

Response to Reviewers' Comments

We would like to express our sincere gratitude to the editors and reviewers for their valuable comments and suggestions, which have greatly improved our manuscript and dataset, making it acceptable for *Earth System Science Data*. In this round, we thank the topic editor for these correction comments. We have carefully reviewed the comments and made the necessary revisions. The changes in the revised manuscript were highlighted in [blue](#).

Q1: Remove the word “holes” in the phrase “missing data holes” in the abstract and elsewhere. This is because “missing data holes” sounds like the “data holes” are missing. Alternatively, you can say “data holes”, and remove the word missing. This is a mandatory fix.

Response: Thank you for this correction. We have replaced "missing data holes" and “missing holes” with "data holes" throughout the text and Figure 1 to enhance clarity and avoid misunderstanding.

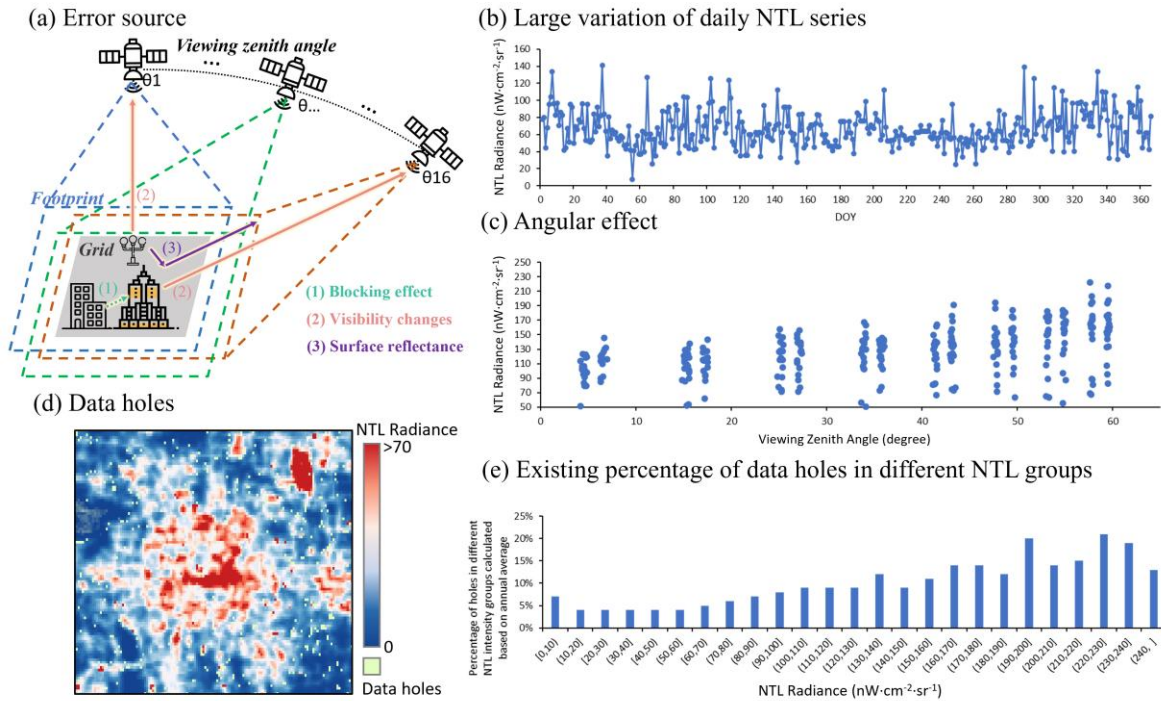


Figure 1: An illustration of spatial mismatch error, angular effect error and data holes of VNP46A2. (a) Error source: Schematic diagram illustrating the existence of spatial mismatch and angular effects, (b) The instability of daily NTL series, (c) Angular effect: The changing trend of daily NTL intensity along with VZA changes within one year, (d) Data holes existence in cloud-free NTL image of Beijing on October 1, 2018, (e) The percentage of data holes in different NTL intensity groups calculated based on annual averages.

Q2: HDNTL and all other abbreviations should be defined during the first term of use. There are many abbreviations in this manuscript and they all need to be written out at first use.

Response: Thank you for this important reminder. We have carefully reviewed the entire manuscript and ensured that all abbreviations, including HDNTL, are now properly defined at their first occurrence.

Q3: Introduction Line 42: “The Day/Night Band (DNB)...is carried”. This sentence is confusing. Isn’t a band a part of the remotely sensed data? Are you talking about a sensor instead? Please revise.

