

Response to reviewer 1

viewer 1	Authors
it's not clear. do you mean 'estimates at the scale of irrigation scheme'?	Yes, we have revised this to field-scale ETa estimates were validated using a smart field weighing lysimeter and the algorithms estimates were evaluated at irrigation-scheme scale using weather-station-based extrapolation
why is this the most important?	We have removed the statement, and revised the section.
if SEBAL is the best-performing algorithm, why specifically mention the reliability of this one? why not highlight its strengths?	We have revised to: While SEBAL is the second-best performing algorithm, the validation of VI-ETa approach in estimating ETa against lysimeter measurements demonstrated its reliability with strong correlations and low error metrics, as a result, the VI-ETa algorithm is a computationally efficient alternative. The uncertainty analysis indicated that extrapolated ETa estimates were reliable within $\pm 7-12\%$. The study demonstrates the potential of accurate ETa estimation to support better irrigation scheduling, which may lead to reduced water overuse, in water-scarce environments
suggest removing this	We have removed the statement.
what kind of measurements? Can we really measure ETa or we can only estimate through proxy, such as changes in soil moisture content in lysimeter?	We clarified that ETa is derived from lysimeter mass balance measurements which include changes of mass due to changes in soil moisture variability.
This reference proposes a method for irrigation scheduling, not supporting the statement "farmers will either over-irrigate or under-irrigate".	We have revised the citation to: (Abd Elbasit and Ratshiedana, 2024).
Include reference Allen, R.G., Pereira, L.S., Raes, D. and Smith, M., 1998. Crop evapotranspiration-Guidelines for computing crop water requirements-FAO Irrigation and drainage paper 56. Fao, Rome, 300(9), p.D05109.	We have included Allen et al. (1998)
From Allen et al. (1998): ETc is "the evapotranspiration from disease-free, well-fertilized crops, grown in large fields, under optimum soil water conditions, and achieving full production under the given climatic conditions"	We have revised: The difference between ETc and ETa is that ETa is influenced by the actual field conditions which are determined through actual field measurements while ETc is based on estimations based on standard Kc values. ETc represents how much water the crop would ideally use, whereas ETa represents the actual amount of water that the crop has used.
Tells was removed	We have removed tells
remove. use abbreviation after defined	We have considered using the abbreviation.
enough for what. How many is enough?	We have revised this and explained more: These stations are still not enough in most parts of South African agricultural landscapes to be representative of field-scale ETc estimation with high accuracy (Ncoyini et al., 2022). According to Ramoelo et al. (2014) South Africa currently

	has only two open-access FLUXNET eddy covariance stations, insufficient for national-scale ET validation across heterogeneous agricultural landscapes.
Since you used the definition of E_{Tc} from Allen (1998), this K_c determination is only true if E_{Ta} is measured for crops under optimal management conditions. You still need to edit this sentence to clarify the difference	We have revised this into: E_{Tc} represents evapotranspiration from disease-free crops grown under optimal soil water and management conditions (Allen et al., 1998), whereas E_{Ta} reflects actual field conditions including water stress.
E_{Ta} under standard conditions (i.e. "from disease-free, well-fertilized crops, grown in large fields, under optimum soil water conditions, and achieving full production under the given climatic conditions")	Revised as recommended
Suggested E_{Ta} not ET	Changed to E_{Ta}
Surface Energy Balance System Su, Z., 2002. The Surface Energy Balance System (SEBS) for estimation of turbulent heat fluxes. Hydrology and earth system sciences, 6(1), pp.85-100.	Revised: model developed by Su (2002) was implemented
Suggested at seasonal scale	Included "at seasonal scale"
you mean SEBS model by Su (2002) or SEB models in general, including SEBAL?	SEBS by Su (2002)
Suggested the use of and Not however	'and' included
Suggested the use of from sources not from areas	Included from sources
Suggested inclusion of were used to developed	We included "were used to developed".
Some sections were circled for removal	We removed all the marked areas.
Error on map: irrogation	Revised to irrigation
You indicate in the first panel that the peak in load cell is due to irrigation event. Could you say something about rainfall events during the experimental period? Was there any rainfall? Was rainfall amount considered in the water balance?	We have included something on rainfall on the text and demonstrated the exclusion of such days in the formulas. Rainfall depth (mm) was aggregated to daily totals and incorporated into the water balance equation alongside irrigation inputs.
Suggested add reference	Reference added: (Chakouri et al., 2020)
Use where not were	Revised to "were used to develop"
Suggested adding were done	We added "were done"
is precipitation also negligible during zero-irrigation days? Did you measure precipitation?	Yes, precipitation was measured using a tipping bucket rain gauge as indicated.
if 1 kg of water in lysimeter equals 14 mm, then in equation (1), it should be $14.14 * (\Delta D - \Delta S)$ to convert kg to mm. Because this is an equation, both sides should have the same unit. I assume the unit of E_{Ta} on the left side is in mm like in equation 2. You cannot subtract kg from mm without conversion even if it's negligible mm	We have revised the equations

