

## ***Interactive comment on “Impact of bushfire and climate variability on streamflow from forested catchments in southeast Australia” by Y. Zhou et al.***

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Received and published: 14 May 2013

Overall

In this paper the authors discuss a very interesting issue which is the effect of bushfires on the streamflow of forested catchments. In this effort they use a set of hydrological models to separate the impact of bushfires from the impact of the normal climate variability. The involved methodology is sound and the obtained results are also interesting. The paper is generally well presented and the language is good. However I have the following important comments that the authors should address or answer.

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## General comments:

1. My most important comment is that the authors completely ignore the effects of fire on soil properties. Several studies have pointed out the impact of forest fires on the hydrological cycle, including reduced infiltration rates, reduced evapotranspiration rates and increased overland flow. Such impact is mainly attributed to the destruction of the vegetation cover and the consequent direct influence on interception, evapotranspiration and overland flow velocity. However, forest fires can also affect hydrological processes indirectly, altering the hydraulic properties of the soil. Fires destroy the top soil organic matter destabilizing the soil structure, they convert the organic ground cover to soluble ash, and they give rise to phenomena such as water repellency.

The authors should mention the effects of fire on soil properties in the introduction of the paper and refer some related works. They may find more information on this issue along with many references in the following recent study: "Soulis K.X., Dercas N., Valiantzas J.D., 2012. Wildfires impact on hydrological response – the case of Lykorema experimental watershed. Global NEST Journal, 14(3), 303-310." They should also discuss and justify why the effects of fire on soil properties are not important for their case. Alternatively, the authors may include these effects in their calculations. E.g. they can replace " $\Delta Q_{veg}$ " ( $\Delta Q$  caused by vegetation changes) with a more general term like " $\Delta Q_{fire}$ " ( $\Delta Q$  caused by bushfire). In the latest case they should revise the discussion and conclusions sections accordingly to take into account these effects.

2. A second important comment is that the bushfire impact on stream flow seems to be lower at the period soon after the fire incident, it significantly increases after this initial period (at least for the first two catchments), and then decreases again (Figs 3,4,5). Typically the effect of fire on streamflow should be more profound the first years after the fire and then it should be decreasing gradually. The authors refer as a possible effect the combined effect of fire and logging; however this behavior should be discussed and justified in more detail. In case that this behavior can't be justified, the authors should at least put some more emphasis on this issue.

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## Specific comments:

1. Title and abstract. As I can understand from the paper text, this study is dealing with the effect of bushfires on streamflow and not with the effect of climate variability. Thus I believe that the term “climate variability” should be removed from the title. The abstract should also be revised accordingly.
2. Introduction. In the conclusions section it is referred for the first time that the ability of the models to reproduce the climate variability was validated in four nearby similar catchments. I consider this as an important part of the study that significantly supports the accuracy of the obtained results. Therefore I suggest that the model validation should be also referred in the introduction and presented in the methodology sections.
3. Page 4403. Study catchments. There is very little information about important characteristics of the studied catchments except for land cover. E.g. there is no information about geomorphology, soil properties, geology, Base flow (BFI), etc. The above information may have an important role in the response of the catchment and the effect of wildfires.
4. Page 4403. Study catchments. It would be useful to have here some information about the four catchments used for validation. For example the validation catchments could be included in the map.
5. Page 4406, Line 8: “considers hydrological response units (HRUs) for each grid or catchment”. This phrase is confusing.
6. Hydrological modeling. After the calibration section it could be added a section describing the validation of the models (see specific comment 1).
7. Page 4413. In Yarra River at Little Yarra catchment there is no obvious increment in the stream flow (figs 3,4,5). For comparison reasons, it would be interesting to calculate and include in the results the  $\Delta Q$  for the pre fire period (calculated with the same methodology as for the post fire period) to have an idea of the magnitude of the

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impact of the model related uncertainty.

8. Figs 3,4,5. It would be helpful for the reader if the rainfall data were depicted in the figures.

9. The possible effect of the big gap in the validation period of the Starvation Creek catchment to the obtained results should be discussed.

10. There are some minor grammatical errors.

Conclusively, I suggest that the paper should be accepted for publication in HESS if the authors adequately address the above issues. In my opinion a minor to moderate revision is needed for this perpose.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 4397, 2013.

**HESSD**

10, C1716–C1719, 2013

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