



Spatiotemporal Distribution of Hydrological Extremes (Drought) in Brazil

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Goals

- (1) To analyze the temporal changes and trends in hydrological droughts
- (2) assess how they are **distributed** and **spatially connected** across Brazil.



large-sample
dataset [1]



1980 2019
535
catchments

Drought events extraction at individual catchment

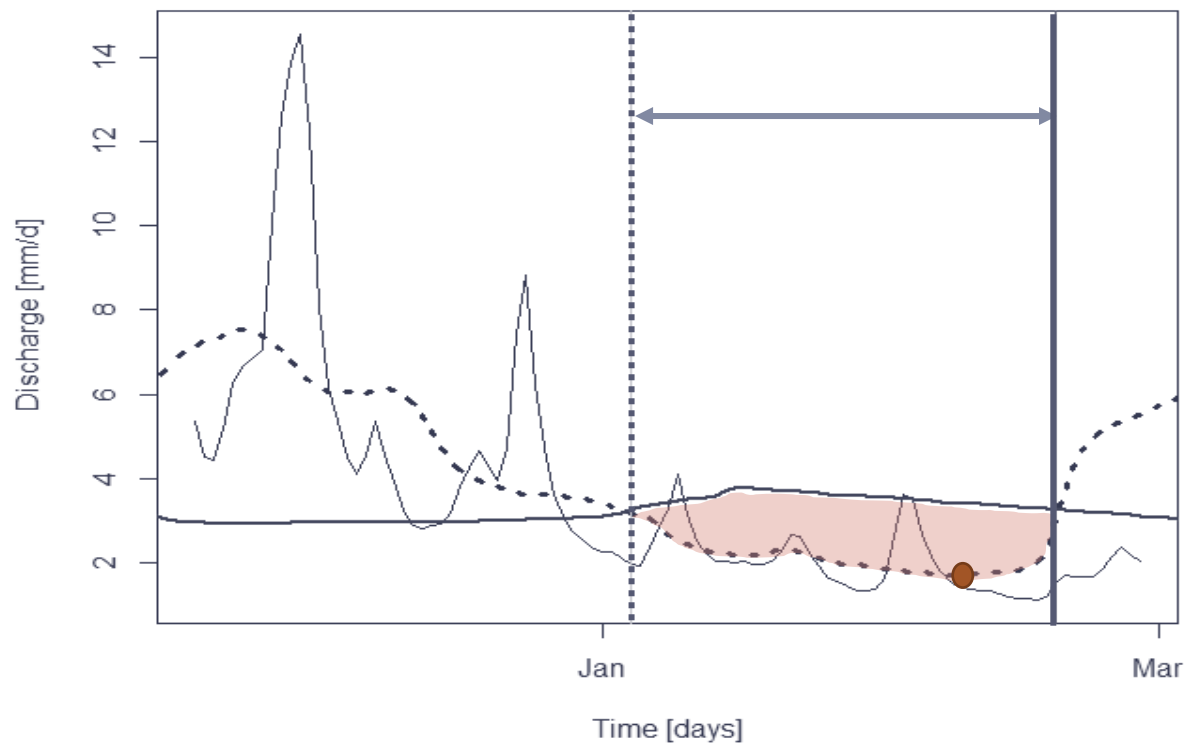
Variable threshold-level approach [2].

1. **Smooth time series** over a 30 days moving window
2. Compute **variable threshold** at the 15th flow percentile
3. **Drought identification** with a minimum duration of 30 days

[1] Almagro, A., Oliveira, P. T. S., Meira Neto, A. A., Roy, T., and Troch, P.: CABra: a novel large-sample dataset for Brazilian catchments, Hydrol. Earth Syst. Sci., 25, 3105–3135, <https://doi.org/10.5194/hess-25-3105-2021>, 2021.

[2] Van Loon, A. F., Laaha, G. Hydrological drought severity explained by climate and catchment characteristics, Journal of Hydrology, 526, 3–14, <https://doi.org/10.1016/j.jhydrol.2014.10.059>, 2015.

