Geophysical Research Abstracts
Vol. 21, EGU2019-10181, 2019
EGU General Assembly 2019

Development and implementation of tools to monitor and forecast post-wildfire debris flows

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In Dec. 2017, the Thomas Fire raged in Santa Barbara and Ventura counties in southern California, eventually burning 1141 km2 of landscape. Before the wildfire was 100% contained, local inhabitants were just returning to their homes and the weather forecast called for heavy precipitation over the recent burn scar. On Jan. 9, 2018, a storm system moved over the mountainous terrain above Montecito, CA and produced intense rainfall rates that triggered deadly debris flows that travelled down the canyons to the Pacific Ocean. Twenty-one people lost their lives (2 are still missing) and more than 400 structures were destroyed or damaged. This event has prompted an effort to advance the tools and instruments to observe and forecast future events on the Thomas Fire burn area and beyond.

This presentation introduces new software and hardware to provide short-term forecasts and observations of debris flows following wildfire. Radar-based precipitation rates from the MultiRadar MultiSensor system (MRMS) are compared to thresholds established from U.S. Geological survey modeling. This product provides a simple yet effective method to project when rainfall rates nearing burn scars are sufficiently intense to trigger debris flows. Secondly, the team is developing more explicit forecasts of debris flows by forcing the logistic regression model with observed MRMS rainfall rates. This model takes advantage of the spatial distribution of model variables along with the 2-min/1-km rainfall from MRMS to highlight specific regions and canyons that are at most risk for being impacted by a debris flow event. Lastly, we introduce a stream radar system deployed in a canyon to provide objective hydrologic measurements of a debris flow event. While the tools and observing systems are being prototyped for the communities living below the Thomas Fire burn scar in southern California, they can be readily regionalized to other burn scars in the western US.