., 2002; Kunkel et al., 2003; Groisman et al., 2004,2005; Alexander et al., 2006; Higgins et al., 2007; Pryor et al., 2009)
- Station based trends have more relevance w.r.t. climate impact on water resources, agriculture and ecosystem

Trend: Frequency of Annual Wet days



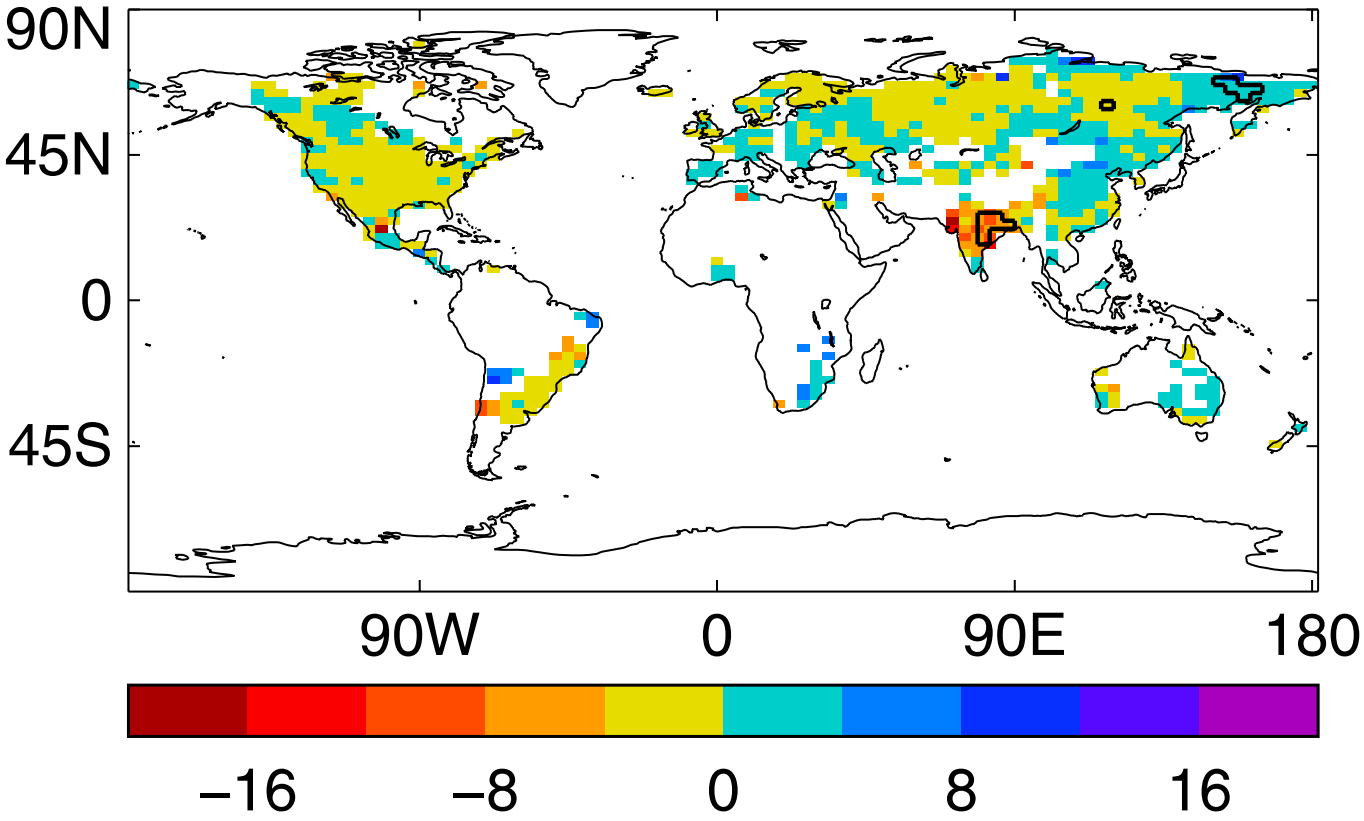


1910-1995
182 stations (Karl et al.,1998)

1895-2002
646 stations (Pryor et al., 2009)

Trend: Mean Consecutive Dry Days

Alexander et al. (2006)



- Also, station level analysis - McCabe et al (2010) for the Southwest

Objectives

- Identify historical trends in frequency of wet days and ‘extreme’ dry spell (maximum length of consecutive dry days) in wet and dry seasons
- Check regional expressions of trends without area averaging station data
- Capture shifts in wet and dry seasons and

Data

- US Historical Climatology Network (USHCN) precipitation data
- Sub-select 774 stations out of 1200 that have at least 80 years of data spanning ~ 1930-2009 with at least 95% availability

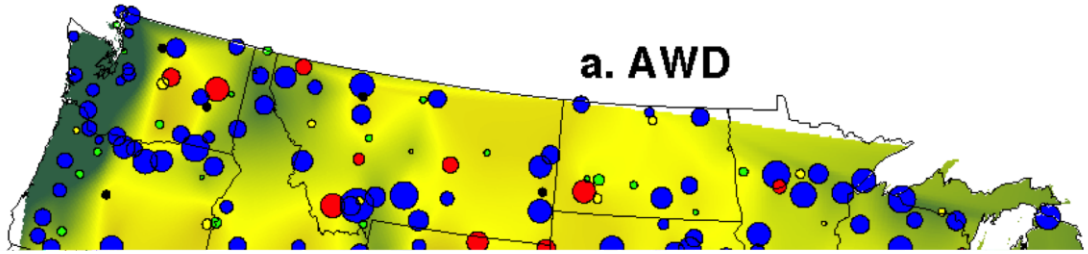
Station-specific precipitation seasons

- How frequency and extreme dry spell characteristics have changed in (climatologically) wettest and driest seasons at each station
- **Wet season** – climatologically wettest 91 days period
- **Dry season** – climatologically driest 91 days period

