

Dear Reviewer

Thank you for the positive and constructive feedback. We provide our response below each comment in green font.

Review of “Towards a global actual evapotranspiration product for the Copernicus Land Monitoring Service” (Manuscript ID: egusphere-2025-4342)

The manuscript presents a comprehensive overview of the design, development, and initial validation of a global operational ETa product set to be released by the Copernicus Land Monitoring Service (CLMS). This work addresses a gap in the current portfolio of global land surface monitoring products. The development of a 300m resolution, dekadal, open-access ETa dataset based primarily on Copernicus data will be a valuable resource for applications in hydrology, agriculture, and climate science.

The manuscript provides a detailed account of the entire processing chain, from input data pre-processing (cloud masking, biophysical trait retrieval, LST sharpening, weather forcing) through the application of two distinct ET models (TSEB-PT and ETLook) to gap-filling and validation. The decision to use an ensemble of the two models is well-supported by the results, which show improved performance over the individual models. While the manuscript describes a product of considerable importance, several major points require clarification and further analysis to strengthen the paper and ensure its full scientific rigor before it can be accepted for publication.

Developing a global, operational product is constrained by certain programmatic, financial and technical limitations. The CLMS products are designed for long-term continuity and are paid for by the European Commission therefore issues like compute efficiency, data storage and dissemination costs or long-term availability of sources of core input data need to be considered. Taking those constraints into account, and in order to satisfy wide range of potential users needs and for consistency with other global CLMS products, the European Commission set the requirements for the CLMS ETa product, as well as its partitioning between soil evaporation and canopy transpiration, of a spatial resolution of 300 m and a dekadal temporal resolution and data availability in near-real-time (NRT). Other product requirements are shown in Table 1. Those requirements in turn impact the design choices presented in this study for the first version of the CLMS ETa product.

A similar clarification will be added to the Introduction (inserted around line 47) of the updated manuscript. However, despite those constraints we believe that the study adds to the scientific understanding of challenges and solutions applicable to global modelling of evapotranspiration.

We provide more details at the specific points below.

## Major Comments

Justification of the Ensemble Approach: The results clearly show that the ensemble mean of TSEB-PT and ETLook outperforms either model individually. However, the manuscript lacks a clear physical or methodological justification for why only the two models were used? Why not include more ET models to produce a more accurate ensemble product?

EB-ET is also based on energy balance method and global product at 5 km resolution. The model can be implemented at any spatial and temporal resolution if the forcing data can be prepared. It also produced latent heat fluxes and sensible heat fluxes. So this paper should clearly specify why the EB or SEBS model were not implemented in this activity. Actually, the simple EF-gap filling method in Chen et al. 2021 can be also used to improve the temporal resolution of this study.

Chen, X., Su, Z., Ma, Y., Trigo, I. and Gentile, P., 2021. Remote sensing of global daily evapotranspiration based on a surface energy balance method and reanalysis data. *J. Geophys. Res. Atmos.*, 126(16): e2020JD032873.

The enhanced SEBS model (ref. Chen et al, JGR 2019) can be also applied to the CLMS. The model code was also publicly available. Table 2 and 3 show that all the input data for running SEBS model were satisfied. Then please explain why it was not tested at the beginning. I think the ETa community have agreed that there are no one ETa model can satisfy the accuracy or requirement from all kinds of applications. Hereby, an ensemble of ETa products from different models are encouraged to be used. CLMS has the resource to merging more datasets produced by models which can be quickly and easily merged in the system.

We agree that two models are the bare minimum for an ensemble and in an optimal case many more models would be selected. However, as outlined in the introduction, this study was conducted within the constraints of creating an operational global product within a given timeline. Addition of extra models to the ensemble not only increases the computational, storage and dissemination costs but also code base and scientific complexity of the product which has a significant cost of itself.

