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Evidence of debris flow occurrence after wildfire in southeast Australia

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With the recent increase in wildfire activity in the southeast Australia, an apparent gap has emerged in relation to our understanding of how the landscape responds to fire and the role of extreme erosion events in the region. Numerous reports of 'flash floods", "mud torrents' and "landslides" in fire affected areas have only recently been recognised as significant events that warrant more detailed investigation. The aims of this study were to i) collect and show evidence of debris flow occurrence following recent wildfires in Victoria; ii) identify thresholds and key hydrological properties; and iii) present preliminary data on erosion rates from selected debris flows. The result showed that twelve out of fifteen recorded extreme erosion events originated from runoff generated debris flows. These occurred in Dry Eucalypt forests in steep and severely burnt headwater catchments throughout mountainous regions of north-, central- and eastern Victoria. The debris flows were triggered by intense, short duration rainfall events with annual exceedance probability in the order of 20%. This is the first study that documents the occurrence of runoff generated debris flows in Australia, so the observations and data are compared with the existing knowledge from similar post-fire responses in the western USA. Typical features common to both systems include low infiltration capacity of burnt catchments, widespread sheet erosion and levee lined rills on steep upper hillslopes and severe channel erosion initiated in response to convergent flow in previously un-scoured drainage lines. Runoff generated debris flow were not recorded in wet or damp forest types suggesting that this process is less likely to operate in these forest environments. One isolated case of mass failure generated debris flow was recorded in wet forest. The outcome of the study indicates that runoff generated debris flows are an important process to be considered during post-fire risk assessment of hydrological hazards.