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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Application of pore water stable isotope method to characterise a wetland system" *by* Katarina David et al.

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Dear Reviewer, Thanks for the constructive review and comments provided for the manuscript. We have included a detailed response to the questions below in responses. It has helped us improve this manuscript. General Reviewer's Comment While I personally support the motivation of this study and also the propagation of isotope methods I regret to say that I have several issues regarding this manuscript:

Title: Reviewer's Comment The title does not fully reflect the work described here. Not only isotope data have been collected and used and the manuscript's main conclusion is based on other data.

Response We acknowledge the title does not fully describe the work completed so we

propose the changed title as follows: "Application of pore water stable isotope method and hydrogeological approaches to characterise a wetland system" Reviewer's Comment Main outcome: The most important, yet qualitative finding of this study is groundwater flow through the wetland system. The presence of high groundwater levels despite high evaporation rate estimates led to the indirect conclusion that lateral groundwater inflow must be effective. This could already be expected, given just the combination of slope (5%), groundwater levels (high) and permeability of bedrock (sandstone –> high). The vulnerability of such systems following e.g. mining activity is based on potential changes of groundwater flow. The main effort of this study, however, was the estimation of evaporation rates which will most likely not be altered by e.g. mining activity. Furthermore, the application of the direct vapor equilibration method was never methodically restricted to non-wetlands and therefore does not constitute a challenge itself that needs to be emphasized.

Response We agree with the reviewer that the effectiveness of groundwater lateral flow in the swamp system could be deduced from a combination of topography and geology drivers. However, the relative effectiveness of groundwater flow in the swamp water balance, has yet to be thoroughly evaluated. Given that this study did not use the piezometer data but mainly relied on stable isotopes, we have provided a quantitative estimate which represents a conservative estimate of a minimum volume of groundwater contribution to the wetland. It is also true, that the direct equilibration method was not restricted to non-wetlands, but the method reported in literature to date has been applied in low permeability unconsolidated or consolidated environments. However, it has never been applied in the relatively high permeability swamp system. We therefore believe that there is a merit in showing the value of applying the method in a swamp environment.

Model selection:

Reviewer's Comment The selected model was developed and applied in desert regions with only vertical water flow, no vegetation, and no lateral groundwater contribution to

the zone under investigation. I therefore doubt that invariance of isotopologue diffusivities is an exhaustive criterion for model selection. Furthermore, the assumption of steady state conditions in a region with pronounced wet and dry season seems to be very far-fetched. The authors should either provide more details why the selected model is still applicable in a vegetated wetland environment with vertical and lateral water flow components or they should use a different approach that better considers subsurface water flow velocities and directions under both dry and wet conditions.

Response Barnes and Allison (1988) model has been applied in experimental and field studies to both arid and non-arid regions. The assumption of steady state characteristics was considered appropriate as the analysis was mainly focused on the outcomes of the dry weather season. However, a wet period was also modelled to see if the model could match the data during this period, not during the transition from dry to wet which would clearly invalidate model assumptions. Stable diffusivities do not represent a complete or only criterion for model selection, in fact vapour diffusion has an impact on effective diffusivity such that it results in its increase therefore they are not stable. The effective diffusivities are the function of water content and they are proportional to the effect of porous medium. Given that the water content decreases as evaporation proceeds the tortuosity will also decrease. The factor that influences diffusivity is in effect a product of tortuosity and volumetric water content.

The selected steady unsaturated conditions model by Barnes and Allison, 1988 has not been restricted to arid regions, in fact, the model has been applied to clay mineral unsaturated experimental laboratory environment and vegetated and non-vegetated impacts. The model relies on Zimmermann (1967) observations of the effects of vegetation on the isotopic profiles and Barnes and Allison (1988) conclude that under vegetation the enrichment will depend on the effect of deep profile due to lower evaporation rates, lower water contents and effect of transpiration.

Further support for the selection of the Barnes and Allison (1988) model for the vegetated wetland environment is also shown in the recent work undertaken by Piayda et

al (2017). They studied vegetation effects on soil water infiltration and distribution as well as dynamics of soil evaporation and grassland water use in a Mediterranean cork oak woodland. They found that regardless of the presence of vegetation or bare soil, the total evapotranspirative water loss of soil and understorey remains unchanged, but infiltration rates decreased by 24%. In their study, below-ground biomass was sampled with soil cores in 5, 15, 30 and 60 cm depth. In total, 80% of root biomass was found to be distributed between 5 and 15 cm depth. Only 5% was distributed above 5 cm and 15% between 20 and 35 cm depth.

