Streamflow modulation by deep regolith in the Snowy Mountains, Australia

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Australian lowland rivers display some of the most highly variable flow regimes found anywhere in the world. However, streams draining alpine and subalpine parts of the Snowy Mountains, Australia, display more consistent baseflow and lower flood pulses. To date, this divergent behaviour has largely been attributed to the role of alpine bogs and snowmelt. Here, we utilise a set of near-surface hydrological monitoring arrays installed as part of the Australian Mountain Research Facility (AMRF) to investigate the role of regolith-hosted aquifers have in moderating streamflow in Australia's highest altitude catchments.

Results from the first year of monitoring (2021-22) indicate that baseflow through shallow regolith-hosted aquifers dominates hillslope hydrological responses in both sub-alpine areas with a marginal snowpack, and alpine catchments that maintain a snowpack throughout the winter. Baseflow results from high infiltration rates into the alpine humus soils and strong vertical and lateral connectivity to the underlying granitic regolith. Recharge during wet winter periods and extended hillslope residence time (weeks to months) contribute to sustained streamflow during dry periods. The alpine regolith structure differs from that observed in low-lying reference regions, where the development of clay-rich subsoil often produces a confining layer that limits recharge to groundwater.

Thus, structural landscape differences likely contribute to the differences in hillslope hydrological response between alpine and lowland rivers in south-east Australia. Importantly, this hillslope buffer will remain under future climates, although loss of snowpack will change the timings and magnitude of seasonal discharge currently experienced across the Snowy Mountains region.