How likely are widespread floods in US river basins? Seeking answers using a stochastic, wavelet-based approach

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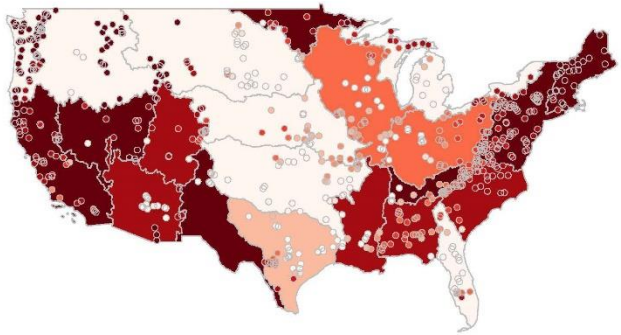
Approach

(1) Simulating large sets of spatially consistent flood event sets

(2) Estimating regional flood hazard for large hydrological regions



More details:
Brunner and Gilleland (under review)

Download R-package: PRSim

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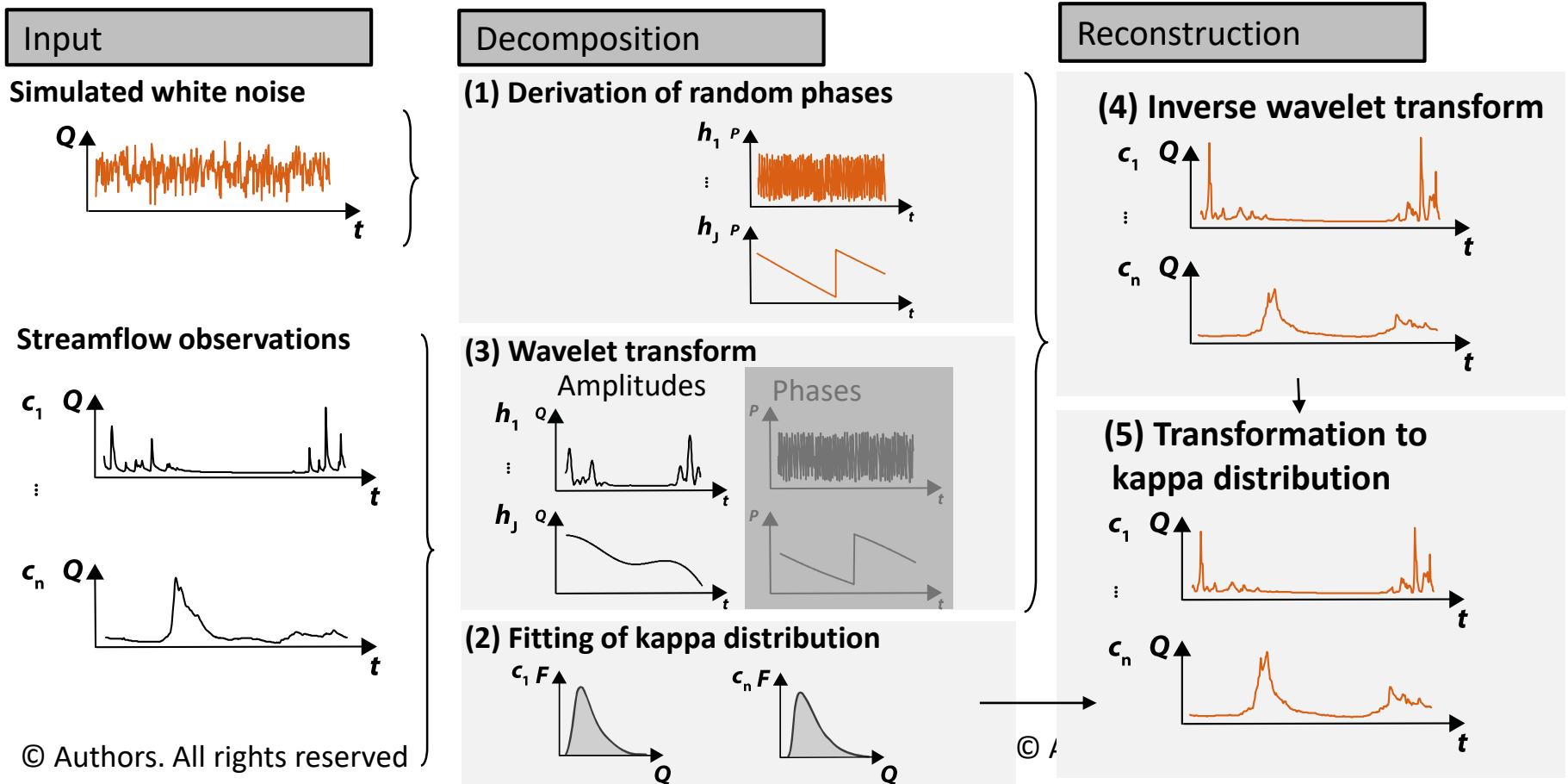
Stochastic simulation using PRSim.wave



