

## ***Interactive comment on “The significance and lag-time of deep throughflow: an example from a small, ephemeral catchment with contrasting soil types in the Adelaide Hills, South Australia” by E. Bestland et al.***

**Anonymous Referee #1**

Received and published: 29 April 2009

This study reports on hydrogeochemical and isotopic observations made during the late autumn to early winter period for a small catchment in southern Australia. Observations were made at the catchment outlet and from trenches made in two of the main soil classes in the catchment (one sandy, one clayey). From these observations, the study makes several inferences about the contribution of different soil horizons (identification of source water) to stream flow in response to a monitored rainfall-runoff event. While the topic is interesting, several clarifications and an overall improved continuity are needed. In addition, there are some parts of the research where a more thor-

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ough discussion is needed before it can be accepted for publication in HESS. These revisions would amount to a major revision.

### General Comments

There is an assumption that the chemical composition pre-event water held in the vadose zone can be made by observing and analyzing rainfall prior to the event of concern (P2603,L14). This assumption is a bit questionable. In humid environments, pre-event water is often characterized by the water flowing in the stream prior to the event of concern. In this ephemeral system, this is clearly not an option since there is no pre-event flowing water. However, is there any reason that previous rain water (sampled one month prior to a major winter event) should represent the store of vadose zone water? This vadose water has interacted with soils and undergone evaporation. This should alter its composition considerably compared to the signature it had as rainfall (here I am thinking primarily about stable water isotopes). Soil suction lysimeters to directly sample soil water would be more representative of the pre-event store of water. Justify the assumption.

Throughout the manuscript, there is an inconsistency with definitions and abbreviations. This is exemplified in Figure 1 by the lack of labeling of site MC1 and MC2. It is impossible to figure out which is which. In addition, SB2 appears nowhere on the map (I assume it is actually labeled SB). What is MCC? In all figures, what is MS? Furthermore, the soil and geology naming conventions in Figure 1 correspond to nothing discussed in the manuscript. Greater clarity is needed here. In another critical example, Phase 1, Phase 2, and Phase 3 (which are often interchangeably referred to as Phases I, II, and III) are never clearly defined. They are apparently defined in an ad hoc manner relating to the duration of the stream flow event while their use in this manuscript is critical. Also, several terms are used interchangeably throughout the manuscript which is inappropriate. Typically, this would all amount to several minor comments, however, since the locations and description of the sites and soils involved in this study and the definition of phases form the central focus, all this inconsistency

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makes the manuscript extremely difficult to understand. The authors must do a better job clearly defining abbreviations and being consistent throughout the manuscript. I have attempted to highlight as many instances as possible in my specific comments that follow.

Along the same lines, the quality in the organization of the figures is lacking. More effort needs to be spent such that the reader can clearly draw meaning from the figures. As they look now, the figures appear to not be much more than a screen dump from some spreadsheet software. For example, the timelines are all inconsistent. Figure 3 has salinity graphed in it without ever mentioning that it is there! If more thought and effort was put into figure organization, the authors could really increase the readability of this manuscript. Again, while this is typically a minor point in most reviews, it is a major concern with this work as much (if not all) of the presentation draws on inspection and interpretation of the figures. In addition, various lines and boxes mark the onset of the various phases of the flows never really line up in the figures. This makes no sense and must be addressed.

The study looks at the influence (primarily) of two soil types with relation to their contribution to of water to stream flow at the outlet of Mackreath Creek. Looking at Figure 1, Mackreath Creek has its outlet flowing through a third and extremely different type of soil (if I understand the figure correctly). This could have significant impact on the hydrogeochemical composition of water sampled at the outlet of this catchment. The authors need to address this and provide support that this does not significantly alter the observations and interpretations they have made in the manuscript. Maybe this influence explains all anomalies to the general model proposed in the discussion? In fact, the authors have overlooked mentioning this third soil type in the site description (soil type LtE in Figure 1).

In general, the manuscript has the feeling that the authors did a lot of work collecting data and analyzing samples but have gained relatively little clear insight to the working of this catchment from a hydrologic perspective. Just reporting a large amount of data

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in some tables and making graphs does not necessarily warrant publication. There is a large amount of inconsistency between the data available through sampling and the inference made. The current manuscript sounds rather like speculation and lacks a certain amount of rigor. Some data point one way while other data points another. Has the collection of data proven or disproven the conceptual model the authors have of how this site works? The manuscript would improve from a more thorough discussion of what precisely was learned from this field investigation. How is this site similar to others in the literature? How is it different? What are the pieces missing? I encourage to authors to focus on this in their revisions.

#### Specific Comments

P2601,L10: What complex systems are you referring to here?

P2602,L7: Change 'component' to 'contribution'?

P2603,L21: Does 'Scott Bottom' rainfall collector refer to SB on Fig.1? Do a better job being consistent and clear.

P2604,L12: I suggest using scientific notation instead of M.

P2604,L16: Change 'day' to 'days'

P2604,L19: 'sandy silty' is not a soil classification.

