

Authors' responses to the comments of Sally E. Thompson

We appreciate your review and comments on our manuscript, "Deriving Subsurface Stormflow Mechanisms with Isotopes and ERT". Your feedback is valuable to us, and we will make the recommended revisions accordingly. We provide detailed responses to each of your comments below.

Dear authors,

I was invited to review this manuscript, accepted, and then was uninvited. This is a little confusing to me, but in the spirit of having reviewed the paper, I'll write this comment as if it were a review.

Firstly, I must say how much I enjoyed reading the manuscript. It is a pleasure to come on the journey into the subsurface with multiple methods with you and to explore runoff generation in action. The manuscript is overall written very well, and I found the conclusions quite convincing. I have some recommendations to consider, including any number of minor thought bubbles contained in comments on the PDF and attached, but some more general points that the authors might consider here.

Thank you!

Technical: Recently we have been doing a lot of timelapse ERT here in Western Australia, and one thing we have noticed is abrupt changes in how resistivity relates to water content that are induced by the addition of new water to the profile. We suspect that this is because our soils are very low in clays (so poor charge carriers themselves) and so the ERT becomes quite sensitive to the changes in pore water concentration caused by dilution/concentration around rainfall events. We would not have picked any of this up except that the ERT is co-located with other moisture sensors and the relationships between resistivity and moisture detected by these sensors changes. I wonder if the authors have explored the petrophysical relations at their site and whether they too change rapidly during wet up and drydown? If so, it may have implications for interpretation of the ERT. (I would now personally always recommend using ERT with a co-located moisture sensor that is less sensitive to the composition of the pore water in order to control for spurious interpretation of changing petrophysics).

We did have a soil moisture sensors at 10, 30 and 60 located close to the center of the irrigation plot. Most of these sensors responded during the sprinkling and the drydown. The soil moisture variations on these sensors related at some point with the variations on the ERT. However, there were reasons why we did not include this data, for example in Trench 3 we got no response to the irrigation at 60 cm and we cannot extrapolate that information to the rest of the 200-m² plot. Additionally, we would not expect a good resolution from the ERT at 10 cm depth with our acquisition geometry.

Motivational: I think perhaps the weakest point of the study is the argument for "why this study and why now"? As the authors note themselves, the findings are rather consistent with many other experimental studies conducted to explore subsurface flow generation in mesic sites (I did also wonder if this literature was reviewed extensively enough as I felt like e.g. studies from

the MaiMai, Panola and similar experimental watersheds perhaps could have been referenced). I felt there was an opportunity for a deeper critical review of the literature and to ask questions that were more penetrating than the fairly general research questions that were posed. One question I really felt would benefit from being addressed in the introduction was "why use (expensive) isotopes and not a different (cheaper) conservative tracer?" The key methodological advantages of this specific tracer / sensor combination could perhaps be outlined more explicitly.

We will clearer state our motivation in better understanding SSF mechanisms. We selected isotopes as they were fairly simple to recover from soil samples in our lab.

Regarding the literature review: that's another project the first author is currently working on as a standalone paper.

Writing: I felt like much of the methodological justification was presented in the uncertainty section of the discussion - I think this would work better in the methods. The discussion did not explicitly address the research questions (which, I think, is because the research questions were general and a bit on the weak side!). Improved questions and an explicit discussion of "these are the answers we found" in the discussion would strengthen the composition of the paper.

As also asked by reviewer 1 we will move some uncertainties up to the methods and try to answer the questions better in the revision.

Overall, I think these are relatively minor issues that would strengthen the presentation of an interesting dataset and an excellent experimental study.

Thank You!