

Water Contributors Identification to City Streams Using Multiyear Analysis of Water Stable Isotopes

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Abstract

Water is scarce in semi-arid and arid areas where urban irrigation consumes a large portion of city water. It is important to manage and conserve water properly to meet the growing demand, especially in the summer season. The purpose of this research is to identify the major contributors to streamflow in the semi-arid Denver metropolitan area, CO, USA, and analyze the temporal variation of streamflow sources using two-year data. In this study, water-stable isotopes ($\delta^{18}\text{O}$ and $\delta^2\text{H}$) were used as the tracer to identify the contribution of different sources such as tap water, precipitation, or irrigation water in Denver urban streamflow. Stream and tap water were sampled every other week and precipitation samples were collected once a month. There were 13 urban and 6 grassland streams, and tap water was collected from 6 different water providers. The USGS real-time streamflow data and BaseflowSeparation function in R package 'EcoHydRology' were used to select the baseflow condition in the streams for sampling. Picarro L2130i Laser Water Isotope Analyzer was used for oxygen and hydrogen isotope ($\delta^{18}\text{O}$ and $\delta^2\text{H}$) analysis of stream, tap, and precipitation water. Results showed that precipitation samples were heavier in earlier summertime than the late summer and 2019 showed greater variability than 2021. Tap samples showed temporal and spatial variability in $\delta^{18}\text{O}$ and $\delta^2\text{H}$ values. Less variability in tap isotopic data could be observed in 2021 than in 2019. Centennial Water and Sanitation District showed a decreasing trend. In the $\delta^{18}\text{O}$ vs. $\delta^2\text{H}$ plot, stream and tap water followed local meteoric water line (LMWL) and global meteoric water line (GMWL) well. But precipitation sample exhibited a slight deviation from the LMWL and GMWL. The similar isotopic range in tap water and stream water supported that tap water was the main source of water during the summertime. In the future, the percent contribution of different sources will be evaluated. Furthermore, the effect of reduced urban irrigation by using efficient irrigation, landscape, or conservation techniques will be analyzed to achieve water security for sustainable urban development.

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10:53 - 10:56



PRCC - Ballroom A (eLightning Theater)

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