

# Climate and Water Resources in the Carolinas: Approaches to Applying Global Climate Change Information to Local and Regional Questions

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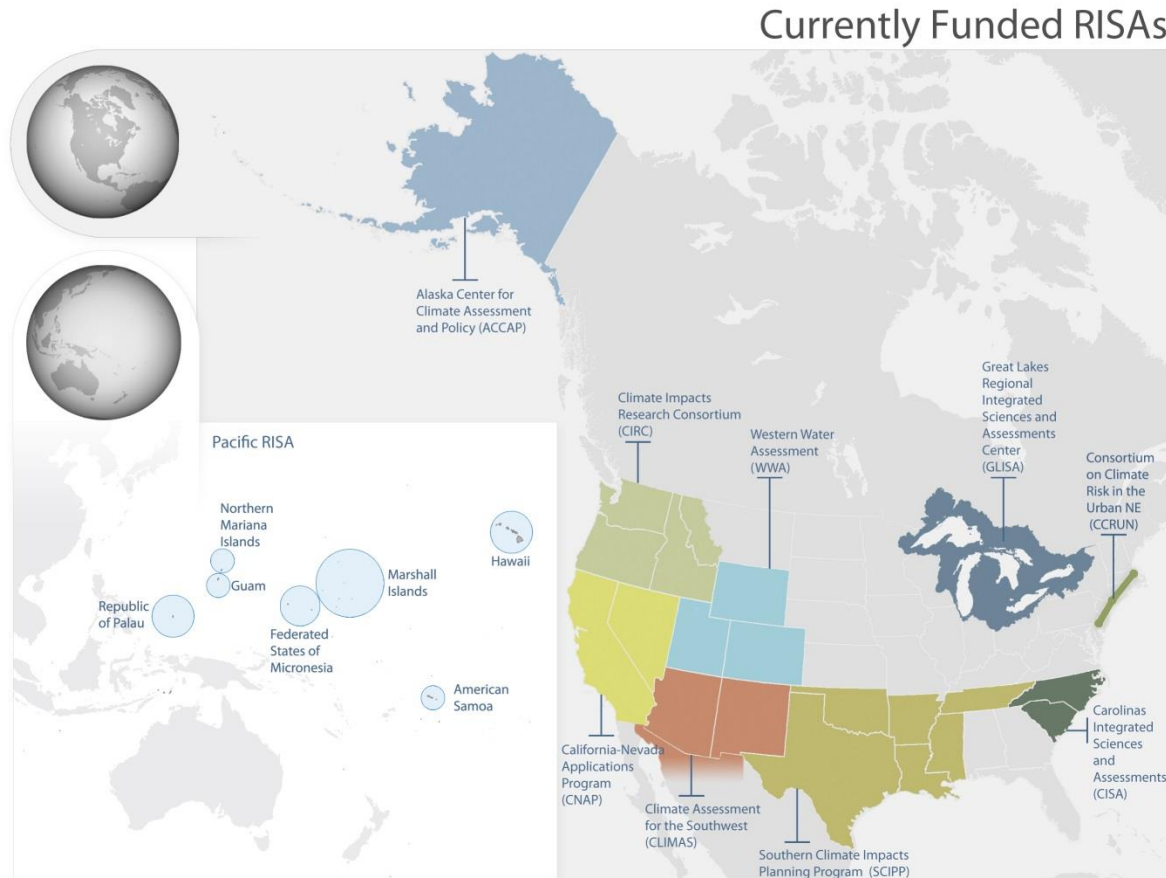


# Outline/Overview

- What is CISA?
- Challenges in using climate change info
- What do decision-makers want to know about climate change in the Carolinas?
- What is CISA's approach to answering these questions?
  - More challenges – and, some suggestions for moving forward
- What other opportunities exist for improving understanding of climate, and use of climate information, in the Carolinas?

# What is CISA?

## NOAA's Regional Integrated Sciences & Assessments (RISA) Program



*“RISA programs support research teams that help build the nation’s capacity to prepare for and adapt to climate variability and change.”*

