

***Interactive comment on* “Technical note on long-term probe misalignment and proposed quality control using the heat pulse method for transpiration estimations” by E. K. Larsen et al.**

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Overview: Larsen et al. in this Technical note address two important issues of sap flow measurements with the heat pulse method, namely (i) data filtering/quality control of the raw heat pulse records, and (ii) errors due to misalignment of the sap flow probes. The authors suggest some statistical thresholds/filters to be applied in the raw heat pulse ratios for data cleaning and present a time-dependent correction to account for probe misalignment. Moreover, they demonstrate the importance of such uncertainties for robust transpiration estimates, by presenting sap velocity and transpiration estimates with and without applying the proposed correction. I find the study topical

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and of interest for the scientific community working on transpiration estimates with the heat pulse sap flow method. However, I feel that the manuscript needs major revisions to better present the motivation and rationale of the study, the developed methods, and the broader implications of the obtained results.

Main comments:

1. The text needs significant editorial improvements to eliminate vague/unclear wording and grammatical errors. Moreover, several parts of the text (including the abstract) need to be revised/rephrased/rewritten to improve the clarity of the text and better communicate the design of the study, results, discussion and conclusions. I have highlighted few specific points below (see Specific comments), yet several other cases exist throughout the manuscript.

2. The methods need to be revised and clarified. In some parts, there are inconsistencies and it is hard to follow. Sometimes the authors refer to V as sap velocity (L130) and other times as heat pulse velocity (L113, L135). Please clarify and use consistently the terms/variables/abbreviations throughout the manuscript. Also, the selected thresholds (L153-161) for the raw data filtering need to be better justified, since at the moment seem quite arbitrary or could be interpreted as case-specific. Also, the data from all eight sensors (or averages across trees, since two sensors per tree were deployed) should be presented, either in the main text, or in the supplementary material. Apart from Fig 5, all figures illustrate data from a single sensor. In addition, more details should be provided in the methods session on how the positions of sensor misalignment were estimated in Fig 2 (and the misalignment for all eight sensors would be interesting to be illustrated, too).

3. I feel that the hydrological community and the readership of this Journal, would appreciate also some figures with the up-scaled transpiration estimates and the resulting biases do to probe misalignment, complementing the existing figures with the sap velocities and the results presented in L265-268.

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4. The suggested time-dependent correction accounts for two effects: probe misalignment and wounding effects. The current experimental design does not allow to disentangle the two. Therefore, the text should be revised so it is clear that the proposed correction addresses issues related to both wounding and probe misalignment.

5. I suggest to include a comparison between sap velocities/transpiration estimates averaged throughout the study period/growing season as calculated with (i) no wounding correction, (ii) traditional (no time dependent) corrections, and (iii) the presented time-dependent correction. This would better emphasise/illustrate the advantages of this Technical note.

Specific comments:

Abstract: the study location, tree species, number of instrumented trees, study period should be clearly stated in the abstract.

L16: 'Whole-plant transpiration' reads redundant, just 'Transpiration' should be enough here.

L17: and Hydrology.

L18: 'wide application range' and L19: 'ready automation': unclear what you mean here. Please consider revising/rephrasing. Similar for 'data readings', I guess what you mean here is the sap flow sensors can provide long-term measurements of sap flow in tree stems with high temporal resolution (e.g., minutes, hours etc.).

L19: 'Several different': reads redundant. 'Several methods' or 'Different methods' should be enough. L20: how the methods were adjusted to different climatic conditions? Unclear statement. Maybe 'tested' instead of 'adjusted'?

L21: 'in the method', unclear to which method you are referring to, here. Please rephrase/revise.

L21-22: if you focus only on the heat pulse method, then that is probably fine, but if

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you are referring to sap flow methods in general, then additional sources of uncertainty should be listed here, e.g., Granier's empirical parameters, zero-flow conditions, see for example:

Flo et al. (2019), A synthesis of bias and uncertainty in sap flow methods, *AGU*, doi:10.1016/j.agrformet.2019.03.012, 271.

Peters et al. (2018), Quantification of uncertainties in conifer sap flow measured with the thermal dissipation method, *New Phytol.*, doi:10.1111/nph.15241.

L23: 'readings' is not the right word here. The readings are what is recorded in the data logger, the proposed method is a data-preprocessing method that can improve the final sap flow estimates, and ultimately the whole-plant transpiration values.

L25: 'imply' is not the right wording here.

L26: 'statistical record to be recorded' unclear what you mean here, please revise/rephrase.

L27-29: This sentence is hard to follow: standard deviation and slope of which quantity? Please revise/clarify.

L40-42: to which direct measurements of transpiration you are referring to here? Please clarify.

L50-54: I cannot follow how the eddy-variance method comes to the discussion here. Eddy-covariance measurements of latent heat are not tree transpiration measurements, but evapotranspiration measurements at the landscape level (including soil evaporation, evaporation from interception, transpiration from over- and under-story, etc.).

L90-100: mentioned that you deployed eight sensors in total, two per tree. I found this information further below in the text, but this has to be very clear from the methods session.

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L94-97: mention the specific depth where the thermocouples are located, and thus the heat velocity is measured. I found this information mentioned in a figure caption (L229) but has to be included in the methods description.

L138: you are referring to the raw heat velocities here I assume and not to sap flow measurements. Here and throughout the text clarify and use carefully and consistently terms such as heat velocity, sap velocity, and sap flux density.

L154: 'ratio' of what?

L160-161: please provide more details on how the specific threshold for the slope was selected/defined.

L286 'Filtration' please change to 'filtering' or 'pre-processing'

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019-257>, 2019.

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