



## Upstream-Downstream Relationships in Terms of Annual Streamflow Discharges and Drought Events in Nebraska

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### ABSTRACT

Upstream-downstream relationships of annual streamflow discharges and severity and frequency of stream-flow drought events are critical in understanding how streamflow droughts propagate over time and space. Such information can be used to resolve water disputes, trigger mitigation strategies, and understand how streamflow changes due to changes in the environment. During drought years, such information is even more critical as water resources are contested. The objective of this research is to study the upstream-downstream relationships of streamflow in Nebraska along four major river systems with diverse hydrologic characteristics and human activities: North Platte, Big Blue, Republican, and Niobrara. The relationships among the upstream and downstream stations along the four rivers are investigated by comparing several statistics derived from the annual flow discharge and on drought events. Trend analysis and coefficient of variation are applied to annual flow discharge values, and a host of drought-related parameters (e.g., annual maximum drought duration, annual accumulated drought duration, number of drought events) are also computed with respect to five different levels of streamflow drought events: water shortage, mild drought, moderate drought, significant drought, and extreme drought. The paired-t test and ANOVA with MIXED procedure are subsequently applied to the statistics to observe whether there is a significant difference between upstream and downstream stations along a river. The analysis allows us to characterize the upstream-downstream relationships of the four river systems, laying the groundwork for further investigations to identify the reasons for some of the trends and observations. These findings will be essential in water resources management during or prior to hydrological droughts.

### KEYWORDS

Streamflow Drought, Upstream-Downstream Relationship, Paired T-Test, Repeated Measures ANOVA with MIXED Procedure, Nebraska

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