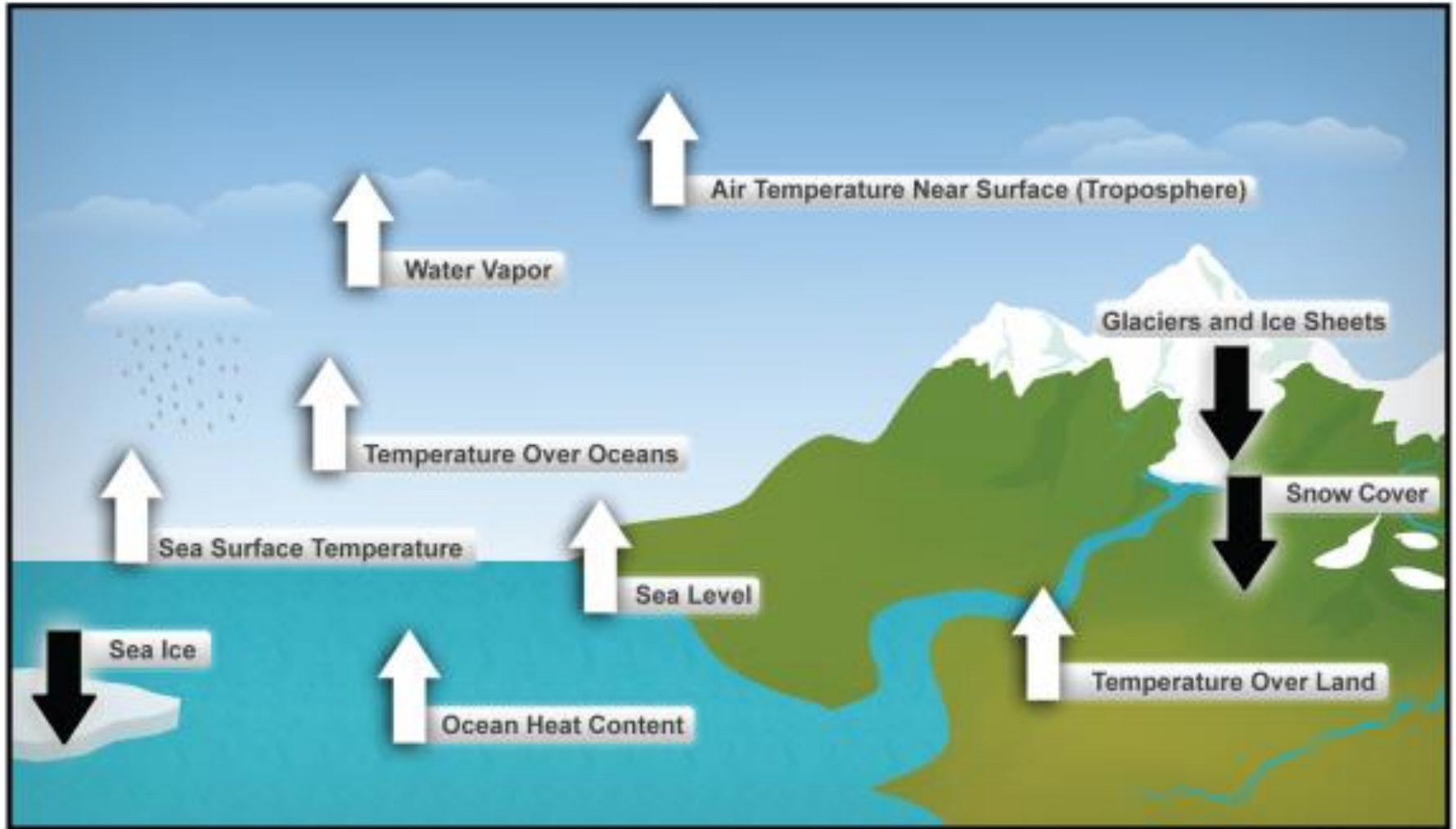
# What is CISA?

- Carolinas *Integrated* Sciences & Assessments
  - Interdisciplinary
  - Scientific and local knowledge
  - Water, coasts, health
- What does CISA *do*?
  - Conducts applied climate research
  - Develops tailored climate information
  - Advances climate adaptation efforts
  - Supports and fosters climate information networks

# Challenges

- For information users *and* information providers
- Translating global climate change information to the local level
- Applying climate model output to specific decisions
- Identifying appropriate tools and resources for different contexts

# Ten Indicators of a Warming World



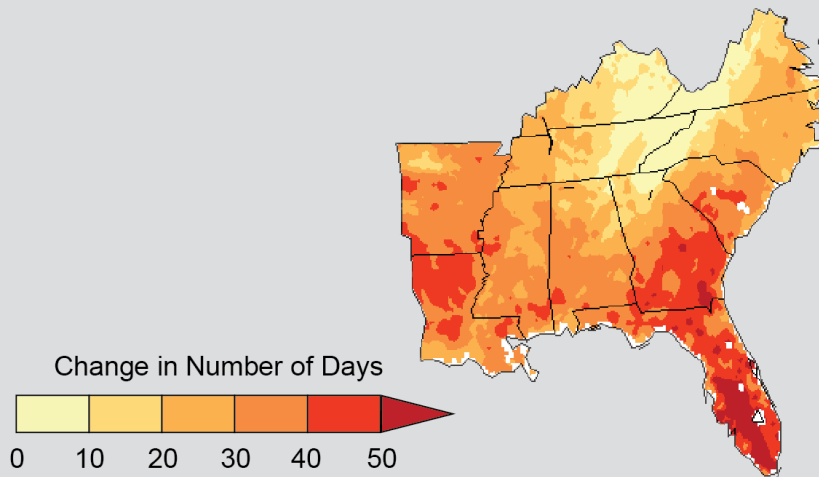
Credit: NOAA

# Projected Changes: Southeast

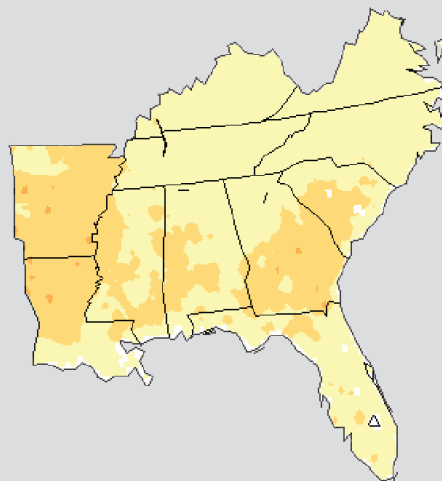
- Sea level rise threats
- Temperature increases
- Precipitation uncertainties
  - Trends and patterns
  - Frequency and magnitude of extreme events
- Water availability reduced
  - Increasing temperatures, evaporative losses
  - Increasing populations, demands

# Projected Change in Number of Days Over 95°F

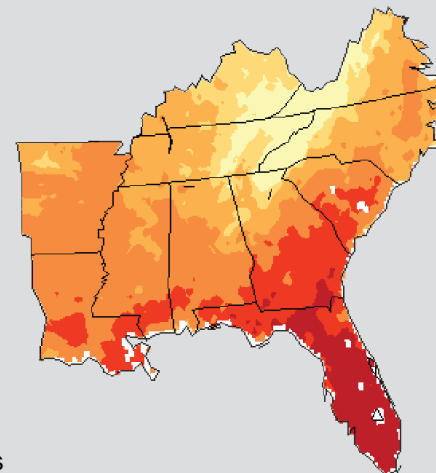
## Projected Difference from Historical Climate



