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Hydrology and Earth System Sciences Discussions

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.

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Response to Anonymous Referee #1

Most of the comments of this referee concerned clarification of the manuscript and graphs. All of the graphs and figures have been re-drafted and the manuscript has been extensively re-written following comments and suggestions by the referees.

Referee #1 makes a point about the pre-event vadose zone waterâĂŤthis point was also

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taken up by the second referee and is an important assumption in this work. Whatever pre-event water in the vadose zone that is still there from previous seasons (not the 2007 wet season) would be expected to have interacted with soil-regolith and to have undergone substantial evaporationâĂŤthis from the long dry and hot summers experienced here as well as the deep rooted eucalyptus trees which draw vadose water from many meters depth. Thus, it is the assumption that in these hilly well-drained areas at the end of the dry season the vadose zone water is not voluminous. In addition, from an analysis of the 7 years of flow data on Mackreath Creek, an average of 150-180 mm of autumn-early winter rainfall is required in order to cause water to flow in the stream. This Autumn rain is assumed to be the majority of the water in the vadose zone. Our water isotope analysis of the 2007 Autumn rain preceding and including the event shows the depleted nature of the vast majority of this rain (April bulked sample of Figure 9) as well as indicating the average water isotope values of winter precipitation. Average winter precipitation is what would be expected to constituent the source water of the vadose zone water. Thus, given these parameters, if the vadose zone water prior to autumn 2007 rain had developed an evaporative signature and constituted a substantial mass, one would expect an evaporative and enriched signature from this water as it flowed through the system during autumn flushing. This was not observed, in fact the opposite was observed in terms of depleted values in stream water and sandy deep soil through flow. These data have been interpreted as representing vadose zone water from the April 2007 drought breaking rainfall due to similar and unusual isotopic values.

Other comments by Referee #1 in terms of interpretation and description of data have been addressed through a re-write of the discussion section as well as other parts of the manuscript. However, we admit that there are outstanding issues with this catchment, as there are with most natural systems. We do not contend that we understand everything about the hydrogeochemistry of this catchment and in fact there are some important findings that we are addressing with on-going research. We contend that this is an honest scientific approach to a very complicated system.

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