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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Contribution of understory evaporation in a tropical wet forest" *by* C. D. Jiménez-Rodríguez et al.

Anonymous Referee #2

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The manuscript entitled "Contribution of understory evaporation in a tropical wet forest" by Jiménez-Rodríguez et al. aims to estimate the evaporation and the contribution of the different canopy layers of a tropical wet forest in Costa Rica. This was conducted through an energy balance approach to quantify fluxes and by using H and O stable isotopes to track water vapor sources. The main results show that half of precipitation (55.9%) was evaporated during the study period. Most of this evaporation is contributed by the overstory (66%), and the remaining comes in similar proportions from the upper and lower understory. The stable isotope analysis of plant water use revealed different sources (precipitation, stream and soil water) for the different plant functional types (palms, lianas, bushes and trees). Vapor water isotopic signatures were somehow homogeneous along the canopy column heights sampled, given they

overlap with each. However, they only overlap with few xylem water samples. This is an interesting study and the manuscript is well written. However, I have six main concerns that in my opinion need to be addressed before publishing. An improved version of the manuscript would be an important contribution to the understanding of dry-season lowland wet forests plant water sourcing and evapotranspiration contribution. Below there is detailed description of the six main concerns followed by minor edits/suggestions. General Comments: 1. There is a very detailed description of the general studied station/plot, sensors used, and equations applied to the data for estimations. At some points this even is excessive and details on towers and subplots that are not used particularly for this study can be skipped (for example simplifying Figure 1). However, there is a need of better explaining the specific sampling design for this study since the information is spread-out through the methods sections under different subtitles and in some cases sampling details and data handling are missing. For example, the sampling dates for each measurement should be stated early on the methods section together with the description of sensors/sampling. At the present version, the reader only gets that meteorological data was collected continuously throughout two months (the dry period) and the sampling for the isotopic analysis was performed during three sampling campaigns (A, B and C), for some samples (I think) on a daily basis (e.g. xylem) and for others every 6 hr (e.g. transpired water) by the end of methods section. How many samples per species/plant functional type were considered? Were these always the same species (and individuals) or was the sampling really done by functional types disregardless the species? (P6-L8-9). Also, from the description I couldn't understand if the soil samples were close to the xylem samples (ideally, they should in order to represent potential plant sources, and mostly considering soil samples n = 2). Soil was sampled at two depths: 5 and 15 cm (P6-L2-3). Given the measurements were carried out during the dry season, I would expect plants might be sourcing water to deeper layers than the ones sampled. Why did the authors not sample deeper layers? Given the net precipitation and evapotranspiration amounts during the sampling period, would the authors suggest that deeper plant absorption is negligible? Another concern related to

isotopic data is how this was handled: was field-campaign data averaged? Was data from all campaigns averaged? Or is it all data presented indistinctively? Finally, were there any statistical analysis made on what is described at P13-L31 and P14-L5-11? Please provide further details on this issues. 2. The measurements were performed on a single plot at La Selva Biological Station in the lowlands of Costa Rica. Working on tropical forests is complicated because of its diverse nature. Because of this issue and considering that only one plot was used for the study, it is important to highlight if there is an estimate of how representative of this ecosystem is this unique plot in terms of structure (canopy layers) and species identity and abundance. Focusing on only one plot would not be a problem if you can somehow link it to the surrounding ecosystem. If not, a lot of effort might have been put into a specific plant-soil arrangement that does not reflect the reality of the tropical lowland wet forest that is trying to represent. 3. The measurements were performed during the dry season. This was surprising since it is not the most representative weather condition throughout the year, and it only lasts two months. This needs to be pointed out at the manuscript. The tittle is misleading in this sense, given at its current format the reader expects a study of the typical "tropical wet forest" conditions. Isotopically speaking, working with dry-season precipitation might be a highlight given it might have a distinctive signal from the wet season if humidity sources differ among seasons. This could be seized when analyzing plant water sources by using the previous work that is cited throughout the text (Sanchez-Murillo et al. 2013) which analyzed precipitation isotopic inputs along the year. By terms of this data, the authors could check if any of the lacking moisture sources can be explained by wet-season precipitation signal stored within the soil profile. In line with this, on P13-L22-23, the authors mention that dry season rainfall events are more convective. 4. An extensive part of the manuscript is devoted to the energy balance description. However, sections 3.3 and 3.4 from the results seem enough for answering the aim of the manuscript, while sections 3.1 and 3.2 seem disconnected to the rest. The discussion has almost none of the elements of sections 3.1 and 3.2 and the link between the meteorological data with the isotopic data is poor. I suggest the authors revise