## Historical Climate (1971-2000)

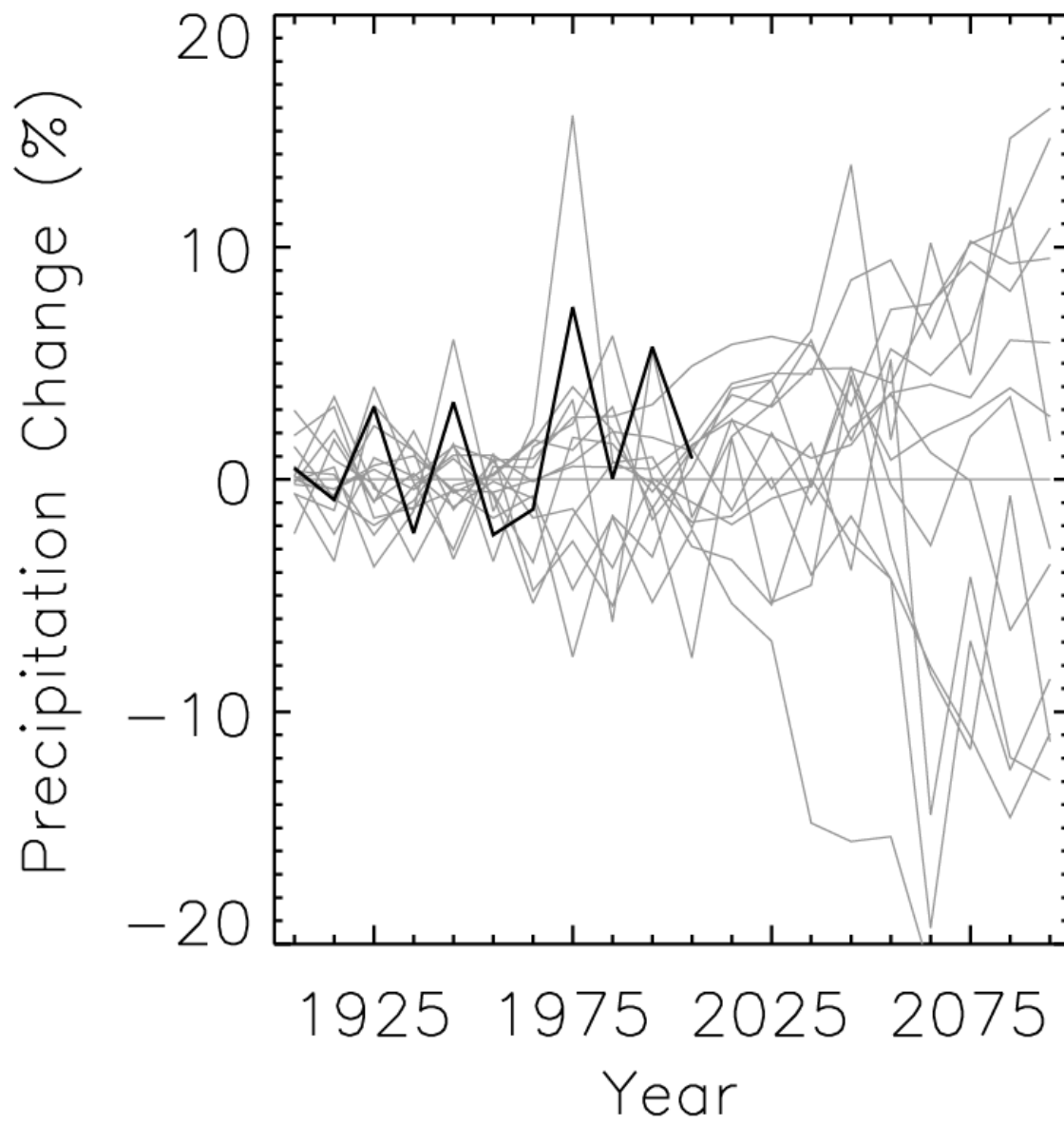


## Projection (2041-2070)



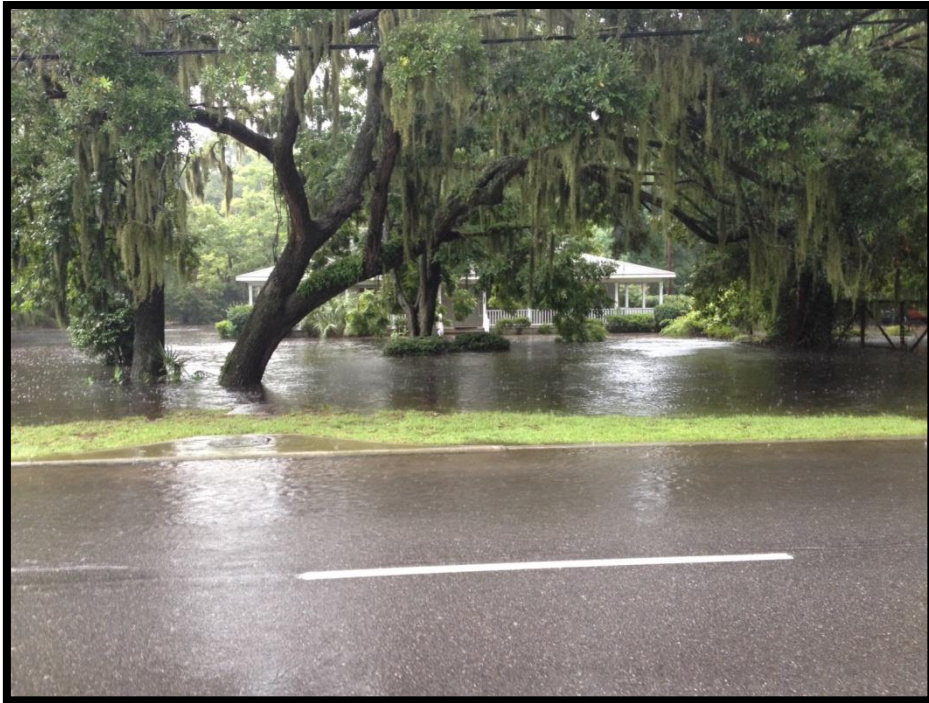
Credit: NOAA NCDC/CICS-NC





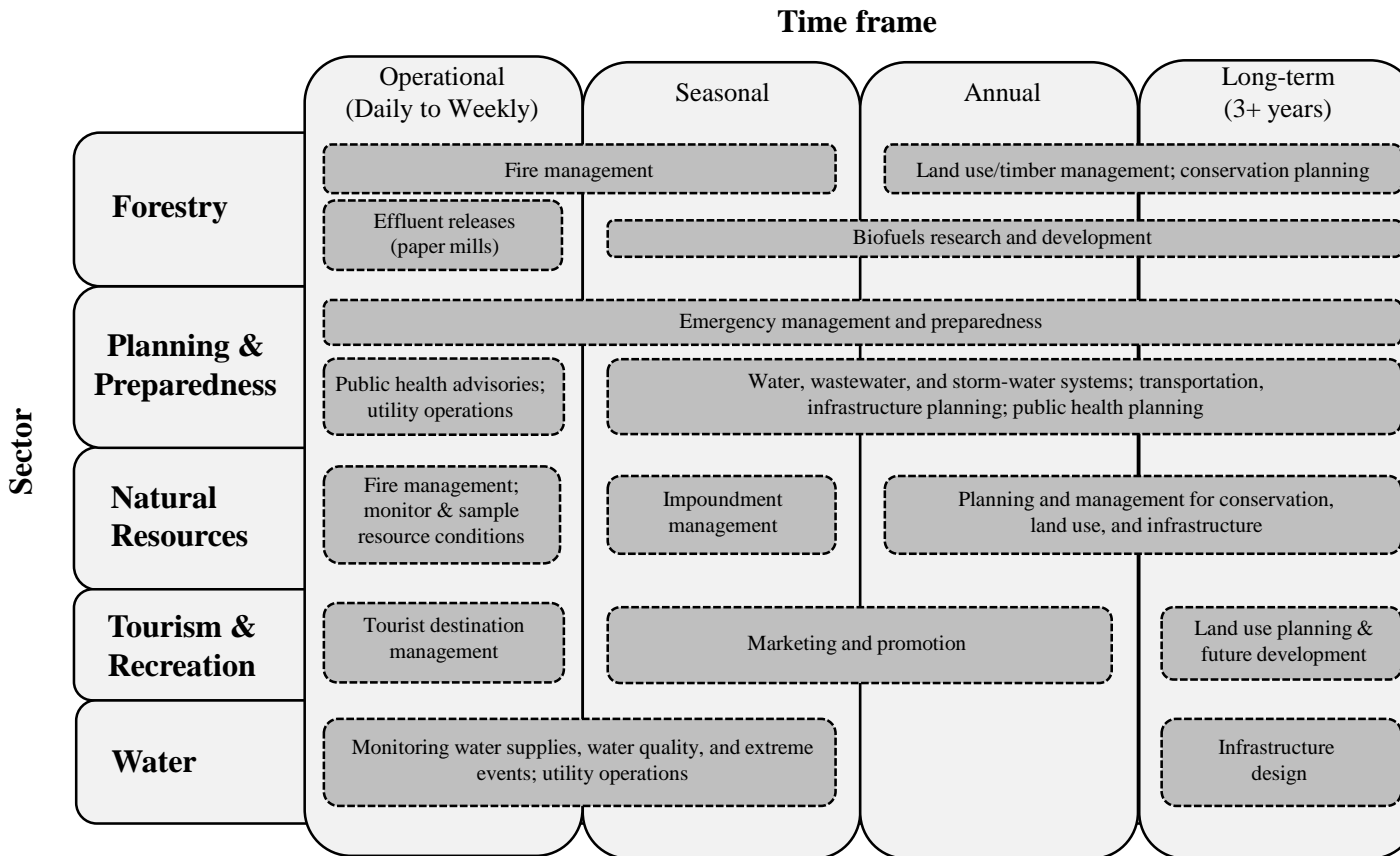
Credit: USGCRP, 2014 NCA

# Severe Events: Floods and Droughts



# What makes climate information useful and usable?

- Context (organizational, political, social, economic)
- “Fit” of information to the context
  - Accessible and available at appropriate temporal and spatial scales
- “Credible”
  - Definition
- “Salient”
  - Definition
- “Legitimate”



Project example	Time horizon of interest	Spatial scale of interest
Guidance for stormwater management and low impact development strategies in coastal areas	Through 2100	Local (low impact development sites)
Water utility long-range planning	2065 (utility's 50-year planning period)	Local (water catchment, utility service area)
Coastal habitat vulnerability assessment	2041-2070	Regional to local (coastal habitats)
Freshwater discharges in the Edisto River	2011-2030	Regional (river basin)
Flooding regimes in Congaree National Park	2041-2070	Regional (river basin)
Salinity intrusion in the Waccamaw River and Winyah Bay	2041-2070	Local (river basin)

# Climate Change Questions

## Decision Makers (Users)

- To what extent is stationarity a valid assumption for water planning and risk assessments?
- Which model output and scenarios are best suited for the Southeast?
- To what extent will future climate affect water levels and precipitation intensity, duration, frequency?
- How will changing water flows, SLR, and salinity conditions affect coastal water resources?
- How will climate change affect specific species, habitats, and ecosystems?

