

Deriving Data-driven Insights from Climate Extreme Indices for the Continental US

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INTRODUCTION

- ❖ SRCC - 1 / 6 National Regional Climate Centers of NOAA
- ❖ Big Data Repositories - Data Acquisition, Management, Analytics and Visualization
- ❖ Climate observations, Extremes, Climate models, Derived grids, Products

INTRODUCTION

- ❖ Types of Data Holdings - Temperature, Rainfall, Snow observations, Tornado / Hail / Wind occurrences, Storm Surge Data, Water Reservoir Data (regional)
- ❖ ACIS - Applied Climate Information System
 - ❖ Big data warehouse, WS API (www.rcc-acis.org)
 - ❖ Python, Go, InfluxDB, HDF5, PostgreSQL, Redis, Javascript, Pandas
 - ❖ Developed by RCCs.

Motivation

- ❖ 3rd National Climate Assessment, 2012.
- ❖ Point-based analysis vs Area-based analysis
- ❖ Single station vs. climate division based.

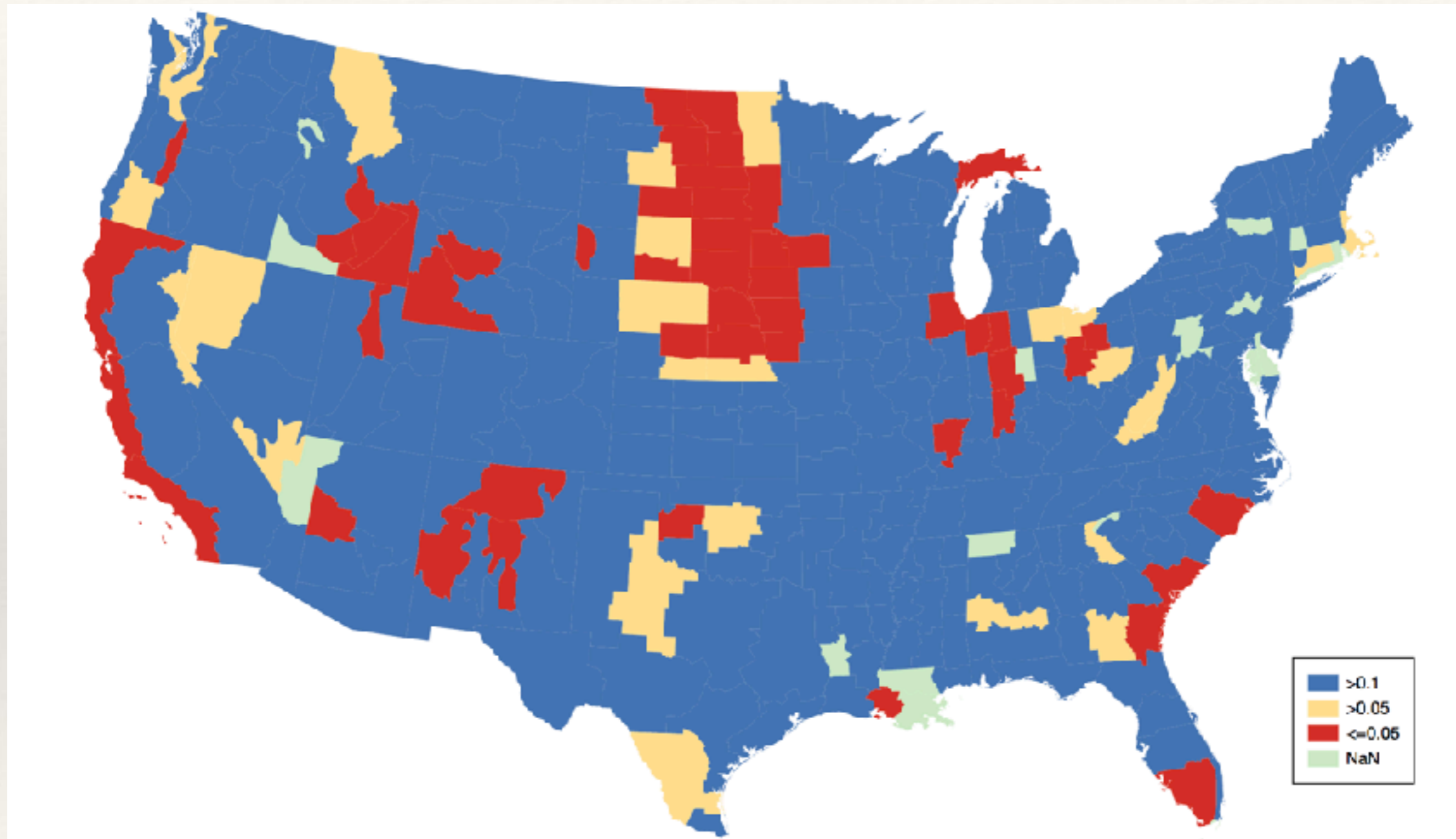
Methodology

- ❖ ACIS archives 26,000 daily climate measurement sites
- ❖ Time period studied - 1946-2015, split into 1946-1980, 1981-2015
- ❖ Measurement sites that had a near complete data record - 3210
- ❖ Developed a new, extreme event dataset, TEF (Threshold Exceeding Frequency Dataset).
- ❖ Redis, Python, Pandas
- ❖ Sites grouped into 344 climate divisions