Response: *Thanks for your insightful comment. You are correct that the Day/Night Band (DNB) is a key sensor of the Visible Infrared Imaging Radiometer Suite (VIIRS), on board the Suomi-National Polar-orbiting Partnership (S-NPP) and Joint Polar Satellite System (JPSS) satellite platforms. We have corrected this unclear description on Line 42:*

“The Day/Night Band (DNB) sensor of the Visible Infrared Imaging Radiometer Suite (VIIRS), is carried aboard the Suomi National Polar-orbiting Partnership (S-NPP) and Joint Polar Satellite System (JPSS) satellites.”

Q4: “challenging since the discrepancy is random from day to day.” -> What does this mean? The word ‘random’ should be used very carefully—do you mean it’s hard to predict? And why?

Response: *Thank you for raising this important point. We agree that the term "random" was imprecise, so we have revised the sentence and clarified the reason as follows:* “The Black Marble dataset grid 740m DNB observations to 15 arcsec geographic latitude/longitude pixels (approximately 500m), resulting in gridding artifacts (Wang et al., 2021; Hu et al., 2024) (Fig. 1a). In addition, the geolocation accuracy of NASA VIIRS swath products has a mean residual of 2 m with a root mean square error of less than 70 m along track and 60 m along scan direction (Wolfe et al., 2013). Both the geolocation uncertainty and gridding artifacts result in a spatial mismatch, which is reported as the relatively large temporal daily NTL radiance variation (Román et al., 2018) (Fig. 1b). Estimating the error using any model or formula is challenging since the discrepancy varies from day to day. ”

Q5: Remove capitals from here: A Self-adjusting method featuring Filter and Angular effect Correction (SFAC).

Response: *Thanks for your suggestion. We have revised "A Self-adjusting method featuring Filter and Angular effect Correction (SFAC)" to use lowercase letters.*

Q6: The term Region of Interest (ROI) is confusing. The reader community of this journal understands that a city sprawls, and that the study area includes the sprawl. ROI usually means Return on Investment. Please replace with ‘region’, or ‘urban region’.

Response: *Thanks for your valuable suggestion. We agree that the abbreviation ROI is prone to confusion with "Return on Investment," particularly for a multidisciplinary readership. We have replaced all instances of "Region of Interest (ROI)" with the clearer and more appropriate term "urban region" throughout the manuscript to accurately reflect the dynamic nature of our study areas.*

Q7: Please watch for extra spaces, e.g. "in GHS-DUC)" and elsewhere.

Response: *Thank you for your meticulous review. We have carefully checked the entire manuscript and corrected all instances of extra spaces.*

Q8: Reviewer 3's comment "Q1: On page 5, line 125, the phrase "Grow a square with... is less than 1" is unclear. What exactly does "less than 1" refer to in this context" requires better explanation. Accordingly, on line 152: "a square region" is not well-defined. What do you mean by this? Without exact description of size and method, someone would not be able to replicate your study, and this aspect if it is important.

Response: *Thank you for highlighting this lack of clarity. We have revised the method description as:*

"Beginning with the central coordinates of each city, as sourced from the United Nations World Urbanization Prospects (WUP): The 2018 Revision, we defined an initial square region with a side length of 0.1 decimal degrees. This square was progressively expanded using a fixed step size of 0.05 decimal degrees. At each step, the suburban and rural area was compared to that of the urban core within the current square. The square expansion continued until the suburban and rural area exceeded the urban core area, and the final square region was adopted as the urban region of each city."

Q9: Line 239: This sentence isn't clear: "For each pixel, the satellite observation angles throughout a year fall into 16 discrete VZA groups."

Response: *Thanks for your constructive comment. We have revised the description to improve clarity:*

"The anisotropic characteristics of NTL and their relationship with satellite viewing angles have been well documented and modeled (Tan et al., 2022; Li et al., 2019). The S-NPP satellite, which operates in a sun-synchronous polar orbit with a 16-day revisit cycle, observes each ground location under a recurring sequence of View Zenith Angles (VZAs). This orbital pattern ensures that observations made every 16

days (e.g., on the 1st, 17th, and 33rd days of the year) have nearly identical VZA values. Consequently, annual observations for each pixel can be grouped into 16 distinct VZA categories, where the differences in VZA between groups are much greater than those within each group.”

Q10: Figure 4: Google Earth is supposed to be capitalized. Please fix this in all locations (it is in other figures as well).

