Stream Temperature Variability and its Relationship to Large-Scale Climate Indices across the United States

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Team

Mohamed

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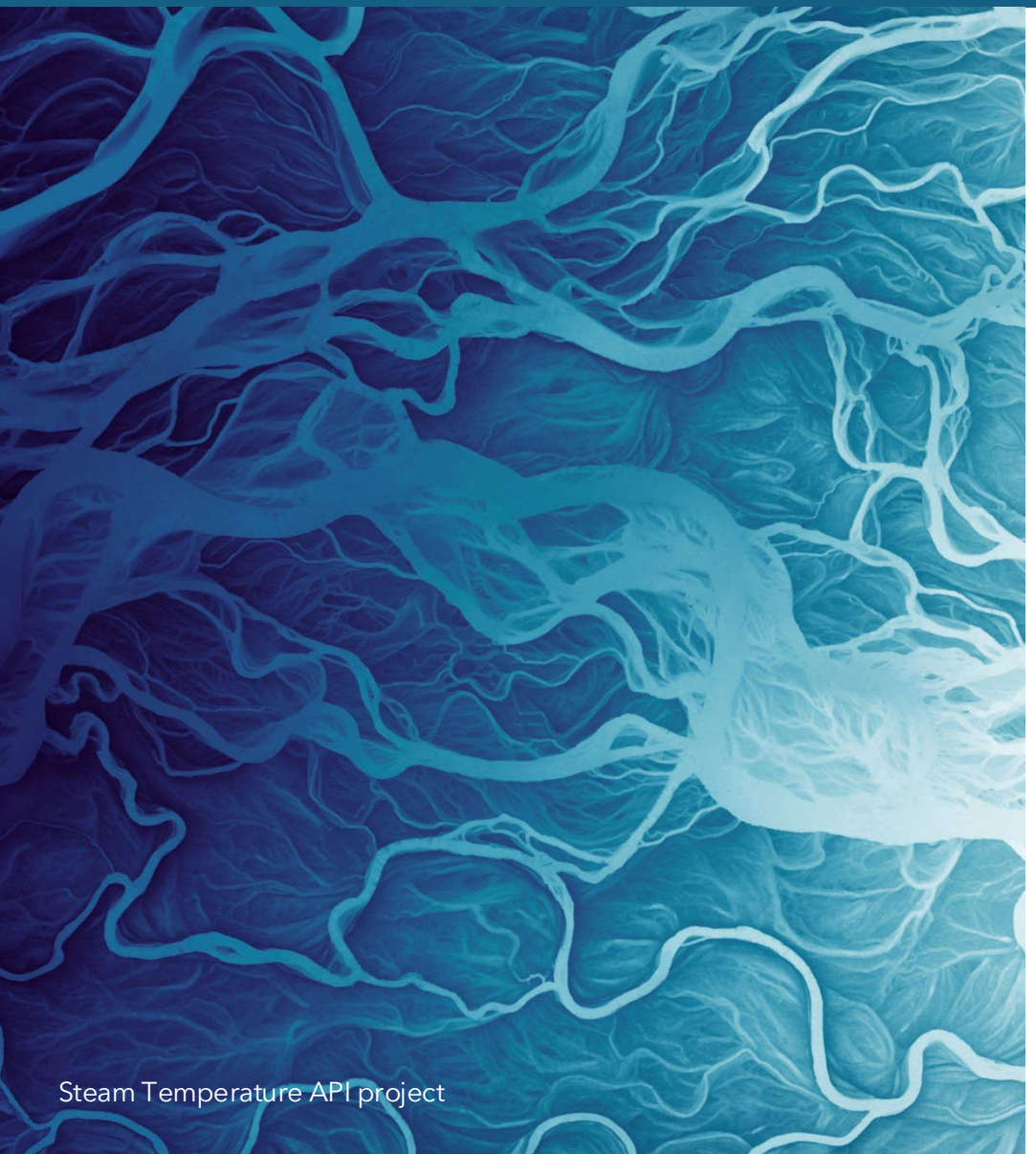
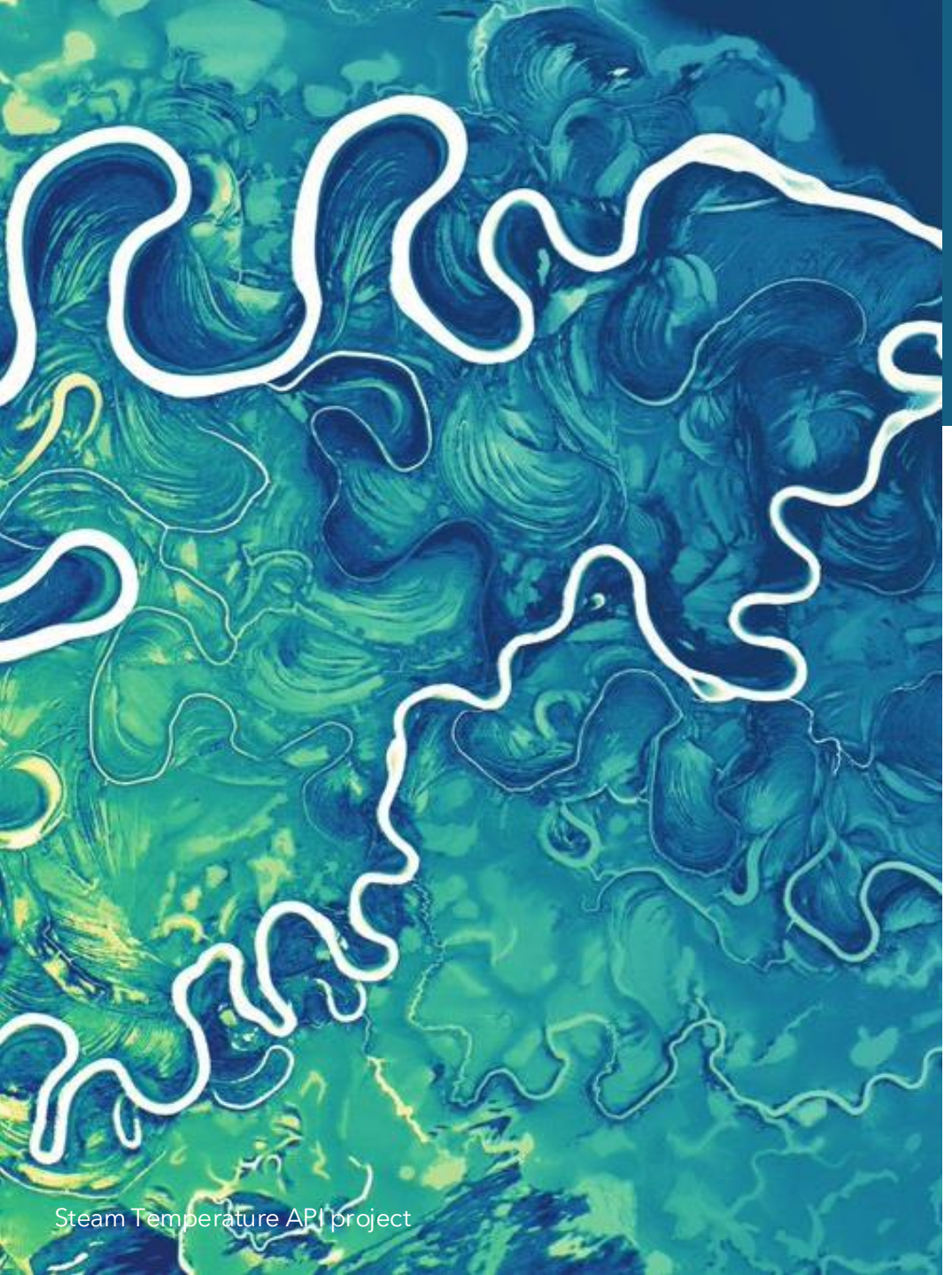
Outline