We also fully agree that no ET model can satisfy the accuracy or requirements from all kinds of applications. Preparatory activities conducted by European Commission to develop an operational CLMS ETa product recommended that two ET modelling frameworks should be further investigated. The first one is the Sen-ET framework (Guzinski et al., 2020, 2021) developed to model ETa with Copernicus data at various spatial scales and using the Two-Source Energy

Balance Priestley-Taylor (TSEB-PT) ET model (Norman et al., 1995; Kustas and Norman, 1999; Anderson et al., 2024). The second is the WaPOR framework (FRAME Consortium & FAO, 2024) developed by FAO through the WaPOR project and using the ETLook ETa model (Bastiaanssen et al., 2012). Both models, although conceptually different, estimate evaporation and transpiration and use LST as one of core input forcings. This recommendation was mainly based on the availability of mature open-source implementations of the two ET models, on previous studies demonstrating the applicability of both models with Copernicus data sources (i.e. Sentinel-3 imagery and meteorological data from European Center for Medium Range Weather Forecasts) (Guzinski et al., 2025) and on FAO's familiarity with both approaches. This does not imply that those two modelling frameworks clearly outperform all other approaches and indeed it has been shown that the performance of an individual model depends on the landcover and climatic conditions (Reitz et al, 2025). However, due to constraints on developing a publicly funded global and operational dataset (outlined previously) there was a need to limit the design of the first version of the CLMS ETa product to those two frameworks. The paragraph above will be added to Section 1 of the manuscript.

Finally, we would like to highlight that original requirements of the CLMS ETa product specified the use of just one ET model. Due to the results of this study, this was later changed to an ensemble despite the increase in operational costs. We would be happy if in a potential v2 of the CLMS ETa product the model ensemble size increased. The core libraries used to produce input data are open-source thus facilitating studies of the behaviors of different models in a global context.

## References

1. Guzinski, R., Nieto, H., Sandholt, I., and Karamitlios, G. (2020). Modelling High-Resolution Actual Evapotranspiration through Sentinel-2 and Sentinel-3 Data Fusion. *Remote Sensing* 12, 1433. <https://doi.org/10.3390/rs12091433>.
2. Guzinski, R., Nieto, H., Sánchez, J.M., López-Urrea, R., Boujnah, D.M., and Boulet, G. (2021). Utility of Copernicus-Based Inputs for Actual Evapotranspiration Modeling in Support of Sustainable Water Use in Agriculture. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* 14, 11466–11484. <https://doi.org/10.1109/JSTARS.2021.3122573>.
3. Norman, J.M., Kustas, W.P., and Humes, K.S. (1995). Source approach for estimating soil and vegetation energy fluxes in observations of directional radiometric surface temperature. *Agricultural and Forest Meteorology* 77, 263–293. [https://doi.org/10.1016/0168-1923\(95\)02265-Y](https://doi.org/10.1016/0168-1923(95)02265-Y).
4. Kustas, W.P., and Norman, J.M. (1999). Evaluation of soil and vegetation heat flux predictions using a simple two-source model with radiometric temperatures for partial canopy cover.

Agricultural and Forest Meteorology 94, 13–29. [https://doi.org/10.1016/S0168-1923\(99\)00005-2](https://doi.org/10.1016/S0168-1923(99)00005-2).

5. FRAME Consortium & FAO: WaPOR methodology, <https://github.com/un-fao/wapor-et-look/wiki>, 2024.

6. Bastiaanssen, W.G.M., Cheema, M.J.M., Immerzeel, W.W., Miltenburg, I.J., and Pelgrum, H. (2012). Surface energy balance and actual evapotranspiration of the transboundary Indus Basin estimated from satellite measurements and the ETLook model. *Water Resources Research* 48. <https://doi.org/10.1029/2011WR010482>.

7. Reitz, M., Volk, J.M., Ott, T., Anderson, M., Senay, G.B., Melton, F., Kilic, A., Allen, R., Fisher, J.B., Ruhoff, A., et al. (2025). Performance Mapping and Weighting for the Evapotranspiration Models of the OpenET Ensemble. *Water Resources Research* 61, e2024WR038899. <https://doi.org/10.1029/2024WR038899>.

