

SUSTAINABLE WATER RESOURCES MANAGEMENT IN A CHANGING CLIMATE

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Climate-related Regional Hydrologic Impacts

Key notion:

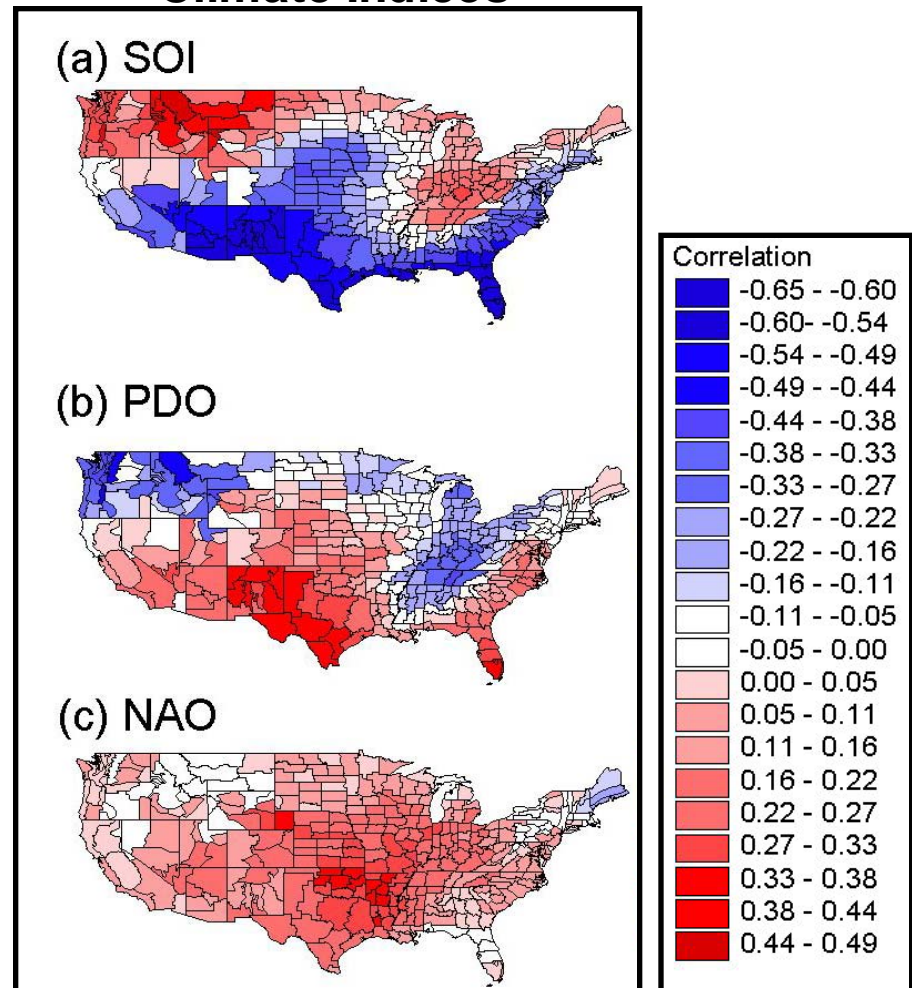
Slowly evolving atmospheric and oceanic states that persist and have dynamical origins → Predictive potential for regional hydrology & water resources

- El Niño/Southern Oscillation (SOI)
- Pacific Decadal Oscillation (PDO)
- North Atlantic Oscillation (NAO)

Example Tools:

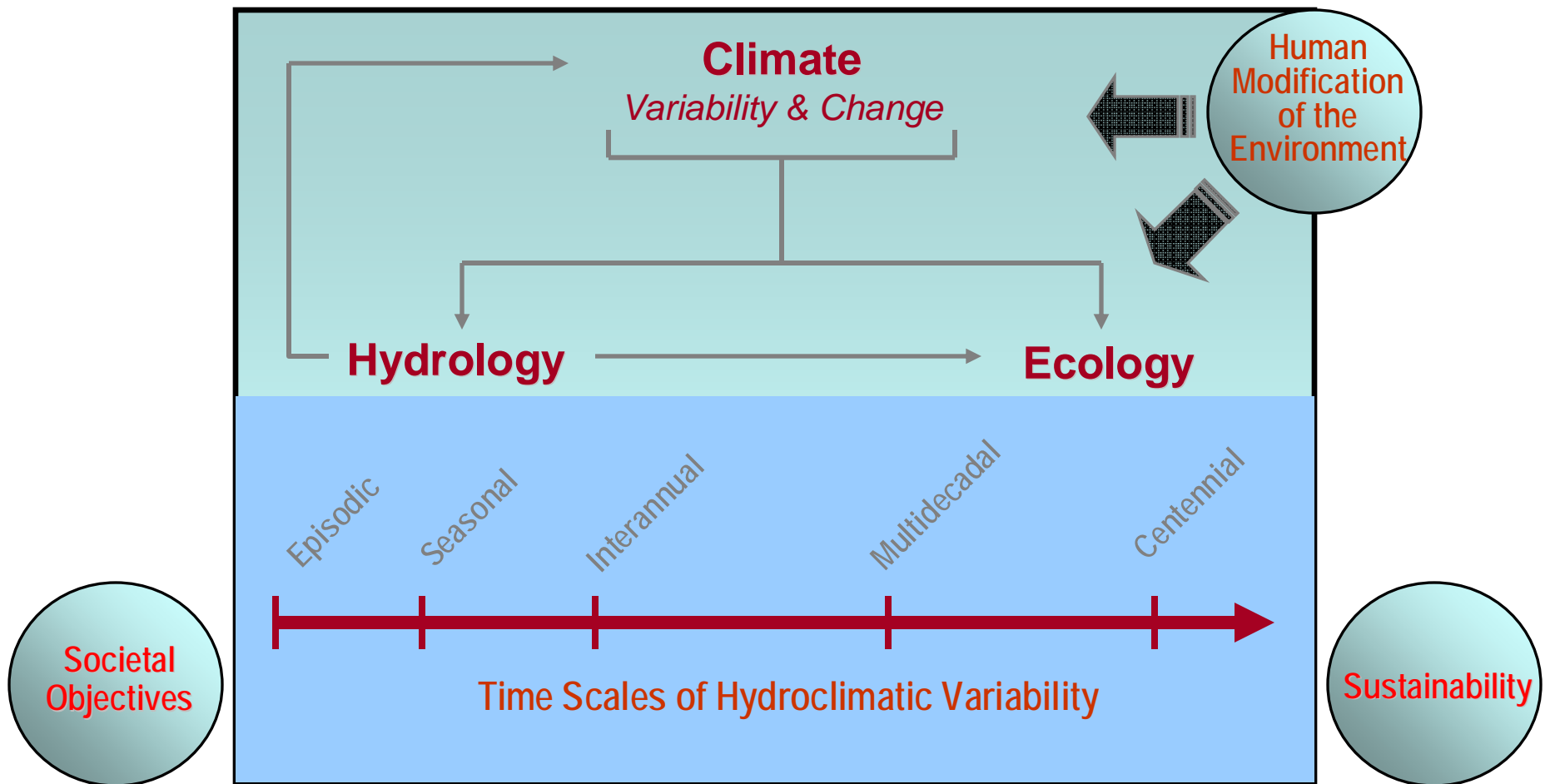
Lead-forecasts at seasonal and longer time scales—potential for proactive management and planning