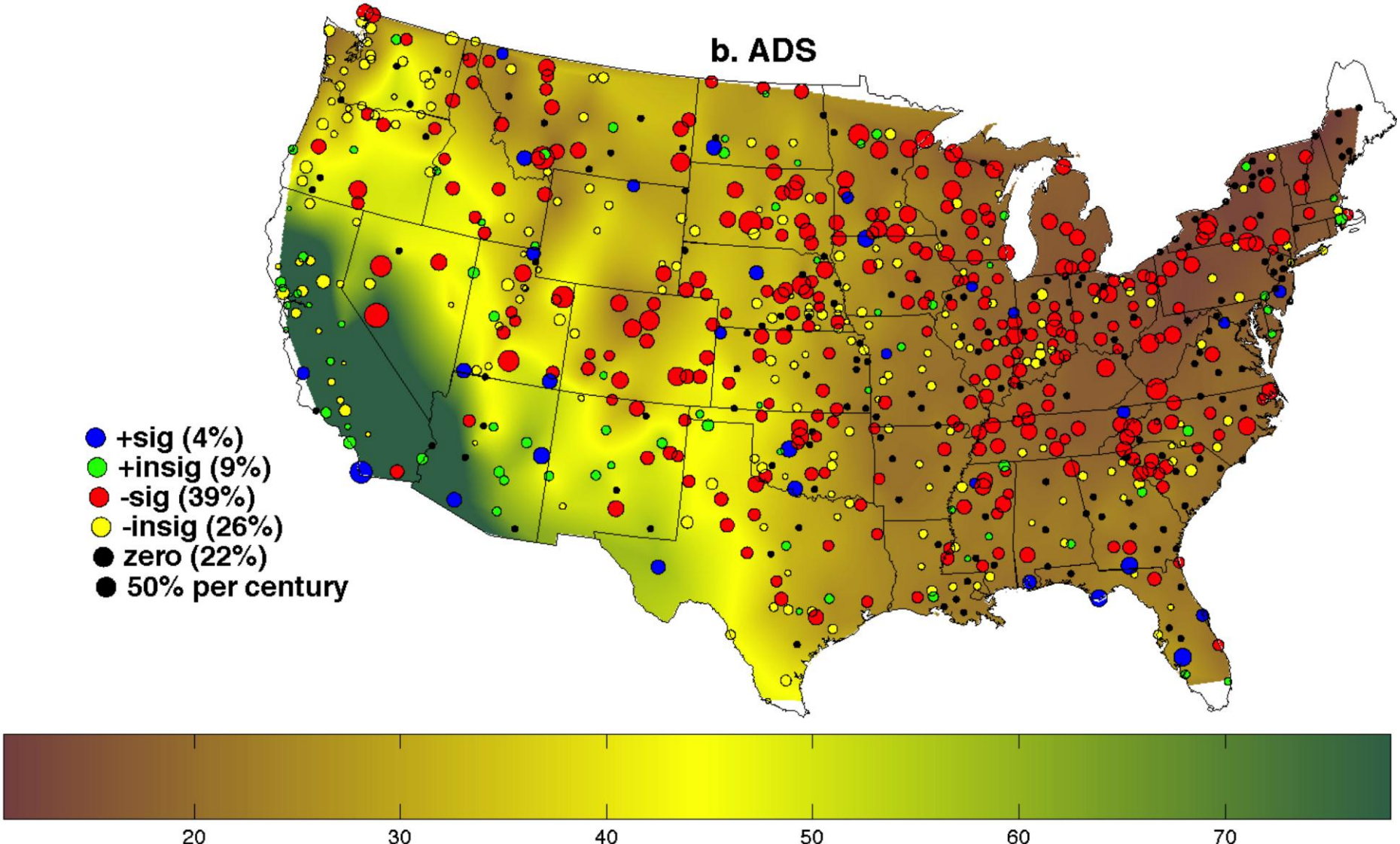
Trend and significance test

- Mann-Kendall test
- Detect trends amidst range of inter-annual to decadal variability
- Stochastic daily precipitation model (Markov modeling system) to generate 1000 synthetic daily time series of occurrence (Gianotti et al., 2012)
- Whether observe trend falls within/outside 5-95% range of probability distribution of 1000 trend estimates derived from stochastically generated

