Geophysical Research Abstracts
Vol. 19, EGU2017-10805, 2017
EGU General Assembly 2017

Predicting hydrological and erosional risks in fire-affected watersheds: recent advances and research gaps

João Pedro Nunes (1) and Jan Jacob Keizer (2)

(1) CE3C: Centre for Ecology, Evolution and Environmental Changes, Faculty of Sciences, University of Lisbon, Portugal (jpcnunes@fc.ul.pt), (2) CESAM & Dept. Environment and Planning, University of Aveiro, Portugal (jjkeizer@ua.pt)

Models can be invaluable tools to assess and manage the impacts of forest fires on hydrological and erosion processes. Immediately after fires, models can be used to identify priority areas for post-fire interventions or assess the risks of flooding and downstream contamination. In the long term, models can be used to evaluate the long-term implications of a fire regime for soil protection, surface water quality and potential management risks, or determine how changes to fire regimes, caused e.g. by climate change, can impact soil and water quality.
However, several challenges make post-fire modelling particularly difficult:
• Fires change vegetation cover and properties, such as by changing soil water repellency or by adding an ash layer over the soil; these processes, however are not described in currently used models, so that existing models need to be modified and tested.
• Vegetation and soils recover with time since fire, changing important model parameters, so that the recovery processes themselves also need to be simulated, including the role of post-fire interventions.
• During the window of vegetation and soil disturbance, particular weather conditions, such as the occurrence of severe droughts or extreme rainfall events, can have a large impact on the amount of runoff and erosion produced in burnt areas, so that models that smooth out these peak responses and rather simulate "long-term" average processes are less useful.
• While existing models can simulate reasonable well slope-scale runoff generation and associated sediment losses and their catchment-scale routing, few models can accommodate the role of the ash layer or its transport by overland flow, in spite of its importance for soil fertility losses and downstream contamination.
This presentation will provide an overview of the importance of post-fire hydrological and erosion modelling as well as of the challenges it faces and of recent efforts made to overcome these challenges. It will illustrate these challenges with two examples: probabilistic approaches to simulate the impact of different vegetation regrowth and post-fire climate combinations on runoff and erosion; and model developments for post-fire soil water repellency with different levels of complexity. It will also present an inventory of the current state-of-the-art and propose future research directions, both on post-fire models themselves and on their integration with other models in large-scale water resource assessment management.