Line 52-57, I don't like the analysis of current ETa gaps. There are many other ETa products which has a daily temporal resolution, which is better than dekadal resolution of this study. I don't agree that "Other ETa datasets have either much lower spatial and temporal resolutions.". The ETa in this paper also has the same problem. You cannot say "Other" ETa datasets....

There are more ETa products should be reviewed and compared in this study, such as EB-ET, MOD16, etc...A comparative table or schematic contrasting ETC with other methods (e.g., MOD16, GLEAM, SEBS) would strengthen the novelty claim.

We should have been clearer here. The short review does not focus on available ET models, of which there are many, but on ET datasets which are produced operationally (i.e. at regular intervals, using well established models and validated outputs, etc.) with global coverage and in near-real-time. We will update line 51-52 to the following:

"..., global ETa datasets that are currently produced operationally and updated in NRT with closest..."

We will also change lines 56-57 to

"Other ETa datasets have either much lower spatial or temporal resolutions ..."

We would also like to point out that MOD16 is actually included in the short overview (Roman et al., 2024).

References:

1. Roman, M. O., Justice, C., Paynter, I., Boucher, P. B., Devadiga, S., Endsley, A., Erb, A., Friedl, M., Gao, H., Giglio, L., Gray, J. M., Hall, D., Hulley, G., Kimball, J., Knyazikhin, Y., Lyapustin, A., Myneni, R. B., Noojipady, P., Pu, J., Riggs, G., Sarkar, S., Schaaf, C., Shah, D., Tran, K. H., Vermote, E., Wang, D., Wang, Z., Wu, A., Ye, Y., Shen, Y., Zhang, S., Zhang, S., Zhang, X., Zhao, M.,

Davidson, C., and Wolfe, R.: Continuity between NASA MODIS Collection 6.1 and VIIRS Collection 2 land products, *Remote Sensing of Environment*, 302, 113 963, <https://doi.org/10.1016/j.rse.2023.113963>, 2024.

I don't agree that ETa from ETMonitor are not produced operationally. Any models can be put in the Copernicus Land Monitoring Service. This is not a proper way show the advantage of the ETa produced introduced in this study.

We agree that ETMonitor is an operational modelling approach, however the dataset finishes in 2021 so it is not produced in near-real-time. We will modify the end of this line to read "...or are not produced in NRT (e.g. ETMonitor - Zheng et al. (2022))." Furthermore, to our knowledge, there is not an open-source version of this model available to the public.

Reference:

1. Zheng, C., Jia, L., and Hu, G.: Global land surface evapotranspiration monitoring by ETMonitor model driven by multi-source satellite earth observations, *Journal of Hydrology*, 613, 128 444, <https://doi.org/10.1016/j.jhydrol.2022.128444>, 2022.

The calculation of soil resistance should also take into account the soil texture and soil classification. The equation 13a only consider top-soil moisture. In addition, the value of b and c were not listed in this paper. I suggest to change this equation and make the new equation can consider the soil texture. This is important for bare soil evaporation. Yuan et al. 2024 have investigated how to improve soil evaporation resistance. Please check equation 14-17 and table 1 in Yuan et al.

Yuan, L. et al., 2024. Long-term monthly 0.05° terrestrial evapotranspiration dataset (1982–2018) for the Tibetan Plateau. *Earth Syst. Sci. Data*, 16(2): 775-801.

Thank you for the reference. Estimating soil texture operationally in a global product with 300 m resolution is a difficult task. Modifying the core equations of ETLook models was also not the aim of this study or envisaged when designing the CLMS ET product. We will however mention that b and c are currently set to a constant values of 800 and -2.1 respectively and discuss the limitation of using constant values.

Eq. 12a and 12b, how  $r_{a,s}$  and  $r_{a,c}$  were calculated should be also described in this paper, since the model was applied at global scale. I think some important issues about  $r_{a,s}$  and  $r_{a,c}$  should be explained.