Correlations: Cold season Precipitation & Climate Indices

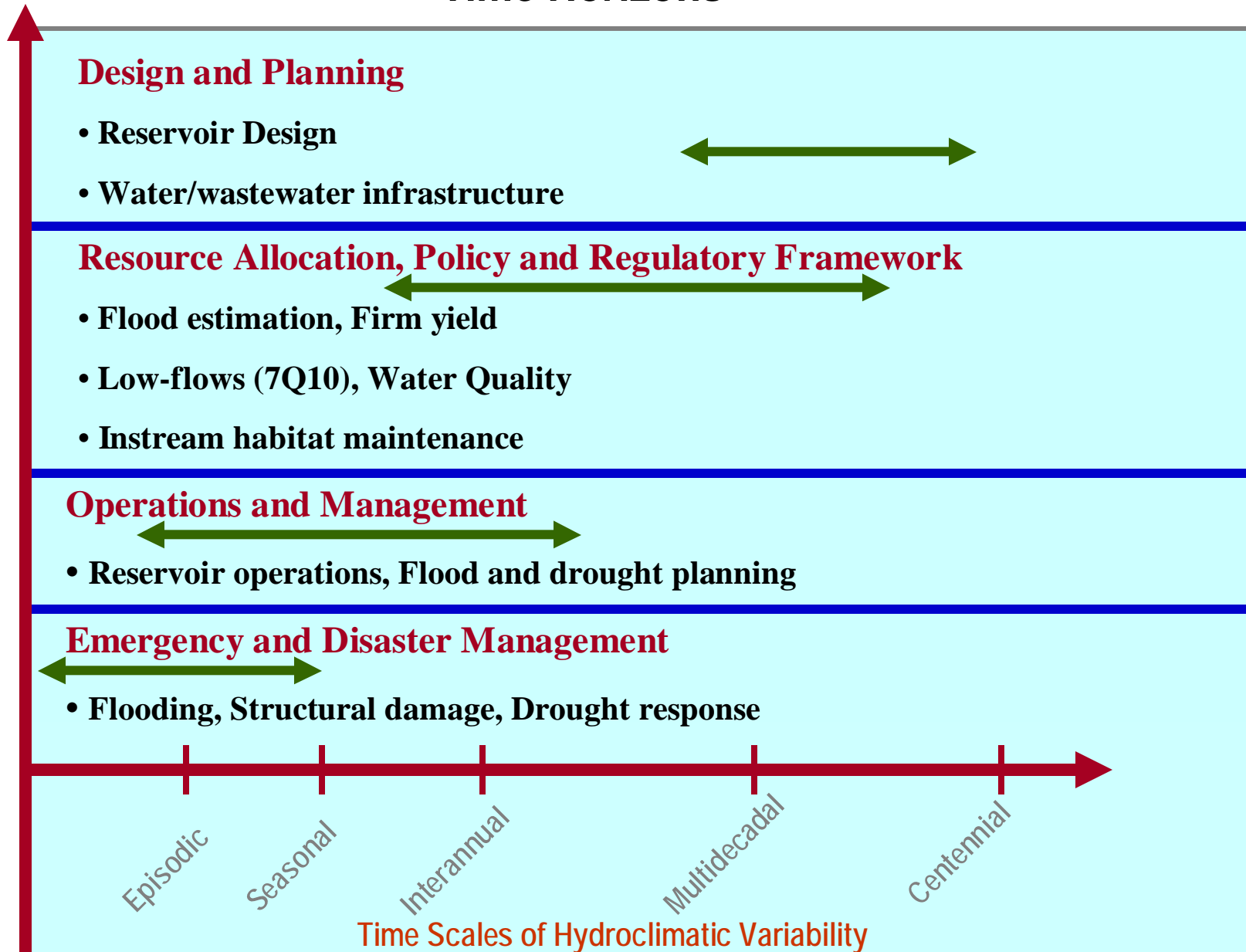


344 US Climate Divisions

Problem Domain

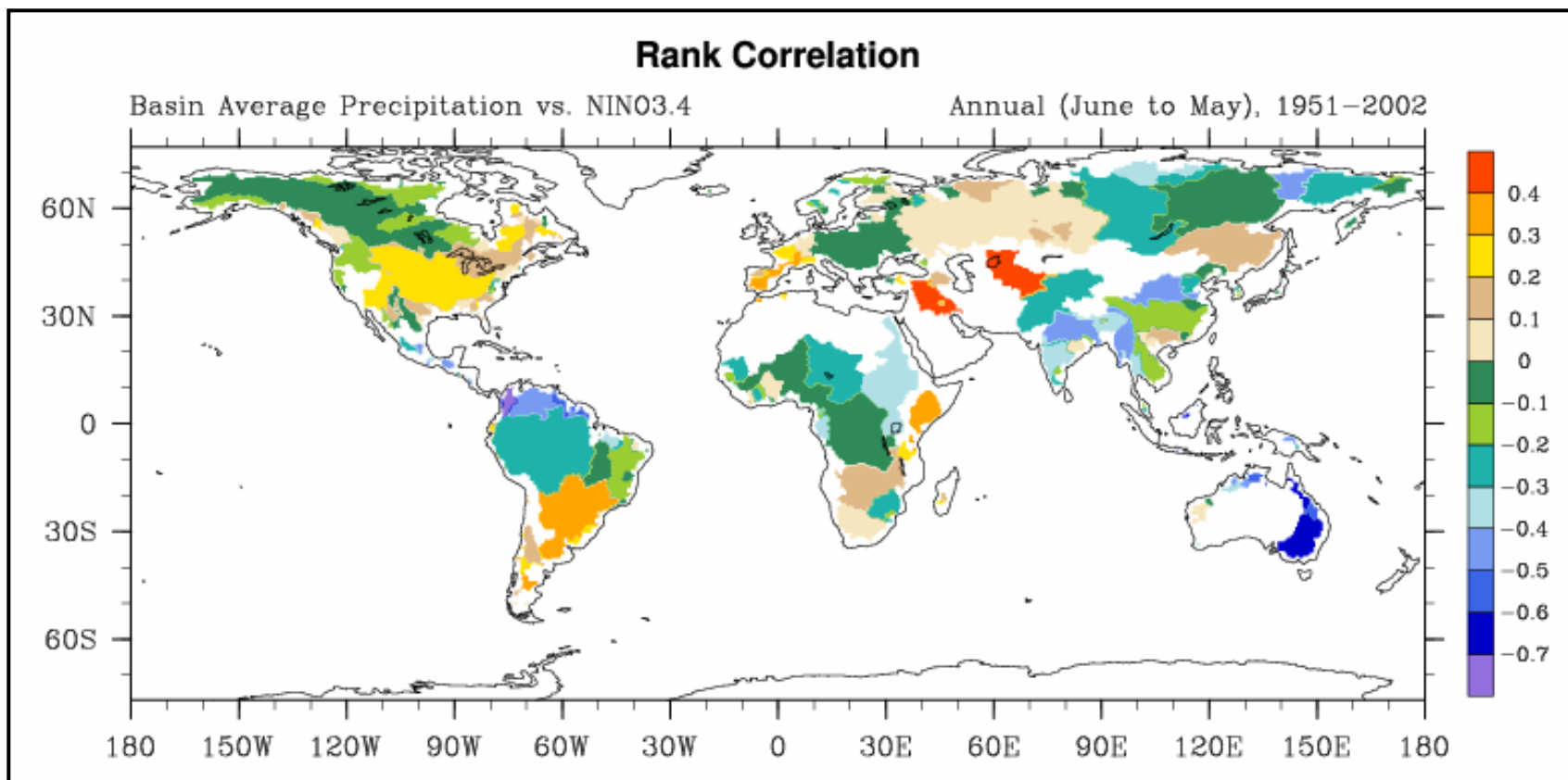


Water Resources and Environmental Management: Time Horizons



The Global Reach of Tropical Climate Variations

El Niño/Southern Oscillation Correlations with
River Basin Average Precipitation



