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The combined effect of topography and vegetation on the temporal evolution of catchment connectivity

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The deconvolution of whole catchment runoff response into its constituent small-scale runoff generation processes remains a grand challenge in catchment hydrology. The extent to which the intersection of topography and vegetation influences the hydrologic connectivity of catchment uplands to the riparian and stream system is largely unknown. Often studied topographic variables can be considered static over timescales of interest for most hydrologic questions. However, less attention has been paid to more dynamic catchment variables, particularly vegetation. Plants can act as spatial and temporal sinks for water through transpiration, adding a biological layer to otherwise topographically/hydrologically controlled runoff generation. The runoff observed at the catchment outlet therefore contains imprints from interactions between both static and dynamic catchment structure. Here we present a modeling framework that explicitly incorporates static (topography) and dynamic (vegetation) catchment structure. We employ sub-daily evapotranspiration data from an eddy flux tower co-located within a highly instrumented (>150 recording groundwater wells) and gaged catchment to parse the effect of current and synthetic vegetation pattern scenarios on the temporal evolution of hydrologic connectivity.