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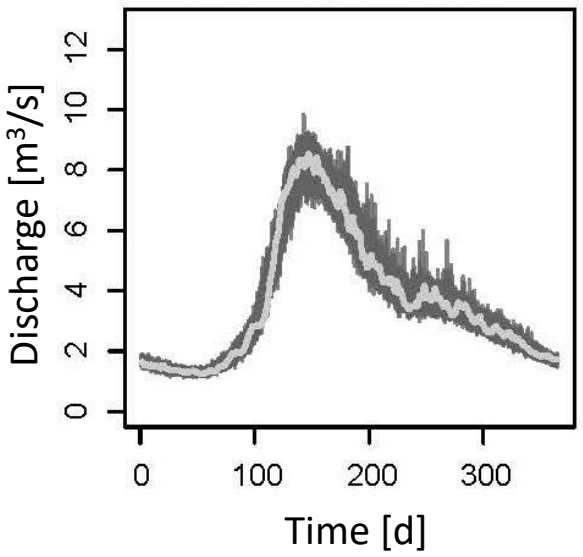
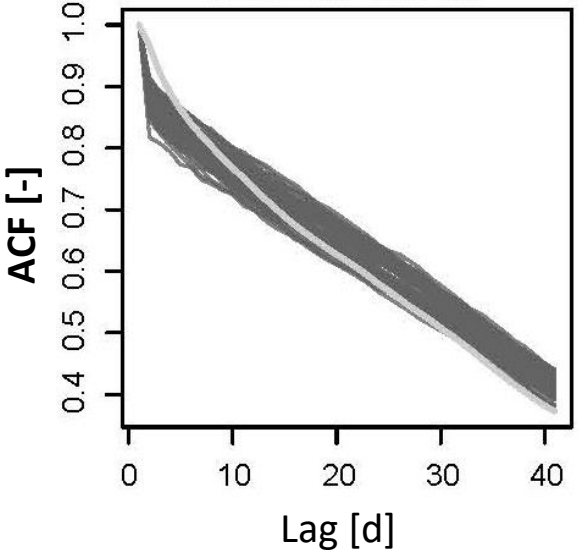
Model evaluation

Observations | Stochastic simulations

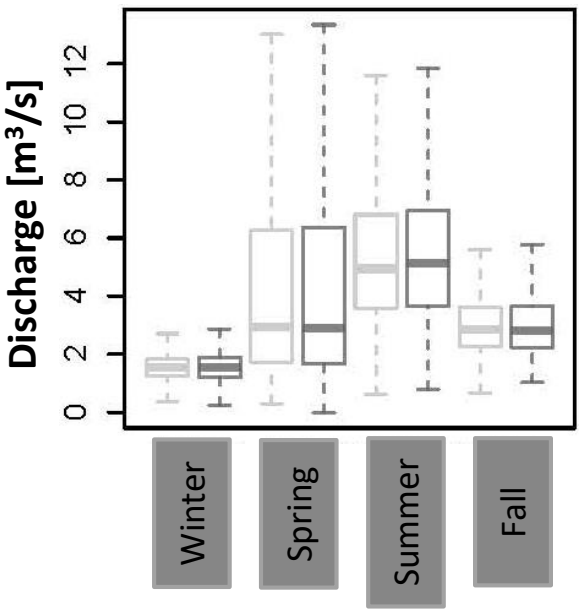
Regime: mean hydrograph



Autocorrelation



Seasonal distributions



Seasonal, temporal, and distributional streamflow characteristics are well reproduced at individual sites