- Problem Statement
- Background
- Data
- Analysis
- Results
- Conclusion & Broader Impacts
- References



Motivation and Impact

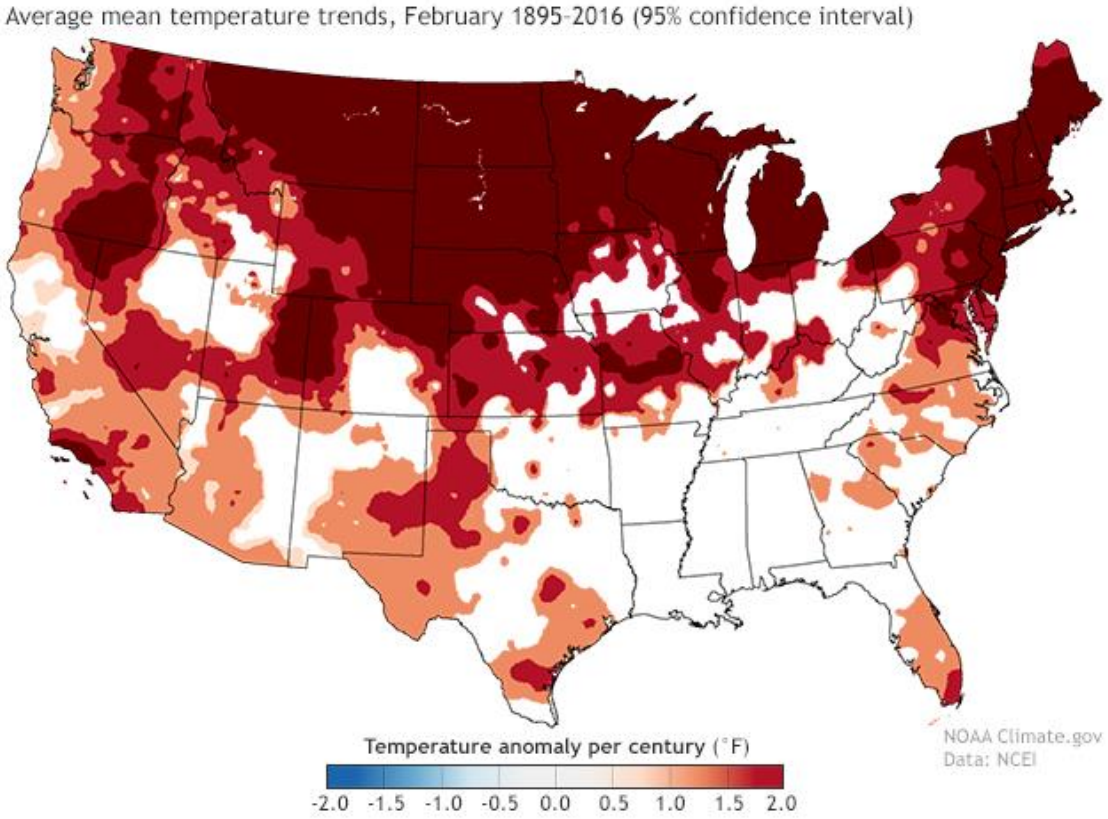
Aquatic ecosystem health

Motivated by climate change

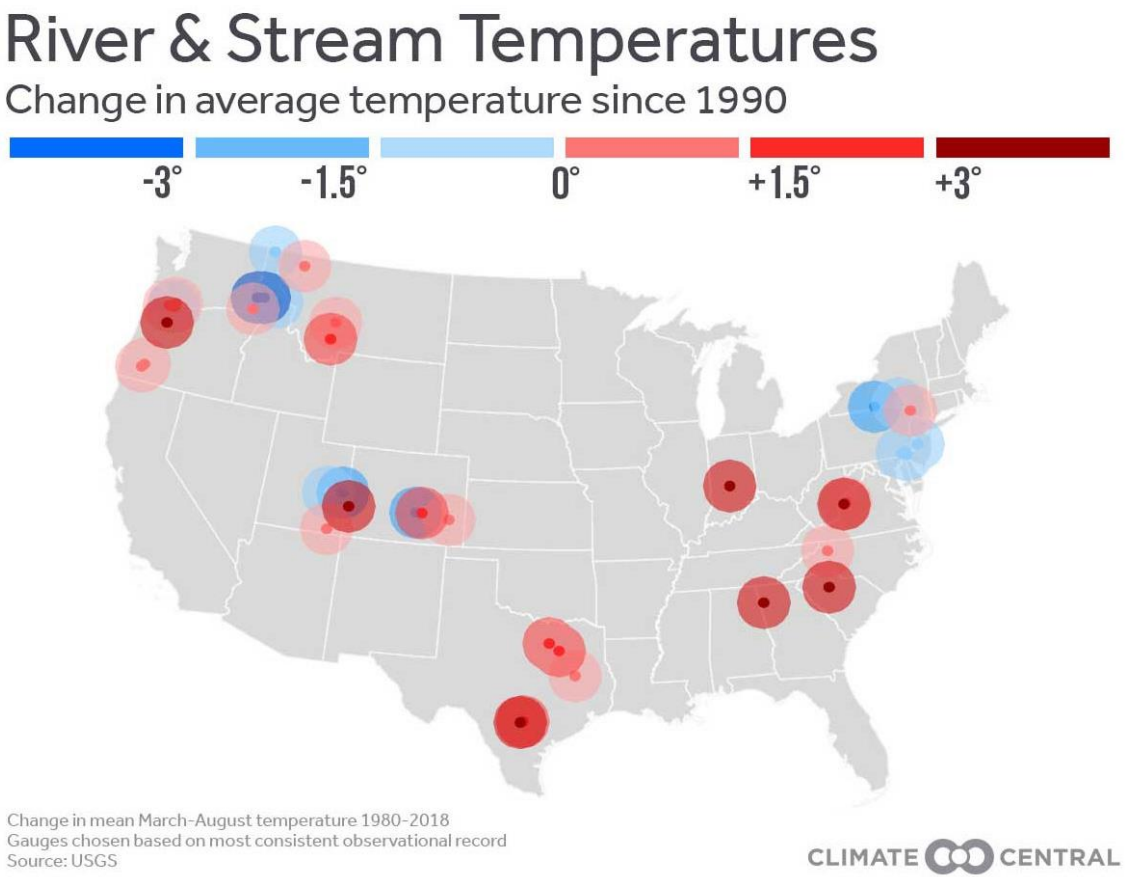
Inspired by data driven resource management

SWT as an Ecosystem Water Quality Indicator

- Drives ecosystem health and societal function
- Serves as a key indicator of freshwater quality
- Analysis of SWT supports climate adaptation and management



Statistically significant temperature trends (p=0.05) for the month of February, over the period 1895-2016.



