General

The manuscript presents an original study investigating the potential use of opportunistic Earth-viewing observations from the Compact Total Irradiance Monitor (CTIM) CubeSat to support continuity of Earth Radiation Budget (ERB) observations. The topic is highly relevant to the climate and radiation budget communities, particularly in the context of increasing concern regarding possible observational gaps following the long-standing CERES record and the future Libera mission. The manuscript is generally well structured, clearly written, and scientifically interesting. The comparison between CTIM and CERES observations demonstrates encouraging agreement and provides a valuable proof of concept for future low-cost complementary ERB observing systems.

The study is also particularly relevant in the broader context of the ongoing transition at NASA and National Oceanic and Atmospheric Administration (NOAA) toward smaller, more autonomous satellite platforms such as CubeSats and SmallSats for ERB observations. These emerging architectures may provide more flexible and cost-effective approaches for ensuring continuity of ERB observations through constellations and increased observational redundancy. This broader context could be introduced more explicitly in the manuscript to further emphasize the relevance and timeliness of this type of work.

However, the manuscript would benefit from a broader discussion of ongoing CubeSat-based ERB initiatives and from positioning the present work within this rapidly evolving landscape. In particular, it would be valuable to discuss the relationship of this study to other recent small-satellite ERB missions and demonstrators, such as RAVAN and Uvsq-Sat / Inspire-Sat, which similarly explore the use of small satellite platforms for complementary ERB observations and climate data record continuity. I also encourage the authors to discuss whether the type of approach proposed here is envisioned as part of future operational or pre-operational ERB observing systems.

In addition, several methodological aspects require further clarification and stronger quantitative justification before the manuscript can be considered for publication. In particular, the collocation methodology, the treatment of viewing-geometry effects, and the interpretation of the residual differences between CTIM and CERES observations should be more thoroughly discussed and validated. More generally, important challenges remain regarding radiometric stability, intercalibration, temperature effects, straylight's, and the achievement of long-term climate-quality observations from small satellite platforms, and these aspects deserve further discussion in the manuscript.

Overall, I find the study promising and relevant for the future of complementary ERB observing systems, but I recommend revision of the manuscript prior to publication.

Specific Comments

*** Introduction

- Line 50: the historical context could be made more precise by mentioning that satellite ERB observations began with Explorer 7 in 1959, which carried the first satellite-based ERB instrument.

- Line 56: please verify the statement that “Six CERES instruments currently operating aboard four satellites”. As of 2026, not all CERES instruments remain operational?

- Line 84: please clarify:
the effective wavelength range associated with CTIM TSI observations,
the effective spectral sensitivity relevant to the opportunistic Earth-viewing longwave observations,
and the CTIM field of view (FOV) for SSI and OLR observations.

- Provide orbital information and Local Time of Ascending Node (LTAN) for CTIM and the CERES satellites used in the comparison.

- The manuscript would benefit from a broader discussion of ongoing CubeSat ERB initiatives, including RAVAN, Uvsq-Sat, Inspire-Sat, and Uvsq-Sat NG. This would help better position the present work within current international efforts on complementary ERB observations from small satellite platforms.

*** Collocation Methodology

- The choice of several collocation parameters appears somewhat arbitrary:
+/-20 min temporal window,
100 km spatial radius,
minimum of 75 CERES footprints,
VZA threshold of 20°.

- Provide either:
a sensitivity analysis,
or a quantitative justification demonstrating that the results are robust to reasonable variations of these parameters.

- For example:
impact of +/-10 min instead of +/-20 min,
75 km or 125 km radius,
sensitivity to the selected VZA threshold.

*** Limb-Darkening Corrections

- The limb-darkening correction appears oversimplified since it is only applied to nearly clear-sky scenes (>95% clear fraction), while cloud-related angular effects likely dominate the remaining spread.

The analysis needs to::
- quantify the fraction of CERES footprints actually corrected,
- indicate the fraction of scenes satisfying the clear-sky criterion,
- and moderate statements regarding the impact of the MODTRAN corrections.

*** Contribution of Each Correction Step

- It is currently difficult to assess the relative contribution of: CTIM spatial weighting, footprint area correction, and limb-darkening correction.

- Consider adding a summary table showing: mean bias, standard deviation, and R^2, for: no correction, spatial weighting only, footprint area correction, and limb-darkening correction.

*** Figure 7 / CTIM Longwave Observations

- Figure 7 clearly shows the expected tropical OLR structures. However:
some artefacts appear visible in the CTIM distribution and should be discussed,
clarify explicitly that these are nighttime descending-orbit OLR observations.

- It would also be interesting to compare the same 2022-2023 period with another independent CubeSat ERB dataset, such as Uvsq-Sat observations:
visualization portal: UVSQ-SAT data visualization portal
NetCDF archive: UVSQ-SAT NetCDF archive

- A comparison of latitude-longitude distributions or time series over the same 2022-2023 period, together with CERES observations, could provide additional insight into the consistency of small-satellite ERB observations.

*** Radiance versus Irradiance

- The distinction between radiance and irradiance should be clarified more carefully throughout the manuscript.

- Figure 7 compares:
CTIM longwave radiance,
CERES outgoing longwave irradiance.

Although the unit differences are mentioned, the comparison may still be misleading. Please either normalize the quantities more consistently or discuss more explicitly the limitations of this qualitative comparison.

*** Conclusions

- Some conclusions regarding future CubeSat ERB capability appear somewhat ambitious. Could you clarify the conclusions.

- The present study demonstrates promising complementarity with CERES, but several important challenges remain insufficiently addressed, including: long-term radiometric stability, absolute Earth-viewing calibration, cloud anisotropy corrections.

Statements suggesting reduced dependence on large dedicated missions should therefore be moderated.

Conclude that it's extremely difficult to determine the absolute value of ERB and EEI from satellite. Satellites are far better at determining the variability/trend.

*** Minor comments

- Equation (1), clarify:
the angular integration limits,
and why integration to $\pi/2$ is appropriate given the effective cutoff near 23° shown in the response function.

- Figure 3: The figure is useful, but the manuscript should specify:
the orbital altitude used for the ground-distance conversion,
and the explicit relationship between incidence angle and surface distance.

- Figure 8: The manuscript notes that only 0.5% of CERES footprints have VZA > 20°.

If so, the practical impact of the footprint-area and limb-darkening corrections may be extremely limited. This should be discussed more explicitly.

- Figure 15

The high correlation ($R^2 = 0.948$) is encouraging but partially expected given:
the large dynamic range of outgoing longwave radiances,
and the dominance of geophysical variability.

Additional diagnostics such as: RMSE, latitude-dependent statistics, or scene-type-dependent statistics, would provide a more complete evaluation of agreement.