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Improving post-wildfire hydrologic simulations with ParFlow in southern California

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Wildfires alter the natural hydrologic processes within a watershed and may impact hydrologic characteristics including surface runoff and subsurface water storage. Generally, post-fire hydrologic models are either one-dimensional, empirically-based models, or two-dimensional, conceptually-based models with lumped parameter distributions. These models are useful in providing runoff measurements at the watershed outlet; however, do not provide distributed hydrologic simulation at each point within the watershed. This work uses ParFlow, a three-dimensional, distributed hydrologic model to represent soil burn severity and evaluate vegetation recovery rate impacts on water components. This model is developed for Devil Canyon, a watershed burned in 2003 by the Old Fire in southern California. The domain uses a 30m-cell size resolution over a 6.7 km by 6.4 km lateral extent. The subsurface reaches 30 m and is assigned a variable cell thickness, allowing an explicit consideration of the soil burn severity throughout the stages of recovery and vegetation regrowth. Vegetation regrowth is monitored using satellite-based Enhanced Vegetation Index (EVI) products. Pre- and post-fire hydrologic responses are evaluated using runoff measurements at the watershed outlet, and using water component (overland flow, lateral flow, baseflow) measurements. The long-term continuous simulations will improve our understanding of post-fire hydrological partitioning between water balance components and the spatial variability of watershed processes.