We will edit lines 361-362 to read:

"...,  $r_{a,s}$  and  $r_{a,c}$  are aerodynamic resistances for heat turbulent transport for soil and canopy respectively calculated following (Allen, 1998) and adjusted for buoyancy using Monin-Obukhov similarity theory in unstable conditions, and  $r_s$  and ..."

#### References:

Allen, R. G., ed.: Crop evapotranspiration: guidelines for computing crop water requirements, no. 56 in FAO irrigation and drainage paper, Food and Agriculture Organization of the United Nations, Rome, repr edn., ISBN 978-92-5-104219-9, 1998.

Line511 reported that the bias in  $\lambda E$  is positive in the majority of the sites and H estimates has dominant negative bias. The lower estimation of sensible heat fluxes and overestimation of latent heat fluxes at global scale has been reported by many other papers. Chen et al. 2019 has solved this issue from energy balance models by considering the canopy-air turbulent diffusion process. This paper did not introduce the method for calculating  $r_{as}$  and  $r_{ac}$  at all. The evaluation results have demonstrated the general problem which reported before. Hereby, I suggest to use the solution of Chen et al. 2019 to update the calculation of  $r_{as}$  and  $r_{ac}$ . Chen et al. 2019 has produced a uniform roughness and aerodynamic resistance calculation method for all kinds of canopy types. The model code was freely shared, Hereby, the aerodynamic resistance scheme should be described and evaluated, otherwise the scheme from Chen et al. 2019 was suggested to be applied in this study.

Chen, X., Massman, W.J. and Su, Z., 2019. A column canopy-air turbulent diffusion method for different canopy structures. *Journal of Geophysical Research: Atmospheres*, 124: 488–506.

Thanks for the suggestion and reference. However, the suggested solution is mostly applicable to single-source energy balance models, via the use of  $k_B^{-1}$  semi-empirical approach. In TSEB, ETLook and other dual-source energy balance models, the use of this excess resistance via the  $k_B^{-1}$  can be neglected (see Kustas et al. 2016) Furthermore, the corrections that Chen et al. 2019 consider that the atmosphere measurements are within the roughness sublayer. However, in this study, the weather forcing processing ensures that both air temperature and wind speed are at 100m above the surface. We will cite the references that detail the derivation of both  $r_{ac}$  (McNaughton & Van Den Hurk, 1995) and  $r_{as}$  (Kondo & Ishida, 1997; Sauer & Norman, 1995)

#### References:

1. Kustas, W.P., Nieto, H., Morillas, L., Anderson, M.C., Alfieri, J.G., Hipps, L.E., Villagarcía, L., Domingo, F., and Garcia, M. (2016). Revisiting the paper “Using radiometric surface temperature for surface energy flux estimation in Mediterranean drylands from a two-source perspective.” *Remote Sensing of Environment* 184, 645–653. <https://doi.org/10.1016/j.rse.2016.07.024>.
2. McNaughton, K.G., and Van Den Hurk, B.J.J.M. (1995). A ‘Lagrangian’ revision of the resistors in the two-layer model for calculating the energy budget of a plant canopy. *Boundary-Layer Meteorol* 74, 261–288. <https://doi.org/10.1007/BF00712121>.
3. Kondo, J., and Ishida, S. (1997). Sensible Heat Flux from the Earth’s Surface under Natural Convective Conditions. *Journal of Atmospheric Sciences* 54, 498–509.

[https://doi.org/10.1175/1520-0469\(1997\)054%253C0498:SHFFTE%253E2.0.CO;2](https://doi.org/10.1175/1520-0469(1997)054%253C0498:SHFFTE%253E2.0.CO;2).

4. Sauer, T.J., and Norman, J.M. (1995). Simulated canopy microclimate using estimated below-canopy soil surface transfer coefficients. *Agricultural and Forest Meteorology* 75, 135–160. [https://doi.org/10.1016/0168-1923\(94\)02208-2](https://doi.org/10.1016/0168-1923(94)02208-2).

