



## **One hillslope does not a watershed make: Analysis of shallow subsurface flow thresholds across 30 hillslopes for six years.**

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Rainfall-runoff data from single hillslope trench studies around the world have indicated the presence of precipitation and soil water storage thresholds that are required for shallow subsurface flow initiation (SSF) and the hydrologic connectivity between hillslopes and stream networks. However, watersheds are composed of many hillslopes of varying sizes and topographic organization. We evaluated the relationship between a simple antecedent precipitation index and the threshold initiation-cessation of SSF for six contrasting snowmelt seasons (2006-2011) across 24-30 different hillslopes in the Tenderfoot Creek Experimental Forest, Montana, USA. The thresholds for SSF initiation and cessation ranged from 0.1-100mm and were exponentially related to increasing hillslope upslope accumulated area (0.06-4.6 ha). While the timing of SSF initiation varied from year to year, the magnitude of the threshold remained relatively consistent for each hillslope across the 6 years of observation ( $\sigma < 15\text{mm}$ ). These relationships suggest that the larger watershed runoff-storage relationship is an integration of the timing and magnitude of precipitation inputs and the internal organization of hillslope storage dynamics. This is an important consideration in the context of predicting the sensitivity of runoff source areas to climate variability and the mixing of landscape source waters and biogeochemical fluxes.