Hydrol. Earth Syst. Sci. Discuss., 9, C5259–C5263, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C5259/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Streamflow response of a small forested catchment on different time scales" *by* A. Zabaleta and I. Antigüedad

A. Zabaleta and I. Antigüedad

ane.zabaleta@ehu.es

Received and published: 15 November 2012

First of all the authors want to thank the anonymous Referee 2 for his helpful comments which, undoubtedly, are contributing to the improvement of the manuscript and its understanding.

The authors have tried to use different sources of information to understand the hydrological functioning of Aixola catchment. However, after having read the comments of the Reviewer 2 we realize that we might not have given enough emphasis to the relationship between daily and event scale data and to the suggestion of water pathways based in the results. We really appreciate all of the comments made by the referee and will take these lacks into account during the revision of the paper.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

In the following we address the specific comments.

RC I miss a closer relation (or better explanation) between the results obtained from the autocorreltion + spectral analysis at the daily scale and those obtained at the event scale (correlations between variables and EC evolution).

AC Some clues of those relations are given in the paper, especially in the conclusion section, e.g. “The quick response of the catchment to almost all the rainfall events and the existence of a part of the catchment with a greater storage capacity (deep soils) deduced from the correlation and spectral analyses agree with runoff event scale data analysis”; “the evolution of the electrical conductivity of waters during runoff events shows that, usually, pre-event waters represent a high percentage of total runoff depth of the events (55-85 %), suggesting that not all the quickflow is “new water” but rather that subsurface flow plays a notable role”. Nevertheless, the authors will try to emphasize these relationships in a reviewed paper.

RC For instance, they say “the catchment response has two components. The first corresponds to the influence of the quicker surface flow . . . while the second component could be interpreted as the later influence of slower flow from other parts of the catchment: : :” The quickflow component could be related to i) saturation excess runoff or ii) infiltration excess runoff or even iii) translatory flow. The results at the event scale can not suggest whether is i, ii ot iii?

AC The results at the event scale (especially those related to the electrical conductivity) show that an important part of the quickflow is “old water” stored in the deep soils of the catchment (up to 13 meters deep). This high percentage of old water in the quickflow component can be explained by a “piston flow” process, old water with high electrical conductivity pushed by new water. Regarding the new water part of the quickflow component, the steep slopes of the catchment and the generally loamy character of the deep soils must be considered, as well as the dense net of forest service paths. In that context, this new water may have its origin, mostly, in the infiltration excess runoff

HESSD

9, C5259–C5263, 2012

generated in the forest paths and in the areas with higher slopes. Two cases in which infiltration excess runoff is most evident have already been explained in the paper, “In two of these events, in September 2004 and August 2005, minimum EC was lower than usual . . .. The events occurred under low initial discharge conditions . . . and with very intense . . . and short duration precipitation that generated large increases in discharge . . . and comparatively low EC values. In these cases, high precipitation intensities would favour infiltration excess runoff and so new water would reach catchment outlet more easily.”. However, saturation excess runoff can also be observed, although not very frequently, in some pasture areas where the soils are locally more clayey. After high amounts of antecedent precipitation perched water levels can appear near the surface saturating the soil.

RC Other questions that arose through the reading: Have the authors observed soil saturation patterns?

AC Saturation excess is not observed very often in the catchment, though, as mentioned above, these patterns have been detected in some specific small areas.

RC When you say “the influence of the quicker surface flow”, how do you know is surface flow?

AC At this stage of the paper we cannot know if it is surface runoff or not, as we are considering data obtained from the correlation and spectral analysis. Moreover, as we will see later in the paper, part of this quickflow is in fact old water coming from the deep soils. So that this is a mistake that the authors have done when writing the paper and it should be reworded as “the influence of the quicker flow”

RC After reading the paper I could also think of translatory flow, ie, new water pushing old water..? Why the authors do not consider this process?

AC The authors do consider that this process happens in the catchment and that it is the origin of the oldwater part of the quickflow, as explained above. In fact, in this

HESSD

9, C5259–C5263, 2012

catchment, translatory flow could explain the rapid hydrograph response and the dominance of pre-event water. However, it is not specified in the paper and this can lead to confusion. We consider that this is something to be corrected in a reviewed paper.

RC Can they give details on where in the catchment they think "infiltration excess runoff" occurs (I believe it is a catchment cover by forest 100%..?)

AC In fact, not all the catchment is covered by forest, above the 3% are urban areas and almost a 10 % is pastureland, where infiltration excess is easier to happen. Nevertheless, this process can also be observed in the forest paths, where the soil is compacted, and more localized, in the forest itself, where the slopes can easily be higher than the 20% and can, sometimes, exceed the 30%. This data will also be highlighted in the reviewed paper.

RC The authors talk about a slow flow component but do not mention subsurface flow (only at the very end there is a quick reference), is there a reason for that?

AC Subsurface flow is more a spatial concept than a concept related with quick or slow flow. Indeed, in the literature there are different examples where it is related to both. As a consequence, and taking into account that we have not measured the water movement in the soil, it might not be adequate to relate slow or quick flow and subsurface flow. In the Aixola catchment, having an impermeable bedrock, slow flow is unequivocally coming from the soils, but there is not enough data to identify the exact pathways contributing to that flow; it can be subsurface or deeper flow. In any case, some clarification in this sense will be included in the paper.

RC Finally, they should better explain in the introduction why it is interesting this research. "Understanding those processes is essential for managing the quality and quantity of runoff especially when environmental conditions (climate or land use) are changing..." eg, is climate or land use changing in the study area?

AC Hydrological impact studies are being carried out in the area in the context of cli-

HESSD

9, C5259–C5263, 2012

mate change and the authors believe that it is essential to understand the hydrological dynamics of the catchment before trying to assess any impact. Moreover, this catchment can be considered as representative of a much extended type of forested catchment in the Basque Country, so that it can give us some clues to understand the hydrology and possible future impact of other similar catchments throughout the observation–conceptualization–modeling sequence mentioned in the Braunschweig Declaration (Schumann et al., 2010).

Schumann, S., Schmalz, B., Meesenburg, H. & Schröder, U. (eds) (2010) Status and Perspectives of Hydrology in Small Basins. Results of the International Workshop in Goslar-Hahnenklee, 2009 and Inventory of Small Hydrological Research Basins. IHP/HWRP-Berichte 10, Koblenz, Germany. http://www.euro-friend.de

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 9257, 2012.