## Researchers (Providers)

- How do models perform in simulating historic extreme rainfall events?
- How can models be used to investigate future changes in rainfall patterns?
- Which models and downscaling methods are appropriate for providing regionally-specific information?
- How can climate models be integrated with other data sources and tools?
- What is the range of streamflow responses to various future climate scenarios?

# CISA Approaches and Suggestions

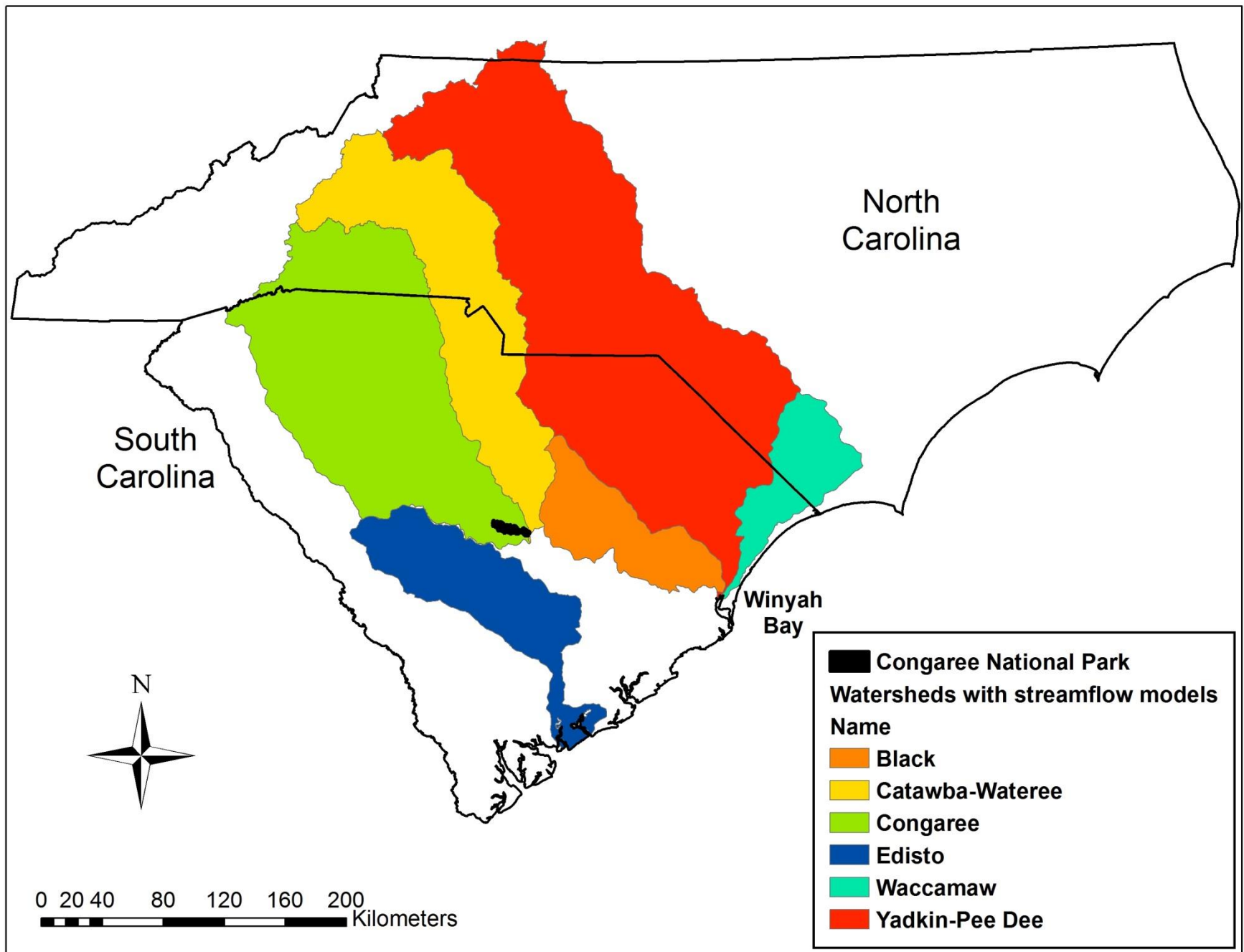
- Innovate and experiment
- Integrate different sources of climate information
  - Including a robust, baseline understanding of past events and impacts
  - 'Top-down' and 'bottom-up' approaches
- Identify and investigate the types and levels of uncertainty associated with the climate (and other) variables that matter most
- Improve understanding of the system of the concern
  - Including connections to climate, variables of greatest concern



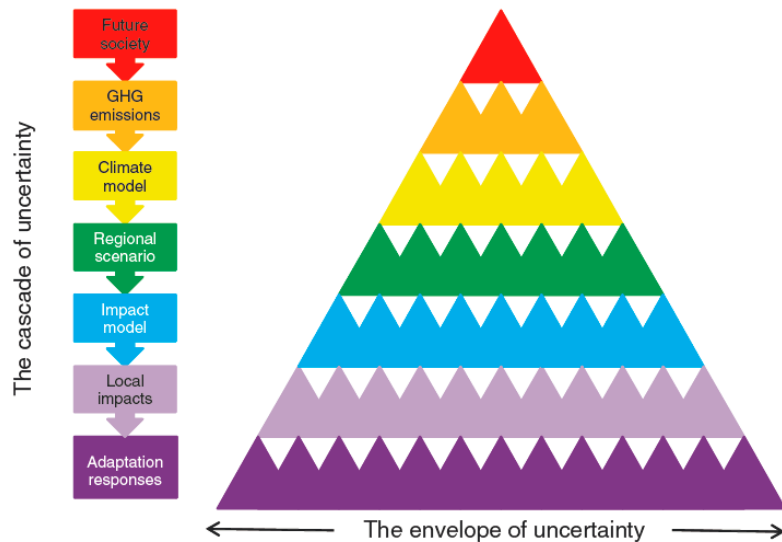
# Integrate different sources of information