Reference: Piayda A., Dubbert M., Siegwolf R., Cuntz M., Werner C., 2017. Quantification of dynamic soil-vegetation feedbacks following an istopically labelled precipitation pulse. Biogeosciences, 14, 2293-2306.

Furthermore, the modelling is considered to be applicable by focusing on vertical flow. We only included the samples from the base of the swamp (not sides) where vertical flow is dominant due to high permeability of the peat. We have not modelled the regional aquifer water balance in this study.

Data collection: Reviewer's Comment: The description of the calibration and validation routine of water stable isotope data is quite confusing. Why did the authors not use the linear regression between known values of liquid standards and raw readings of the respective headspace vapors to calibrate the unknown sample values? Response The calibration was undertaken as follows: a linear regression relationship was established between the known liquid standards i.e. two LGR standards and VSMOW and corrected vapours of the same standards. The standards' vapours were expressed as water using the fractionation factor at 25C. The regression equation was then applied to raw readings of the vapours for samples. This was used to calibrate and normalise the samples. This detail was not clearly explained in the manuscript and has now been added.

Reviewer's Comment What did they correct the readings for? Response The readings

were also corrected for instrument drift.

Reviewer's Comment Or did they mean "calibrate" when they wrote "correct"? Response: It is acknowledged that terminology in the manuscript needed to be more consistent. Standards were used to calibrate the samples as per the above response, and corrected for instrument drift.

Reviewer's Comment Why did they (have to) calculate individual fractionation factors? This would not have been necessary if all standards and samples had been stored sufficiently long and analyzed subsequently in a temperature-controlled environment following the principle of identical treatment. Response: the fractionation factor was not calculated individually, it was only applied to measured standard's vapours to express as water. This was used for regression with liquid standards. The regression was then applied to raw sample readings. All samples and standards have been stored at 4°C prior to the analysis, and all have been allowed the same time on the lab bench in the temperature controlled laboratory and have followed the same treatment.

Reviewer's Comment Also, reported uncertainties as measures of data quality are meaningless if they are not based on the authors' applied standard operation procedures. Response: Standard operational procedures were followed, all samples were prepared in the same manner, at the same temperature and at the same time, stored at the same temperature, and were all allowed the same time prior to being prepared for analysis. The laboratory was temperature controlled.

Specific comments and Technical corrections

Reviewer's Comment: P2 L7-8: "aiming at" instead of "enabling". The ability to quantify components of the water balance depends on environmental conditions, not on the method of data collection. Response Thanks, this is corrected in the manuscript.

Reviewer's Comment P2 L8-10: insert "potentially" before "enables". Otherwise this statement is too strong. The technique itself only enables collection of isotope data.

Understanding of processes is a different thing. Response Thanks, the word has been inserted as suggested.

Reviewer's Comment P2 L11 & elsewhere: the numbers following the delta symbol have to be in superscript Response Thanks, all numbers following delta symbol are in superscript in the manuscript, the HESS conversion to pdf caused this change and converted them to normal numbers

Reviewer's Comment P2 L12: is the porewater compression technique the most widely applied and accepted benchmark? Response This has been reworded to say, "with other reported physical and chemical techniques". Also, current literature provides good comparison and results comparable or better to those of other methods (Hendry et al, 2015)

Reviewer's Comment P2 L19-21: the finding of sand underlying the swamp can't really be credited to this study as it had been described before in studies cited by the authors. Response True, but other cited literature did not specifically relate to this area. The sand underlaying the swamps will influence the response of the swamp to disturbances such as mining, in contrast to lower permeability clay. The geology of the Newnes Plateau area where these swamps are located, comprises Burralow formation which is known to have thin interlayered siltstone and mudstone layers. Other studies (referenced in the manuscript) were undertaken in the area which is underlain by Banks Wall Sandstone, which is cleaner quartz sandstone.

Reviewer's Comment P3 L9: multi, not muliti; sedimentary, not sedimentatry Response Thanks, this is now corrected in the manuscript.

Reviewer's Comment P3 L11 and throughout MS: the references cited in the MS do not match the ones listed in the references section. I was therefore often unable to find the referenced statements in the cited literature Response Thanks, this has been checked and corrected.

