➢ AC to Referee #2: General Comment

The manuscript aims to develop a new evapotranspiration (ET) product using collocation techniques. It has the potential to be a useful contribution to the literature and to the broad userbase of ET products. Nonetheless, a few major issues need to be addressed before it can be considered for publication.

AC:

We greatly appreciate the professional and constructive feedback provided by the reviewer. We will respond to each comment individually, and in the following responses, the line numbers corresponding to the added or revised content will be based on the updated version without highlights. You can open the PDF file's table of contents view to navigate to the relevant sections directly.

The responses will be in the following format:

- Reviewer's comments are shown in black.
- Our responses are shown in blue.
- The modifications to the manuscript are shown in orange.
- Previous contents in the old version (for comparison if needed) are shown in grey.

1 AC to Referee #2: Major Comments

1.1 Q1

First, the construction of the products should be justified by a clearly outlined rationale. The new ET product is built from multiple ET solutions with different temporal coverage. How are those individual products selected for each analyzed period, and when three instead of two products are selected, what is the corresponding gain in terms of performance?

AC:

Thank you for your inquiry. We have provided justification and description for the product selection in the beginning of the datasets section, based on three considerations: (1) Maintaining consistent original spatiotemporal resolution among the products to minimize potential downscaling operations and avoid introducing additional errors; (2) Ensuring three or more products within the same resolution or period, aligning with the collocation method where lag-1 sequences from two products, are typically selected as the third input, aiming to incorporate more information for effective fusion; (3) Choosing products with relatively high visibility, widespread usage, and global coverage. In addition, we also address the existence of high-resolution regional ET product, which could be used for further update of CAMELE.

The relevant explanations have been added to the beginning of the datasets section:

Revised Contents (Line 145 to 159) :

"…We selected five widely used ET products that spanned the period from 1980 to 2022. When selecting these products, our aims are to ensure: (1) consistency in original spatiotemporal resolution among the products: minimize potential downscaling operations and avoid introducing additional errors; (2) having three or more products within the same resolution or period: incorporate more information for effective fusion; (3) products with extensive global observational sequences: gain basic recognition from the community. While we acknowledge the existence of other higher-precision products, their integration would require either downscaling or upscaling other products, potentially introducing uncertainties. Therefore, we chose the combination outlined in the manuscript. Despite its relatively lower resolution compared to some products, it still contributes to our understanding of ET variations, facilitating advantageous exploration. Furthermore, we incorporated in-situ observations and Lu et al. (2021) 's global 0.25° daily-scale ET product derived using Reliability Ensemble Averaging (denoted as REA) to compare our merged product comprehensively…"

1.2 Q2

Second, the manuscript demonstrates the consistency of the proposed product with its peers, but I believe it is more important to highlight the unique strength and weakness of the new product. When and where does the new product outperform or underperform its peers? Does it improve upon its individual constituents in terms of characterizing the long-term trend, seasonality, inter-annual variability, or the extremes of ET?

AC:

Thank you for your valuable suggestions. We have conducted further analysis of the performance of the CAMELE product and have emphasized several strengths:

1. It effectively captures the multi-year linear trend.
2. Enhances the accuracy of estimating multi-year mean values.
3. Better characterizes extreme values of ET (5th and 95th percentiles at monthly scale).

We have also acknowledged the limitations of CAMELE:

1. lower resolution compared to regional high-resolution ET products, limiting its potential for regional analysis.
2. potential overestimation of seasonality.

We have included additional analyses in the results section 4.3 and 4.4 (new subsections) focusing on trend, seasonality, multi-year average, and extreme values to address these aspects. A new section discussing future improvements has been added (5.4, new subsection). Modifications have been made to the abstract and conclusion to reflect these changes.

1.2.1 Revision in Abstract (Line 34 to 38)

"…In addition, comparisons indicate that CAMELE can effectively characterize the multi-year linear trend, mean average, and extreme values of ET. However, it exhibits a tendency to overestimate seasonality. In summary, we propose a reliable set of ET data that can aid in understanding the variations in the water cycle…"

1.2.2 New Contents regarding regional ET data (2 Datasets, Line 151 to 156):

"…While we acknowledge the existence of other higher-precision products, their integration would require either downscaling or upscaling other products, potentially introducing uncertainties. Therefore, we chose the combination outlined in the manuscript. Despite its relatively lower resolution compared to some products, it still contributes to our understanding of ET variations, facilitating advantageous exploration…"

1.2.3 New Contents about multi-year mean and extreme ET value (4.3 Results, Line 732 to 761):

"…For site comparisons, we have selected monthly mean ET values and three quantiles (5th, 50th, and 95th) to represent the products' performance in estimating ET's average and extreme values.

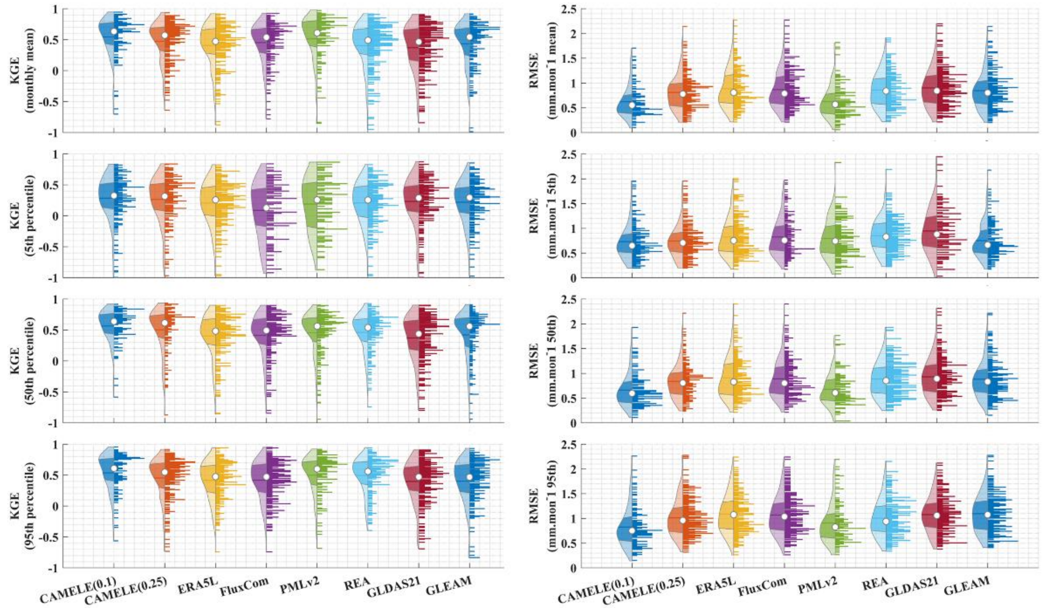

Figure 10 Violin plots depicting the KGE and RMSE metrics calculated for CAMELE and other products based on the monthly mean, 5th, 50th, and 95th percentiles at each FluxNet site. The left four columns represent KGE plots, while the right four columns represent RMSE plots. The dots in the violin plots represent the median, and the horizontal lines represent the mean.