Temporal drought events variation



- Deficit (mm/event)
- Intensity (mm/day)
- Duration (days)
- Number of events

- **Deficit** is the sum of deviations from threshold times number of days (mm/event)
- **Intensity** is the minimum discharge (mm/day)
- **Duration** is the number of consecutive days below a threshold (days)

Step 3

Spatial drought connectivity

Binary drought event matrix [3]

		catchments			
catchments	1				
	1	1			
	0	1	1		
	1	0	0	1	

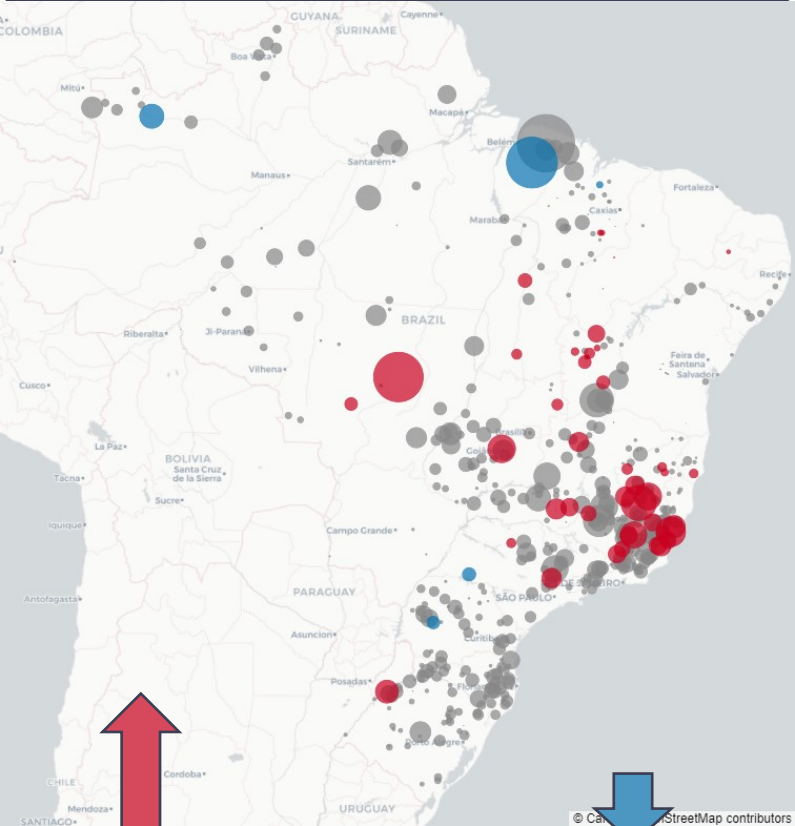
We identify the number of catchments with joint drought using the binary drought event matrix and compute their spatial connectivity.

[3] Brunner, M. I., Papalexiou, S., Clark, M. P., & Gilleland, E. How probable is widespread flooding in the United States? *Water Resources Research*, 56, <https://doi.org/10.1029/2020WR028096>, 2020.

