STATISTICAL AND HYDROLOGICAL MODELING & THEIR RELATION TO CLIMATE AND LAND COVER

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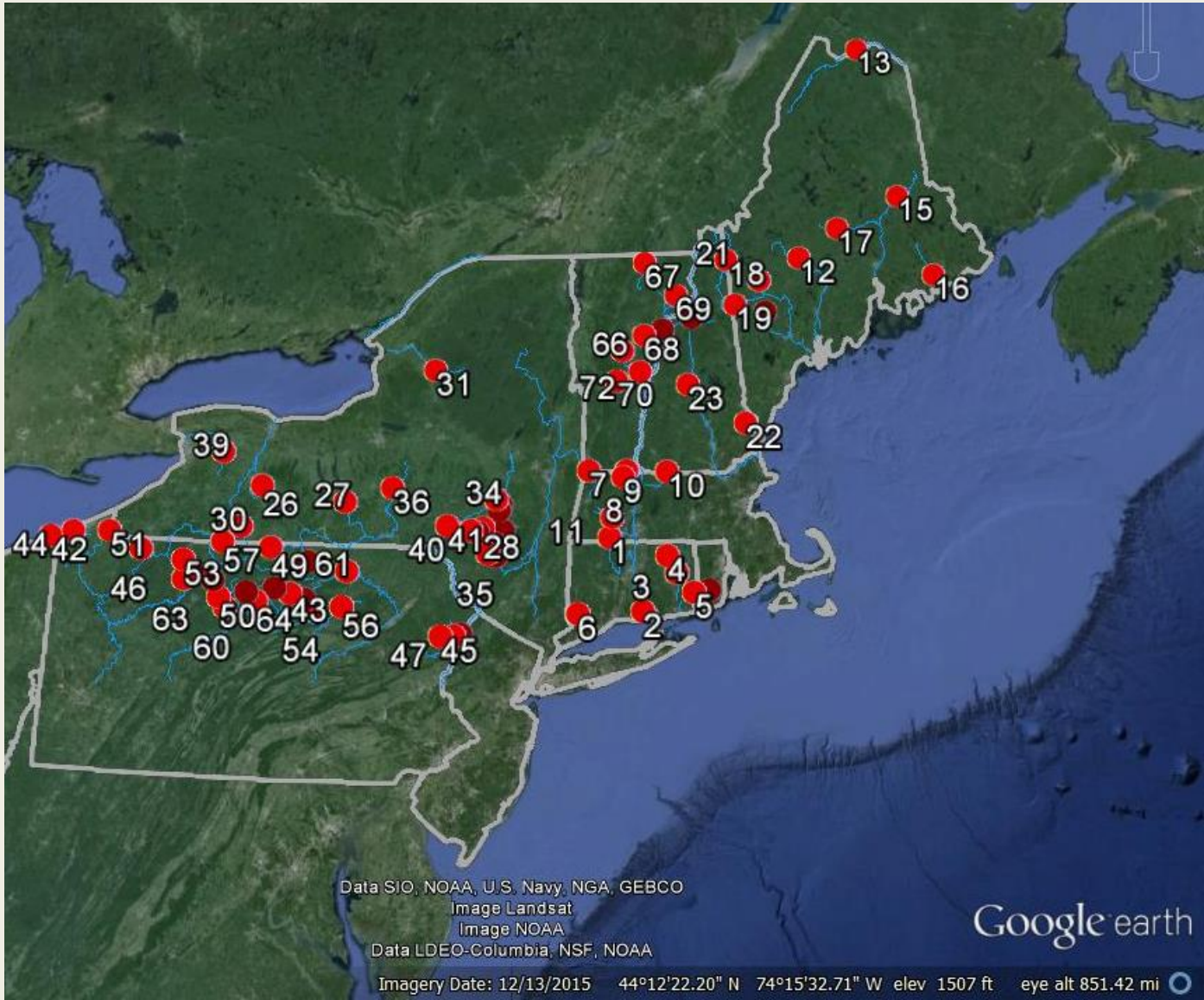
Statistical Modeling