Reviewer's Comment P3 L12, 16 & 19: why do the authors distinguish between Australian and international literature? Is one more relevant or trustworthy than the other? Response The reason for distinguishing between Australian and international literature is due to climate in which these swamps were formed. In the northern hemisphere where most wetland work is reported, the swamps were formed since the last glaciation in Holocene, while in Australia they were formed in the non-glaciated period. A study by Fryers et al (2014) found that highly variable nature of hydrological regime in Australia these swamp systems have different formation and evolution compared to those in the northern hemisphere climates. The information has been added to manuscript.

Reviewer's Comment P3 L17: insert "other" before "environmental tracers" Response Thanks the word has been inserted.

Reviewer's Comment P3 L18: please specify the processes you are referring to Response This refers to hydraulic connectivity processes. The text has been updated in the manuscript.

Reviewer's Comment P3 L26: all THPSS terms should start with capital letters. Or none. Response All THPSS terms are now capitalised

Reviewer's Comment P3 L31 & elsewhere: citation style: put years in braces Response Thanks, this is corrected throughout the text.

Reviewer's Comment P4 L3: "swamp behavior" is too sloppy, please specify Response Changed to "hydrogeological changes in the swamps"

Reviewer's Comment P4 L18: given that especially rainfall and surface water can vary on very short timescales with unknown time lags relative to soil water which in turn is subject to dispersion, how can these be considered distinct endmember points? Response Rainfall, and as a result surface water, do vary based on the rainfall intensity, source of rainfall (Eastern Coast Low or Western Through) and season, however they are considered the endpoints given their role in the input and output part of the wa-

ter cycle. Also, these natural variations have been very well documented by rainfall sample collection, which has allowed us to compare detailed variations of rainfall and groundwater in this manuscript.

Reviewer's Comment P5 L5: a verb is missing after "and" Response Reworded as follows "'and they occur at highest elevation"

Reviewer's Comment P6 L2-4: if this does not affect the site under investigation, then why mention? Response The plantation was mentioned, as it is immediately next to the catchment boundary of the swamps in this study. However, other swamps not in this study can be affected by changes in the plantation. Therefore, the explanation was given to provide clarification.

Reviewer's Comment P6 L7: "fed by groundwater discharge" is a contradiction. I suggest to use the expression"fed by lateral groundwater inflow" Response Thanks, changed as suggested.

Reviewer's Comment P6 L16-19: please provide numbers rather than "below average" or "above average " Response Numbers added as suggested:" for February to April (46.6mm, 36.8 mm, 6.6 mm and 20.8 mm for each of the months)" and '' above average rainfall from June to September (170.2 mm, 102 mm, 61.8 mm and 92 mm for each of the months"

Reviewer's Comment P7 L5: can you please provide here already the number of samples as well as the achieved spatial depth resolution of sampling? Response This has been added to the manuscript as follows: A total of 34 pore water samples and 5 surface and groundwater samples were collected during May 2016. During October 2016 sampling event 14 pore water samples and 13 surface and groundwater samples were collected. A total of 27 pore water samples and 6 surface and groundwater samples were collected in May 2017. The spatial depth resolution varied from 10 to 20 cm depending on the penetration of the corer.

Reviewer's Comment P7 L7: why had sampling holes to be restored or why is this important to be mentioned? Response Because the field work was undertaken in a sensitive environmental area protected by State and Federal legislation and is part of the World Heritage Area, therefore the sampling holes could not be left open to modify conditions in the swamp, but were filled after sampling. Reviewer's Comment P7 L7: excess of what? Why was not all soil material sampled? Response Thanks, word ''excess" replaced by ''soil"

Reviewer's Comment P7 L13: please specify what you mean by "nature" Response This includes colour, shape of the grains and size of grains. This has been explained in the manuscript now.

Reviewer's Comment P7 L13: "were described" instead of were described" Response Thanks, the words are now separated.

Reviewer's Comment P7 L16: why were samples vacuum packed? How and how long were they stored prior to analysis? Response Samples were vacuum packed, to avoid equilibration with the air in the bag. The samples were stored for three days in the cool environment at 4°C temperature.