SWT In a Warming Climate

Advances in SWT Measurement

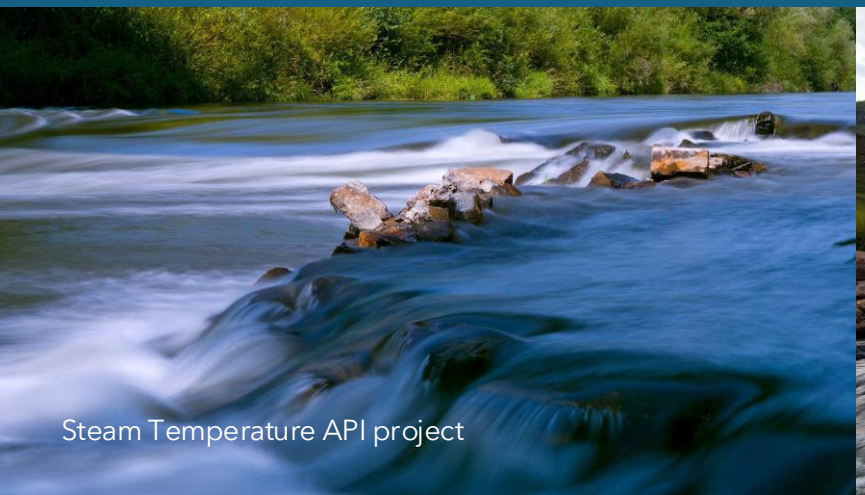
USGS NATIONAL WATER DASHBOARD

REAL-TIME MONITORING

INCREASED CONTEXTUALIZATION FOR WATERSHED MANAGEMENT

IMPROVEMENTS IN PROCESS MODELS AND MACHINE LEARNING

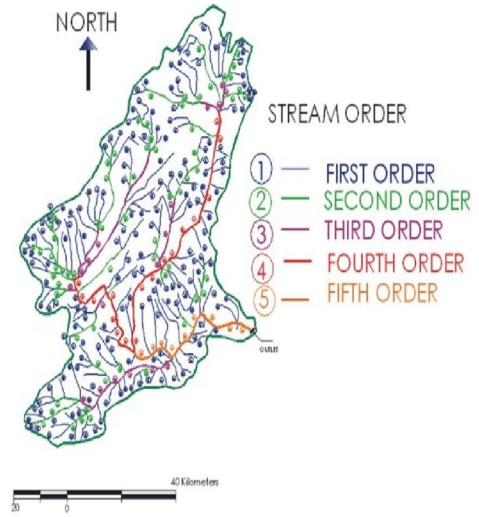
GOAL: Develop a SWT Dashboard for Enhanced Trend Analysis across the United States



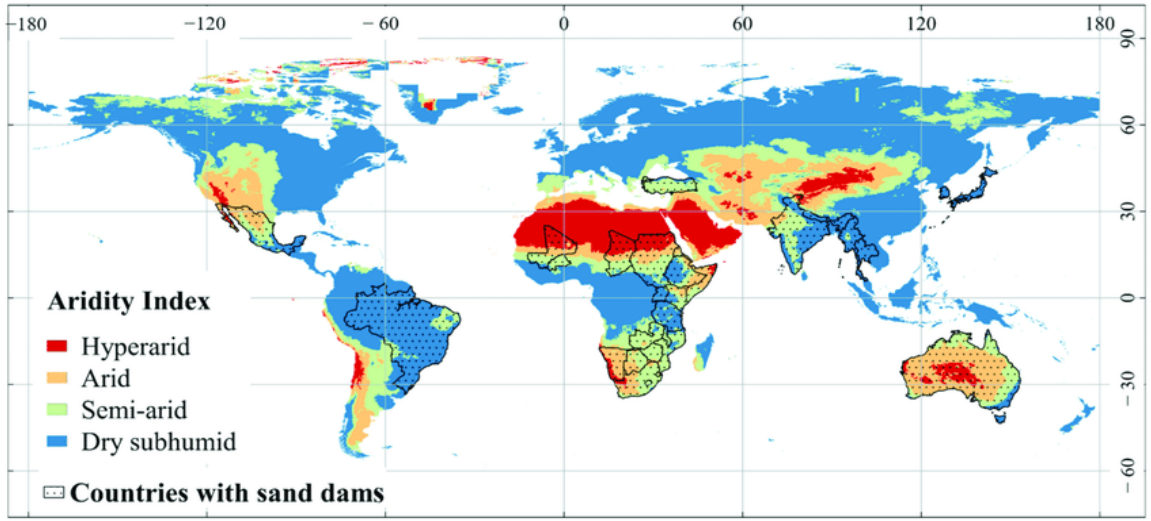
Steam Temperature API project

Data Retrieval

- SWT Observations
- Stream Order
- Aridity Index
- HUC-02



Types of Climate	Values of Ia_{DM}
Arid	$Ia_{DM} < 10$
Semi-arid	$10 \leq Ia_{DM} < 20$
Mediterranean	$20 \leq Ia_{DM} < 24$
Semi-humid	$24 \leq Ia_{DM} < 28$
Humid	$28 \leq Ia_{DM} < 35$
Very humid	$35 \leq Ia_{DM} \leq 55$
Extremely humid	$Ia_{DM} > 55$