358 major river basins; 1951-2002 period

Palmer Drought Severity Index: Taking a long view

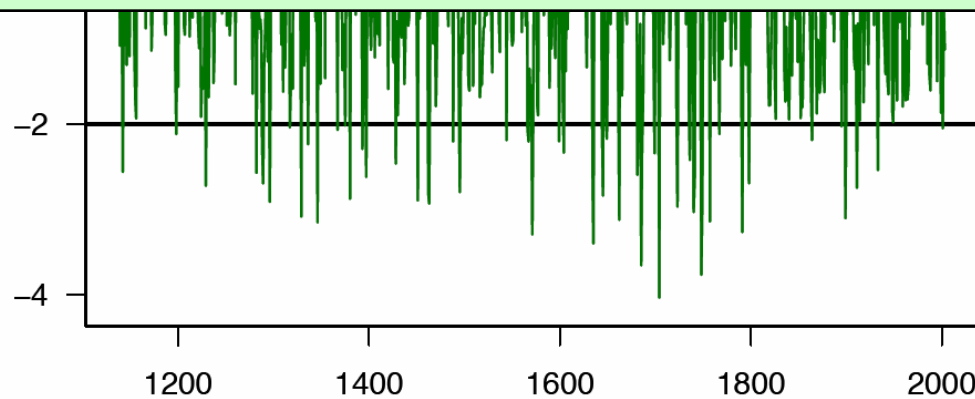


Wet periods/
Dry periods/
Droughts

Chapter 587. Rulemaking

Natural drought condition. “Natural drought condition” means moisture conditions as measured by the Palmer Drought Severity Index with values of negative 2.0 or less.