check the font type to follow authors' guide. E _{Ta} , should be regular, not italic since it's multi-letter variable. L _m and D _m should have 'm' in subscript	We have revised this part in the manuscript
include these formulas, either in main text or appendix/supplementary.	Included the NDVI formula in supplementary material Equation (S7)
which models exactly?	The linear models
what kind of relationships? do you refer to linear relationship in Equation 6?	Linear relationships
o must be subscript, same in equation 5 and 7	O has been standardized
U ₂ in FAO56 E _T formula strictly means windspeed measured at 2 m. If you measured windspeed at 1.2m, you must convert to 2m windspeed using wind profile relationship (see equation 47 in Allen et al., 1998). This will increase your windspeed by 12% and affect your results	Measurements were done at 2 m as indicated on Moeletsi et al. (2022)
why this and not 0.34 as in Allen et al., 1998?	We corrected the typo of 0.38 to 0.34 for daily timestep grass reference crop as per Allen et al. (1998).
refer to Table S2	We have referred to Table S2 in the manuscript
consider using consistent variable, either LST or T _s , not both	We changed to LST consistently throughout the manuscript.
how were these anchor pixels selected?	We have explained how the pixels were selected as: the hot pixels were identified over dry, bare soil surfaces characterized by high LST and low NDVI values, representing conditions of minimal ET. Cold pixels were selected over dense vegetation areas exhibiting high NDVI and low LST which are indicative of maximum E _{Ta} under well-watered conditions. The anchor pixels were selected manually following the standard SEBAL methodology to ensure that they represented the extreme energy balance conditions within each satellite scene.
either 'The SEBS approach' here or full form. Also, the same for 2.4.2	We have used SEBS
which theory?	We have removed this part.
which variables specifically?	Variables including air temperature, wind speed, relative humidity, incoming solar radiation and incoming longwave radiation
what are NDV _{imin} and NDV _{imax} ? are they min and max of a scene or constant values for every scene?	NDV _{imin} is the minimum NDVI and NDV _{imax} is NDVI maximum
Reviewer suggested selective	We have included selective
should also include LST	We included LST, see Table S3.
Add labels of crop type	We have added the labels of crop type
what strikes me is that day 159-255, the NDVI-K _c relationship is different from day 255 onwards.	We understand the reviewer's observation. However, during DOY 159–255, the crop was in the vegetative to mid-season growth stage, where canopy development was increasing

	NDVI reflecting green biomass and leaf area, Kc increased consistently with NDVI due to rising transpiration dominance. In this phase, the NDVI–Kc relationship was strong and nearly linear as ET was being largely controlled by canopy transpiration. However, after DOY 255, the crop entered the late season where leaf chlorophyll declined while some structural biomass remained. As a result, NDVI may remained relatively high due to residual canopy structure, as a result; Kc declined due to reduced transpiration and stomatal activity This led to a decoupling between NDVI and Kc where NDVI no longer represented crop water use accurately.
In previous review, I suggested averaging ETa values across all 4 models to produce mean or CoV maps of 4 models, and not "averaging across time" like authors interpreted. This is to show how 4 models agree and disagree spatially. Please include as requested.	We have included maps of mean ETa.
Although the labels of colormap seem homogenized across all models, the maps themselves look exactly the same as in previous version. For example, in CWSI (27October2019), the range was 2.31 to 6.8 in the previous version. I would expect that when you change the range to 0-9.5, the color of the map would be closer to yellow since you decreases the minimum and increase the maximum. However, the new map looks exactly the same as before. Please double-check that you have changed visualization range, not only the labels	We have revised the maps as suggested.
this is not "minimal". For on-farm irrigation application, <1mm/day MAE is only acceptable	We have revised this section.
You mean "seasonal ETa"? In fig6, SEBS actually does not perform well in terms of daily ETa (MAE is 1.17 mm/d, bias of 0.89 mm/d)	We have revised this section.
the table missing the result of CWSI	We have added CWSI on Table S4.

Response to reviewer 2

Reviewer 2	Authors
This title does not match the one included in the response to reviewers	The title on the manuscript is the latest revised title.
The information in this table is not necessary to follow and can be easily accessed by readers from multiple sources.	We understand the reviewer’s suggestion; however, we understand the table is very short and makes it easier for readers or those reproducing the methods using these bands.
This selection deserves an explanation	Anchor pixel selection described

Change farm to field	Changed to field
Reviewer suggested: and would not comply with the requirements of some modeling schemes, as the CWSI	Added “and would not comply with the requirements of some modelling schemes, as the CWSI”.
It is more logical to present the validation of the methods at the point scale using lysimeter measurements first, and then perform a scale-up to analyze the irrigation district.	Presentation revised
These values does not agree with figures in Fig.8	We have revised this section.
The figure demonstrates that the adjustment of VI is superior to SEBAL, which tends to both overestimate and underestimate measurements similarly, leading to a reduction in bias. This should be acknowledged in the text, including a discussion of the RMSD difference, as the current text suggests the opposite of what is illustrated in Figure 6.	We have revised this section.
These values were swapped because the lowest values corresponded to VI rather than to SEBAL, as stated in the text.	We have revised this section.
Unless Figure 8 is mistaken, this conclusion is very surprising, as the results in both Fig. 6 and 8 indicate that VI-ETa performs better than SEBAL.	We have revised the errors.
What implications does the comment refer to?	We have revised the discussion to: This study focused on the evaluation of multiple remote sensing-based ETa algorithms against lysimeter observations and extrapolated ETa values using weather stations. The main findings of this study were the observed differences in model performance. The findings indicate that the VI-based ETa algorithm produced the most accurate estimates, followed closely by SEBAL, while SEBS showed comparatively lower accuracy. In contrast, the CWSI-based ETa algorithm demonstrated limited reliability. The study findings demonstrate the strengths and limitations of each algorithm as well as their implications for operational water management in irrigated agriculture
This observation was done and demonstrated by several authors (see one of the references below) since the 80', more than 30 years before Niu et al. Please, check more appropriate citation from the review paper by Pocas et al. 2020 - Bausch, W.C. and C.M.U. Neale. 1987. Crop coefficients derived from reflected canopy radiation: A concept. Transactions of the ASAE 30(3):703-709.	We have included Bausch and Neale (1987), Niu et al. (2020) and Pocas et al. (2020).

- Pocas et al. 2020: https://doi.org/10.1016/j.agwat.2020.106081	
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