Results

● No trend ● Increasing ● Decreasing (size) Theil-Sen estimator

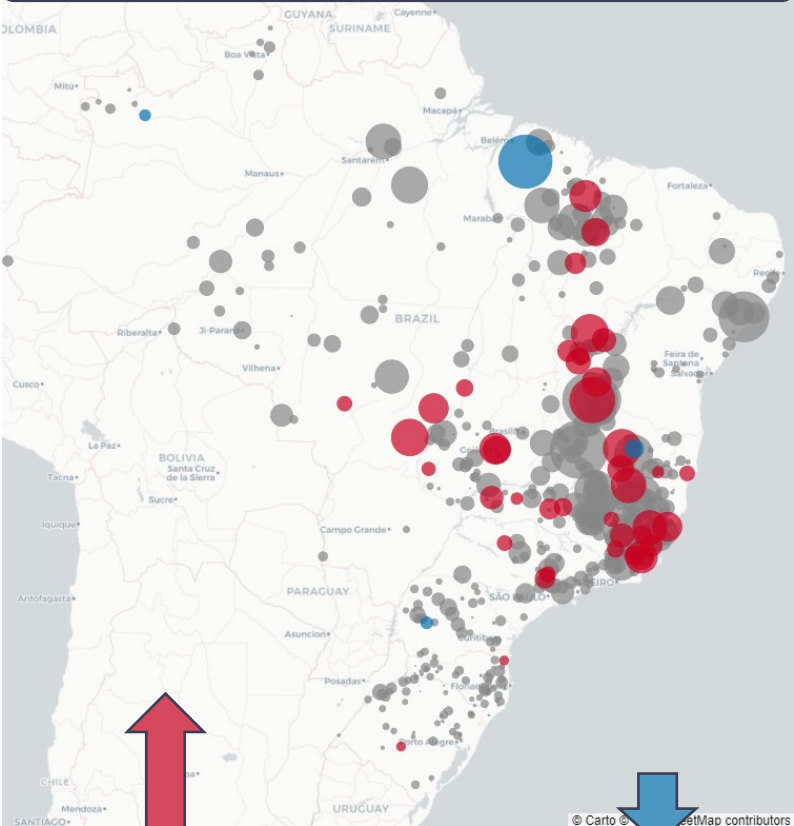
Deficit



9%
increasing
trend

1%
decreasing
trend

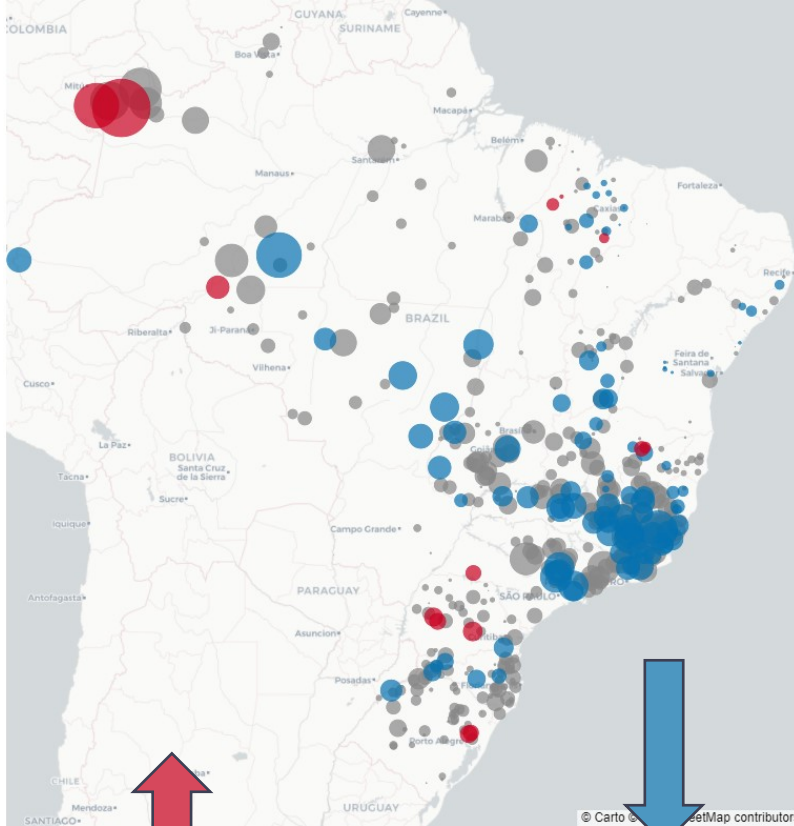
Duration



9%
increasing
trend

1%
decreasing
trend

Intensity



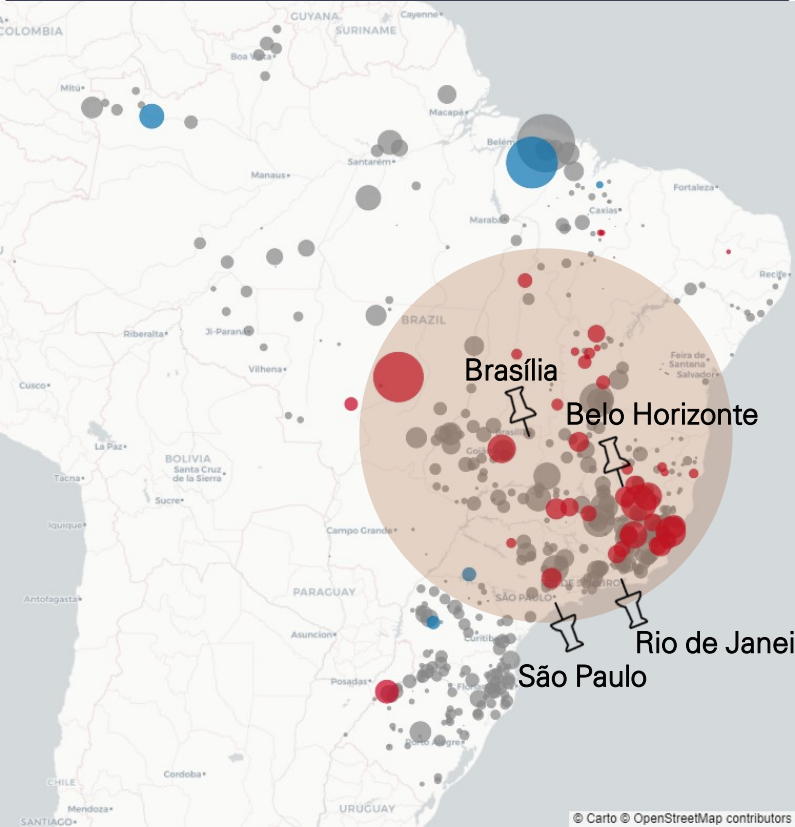
3%
increasing
trend

19%
decreasing
trend

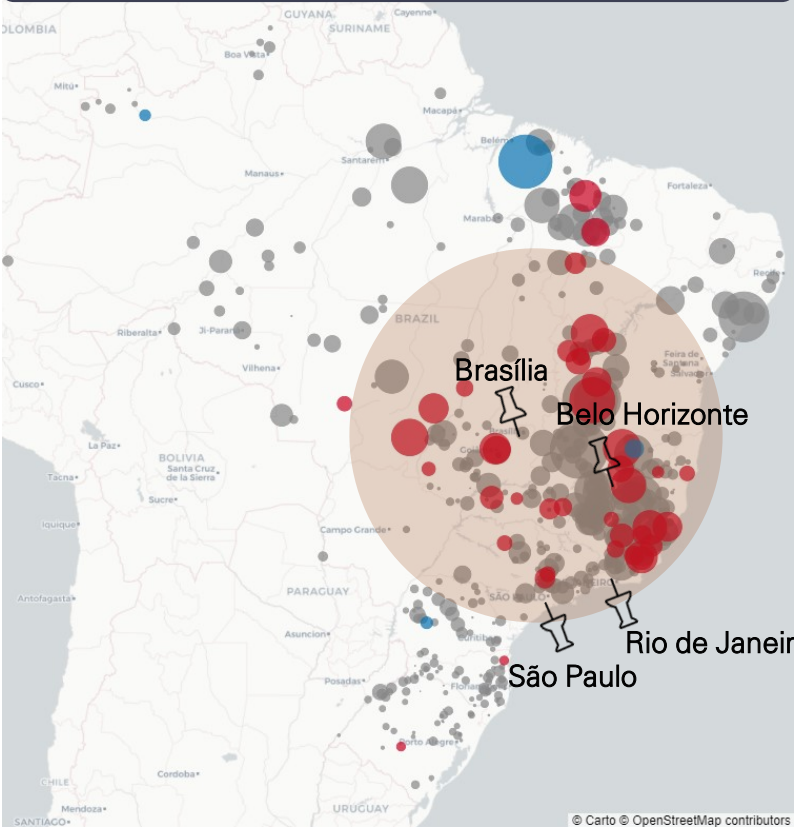
