

DRINET: Developing Community-based DRought Information Network Protocols and Tools for Multidisciplinary Regional Scale Applications

URL: <http://drinet.hubzero.org/>

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Drinet Project Overview

- NSF funded:
 - Data Interoperability Networks
 - co-funded by OCI and Hydrologic Sciences, 3 year project
- Mission
 - Create a platform, DRINET, for collecting, synthesizing and disseminating local and regional drought related data
- Objectives
 - Standardize process for collecting drought related information at local and regional scale
 - Repurpose data for modeling, decision making, and further research in causal effects and drought triggers
 - Disseminate information and knowledge to aid decision making, research and education

DRINET Team

drINET

DROUGHT
RESEARCH
INITIATIVE
NETWORK



Search

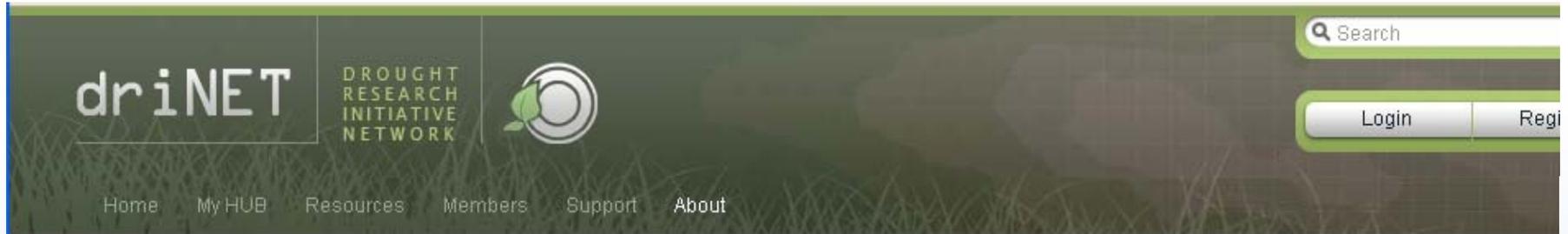
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DRINET Team



Advisory Board:

Jan Curtis (NRCS, Portland, Oregon)

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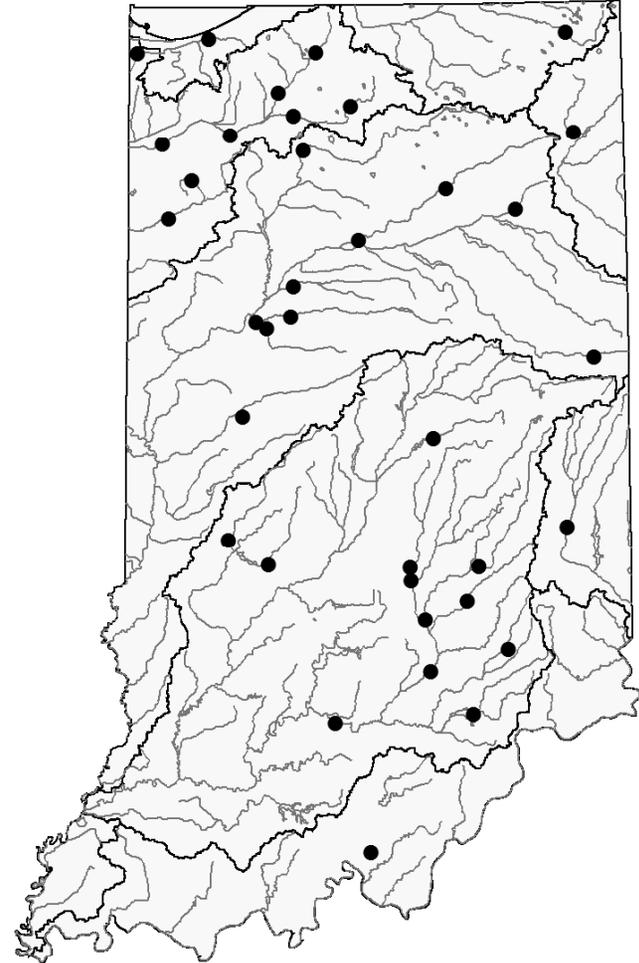
S.I. Sritharan (Prof., Central State University, OH)

J. Untenierrier (Indiana Water Shortage Task Force)

CYBERINFRASTRUCTURE

Data Sources & Study Area

- Precipitation
 - NCDC hourly precipitation dataset
 - 53 stations with record length greater than 50 years
 - NCDC daily precipitation dataset
 - 73 stations with record length greater than 80 years
- Streamflow
 - USGS unimpaired daily mean flow
 - 36 stations with record length greater than 50 years



