

Throughout the revision of the manuscript, the authors have corrected the comments by the reviewers and have addressed them accordingly.

Anonymous Referee #1

General comments

In the manuscript entitled 'Using isotopes to understand evaporation, moisture stress and re-wetting in catchment forest and grassland soils of the summer drought of 2018' the question is addressed, how the drought 2018 affected two different land-use/soil community sites in a catchment in NE Germany. The two plot sites were monitored during a period of water stress, when the catchment could no longer sustain blue water fluxes (e.g. stream flow) or green water needs (e.g. crop production), and the subsequent recovery.

Ecosystem response to this climatic anomaly is investigated by using water stable iso-tope data of precipitation and throughfall, stream-, groundwater and especially from soil water profiles. Monthly soil profile samples in 6 different depths down to 1 m under two different land-use types were taken from September 2018 to February 2019. Soil water isotopes were analysed using direct vapor equilibration laser spectrometry (DVE-LS). These data were used to estimate mean transit times (MTT) in the soils at the different depths as well as young water fractions, using a fitted sine-wave method. Based on collected meteorological and sap flow data ET-pot was calculated. Soil moisture was monitored in three different depths at both sites. Drought severity was quantified with the SPI, based on long-term precipitation data from the DWD.

It could be shown that the forest soils were dominated by rapid young water fluxes after rainfall events whereas the grassland soils were more retentive and dominated by older water. It is concluded that implications for blue and green water management should be investigated in a greater range of representative vegetation/ soil units and that further research efforts on climate change and management adaptations in the critical zone of drought sensitive ecosystems is needed.

Overall, the manuscript is well structured and nicely written.

The topic fits well to the scope of the journal and appears to be of interest for the read-ers; I only suggest moderate revisions prior to acceptance and publication in Hydrology and Earth System Sciences.

We thank the reviewer 1 for the encouraging comments on our manuscript. We are grateful for this very detailed and careful review of our work.

Specific comments

Title

Please add which isotopes were investigated, either 'water stable isotopes' or 'stable isotopes (d18-O, d2-H)'.

We specified this as 'water stable isotopes' in the manuscripts title.

Evaporation or Evapotranspiration?

We choose evaporation as the focus of the isotope techniques is on evaporation.

L. 4

Please add 'water' before ". . .stable isotopes to. . ."

'water' was added to particularize the isotopes used.

L. 47

Compared to e.g. soil moisture probes, laser absorption spectroscopy is not really "inexpensive". . . I wouldn't go too deep into the history of stable isotope measurement techniques, but it could be added

that compared to traditional mass spec. techniques, laser absorption spectroscopy is relatively inexpensive. Mentioning that the invention of laser absorption spectroscopy has facilitated several new techniques in the last ten years would also emphasise that your approach is relatively new.

Thanks for the suggestion. We have added more detail on that.

L. 52

Developed by whom? Not by Hendry et al., maybe they improved. Please delete “e.g.,” in the brackets.

Thank you. This was indeed very misleading.

L. 60

Shift “To” to line 59 after “study”

Thank you. We adjusted it.

L. 66

‘located’ instead of “based”

Changed according to suggestion.

L. 123

Throughfall was sampled as well at 1 m height? Which distance between the five gauges?

We added more detail regarding the experimental setup of the throughfall to the revised manuscript.

L. 131

blank is missing between “for” and “d2H”

Adjusted. Thank you.

L. 132

Please complete “. . .from October 2018 to. . .”

We completed this (to February 2019)

L. 143

Please provide part-no. of sample bags

Thank you. Indeed part-no changed in comparison to older studies.

L. 146

Please insert ‘gas’ after “headspace”

Done as suggested.

L. 147

What kind of ‘standards’ were used?

We added more detail to the standards (liquid/ 10ml) but too much detail might be confusing as these standards are only used for calibration and not relevant for the further storyline.

L. 150

d-Excess should be introduced somewhere here.