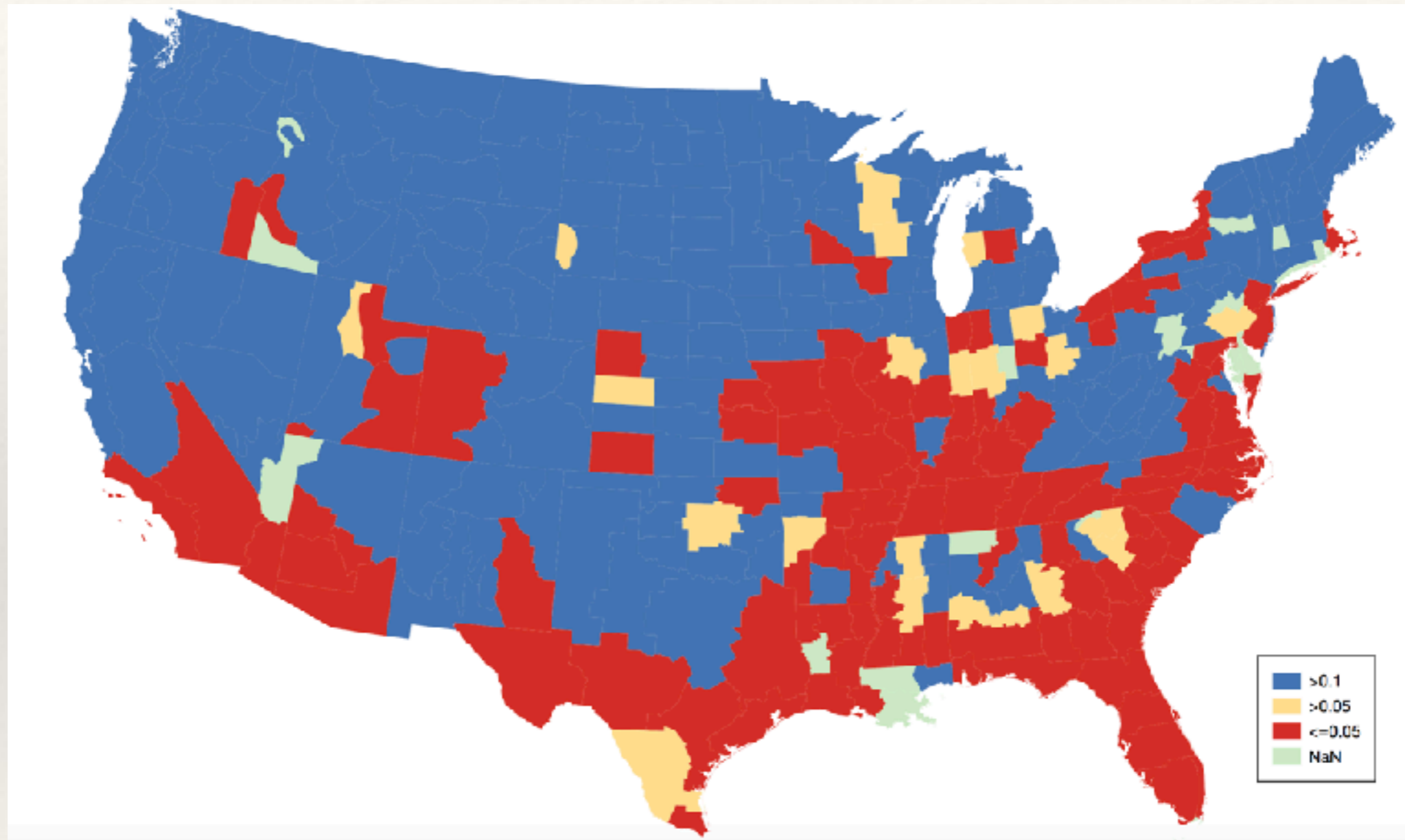
Methodology

- ❖ Analyzed / compared annual frequency of days above a certain threshold (extreme) for the time periods
- ❖ Is there an increasing or decreasing frequency of occurrence for each threshold?