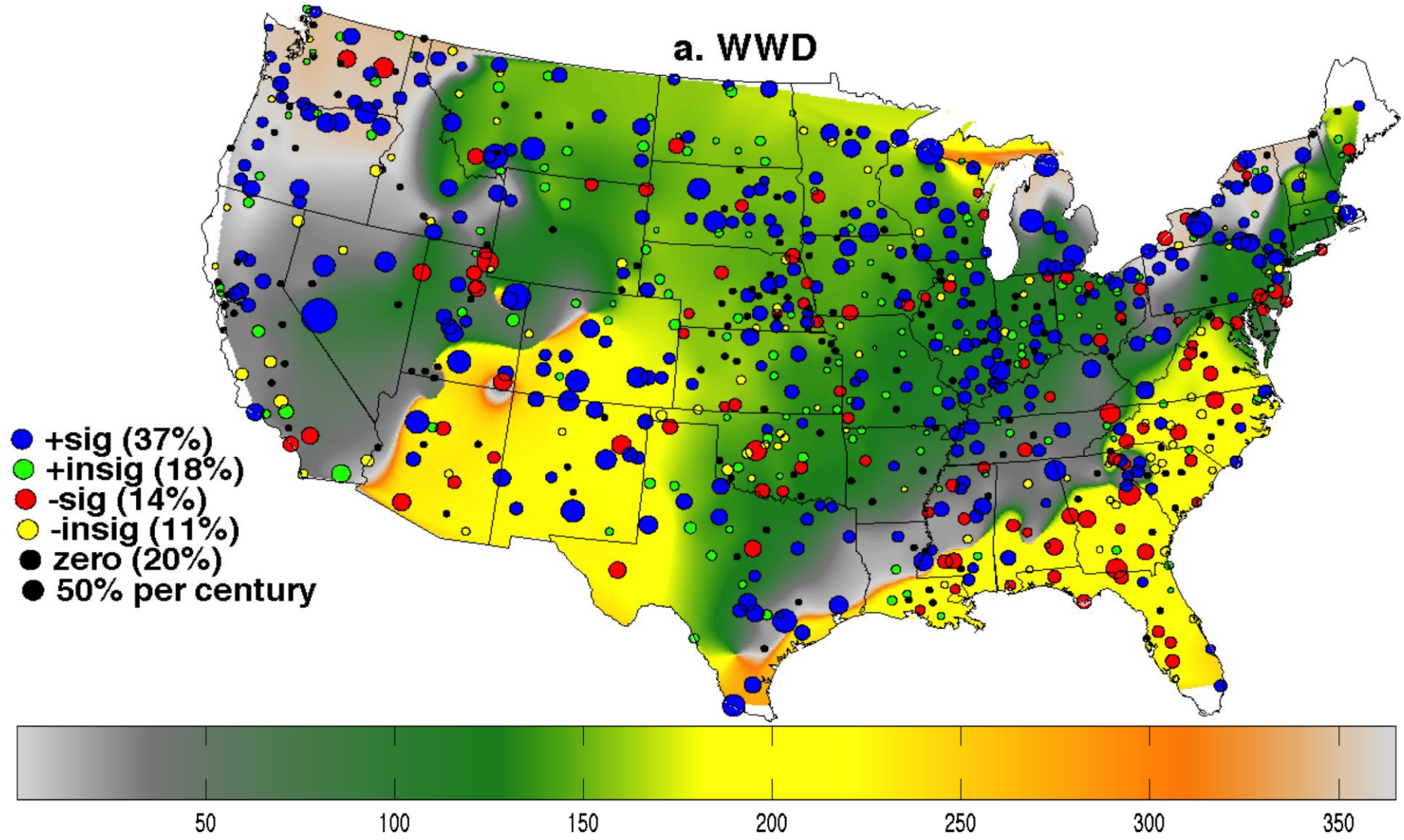
Trend: Frequency of Annual Wet days



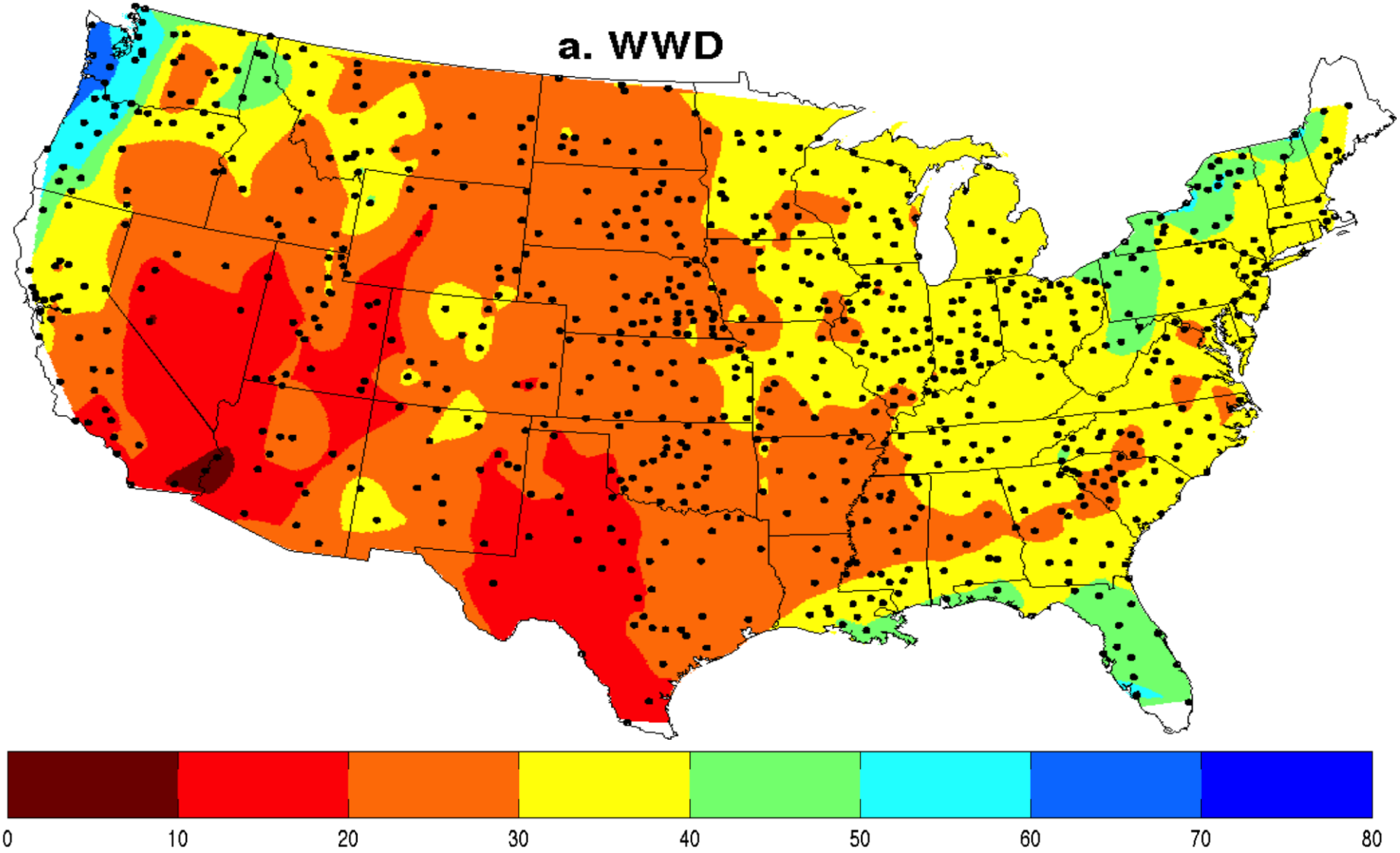
Trend: Extreme Dry Spell (annual)