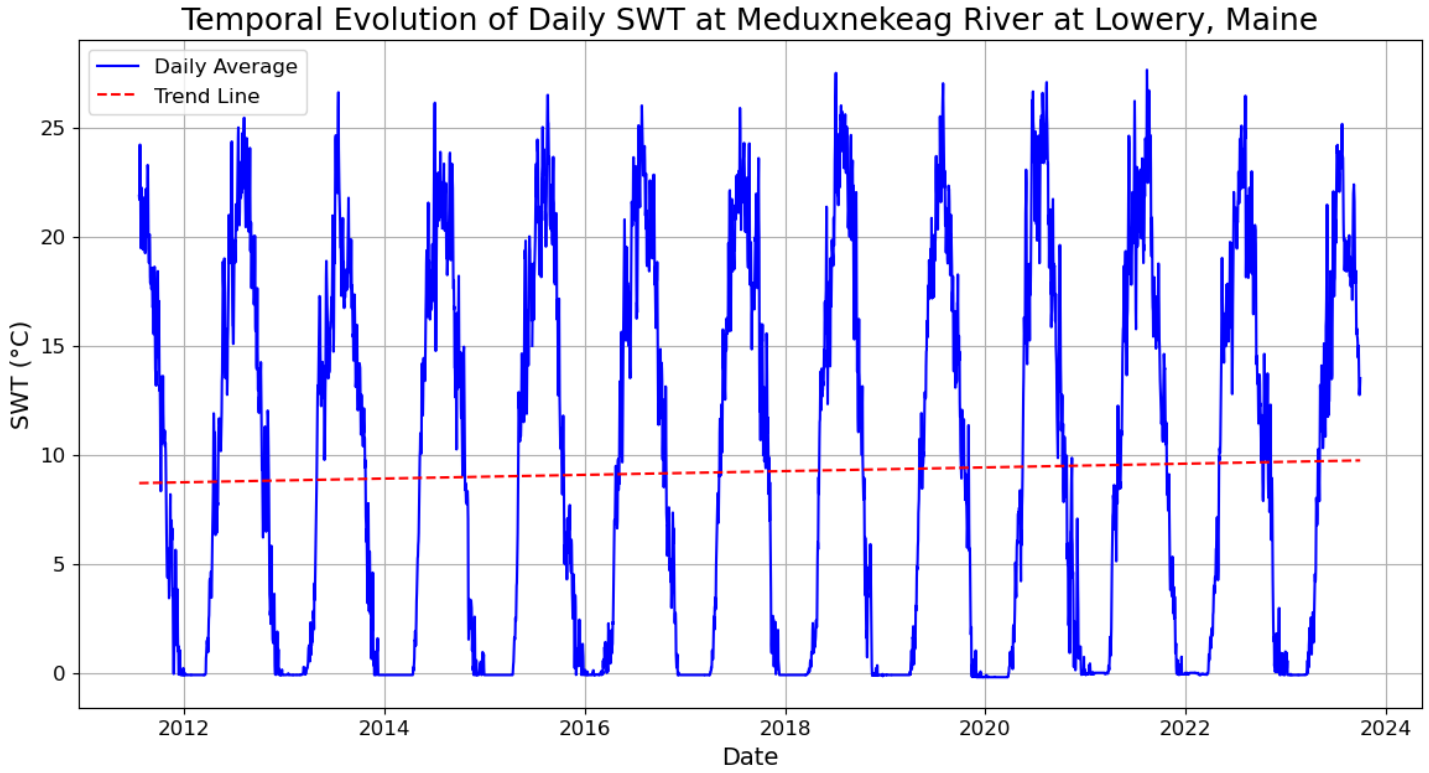
Data Analysis

- Non-parametric tests
  - Sen Slope
  - Mann-Kendall
  - Pettitt

Evaluate non-monotonic trends

```
pip install pymannkendall
```

```
pip install pyhomogeneity
```



Result – SWT Variability Dashboard

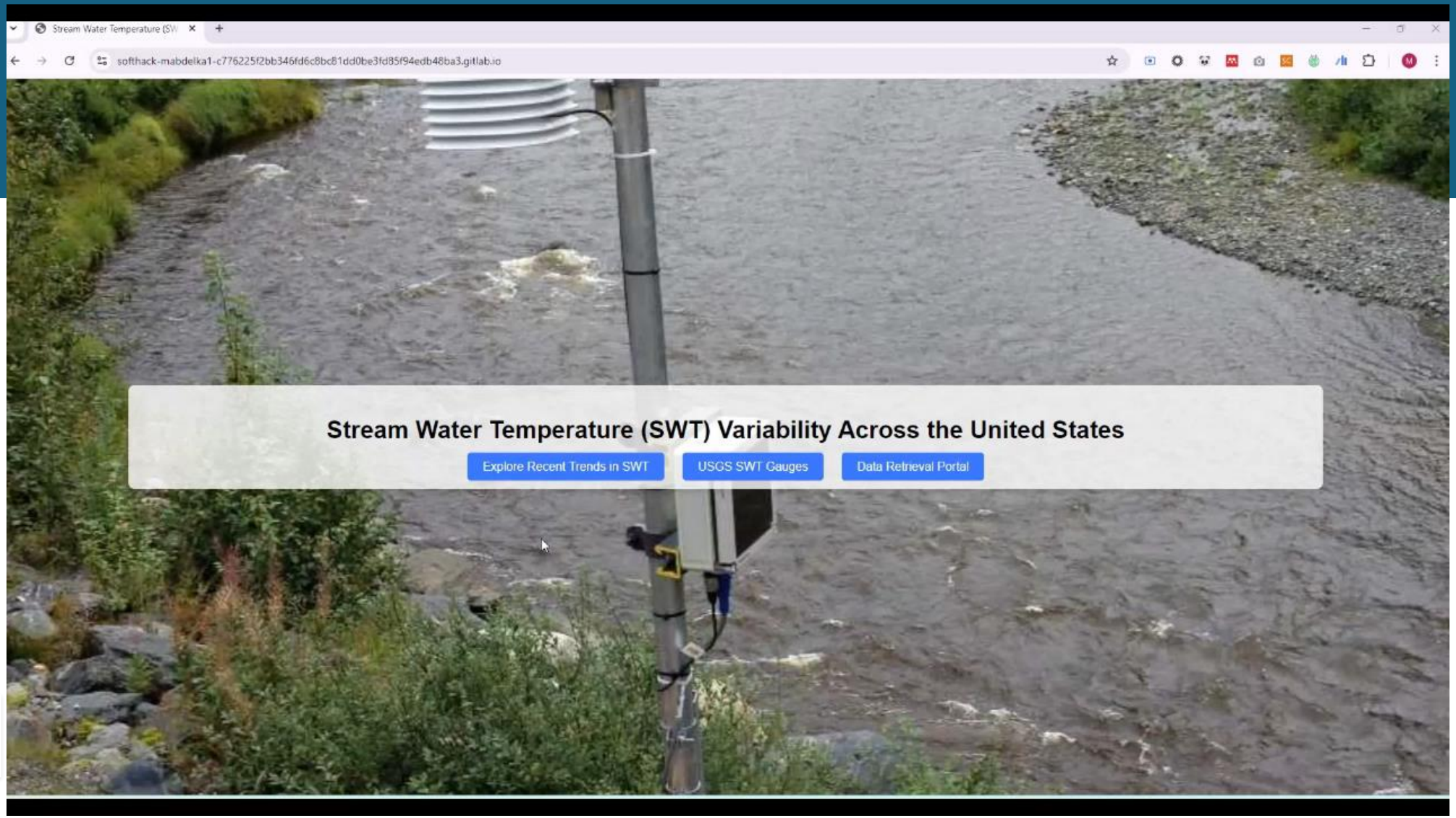
Folium

python

HTML

GitLab

HYDROSHARE



Name	Street Address	City	State	EPA Region	Contact Info	Source ID	Facility Type
U.S. Ecology Idaho Inc Site B	20400 LEMLEY RD	GRAND VIEW	ID	10	208834-2275	4516	RCRA Subtitle C Landfill with Low Activity Radioactive Waste Authority, Commercial Radioactive Waste Disposal Facilities
U.S. Doe Waste Isolation Pilot Plant	34 LOUIS WHITLOCK DRIVE	CARLSBAD	NM	06	575234-8177	4537	Federal Radioactive Waste Disposal Facilities
U.S. Ecology Texas LP	3277 COUNTY ROAD 69	ROBSTOWN	TX	06	361387-3518	4565	RCRA Subtitle C Landfill with Low Activity Radioactive Waste Authority, Commercial Radioactive Waste Disposal Facilities