- ❖ 20 different thresholds
- ❖ 3 non-parametric statistical tests - Mann-whitney, Wilcoxon, Kolmogorov-Smirnov.

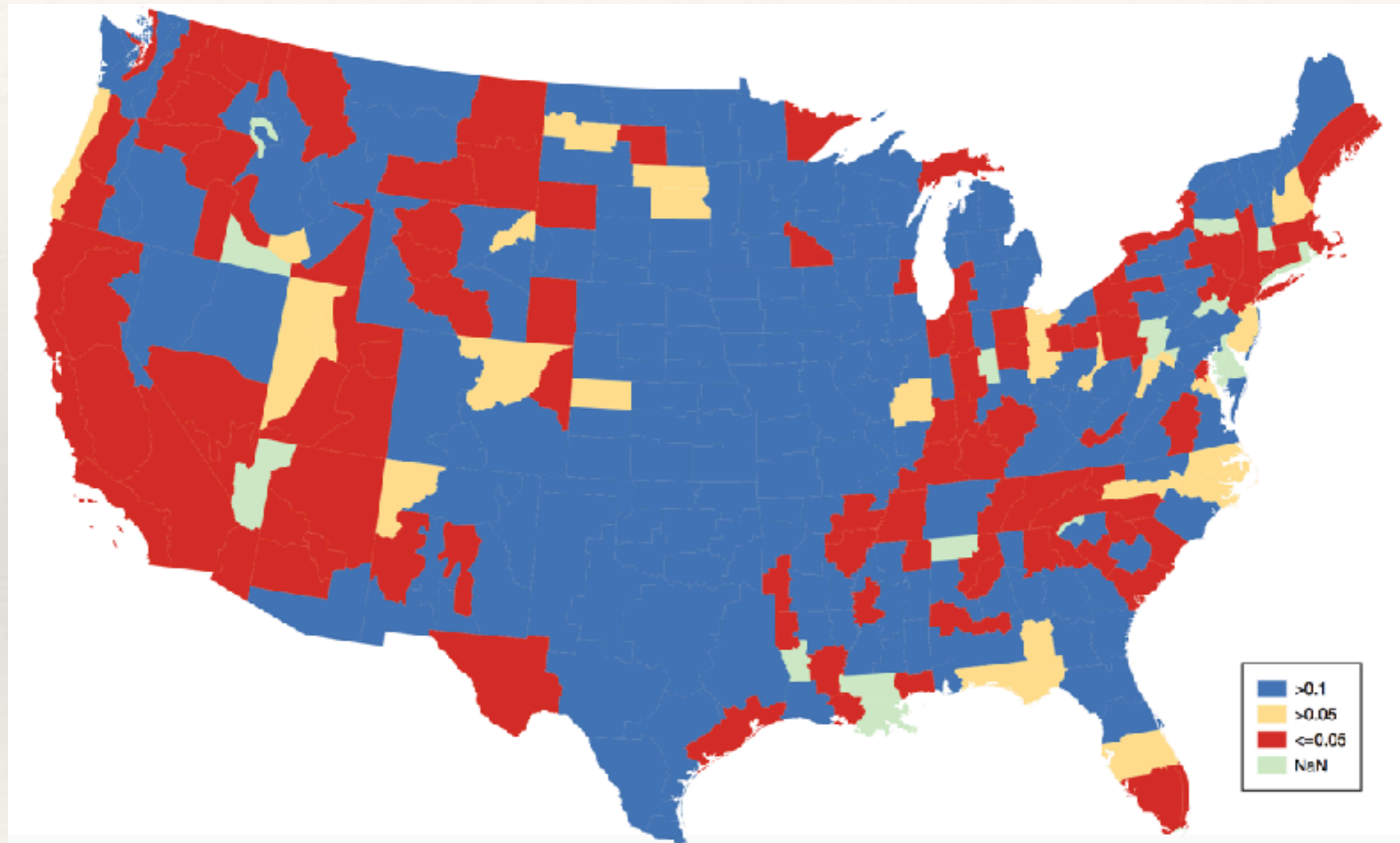
Max Temp ≥ 95 (Wilcoxon)



