

A DATA-DRIVEN APPROACH FOR UNDERSTANDING THE DYNAMICS OF REGIONAL WATER RESOURCES IN THE NORTHERN GREAT PLAINS

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Space-for-time substitution has been long recognized in ecology and geomorphology as an essential, if not unique, data-driven approach to understand long-term system dynamics. While the approach has been accepted qualitatively, validation has been a challenge. Here we present evidence from a suite of surface-water complexes along a climate gradient in the Prairie Pothole Region to both validate and apply space-for-time substitution. Our comparison of the spatial and temporal trends of water-body population dynamics revealed a common pathway of response to the climate variability in space and time. The validation of space-for-time substitution in hydrologic systems not only answered an important science question in its own right, but improved understanding of climate-forcing and hydrologic-response mechanisms for pothole water bodies. This study also has produced important regional-scale implications including, for the first time, a complete picture of the heterogeneous spatial and temporal water-body distribution across the entire Prairie Pothole Region and an understanding of how the patterns of abundances of lakes and wetlands vary with climate.