Results

● No trend ● Increasing ● Decreasing (size) Theil-Sen estimator

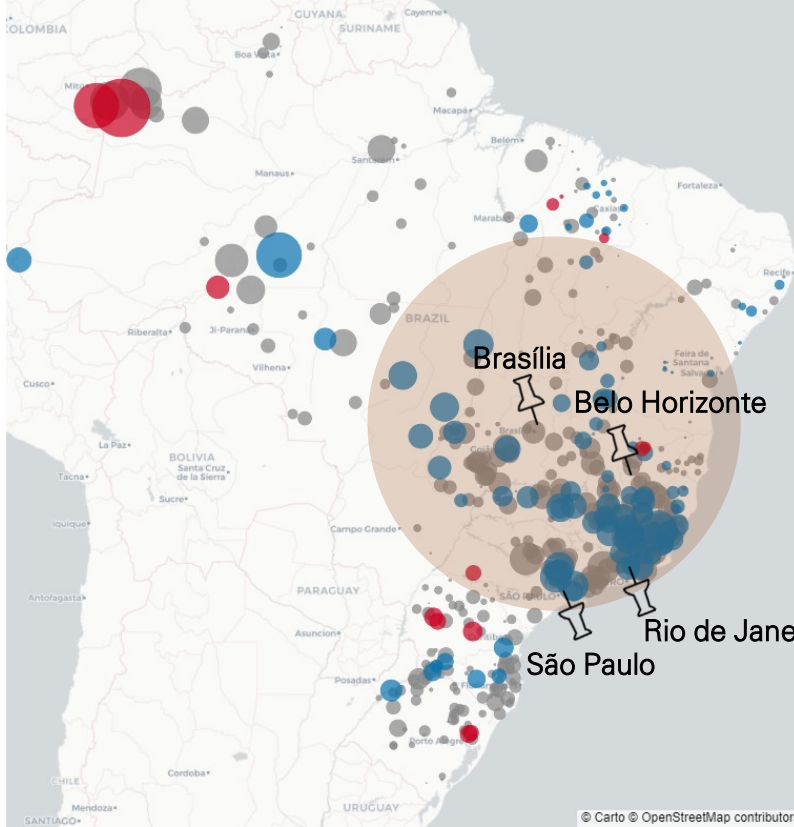
Deficit



Duration

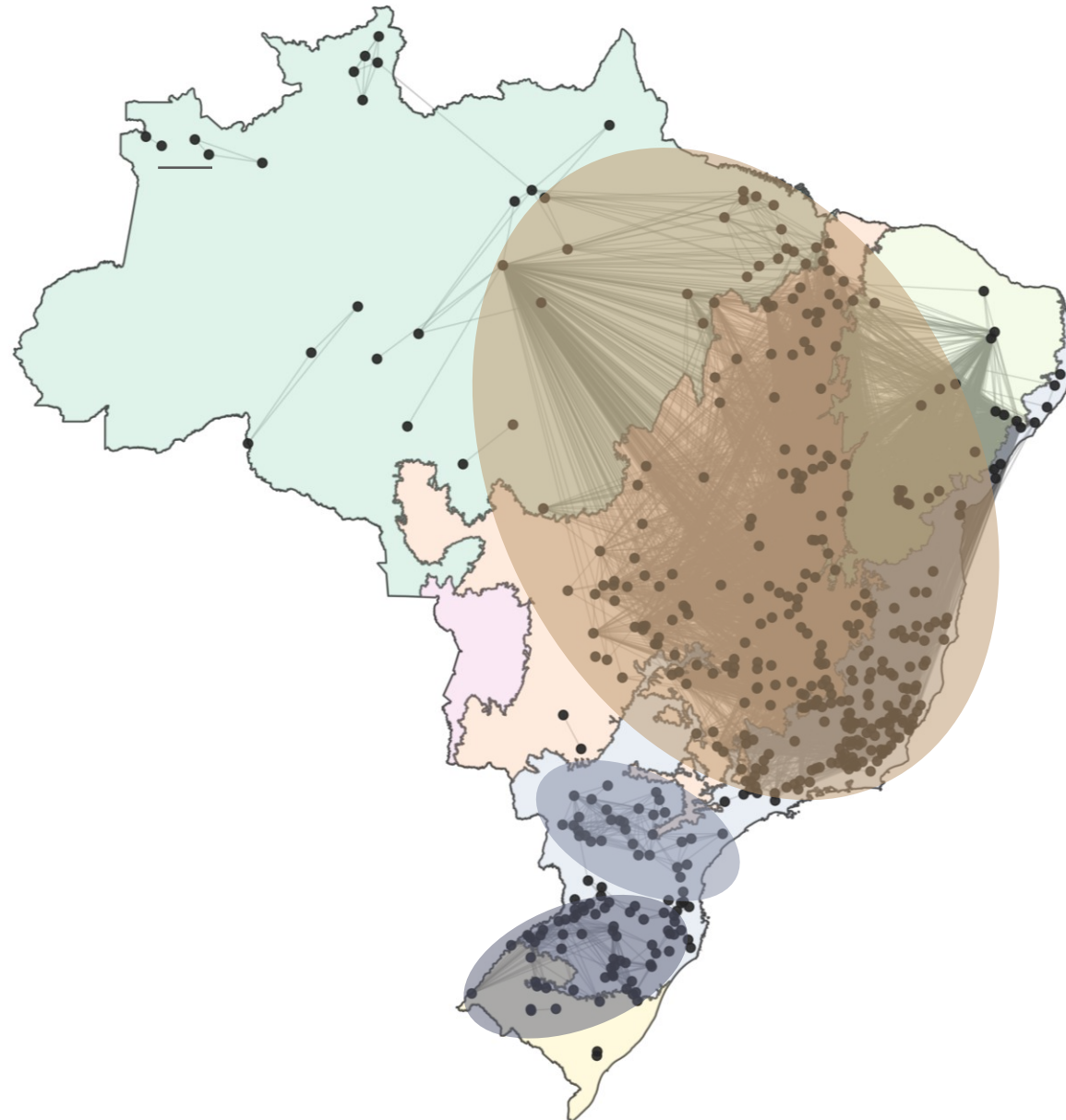


Intensity



Results

- Catchments
 - Connections
- Biomes**
- Amazon
 - Cerrado
 - Caatinga
 - Atlantic forest
 - Pantanal
 - Pampa



Results

- Water management strategies need to consider catchments with the increasing trend in drought;
- Connectivity patterns can be used to group regions according to their co-occurrence of drought events.



SPATIOTEMPORAL DISTRIBUTION OF HYDROLOGICAL EXTREMES IN BRAZIL

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Thank you!

Questions and feedback?

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Acknowledgments

