Dear. Referee #1

We uploaded response letter for the comments of all reviewer and revised manuscript entitled, "Retrieval pseudo BRDF-adjusted surface reflectance at 440 nm from Geostationary Environmental Monitoring Spectrometer (GEMS)".

All comments of reviewers were seriously touched by authors and answered in response letter. We tried our responses can satisfy all reviewers, and our manuscript has been more improved by your advice.

Comments and Suggestions for Authors as follows (Referee 1):

1. After reading through the entire paper, I found a few areas that could benefit from further clarification. It would be helpful to expand on the description of the overall process outlined in lines 138-141 to make it easier for readers to follow. Initially, I assumed Figure 1 was a flowchart illustrating the algorithm, with the bottom row representing gap filling. This led me to believe that the method primarily uses BSR while incorporating LER and TOC for gap filling. It took me some time to realize that my interpretation of the flowchart was incorrect. It would be useful if the flowchart clearly indicated the structure of the algorithm, and the text explained that BSR is compared with LER and TOC to validate the BSR results. Even as I write this review, I'm not entirely sure if my understanding of the flowchart is accurate.

➔ Thank you very much for your insightful feedback. We appreciate your observations and agree that the process outlined in lines 138-141 could benefit from further clarification.

In this study, after calculating BSR and LER, we verify the results with the actual TOC data and compare the performance of BSR with LER. If BSR cannot be calculated, we perform gap-filling using LER. However, since this is a minor aspect of the study, it was not initially included in the flowchart. To address potential confusion, we have now provided a more detailed explanation of the study's flow in the text and have revised the flowchart for better clarity.

Below, we have included the revised text and the updated flowchart for your review. The modified parts are as follows: (The previously written parts are in blue and italics, and the newly added/replaced parts are in red and italics.)

Figure 1 depicts a comprehensive flow chart of the BSR retrieval algorithm, which comprises two primary steps: (1) atmospheric correction and (2) BRDF modeling and BSR retrieval. Subsequently, the constructed GEMS BSR and LER were validated through comparative analysis with the GEMS TOC in this study.The methodology and underlying assumptions are detailed in the subsequent subsections.

Figure 1 depicts a comprehensive flow chart of the BSR retrieval algorithm, which comprises two primary steps: (1) atmospheric correction and (2) BRDF modeling and BSR retrieval. To evaluate the applicability of the BSR derived in this study, validations were performed against the GEMS Top-of-Canopy (TOC) data as reference data. Additionally, a comparison was made with the LER data

generated using the traditional minimum reflectivity method. Both GEMS BSR and LER were validated against the GEMS TOC data to compare their accuracy, followed by a direct comparison between BSR and LER. The detailed methodology and underlying assumptions are provided in the subsequent subsections.

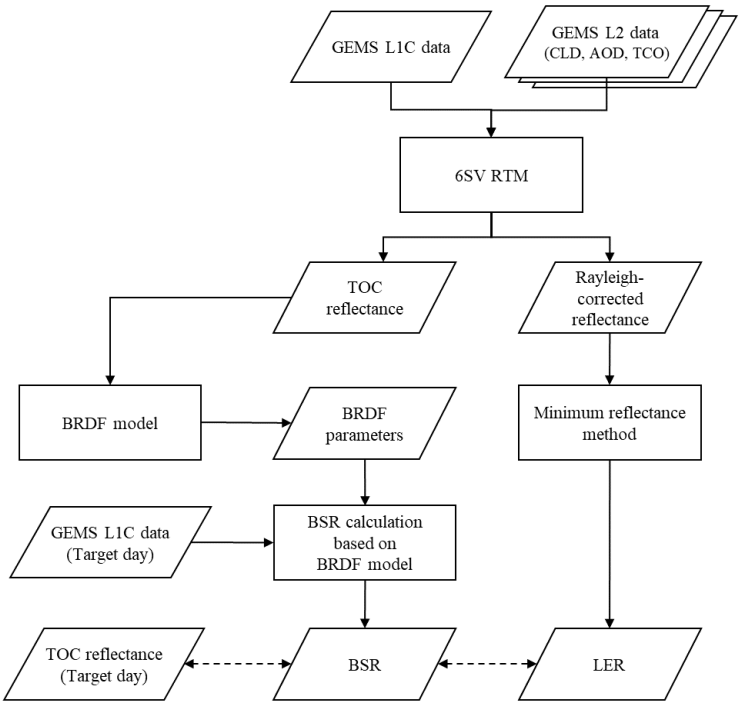

Fig 1. Flow chart of this study (Figure 1 in article; Before the change)