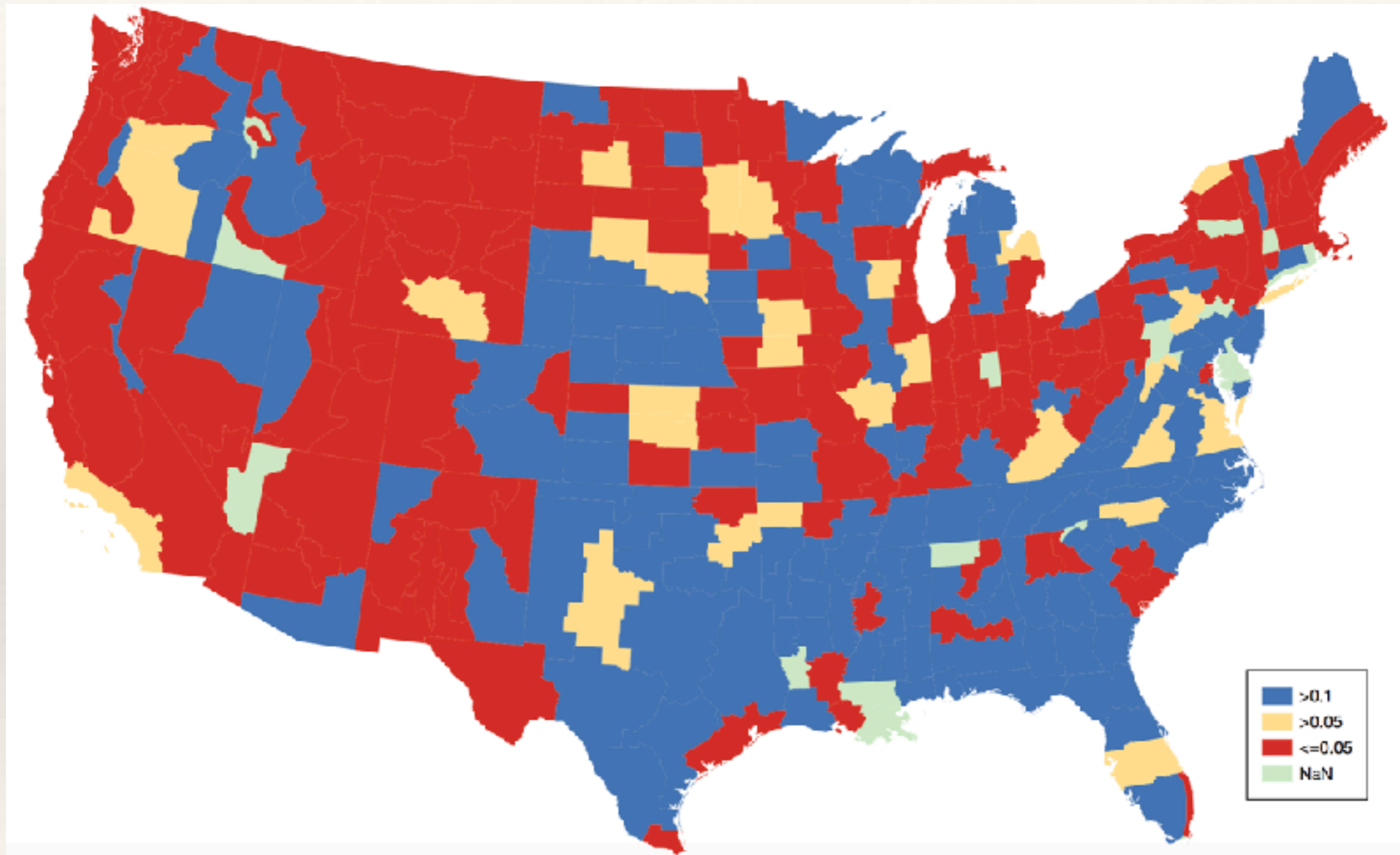
Min Temp ≥ 75 , Wilcoxon