Chen et al. 2021 has adopted an assumption of constant EF during consecutive days. If CLMS can provide daily surface radiation components for both cloudy and clear days. Then the EF gap-filling technique can be also applied to CLMS. This will help CLM to produce a daily ET product not 10 days product. The accuracy of available surface radiation is important for ETa accuracy on cloudy day. This is due to that ET on cloudy days was limited by energy not by moisture availability. That`s why the ET gap-filling method in Chen et al. 2021 can be successfully used for global daily ET calculation.

Chen, X., Su, Z., Ma, Y., Trigo, I. and Gentine, P., 2021. Remote sensing of global daily evapotranspiration based on a surface energy balance method and reanalysis data. *J. Geophys. Res. Atmos.*, 126(16): e2020JD032873.

Thank you for the comment and the reference. We would like to point out that internally we do produce daily, gap-filled ET product which is then averaged to the dekadal temporal resolution. This is done due to operational constraints (storage and dissemination costs) as well as to align with other CLMS products (e.g. products on vegetation and productivity). We will clarify this in the revised manuscript. In addition, we use a method which uses a ratio between reference and actual ET (what we term crop-stress coefficient  $K_{s,c}$ ) and the calculation of reference ET takes the availability of surface radiation into account. Using the constant EF approach suggested by the reviewer poses the challenge of estimating net radiation at daily time-scales, and considering that LST is key for net longwave radiation, additional uncertainties will arise on cloudy days.

The significant discrepancy between TSEB-PT and ETLook in forested areas (Figs. 10, 11) is a critical finding. The discussion attributes this largely to differences in transpiration estimates. The manuscript would be strengthened by a more in-depth analysis of the potential causes. For example, how sensitive are the models to the parameterization of aerodynamic resistance (highly dependent on canopy height in TSEB-PT) versus the soil moisture stress factors (derived from an LST-fractional cover trapezoid in ETLook)? A focused discussion on the challenges of modeling forest ET, particularly for these two modeling approaches, is needed.

We agree that more detailed discussion should be added on the performance of the two models, and the ensemble, in different conditions and therefore in the revised manuscript we will

introduce a section dedicated to this topic. In the revised manuscript we will also use data produced with improved parameterization of TSEB-PT and ETLook models which we expect to reduce those differences.

The poor performance in urban areas is acknowledged, but simply stating that the models were not designed for this land cover is insufficient for a global product description. The authors should briefly discuss the specific challenges (e.g., impervious surfaces, complex energy balance, irrigation of urban vegetation) and outline, even if just as a perspective for future work, how this might be addressed in a potential future product version (e.g., via a dedicated urban land cover class with adjusted parameters or a post-processing step).

This is a valid point and we will briefly discuss the challenges specific to the urban land cover:

- Strong shadowing effects due to (tall) buildings that alter the energy balance
- Increased complexity in evaluating the turbulent transport between the surface and the atmospheric boundary layer caused by the interaction between buildings of different heights and vegetated surfaces
- Additional heat and water vapour sources interacting between themselves and with the atmosphere: buildings, paved roads, parks with different canopies coexisting (grass/tress)

Near-Real-Time (NRT) vs. Reanalysis Trade-off: The manuscript identifies the use of forecast meteorological data and one-sided (NRT) gap-filling as a key difference from the reanalysis WaPOR product, contributing to more gaps and potentially higher uncertainty (Fig. 16, Table 11). This is a fundamental design choice with clear implications for users. The authors should more explicitly discuss the trade-offs between timeliness (NRT) and accuracy/completeness (reanalysis). A quantitative estimate of the accuracy gain expected from a future reanalysis version, based on the results in Table 11, would be highly valuable for the user community. The production for NRT dataset is one of the requirements / constraints from the European Commission for the CLMS ETa product and the first version of this product will be produced only in the near-real-time mode, e.g. there will be no reprocessing 2-3 months after the production date to perform improved gap-filling or use reanalysis meteorological data (like is done e.g. in WaPOR). Therefore, while we agree that the evaluation of the accuracy gained from a future reanalysis version is certainly interesting, it is also out of scope for this manuscript.