Table 6 Average values of KGE and RMSE corresponding to different products, calculated based on the results obtained for each site. The bolded sections indicate the schemes with the best performance in their respective metrics.

Product		**KGE**			
		Mean	**5th**	**50th**	**95th**
0.1°-daily	**CAMELE**	**0.54**	**0.28**	**0.57**	**0.54**
	ERA5L	0.41	0.21	0.40	0.42
	FluxCom	0.45	0.09	0.42	0.42
	PMLv2	0.52	0.19	0.46	0.50
0.25°-daily	**CAMELE**	**0.47**	**0.26**	**0.50**	0.45
	REA	0.40	0.21	0.46	**0.50**
	GLDAS21	0.37	0.23	0.37	0.40
	GLEAMv3.7a	0.43	0.22	0.42	0.40
Product		**RMSE (mm/mon)**			
		Mean	**5th**	**50th**	**95th**

0.1°-daily	**CAMELE**	0.63	**0.73**	**0.66**	**0.83**
	ERA5L	0.89	0.83	0.91	1.09
	FluxCom	0.87	0.83	0.89	1.07
	PMLv2	**0.63**	0.80	0.68	0.91
0.25°-daily	**CAMELE**	**0.81**	**0.74**	**0.84**	1.01
	REA	0.86	0.85	0.88	**1.01**
	GLDAS21	0.90	0.95	0.93	1.08
	GLEAMv3.7a	0.85	0.75	0.88	1.10

The information in Figure 10 corresponds to the data presented in Table 6, which involves the calculation of KGE and RMSE at each site, followed by statistical analysis. From the distribution of the violin plots, it can be observed that a violin plot with a closer belly to 1 indicates better results in terms of the KGE.

The results show that CAMELE outperforms other products in the estimation of monthly averages and the 5th, 50th, and 95th percentiles at both 0.1° and 0.25° resolutions. Its performance in capturing monthly averages is noteworthy, with a noticeable improvement in the KGE and RMSE metrics relative to the inputs. Examining the results for percentiles, CAMELE shows a relatively poorer estimation for shallow values (5th percentile) but still demonstrates some improvement compared to the input data, albeit influenced by input errors.

At 0.1°, PMLv2 and FluxCom perform just below the fusion result, aligning with the previous error and weight analysis. At 0.25°, GLEAM and REA closely follow CAMELE, with REA exhibiting slightly better estimation results for extremely high values (95th percentile) than CAMELE. Despite this, the analysis results still indicate that the products obtained reflect well the multi-year averages and extremes of ET, holding promise as reliable products for analyzing ET variations…”

1.2.4 New Contents about multi-year trend and seasonality (4.4 Results, Line 798 to 846):

“…In this section, we first validate and compare the performance of CAMELE with other products in estimating multi-year trends and seasonality at the site scale. Due to the inconsistent time lengths of FluxNet sites, trends at many sites are not significant. Therefore, we deliberately selected 13 sites with continuous evapotranspiration (ET) observations for the same 11-year period (2004 to 2014) and with significant trends. The annual ET values for each year were calculated as the mean of the 13 sites for that year, allowing the computation of linear trends and seasonality. We employed singular spectrum analysis (SSA), which assumes an additive decomposition A = LT + ST + R. In this decomposition, LT represents the long-term trend in the data, ST is the seasonal or oscillatory trend (or trends), and R is the remainder.

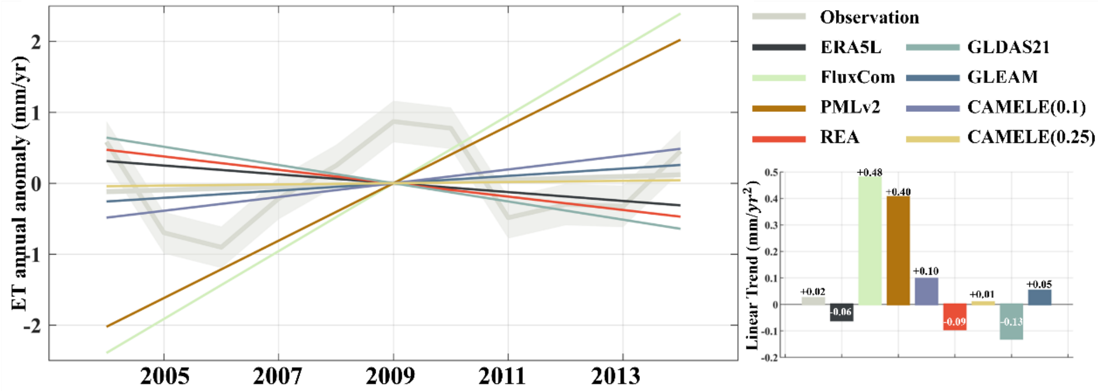

Figure 13 Comparison of linear trend from 2004 to 2014 among 13 FluxNet sites using CAMELE and other products. The trends have been subjected to SSA decomposition, removing seasonality. The gray enveloping line represents the mean plus the standard deviation of the 13 sites.