Standardized Index Method

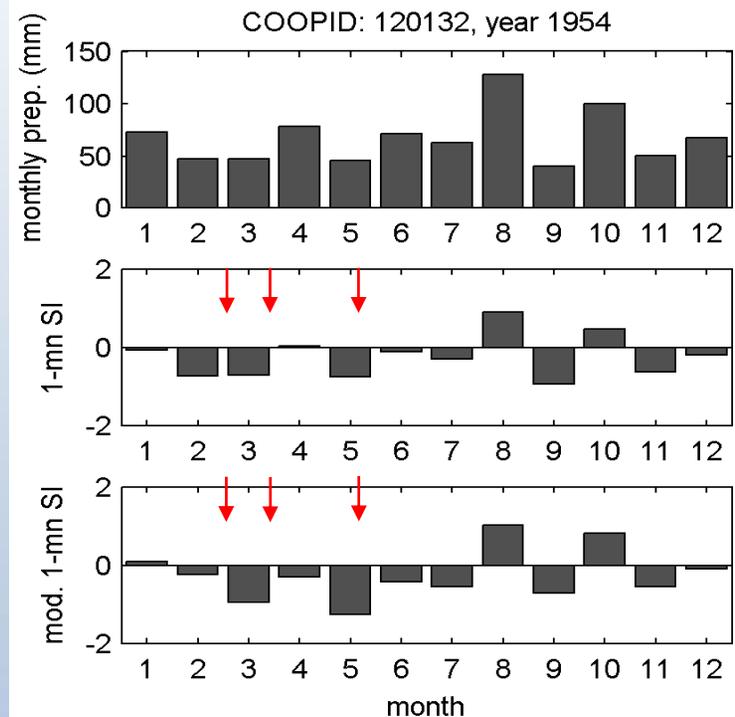
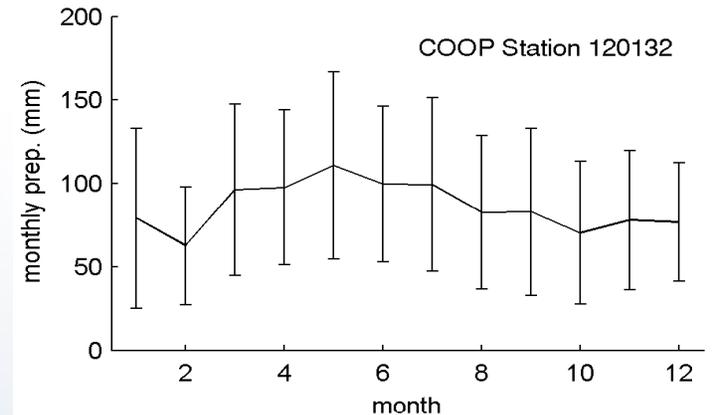
- Proposed by McKee *et al.* (1993)
- Generalizable to various types of observations
 - For precipitation: SPI
- For a given window size, the observed precipitation is transformed to a probability measure using Gamma distribution, then expressed in standard normal variable

Probabilities of Occurrence (%)	SI Values	Drought Monitor Category	Drought Condition
20 ~ 30	-0.84 ~ -0.52	D0	Abnormally dry
10 ~ 20	-1.28 ~ -0.84	D1	Drought - moderate
5 ~ 10	-1.64 ~ -1.28	D2	Drought - severe
2 ~ 5	-2.05 ~ -1.64	D3	Drought - extreme
< 2	< -2.05	D4	Drought - exceptional

- Though SIs for different windows are dependent, no representative window can be determined