- Drought flow variance for Community Water Systems

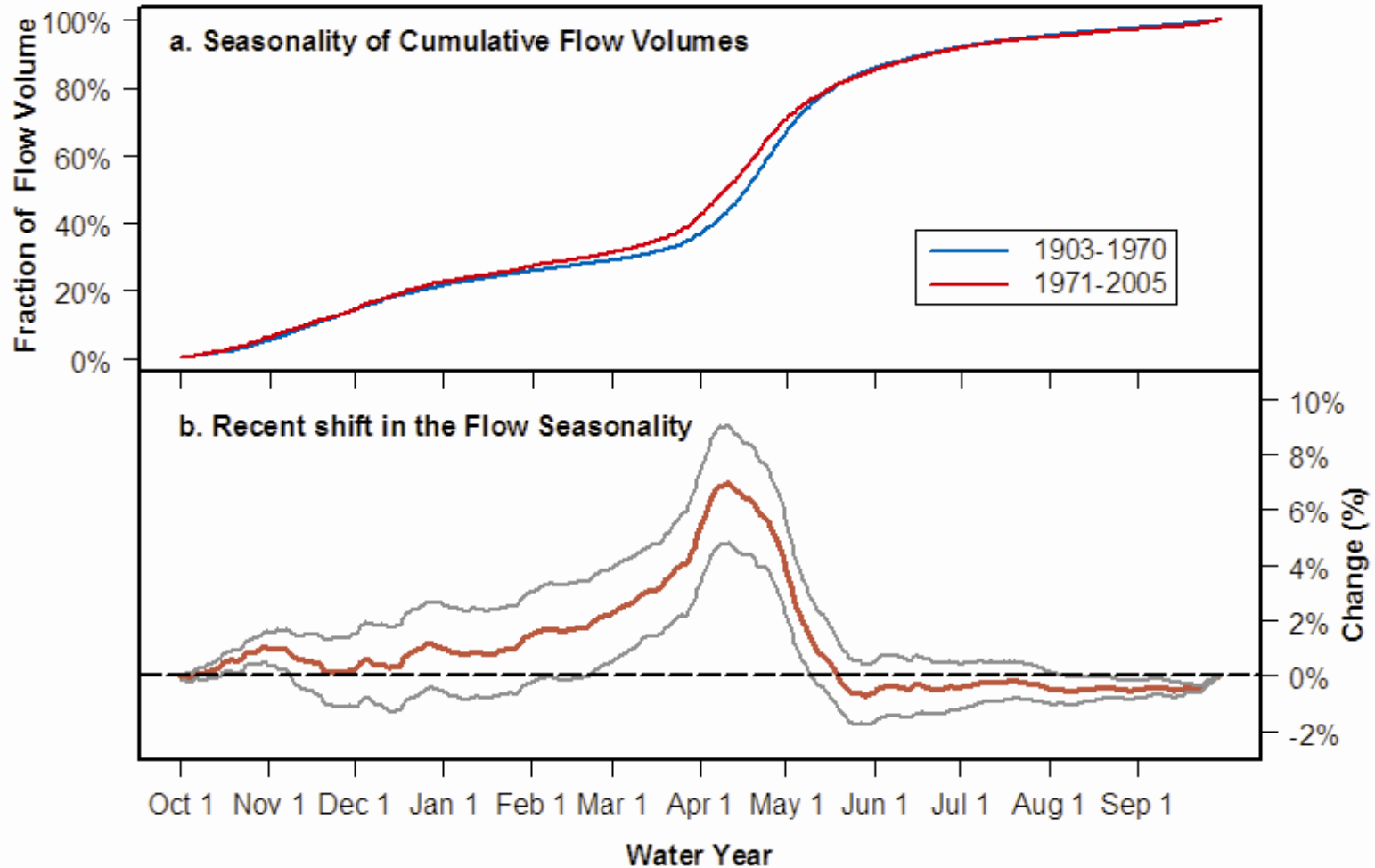


Wet periods/
Pluvials
Dry periods/
Droughts

year
1991

Piscataquis River at Dover-Foxcroft, Maine

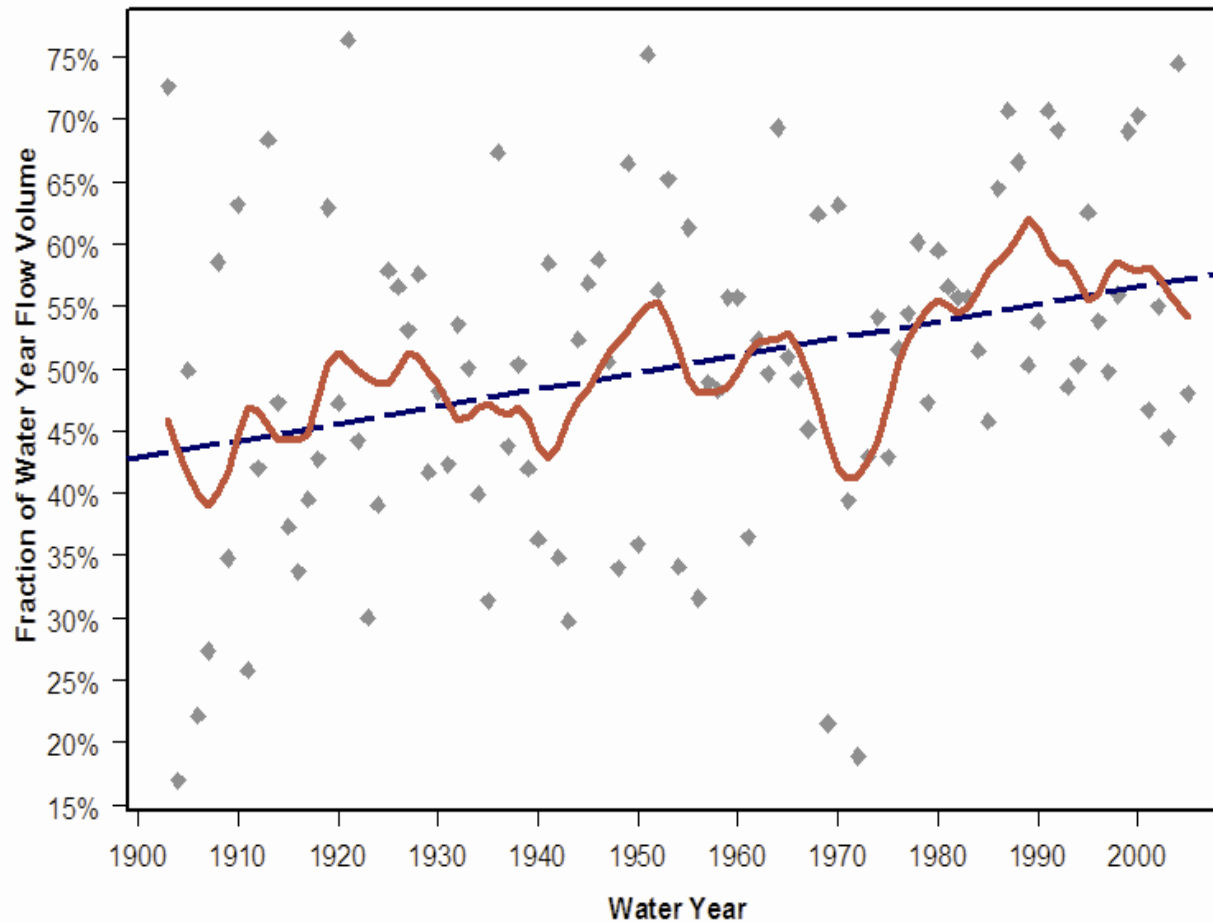
Long-term changes in the streamflow



Detailed Nature and Extent of Changes

Piscataquis River at Dover-Foxcroft, Maine

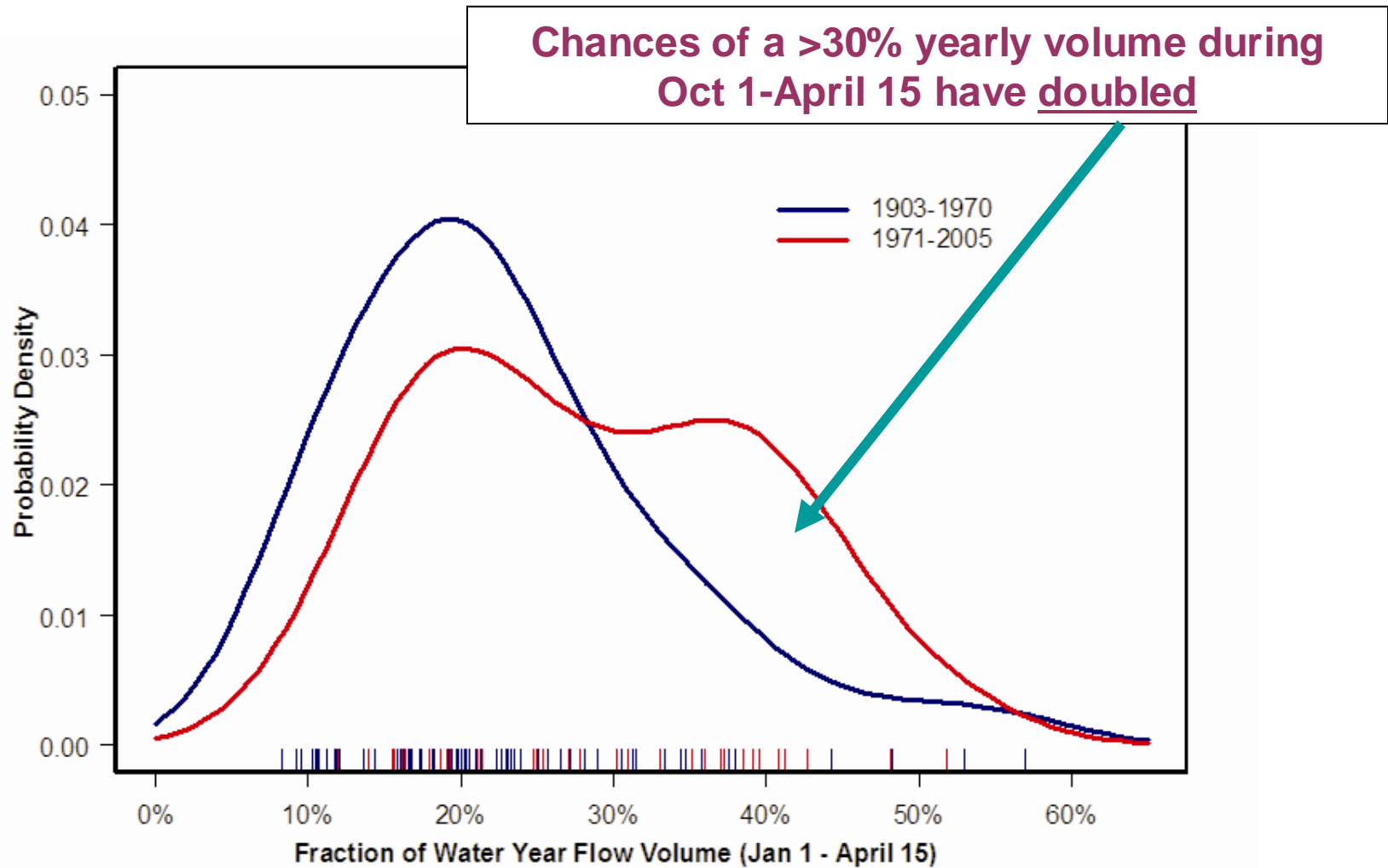
Long-term changes in the streamflow