Reviewer's Comment P8 L1: insert "data" before "for precipitation" Response Thanks the word is now inserted

Reviewer's Comment P8 L9: 17-24 hours is too short for reaching complete isotopic equilibrium between soil water and headspace vapor. It should be several days, up to one week for clayey samples (Wassenaar et al, 2008). Or do the authors have indication that complete isotopic equilibrium between all relevant fractions of soil water was reached? If so please describe Response The sample equilibration time is dependent whether the core is intact or broken into small pieces, and if it is unconsolidated. For each geologic material the equilibration time needs to be established experimentally. The core samples in Wassenaar et al (2008) study, were intact and consolidated, low permeability representing the worst-case scenario in terms of time required, therefore

the time when samples were fully equilibrated was after 3 days. Similar findings were reported in David et al (2015) where testing was done on consolidated, low permeability sandstone and siltstone cores. However, in this research the geologic medium is the high permeability, loose, broken down and unconsolidated peat, organic material, sands and silt. As a result of this the equilibration time was reduced to up to 24 hours. After this time the full equilibration was achieved which is evident in headspace water content of between 25000 to 29000 ppm, as reported in (Wassenaar et al, 2008; David et al, 2015).

Reviewer's Comment P8 L10: I suppose this concentration range yields minimum data noise on a LGR instrument? Such a large range of vapor concentrations, however, probably indicates non-isothermal storage prior to and during analysis. Can the authors please comment on pre-analysis storage conditions with respect to the principle of identical treatment of samples and standards? Response The concentration range is required for the analysis, i.e. a minimum of 5% of moisture content per sample. Below this range the results are not accurate. The variation is due to different lithological characteristics of samples, different moisture content and hydraulic conductivity. Before the analysis all samples and standards were stored in the cool place at 4°C and were then transferred to the lab bench when preparing for the analysis. The temperature in the lab is controlled.

Reviewer's Comment P8 L13: what kind of plastic tube? Was it diffusion-tight material? Else, the authors might have sampled a mixture of sample headspace and an unknown fraction of ambient vapor. Response It is a flexible, thick walled plastic tube which is connected with fittings to LGR inlet on one side and with needle on the other side. The contamination by atmospheric air is considered negligible. This is based on the measurement of ambient air moisture of around 14,000 to 15,000 ppm, while the headspace for samples had a range of 23,000 to 28,000 ppm H2O. Also, given high moisture content in the sample/bag the contamination is negligible based on mass balance. Reviewer's Comment P8 L15: 20 minutes appear way too short. See also

comment to P8 L9 Response The standards are pure liquid and therefore require little time for equilibration. Wassenaar et al (2008) report 5 minutes for liquid samples, David et al (2015) report 20 minutes.

Reviewer's Comment P8 L15 & elsewhere: the expression "_18O/_2H" is conceptually wrong and misleading given that this could be interpreted mathematically as a ratio of two isotope ratios Response Thanks, corrected to δ18O and δ2H throughout.

Reviewer's Comment P8 L18: what was the volume of the standards? Did you prepare replicates or were the standards' headspaces analyzed repeatedly? Response The volume of standards was 1 ml (about 5-7 drops) and they were prepared as replicates after each set of 3 samples. It is not possible to sample the headspace repeatedly, as 1 L headspace only allows sampling once. Inflating with dry air again results in incorrect readings.

Reviewer's Comment P8 L20-21: does this refer to liquid analyses or the direct vapor equilibration method? Response This relates to direct vapour equilibration method. This has been added to the manuscript to clarify.

Reviewer's Comment P8 L21-22: how do these timespans compare to sampling time of the individual sample headspaces? If this is the precision reported by the manufacturer I would prefer to read about the precision the authors achieved when following their standard operation procedure (also in P9 L2) Response The sampling time of the individual headspace was from 35 to 60 seconds. After each full set of samples and standards the analysis was suspended for about 10-15 minutes to allow the LGR instrument to reach the stable readings of the ambient air. The instrument precision is reported in L21-22, but the reproducibility of the results resulting from this study is reported in L20-L21. Each dataset was corrected for the instrument drift, and when following the standard operating procedures, the precision in this research was 0.63‰ δ2H and 0.23‰ δ18O over 70 seconds.

Reviewer's Comment P8 L26: LGR's technology is called e.g. OA-ICOS, but not IRMS

Response Corrected typo to Off axis -integrated(OC-ICOS) cavity output spectrometry. The LGR used for liquid samples was not the same instrument.

Reviewer's Comment P8 L30: please provide a reference for the LOI method Response The reference for LOI is provided Heiri et al (2001) Reviewer's Comment P9 L5: this contradicts MS title which prominently mentions isotope data Response The authors consider it important to have a section in the manuscript which defines the stratigraphy, organic matter and moisture content as this helps understand and support the isotope data.

Reviewer's Comment P10 L4: what is "sub-angular" quartz? Response Term "Sub-angular" defines the roundness of quartz or any other sediment grain. This is important as it can point to information on transport of the material.