which results strictly address the aims of the manuscript or revise the aims to include all presented results and that this is balanced and cohesively presented throughout all sections of the manuscript. Also, and in line with comment 2, there is no explicit hypothesis and/or explicit relevance of the study that justifies and drives the attention of the reader. For example, understanding the contribution of canopy layers to lowland forests evaporation during dry season in the context of global changes (forest retraction due to deforestation / thinning of forests - i.e. prevailing of overstory / climate change). The manuscript needs a conductive thread for keeping the author from feeling it is a mere description of evaporation patterns at a single plot. I see the relevance of this study for lowland forests' evapotranspiration knowledge; but the authors need to make it explicit. 5. Spatially there is not much to say about the isotopic analysis, because of the low spatial representativeness. But temporally, the three sampling periods show very different precipitation characteristics (intensity, duration and amount - clearly shown on Figure F1). A temporal analysis on their isotopic differences and consequently, on plant-water sourcing would be interesting to see. I suggest the authors do more bold analysis following temporal questions on the isotopic sampling. 6. Given the number of figures and tables, and the relevance of each figure/table, I would suggest moving Table 1 (list of sensors) to an Appendix and including Figure H1 (dual isotope plots per sample type) to the main text. Even though Figure 6 contains all data together from Figure H1 which is needed, the latter breaks the different samples in different panels which is graphically clearer for a deeper assessment of the isotopic analysis.

Minor comments - P1-L18. "focused" on past tense. - P2-L25-26. Even though isotope fractionation during root water uptake was considered for many years as something that occurred only in xerophytic or salt-tolerant species (e.g. Ellsworth and Williams 2007, Plant Soil, 291(1–2), 93–107); you should recognize that there is growing evidence that shows that fractionation might be more common than previously thought. For example see: Martín-Gómez et al. 2017 (Tree Physiol., 37(4), 511–522); Vargas et al. 2017 (New Phytologist, 215, 582–594); Barbeta et al. 2019 (HESS, 23(4), 2129-2146). Discussing if the wet tropical species studied here show/or not fractionation

in light of those studies would be interesting. - P3-L28. Provide full name of species when first mentioned. - P8-L4-10. There is a confusion with d-excess. The d-excess is defined as d = d2H-8*d18O by Dansgaard 1964. This is an index of non-equilibrium of global precipitation (i.e. derived from the GMWL). What the authors are referring to here is the line-conditioned excess, lc-excess, proposed by Landwehr & Coplen (2006, International conference on isotopes in environmental studies, Pp. 132-135, Vienna: Int. At. Energy Agency), which is defined as lc-excess = d2H-a*d18O-b, where a and b are the coefficients of the local meteoric water line. - P9-L25. Be consistent in the way you present the date; in most places it is presented as year-month-day and in others day-month-year (for example compared to P9-L7-9). - P10-L6 and L20. Most of results are presented in past tense, here they are in present, use the same tense across the results section. - P11-L8-9. Move this sentence to discussion. - P17-L3. I suggest the authors discuss on water partitioning between trees and lianas in the light of the article by De Deurwaerder et al. 2018 (Tree Physiology 38, 1071–1083). This article also discusses on water partitioning between trees and lianas at dry season on tropical forests of French Guiana. Like this study, the authors found that lianas use more shallow soil water. - Section 4 (conclusions). The conclusions are a repetitive description of the results. The manuscript would benefit with deeper implications of the study for the understanding of understory/overstory evaporation fluxes in tropical wet forests during dry season. - Please revise the figure captions. In general, they are short and little descriptive. Captions should be self-explanatory.

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