**Fraction of the total water year volume
flowing during the October 1-April 15 period**

Piscataquis River at Dover-Foxcroft, Maine

Long-term changes in the streamflow



Piscataquis River at Dover-Foxcroft, Maine

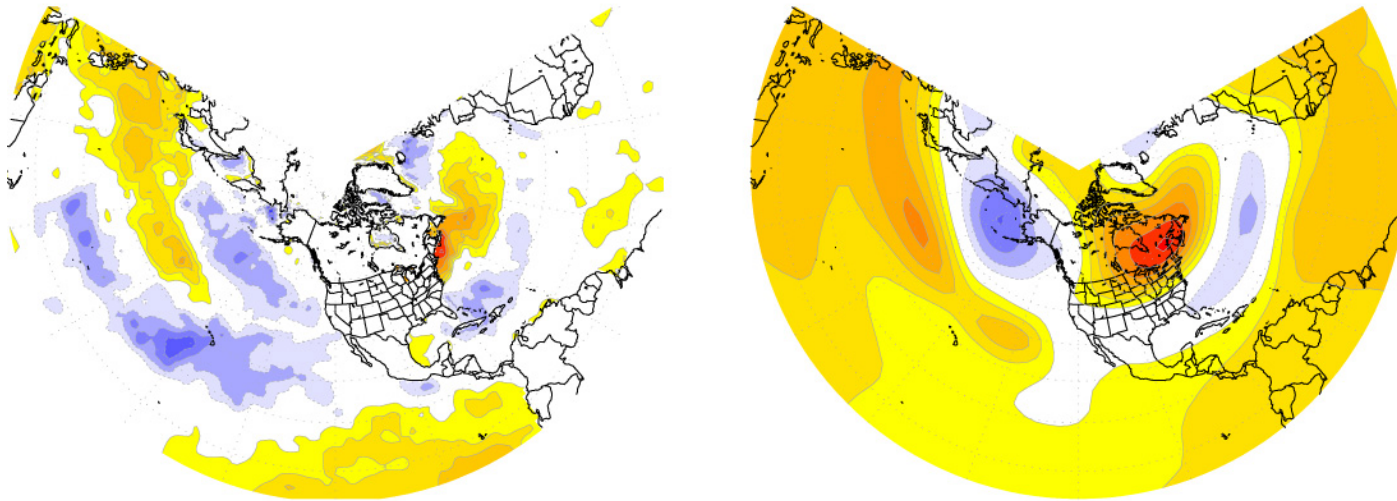
Climatic Linkages: Diagnosis

Northeast FMA Temperature Correlations

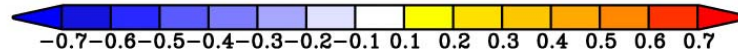
SST

250mb Heights

Observations



Correlation Coefficient



Piscataquis River at Dover-Foxcroft, Maine