Reviewer's Comment P10 L5: please describe how grain size distributions were determined. If this information was taken from other publications, it should appear in section 2 rather than the result section. Response The description of the lithology in L5 and grain size was determined by logging the samples as soon as they were extracted. This included defining the lithology, grain size and colour. The logging was undertaken for this research on the core samples that were extracted and is not taken from other publications. A sentence was added to the methods section: The samples were geologically logged after extraction, by noting the lithology, grain size and roundness, matrix and colour. Additional sentence was added to results section: The cross -sections presented in Figures 3 to 5 were prepared on the basis of logged cores extracted as part of this research.

Reviewer's Comment P10 L9: "dark" is not a color Response Thanks, this has been clarified as follows: ''dark grey"

Reviewer's Comment P10 L10: can the authors please comment on the "organic smell". Volatile organic compounds likely have a strong effect on laser-based isotope analysis that needs to be considered for such samples. Response The ''organic smell' relates

here to peat sediments, pointing out to the high presence of organic material. This is not related to volatile organic compounds, which are not present in young (Holocene) sedimentary environments. This has been clarified in the manuscript.

Reviewer's Comment P11 L5: "can be explained" seems to be not only descriptive and should appear in the discussion rather than the result section Response Thanks, this was moved to Section 5.1

Reviewer's Comment P12 L1: please insert some specification after "of" Response The sentence has been reworded to read: The relationship between surface water, swamp groundwater, regional groundwater and swamp pore water the δ18O and δ2H data.

Reviewer's Comment P12 L3 & 8: the intercepts in the linear equations should have a the "unit" ‰ Response Thanks, the unit was added.

Reviewer's Comment P12 L9: it appears to me that the slope is slightly higher, but the intercept is similar Response We agree with the reviewer's comment for May 2017, the sentence was added to the manuscript: The exception is May 2017 when the slope of LMWL is slightly higher, but the intercept is similar.

Reviewer's Comment P13 L9: "likely to be": see comment on P11 L5 Response Thanks, this sentence was moved to Section 5.2.

Reviewer's Comment P14 L3 & throughout MS + supplement: stable isotope data should be consistently reported with two decimal places for _18O data and one for _2H data Response Thanks, this is corrected now throughout the document.

Reviewer's Comment P14 L5 "it seems unlikely": see comment on P11 L5 Response This sentence was moved to Section 5.2.

Reviewer's Comment P14 L10: this seems to be a misinterpretation potentially affecting overall results. This regression line is not to be mixed up with evaporation lines (See Benettin et al, 2018, for details). Further, it should not be interpreted in the results

section. Response Thanks, the sentence was removed from the results section. We agree that the regression line should not be mixed up with evaporation line and as per Benettin et al (2018). The sentence that was removed tried to explain the slope of the regression line, and differentiate it from the wet weather line. The text explains the importance of small and big rainfall events on the pore water response. The presentation of the rainfall isotopic signature and absence of direct correlation with swamp sediment isotopic pore water data, confirms the ideas discussed in Benettin et al (2018) paper. It is not considered that the sentence in question has bearing on the overall results, as matching of observed data to the model provides a clear indication of evaporation in the upper horizon for May 2016 dry weather sampling period.

Reviewer's Comment P14 L14: Since the authors present a LMWL, I would suggest to report lc-excess values (Landwehr & Coplen, 2006) rather than D-excess values Response We acknowledge that reporting lc-excess is a good concept, however in this research we consider that D-excess provides a better indication. The reason for this is because the slope of the LMWL is close to 8 similar to that of the GMWL. Another reason for reporting D-excess is to allow other researchers to use the results of this study by comparing to well-defined GMWL.

Reviewer's Comment P14 L15-20: this paragraph appears twice Response Thanks, this is now corrected.

Reviewer's Comment P14 L23: "we would expect": see comment on P11 L5 Response Thanks, this sentence was moved to Section 5.2

Reviewer's Comment P14 L25: "seems to suggest": see comment on P11 L5 Response Thanks, this sentence was moved to Section 5.2

Reviewer's Comment P14 L29: "may be": see comment on P11 L5 Response Thanks, this sentence was moved to Section 5.2

Reviewer's Comment P15 L8: "assumed to be": see comment on P11 L5 Response

Thanks, this sentence was moved to Section 5.2

Reviewer's Comment P16 L1 & 7: insert "values" or equivalent before "of pore" Response Thanks, word 'values' has been inserted