Spatial Representativeness of Validation: While the use of 104 sites is commendable, the geographical bias towards East Asian, and Australia is a limitation (Fig. 4). The authors rightly note that some climates are represented by proxy (e.g., dry regions in Spain), but the validation remains weak in the tropics and parts of Africa and Asia. This should be explicitly stated as a

limitation of the current validation. The authors should also comment on the potential impact of this bias on the reported global performance metrics.

This is a valid point and we will mention this limitation and potential impact in the revised manuscript. We will perform validation with additional flux towers located in South America, Africa and Asia.

#### Minor Comments

Abstract: Those data were then used to drive two evapotranspiration models: TSEB-PT and ETLook. A prototype implementation of the ETa processing chain was used to produce ETa data across a globally representative range of climatic zones and plant functional types. Two models were used but here did not inform the readers how the two models were combined to produce the ETa product. A transfer or connection needed between these two sentences.

Thank you for pointing this out, we will clarify this in the revised manuscript.

Abstract and Introduction: The abstract could be slightly more specific about the key innovation—namely, the operational, Copernicus-based ensemble approach at 300m resolution—and its validation outcome.

Thank you for the suggestion, we will modify the abstract accordingly.

Section 2.2 (Cloud-Masking and Gap-Filling): The decision not to gap-fill LST is well-argued. However, for the operational product, how will persistent cloud cover (e.g., in equatorial regions, as shown in Fig. 2) be handled? A brief comment on the expected data availability in these regions would be useful.

While the gap-filling of inputs is not performed, gap-filling of outputs is essential, as is mentioned on lines 142-245.

Section 3.2.2 (Instantaneous Fluxes): The positive bias in  $\lambda E$  and negative bias in H for TSEB-PT (Fig. 12) suggest a potential issue with energy balance closure at the instantaneous time step, even if the daily/daily aggregate performs well. This warrants a brief discussion.

We agree with the reviewer. The validation results could potentially change depending on the energy balance closure (EBC) method and variants. In order to ensure transparency and minimize any scientific bias by us, we prioritize the use of the energy balance correction provided by the dataset, which usually is the Bowen Ratio method adopted by the FLUXNET (Pastorello et al., 2020) community and implemented in different datasets: ICOS, Ameriflux, OzFlux. In other stations we leave the flux uncorrected. How to deal with the EBC when validating ET models is still an open question for scientific debate.

#### References:

1. Pastorello, G., Trotta, C., Canfora, E., Chu, H., Christianson, D., Cheah, Y.-W., Poindexter, C., Chen, J., Elbashandy, A., Humphrey, M., et al. (2020). The FLUXNET2015 dataset and the ONEFlux processing pipeline for eddy covariance data. *Sci Data* 7, 225. <https://doi.org/10.1038/s41597-020-0534-3>.

Section 4.4 (Potential Improvements): The suggestion to use a temporal running mean for biophysical parameters is interesting. The authors should clarify if this is planned for the initial operational release (end of 2025) or for a future reprocessing.

All the potential improvements are planned for a potential (i.e. currently unknown) v2 of the CLMS ETa product. We will clarify this in the revised manuscript.

Line 112-114, In addition, LST under clouds is different to LST in clear-sky conditions and using gap-filled values can lead to energy imbalance at the land surface. Therefore, LST is usually not gap-filled, especially if it is to be used as input into ETa models. If the gap-filled LST values under clouds were not accurate, then this can cause energy imbalance. But this does not mean the gap-filled LST cannot be used for ETa calculation. These two sentences should be rephrased. We are unaware of operational methods to accurately gap-fill LST under clouds without the use of other types of sensors, such as passive microwave. But it is true that if accurate LST gap-filling was performed then energy imbalance wouldn't be an issue. Therefore, we will modify this line to avoid confusion.

Line 214, canopy structure (LAI and Campbell (1990) leaf inclination distribution parameter). Thank you, this will be corrected.

Line 337, series resistance network (in analogy to electrical systems) which depend on aerodynamic and meteorological conditions..... meteorological conditions influence aerodynamic, one is about mesoscale, the other is about microscale. Both meteorological and aerodynamic were parallel used, they are partly overlap. Rephrase this sentence. We will rephrase the sentence as “series resistance network (in analogy to electrical systems) which depend on canopy structure (roughness) and weather (wind and atmospheric stability) conditions”.