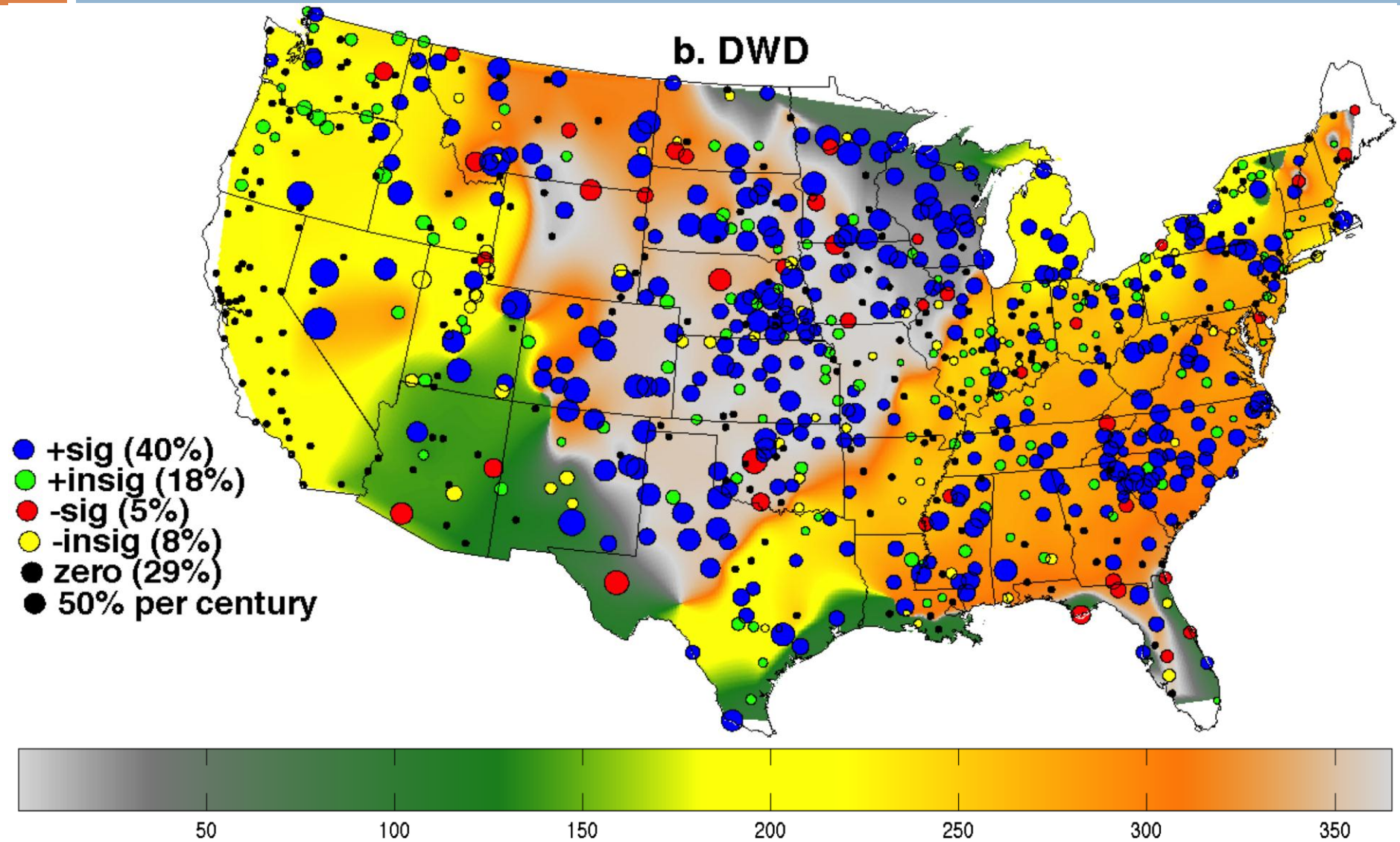
Trend: Frequency of Wet Season Wet Days



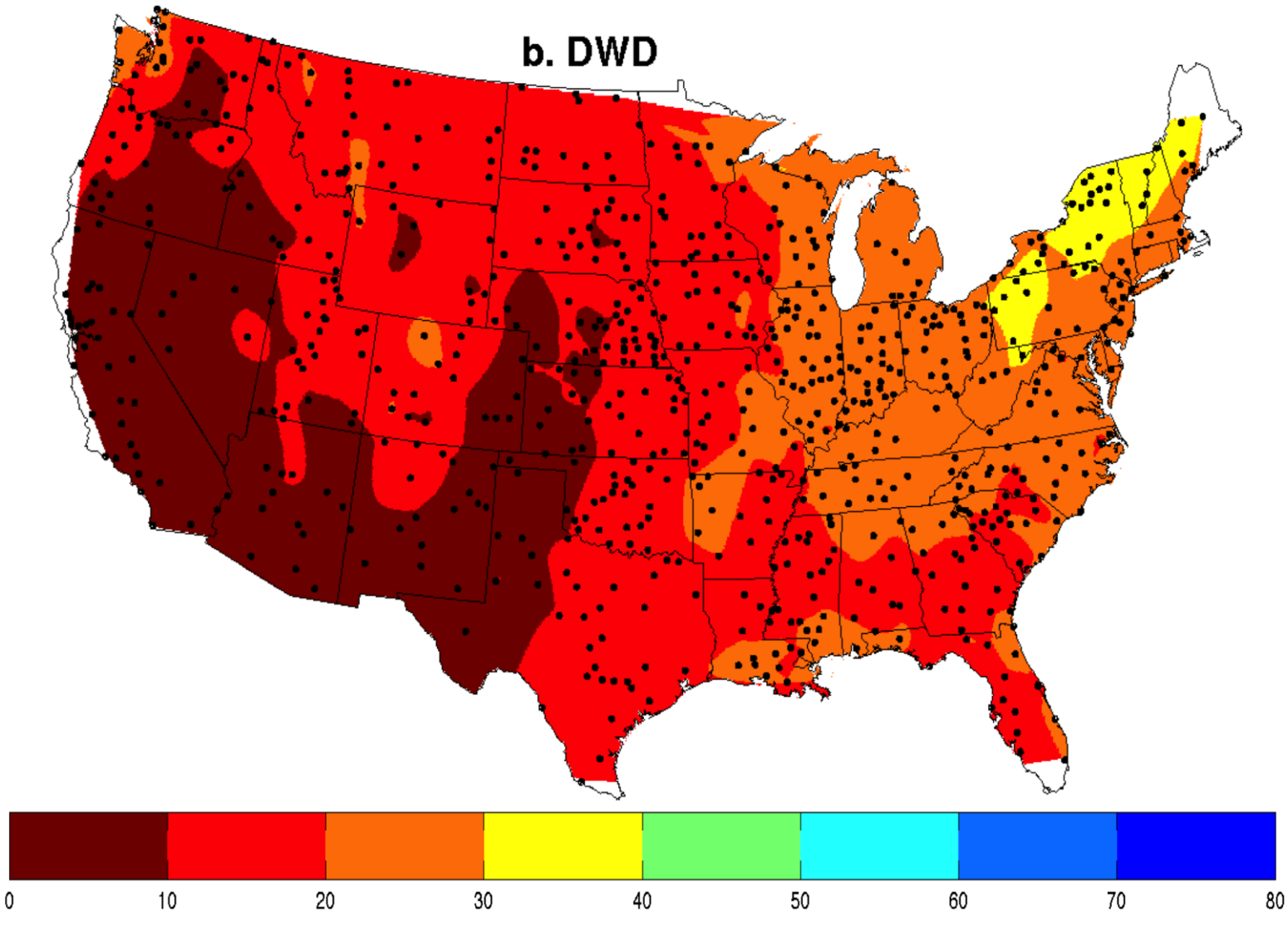
Climatology: Frequency of Wet Season Wet Days