Reviewer's Comment P16 L8-9: "due to": see comment on P11 L5 Response Thanks, this was reworded as follows: ''however slightly more depleted and similar to significant rainfall in March 2017"

Reviewer's Comment P16 L11: is the number in braces a __-value? Response Thanks, word "values" added

Reviewer's Comment P16 L11: "is a reflection": see comment on P11 L5 Response Thanks, this was reworded to: ''and is similar to typical winter rainfall signature"

Reviewer's Comment P16 L13: isn't this just a water balance rather than a water and mass balance? Response True, corrected

Reviewer's Comment P16 L19: "very" = "vary"? Response Thanks, changed to ''vary"'

Reviewer's Comment P16 L26-27: the description how data were collected should be provided in the method section Response Thanks, this was moved to Section 3.2.

Reviewer's Comment P17 L8 & 9: "is related to": see comment on P11 L5 Response Thanks, sentence was moved to Section 5.1.

Reviewer's Comment P18 L12: "groundwater recharge" is misleading as it describes the replenishment of groundwater. I suggest to use "lateral groundwater inflow" instead. Response This has been updated as suggested.

Reviewer's Comment P18 L11-18: the information on e.g. slope, vegetation, age dating should be provided in the section describing the study site (section 2) Response The information as suggested by the reviewer has been moved to Section 2.

Reviewer's Comment P18 L22: why not report salinity data? Do they support the sur-

prisingly high evaporation estimates? Response The salinity data has been referenced here to another report (David et al, 2018), but please note the evaporation estimates are relatively high. This means that they are high for upland swamp and this specific environment but not high compared to evaporation at lower elevations. As a result, the evaporation does not cause an increase in salinity as expected in arid environments. Also, as mentioned, the regional groundwater contribution of fresh water also means that salinity is not an issue in this area.

Reviewer's Comment P18 L26: insert "values" or equivalent before "of pore" Response Thanks, the word 'values' has been added.

Reviewer's Comment P18 L27: discharge: see comment on P6 L7 Response Thanks, changed to ''inflow"

Reviewer's Comment P18 L30: I would expect that upward flow supporting high evaporation rates would result in an increase of EC in surface water. Response Upward flow is from the regional groundwater in sandstone, this water Is fresh and depth to water (4.5 m bgl) below evaporation influence. Therefore, no increase in EC is likely, in particular due to estimated groundwater contribution in the dry weather period.

Reviewer's Comment P20 L15-16: evaporation always occurs at the liquid-vapor interface (the "surface"). How can evaporation ("to at least 60cm") occur below the water table (28-38cm)? Response The sentence was not aiming to say that evaporation proceeds below the water table, but that if evaporation only was occurring, without regional groundwater inflow, then more water would be evaporated from the surface and the depth to water would be greater. This has been reworded.

Reviewer's Comment P20 L19: "measured"? This number was rather calculated than measured Response Thanks, this has been updated as per suggestion.

Reviewer's Comment P20 L25: this figure should be presented and described in the results section Response This figure, and Table 2 have both been moved to results

Section on Water balance.

Reviewer's Comment P21 L6: "clearly defined endmembers": see comment on P4 L18 Response The text has been reworded to say ''endmembers". As mentioned in the earlier response, although the rainfall signature changes, we can track this signature as there is a good dataset of stable isotope data for precipitation. A sentence was added as follows: Although the stable isotope data in precipitation changes in the short term, this end member is well constrained based on the good quality dataset for precipitation.

Reviewer's Comment P22 L1: difference in what? Response Thanks, text added '' in δ18O and δ2H values"

Reviewer's Comment P22 L9: "of precipitation" after "signature" Response Thanks, the suggestion was added

Reviewer's Comment P22 L27-28: This conclusion has been drawn before (Wassenaar et al, 2008) and can't be credited to the present study Response Thanks, reference added.

Reviewer's Comment P22 L29-32: this statement is not conclusive and rather belongs to the introduction Response Text has been moved to introduction

Supplement: how come that foil weights differ by more than factor 4? Did the authors not use standardized sample bags (e.g. Ziploc) with comparable weights? If not this would be a violation of the principle of identical treatment. Response The samples for gravimetric water content determination were dried in the oven, therefore they were placed in the aluminium foil cups. These cups, were not the same in weight for each sample. However, the standards under which this analysis was done (ASTM D2974-14, 2014 and ASTM D2216-10, 2010), allows for some change in weight. As a result, the equation to calculate gravimetric water content requires weighing of foil.