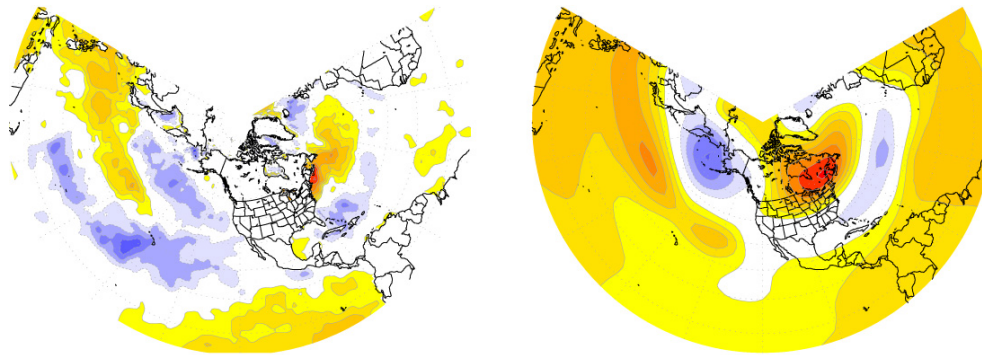
Climatic Linkages: Attribution

Northeast FMA Temperature Correlations

SST

250mb Heights

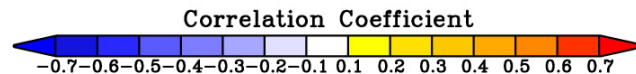
Observations



NASA Atmospheric Climate Model

Nine renditions of climate with prescribed historical ocean temperatures

Major drivers of regional temperature variability are reproduced



Take-home message

- ❑ **The changing envelope of climate variability over the last century is mirrored in streamflow**
- ❑ **Knowledge base for rulemaking must integrate climate-hydrology-ecosystems-societal needs**
- ❑ **An improved understanding of the slow climate variations (annual to decadal and longer time scale) promises a foreknowledge of regional hydrologic variability, thus opening a way to develop predictive tools that use climate precursors as a guide to proactively adapt water resources management and operating plans on within-year and longer time scales.**