

SEASONAL ISOTOPE HYDROLOGY OF APPALACHIAN FOREST CATCHMENTS

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Abstract: Seasonal hydrologic behavior of small forested catchments in the Appalachians was studied using oxygen-18 as a tracer. Oxygen-18 in samples of precipitation and streamflow were used to determine seasonal variations of subsurface water recharge and movement within two 30-40 ha forest catchments (Watershed 3 and 4) at the Fernow Experimental Forest in northcentral West Virginia and a 1,100-ha forested catchment in northcentral Pennsylvania for the period March 1989-March 1990. Precipitation or throughfall in both regions showed expected seasonal sine-wave variations in oxygen-18 with minima occurring in winter and maxima occurring in summer. Baseflow stream samples for both small watersheds at Fernow showed similar seasonal sine-wave variations in oxygen-18 with amplitudes damped by about 90% and time lags to peak oxygen-18 of about 110 days relative to precipitation variations. Damping of amplitudes on the Fernow basins was equivalent to a mean transit time for subsurface baseflow water of about 1.5 years. Baseflow oxygen-18 on the larger Pennsylvania basin showed no discernible seasonal pattern in oxygen-18, which indicated mean transit time of subsurface water was at least 3-5 years. These results imply that both small Fernow basins exhibit relatively shallow and rapid recycling of subsurface water and that both basins would respond quickly and similarly to changes in watershed condition. On the larger Pennsylvania basin, a much larger, more slowly-cycling groundwater reservoir exists and baseflow would respond much more slowly to changes in watershed conditions.

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