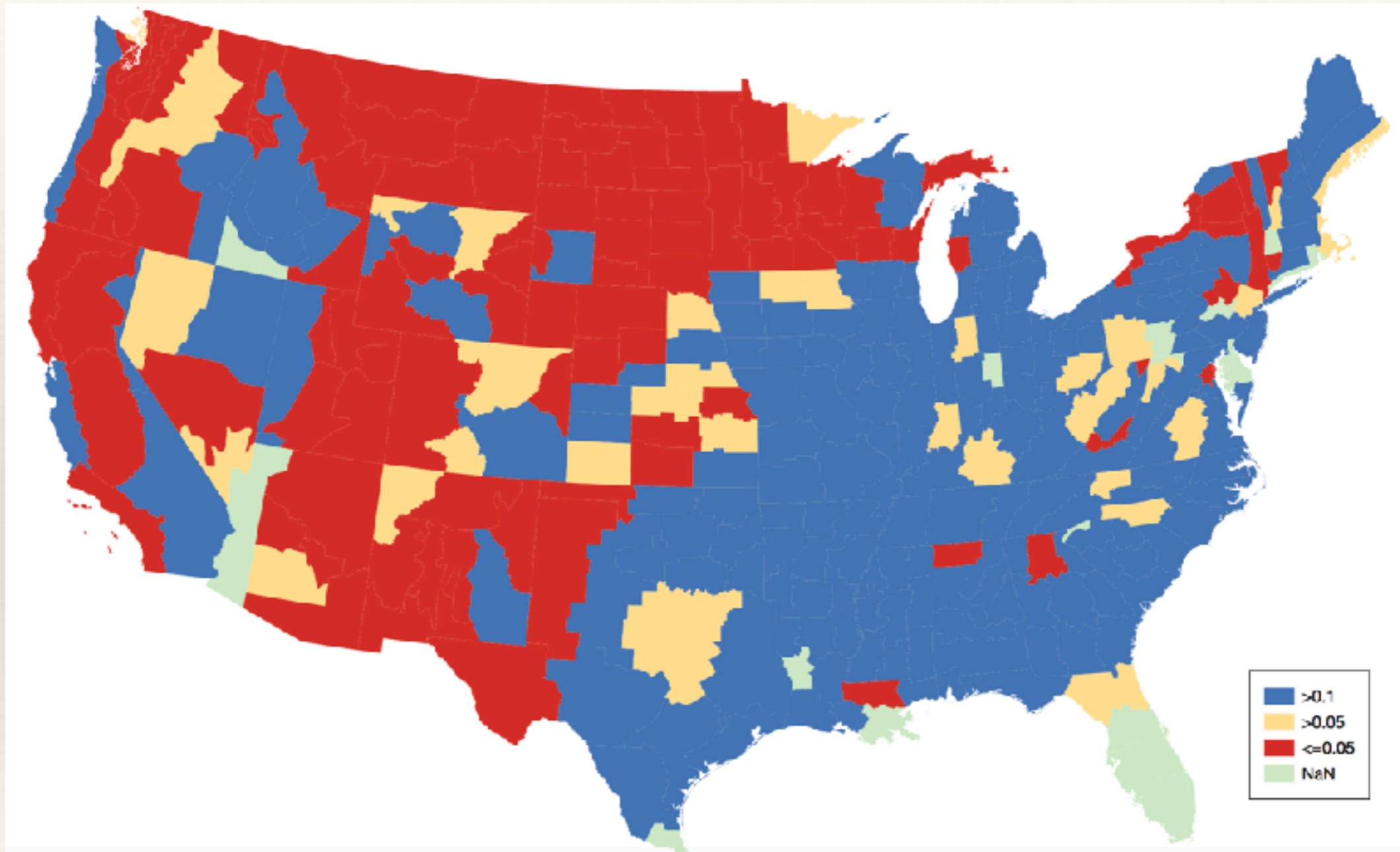
Min Temp ≥ 65 , Mann-Whitney



