



Relations between Rainfall and Postfire Debris-Flow- and Flood-Event Magnitudes for Emergency-Response Planning, San Gabriel Mountains, Southern California, USA

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Following wildfires, emergency-response and public-safety agencies are often faced with making evacuation decisions and deploying resources both well in advance of each coming winter storm and during storm events themselves. We here provide information critical to this process for recently burned areas in the San Gabriel Mountains of southern California. The National Weather Service (NWS) issues Quantitative Precipitation Forecasts (QPFs) for the San Gabriel Mountains twice a day, at approximately 4 am and 4 pm, along with unscheduled updates when conditions change. QPFs provide estimates of rainfall totals in 3-hour increments for the first 12-hour period and in 6-hour increments for the second. Estimates of one-hour rainfall intensities can be provided in the forecast narrative, along with probable peak intensities and timing, although with less confidence than rainfall totals. A compilation of information on the hydrologic response to winter storm events from recently burned areas in southern California was used to develop a system for classifying the magnitude of postfire hydrologic events. The three-class system is based on differences between the reported volume of individual debris flows, the consequences of these events in an urban setting, and the spatial extent of the response to the triggering storm. Threshold rainfall conditions that may lead to debris flow and floods of different magnitude classes are defined by integrating local rainfall data with debris-flow- and flood-event magnitude information. The within-storm rainfall accumulations (A) and durations (D) below which Magnitude I events are expected, and above which Magnitude II events may occur, are defined by $A=0.4D^{0.55}$. The function $A=0.6D^{0.50}$ defines the within-storm rainfall accumulations and durations above which a Magnitude III event will occur in response to a regional-scale storm, and a Magnitude II event will occur if the storm affects only a few drainage basins. The function $A=1.1D^{0.46}$ defines the rainfall conditions above which Magnitude III events can be expected. Rainfall trigger-event magnitude relations are linked with potential emergency-response actions in the form of an emergency-response decision chart. The chart leads a user through steps to 1) determine potential event magnitudes, and 2) identify possible evacuation and resource-deployment levels as a function of either individual storm forecasts or measured precipitation during storms. The ability to use this information in the planning and response decision-making process may result in significant financial savings and increased safety for both the public and emergency responders.