Response: *Thanks for your constructive advice. We have corrected the capitalization of "Google Earth" in Figure 4, 6, 11, and throughout the entire text.*

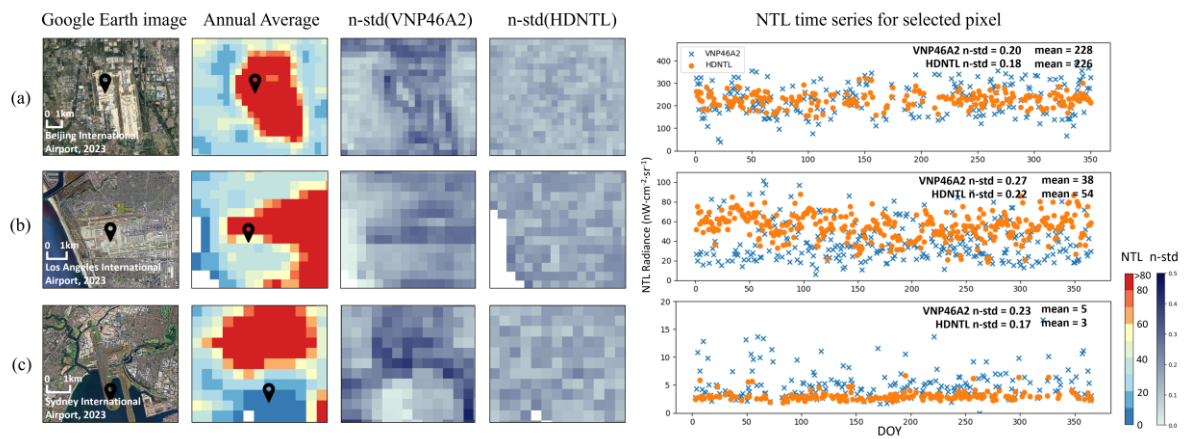


Figure 4: Spatial mismatch correction effectiveness in less-angular effect areas within airport cases. (a) Beijing International Airport, (b) Los Angeles International Airport, (c) Sydney International Airport. Google Earth images © 2025 Google LLC.

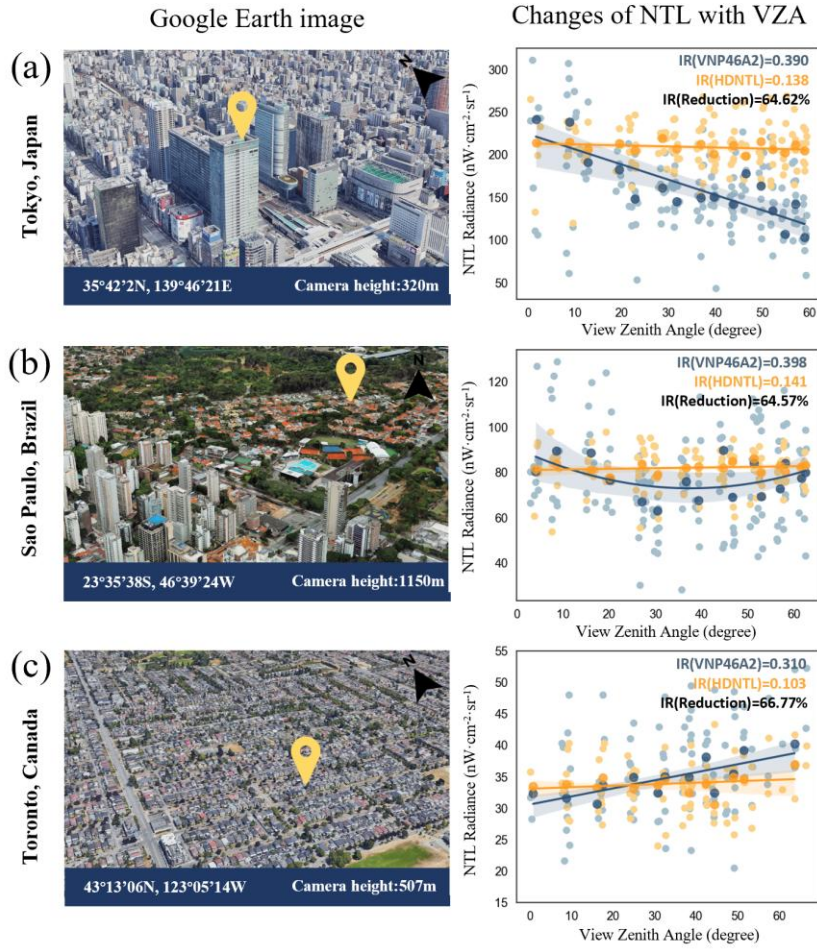


Figure 6: Angular effect and its correction effectiveness in different built-up environments. Google Earth images © 2025 Google LLC.

