Quantifying the effect of post-wildfire soil water repellency on runoff

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Several factors are believed to contribute to post-wildfire flooding and debris flows. One contributing factor—the occurrence of post-wildfire soil water repellency—lacks a quantitative mechanism to incorporate the effects in physically-based runoff models. For this study, a physically-based model was developed linking the contact angle (degree of water repellency) to sorptivity. The model was verified in laboratory experiments using a silica sand proxy. The effects of water repellency on infiltration were illustrated. Further, the effect of water repellency on runoff was simulated using the AGWA-KINEROS2 watershed model with data from rainfall following the 2009 Station fire in the San Gabriel Mountains of southern California, USA. Results show water repellency has a quantifiable effect on runoff production, an effect enhanced by the dry soil moisture conditions common after wildfires.