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Hydrology and Earth System Sciences
Discussions

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

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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:

1. Possible ambiguities concerning the runoff process HOF and SOF have been clarified (see point 4, 8, 9 in specific comments).

2. Agreed and corrected.

3. Our manuscript has been checked by a proficient native speaker.

Specific comments:

1. Agreed and corrected.

2. Agreed and order of tables changed accordingly.

3. Agreed and changed.

4. 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. 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: Agreed, figure modified accordingly.

7. 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. 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 Scherrer′s scheme is limited to sites without shallow groundwater, thus it can be applied to the Podzol hillslope (PZ) only.

9. Agreed and will be clarified in the final manuscript. We will point more clearly to the observed main subsurface drainage feature.

10. Fig. 1 The asterisk is now explained in the caption of the figure.

11. Fig. 8b See above (-> points 8, 9 and 4).

12. Technical corrections: Agreed and 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.

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