

Response to editor/reviewer's comments on HESS-2024-373 'Assessing deficiencies in remotely sensed actual evapotranspiration (AET): introducing AET signatures'

#	Remarks to author by	Author's response
a)	Editor	
1	<p>Dear Hansini Gardiya Weligamage and co-authors,</p> <p>thank you for implementing the comments of the reviewers. Both reviewers find that the ms was improved substantially. Reviewer 1 thinks the paper is ready for publication, Reviewer 2 has some more propositions for improvement. I agree that the ms has much improved, but I more with Reviewer 2 and see further room for improvement. I also have additional comments on the manuscript from my own reading to be implemented in another review round. Please proceed as earlier and answer to all comments and suggestions in a step by step response and attach a version of the ms with track changes to support the review process.</p> <p>I am confident that the additional suggestions are easy to implement and I am looking forward to the next version of this ms.</p> <p>Kind regards, Anke Hildebrandt</p>	<p>Dear Anke Hildebrandt,</p> <p>Thank you for informing us about the reviewers' responses to the first round of revised manuscript.</p> <p>We were happy to further improve the manuscript and have revised it by incorporating both your comments and those from the reviewer.</p> <p>The changes have been in response to the comments listed below.</p> <p>Thank you</p>
	Additional comments	
2	<p>Here are my additional suggestions. With kind regards, Anke Hildebrandt The introduction of the signatures is still not easily accessible in the current form. Section 2.1 should be carefully organized and visually structured such that all signatures can be found easily and Table 1 is not required any longer.</p> <p>Feel free to introduce subheadings for each signature and number them in the text as it is now the case in Table 1.</p> <p>All equations, including those for signatures, should be set apart in their own line, numbered and all the symbols be explained.</p> <p>There is not need to repeat the equation itself in prose (e.g. like in Line 108-109).</p>	<p>Thank you for these couple of comments.</p> <p>In the revised manuscript, we have included a figure (Figure 1 in the revised manuscript) to visually represent the AET signatures, and the previous Table 1 has been removed.</p> <p>In addition:</p> <p>Subheadings have been introduced for each signature. Please refer to sub section 2.1.1 – 2.1.8</p>

		<p>All equations are now set on their own lines, with all symbols clearly defined.</p> <p>We agree with this point and the revised manuscript no longer repeats equations as before.</p>
3	<p>I strongly suggest to refer to the guidelines for the use of units, symbols and equations in hydrology by the IAHS: https://iahs.info/Publications-News/Other-publications/Guidelines-for-the-use-of-units-symbols-and-equations-in-hydrology/</p>	<p>Thank you for this link.</p> <p>We referred to it and simplified the equations as possible.</p>
4	<p>The equations are currently hard to digest as there are multi letter variable names with mixed with prefixes and indices. The readability of the equations would be improved, if they would be written in the compact form. This could be achieved, for example, if all variable symbols would consist of only one letter and everything else be moved to the index, e.g. PET would be E_pot, normalized potential evapotranspiration would be E_pot,norm,m or shortened further by using a prime E_{pot,month}' (the prime indicating the normalization).</p>	<p>We agree with this comment. Incorporating the suggestion, we specifically improved the AAP signature, which previously had distinct difficulties in interpretation.</p> <p>However, we retained the AET and PET notations rather than using E_{pot}, and E_{act} forms, as they are more commonly used in hydrological literature. Using E_{pot}, and E_{act} forms would also complicate other equations (e.g., CV and Water stress) by introducing additional subscripts ('pot' and 'act').</p> <p>However, following the reviewer's comment in #7, we removed the temporal information to simplify the notations in equations.</p> <p>Example of changes to the equations:</p> $AAP = \frac{\sum_{i=1}^{n-1} \frac{1}{2} (E_i - A_i + E_{i+1} - A_{i+1})}{\sum_{i=1}^{n-1} \frac{1}{2} (\max(E_i, A_i) + \max(E_{i+1}, A_{i+1}))}$ <p>where, E is the normalised monthly PET and A is the normalised monthly AET, and i is the monthly timestep</p> $CV_{monthly} = \frac{S_{AET}}{AET}$
5	<p>In the use of the equations, please adhere to the mathematical meaning of the symbols, for example, the integral sign in the AAP signature is not mathematically correct. These are discrete values and therefore they are sums not integrals.</p>	<p>We agree with your comment and the equation (eq 4) was revised as follows:</p> $AAP = \frac{\sum_{i=1}^{n-1} \frac{1}{2} (E_i - A_i + E_{i+1} - A_{i+1})}{\sum_{i=1}^{n-1} \frac{1}{2} (\max(E_i, A_i) + \max(E_{i+1}, A_{i+1}))}$

