Response to Reviewer 1 Comments

1. Summary

Thank you very much for reviewing our manuscript and providing valuable comments and suggestions during your busy schedule. Your suggestions are of great significance in guiding our research work, and we would like to express our heartfelt thanks to you. We will respond to your questions and suggestions one by one.

2. Point-by-point response to Comments and Suggestions for Authors

Comments 1: *[Why is 471 input data points selected? Does this number have any significance? And what are the reasons for setting various parameters?]*

Response 1: We thank the reviewer for the insightful question regarding the parameter selection.

The input lookback length is set to 144 time steps, which corresponds to 24 hours given the 10-minute sampling rate of the data. This duration was chosen because it encompasses a full diurnal cycle, allowing the model to learn the characteristic intra-orbit illumination and eclipse transitions that occur approximately every 90 minutes.

The forecasting horizons of 144, 432, and 720 steps (representing 24, 72, and 120 hours, respectively) were selected to provide a balanced and comprehensive evaluation of the model's performance across short-, medium-, and long-range prediction scenarios, all under a consistent experimental setup.

We have clarified this rationale in the revised manuscript within Section 4.2 (Page 16, Lines 495-500). The supplementary content is as follows: *"[The lookback window is set to 144 time steps, which equals 24 hours at 10-minute sampling. This duration spans a complete daily cycle, enabling the model to learn both intra-orbit illumination/eclipse transitions and diurnal thermal variation. Forecast horizons are set to 144, 432, and 720 steps, corresponding to 24, 72, and 120 hours. These three horizons provide a balanced evaluation of short-, medium-, and long-range prediction scenarios that are relevant to operational planning.]"*

Comments 2: *[The data figures in the manuscript are not clear enough; please readjust their format.]*

Response 2: We thank the reviewer for the valuable feedback regarding figure clarity. In response, **we have comprehensively revised Figures 6, 7, 8, and 9 with the following specific enhancements**:

- For all figures, we universally increased font sizes for axis labels, legends, and data annotations to ensure readability. The overall resolution and layout were also optimized for sharper visual presentation.
- Specifically for Figures 6 and 7, we adjusted the color schemes to provide better contrast and more distinct visual separation between different data series, preventing any potential ambiguity.
- For Figure 9, we have incorporated an enlarged inset to clearly highlight the intricate details of the key region, which was difficult to discern in the original version.

We believe these targeted revisions have significantly improved the clarity and interpretability of the figures, and they now meet the required standards. These revised figures have now been incorporated into the updated manuscript for your review.

