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Finding simplicity in complexity: modelling post-fire hydrogeomorphic processes and risks

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Post-fire runoff and erosion can shape landscapes, destroy infrastructure, and result in the loss of human life. However even within seemingly similar geographic regions post-fire hydro–geomorphic responses vary from almost no response through to catastrophic flash floods and debris flows. Why is there so much variability, and how can we predict areas at risk? This presentation describes the research journey taken by the post-fire research group at The University of Melbourne to answer this question for the se Australian uplands. Key steps along the way have included identifying the dominant erosion processes (and their forcings), and the key system properties controlling the rates of these dominant processes. The high degree of complexity in the interactions between the forcings, the system properties, and the erosion processes, necessitated the development of a simplified conceptual representation of post-fire hydrogeomorphic system that was conducive to modelling and simulation. Spatially mappable metrics (and proxies) for key system forcings and properties were then required to parameterize and drive the model. Each step in this journey has depended on new research, as well as ongoing feedback from land and water management agencies tasked with implementing these risk models and interpreting the results. These models are now imbedded within agencies and used for strategic risk assessments, for tactical response during fires, and for post-fire remediation and risk planning. Reflecting on the successes and failures along the way provides for some more general insights into the process of developing research-based models for operational use by land and water management agencies.