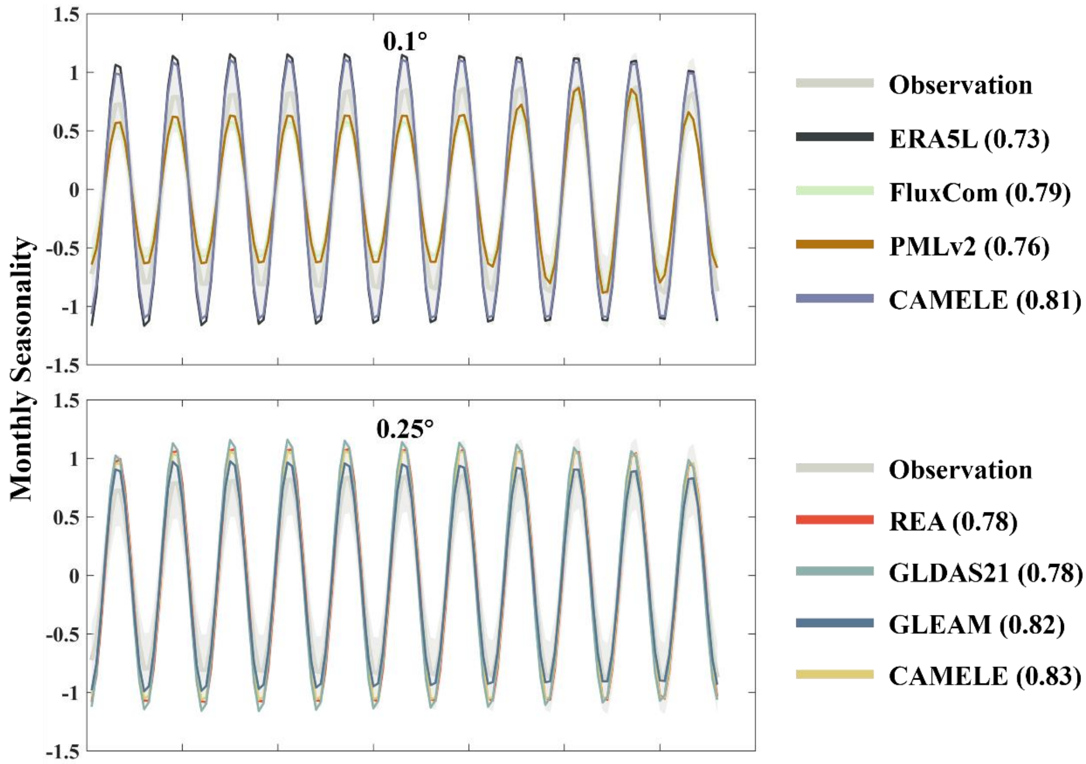

Figure 14 Comparison of seasonal variations from 2004 to 2014 among 13 FluxNet sites using CAMELE and other products. The seasonality has been obtained through SSA decomposition, with the gray area representing the observed values. The parentheses in each product name indicate the KGE coefficient comparing with the observed values.

In Figure 13 and Figure 14, based on observations from FluxNet sites, we analyzed the performance of CAMELE and other products in estimating the linear trend and seasonality of ET over multiple years. It is important to note that we only present the analysis results for 13 sites with continuous 11-year observations, and the performance of different ET products in trend estimation at individual sites still varies, not fully reflecting the overall performance on all grids in terms of trend and seasonality. Nevertheless, such a comparison can still provide valuable insights.

Examining the results of the linear trend, both PMLv2 and FluxCom exhibit a significant upward trend, well above the observations. On the contrary, ERA5L, GLDAS, and REA show a noticeable downward trend, while CAMELE demonstrates a gradual upward trend closer to the observations. Additionally, GLEAM slightly outperforming CAMELE at a resolution of 0.25°. Overall, CAMELE shows good agreement with site observations in capturing the multi-year linear trend of ET.

Continuing with the analysis of seasonality, the KGE index comparing each product's results with observed values is provided in parentheses next to the product name. Generally, all products exhibit a good representation of ET's seasonal variations. CAMELE's 0.1° seasonal results closely match FluxCom (with the two lines almost overlapping). However, the fluctuations it reflects are higher than the observed values. This is likely due to keeping the 8-day average results of FluxCom consistent with PMLv2 every 8 days, and the variability in ET primarily originates from ERA5L results. This aspect may need improvement in subsequent research. At 0.25°, CAMELE's seasonal representation is closer to the observed results. The differences in CAMELE's performance at the two resolutions are mainly attributed to input variations, which we discuss in the following section as potential areas for improvement.

The results indicate that CAMELE effectively captures the multi-year changes in ET, but at 0.1°, it tends to overestimate seasonal fluctuations…”

1.2.5 New Contents for future update (5.4 Discussion, Line 1034 to 1060):

“…In this section, we delve into the potential applications of our product and outline our commitment to future enhancements to maintain its accuracy and relevance.

Here, we identify three potential applications for our transpiration product: (1) Global ET Trends: Our product facilitates global-scale analysis of current ET patterns and long-term trends, essential for comprehending ecosystem responses to evolving environmental conditions in a warming climate; (2) Transpiration-to-Evapotranspiration Ratio: Our merging approach can fuse multi-source global gridded transpiration data, allowing for the examination of the transpiration-to-evapotranspiration ratio. This analysis can enhance water resource management and water availability predictions in diverse regions; (3) Attribution analysis: Our product is a valuable tool for attribution analysis, helping researchers identify the drivers of patterns. This knowledge is crucial for understanding the roles of climate variability, land-use changes, and other factors in shaping terrestrial water fluxes.

Furthermore, we are committed to enhancing our product proactively. Key strategies include: (1) Data Update and Validation: To ensure our product's continued accuracy and reliability, we will prioritize regularly updating the data used in this study to the latest versions. By adopting this approach, we aim to provide users with results that reflect the latest advancements in scientific knowledge; (2) Enhanced Integration and Error Reduction: We continually refine estimates by incorporating additional data sources and implementing extended collocation method to minimize errors; (3) Integration of High-Resolution Regional ET Data: Recognizing the significance of regional-scale insights, we will focus on improving the accuracy of CAMELE by integrating higher-resolution regional ET data. This integration will enable more precise regional estimation.

In summary, these endeavors collectively represent our commitment to maintaining our product's quality and relevance, ensuring its value for the scientific community…"

1.3 Q3

Third, the organization of the manuscript can be improved, too. I list some of my suggestions in the detailed comments below. For example, the discussion of the non-zero ECC spreads across two subsections in the Discussion, and I think they should be merged and moved to the result section. I think addressing these issues will strengthen the scientific robustness of the manuscript and facilitate the adoption of the new product.

