We thank the reviewers of this manuscript. The constructive criticism has helped to further improve it and clarify some remaining issues. We provide below a point-by-point response to each of the reviewers comments, highlighted in green.

We'd like to mention that the dataset has been updated in accordance with a previous reviewer comment. Both the land surface temperature and net radiation dataset are identical to the previous version but have been post-processed to better follow coast-lines and inland water bodies.

Most importantly, as we understand, is that both reviewers have taken an issue with the lack of direct validation of the land surface temperature dataset. We had argued that the validation based on outgoing longwave radiation against FluxNet measurements should be sufficient. We understand this remains an issue and have followed the comments of Reviewer #2 and have reworded the title from "High-resolution all-sky land surface temperature and net radiation over Europe" to **"1 km all-sky net radiation over Europe enabled by the merging of land surface temperature retrievals from geostationary and polar-orbiting satellites."**

Reviewer #1 response

1. The novelty of the proposed algorithm should be emphasized. Motivation is the key to the introduction section. Need improvement: Summarize the knowledge gap here and justify why a new approach is needed.

Thank you for the suggestion. We have expanded the motivation of the study in the introduction section highlighting that our approach is consistently based on the surface energy balance by downscaling individual radiation components. This seems to be the most 'natural' way of producing high resolution net radiation estimates from the available data sources.

2. P3, it is recommended to provide a summary of previous methods used for generating all-weather LST and SNR in the introduction part. For instance, mention relevant papers such as:
Jia, Aolin, et al. "Global hourly, 5 km, all-sky land surface temperature data from 2011 to 2021 based on integrating geostationary and polar-orbiting satellite data." Earth System Science Data 15.2 (2023): 869-895.

Xu, Shuo, and Jie Cheng. "A new land surface temperature fusion strategy based on cumulative distribution function matching and multiresolution Kalman filtering." Remote Sensing of Environment 254 (2021): 112256.

We now mention existing studies in the introduction as well as Discussion, including the ones mentioned above. In addition mentioning the papers we shortly describe the approach/methodology they present.

3. The data quality of in-situ measurements was not well displayed, which is crucial to evaluate the reliability of satellite data. It is recommended to add more detailed information such as the instruments used and the accuracy of station observations.

We acknowledge that the FLUXNET measurements have an error (difference to the 'truth' at the local scale that they sample), but that the pixel-to-local 'representativeness' error (difference between pixel truth that we aim for, and the local truth the smaller tower footprint) is much larger.

Unfortunately, we cannot solve this issue but argue that using as many stations as possible benefits the validation, also in areas where the spatial heterogeneity is large (see also next comment).

We have added this statement to the Discussion section, see page 21, L386.

4. Line 240. The worse match between observations and in situ data may indicate high spatial heterogeneity. If the site is located in an area with high spatial heterogeneity, it may not be suitable for validating satellite data. It is important to provide additional clarification regarding the factors contributing to the worse validation results observed at certain sites.

Thank you, we agree with the observation. We have clarified this in the next. We also argue the case for keeping all available in-situ data as the availability is already quite sparse and we want to carry out the validation in as many locations as possible, even under challenging circumstances.

"Since the availability of in-situ measurements is already fairly limited, we argue that carrying out the validation also in challenging terrain benefits the overall accuracy assessment." P9, L258.

5. Section 4.2. When discussing the merging of LST, it is important to compare the merged LST with in-situ measurements. Include a comparative analysis between the merged LST data and the corresponding in-situ measurements to demonstrate the accuracy and reliability of the merging process.

As highlighted at the very top of this reviewer response, we have modified the title. This change accounts for net radiation being the focus and the final product of this study. Land surface temperature has been indirectly validated via longwave outgoing radiation against FluxNet measurements but we agree that land surface temperature should not be presented as a final validated dataset in the title. It is a means to the end. We have also modified other parts of the manuscript to reflect this shift of focus, e.g. the abstract and introduction.

6. During the validation process, it is crucial to report the accuracy of clear-sky data (such as LST and SNR) separately from the accuracy of cloudy-sky data. This differentiation is important as it provides a comprehensive evaluation of the algorithm's performance under varying sky conditions.

We have added a comparison of the final SNR product in terms of performance between clear-sky and cloudy sky days in section 4.5. See Page 17 text and Figure 8.

7. In the conclusion section, it is important to outline the novel aspects and improvements introduced by the proposed method and the generated products, highlighting their advancements compared to existing methods and published products.

We have added existing studies to the Conclusion section of the paper. Conceptually we highlight their differences. A quantitative comparison has not been added as this is not the scope of this paper and would prove difficult due to differing spatial and temporal domains.

Reviewer #2 response

The revised manuscript "High-resolution all-sky land surface temperature and net radiation over Europe" has been largely improved. However, there are still several concerns from my viewpoint.

1. In the response to my comment 1, authors explained that the land surface temperature (LST) data is an intermediate product and did not need accuracy assessment. However, the LST data has been shown in the title of the manuscript and described in the abstract. As a published dataset, the LST data should be reliable to be used. Otherwise, no need to be shown in the title.

We understand the concerns of the reviewer and have directly addressed this by modifying the title. The focus of this study is on producing net radiation data and the land surface temperature merging served this overall goal. While the temperature was indirectly validated via outgoing longwave radiation against FLUXNET measurements a direct validation would be necessary when directly advertising a novel land surface temperature product.

2. In the response to my comment 4, authors think that a systematic review of existing LST datasets in not necessary. The ESSD journal focus on the novelty and description of the published datasets instead of the novelty of the method. Therefore, a solid description on existing datasets is very important to show the novelty of this study. I suggest authors highlight the novelty of their dataset by comparing with existing datasets. As I know, there are several other gap-less LST datasets covering the current study area (even larger areas). No needs for listing all the literature, but it is necessary to do discussion).

We thank the reviewer for their comment and have now added several recent studies focusing on the creation of all-sky land surface temperature products. In the newly added Discussion section, see page 20, we mention the methodologies and how our approach differs. This is partly also handled in the introduction section.

3. The authors are suggested to double check their descriptions. Examples of issues are listed as follows. 1) Lines 70 and 84, what does "??" mean? 2) Line 224, what does "nore details" mean? 3) Line 378, what does "the the Sentinel 3 LST…" mean?

Thank you very much. We have carefully revised the manuscript to avoid these mistakes.