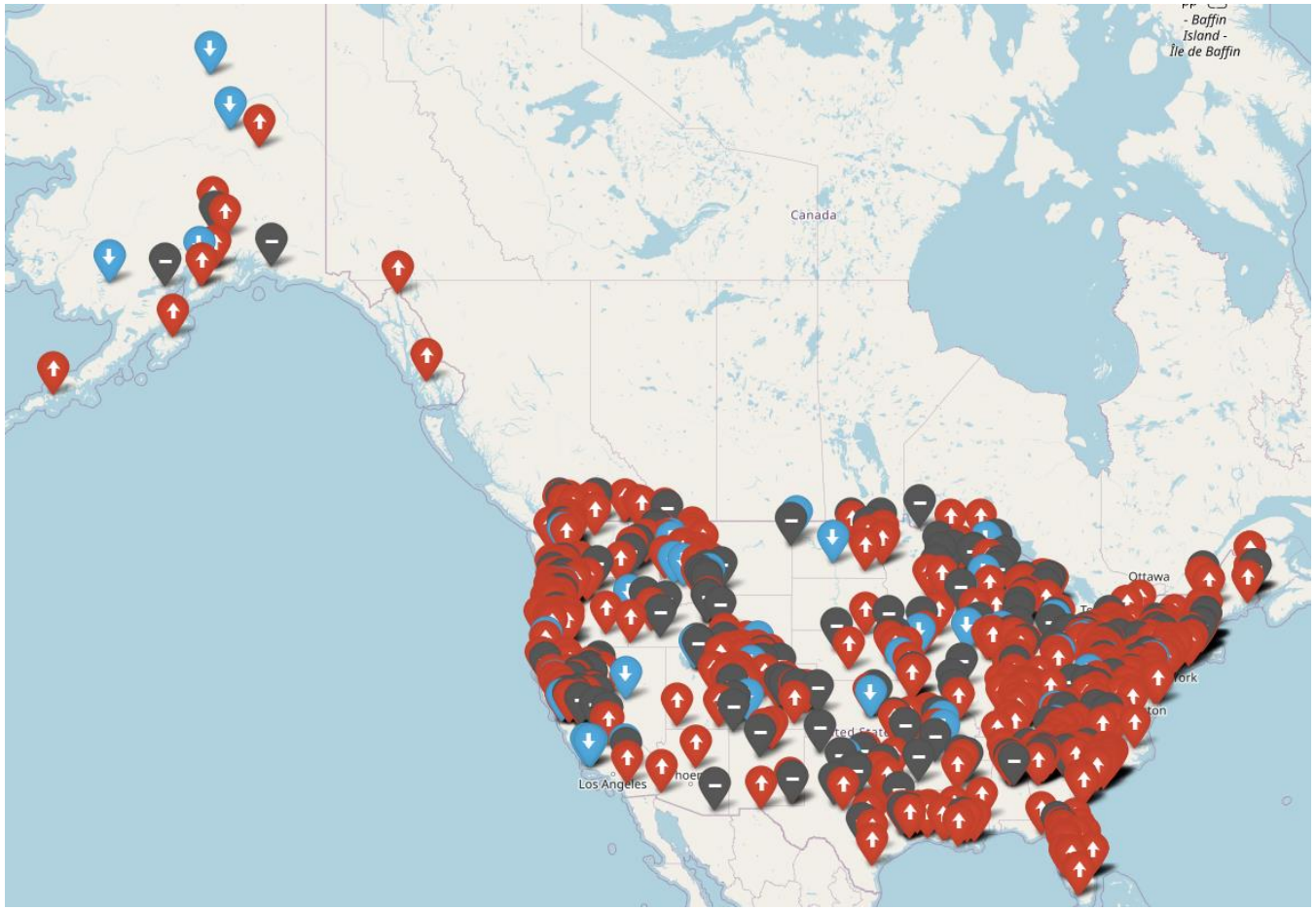
	A	B	C	D	E	F	G	H
1	longitude	latitude	id	state_code	epa_regio	facility_su	facility_type_ids	
2	-120.172	41.53219	20205	CA	9	1	2	
3	-85.9257	33.6805	20206	AL	4	1	2	
4	-87.9955	31.279	20207	AL	4	1	2	

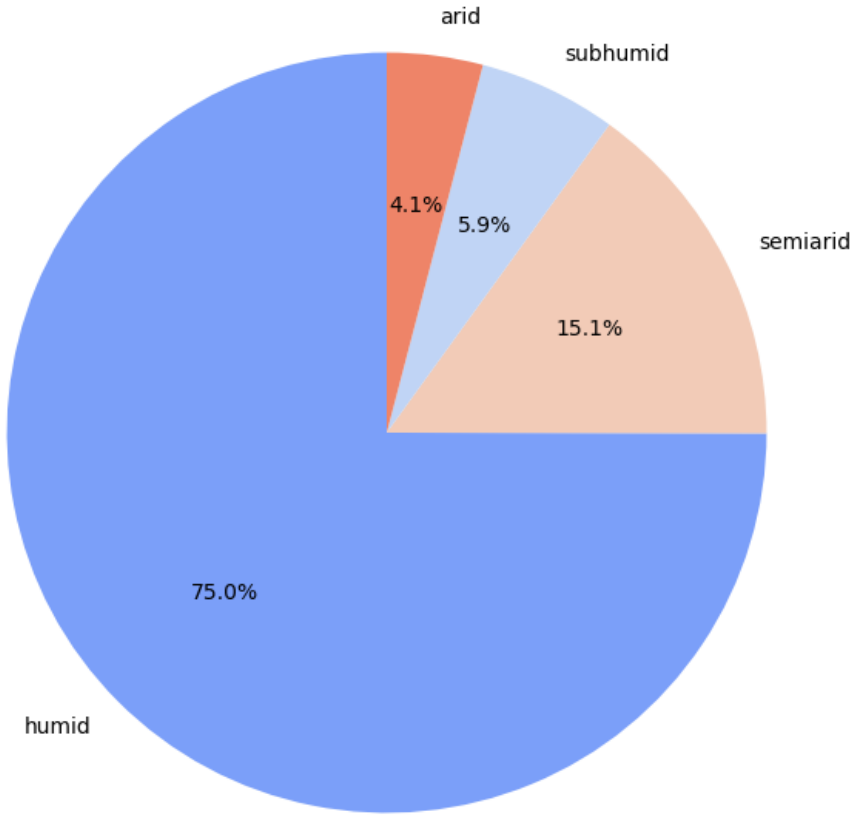
E	F	G	H	I
EPARegion	ContactInfo	SourceID	FacilityType	CategoryAssignment
04	229-317-2629	15635	Rendering Facilities	Category6
04	229-317-2629	15636	Rendering Facilities	Category6

Thermal Heat Sources – Valuable Resource

Trend Analysis Results:

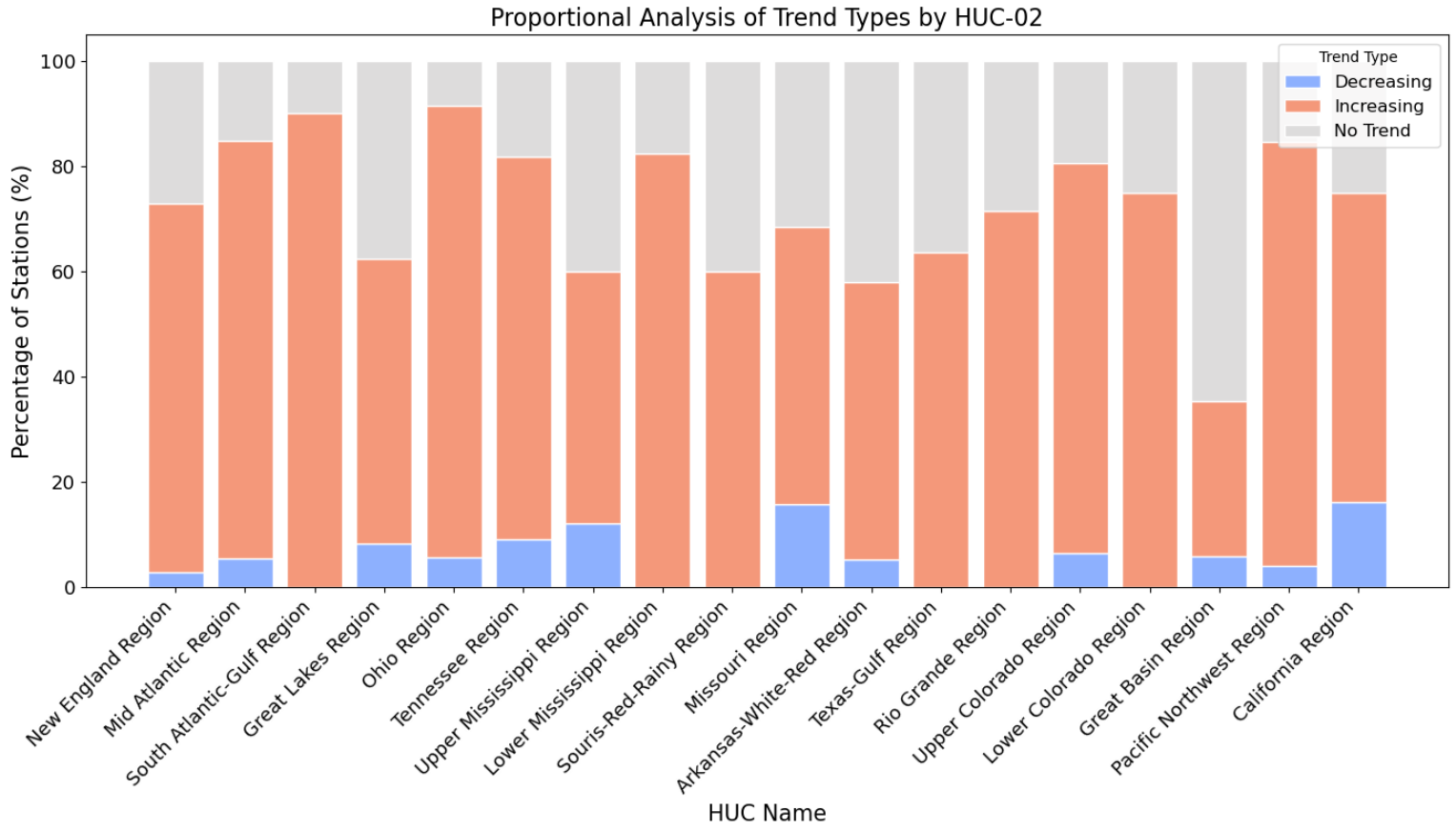
An Alarming Increase in SWT across the United Stated