AC:

Thank you very much for your detailed suggestions. We will address each of your points in the "detailed comments" section.

2 AC to Referee #2: Detailed Comments

2.1 Line 173-175

L173-175. The rationale of choosing GLDAS-2.0/2.1 is questionable. Given the difference in the underlying modeling/reanalysis schemes, the error structures of GLDAS and ECMWF-based ET estimates are inherently different regardless of what sets of meteorological forcing are used. When selecting the GLDAS products, one could arguably choose the ET products that are driven by the more reliable forcing.

AC:

Thank you very much for your valuable suggestion. We acknowledge the significant differences between different versions of GLDAS-2, and our choice here was aimed at covering the period from 1980 to 2022. We have added explanations regarding the differences in GLDAS-2 versions and cited recent literature highlighting non-zero ECC between GLDAS2.2 and ERA5L.

Revised Contents (Line 199 to 213):

"…This study aimed to cover the research period from 1980 to 2022. Non-zero ECC between the transpiration estimates of GLDAS-2.2 and ERA5L has been reported in a recent study (Li et al., 2023a). Considering the similarities in the calculation of ET and transpiration of GLDAS and ERA5L, this report partially indicates a correlation. Therefore, GLDAS-2.0 and GLDAS-2.1 were selected as inputs instead. The "Evap_tavg" parameter representing evapotranspiration is derived from the original products and aggregated to a daily scale. For more detailed information on the GLDAS-2 models, please refer to NASA's Hydrology Data and Information Services Center at http://disc.sci.gsfc.nasa.gov/hydrology.

Despite the same forcing between GLDAS-2.1 and GLDAS-2.2, significant differences exist between the model results of different GLDAS versions (Qi et al., 2020, 2018; Jiménez et al., 2011). The non-zero ECC will generally still be met between different versions. Thus, we still need to analyze the non-zero ECC situations between ERA5L and GLDAS-2.0 and 2.1, which will be assessed in the discussion sections…"

References:

Li, C., Liu, Z., Tu, Z., Shen, J., He, Y., and Yang, H.: Assessment of global gridded transpiration products using the extended instrumental variable technique (EIVD), Journal of Hydrology, 623, 129880, https://doi.org/10.1016/j.jhydrol.2023.129880, 2023a

Jiménez, C., Prigent, C., Mueller, B., Seneviratne, S. I., McCabe, M. F., Wood, E. F., Rossow, W. B., Balsamo, G., Betts, A. K., Dirmeyer, P. A., Fisher, J. B., Jung, M., Kanamitsu, M., Reichle, R. H., Reichstein, M., Rodell, M., Sheffield, J., Tu, K., and Wang, K.: Global intercomparison of 12 land surface heat flux estimates, J. Geophys. Res., 116, D02102, https://doi.org/10.1029/2010JD014545, 2011.

Qi, W., Liu, J., and Chen, D.: Evaluations and Improvements of GLDAS2.0 and GLDAS2.1 Forcing Data's Applicability for Basin Scale Hydrological Simulations in the Tibetan Plateau, JGR Atmospheres, 123, https://doi.org/10.1029/2018JD029116, 2018.

Qi, W., Liu, J., Yang, H., Zhu, X., Tian, Y., Jiang, X., Huang, X., and Feng, L.: Large Uncertainties in Runoff Estimations of GLDAS Versions 2.0 and 2.1 in China, Earth and Space Science, 7, e2019EA000829, https://doi.org/10.1029/2019EA000829, 2020.

2.2 Line 252

L252. It would be ideal to show the distribution of the selected sites on a map.

AC:

Thank you very much for your suggestion. Updated.

New Figure (Line 303 to 304):

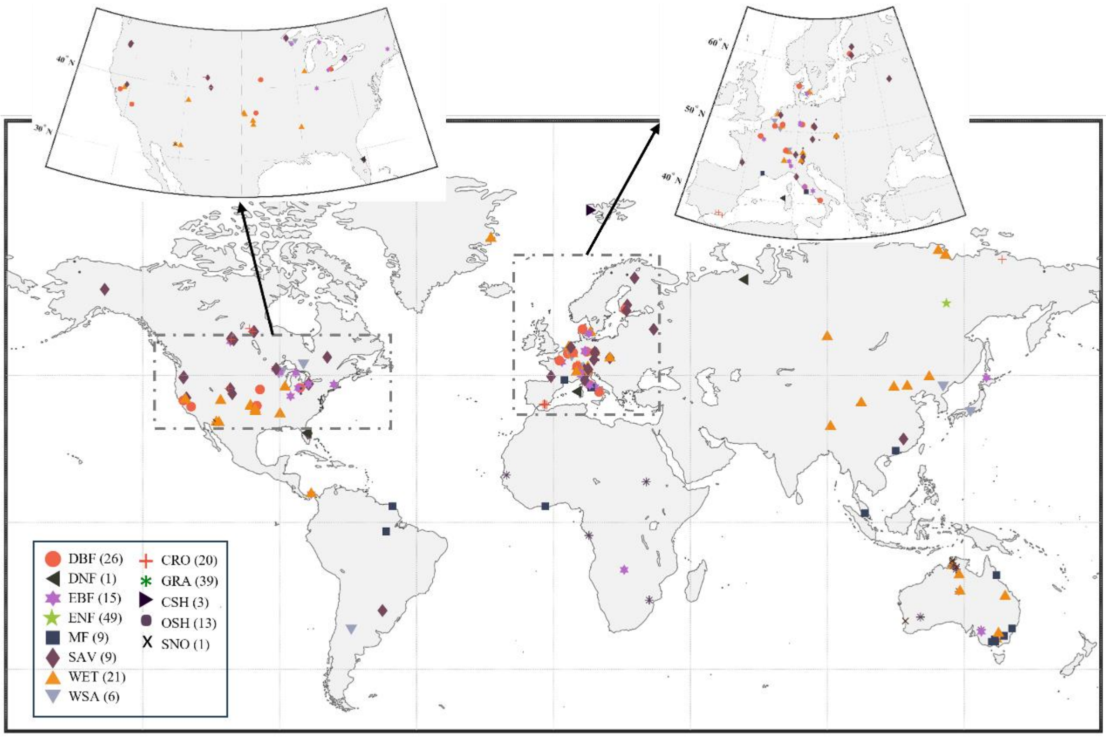

Figure 1 Global distribution of selected FluxNet Sites.

