

Spatial and temporal variability of hillslope hydraulic conductivity in the Colorado subalpine zone

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Abstract. Soil hydraulic conductivity (K) is often assumed spatially and temporally stationary, but steep forested hillslopes can exhibit high variability in soil properties. We investigate hydraulic properties of soils on three plots on a subalpine hillslope in a seasonally snow-covered conifer forest to improve understanding of how soil variability affects subsurface flow. The hillslope is at 2900m elevation within the Fraser Experimental Forest in Colorado, USA. Our study consists of two parts: (1) a temporal infiltrometer survey on two plots, one disturbed and one undisturbed, over two summers from June to August 2008 and 2009 to detect temporal patterns in K and (2) a spatial infiltrometer survey on three plots, two undisturbed and one disturbed, to detect spatial variability in K and the effects of disturbances on K. For the temporal study, a Decagon Mini-disk infiltrometer was used to collect measurements during the summer of 2008 twice weekly from June to August to derive surface K at 18 locations. Results from the temporal survey show K values ranging from 0.036 cm hr⁻¹ to 20 cm hr⁻¹ at 2 cm of tension, with wide variation both between the plots and within each plot. The infiltrometer was used for the spatial survey to derive K in three 25 m² subplots in August 2008. Variograms detected range values up to 1 m at 1 cm of tension. K values ranged from 0.01 cm hr⁻¹ to 8.23 cm hr⁻¹ with skew distributions both in their original scale and log 10 transformed with no apparent pattern.

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