Modified SI

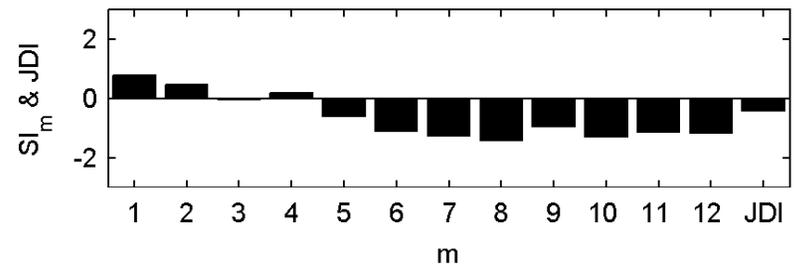
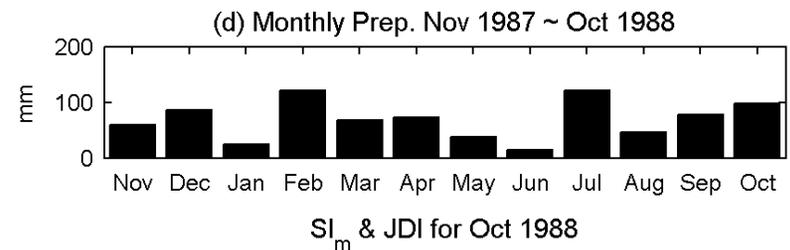
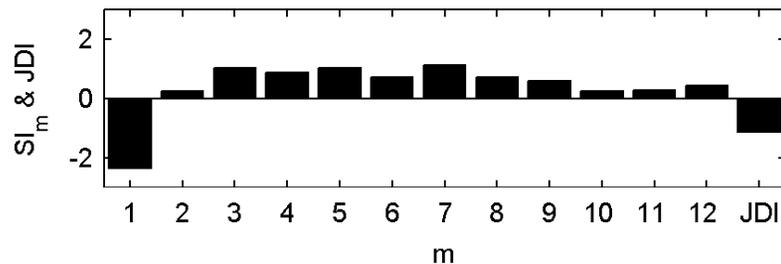
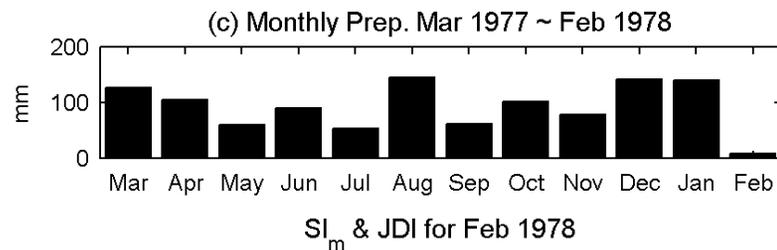
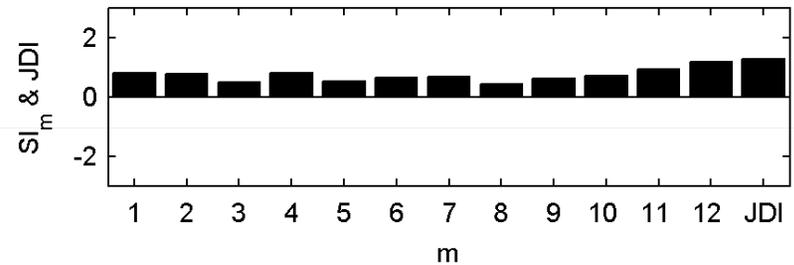
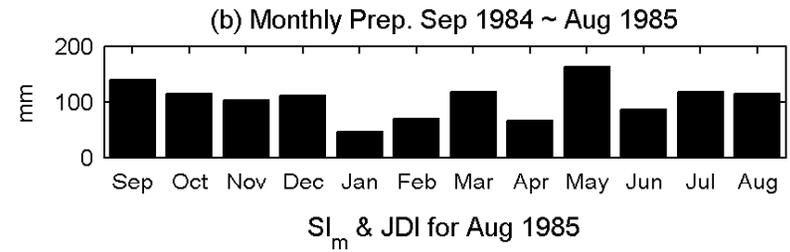
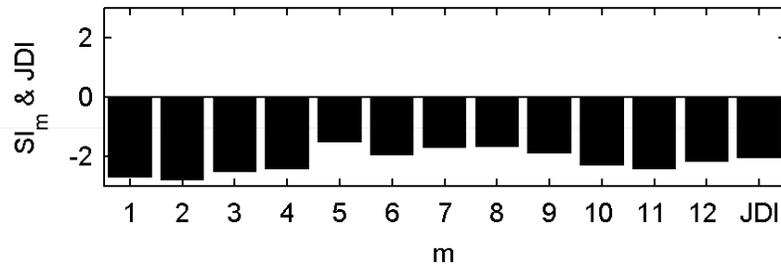
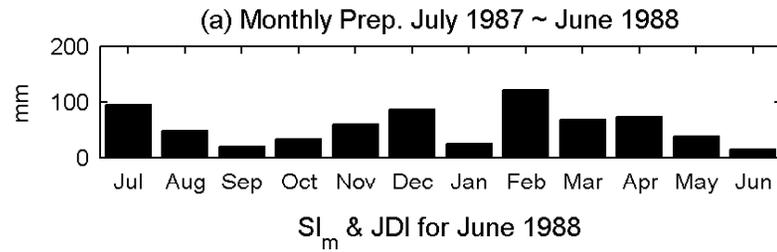
- Limitations of the conventional SI approach
 - Significant auto-correlation exists in samples
 - Cannot account for seasonal variability
 - Gamma distribution may not be suitable
- Modified algorithm
 - Samples grouped by the “ending month”



Joint Deficit Index (I)