2.3 Line 271

L271. The methodological detail for Sections 3.1 can be trimmed as they are widely available. Highlighting aspects that are either implemented or discussed in this study would be sufficient, e.g. the assumptions, especially regarding the cross-correlated errors.

AC:

Thank you very much for your suggestion. We have trimmed approximately 25% of the content in Section 3.1, retaining essential formulas and crucial mathematical assumptions discussed in this study.

2.4 Line 393-400

L393-L400. This should go to the intro. Overall the method session needs to focus on clarifying the rationale of the chosen methodology and how they are directly implemented for this study.

AC:

Thank you very much for your suggestion. We have revised and relocated the content to the introduction section as recommended.

Revised Contents (Line 103 to 112):

"…Moreover, error information derived from collocation analysis is valuable for merging multi-source data. This was initially applied by Yilmaz et al. (2012) in the fusion of multi-source soil moisture products and later improved by Gruber et al. (2017) and further applied in the production of the European Space Agency Climate Change Initiative (ESA CCI) global soil moisture product (Gruber et al., 2019). Dong et al. (2020b) also adopted this approach to fusing multi-source precipitation products. In the study of evapotranspiration, Li et al. (2023c) and Park et al.(2023) utilized a weight calculation method that does not consider non-zero ECC and fused multiple ET products in the Nordic and East Asia, respectively, achieving satisfactory fusion results…"

2.5 Line 430

L430. One of the PMLv2 should be GLDAS.

AC:

Thank you for pointing out the mistake. Updated.

Revised Contents (Line 461):

"…analyze the performance of five sets of ET products (ERA5L/ PMLv2/FluxCom/GLDAS2/GLEAMv3) at the global scale…"

2.6 Line 430-439

L430-439. I understand this is a prior work that is directly related to this study, but the summary of this prior finding should go to the intro. Only the key assumptions made based on this prior work need to be highlighted in the method section (in this case, the non-zero ECC pairs).

AC:

Thank you for your suggestion. Firstly, the conclusions of this prior work are mentioned in the Introduction:

Unchanged Contents (Line 116):

"…Li et al. (2022) global ET product evaluation research revealed clear non-zero ECC conditions between ERA5L, GLEAM, PMLv2, and FluxCom…"

Considering that this part of the Introduction primarily discusses the application of collocation methods in ET, we chose to leave out non-zero ECC pairs in this section. Secondly, the current placement in the Method section, specifically in the Combinations subsection, is deemed appropriate.

2.7 Line 454

L454. I don't fully understand the rationale of grouping different products within each scenario. For Scenario 1, e.g., is the goal here to include as many products as possible within a given period? If that's the case, it will be helpful to clarify the gain in terms of performance of doing so.

AC:

Thank you for your valuable feedback. In response to your **Major Comments Q1**, we have updated the Datasets section to clarify product selection and matching. Additionally, we have revised the corresponding explanation following the table to specify the goal of including three or more products whenever possible. This aims to optimize the performance within a given period.

Revised Contents (Line 486 to 493):

"…It should be noted that the same product can have different versions. In this study, appropriate versions are selected based on the following principles: (1) Selection based on the corresponding data coverage duration and ensuring more products to gain more information; (2) Choosing the latest version while considering the assumption of non-zero ECC conditions; (3) Making efforts to select the exact product versions for different periods, to avoid uncertainties caused by version changes. We selected a subset of sites to compare the fusion results using different versions, and the corresponding details will be presented in the discussion section…"

2.8 Line 477-484

L477-484. This should go to the Method section.

AC:

Many thanks to your suggestions. This part has been moved to the Datasets section.

Revised Contents (Line 156 to 159):

"…Furthermore, we incorporated in-situ observations and Lu et al. (2021) 's global 0.25° daily-scale ET product derived using Reliability Ensemble Averaging (denoted as REA) to compare our merged product comprehensively…"

2.9 Line 485

L485. What about the correlated errors?

AC:

The results of correlated errors are discussed in the Discussion section, where we believe it is more appropriate to address them.

2.10 Line 621-629

L621-629. This is more informative than the global statistics. I think it will be useful for the readers to adopt the new product if the authors can highlight when/where and over what spatiotemporal scales that CAMELE outperforms other products substantially. From a practical standpoint, establishing the *unique* strength of the proposed product is more important than showing its consistency with its peers.

AC:

Thank you once again for your valuable suggestion. We have incorporated additional analysis addressing your concern, and the relevant content can be found in the response to your **Major Comment 1.2**, eliminating the need for duplication here. Furthermore, we have provided an in-depth analysis highlighting the consistent superior performance of CAMELE across various PFTs, emphasizing the reliability of the fusion approach.

Revised Contents (Line 701 to 721):

"…From the results, it is evident that CAMELE performs well across various vegetation types. To delve deeper into the reasons behind this performance, we conduct site-scale analyses at two resolutions, evaluating errors and computed weights for different PFTs sites. These are visualized in radar chart format in Figure 8.