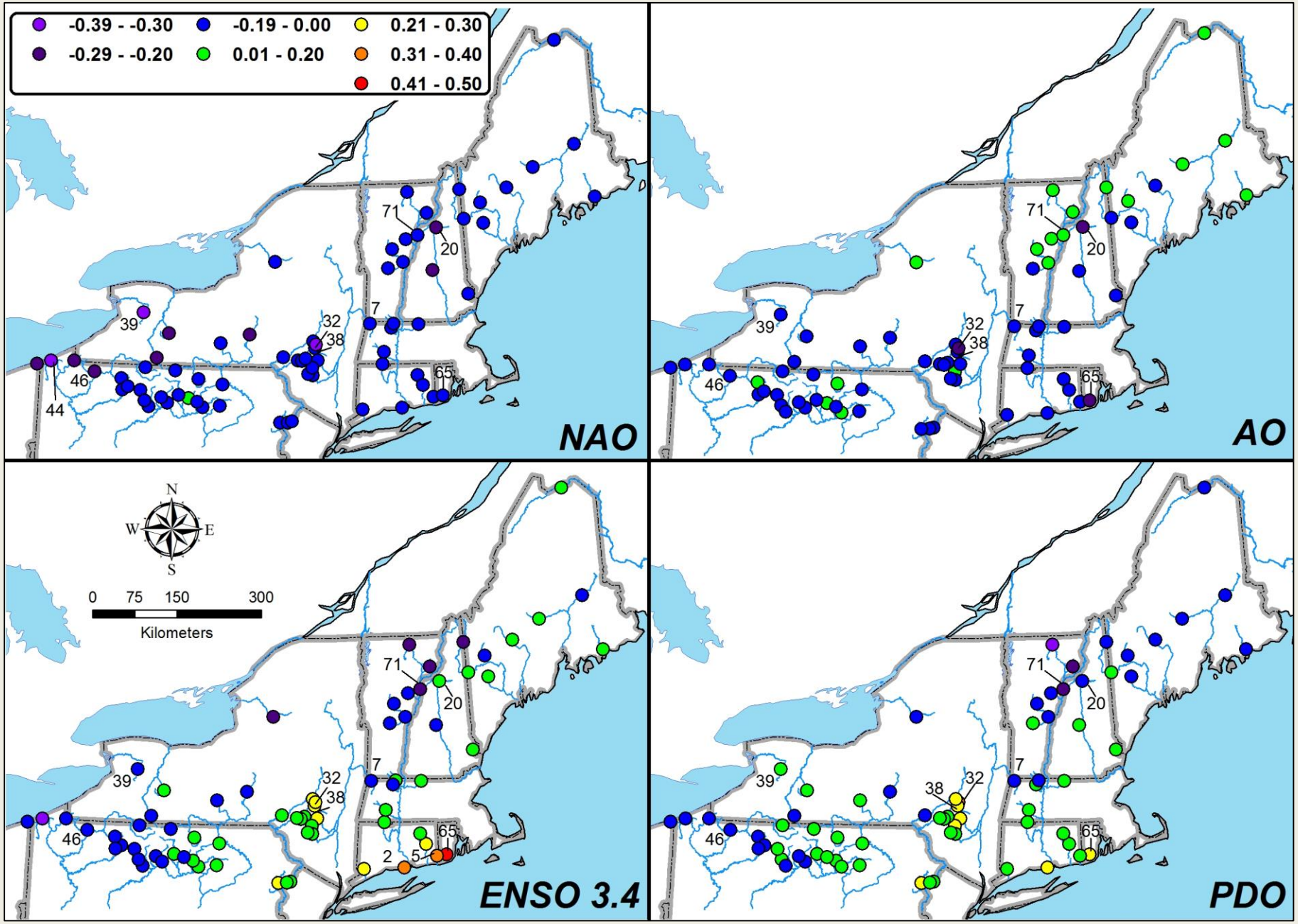
A wavelet is a small wave that grows and decays in a limited time-period.