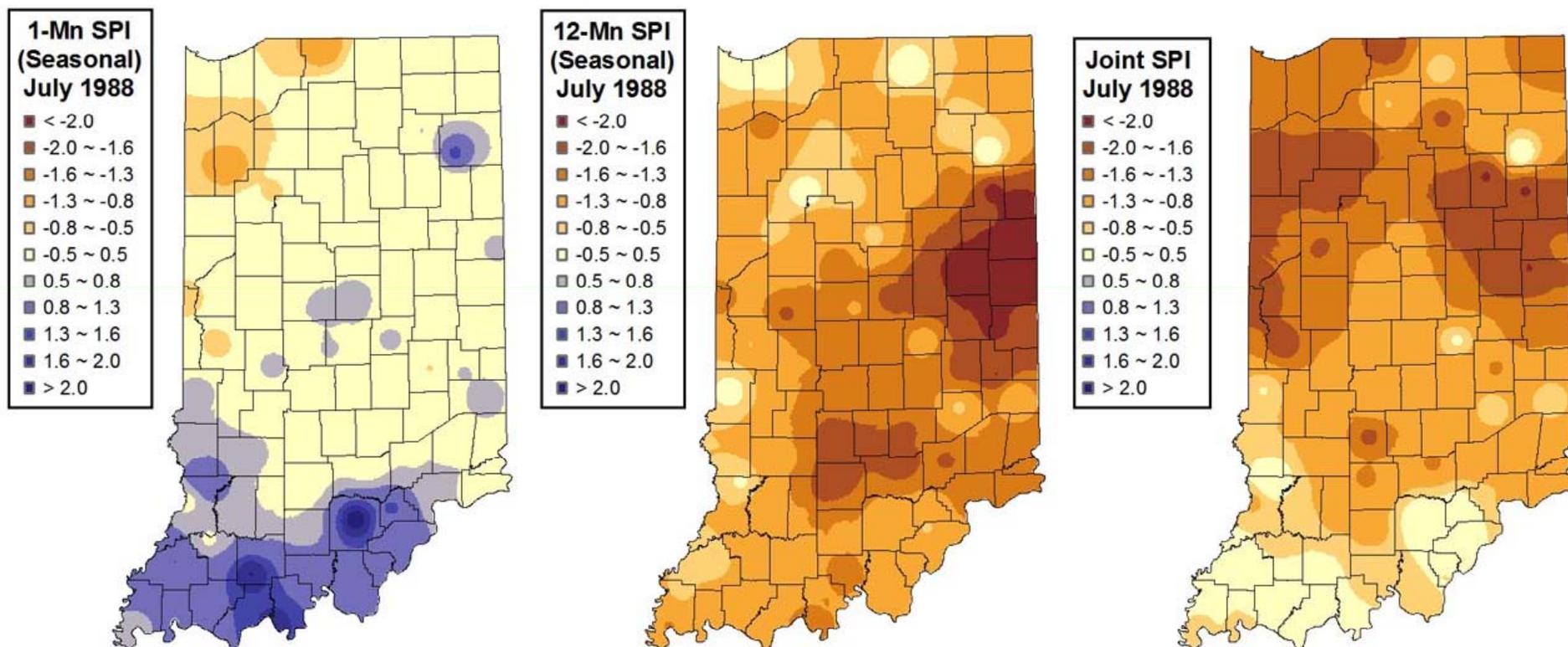
- Modified SI provides better statistical footing and helps alleviate the effect of seasonal variability
- The joint deficit index (JDI) is constructed by using copulas to express the joint behavior of modified SIs over various time windows.
- JDI can offer an objective and probability-based overall drought description. It is capable of capturing both emerging and prolonged droughts in a timely manner.
- JDI has potential to be applied on different types of hydrologic variables, and can be used to derive an inter-variable drought index

Joint Deficit Index (II)



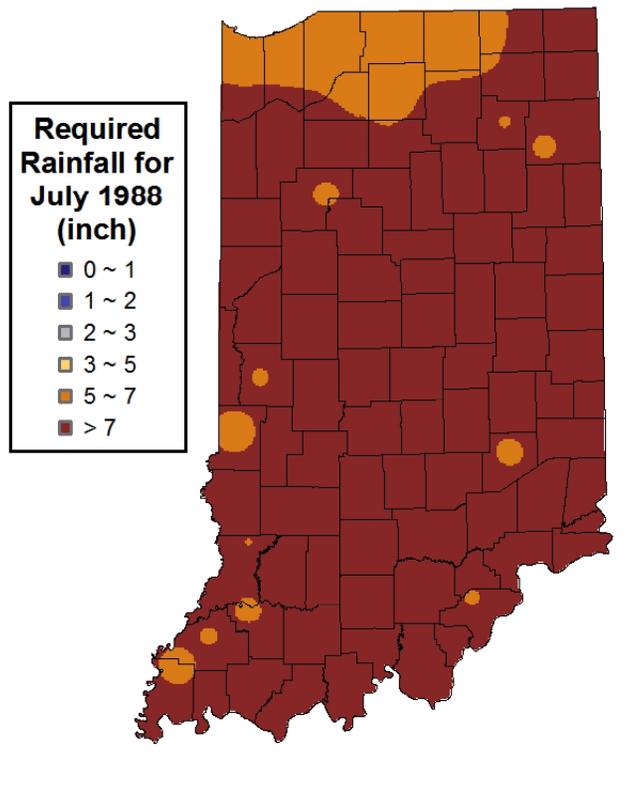
Joint Deficit Index (III)

- Comparison between 1-Mn, 12-Mn, and joint SPI
 - 12-Mn SPI changes slowly, weak in reflecting emerging drought
 - 1-Mn SPI changes rapidly, weak in reflecting accumulative deficit
 - Joint SPI reflects joint deficit