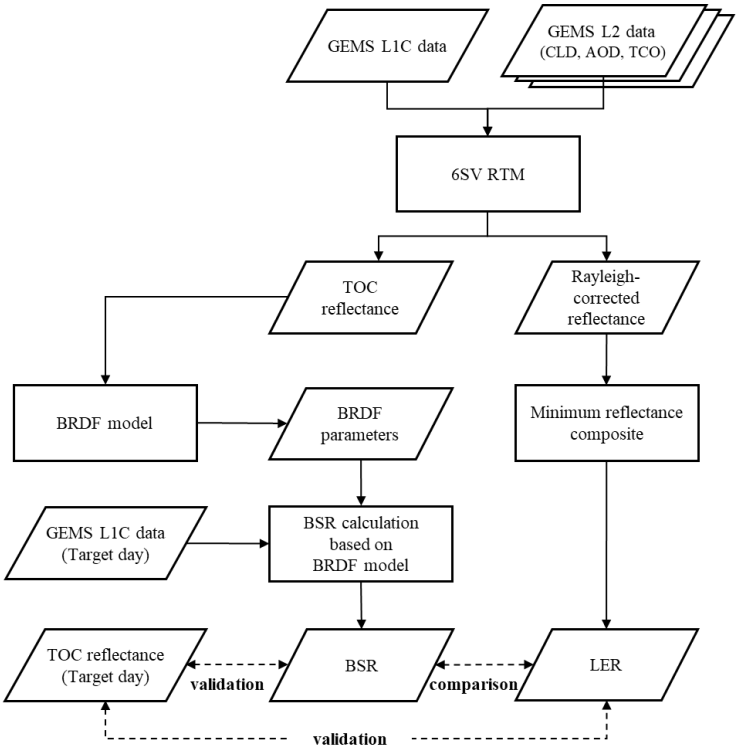

Fig 2. Flow chart of this study (Figure 1 in article; After the change)

2. Additionally, if this method uses LER for gap filling, does it create any discontinuity between the pixels that use BRDF modeling and those where LER is applied? It would be beneficial for the authors to address this and discuss any potential issues with continuity if applicable.

➔ Thank you for your thoughtful comment. We acknowledge that BSR and LER utilize different algorithms, which may result in discontinuities between pixels when applying the gap-filling algorithm. While no obvious discontinuities are visible to the naked eye, it is possible to consider these as discontinuities in a strict sense due to the differing calculation methods.

However, since the number of pixels requiring gap-filling by this method is very small, we believe that introducing additional artificial methods may not be desirable. Instead, we will conduct further work to identify gap-filled areas within the quality flag and other relevant indicators.

3. Regarding the title of Section 4.4, GEMS LER is mentioned as one of the LER databases, but it's unclear whether it was used in Section 4.4. I tried to find a comparison with GEMS LER in this section but couldn't locate any reference to it. If this omission is accurate, it might be better to remove GEMS LER from the section title.

➔ Yes, we have removed "GEMS LER" from the subsection title. Thank you.

4. Lastly, I'm uncertain if it's appropriate to describe this method as a "novel concept" or "novel approach" in the abstract and conclusion. Although this study uses the new hyperspectral sensor GEMS, the methodology (BRDF modeling, LER) itself doesn't seem particularly innovative. Thus, I'm not sure if these terms accurately represent the uniqueness of the approach.

➔ We strongly agree with the comments provided. We initially stated that our study was innovative because it was the first attempt to apply atmospheric correction and BRDF modeling within the official output algorithm of a current environmental satellite such as GEMS. However, as the reviewer mentioned, the methodology itself may not be innovative. In light of this, we have revised the text to convey that it represents the first practical application of this approach. Below are the changes we made to the Abstract and Conclusion. The modified parts are as follows: (The previously written parts are in blue and italics, and the newly added/replaced parts are in red and italics.)

(Line 5-7; In Abstract)

(Before the change)

This study introduces a novel approach to surface reflectance retrieval, termed background surface reflectance (BSR), which leverages a semi-empirical Bidirectional Reflectance Distribution Function (BRDF) model to simulate surface reflectance based on BRDF components

(After the change)

This study is the first to assess the applicability of background surface reflectance (BSR), derived using a semi-empirical Bidirectional Reflectance Distribution Function (BRDF) model, in an operational environmental satellite algorithm.

(Line 395-396; In Section 5. Conclusion)

(Before the change)

This study introduced the novel concept of BSR as an alternative output to resolve the output precedence dilemma between land surface reflectance and other L2 outputs applied to GEMS, a hyperspectral satellite observing in the UV-VIS range.

(After the change)

This study represents the first practical application of BSR as an alternative output to resolve the output precedence dilema between land surface reflectance and other L2 outputs applied to GEMS at 440 nm, evaluating its feasibility for operational use.

5. Line 140 : GEMS TOC -> GEMS Top of Canopy (TOC)

➔ We have revised the relevant sections as suggested. Thank you.

6. Line 173 : paragraph is duplicated in line 185

➔ We have reviewed the relevant sections and deleted the redundant parts. Thank you.

7. Line 212 : does ‘15 d’ means 15 days?

➔ Yes, that is correct. We have revised the relevant section to 15 days. Thank you.

8. Line 239 : does ‘SFC’ meas surface reflectance?

➔ Yes, SFC stands for Surface Reflectance, which in this study is synonymous with TOC (Top-Of-Canopy) Reflectance. However, for consistency throughout the paper, we have changed it to TOC Reflectance.

9. Line 373 : I guess author was intending ‘GEMS TOC’ not ‘GEMS, TOC’

➔ We have revised the relevant sections as suggested. Thank you.