- ***Objective***: describing and linking the variability in northeastern United States natural rivers with large atmospheric circulation patterns using wavelet analysis.
- ***Natural Rivers Data***: 72 USGS stream gages (HCDN-2009) ranging from the Susquehanna River in northern Pennsylvania to the Saint John River in Maine.
- ***Climate Indices Data***: the North Atlantic Oscillation (NAO), the Arctic Oscillation (AO), the El-Niño 3.4 (ENSO 3.4), and the Pacific Decadal Oscillation (PDO).

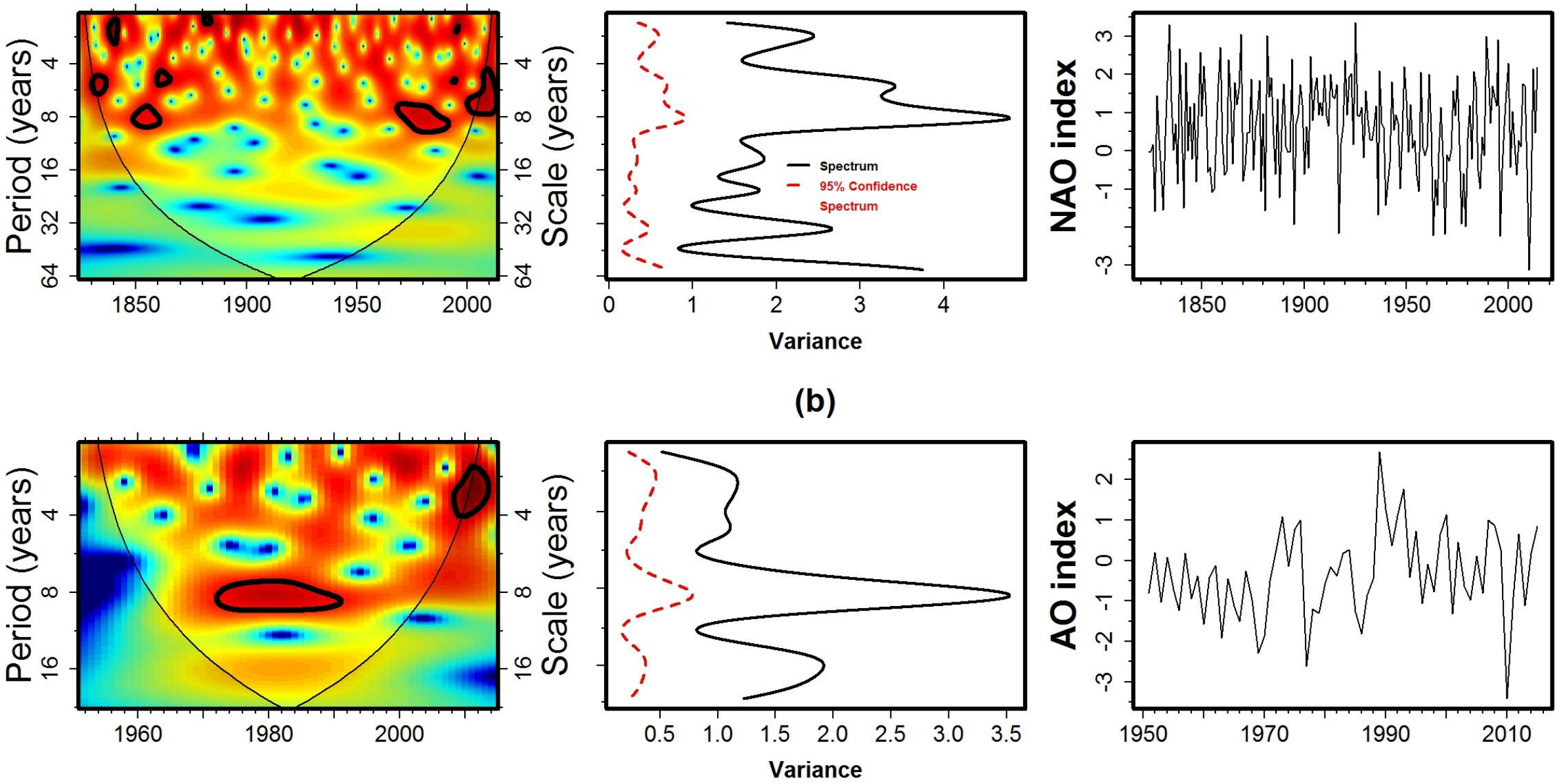


Correlation between climate indices and runoff regimes

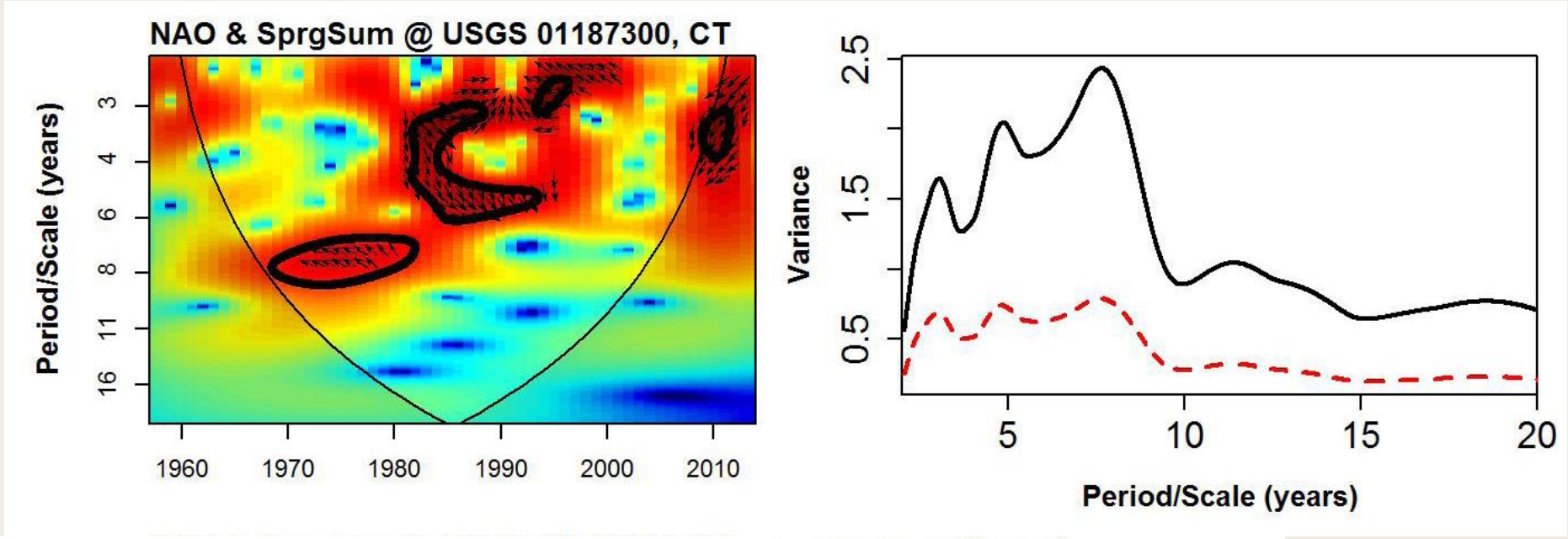
the PDO and the ENSO 3.4 climate indices generally show a positive correlation with *Spring flows*, while the NAO and the AO indices show a negative correlation with *Spring flows* at many study sites