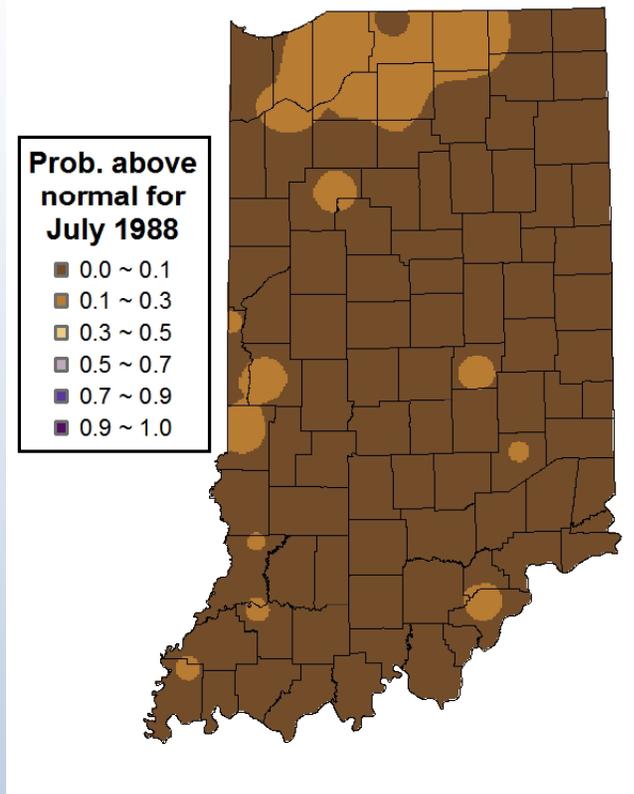


Example: Precipitation droughts

- A risk-based assessment of droughts can be useful for planning purposes. To assess these risks more accurately, we propose the use of the joint deficit index to characterize droughts.



Required 1-month precipitation for normalcy, i.e. projected water deficit



Probability of recovering from drought in one month

DRINET Precipitation deficit viewer

drinet - Middleware: View: Water Deficit Viewer (3:54 pm) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://drinet.hubzero.org/mw/view/273?tool=deficitviewer_r6

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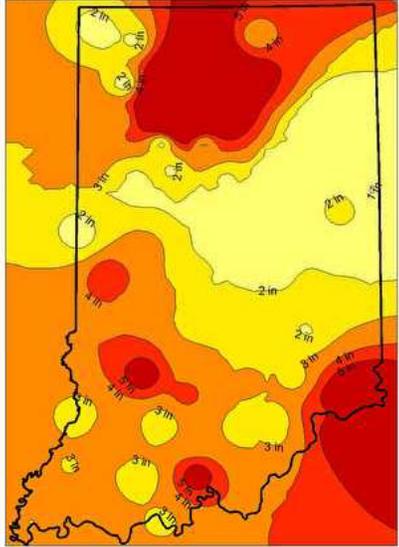
drinet - Middleware: View: Water Def...

Tool Questions? About Refresh Window Popout Close

Simulate About this tool Questions?

Result: Image Sequence

Required future 01 month precipitation (inch) - 192101



Valid Range: Jan 1921-Sep 2007
You can view upto 9 years of deficit images at once.

Start Year: 1921
Start Month: 1
End Year: 1921
End Month: 2
Time Window: 1
View Type: 1