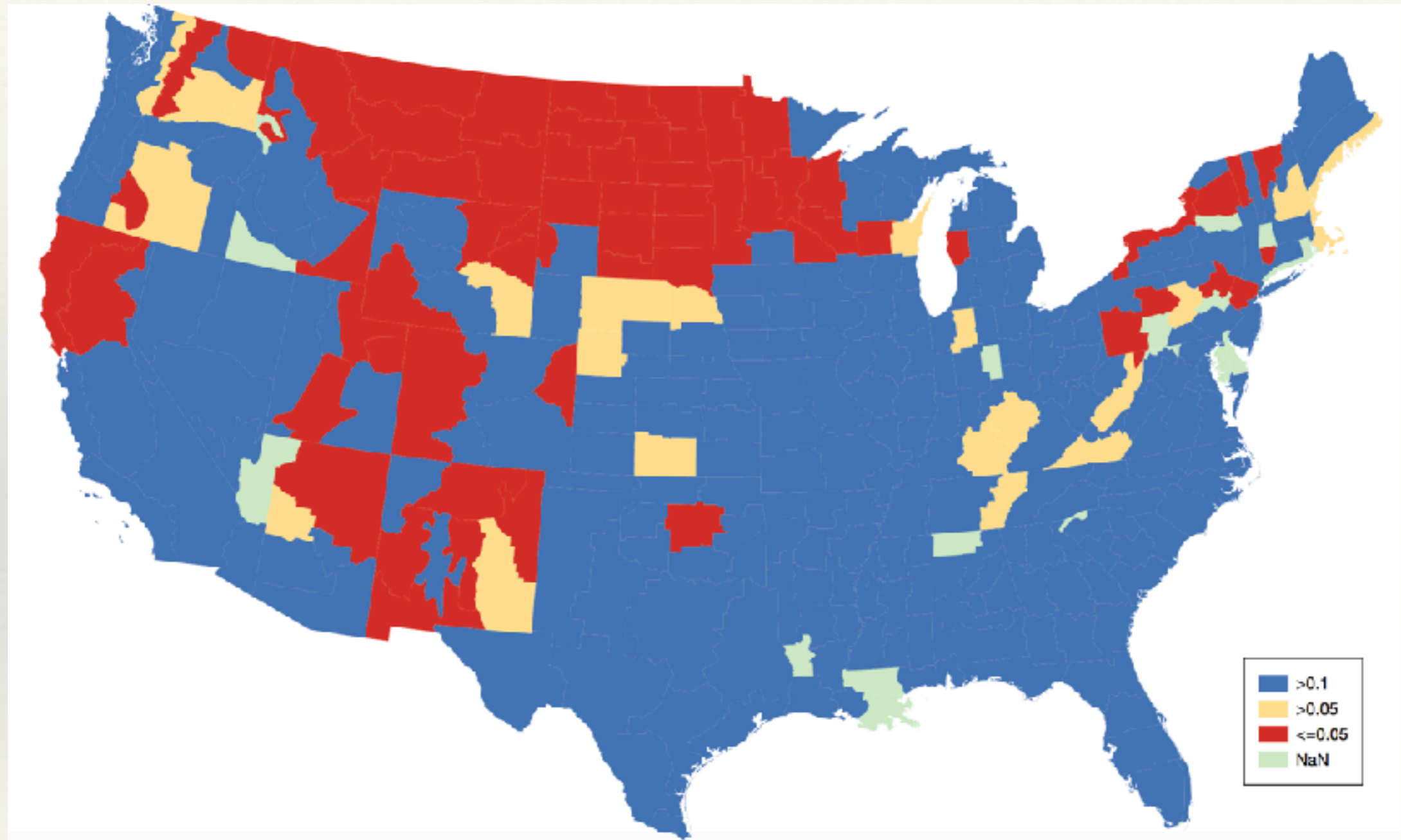
Min Temp ≤ 32 (K-S)



