Geophysical Research Abstracts
Vol. 16, EGU2014-290, 2014
EGU General Assembly 2014

Improving post-fire rainfall-runoff modelling: The applicability of remotely sensed Leaf Area Index data as input for modelling catchment scale post-wildfire hydrological response.

Christel Melissa van Eck (1,2), Saskia Keesstra (1), Diana Catarina Simões Vieira (2), João Pedro Nunes (2), and Jan Jacob Keizer (2)

(1) Soil Physics and Land Management Group, Wageningen University, Wageningen, the Netherlands (cmve@ua.pt), (2) CESAM, University of Aveiro, Environment & Planning, University of Aveiro, Aveiro, Portugal

Wildfires are a frequent phenomenon in European Mediterranean ecosystems. Fire-induced changes in the physical, chemical, and biological characteristics of the soils and the damaging or even complete removal of vegetation influence the post fire hydrology of catchments. Especially the first few years after a wildfire are marked by increased runoff and erosion and related risks such as floods. The subsequent decrease in runoff and erosion is generally held to be mainly related to post-fire vegetation recovery, emphasizing the importance of vegetation re-growth in restoring the pre-fire hydrological conditions of a burnt catchment. The often fast pace of vegetation recovery in the Mediterranean region limits the time available for research during this so-called window-of-disturbance. This study proposes the use of remote sensing (RS) images for quantifying post-fire vegetation recovery and its integration in post-fire rainfall-runoff modelling in order to facilitate estimating vegetation abundance and improve runoff predictions. To this end, the Leaf Area Index (LAI) - a commonly used parameter to represent interception in process-based rainfall-runoff models - was derived from the Normalized Difference Vegetation Index (NDVI) as calculated from Landsat-5 TM and Landsat-7 ETM+ imagery. This was done for five rainfall events that occurred during contrasting seasons of the first 2 years after a wildfire in a micro-catchment in Serra de Lousã, central Portugal. A process-based rainfall-runoff model (LISEM) was applied to each of the five rainfall events using LAI data obtained not only from RS imagery but also from field measurements. For both methods of estimating LAI, model performance was assessed by means of the Nash-Sutcliffe coefficient (NSE) as well as the coefficient of determination (r2). Overall, the results showed a better model performance for events that occurred during winter than during summer, independent of the LAI input maps. Furthermore, model performance was very similar for the RS-based and the ground-based LAI maps, reflecting the similarity in LAI estimates obtained with the methods. Thus, the present results suggest that especially during the early stages of the window-of-disturbance remote sensing can be a suitable alternative for ground-based measurements, even though it does not necessarily improve runoff predictions.