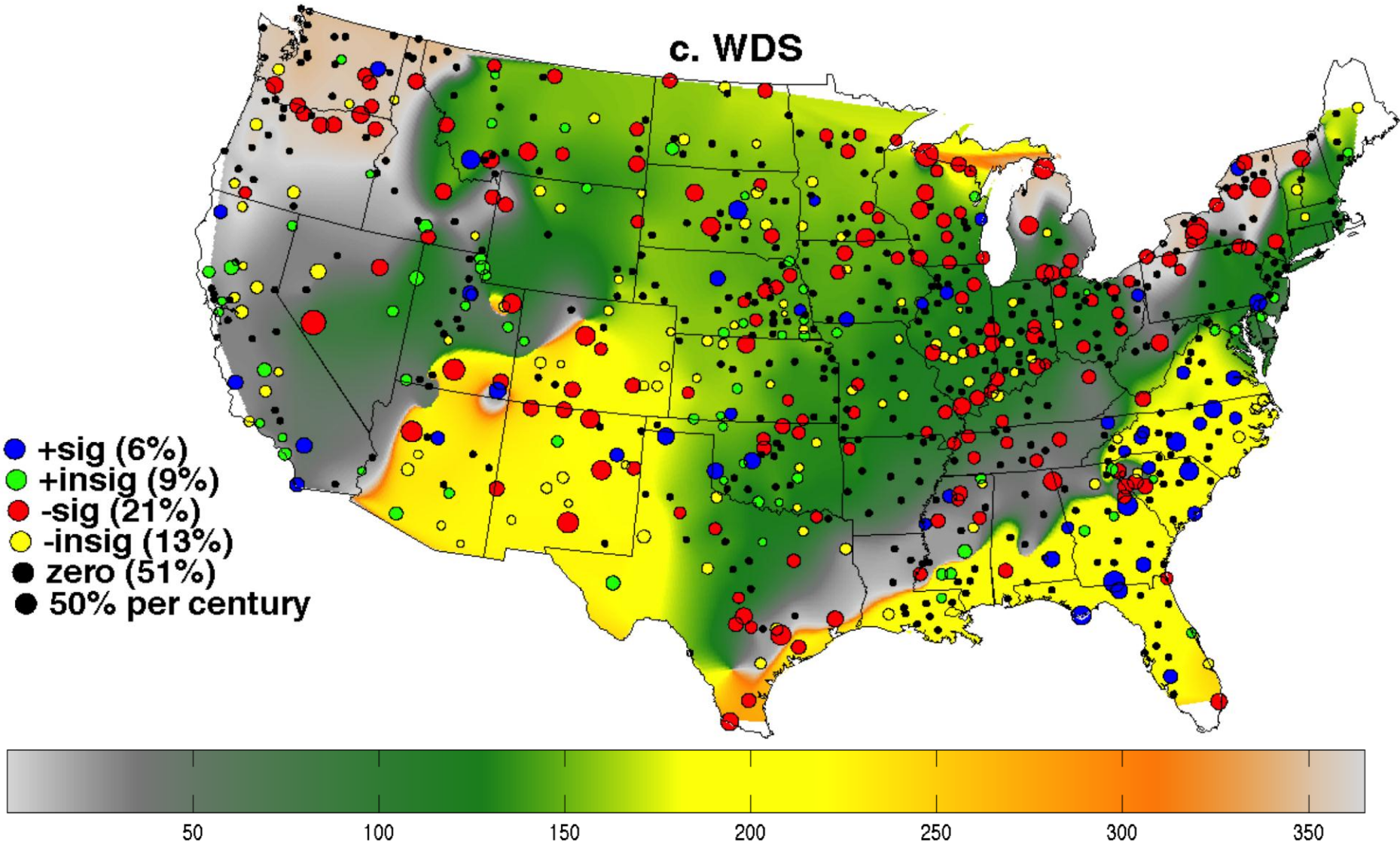
Trend: Frequency of Dry Season Wet Days



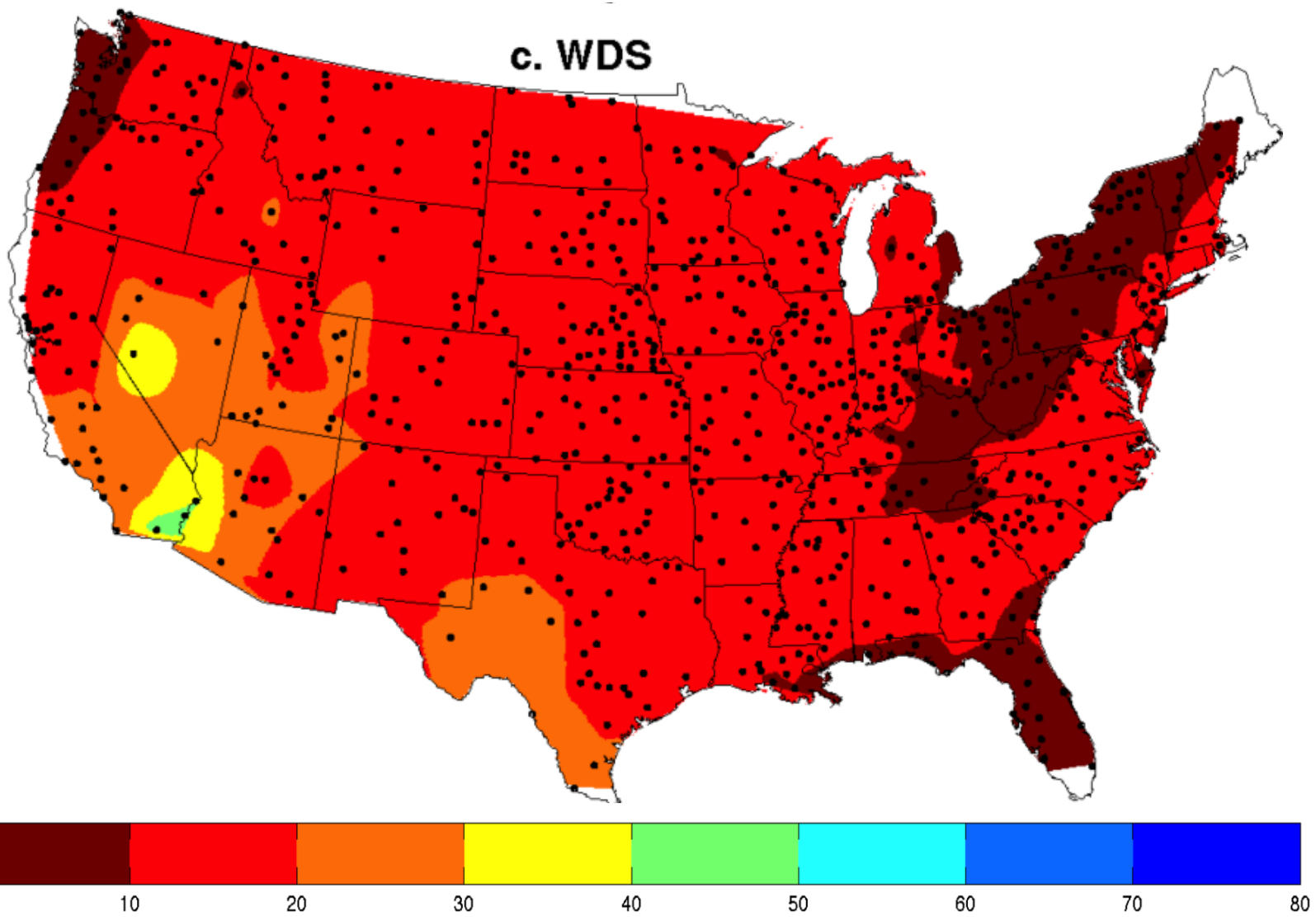
Climatology: Frequency of Dry Season Wet Days