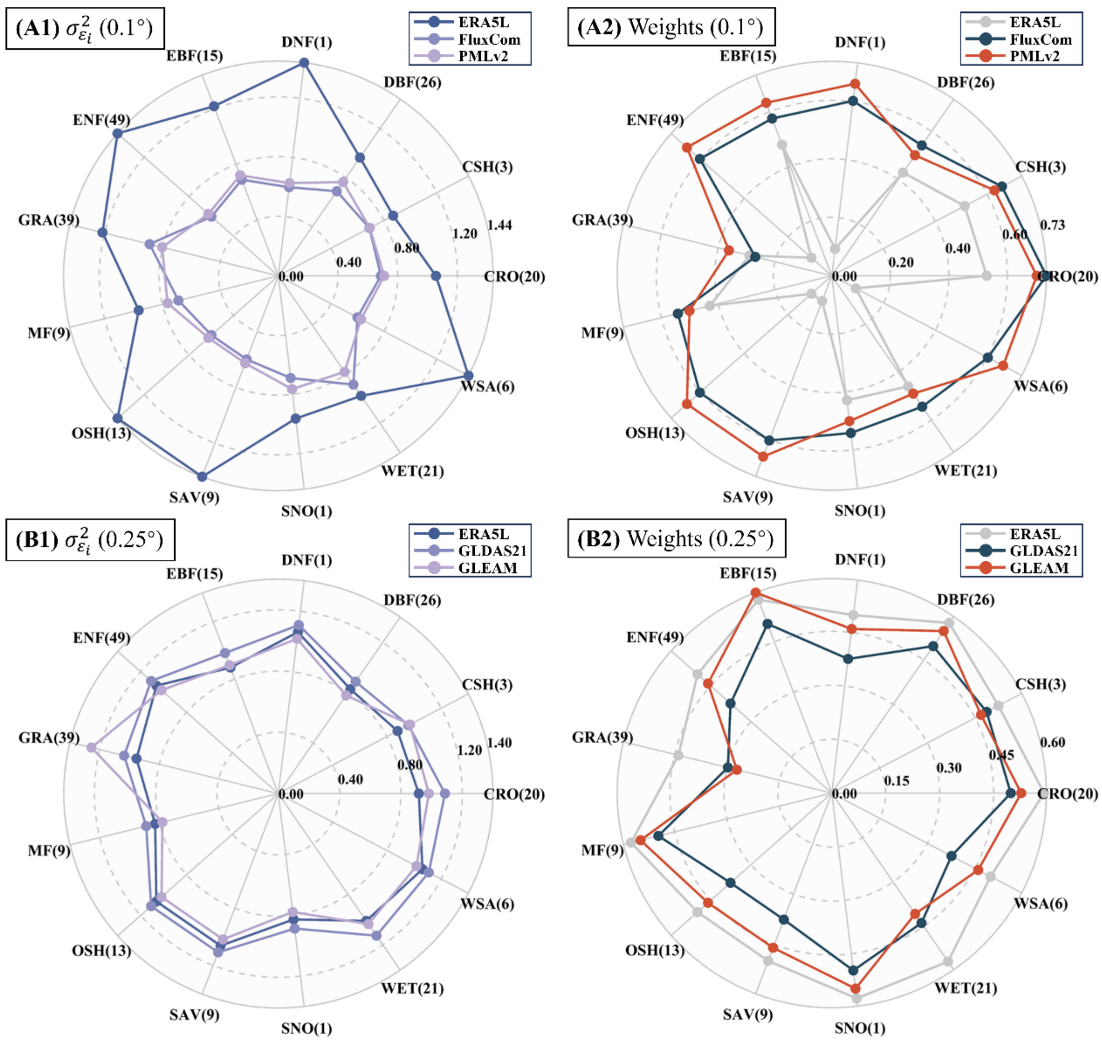

Figure 9 Mean collocation-based errors and weights of different products at various PFTs sites at (A) 0.1° and (B) 0.25° resolutions. The parentheses next to each PFTs name denote the corresponding number of sites.

The results from Figure 9 demonstrate that the error-weighting calculation method based on collocation effectively considers the error situation of inputs, thereby providing reasonable weight assignments. At 0.1° resolution, ERA5L's error is significantly higher across all PFTs than FluxCom and PMLv2, resulting in relatively lower corresponding weights. FluxCom and PMLv2 exhibit closer performance, with higher weights at most PFT sites. At 0.25° resolution, ERA5L, GLDAS21, and GLEAM perform more evenly, with minimal differences, resulting in closer weights. The weights for different inputs vary noticeably with changes in PFTs, depending on the performance of other products within the same combination. Products with more significant errors correspondingly have lower weights, affirming the rationale behind the fusion method. However, it is essential to note that the presented results depict the mean values of errors and weights across all sites; there might be variations among sites with the same PFTs…”

2.11 Line 635

L635. How does the proposed product and its peers compare with the FluxNet in terms of long-term average and trend?

AC:

Thank you again for your suggestion. We have incorporated additional analysis comparing the proposed product and its peers with FluxNet in terms of long-term average and trend. The relevant details can be found in our responses to your Major Comments

1.2.3 New Contents about multi-year mean and extreme ET value (4.3 Results, Line 732 to 761):

1.2.4 New Contents about multi-year trend and seasonality (4.4 Results, Line 798 to 846):

2.12 Line 677

L677. I think only the statistically significant trends should be shown.

AC:

We sincerely appreciate your insightful comments, which are crucial for the accurate calculation of trends. We have re-plotted the trends for various products, including 0.1° (2001-2015) and 0.25° (2000-2017) datasets, along with CAMELE, highlighting regions with significant changes. The trends are estimated using Theil–Sen's slope method, and their significance is tested with the Mann–Kendall method. The dotted areas indicate trends passing the significance test at a 5% level.

Additionally, we have rectified the coding error in the original 0.1° trend plot, where latitude variation was incorrectly portrayed as the dependent variable. Please find the corrected trend for CAMELE, demonstrating consistency among input ensemble members. Furthermore, modifications have been made to the figure captions for clarity.

Revised Figures (Line 850 to 862):