We included a short introduction to the d-excess concept.

L. 150-152

Method or results section?

We presented this information here to give insight into the method and its precision.

L. 157

Please add 'oil' after "paraffin"

Thank you. We specified it to "paraffin oil"

L. 171

Where can I see "young water" in figure 2?

This was a mistake – we removed the reference to Fig 2 here.

L. 171-172

Method or results section?

We mentioned this here to clarify the definition of young water in the applied method.

L. 213

One would always expect slightly evaporated signals in throughfall (enriched in heavy isotopes) compared to precipitation. In your study it is opposite (Fig. 4, Table 4), this seems to be in contradiction to your soil profile data (Table 5). Please elaborate on this.

We have a slightly unusual situation in that catchment in addition to the major drought during the study period. The low impact of interceptions storage evaporation on the isotopic composition of throughfall seems counterintuitive. We think that the precipitation characteristics reduce this effect at this forested site. Summer precipitation (with highest expected impacts) usually occurs as a few convective (higher intensity) events. These characteristics lead to little dripping and complete emptying of interception storages until the next precipitation event (which hardly occurred during the study period anyway). Enriched signals in forest soils are therefore linked to the process of soil evaporation fractionation. Nevertheless, we cannot exclude canopy effects for other stands in the catchment or even generally for this site as we did not sample stemflow.

L. 223

Please delete one of the "in" before "Figure 4"

Done

L. 225

Is the sample number of precipitation really higher than throughfall? According to Table precipitation (68), throughfall (136). Please clarify.

You are right. we changed that.

L. 232

I like the heat map (Figure 5), but you could think about providing a figure for each site with the soil profile isotope data as supplemental material.

The heatmap enables easy visual interpretation of the isotopic dynamics. (But we will add soil profiles as supplemental material).

L. 238-240

Not clear what you mean, please rephrase.

Rephrased

L. 259

'upper' instead of "top"

Done as suggested.

L. 260

Please insert 'the upper' before "three of the. . ."

Done.

L. 289

Insight 'into' instead of "in"

Done.

L. 316

Please replace "soils" by 'soil layers'.

Thank you. We adjusted it.

L. 324

Stick to "α-values" to be consistent with L. 323 and Table 6.

We changed it.

L. 338

Please insert 'in' or 'reported from' before ". . .the previous winter".

We added 'in'.

L. 342

'storage,' instead of "stores"

Thank you. We changed it as recommended.

L. 356-357

". . .urgency with the by. . ." ??? Please rephrase.

Corrected.

L. 369

". . .headwater. . ." is 'catchment' missing?

Added 'catchment'.

L. 376

Please add 'the two' between "between" and "sites"

Done.

L. 378

Please insert '1' before "year old)"

Corrected.

Fig. 1

There is enough space to put the overview beneath the detailed maps – makes the layout of the figure a bit clearer.

Right part: please replace "Landuse" by 'Soils'

Legend title was adapted.

Fig. 3

Legend: 'h' is missing in "Troughfall"

Corrected.

Fig. 5

Please label forest and grassland.

Corrected

Table 4

Deltas are missing in header

Are 5th and 95th percentile of d18-O identical for precipitation and throughfall? Stream: 5th and 95th percentile of d18-O both -8.6? Please double-check.

We double-checked table 4 and precipitation and throughfall numbers are correct. Stream 95th percentile was corrected. Thank you!

Table 5

Caption: 'soil water isotope samples' instead of "soil isotopes samples"

Thank you. We changed 'soil isotope samples' to 'bulk soil water isotope samples' to clarify.

Global changes

I would prefer "and" instead of "&" (e.g. l. 62, 112, 136)

We changed many '&' to 'and'.

please change "stable water isotopes" to 'water stable isotopes' check '-' vs. '–' throughout the manuscript (e.g. L. 287, L. 291)

We checked and corrected this throughout the manuscript.