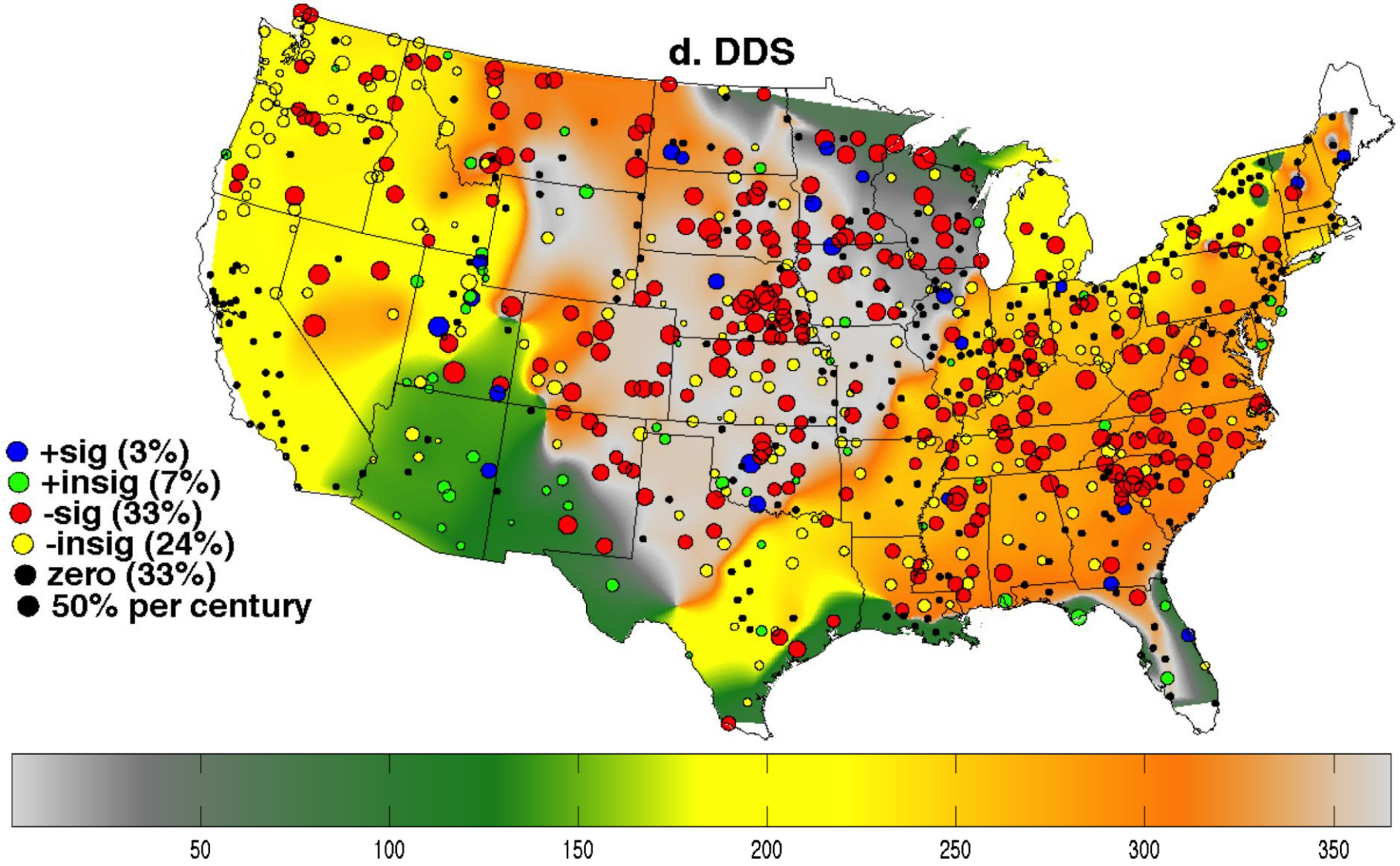
Trend: Extreme Wet Season Dry Spell



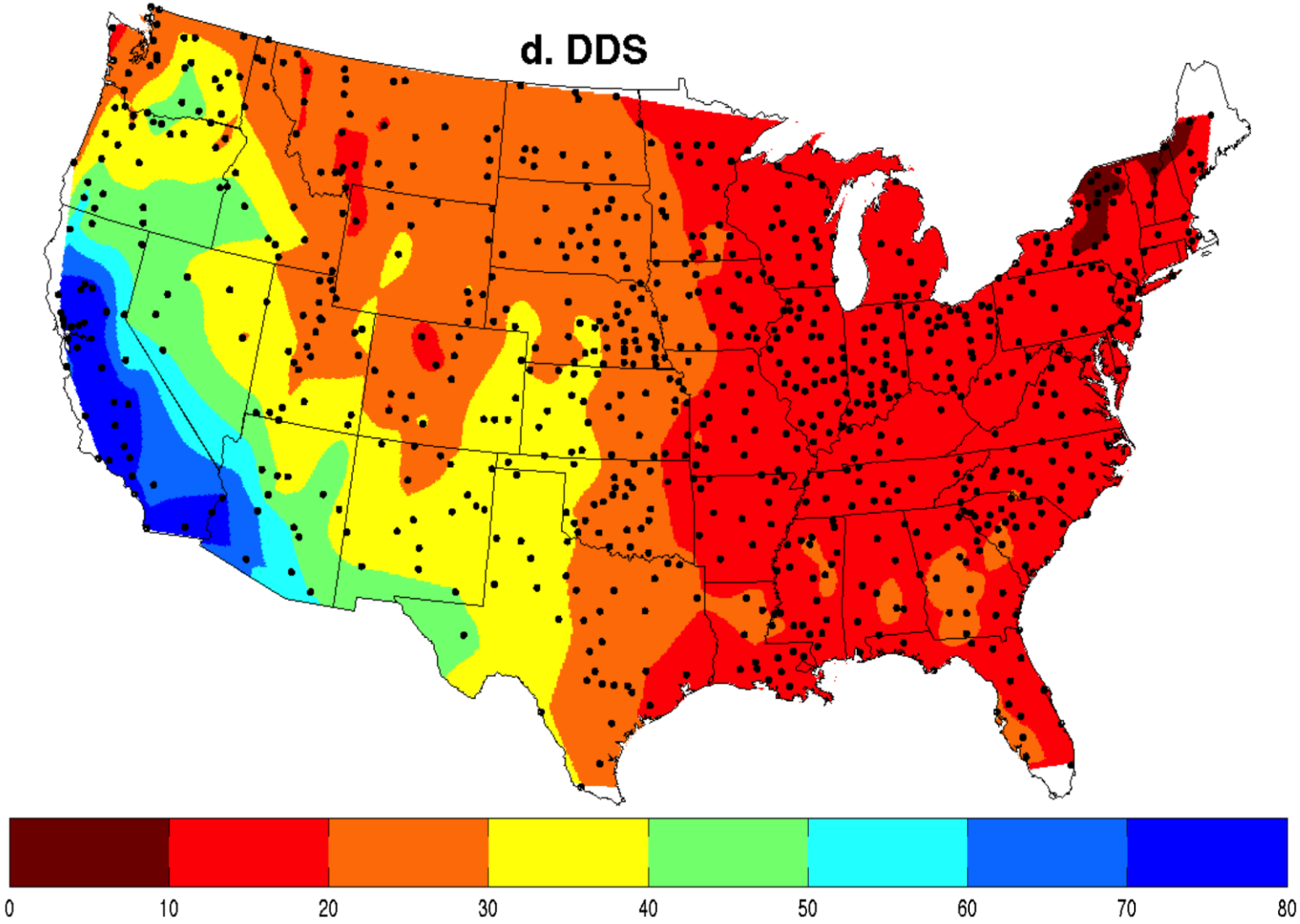
Climatology: Extreme Wet Season Dry Spell