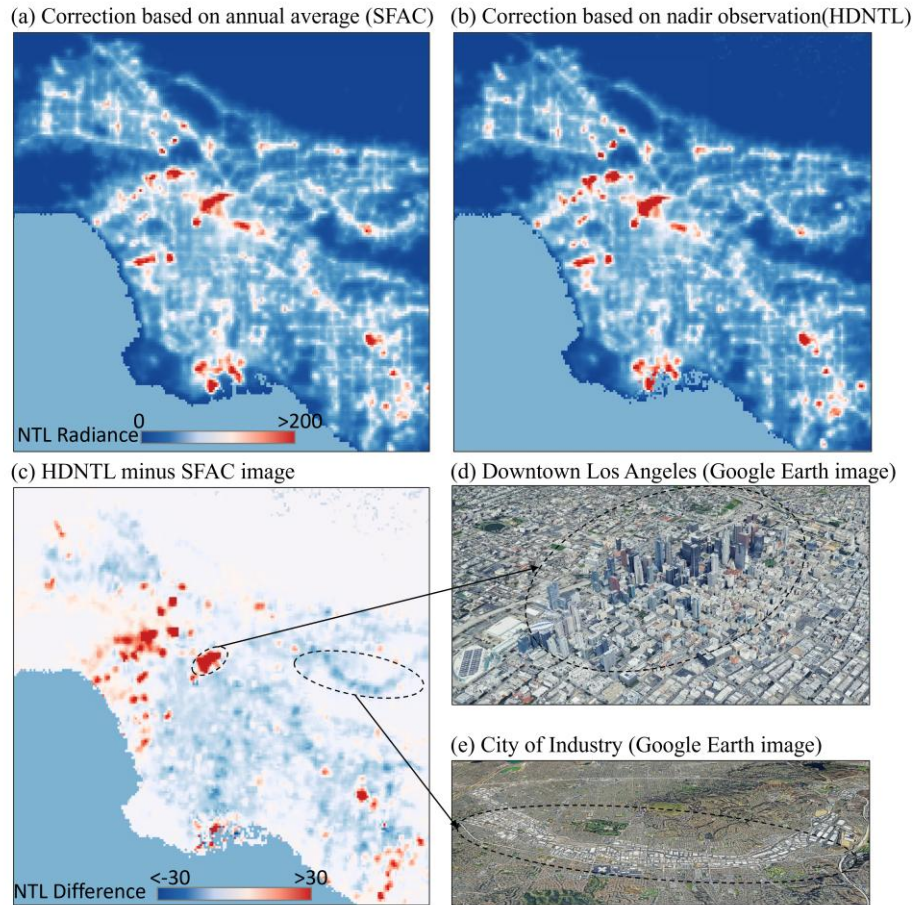


Figure 11. Comparison of angular correction results based on nadir correction (HDNTL) and annual mean correction (SFAC). Google Earth image © 2025 Google LLC.

Q11: “We also chose the runway pixel.” - . should be “We also chose a runway pixel.”

Response: *Thanks for your insightful comment. We have revised the text.*

Q12: In Figure 6, please write out what VZA stands for and the unit of measurement for each (in the scatterplot).