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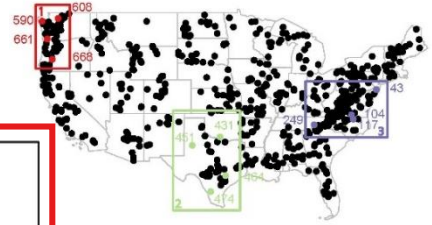
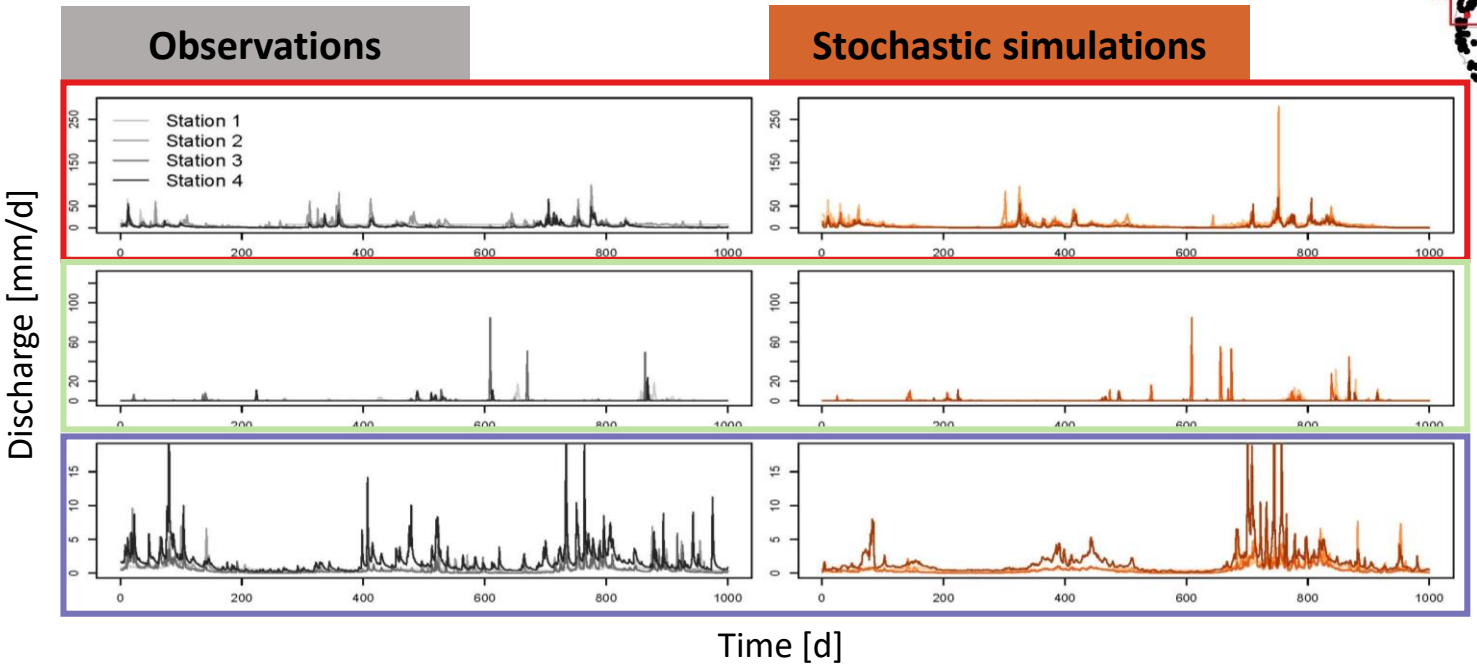
Spatial model evaluation





Spatial streamflow characteristics between multiple sites are well reproduced.