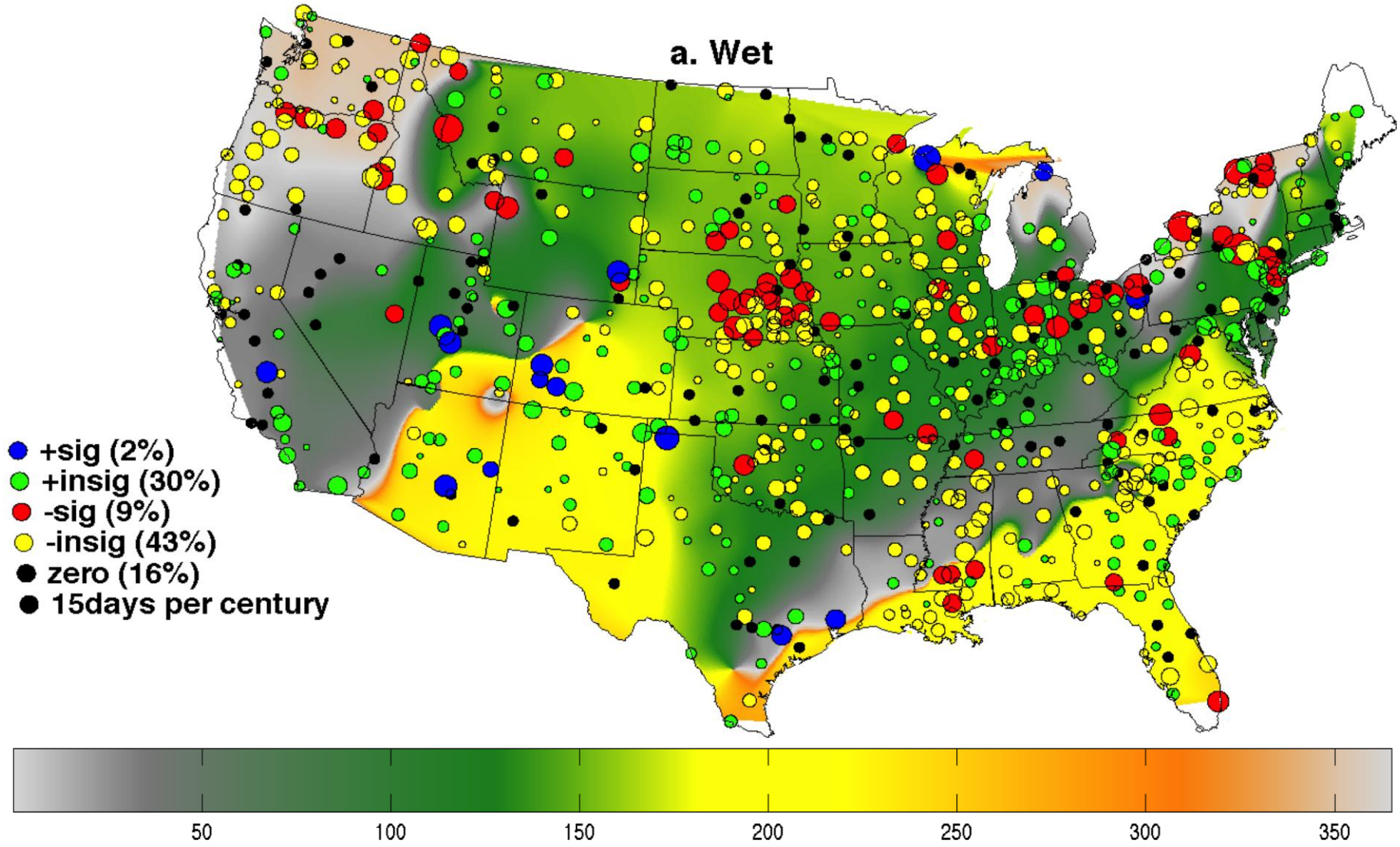
Trend: Extreme Dry season Dry Spell



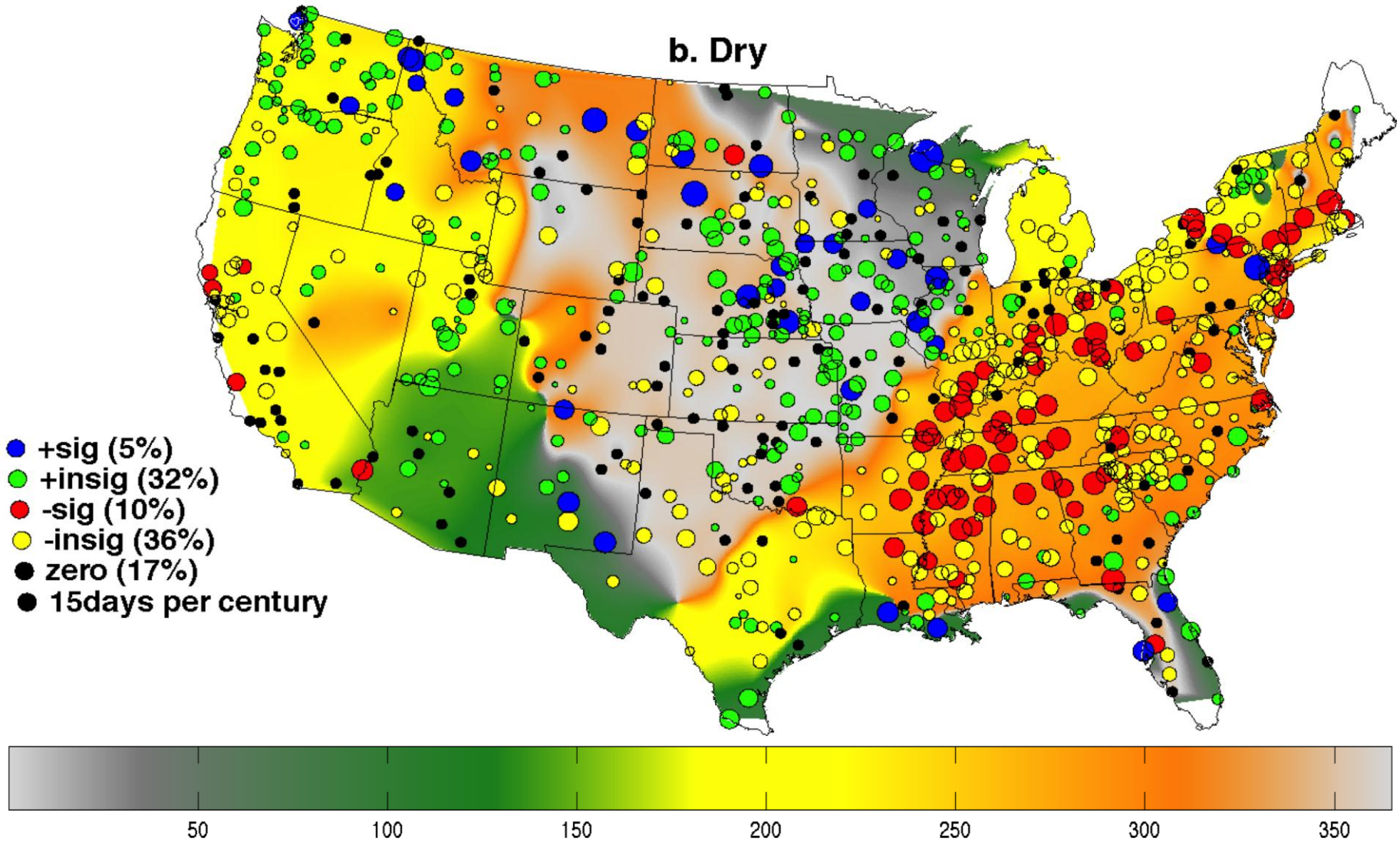
Climatology: Extreme Dry season Dry Spell



Shift in Wet Season



Shift in Dry Season



Summary

- Presented trends and significance at station level
- Station specific trends showed regional consistency
- Over most stations occurrence of precipitation has been trending upward in wet and dry seasons with greater number of stations with positive trends in dry season
- SE or the Atlantic Plains had negative trends in wet season
- Length of dry spells has been trending downward in wet season (except Atlantic Plains)
- Wet/dry seasonal shifts were significant for various

Thank you