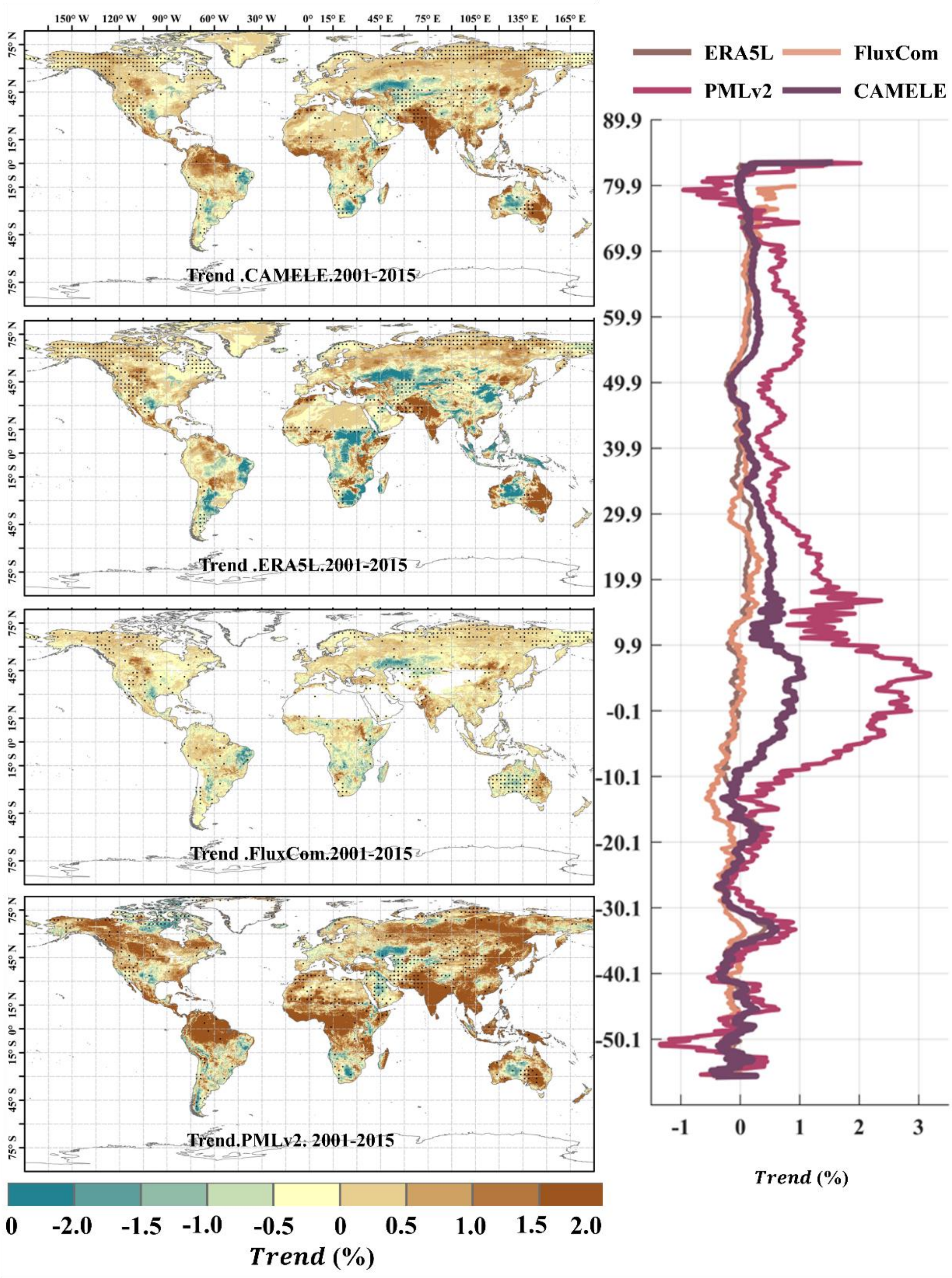

Figure 15 Global distribution of multi-year linear trend at 0.1° for CAMELE, ERA5L, FluxCom, and PMLv2, depicted alongside corresponding average trend with latitude. The trend is estimated with Theil–Sen's slope method, and the significance level is tested with the Mann–Kendall method. The dotted area indicates that the trend has passed the significance test at 5 % level.