		where, E is the normalised monthly PET and A is the normalised monthly AET, and i is the monthly timestep
6	Some signatures do not require equations (such as the 12-month lag correlation of monthly AET) in those cases there is no need to use equation typesetting.	Agreed and we have removed equation type setting from signatures such as median of annual AET (section 2.1.2), Periodicity (section 2.1.3), and timing of the seasonal peak (Section 2.1.4).
	Detailed Comments	
7	Line 91: I believe with sigma you mean the empirical standard deviation? Please specify. Indeed, you could even write out the standard deviation. Also just as a note, in my experience sigma is mainly used the theoretical distributions, and s is used for empirical standard deviations. Finally, in order to decrease the size of the indices, I propose to only use the annual in the index of the CV to distinguish between monthly and annual scale, but only mention it in the description around the equation.	Thanks for highlighting this. As per the suggestion annual CV (similarly monthly CV) was revised as follows: $CV_{annual} = \frac{s_{AET}}{\overline{AET}}$ where s_{AET} is the sample standard deviation of annual AET, and \overline{AET} is the sample mean of annual AET Similarly, monthly CV and water stress equations were revised. Please refer to equation 2 and 3
8	Line 114 (AAP): A sum should be used instead of the integral, as this this metric is calculated based on discrete measurements or model output.	We agree with your comment and the equation (eq 4) was revised as follows: $AAP = \frac{\sum_{i=1}^{n-1} \frac{1}{2} (E_i - A_i + E_{i+1} - A_{i+1})}{\sum_{i=1}^{n-1} \frac{1}{2} (\max(E_i, A_i) + \max(E_{i+1}, A_{i+1}))}$ where E is the normalised monthly PET and A is the normalised monthly AET, and i is the monthly timestep
9	Lines 103 consider using the term „intrannual“ temporal variation in line with Line 91 (interannual variation).	The sentence is revised as follows L107 - The intra-annual (monthly) variability is quantified using <i>coefficient of variation of monthly AET</i> ($CV_{monthly}$).
10	Line 119-121: The formulation of this sentence is confusing and probably accidentally includes two messages. The second part of the sentence refers to the denominator, and can therefore not be the reason for how the nominator is calculated. Please review.	Thank you for highlighting this. This sentence is revised and moved in the paragraph as follows: L125-130: “Then, the numerator is calculated by applying the trapezoidal rule to the absolute difference between normalised monthly PET and AET. Taking the absolute difference between values in the numerator captures the degree of asynchronicity between AET and PET curves, regardless of which of the curves happens to be greater at the given point in time. The denominator of the metric is then similarly calculated

		using the trapezoidal rule applied to the maximum value among normalised PET and AET at each monthly time step.”
11	Line 133: Please also move the equations stating the calculation of the anomalies up here and explain all used symbols. Are P_{anom}^2 and AET_{anom}^2 summed over the entire record? Can you add this information maybe be indicating over which indices the sum in the denominator runs?	<p>Thank you for this comment. Each symbol is now explained in the revised manuscript under section 2.1.8 as follows and also the denominator of the equation was improved including the indices info.</p> $R = \frac{\sum_{i=1}^n P'_i * AET'_i}{\sqrt{\sum_{i=1}^n P'_i{}^2 \sum_{i=1}^n AET'_i{}^2}}$ <p>where,</p> <p>i indexes rainfall events which exceed the predefined rainfall threshold.</p> <p>P'_i is the rainfall anomaly for event i, defined as:</p> $P'_i = P_i - \bar{P}$ <p>with P_i is the rainfall depth of event i, and \bar{P} is the mean rainfall calculated from all the selected events exceeding the predefined rainfall threshold.</p> <p>AET'_i is the AET anomaly associated with the rainfall event i, defined as:</p> $AET'_i = AET_{i+j} - \overline{AET}$ <p>j is the lag (in days) at which the maximum AET occurs after rainfall event i, with $0 \leq j \leq 10$ in this study</p> <p>AET_{i+j} is the maximum daily AET observed within a window of up to j days after rainfall event P_i, and</p> <p>\overline{AET} is the mean of maximum AET observed across all the events.</p>
12	Table 1 last line, signature 8: With „position of the rainfall event“ do you mean the starting day? Please formulate more specifically. I am assuming that the equations are applied to daily time series? Can you specify?	<p>Thank you for this comment. This comment and the above comment refer to the same signature. As per the above response, we have revised the equation and defined each symbol.</p> <p>We hope that clarifies this comment.</p>
13	Line 196: Please add here (not as Reviewer 1 suggest in the figure caption, where it first appears) equations for how the NSE and KGE are calculated and cite the original publications. Please also give a reference for how their components are differentiated.	<p>NSE and KGE metrics are cited in L228, equations are added and variables are defined from L238 – 248 in the revised manuscript.</p> <p>References are added under References.</p>

14	<p>References: Please correct the citation for Gardiya Weligamage et al., 2025. This manuscript is still a preprint, but it currently reads like a published paper. The proper citation is:</p> <p>Gardiya Weligamage, H., Fowler, K., Saft, M., Peterson, T., Ryu, D., and Peel, M.: Using evapotranspiration signatures to assess evapotranspiration realism in rainfall-runoff models, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2025-3373, 2025.</p>	<p>Thanks for highlighting this.</p> <p>The reference was corrected as suggested.</p>
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