Geophysical Research Abstracts
Vol. 12, EGU2010-7455, 2010
EGU General Assembly 2010

Simulating the temporal patterns of soil water repellency and their effects on surface runoff generation for burnt hillslopes in central Portugal

João Pedro Nunes, Maruxa Malvar, and Jan Jacob Keizer
CESAM & Dept. Environment and Planning, University of Aveiro, Portugal (jpcn@ua.pt)

Wildfires can cause significant changes to hydrological processes through, among other processes, changes to soil water repellency. Hydrological modelling in burnt areas is still a challenge, since most current models do not properly represent the seasonal evolution of repellency nor its impacts on surface runoff generation. This presentation will focus on the development of an empirical model predicting soil water repellency for recently burnt eucalypt stands in central Portugal, and its incorporation in the surface runoff component of the Morgan-Morgan-Finney (MMF) erosion model.

The work focuses on two eucalypt hillslopes in central Portugal, burnt in 2005, with different forest management practices. In the framework of the EROSFIRE project, measurements were carried out from 2005 to 2007, and included weekly runoff collection and bi-weekly transects detailing soil water repellency and other factors like soil moisture at different points along the hillslope and at different depths at each point. The measurements revealed a seasonal pattern of repellency, with non-existent to low values during the wet season (approx. October to March) and strong to extreme values during the dry season. Soil moisture and runoff generation patterns showed some relationship with repellency, with the latter being higher in periods with both high rainfall and repellency, mostly in transition periods between the dry and wet seasons.

The evolution of soil water repellency patterns in time was simulated as an empirical function of rainfalland potential evapotranspiration, the former decreasing repellency and the latter increasing it. The simulation showed reasonable results, especially for the lower quartile of the repellency measurements (correlations of 0.74 and 0.90).

The results of the soil water repellency model were used in the MMF model to modify runoff generation, by lowering the maximum soil water capacity by a proportional factor to repellency; this factor was also estimated empirically. Model performance increased greatly with this modification (correlations increasing from 0.70 to 0.98, and from 0.46 to 0.83).

Overall, the main conclusion of this work is that a simple simulation of soil water repellency for burnt hillslopes is possible, based on rainfall and precipitation; and that the addition of this parameter can greatly improve the performance of runoff models.