Line 350, can CLMS produce Sdaily? If yes, then EF gap-filling method adopted in Chen-s paper can be also used to produce a daily ETa.

Please see reply to the major comment on the gap-filling approach.

Line 382-383, I can understand how did you get Ksc for cloudy days or target date, then I got lost how did you derive ETa for cloudy days or target date using continuous Ksc? Please add

description on how to use daily Ksc to derive daily ETa or accumulated ETa for each 10 days. The details were omitted for brevity (the article is already on the longer side) but are available in the mentioned reference (Guzinski 2021). In short, the closest available Ksc (potentially adjusted for soil drying and wetting as described in Guzinski 2023), is multiplied by reference ET on the target date to estimate the ETa on that date.

References:

1. Guzinski, R., Nieto, H., Sánchez, J.M., López-Urrea, R., Boujnah, D.M., and Boulet, G. (2021). Utility of Copernicus-Based Inputs for Actual Evapotranspiration Modeling in Support of Sustainable Water Use in Agriculture. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* 14, 11466–11484. <https://doi.org/10.1109/JSTARS.2021.3122573>.
2. Guzinski, R., Nieto, H., Ramo Sánchez, R., Sánchez, J.M., Jomaa, I., Zitouna-Chebbi, R., Roupsard, O., and López-Urrea, R. (2023). Improving field-scale crop actual evapotranspiration monitoring with Sentinel-3, Sentinel-2, and Landsat data fusion. *International Journal of Applied Earth Observation and Geoinformation* 125, 103587. <https://doi.org/10.1016/j.jag.2023.103587>.

Line 388, a simple water-balance approach indicates that the soil is wet, what kind of water balance approach can be used to indicates the soil is wet?

We refer here to the simple equation (3) from Section 2.2.2 of Guzinski et al. 2023. However, the word “wet” might not be the most accurate here and we will rephrase it to “... indicated sufficient moisture in the soil”.

References:

1. Guzinski, R., Nieto, H., Ramo Sánchez, R., Sánchez, J.M., Jomaa, I., Zitouna-Chebbi, R., Roupsard, O., and López-Urrea, R. (2023). Improving field-scale crop actual evapotranspiration monitoring with Sentinel-3, Sentinel-2, and Landsat data fusion. *International Journal of Applied Earth Observation and Geoinformation* 125, 103587. <https://doi.org/10.1016/j.jag.2023.103587>.

Figure4, there are no flux measurement collected from eastern Asian, I suggested to use the following flux measurement to verify the ETa product

Ma, Y. et al., 2020. A long-term (2005–2016) dataset of hourly integrated land–atmosphere interaction observations on the Tibetan Plateau. *Earth Syst. Sci. Data*, 12(4): 2937-2957.

Thank you for the reference. This dataset unfortunately does not cover the period when both Sentinel-3 satellites were operational. We will however add validation from more stations in eastern Asia in the revised manuscript, in particular sites contained in the recently released JapanFlux 2024 dataset (Ueyama et al., 2025).

Reference:

1. Ueyama, M., Takao, Y., Yazawa, H., Tanaka, M., Yabuki, H., Kumagai, T., Iwata, H., Awal, Md.A., Du, M., Harazono, Y., et al. (2025). The JapanFlux2024 dataset for eddy covariance observations covering Japan and East Asia from 1990 to 2023. *Earth Syst. Sci. Data* 17, 3807–3833. <https://doi.org/10.5194/essd-17-3807-2025>.

Figure 10 shows that the ET from model and measurement have high difference. How can the data users diagnose the error source of the ET product? The paper should give some demonstration on this aspect.

The CLMS ET product will have a number of quality layers, including standard deviation between the ET estimated with the TSEB-PT model. A larger standard deviation can imply larger uncertainty in the retrieved ET. We will mention this in the revised manuscript.