Hydrol. Earth Syst. Sci. Discuss., 8, C4772–C4775, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C4772/2011/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Hydrological response of a small catchment burned by experimental fire" *by* C. R. Stoof et al.

C. R. Stoof et al.

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Received and published: 2 November 2011

REVIEWER COMMENT The paper is interesting and has some useful information, even though the time series is relatively short, presumably the function of a PhD deadline.

AUTHOR RESPONSE Thanks for the compliment. Our time series is relatively short because our focus is on the most vulnerable period for flooding and erosion – the first year after fire. Please refer to our response to Referee #1's for additional explanation. We did plan a longer pre-fire monitoring period than presented in the manuscript (including two summers and two winters) but due to data logger malfunctioning in both the (to be) treated and control catchments the first 9 months of streamflow and soil

moisture data were not usable and therefore left out of the manuscript.

REVIEWER COMMENT I was disappointed with the explanation of the statistical analysis in the methods section, this needs to be completely rewritten in my opinion. For example, there is no mention of how the crosscorrelation was done and the results of this analysis are vague: how do you put the results of a cross-correlation into an ANOVA to extract a result (Table 4), this seems quite illogical based on the table caption and there is no detail on how or why this was done in the methods. The authors then draw several important conclusions and discussion points from this analysis, so it's methodology definitely need to be explained better. Additionally, I am unsure which correlation method was used and there is no obvious discussion on what variables were put into the ANCOVA or why an ANCOVA was even used instead of other methods. On p 4063, line 13, they say that the ANCOVA analyses were performed at the time scale appropriate for each spatial scale, that's not very informative! And needs improvement. The Q-Q plots used in fig 3 are not described in the methods, what data is used, what do they do and how are they analysed?

AUTHOR RESPONSE The reviewer makes a very important point that is also raised by the other two reviewers. In the revised version, we will discuss why we selected the statistical methods, and include more detail about these methods.

REVIEWER COMMENT In the introduction, the authors state that water repellency can be induced by wildfire. I note that there are many published papers that show it can also be destroyed in many ecosystems, so the statement on p 4054 lines 25, 26 need correcting.

AUTHOR RESPONSE Soil water repellency can indeed also be destroyed during fire, although this doesn't happen regularly because soil temperatures often remain below the threshold temperature that is required for this (280-400°C, (DeBano, 2000)). The reason we did not mention the fact that repellency can be destroyed by fire is because the destruction of soil water repellency at the surface is always associated with the

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presence or development of water repellent soil underneath where soil temperatures remained below 280-400°C but were still high enough to induce soil water repellency (Letey, 2001). This subsurface layer of repellent soil remains an issue during post-fire rainfall events, which means that the shallow destruction of repellency does not rule out soil water repellency as a factor that can affect hydrology. For your information, destruction of soil water repellency by fire was not observed in the Valtorto catchment.

REVIEWER COMMENT On p 4055, line 27, increases should be increase

AUTHOR RESPONSE Good eye, thanks. Will change this in revised version.

REVIEWER COMMENT The statement relating to prediction of risk of flooding in burned areas, p 4057 line 9, needs elaboration.

AUTHOR RESPONSE With improved understanding of when, why and how fire changes hydrologic processes, one can potentially create tools to predict flooding events after fire. We will change the phrasing of this sentence to clarify that the prediction follows from the improved understanding.

REVIEWER COMMENT In section 3.5, the authors talk circumstantial evidence provided by the soil moisture probes, p 4068 line 10. They then analyses this data and talk conclusively about a shift in moisture through time (Fig 9). I don't think it's appropriate to draw conclusive results from circumstantial evidence!

AUTHOR RESPONSE In Fig 9 we demonstrate how the relationship between top soil moisture and the occurrence of runoff (in the stream) has changed after the fire. We used the phrase "circumstantial evidence" to indicate that there is no direct relationship between runoff and measurements of soil moisture in the top 2.5 cm of the soil, but that this can be elucidated from the data. Probably "suggest" is a simpler way to indicate the same thing.

REVIEWER COMMENT I am not sure it is possible to extract the small scale of this experimental study to describe how wildfire works at a larger scale. I think it would be

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better to stick to drawing conclusions related to the study area and perhaps the local region, but not catchments everywhere, as indeed they point out in the first few lines of section 4.5

AUTHOR RESPONSE I think our definition of small and large scale is somewhat different from what the reviewer is pointing at. Most hydrological studies on the impact of fire use small-scale approaches: plot and hillslope scale. In this light, the catchment scale studied in this manuscript can be considered large. In the revised version we will clarify this definition of scale, because for one working in large basins of several hundred square kilometers, a first-order catchment is indeed small.

REVIEWER COMMENT A number of references appear to be grey-literature derived from conference proceedings. My opinion is that these references and any conclusions derived from the should not be included, stick to scientifically peer-reviewed journal articles where possible.

AUTHOR RESPONSE We agree that preference should be given to citing peer-reviewed papers. We replaced several conference papers by peer-reviewed publications; please refer to the overview attached to the response to reviewer #1. Because we found no alternative to the formal literature for four remaining references, we will leave these in only where we give an overview of the studies that have been done (e.g. in introduction) – we will delete these citations where we discuss the results of these 'grey' studies (e.g. in discussion).

DeBano, L.F. 2000. The role of fire and soil heating on water repellency in wildland environments: a review. Journal of Hydrology 231-232:195-206. Letey, J. 2001. Causes and consequences of fire-induced soil water repellency. Hydrological Processes 15:2867-2875.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 4053, 2011.