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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Exploring water cycle dynamics through sampling multitude stable water isotope pools in a small developed landscape of Germany" *by* N. Orlowski et al.

Anonymous Referee #3

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General comments:

The authors present an interesting case study and an extensive dataset about the water cycle dynamics in the developed Schwingbach catchment based on stable isotope data from the water components precipitation, soil water groundwater, and stream water. The presented sampling approach and the methods used are valid so far and described in detail. The observed signatures of the individual components and their interactions are described in detail. The reactions of groundwater and stream water to precipitation events have been already described in an earlier study and this process knowledge is now supported with the stable isotope sampling carried out in the

Schwingbach catchment. It seems that groundwater dynamics are dominating the hydrological system of the Schwingbach catchment. The submitted study presents no new methods or the identification of unknown processes. However, substantial stable isotope datasets in developed landscapes are rare and improved process knowledge is important for hydrological modeling and for a better understanding of biogeochemical processes as mentioned in the introduction section of the presented manuscript. It would be an asset for the study to include additional findings about the groundwater dynamics and the process of recharge in the study landscape. The spatially distributed stable isotope soil profiles together with the groundwater signatures would be a perfect dataset.

The study is in the scope of the journal and I recommend the presented case study for publication in HESS after revising the submitted manuscript based on the suggestions of the review process.

Specific comments:

The introduction section is well written and the relevant processes and fundamentals of stable isotope hydrology for this study are addresses. However, I suggest modifying the structure at one point. There are some research needs (Page 1811, Line 21 – Page 1812, Line 6) mixed with more fundamental background information.

Please add a few words about the relevant processes of groundwater-surface water interactions and add some benchmark studies (e.g. Sklash and Farvolden, 1979) in the groundwater part oft he introduction section.

The reference Garvelmann et al. (2014) is not appropriate on page 1811, Line 13, since no MRT calculations have been conducted in this study.

The expression "stable isotope components" might be more appropriate at some passages than using "stable isotope pools" (e.g. Page 1814, Line 21).

Please provide the catchments size and the altitudes at the beginning of the study area

section. Furthemore, I suggest to provide the discharge (additionally) in millimeters to allow a better comparison between the two catchments.

How was snow sampled (Page 1817, Line 12)? This is an important information. Solid samples were used in a number of past studies. This is valid for characterising the stable isotope signature of precipitation input. However, Taylor et al. (2001, 2002) have shown that there is a significant difference between the stable isotope signature of solid samples and meltwater samples and they suggest to use meltwater samples in hydrological studies. I suggest to at least shortly discuss this issue in the paper.

Including equation 1 (Page 1819, Line 15) is not crucially necessary.

Can you explain in more detail, why the isotopic signature of stream flow seems be influenced by snowmelt only at site 64?

That groundwater is mainly recharged during the winter season well known. During this period the transpiration by vegetation is significantly reduced and water available for recharge. Please include this point in your discussion on groundwater recharge on page 1825.

Why are the groundwater stable isotope signatures so different? Please explain the statistical differences in more detail. It seems to be related to the different land use forms as you mentioned in the paper. Please provide additional information about this issue. There is probably more potential to explain this issue in combination with the soil profiles.

You explain the values observed at piezometer 32 with the influence of snowmelt. Again, why seems the snowmelt signal only influence the values at this location? Please provide more information about this particular site compared to the other piezometer sites.

It would be nice to show the soil moisture values of the soil profiles in section 3.4. Please clearly mention in your discussion of the stable isotope profiles that the study

of Garvelmann et al. (2012) was carried out on a hillslope. Therefore the results of the two studies are not directly comparable due to the differing topography of the study areas.

I suggest including the information about precipitation and the local meteoric water line in section 3.5 into the description of the precipitation values (section 3.1).

It would also be nice to show the deuterium-18-O plots at the beginning of the results section for an overview of all samples used in the study.

Technical comments: Page 1812, Line 7-9: Please revise the structure of this sentence.

Page 1816, Line 19: was instead of were

Page 1820, Line 15: "...rainfall was collected at 15 open field site locations.."

Page 1820 Line 17-19: Please revise this sentence for more clarity. Which information refers to which citation?

Page 1821, Line 28: Schürch, Schurch or Schuerch? Check also in refernces list.

Page 1822, Line 8: Deuterium-excess of what? (Please remove section title or reviose)

Page 1824, Line 24: mean transit time

Page 1829, Line 24-25: Please revise this sentence for more clarity.

Figure 1: Is it possible to include the locations of the stable isotope soil profiles?

Figure 3: There is no dashed line at d=10 (or the quality of the figure was to bad...)

Figure 4+5: Please provide the discharge in mm/day. It would be nice to include the average stable isotope values with a fine solid line for a better comparison.

I kindly invite the authors to recheck the citations and the references list very carefully in the manuscript. For example Klaus et al. is from 2015 (please revise throughout the manuscript).

References

Sklash, M.G. and Farvolden, R.N. (1979). The role of groundwater in storm runoff. In: W. Back and D.A. Stephenson (Guest-Editors), Contemporary Hydrogeology âĂŤ The George Burke Maxey Memorial Volume. J. Hydrol., 43: 45-65.

Taylor, S., Feng, X., Kirchner, J.W., Osterhuber, R., Klaue, B. and Renshaw, C.E. (2001). Isotopic evolution of a seasonal snowpack and ist melt, Water Resources Research, 37, 3, 759-769.

Taylor, S., Feng, X., Williams, M., McNamara, J. (2002). How isotopic fractionation of snowmelt affects hydrograph separation, Hydrological Processes, 16, 3683-3690.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 1809, 2015.