DATA-DRIVEN ANALYSIS OF PATTERNS AND DRIVERS OF FLOW CHANGE IN THE SANTA FE RIVER BASIN OF FLORIDA

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Characterizing and quantifying the relative impacts of climatic, hydrogeologic, and anthropogenic drivers of stream discharge is a topic of high importance to water scientists and water resource managers. The Santa Fe River Basin in North Central Florida is a well-gaged, hydrogeologically complex system that is known to be impacted by anthropogenic changes in land use and groundwater withdrawals, making it an ideal system for the study of drivers of flow change. While physics-based hydrologic models are available to be used as tools for studying causes of flow change, there is a need to verify the predictions made by these models which are dependent on underlying assumptions and calibration. Further, the high availability of observational data on the system lends itself to a data-driven approach for characterizing patterns of change within and between the many variables interacting in the system. Thus, a suite of timeseries-based, data-driven analysis methods were performed on in-situ, remotely sensed, and derived datasets to characterize patterns of autocorrelation and cross-correlation and to detect causal relationships between variables related to flow, evapotranspiration (ET), precipitation, groundwater levels, and water use. Wavelet coherence results indicate a recent change in rainfall-runoff relationships with coincident increases in remotely sensed actual ET in the Upper Santa Fe River Basin, where the Floridan Aquifer is confined. Convergent cross-mapping results suggest a stronger influence by groundwater on baseflows throughout the basin relative to precipitation. However, a stronger influence by remotely sensed leaf area index, relative to precipitation, on baseflow was only detected for the Lower Santa Fe River Basin where the Floridan Aquifer is unconfined. Our findings could be used to help inform hydrologic modelers regarding model parameterization and decision makers regarding water and land use for the focus area and similarly impacted systems, but the results should be corroborated using other modeling methods.

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