Response: *Thanks for your constructive comment. We have corrected Figure 6.*

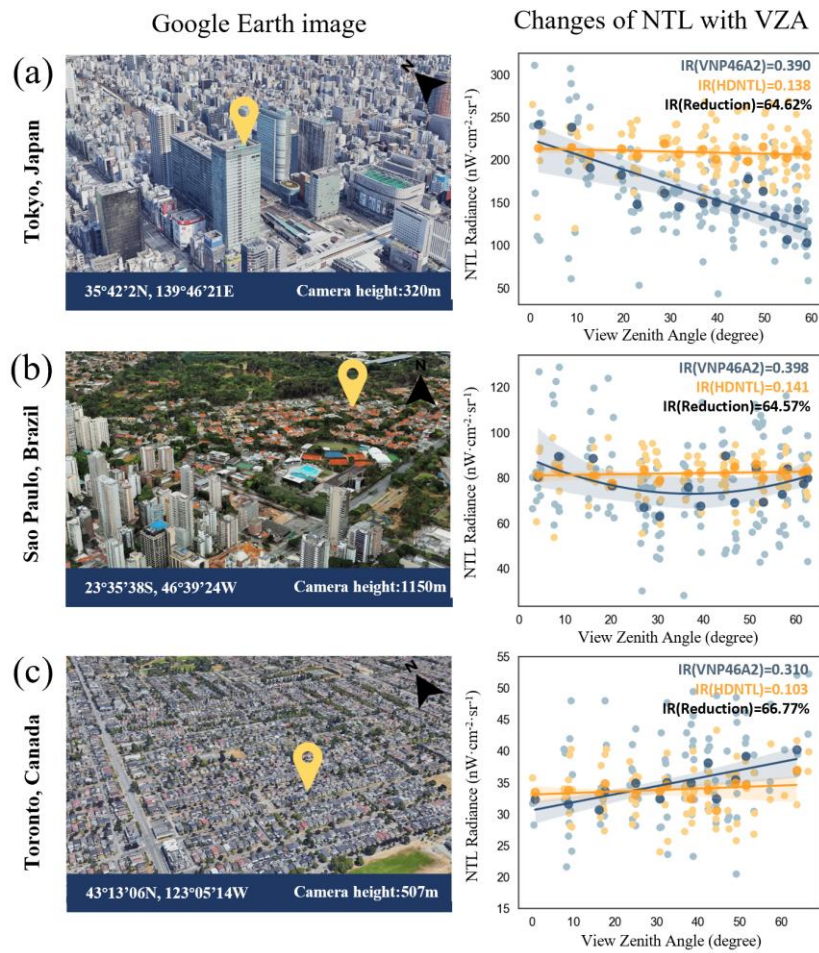


Figure 6: Angular effect and its correction effectiveness in different built-up environments. Google Earth images © 2025 Google LLC.

Q13: Figure 7 also needs unit of analysis labels on the scatterplot. Please write out what RMSE and MAE are in the caption.

Response: *Thanks for your comment. We have revised Figure 7 and its caption.*

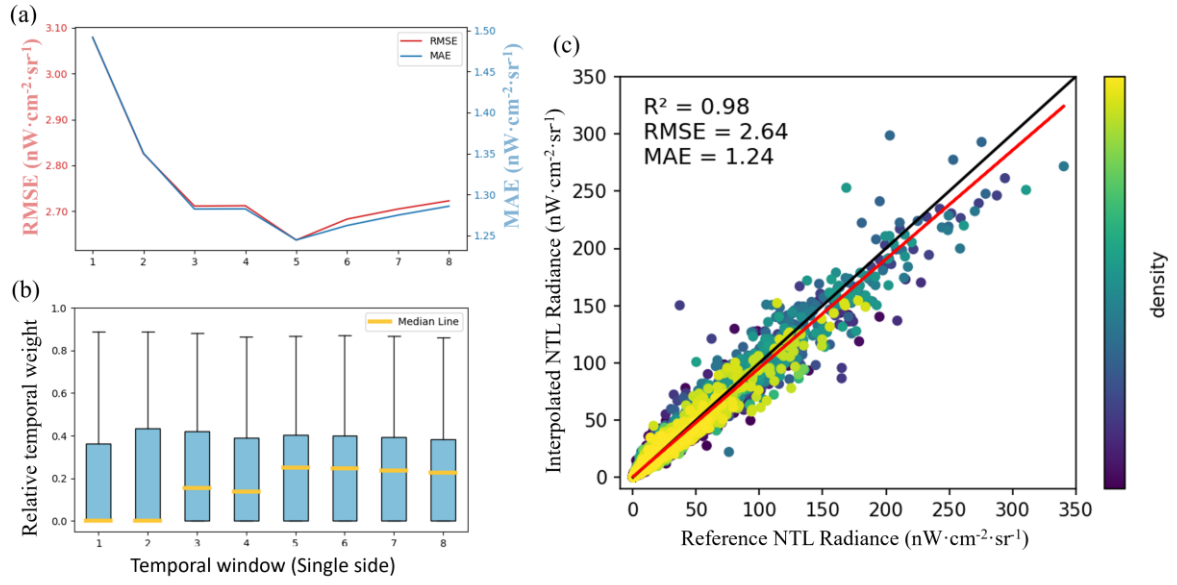


Figure 7: Interpolation accuracy test. (a) The Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) of interpolation by different time windows, (b) The relative temporal weight of different time windows, (c) The comparison between reference data and its interpolation by the 5-day temporal window.