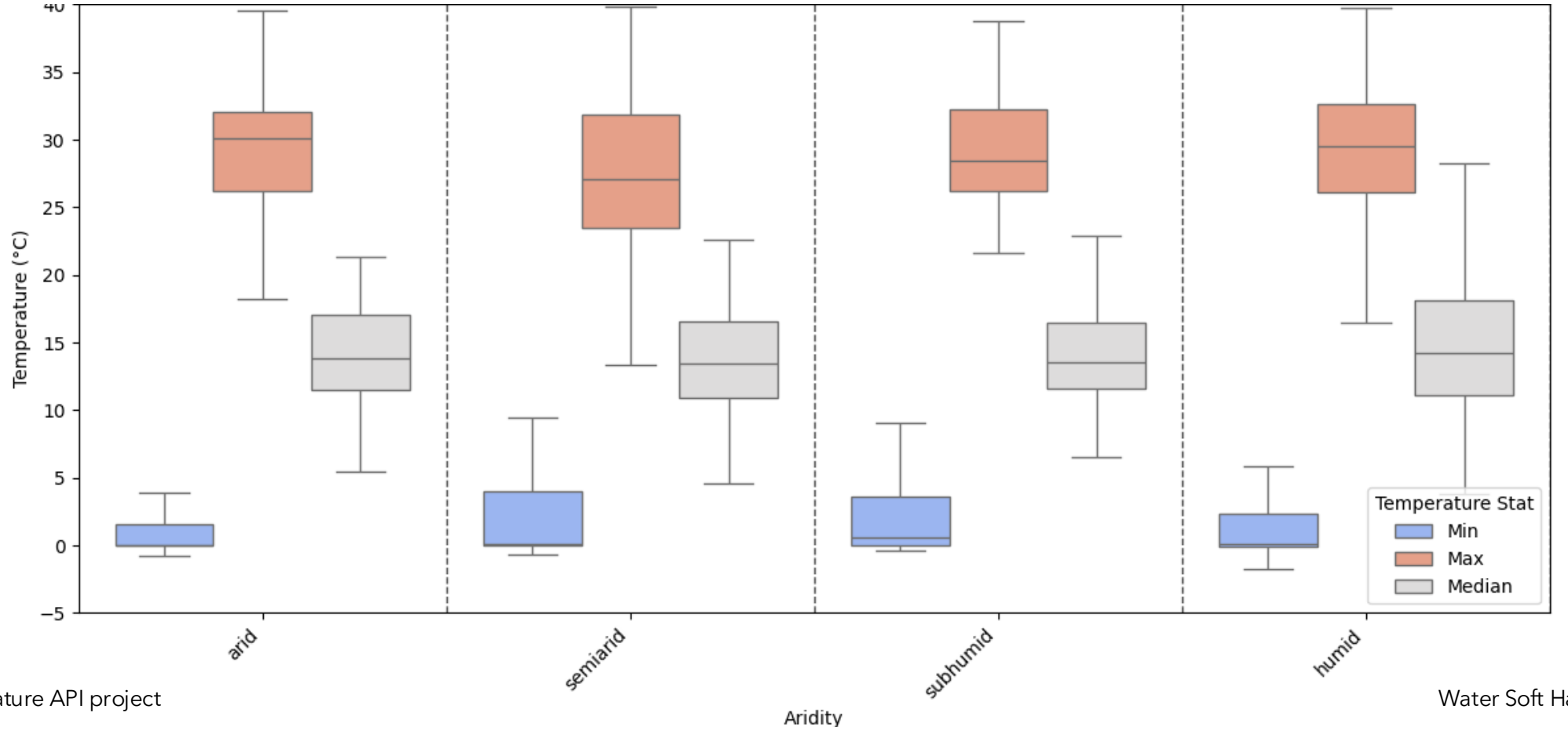


Stations Distribution by aridity zones

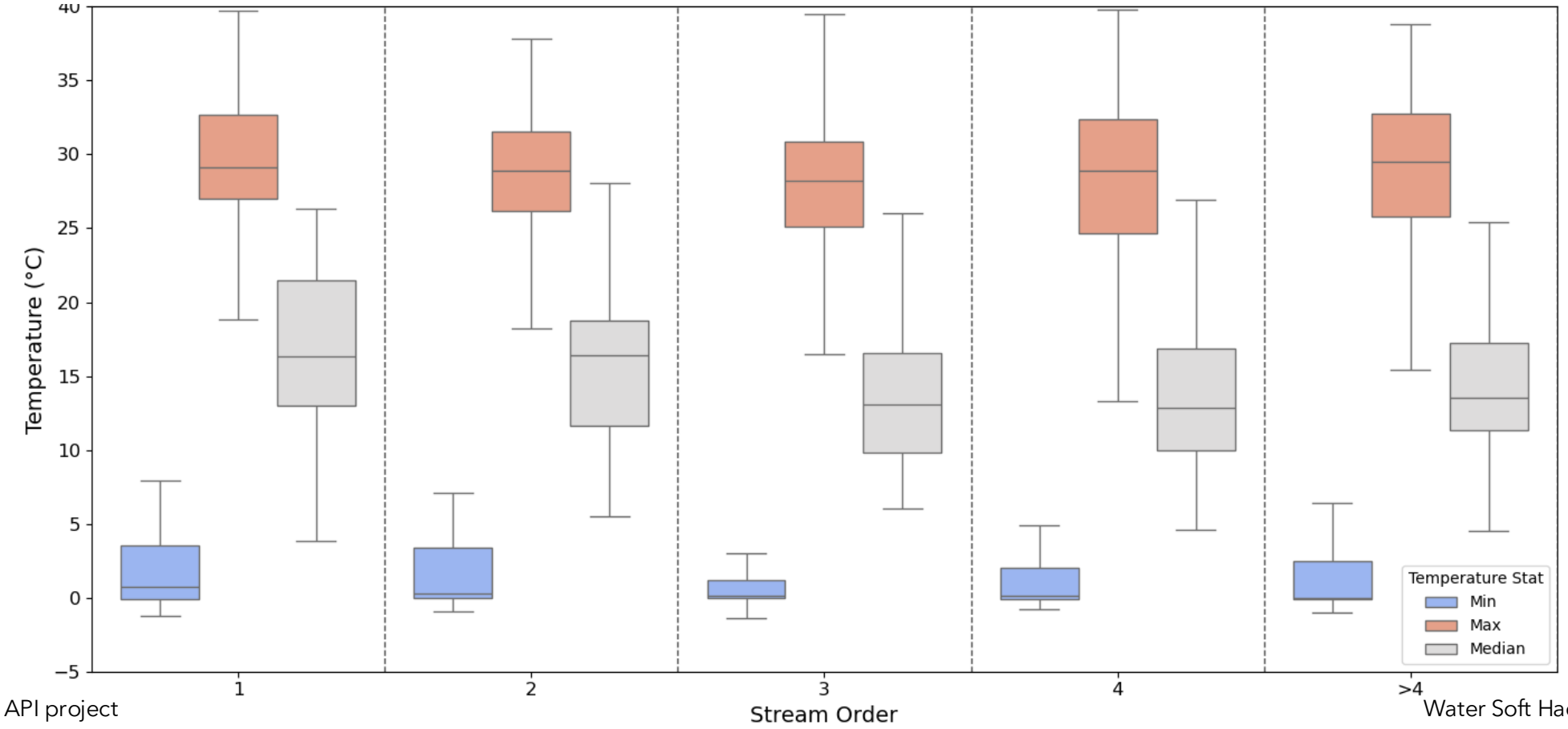
Result – Trends as Function of HUC2 Regions



Result – Aridity Index

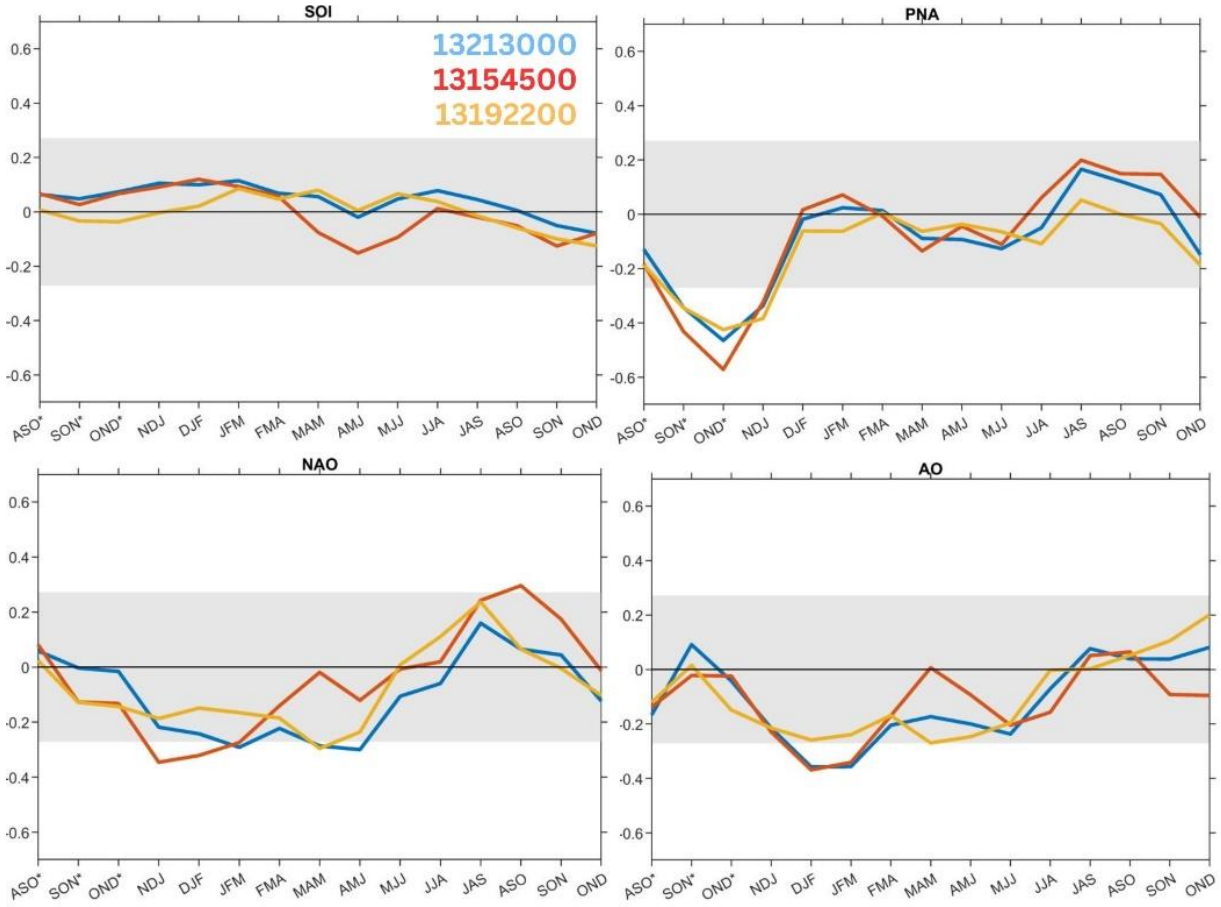


Result – Stream Order



Result – Link with Large-Scale Climate Indices

- Seasonal patterns in the relationship between maximum recorded SWT and selected climatic indices.
- Seasons marked with an asterisk denote the period preceding the water year of the recorded maximum SWT.
- Relationships extending outside the shaded region demonstrate significance at the 10% confidence level.

