

Comment on hess-2022-328

Anonymous Referee #2

Referee comment on "Technical note: Validation of Aleppo pine transpiration rate measurements using the heat ratio method under laboratory conditions" by Ana M. Sabater et al., Hydrol. Earth Syst. Sci. Discuss.,
<https://doi.org/10.5194/hess-2022-328-RC2>, 2022

The main objective of the study is to validate sap flow laboratory-made sensors based on the HRM method, a method mainly recommended for reverse and low-intermediate sapflow rates, therefore recommended for plant species growing under limiting environmental conditions such as Aleppo pine trees. Measurements are carried out in three young trees under controlled conditions for about sixty days, and then compared with the readings of precision load cells for subsequent validation. In addition, the work has two other complementary objectives, the first is to study the effect of a dynamic calibration of the base flow (in case zero flow is not achieved under environmental conditions when it is expected) as a consequence of probe misalignment, and to study the responses of sap flow to the environmental variables of REW and DPV. In my opinion, the topic is of interest to HESS readers since it presents a methodology that has been used for Aleppo pine but has not been validated under laboratory or field conditions. However, I am afraid that the work has significant weakness points that makes its publication unsuitable for a journal like HESS unless the authors can improve the study by increasing tree sample size and the range of environmental conditions to be clearly representative of natural conditions for Aleppo pine, apart from other aspects that are indicated below. First, the small number of individuals used in the experiment does not allow an adequate quantification of tree variability, and therefore, to properly test the method. On the other hand, the environmental conditions during the experiment do not seem to be representative of the ranges observed/ expected under field conditions, making the study incomplete to test the validity of sapflow sensors for natural conditions of Aleppo pine, which is in turn one the main purposes of the study. Third, the study has the complementary objective of testing a dynamic calibration for probe misalignment (that is recommended for periods greater than 3 months), but in the end the work applies a systematic approach based on the study they follow, and therefore it seems very similar to the classical approaches where the correction does not vary with time since installation. Finally, I consider the objective of studying the relationships between transpiration and environmental variables for the conditions presented in the work (not representative of the natural ranges and for young individuals) do not contribute to the topic, especially

when there are other published works that have already described them for mature Aleppo pine trees growing under natural conditions.

Other suggestions:

L40-41: please indicate for which region/s you are indicating these expected changes.

L42-43: Climate will affect water use but also other important processes related to ecosystem functioning and survival. This sentence should be improved.

L45: Please consider this change to be carried out: "and therefore, for a better definition of the required adaptive forest management".

L47-48: delete "water fluxes to the atmosphere".

L49: I suggest "at the annual basis".

L49-51: This sentence requires supporting literature: "Additionally, transpiration provides plant-level information and is important in water status, leaf cooling and nutrient transport"

L52: I suggest changing "inferred" by "measured".

L52-61: This sentence is too general and misses information about main differences among the approaches, implications of using one method instead the others, others methods, etc. Also, I would suggest to improve the citations in order to indicate the most significant works for each category. In my opinion, you should better explain why the sap flow technique is the most use one given that the current explanation is quite simple (take also into account you mention "leaf measurements" but you don't mention any method before based on this type of measurements such as chambers or porometers). L61: I am not able to follow this sentence, please review it: "...can be applied irrespectively of both orographic and atmospheric conditions".

L62-63: Please add references to support your statements

L65: Replace “works” by “articles”; please indicate more articles. The sentence “is quite reliable for determining transpiration” should be better defined due to under its current form is quite imprecise.

L66-72: A better explanation of the HRM method is required and then entering into the advantages of using it versus other approaches. I think this entire paragraph you should be rewritten.

L73: Consider to include this part in the previous section.

L108-L110: I am not able to follow this statement: “This study tries to offer a response to the need to perform calibration on sap flow probes in an isohydric water-saver species (i.e. low transpiration rates) by providing high-quality sap flow data (Dix and Aubrey, 2021)”.

L114-116: Please consider to remove this as an “auxiliary” objective and all the related sections (material and methods, results in 3.2). As any experimental environmental study developed under laboratory conditions, you should secure to obtain representative data for the ranges of environmental conditions describing the expected field variations. In this sense, you should clearly explain and describe the environmental conditions under the experiment was developed. In fact, in the discussion section you mention low REW and high VPD conditions were not simultaneously achieved during your experiment, thus this common drought pattern for Aleppo pine was not properly covered for your sapflow experiment (also indicated in figure 2). Please consider then to remove this as an objective, and explain better the environmental conditions during your experiment (irrigation doses, soil water content dynamics, solar and VPD dynamics). In addition, transpiration relationships with REW and VPD are widely described in several works for Aleppo pine under field conditions, thus reporting them under laboratory conditions is not contributing with relevant information for the subject.

L130: I suggest to include substrate in the title: “Plant and substrate materials”. I suggest to move all the basic parameters for sap flow calculations to the section 2.3 focused on the HRM method (wood density, sapwood area, etc.).

L132-133: Information about plant structure is required (height, diameter).

L134: Please replace “measured” by “estimated”

L150-152: I am not able to follow what you mean here; please remove the sentence if you are indicating that you calibrate your load cells, as this is obvious.

L154-158: Please rewrite to remove repeated information. Also, I am not sure about the way you explain your approach here. I understand that water loss measurements are the way to validate your sap flow sensor, since they are the true values. I would suggest to modify this part to highlight this fact and not considering them at the same level as in the current form.

L161: I am not sure about this explanation (The limitation of having only three individuals was overcome by including a long experimental period (57 days) using half-hourly measurements); are you sure that temporal variation is comparable to tree-to tree variation?

L164-168: The description of your sap flow sensor construction is further explained in Appendix A but I think some significant information should be indicated also here (heat pulse energy, number and distance of radial measurements, aspect where sensor is installed). Please, consider to add heat pulse energy and distance of radial measurements as well to the Appendix A.

L172-192: Since Larsen et al. (2020) stated that their correction is suitable to be applied when measurements are taken for more than 3 months, I don't properly follow why you applied this approach here. I see you consider a fixed correction (L188-190) based on Larsen's approach. Larsen approach is a dynamic calibration based on changes on zero flow with time. I believe that your experimental design is therefore not suitable to address this properly, given the duration of your experiment and the corresponding fixed correction you applied.

An important aspect that should be mentioned and clarified is that probe misalignment is not expected when sensor needles are properly installed. In this sense, the small differences you show in the result section when comparing uncorrected and corrected lectures seem to be related to that fact, and therefore, the necessity to apply a correction factor is not justified. This would again imply that your experimental design is not suitable to apply a dynamic calibration.

Another important point is that you do not mention anything about wounding effect and the corrections proposed for addressing this. Did you apply the classical approach by Swanson and Whitfield (1981)? Other? Please, clarify this. In case you don't correct your lectures, you should also justify why.

L165: I am not sure about Williams et al. (2004) as the more appropriate reference here. I would indicate Marshal (1958) instead of.

Figure 1. What about the linear behaviour of residuals from 0.20 cm/h on in subfigures c) and d), especially from pine 3? I think you should further discuss this aspect

Please consider combining Tables 1, 2 and 3 in order to ease the comparisons.

Consider to include “,” after et al. in all the references.

Although text flows well, the english should be deeply reviewed since there are several mistakes and sentences which should be rewritten.