Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2017-77-AC4, 2017


Hydrology and Earth System Sciences Discussions

Open Access EGU

HESSD

Interactive comment

# *Interactive comment on* "Identification of runoff formation with two dyes in a mid-latitude mountain headwater" *by* Lukáš Vlček et al.

**Lukáš Vlček et al.**

vlcek@natur.cuni.cz

Received and published: 2 May 2017

First, we would like to thank the referee for his review and the valuable comments. Typos and ambiguities in references were corrected and the manuscript was revised accordingly

General comments: Ambiguities concerning runoff processes HOF and SOF need to be clarified.

Authors: Possible ambiguities concerning the runoff process HOF and SOF have been clari- fied (see point 4, 8, 9 in specific comments).

At least two citations mentioned within the text cannot be found in the references-list.

Authors agree and it will be corrected.

Perhaps it is recommended to check the article by a native speaker once more.

Authors: Our manuscript has been checked by a proficient native speaker.

Specific comments: 1. literature references need to be revised and should be brought to a uniform condition. E.g. (HladnÃ¡ and Kašpárek, 2005; HladnÃ¡ et al., 2005; Flury et al, 1995; Flury and Flühler, 1995; Hümann et al., 201; Hümann et al., 2011. . .)

Authors agree, it will be corrected.

2. Perhaps it would be recommended to change the order of the tables 1 and 2 in the chronological appearance

Authors agree and order of tables will be changed accordingly.

3. (Eriophorum sp. L.); (Sphagnum sp. L.)

Authors agree and it will be changed.

4. "Vertical hydrological conductivity (HCv) was measured on-site with a single-ring infiltrometer (Flow-Group Comp.). . . .. A low HCv in the topsoil is supposed to generate rather surface flow – likely saturation overland flow (SOF) and possibly Hortonian overland flow (HOF) to a minor extent – or near-surface biomat flow (BMF; Sidle, 2007) during high intensity storms." This line of argument is not understandable: The very low conductivity at the surface (infiltrometer) implies inhibited infiltration and thus infiltration excess = HOF!

Authors: We agree, there is a contradiction in our data/field observations, however in our opinion none of the data/observations overrules the other. Vertical hydrological conductivity (HCv) was measured in situ with a single-ring infiltrometer. The measured HCv was very low, on the other hand no surface flow was observed even during heavy rainfall events (field observation and thus "soft data"). The very low HCv measured in the soil matrix suggests – but does not prove – 'Hortonian overland flow' (HOF) at the hillslope, as macropores for instance are likely not well represented in this small-scale on-site measurement (scale issue). As the scale of our HCv measurement is in the order of decimeters (10 cm x 10 cm), the focus is on measuring the hydraulic conductivity of the soil matrix. Thus, the soil matrix's vertical hydraulic conductivity properties are not the ultimate answer on the prevailing runoff formation processes at our test site – it's rather one aspect contributing to the larger picture. As a matter of fact, the contradiction between the soil matrix properties (HCv) and the field observations were the motivation to investigate the runoff formation processes at the hillslopes with dye experiments. We understand the differences between the terms 'Hortonian Overland Flow' (HOF) and 'Saturation Overland Flow' (SOF), definitions are given in subsection 8.

5. "Due to previous rainfall events, the soil moisture ranged between 0.40-0.45 VWC." 0.40 (lowest value) due to previous rainfall events? âĂć In order to facilitate the readability of the text perhaps it would be better to change the order of fig.4 ab and 5 ab: 4a frontal, 4 b lateral; 5a lateral 5b frontal; 4a frontal, 4 b lateral; 5a frontal 5b lateral.

Authors: Soil moisture was measured on-site. Previous rainfall events were recorded off-site (nearby meteo station in 400 m distance) several days before our experiment started, see Fig. 2. The Peat Bog stays in a humid climate permanently wet, thus 40% VWC is for the Rokytka test site as dry as it gets in early summer. The summer 2015 was relatively dry and the previous rainfall events were rather small and less frequent than in a normal year. Text will be reformulated accordingly.

6. Change order of Fig. 4.

Authors agree, figure will be modified accordingly.

7. "This is noteworthy since the proportion of the Peat Bog ranges from 60% at the 2nd order stream headwater to less than 30% at the 3rd order 15 stream catchment; the remaining areas are covered by Podzol." Table 1 gives PB 44% RH. 60% or 44%?

Authors: Table 1 (changed order as suggested by the referee: now Table 2) shows the coverage of the soil type ‘Histosol’ (WRB, 2006). ‘Histosols’ are the dominant soil type in Peat Bog areas, but other soils types occur as well: partly ‘histic soils’ and partly ‘Fluvisols’ (WRB, 2006) at the bottom of the valley. Therefore, the given values are correct: Rokytka Headwater (RH) = 44% and Otava River Headwater (OR) = 20%. 8. “According to the runoff formation decision scheme by Scherrer and Naef (2003), the dominant runoff formation process at the Podzol hillslope can be classified as a combination of delayed Hortonian overland flow (HOF) and delayed subsurface stormflow (SSF2).” This is a clear contradiction to the observed results. At P16 L12 ist is mentioned that “. . .deep percolation into the bedrock dominated. . .”. So deep percolation DP is the primary runoff formation process at the Podzol hillslope (fig.8). This incongruity calls for an explanation.

Authors: We agree with the referee, that the dominant runoff formation mechanism detected by our dye experiments at the Podzol hillslope was clearly ‘deep percolation’ (DP). The experimental results do not suggest that HOF or SOF are dominant runoff formation processes for mid-range intensity storms. However, ‘surface-near flowpaths’ cannot be completely excluded concerning larger storms with higher intensities – we observed slightly detectable, short-distance initiations of surface-near flowpaths (yet not a dominant feature at our experimental esttings). The point is that in the discussion we intend to confront our experimental findings at the Rokytka test site with an established runoff formation classification scheme (Scherrer and Naef, 2003) for flood-causing extreme events, which can be applied to one of our hillslopes. This scheme suggests delayed HOF and delayed SSF for the Podzol hillslope. The Scherrer scheme has been developed and applied for high-intensity storm events in Switzerland (intensities > 50mm/h). Our experimental intensities represent rather average annual storms (intensities 20- 30 mm/h). We will clarify that in the final version of the manuscript. The Scherrer0s scheme is limited to sites without shallow groundwater, thus it can be applied to the Podzol hillslope (PZ) only.

9. “Our hypothesis of HOF was confirmed for the Peat Bog hillslope. . .” see the above

statements on HOF, SOF.

Authors agree and it will be clarified in the final manuscript. We will point more clearly to the observed main subsurface drainage feature.

10. Fig.1 Well designed illustration. WLPWS* What does the asterisk stand for?

Authors: The asterisk is now explained in the caption of the figure.

11. Fig.8b (saturation overland flow, SOF) see the above statements on HOF, SOF.

Authors: See above (-> points 8, 9 and 4)

12. Technical corrections: P8 L9 for two weeks. P11 L7 to to test P13 L6 Burt Burts

Authors agree and it will be changed as suggested.

References: IUSS Working Group WRB.: World reference base for soil resources 2006. 2nd edition. World Soil Resources Reports No. 103. FAO, Rome. ISBN 92-5-105511-4, 2006.

Scherrer, S. and Naef, F.: A decision scheme to indicate dominant hydrological flow processes on temperate grassland, Hydrol. Process., 17(2), 391 – 401, doi:10.1002/hyp.1131, 2003.

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2017-77, 2017.