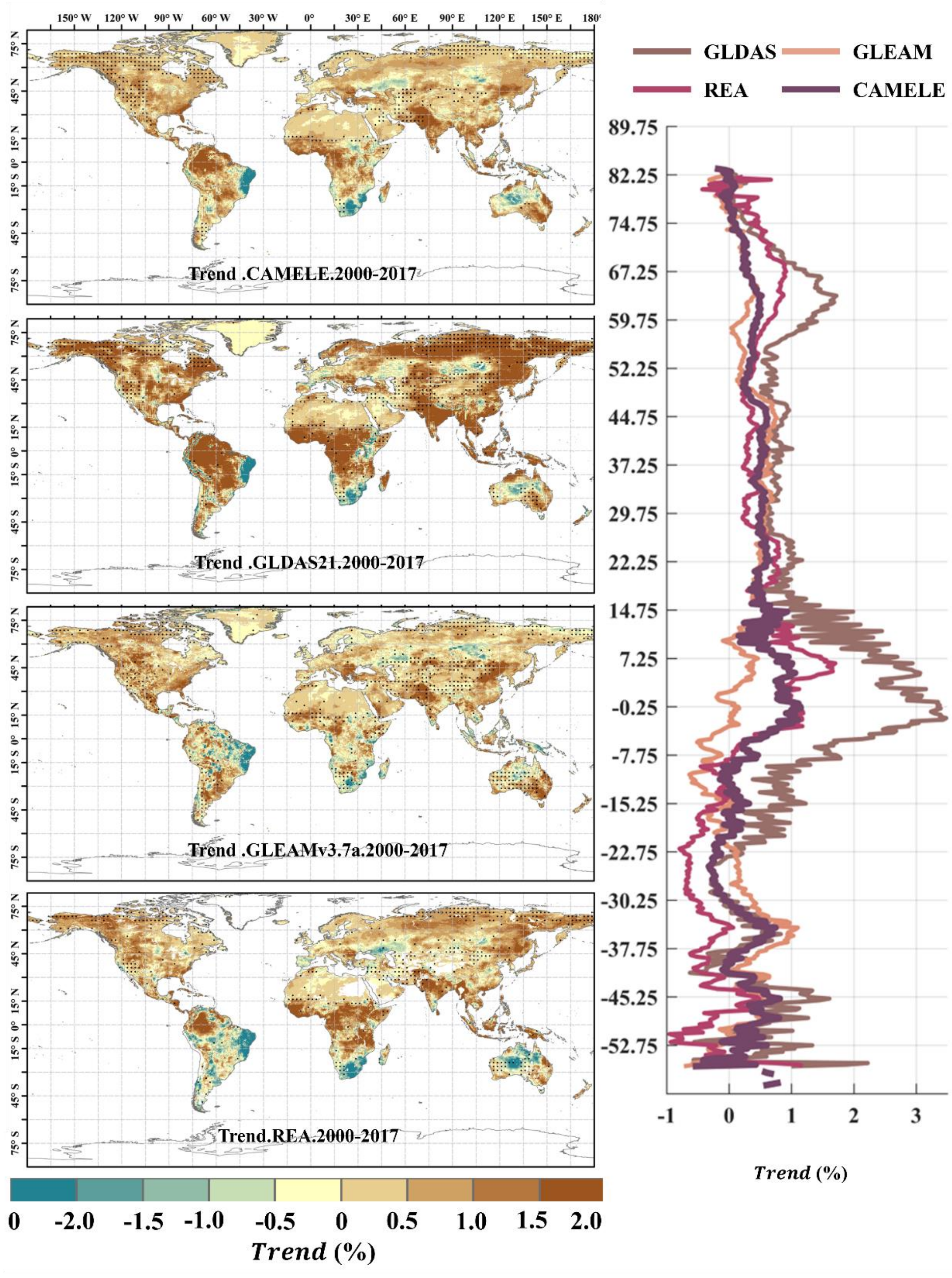

Figure 16 Global distribution of multi-year linear trend at 0.25° for CAMELE, GLDAS2.1, GLEAMv3.7a, and REA, depicted alongside corresponding average trend with latitude. The trend is estimated with Theil–Sen's slope method, and the significance level is tested with the Mann–Kendall method. The dotted area indicates that the trend has passed the significance test at 5 % level.

Previous Figures

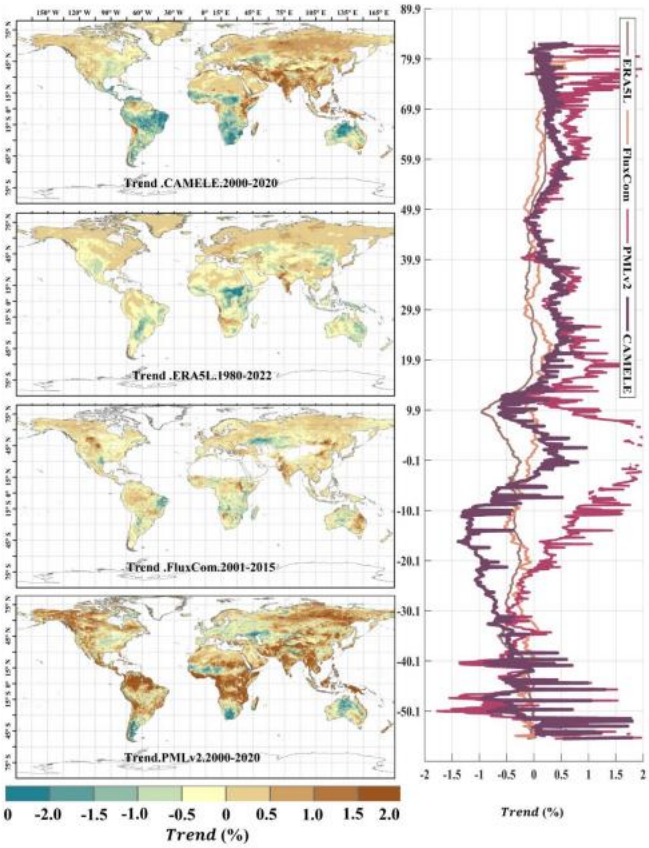

Figure 9 Global distribution of multi-year linear trend at 0.1° for CAMELE, ERA5L, FluxCom, and PMLv2, depicted alongside corresponding variation curves of average with latitude.

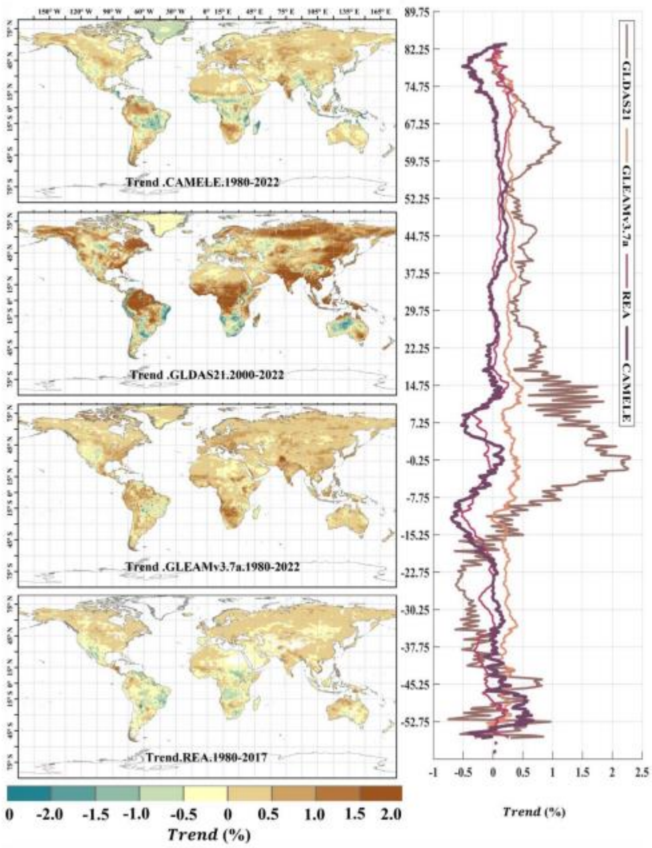

Figure 10 Global distribution of multi-year linear trend at 0.25° for CAMELE, GLDAS2.1, GLEAMv3.7a, and REA, depicted alongside corresponding variation curves of average with latitude.

2.13 Line 745

L745. This should go to the result section. It is not clear to me how different treatment of the cross-correlation pairs will impact the final product.

AC:

Thank you very much for your suggestion. We still believe that placing it in the discussion section is more appropriate for two reasons:

(1). The results section primarily focuses on discussing the evaluation results of CAMELE and comparing its performance with other products. As mentioned earlier, we have already included a detailed analysis of trend, seasonality, mean, and extreme, making the section quite extensive. Adding the ECC part might seem abrupt to readers solely interested in ET.

(2) We have specified which two groups have non-zero ECC, serving as a test of the validity of our hypothesis.

Setting non-zero ECC in collocation calculations requires careful consideration. In our case, we are validating the correctness of our non-zero ECC pairs, not attempting to compare the effects of all possible pairs, which would be impractical. Furthermore, we have discussed the scenario without setting non-zero ECC in Section 5.3 (i.e., the results of the traditional TC method), providing a comprehensive discussion on non-zero ECC in this context.