Project example	Information and tools used to answer question
Guidance for stormwater management and low impact development strategies in coastal areas	Historical climate observations Climate model output
Water utility long-range planning	Historical hydroclimate observations Reservoir level records Rainfall-runoff model Utility operation model Downscaled climate model output
Coastal habitat vulnerability assessment	Climate model output
Freshwater discharges in the Edisto River	Downscaled climate model output Runoff and water quality assessment tool
Flooding regimes in Congaree National Park	Downscaled climate model output Hydrologic model Reservoir operation model
Salinity intrusion in the Waccamaw River and Winyah Bay	Downscaled climate model output Hydrologic models



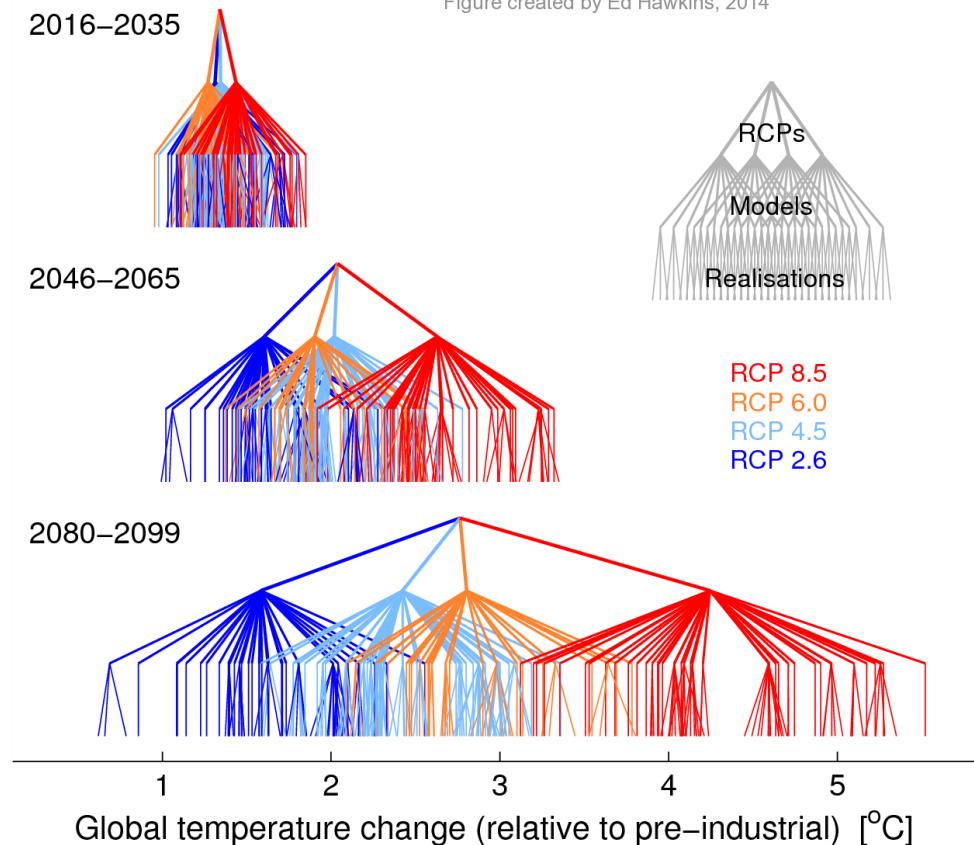


# Identify and Investigate Uncertainties

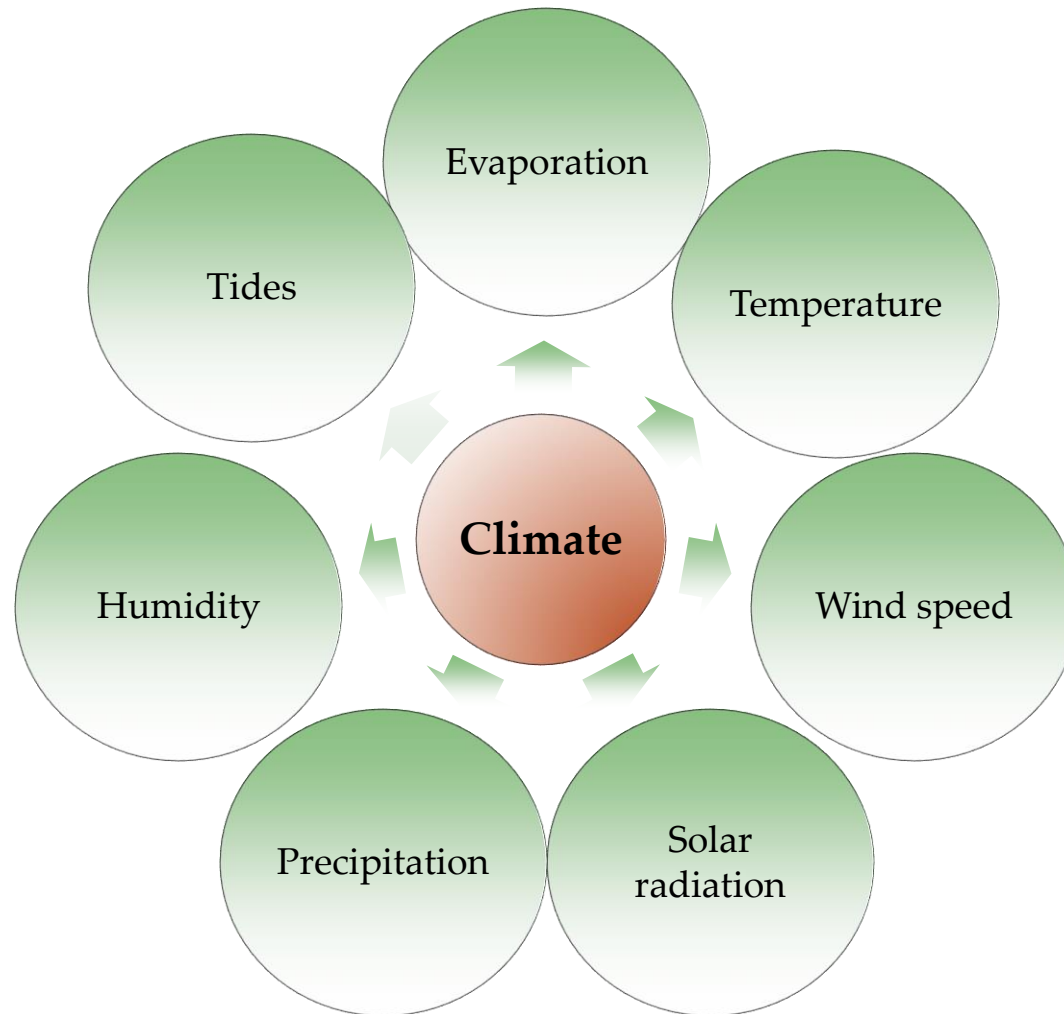