Selected Range: 1/1921 - 2/1921

Frame = 0

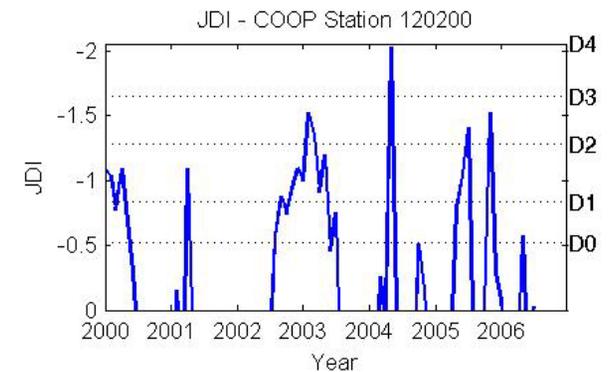
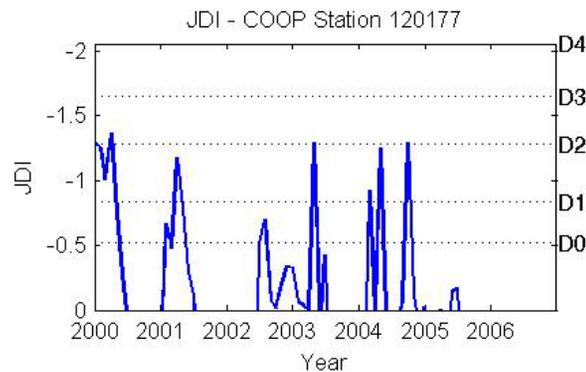
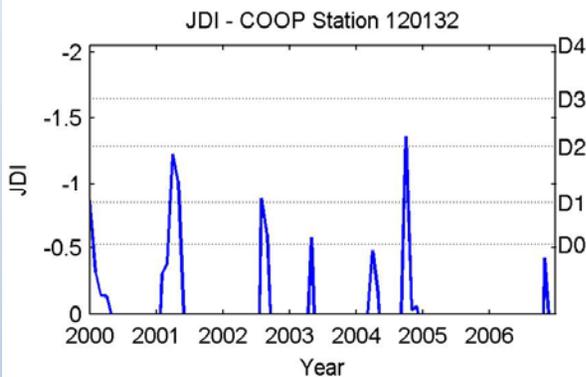
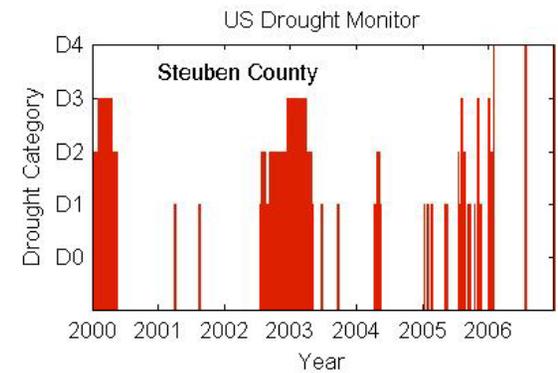
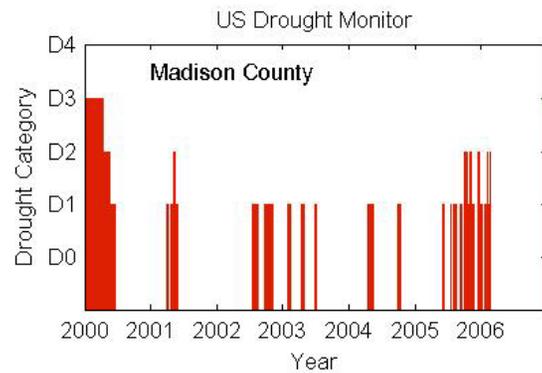
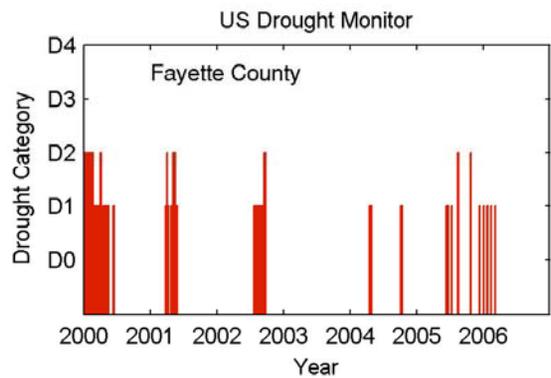
1 result Parameters... Clear