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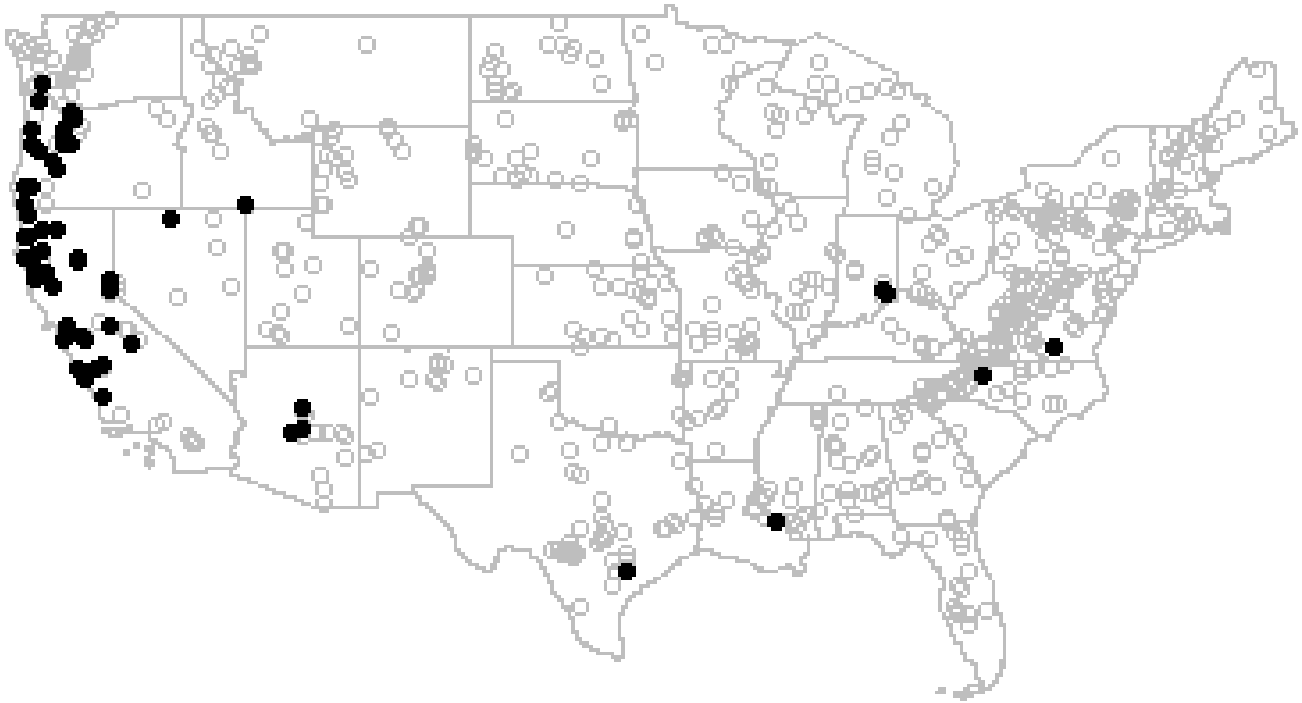
Stochastic simulation of spatial flood events



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Approach

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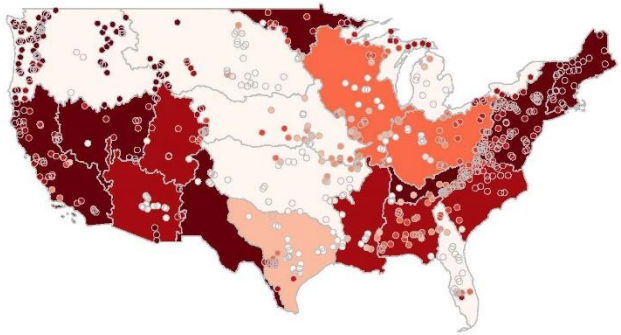

PRSim enables the generation of spatially consistent flood event sets

More details: Brunner and Gilleland (under review)
Download R-package: PRSim

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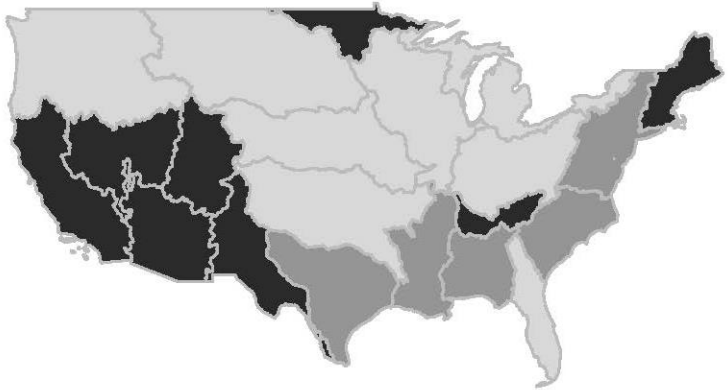
Estimation of regional flood hazard

(1) Simulation of a large set of continuous time series using PRSim.wave
(2) Extraction of peak-over-threshold flood events
(3) Computation of probability of regional flooding
(4) Division of United States into regional flood susceptibility regions

Susceptibility regions



- Widespread, severe floods
- Widespread, moderate floods
- Regional, moderate floods