## Cascade of Uncertainty in CMIP5

Figure created by Ed Hawkins, 2014



# What climate variables are most important for the system(s) of concern?



# Connect climate to interests, conditions

- Atlas of Hydroclimate Extremes for the Carolinas

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## Carolinas Precipitation Patterns

Albemarle Stanly County | NC Climate Data

Station Overview

[Average Monthly Precipitation](#)

[Annual Departure from Normal Precipitation](#)

[Seasonal Precipitation \(1986–2015\)](#)

[SPIs](#)

[Probability Density Function](#)

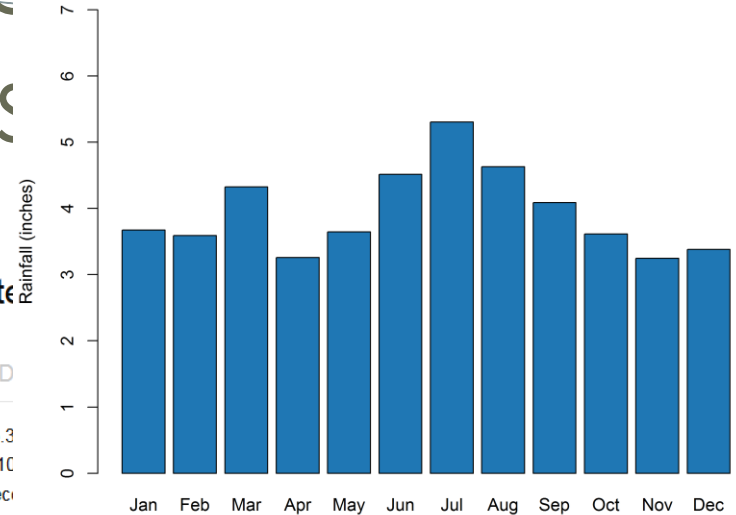
[Seasonal Probability Density Function](#)

[Recurrence Intervals](#)

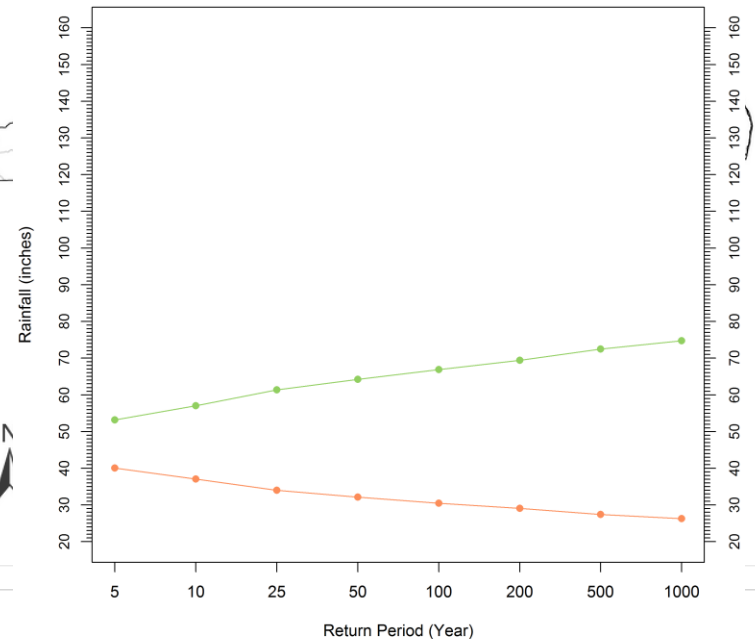
Location: 35.3  
Elevation: 610  
Period of Record: 1986–2015  
Average Annual Precipitation: 4.1 inches