800 x 780

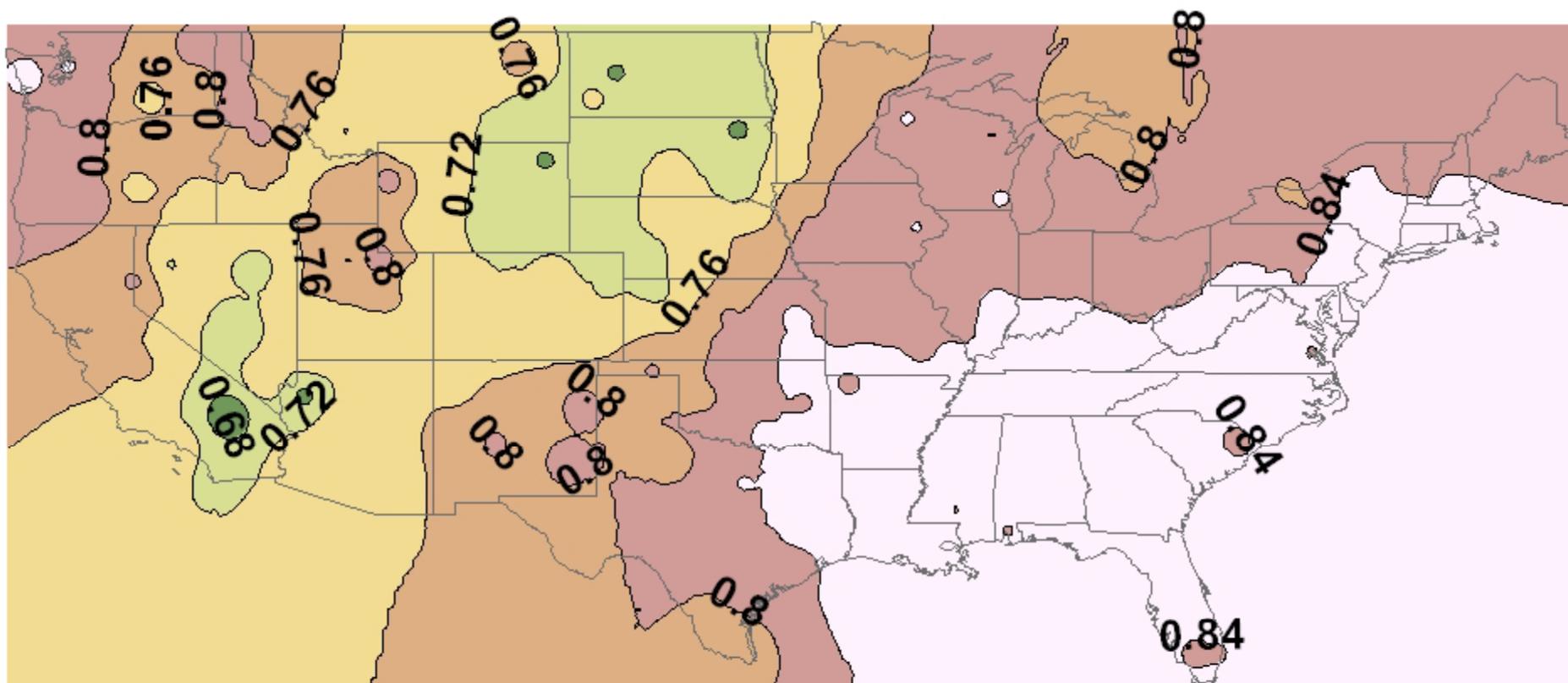
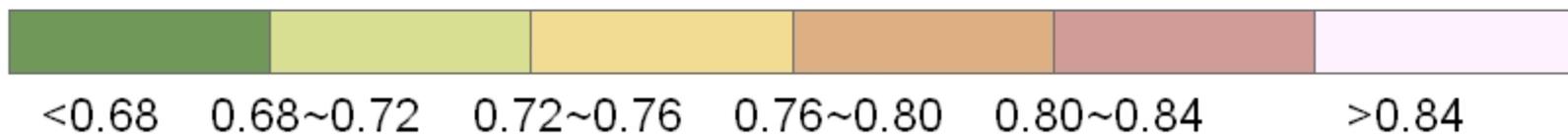
Share session with (enter usernames separated by spaces or commas): Read-Only? (Session is currently not

