Geology Broadly Predicts Summer Streamflow in Volcanic Terrains: Lessons From the Oregon Cascades

Many high Cascades geology exhibits higher unit streamflows and slower summer recessions than those with Western Cascade (7–40 Ma) geology. Since July 2003, gauging of thirteen 1st to 4th order High Cascade streams in the McKenzie River basin has shown that some High Cascade streams are runoff-dominated, like Western Cascade streams, while others are fed by large volume cold springs, with relatively steady flow. During the summer, these spring-fed streams provide over 80% of the flow to the McKenzie River. In winter months, runoff-dominated streams respond rapidly to rain and rain-on-snow events and become the major water source to the McKenzie River. Spring-fed streams also respond to precipitation events, but show muted and delayed hydrograph peaks. Summer flow behavior and response to individual events varies between springs, even between those that are located less than 1 km from each other. Oxygen isotope analysis suggests that closely spaced springs may have recharge areas differing by over 150 m in average altitude. These springs emanate from lava flow toes or contacts; thus, paleotopography, including buried channel networks, and lava flow characteristics, such as primary and secondary porosity, are also likely to be important determinants of event and seasonal streamflow response.
geologic differences are useful for predicting streamflow in large basins and over
seasonal to interannual timescales, but at the headwater catchment spatial scale, or
event time scale, groundwater–fed streams exhibit variability that cannot be
predicted by regional geology alone. Prediction at these scales will require more
detailed knowledge of local geologic and meteorologic variability.

DE: 1829 Groundwater hydrology
DE: 1860 Runoff and streamflow
DE: 1884 Water supply
SC: Hydrology [H]
MN: 2004 AGU Fall Meeting