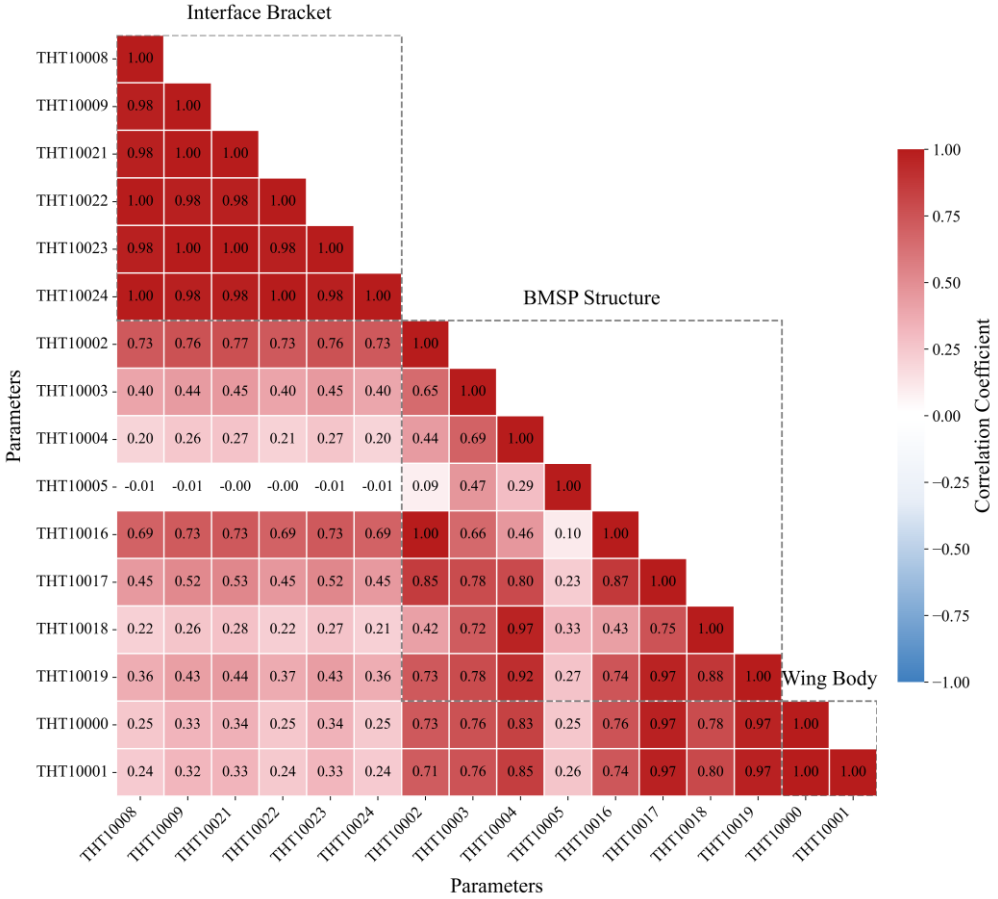
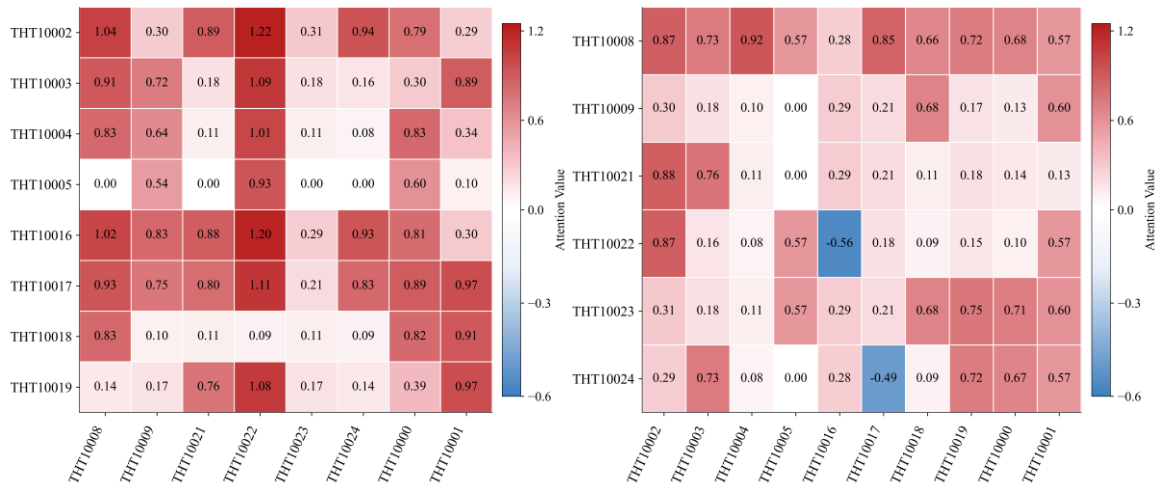
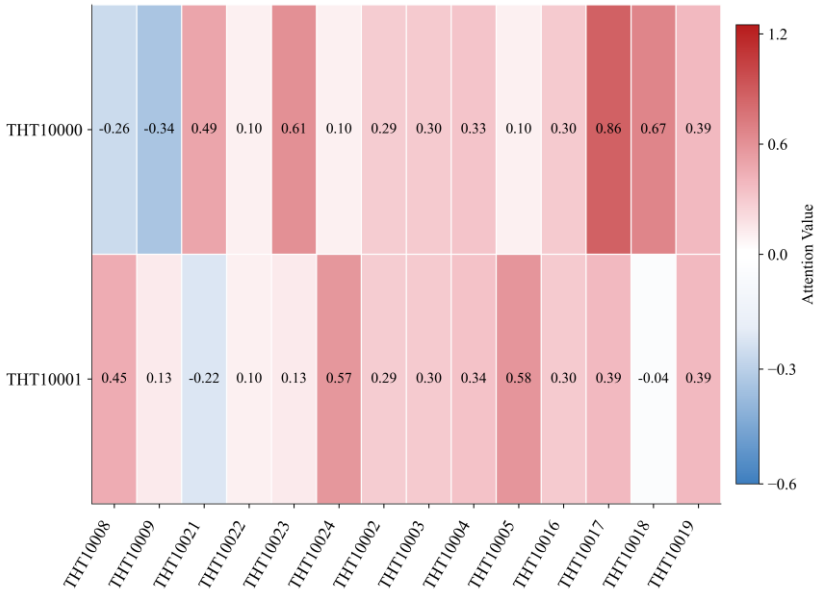


Figure 6. Pearson Correlation Matrix of Solar Array Temperatures.



(a) BMSP Structure as Query

(b) Interface Bracket as Query



(c) Wing Body as Query

Figure 7. Cross-Attention Analysis by Structural Grouping.