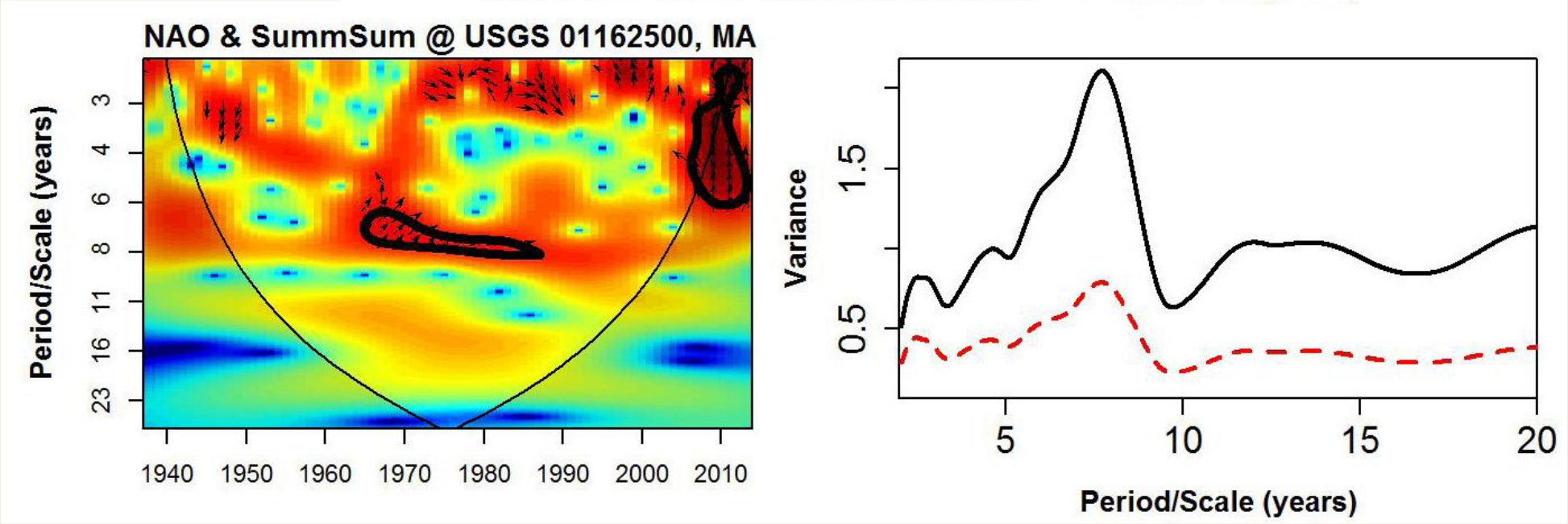


Climate indices wavelet analysis



Coupling between climate indices and runoff regimes



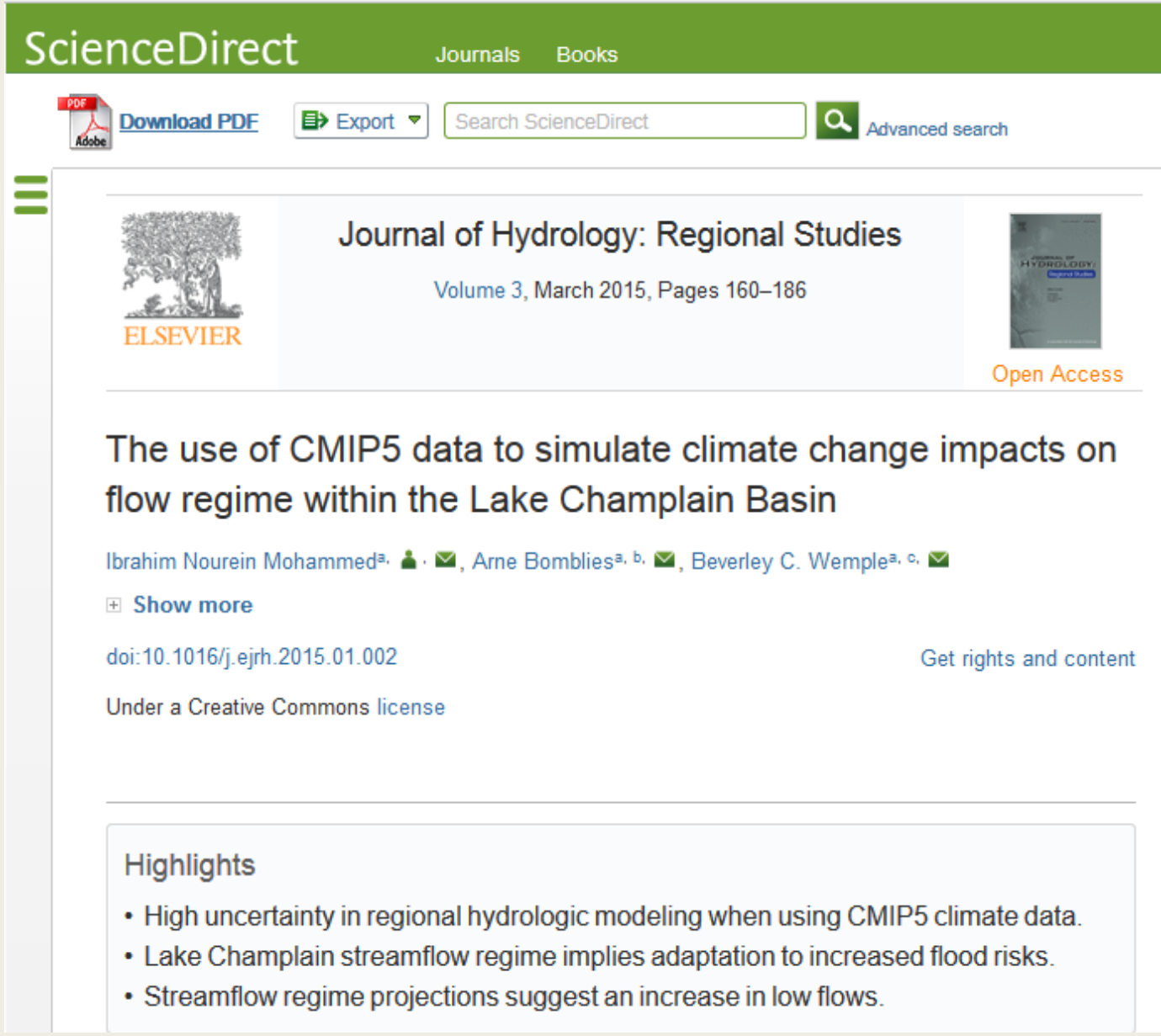


Summary

- A 2–8 year strong periodicity activity is manifested by the NAO, the AO, and the ENSO oscillations
- The runoff regime variability for the northeastern United States is connected to the NAO, the AO, and the ENSO 3.4 climate indices at low frequency (4–8 years).
- The correlation analysis for runoff regime and climate indices winter conditions suggests some distinct spatial patterns among most of the indices for both Spring and Summer flows that are not coherent across the region but rather exhibit trends with latitude or distance from the coast.

Hydrological Modeling Mad River Example

- ***Justin Guilbert*** is expanding this modeling work to examine the impacts of climate on watershed hydrology in the northeastern United States
- ***Cam White*** is also working with the Mad River model to gain understanding of alternative approach to the use of downscaled climate data to project future streamflow regimes.



Mohammed, I. N., A. Bomblies, and B. C. Wemple (2015), The use of CMIP5 data to simulate climate change impacts on flow regime within the Lake Champlain Basin, *J. Hydrol. Reg. St., 3, 160-186, doi:10.1016/j.ejrh.2015.01.002.*

Hydrological Modeling Missisquoi River Example

- This work has been used with multiple studies within the Integrated Assessment Model (IAM) studies,
- Work is on-going to understand the spatial and temporal variability of the streamflow nitrate release due to land use and land cover changes at the Lake Champlain Basin.