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Identifying throughfall flowpaths in the forest canopy

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As precipitation moves through the canopy, it is routed via a number of flowpaths to the soil that give rise to spatial variability of infiltration. The temporary detention of water in canopies that smooths intensity of throughfall delivered to the forest floor also entails flow along canopy surfaces to cause spatial redistribution. However, details of linkages between these two phenomena remain unclear, preventing development of a general conceptual model for how water is routed through forest canopies. We investigated the relationship between point throughfall amount and intensity smoothing using 25 tipping bucket rain gauges both under and above a coniferous forest canopy in 11 storms. Overall, hydraulic residence time in the canopy was negatively correlated with storm-total throughfall amount, i.e. locations with more throughfall generally had intensity fluctuations more like rainfall. This effect was greatest in storms with higher intensity and higher ratio of evaporation to intensity, and was not related to wind speed. Thus, at least in this forest, it appears that both evaporation and high intensity can enhance concentration of throughfall into preferential flowpaths through the canopy, by the opposing mechanisms of either retarding or enhancing flowpath development, respectively.