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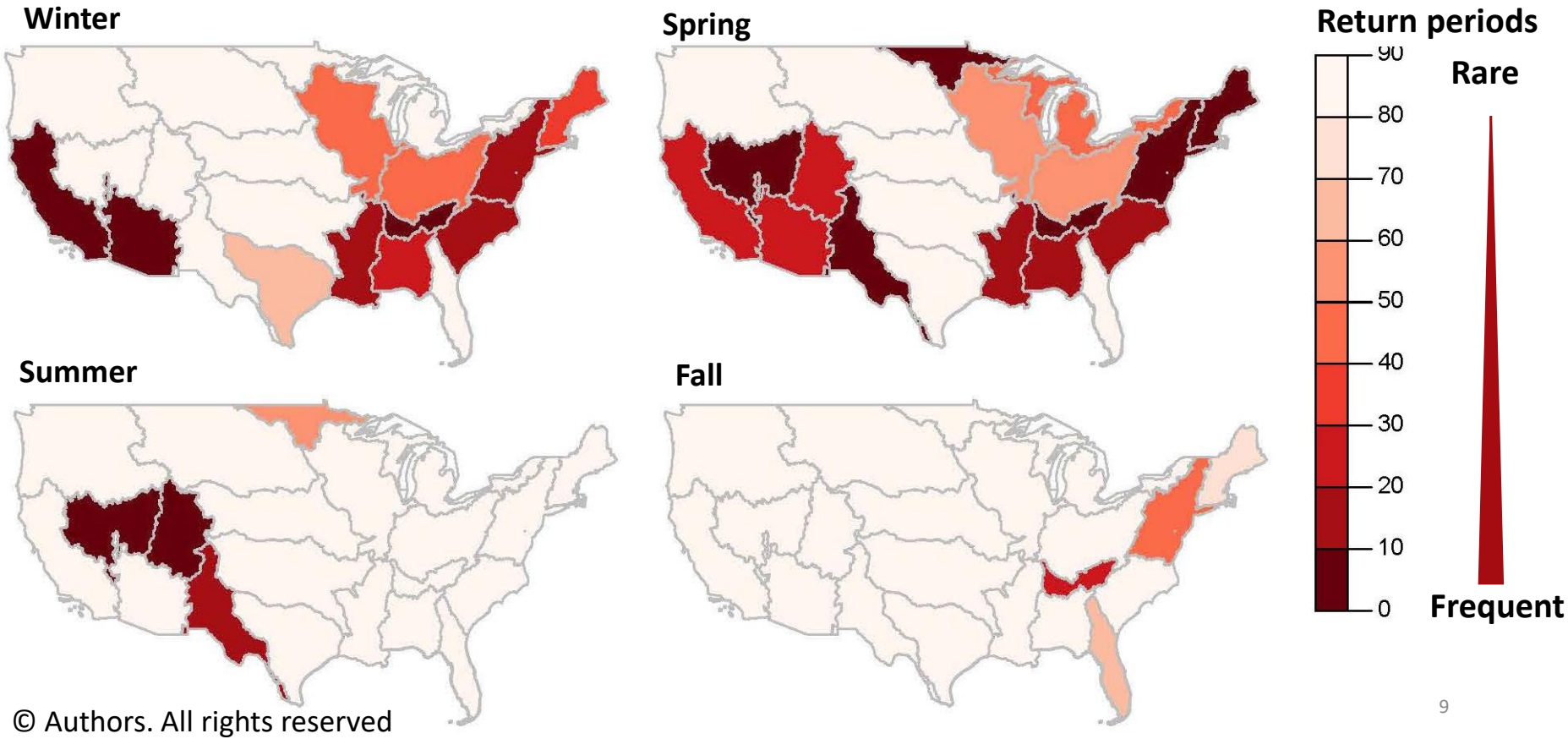
Susceptibility to widespread flooding



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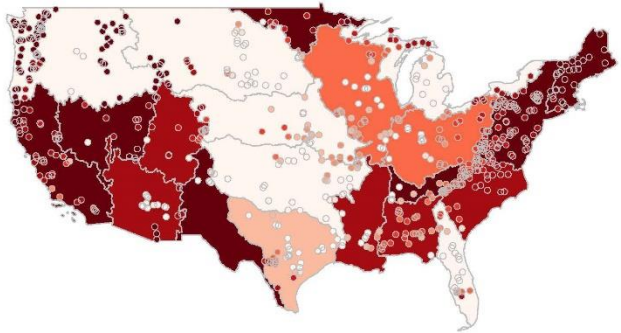
Conclusions

PRSim allows for the stochastic simulation of spatial extreme floods

The susceptibility of widespread flooding is highest in the Southwestern US



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Reading:

Brunner et al. 2019. *HESS:* Technical note: Stochastic simulation of streamflow time series using phase randomization

Brunner and Gilleland 2020. *HESS under review:* Stochastic simulation of streamflow and spatial extremes: a continuous, wavelet-based approach

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