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Integrated climate and geomorphic controls on space-time variability in coupled canopy and soil water and carbon cycling in an experimental watershed

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Forest watersheds respond to external disturbance through a transient adjustment of the spatial patterns of leaf area, their soil water and streamflow regimes. We investigate the integrated dynamics of vegetation canopy regrowth and water balance of experimental catchments in the Coweeta Long Term Ecological Research site using a combination of inductive and process modeling approaches. The inductive approach extracts hydrological signatures from long rainfall-runoff time series during a period of canopy regrowth following clear cutting and forest conversion. The comparative study of an aggrading white pine catchment and an adjacent, undisturbed broadleaf catchment captures nonlinear responses including long term regrowth impacts on evapotranspiration, as well as species level phenologic and physiologic differences. We use a distributed ecohydrologic model to further investigate the observed streamflow behavior and implications for coupled carbon and water cycling in these catchments. Results of the combined inductive and deductive methods are complementary and allow a more detailed development and testing of our perceptual model of forest watershed ecosystem dynamics.