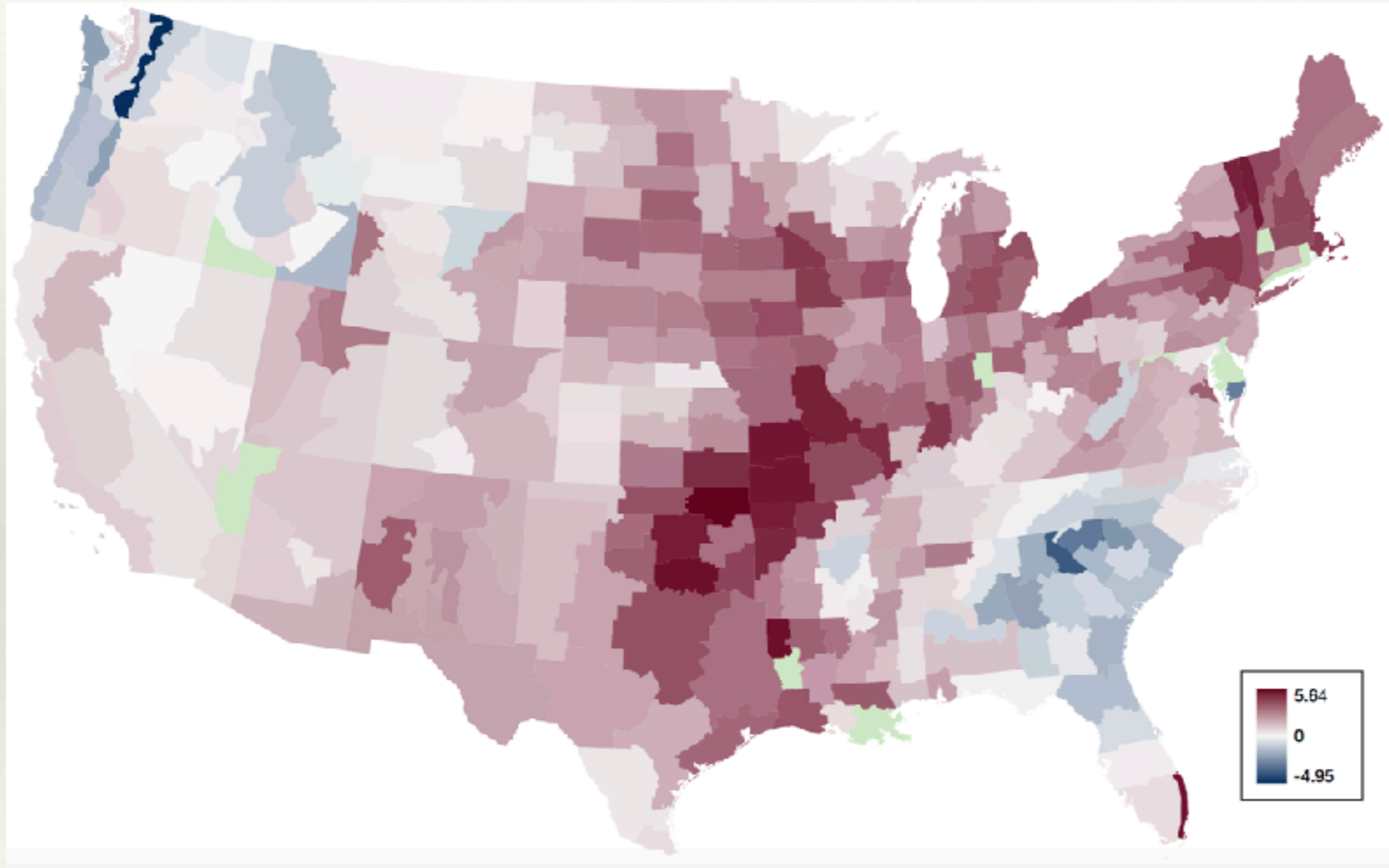
Min Temp ≤ 10 (M-W)