Done

US Drought Monitor versus JDI



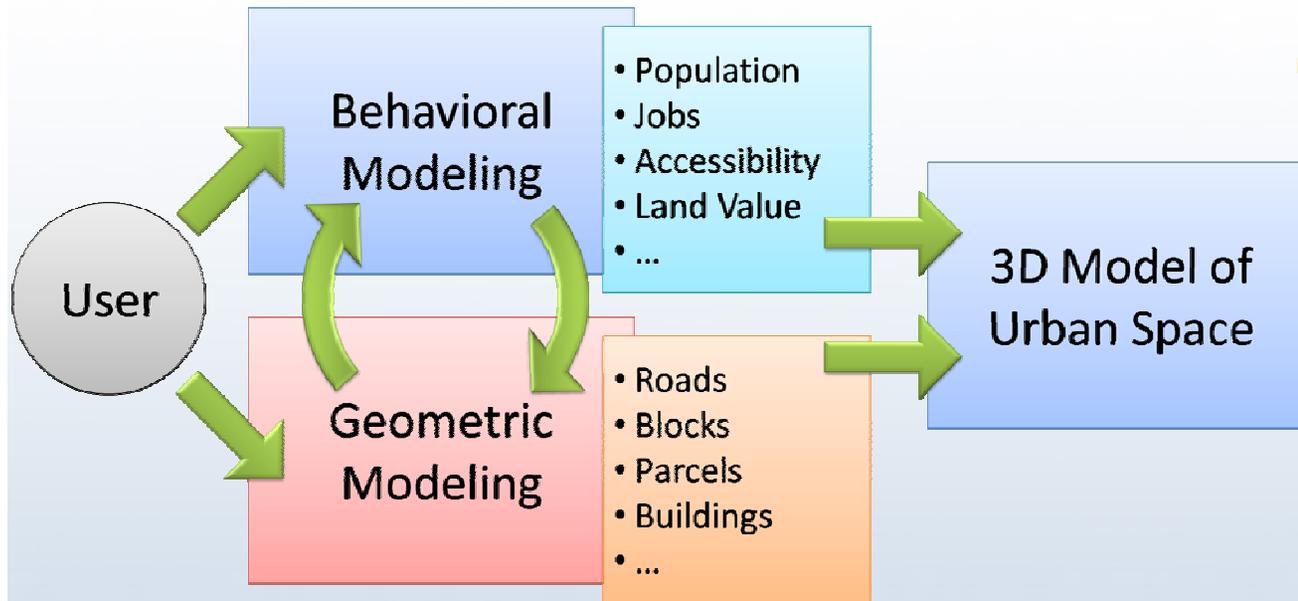
Spearman's rho between PDSI and JDI



Comparison of PDSI computed from TD-9640 and JDI. Average Spearman's rank

Modeling the Appearance and Behavior of Urban Spaces

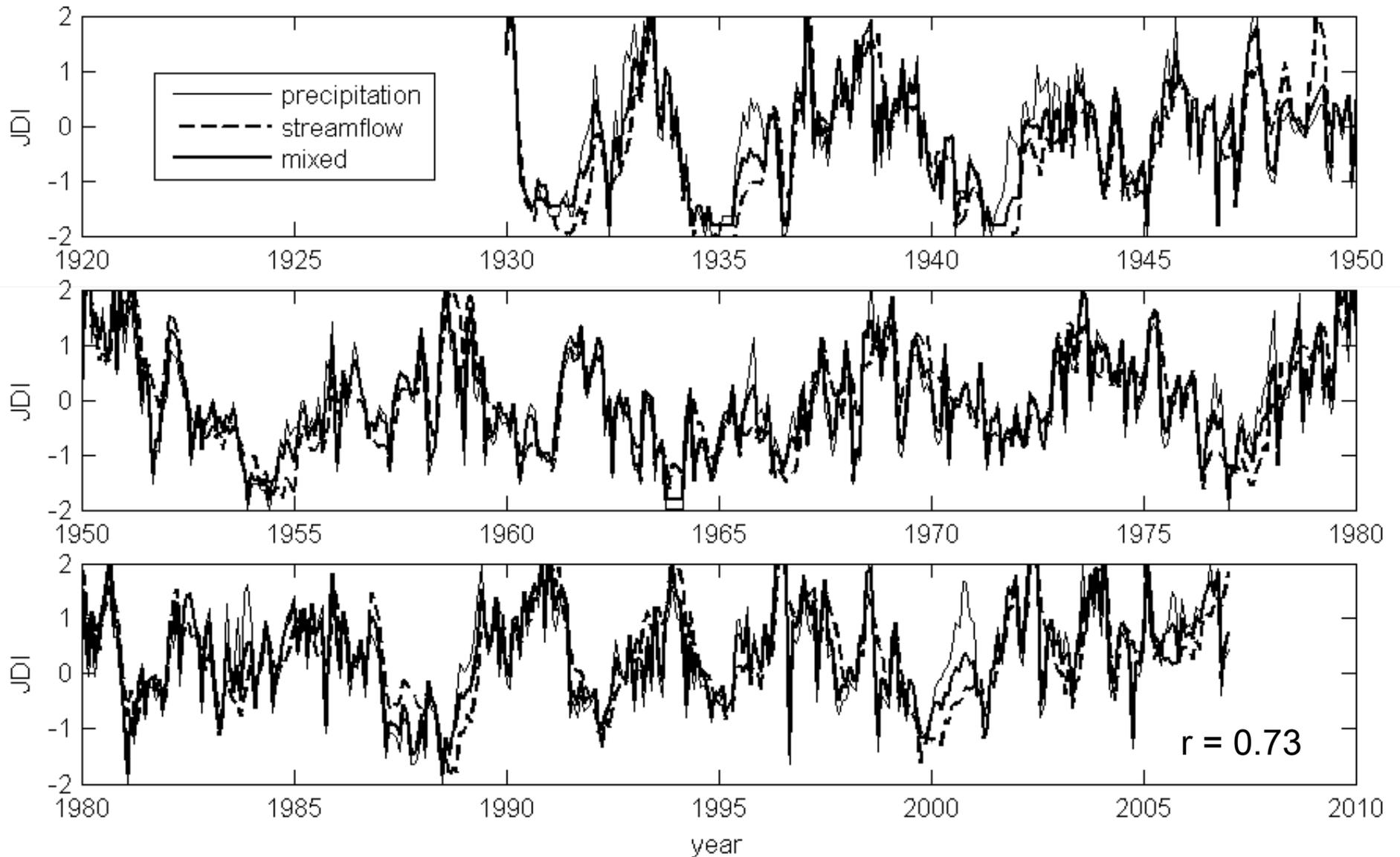
Daniel Aliaga (Computer Science)



- Incorporate additional non-geometric data
 - How does drought/water affect urban growth?
 - Can cities/states be designed to be more tolerant to drought?
 - How do we incorporate other climate-related factors?



Precipitation vs. Streamflow



Future Efforts from DRINET Team

- How is the evolution of cities (urban growth) influenced by water shortages?
- What relationships exist between droughts based on precipitation, stream flows, and groundwater levels?
- Can we construct a space-time statistical model for droughts?
- How can we display streamflow-based JDI analysis?
- What are the water quality and air quality impacts of droughts?
- How can uncertainty be visualized and conveyed for drought information?

Thank you!

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