### ALBEMARLE

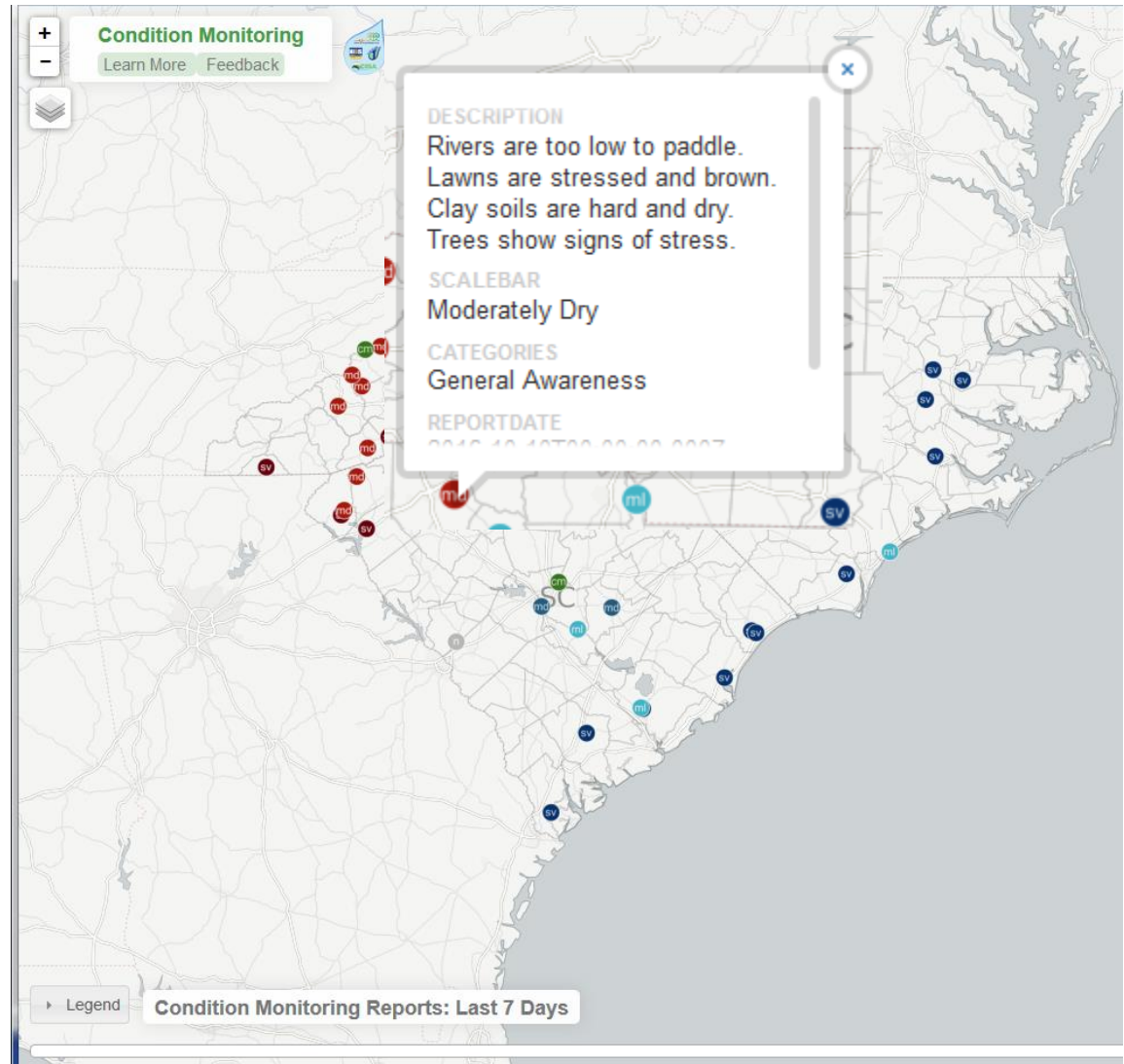


### ALBEMARLE 12-Month Precipitation



# Connect climate to local interests, conditions, and impacts

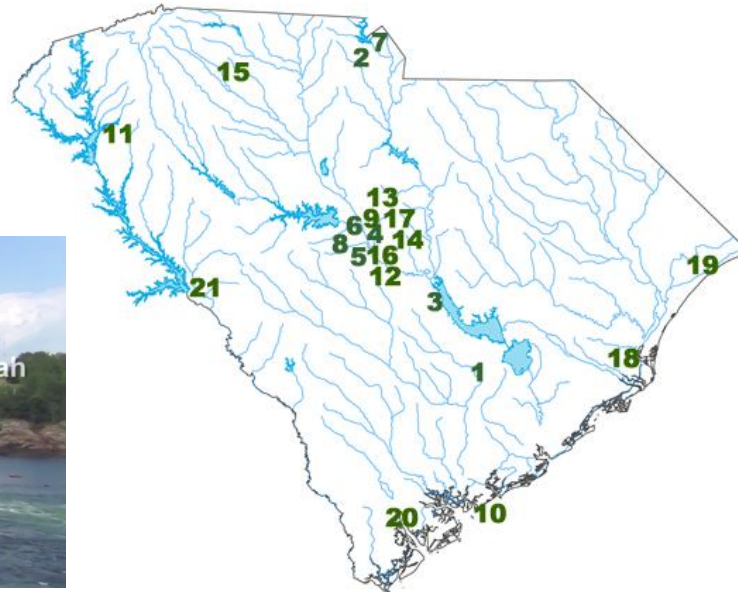
- Citizen Science-Condition Monitoring Project
  - Community Collaborative Rain, Hail & Snow Network (CoCoRaHS)





# Connect climate to local interests, conditions, and impacts

- CISA Videos



# For more information:

- Carolinas Integrated Sciences & Assessments (CISA)
  - <http://www.cisa.sc.edu/>
  - [cisa@sc.edu](mailto:cisa@sc.edu) (email)
- CISA's Water and Climate Videos
  - [http://www.cisa.sc.edu/outreach\\_videos.html](http://www.cisa.sc.edu/outreach_videos.html)
  - Available on YouTube
- CoCoRaHS-Condition Monitoring Project
  - <http://www.cisa.sc.edu/cocorahs.html>
- Kirsten Lackstrom, Research Associate
  - [lackstro@mailbox.sc.edu](mailto:lackstro@mailbox.sc.edu)
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