P2604,L21: What are MC1 and MC2?

P2604,L24: This sentence needs major edit.

P2604,L25: This sentence is unclear to me – do clayey duplex soils appear or not appear on large areas of clayey duplex soil substrate? Re-write.

P2605,L1: Which sites? The trench sites?

P2605,L9: Change 'hill-slope' to 'hillslope'

Methods: You are using interflow and later subsurface flow interchangeably?

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Methods: Were any steps taken to stop evaporation of collected samples before they were transferred to McCartney bottles? Pretty important for stable water isotopes.

P2606,L11: Change 'ith' to 'with'

P2606,L13: Define your ICP abbreviation here.

P2606,L20: Did you measure EC or salinity? Are they exactly the same thing (or is once inferred from the other)? Be precise and consistent.

P2606,L20: Where were samples collected? At the outlet?

P2606,L22: Auto-sample? Sounds like methods to me.

P2606,L26: By incomplete you are referring to the interflow trench samples?

P2607,L1: What is ICP?

P2607,L2: What is YCI EC?

P2607,L3: What is ICPAOE?

P2607,L4: What is TDS?

P2607,L8: Change 'Overall' to 'On average'?

P2607,L13: This comes across as discussion mixed into results

P2607,L16: Really 'hydrochemically'? Thus far in the paper, you have only presented EC measurements.

P2607,L23: What are Phases 1 and 2?

P2607,L23: How are they interesting?

P2607,L24: What is Phase III?

P2607,L24: Figure 2 says there is low overland flow from the sandy soil sites, but you have observed overland flow in all three phases of the storm event. Is this consistent?

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P2607,L28: What is Phase three?

P2607,L28: How confident are you that having your trenched filled with what did not disturb your sampling during this period?

P2608,L4: What is 4B?

P2608,L9: Only chlorine, sodium, and silica are shown in Fig. 5.

P2608,L11: Here and throughout, general statements are made like clayey soil throughflow waters are high in chlorine than most of the sandy throughflow. When I look at Figure 5 (and others), it is extremely variable as to when one sampling location is high than another. For example, during all of phase 1 and 2, MC1 BC is higher than SB2 AB in chlorine concentrations. These general statements are not insightful nor are they helpful. The authors should refine them.

P2608,L23: How certain are you that chlorine was conservative?

P2608,L23: Could this missing component be the third soil type (LtE)?

P2609,L4: This is a bad sentence. Rewrite.

P2609,L7: There is no Figure 6c.

P2609,L24: Figure 7a is only stream water.

P2609,L28: Here and throughout, statements like 'will be discussed below' are a bit redundant. It makes the manuscript comes across as poorly written.

P2610,L8: Here you state April 2007 while six lines later you state May 07. Please be consistent here and throughout with you referencing.

P2610,L11: Significant compared to wait? Is this statistical significance?

P2610,L24: 'oxygen and hydrogen isotopes'. Earlier, you call them oxygen and deuterium. Sometimes you are using delta notation. I strongly suggest picking one naming convention and using it exclusively. This comment extends to all parts of the manuscript

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and not just this stable water isotope section.

P2611,L1: The phases are not labeled on Fig 8. This makes interpretation impossible.

P2611: Can you really draw these inferences with regards to the temporal patterns of isotope values and timing of the events given your sampling frequency?

P2612L2: Can you speak some on the effect of landscape position in your interpretation here? Are the soils the only mechanism for the results you see? What would happen if you dug your trench in a different region of the hillslope or perhaps in a different hillslope (more steep for example)?

P2614L3: Does this mean that all your reasoning is incorrect? The source of the oldest water does not have the most weathering?

P2614L16-29: With respect to the proposed model. Please clarify. The clayey system has low conductivity which promotes rapid overland flow while the sandy system has high conductivity which allows for infiltration and does not lead to overland flow development (Figure 2). However, clayey soils also have shorter residence times than the sandy soils in your model. This might not necessarily be inconsistent, but sounds that way when stated like this. I would imagine quick flows occurring on top of (not through) the clayey layers.

P2614L16-29: Your conceptualization does not include any reference to the EC measures that I can see. Is there any specific reason for this? Could this information be used to support your argumentation for colloid facilitated transport by connection with TDS?

P2615L10: Perhaps your conceptual model is incorrect?

P2615L12: Possibilities are always possible (redundant).

All Tables: I am not in support of simply putting all your data in the tables. This adds little to the presentation of the research. I suggest using a table to summarize data more

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efficiently or not have them at all.

All Tables: Perhaps you can give a simple table that clearly describes each of the sampling abbreviations you are using (like what is Site P?)

Table 2: Should the column header be MS or Site ID? This table is a mess.

Figure 1: There is a clear disconnect between the legend and what the abbreviations mean. For example, what is 'MC'? This has not been defined anywhere. Also, the soil labels make no sense with regard to the rest of the manuscript. Maybe consider using colors with more contrast.

Figure 9: It is not easy for me to see which points are labeled by the text within the figure.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 2599, 2009.

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