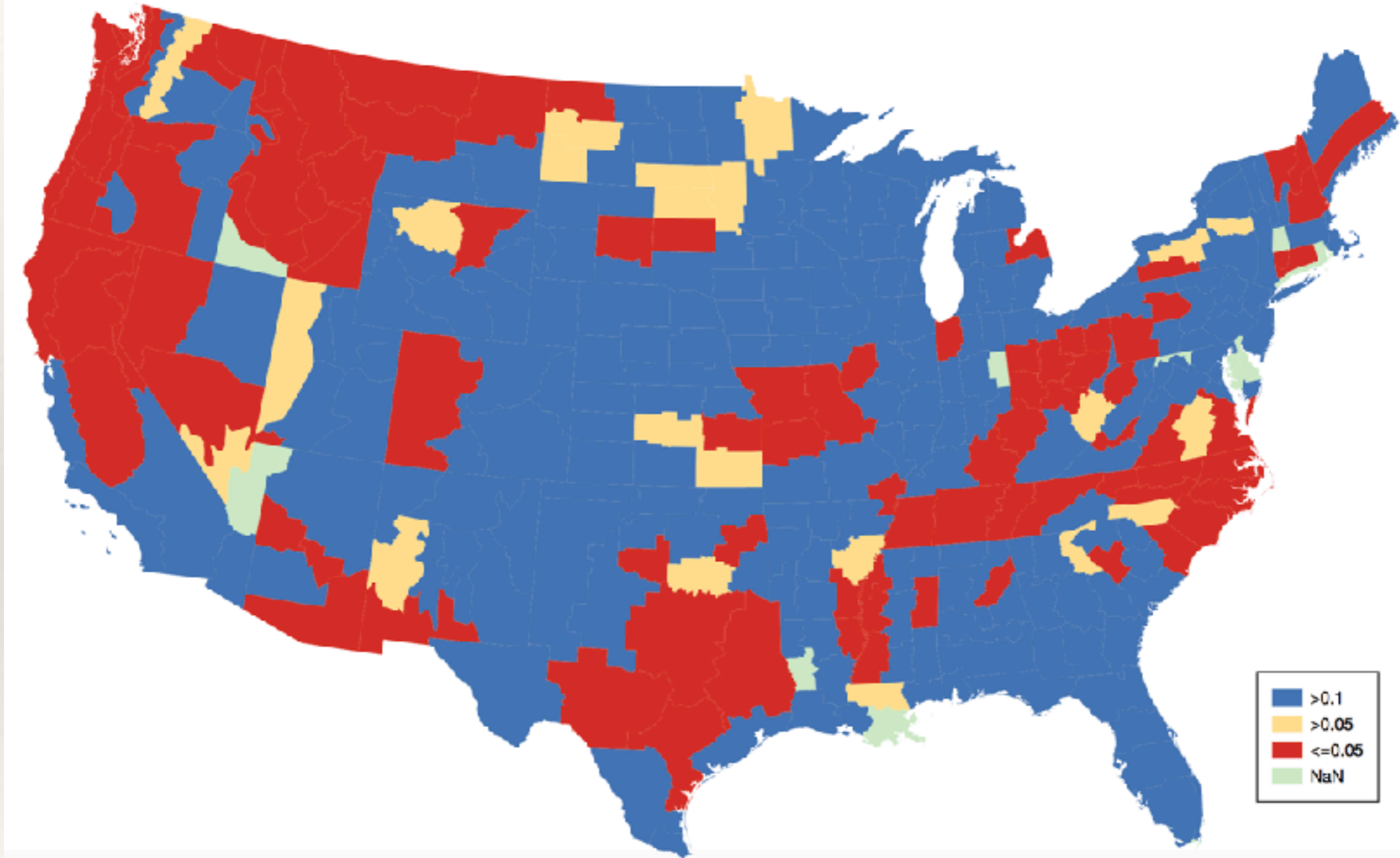
Min Temp ≤ 0 (M-W)



Rainfall Totals



Snowfall Totals



Analysis

- ❖ Southern and warmer parts of the the US seeing warmer night time temperatures (min temp ≥ 75)
- ❖ Northern parts known for cooler nights in the summer experiencing warmer nights (min temps ≥ 65)
- ❖ North-east, mid-west and west of the Rockies - experiencing fewer days with min. temperatures ≤ 32 .

Analysis

- ❖ In general, lower snowfall amounts in areas such as Idaho, Montana, Wyoming, Washington, Oregon and portions along the Appalachian Range.
- ❖ Rainfall totals - vast portion of continental US - experiencing increased rainfall, but not a significant change.

Outcomes and Future Extensions

- ❖ High night time temperatures and effect on crop yield
- ❖ Tourism industry - ski resorts (lower snowfall, less number of days with min temp ≤ 32)
- ❖ Inland water transportation - drought and shallow water
- ❖ Load on the energy grid and impact on propane heating industry
- ❖ Impact on health - pollen / allergies, ecological changes.