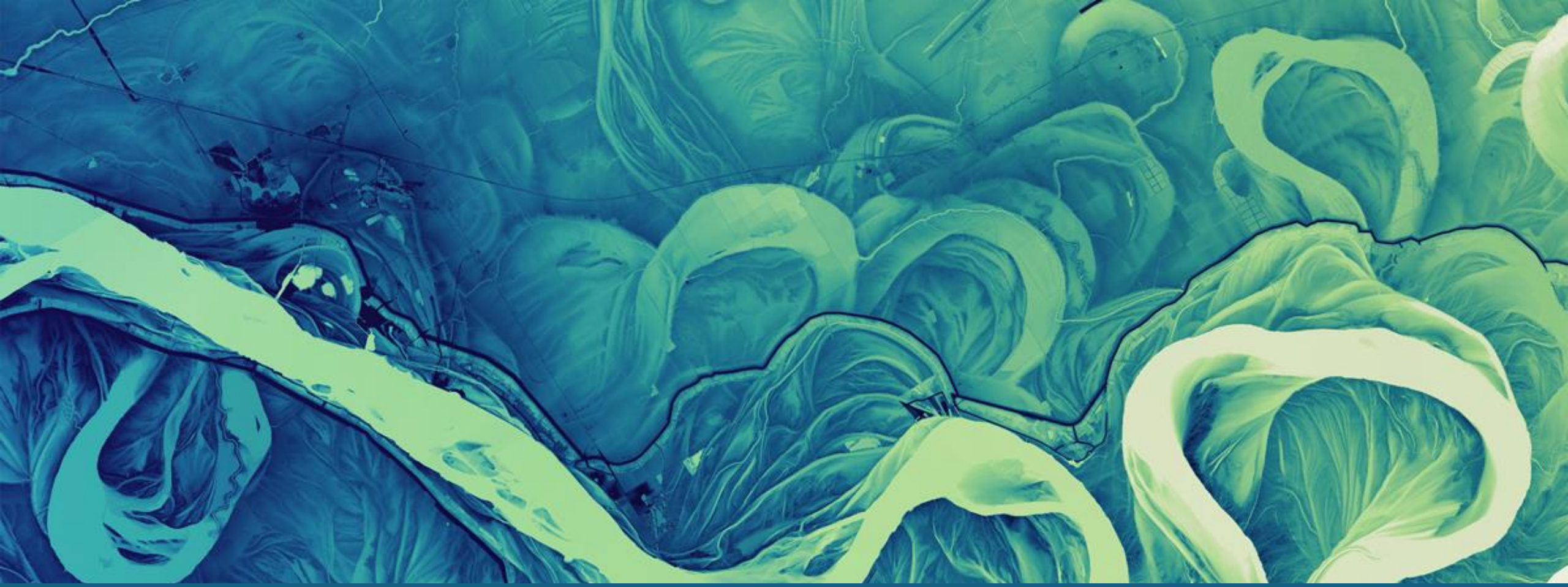


Conclusions

Our study found that stream water temperatures show the greatest variability in humid regions.

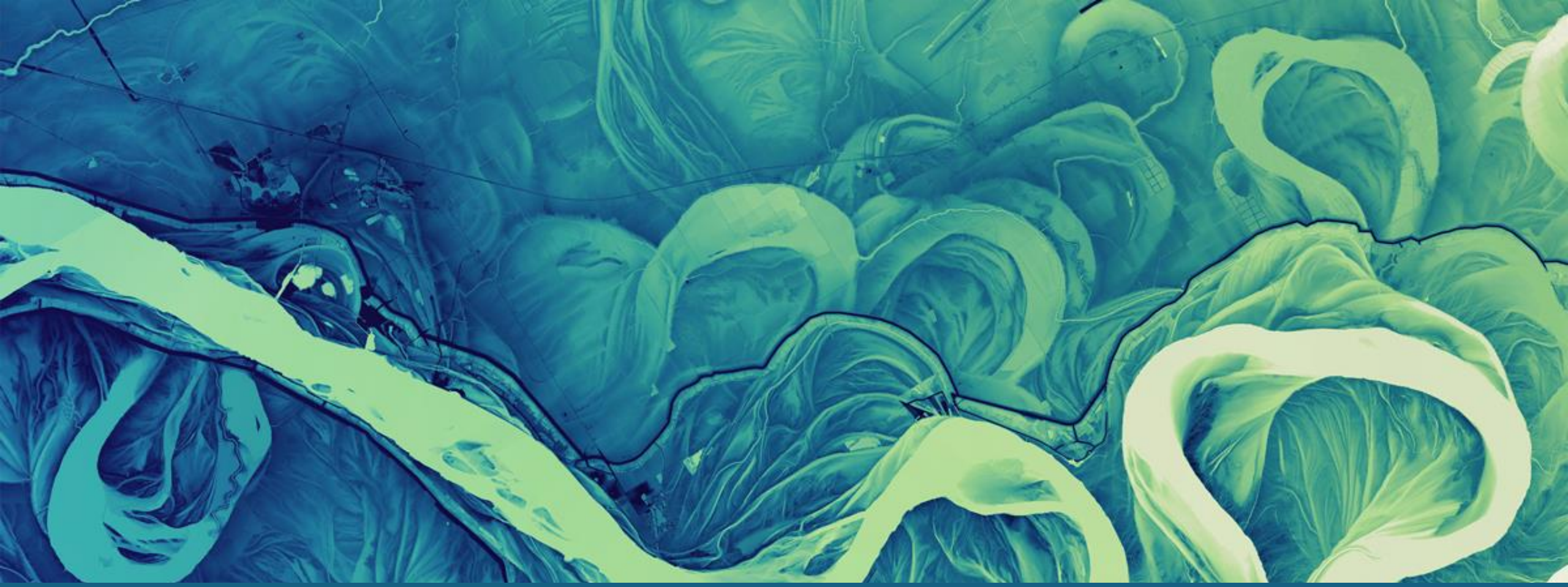
Across all hydrologic unit regions regions, there is a concerning uniform increase in stream water temperatures.

SWT variation as function of stream order did not display a significant spatial relationship.



Thank you for your attention!

Claudia, Mohamed, Steve, Ochithya, Cielo



Questions?
Join our Menti Poll!

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