Comments 3: *[During the collection of the dataset mentioned in the manuscript, whether there are missing values or outliers is not stated, and the part about data preprocessing is not explained. If there are such issues, please specify the handling methods.]*

Response 3: We thank the reviewer for the valuable comment. As clarified in the revised manuscript, **this study uses the ESA provided 10-minute resampled dataset, which has already undergone preprocessing by the European Space Agency.** This version integrates calibrated telemetry data and statistical resampling to address missing values and irregular sampling. Therefore, no additional data cleaning or outlier handling was required in our analysis.

The updated text can be found in the Section 4.1 (Page 14, Lines 460-463). The revised content is as follows: *"[This dataset covers multivariate temperature telemetry data of GOCE satellite solar array from March 2009 to June 2012, using ESA's recommended 10-minute resampling data, which has undergone prior calibration and statistical resampling by ESA to ad-dress missing values and irregular sampling rates.]"*

Comments 4: *[The conclusion section does not adequately extract the innovations in the manuscript; it is recommended to readjust it.]*

Response 4: We sincerely thank the reviewer for this crucial suggestion. We have thoroughly rewritten the Conclusions section (Section 5) to explicitly and coherently summarize the key methodological innovations of our work.

The revised conclusion now clearly articulates that our main contribution lies in the integrated design of the CA-PatchTST framework, which combines three complementary components:

- Moving-average decomposition matched to the orbital cycle to suppress noise and stabilize long-horizon learning.
- A patch-based, channel-independent encoder to enhance local feature extraction and

global temporal representation while improving computational efficiency.

- A cross-attention mechanism that captures inter-device thermal coupling, yielding predictions with physically interpretable attention patterns that align with empirical correlation analysis.

These revisions ensure that the innovative aspects of our work and their collective impact on forecasting performance are immediately clear to the reader. The updated text can be found in the Section 5 (Page 24, Lines 722-736). The revised conclusion is as follows: *"[This paper proposes CA-PatchTST, a multivariate forecasting framework for solar array temperature, and validates its superior performance on the GOCE satellite telemetry dataset, where empirical results demonstrate consistent improvements in MAE, RMSE, and MAPE across multiple horizons, confirming the model's accuracy and robustness for long-horizon on-orbit forecasting. The methodological contribution lies in the coherent integration of complementary modules into a unified pipeline: the moving-average decomposition, matched to the satellite's orbital cycle, suppresses high-frequency fluctuations and stabilizes long-horizon learning; the patch-based, channel-independent encoder enhances local feature extraction and global temporal representation while improving computational efficiency; and the cross-attention mechanism captures inter-device correlations by fusing auxiliary thermal streams, with learned attention patterns aligning with physical couplings revealed by the Pearson correlation matrix. Together, these components form a compact and interpretable framework whose primary application value is to provide critical data support for autonomous satellite operations and informed power system decision-making.]"*

Comments 5: *[The format of some references is incorrect.]*

Response 5: We thank the reviewer for highlighting this issue. We have conducted a thorough review of the entire reference list and corrected any formatting inconsistencies to ensure full compliance with the Sensors journal style guide.

The corrections include standardizing the author name formats, journal title abbreviations, punctuation, and citation order. The revised and uniformly formatted reference list is now presented in the manuscript. The updated reference can be found in Page 25-27, Lines 759-840.

3. Response to Comments on the Quality of English Language

Point 1: *[The English could be improved to more clearly express the research.]*

Response 1: We sincerely thank the reviewer for this valuable feedback and for highlighting areas where the language can be enhanced for greater clarity. In direct response to this comment, we have meticulously proofread the entire manuscript and implemented comprehensive revisions to correct grammatical errors, improve sentence structure, and refine the academic style. Specific improvements include, but are not limited to:

- Correcting grammatical and syntactic issues, such as subject–verb agreement and verb tense consistency (e.g., "...telemetry data, which **provide**..." in the Abstract, Page 1, Line 16; and "... and **captures** cross variable dynamic correlations..." in the Introduction, Page 2, Line 83).
- Improving article and preposition usage to enhance precision and readability (e.g., "... information interaction **among variables**..." in the Methodology, Page 7, Line 284; and

"... **channel-independent** modeling approach..." in the Methodology, Page 10, Line 356).

- Refining sentence structure and academic tone to achieve smoother flow and stronger logical coherence across paragraphs (e.g., "Table 1 provides detailed component descriptions and tensor shapes for reproducibility" in the Results, Page 12, Line 441-442; and "…confirms the complementary roles of the two components..." in the Conclusion, Page 23, Line 676-677).

We believe these thorough revisions have significantly improved the fluency, clarity, and overall quality of the English language throughout the manuscript, ensuring it meets the high standard required for publication.