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Stable Isotopes of Modern Water (δ^2H and $\delta^{18}O$) across the Pacific Northwest, USA: A Framework for Understanding Past, Present, and Future Climate

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Stable isotopes of meteoric water (δ^2H and $\delta^{18}O$) are well established chemical tracers used to characterize numerous aspects of the hydrologic cycle. Stable isotope research that includes both spatial and temporal dimensions can be used to understand moisture cycling and provide a framework for studies of past and future climate. Here, we present an extensive new dataset of stable isotopes from meteoric water throughout the Pacific Northwest, USA. Water samples include precipitation (rain and snow), surface water (streams and lakes), and groundwater (springs and wells), collected over multiple years. δ^2H and $\delta^{18}O$ values from these samples are integrated with published datasets to create a comprehensive regional isoscape. Spatial patterns in stable isotopes are interpreted in terms of topography and climate, both of which vary significantly throughout the region. Temporal records allow us to describe seasonal and inter-annual variation, which we attribute to changes in moisture source and local atmospheric conditions. We also compare results between sample types to describe the relationship between precipitation, surface water, and groundwater, providing constraints on water reservoir residence times. Our results provide a foundation for studies of past and future climate, as climate research requires an understanding of the environmental factors responsible for temporal changes in isotopic composition, as revealed in the geologic record. They also provide a key input for models that predict climate change and associated changes in water resources.