

## ***Interactive comment on “Event and seasonal hydrologic connectivity patterns in an agricultural headwater catchment” by Lovrenc Pavlin et al.***

### **Anonymous Referee #2**

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This study analyses the connectivity between hillslopes and stream within an agricultural small catchment by looking at the spatial and temporal similarity between groundwater, soil moisture and streamflow dynamics. The study is quite complex and my overall opinion is that it is difficult to follow. I hope some of my suggestions below might help to make the reading a bit smoother. The data collected as well as the analysis carried out in the study are quite nice and show an interesting way to examine catchment hydrological connectivity. My recommendation is moderate revisions are needed before publication.

Here are my comments:

1. I miss an explanation about why is interesting to study connectivity in an agricultural catchment -in other words, why are you carrying out this study in an agricultural

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catchment? There is a very brief reference to it in the last sentence of the Conclusions but I think it is necessary to extend this much more, by including an explanation and references in the Introduction. I think you can say something about it in L67.

2. As I said above, it is a complex study. A better correspondence between the key questions and the subsections of the Results and Discussion sections will improve the reading of the whole paper. Also, by better explaining how you are specifically going to answer these questions. Mainly: K1: “What are the spatial and temporal patterns in the relationship between the streamflow, groundwater and soil moisture responses to precipitation events in an agricultural headwater catchment?” - You have to explain somewhere how are you going to look at the temporal patterns (through wetness conditions). I think I have not seen it before the Results. - In the discussion, “4.1. Spatial patterns of groundwater and soil moisture responses” should be “Spatial and temporal patterns of groundwater and soil moisture responses to precipitation”..? K2: “Is the relationship between the streamflow and groundwater or soil moisture dynamics more related to site- or event-characteristics?” You have to say somewhere that for this you use the type of response. Also, what variables do you use to characterise the event. I think nothing is said before the Results.

3. The type of responses (L260-278) should be in the Results sections.

4. Landscape units of Fig1 and landscape position (Table 1) are the same? Then use the same term (in all figs -eg fig 7-, tables and text) otherwise is confusing.

5. In L215 you say “similar patterns exist among the stations in the same unit” but later on, in 3.2.1, “the other two landscape units show only low co-occurrence rates of groundwater response types between stations in the same unit” (L365). So this is a bit confusing, at least the way it is explained. Looking at how similar the hydrological response is within the landscape units is quite interesting and an important result. I think it should be further and more clearly discussed in the text.

6. The temporal pattern of similarity is only discussed with two references (Blösch et

al 2016 and Penna et al. 2015). I think this should be expanded.

7. Minor comments:

L40-42. Can you include studies carried out in other landscapes than grasslands and forest? For instance you can take a look at Latron & Gallart 2008 (old abandoned terraces).

L50. Rosenbaum et al. (2012): what is the type of landscape here?

L59-60. “Separation of temporal scales could also be linked to a separation of scales in space (Széles et al., 2018)”. This sentence deserves a bit more explanation,

Methods: you are using data of only two years, 2017 and 2018. You should indicate how representative they are (were they wet/dry/averaged years?)

Fig 1. Please include the legend of the landscape units.

L137. 60 cm? In L130 you say 5,10,20 and 50 cm

L143. “interpolate”. As soil moisture is collected every 15 min I guess you use 4 times the same value (for the hourly time step)..?

L189. “2.5 Event response definition and characterisation” You should indicate “Groundwater and soil moisture response definition and characterisation at the event scale”. In 2.4. you maybe need to add “Rainfall-runoff event definition and characterisation”

L264. You suddenly use GW and SM - define it before and use it from the beginning.

Fig 6. The legends of HI may have an error. In the text (L219) it is said that “Clockwise loops, where x lags behind y, have negative HI values and counter-clockwise loops, where y lags behind x, positive HI values”. Fig b), eg, is a counterclockwise and HI is negative. Is there a mistake?

L373. This sentence sounds a bit strange: “Only events when both events have a

response are considered”

Fig. 13. I do not understand why you depict the day of the year while at season scale you use weekly time-step (L150)

L 412. This sentence is not clear: “Even upper slope groundwater stations which do not correlate to other stations are well correlated to each other”

L551. This statement needs further explanation: “4). Negative seasonal time shift of some stations suggests that soil moisture – i.e. catchment wetness - controls the stream baseflow.”

L565. What do you mean by “the dominant dynamics is seasonal”?

L575. The explanation to the reference to the study by Exner-Kittridge et al. (2016) should be better connected to your results.

L586. “but changes with catchment wetness conditions” -indicate in which sense

L593. This statement needs further explanation: “Differences in the similarity give us an insight into the interaction between the two subsurface systems.”

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