Snow and soil moisture response across elevation, aspect and canopy variables in a mixed-conifer forest, Southern Sierra Nevada

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Background

A water-balance instrument cluster that included distributed snow-depth measurements and vertical profiles of soil temperature and volumetric water content was deployed in summer and fall of 2007 at the Southern Sierra Critical Zone Observatory (CZO), at an elevation of 600-2000 m. The CZO is co-located with the Kings River Experimental Watersheds, a U.S. Forest Service integrated watershed research site. Instruments were deployed to capture both north- and south-facing aspects, as well as differences in canopy cover across the instrument cluster.

Location and layout

First-year (2008) results from 97 soil and 27 snow sensors arrayed around 11 trees at 3 aspects and 2 elevations

Interpretation

Snow accumulation & melt

Snow is generally deeper at the upper sites (left 3 panels) than lower sites (right 2 panels), resulting in earlier drying of surface soils for the lower elevation sites.

Peak snow depth occurred on Feb 26; 3 weeks later over 1/3 of the snow had melted and the lower south site was nearly snow free. Snow persisted for up to 8 weeks at the upper north site.

Evapotranspiration

Late summer water contents at all depths approach low values across all sites, indicating that tree water uptake exploits the whole root zone. If no water is available at the shallower depths, tree roots become more active at the lower depths.

Temporal variations in soil moisture are very consistent. Soil moisture is high in the winter, followed by decreases in the spring and summer, with periodic rises in soil moisture with rain in mid-May and mid-July.

Evapotranspiration

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Vertically, soil moisture profiles show higher surface than subsurface soil moisture in the winter, with an inversion occurring in the spring and summer, causing lower soil moisture at the soil surface than at depths. This is likely due to soil evaporation.

Evapotranspiration

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https://snri.ucmerced.edu/CZO