

General Comments

This manuscript presents a rare and valuable case study of an extreme convective outbreak south of the Himalayas on 19 May 2022, during which both a massive TLE outbreak and multi-layer concentric gravity waves were observed. The combination of amateur photography, ground-based airglow imaging, satellite observations, and model results provides a strong basis for studying vertical atmospheric coupling from the lower atmosphere to the thermosphere, and offers a valuable test case for understanding how extreme convection drives multi-layer electrical and dynamical coupling.

The study is generally well organized, and the scientific storyline is clear. The observations of long-distance MLT CGW propagation and thermospheric CGWs are particularly interesting. The interpretation that the thermospheric waves are likely secondary gravity waves is plausible, and the proposed role of background winds in controlling their asymmetric observability is physically reasonable.

The manuscript is suitable for publication after the authors clarify several methodological details and improve the presentation. In particular, the authors should better explain the uncertainty of the ray-tracing results, the criteria used to identify MLT ducting, and the evidence linking the multi-station OH wave observations to the same CGW system. I recommend minor revision.

Overall, this is a scientifically interesting contribution with a valuable multi-instrument dataset. The required revisions are mainly related to clarity, reproducibility, and wording rather than the main conclusions.

Specific Comments

1. The phrases “first large-scale detection” and “largest documented sprite outbreak observed from China” should be made consistent.
2. Please provide uncertainties for the 260–280 m s⁻¹ phase speeds, or describe the main error sources.
3. The inferred source altitude near 150 km should be accompanied by an uncertainty range or a brief explanation of ray-tracing sensitivity.
4. Please explain more clearly why the OH wave packets observed at Lhasa, Xining, and Xinglong are identified as the same wave system.
5. The ducting analysis should clearly state the criterion used for identifying ducting layers and whether the background wind is projected along the propagation direction.
6. The physical meaning of Fig. 13 should be explained more clearly, especially why the hatched regions imply that gravity waves cannot continue vertical propagation.

7. Please provide more details on the reverse ray-tracing method, including initial conditions, background fields, integration settings, and stopping criteria.
8. The word “simultaneous” should be used carefully, since AIRS, TLE, and airglow observations occur at different times during the event.

Technical Corrections

1. Line 120: change “between ~50 and500 km” to “between ~50 and 500 km”.
2. Fig. 4 caption: “Aqua/ARIS” should be “Aqua/AIRS”.
3. Fig. 7 caption: “CGWS” should be “CGWs”.
4. Fig. 11 caption: “TIEGCM” should be “TIE-GCM”.
5. Section 3.5.2: “themosphere” should be “thermosphere”.
6. “Prandtlnumber” should be “Prandtl number”.
7. Remove the extra space in “[https://user.eumetsat.int /data-access/eumetview](https://user.eumetsat.int/data-access/eumetview)”.
8. Please verify the year of Schmetz et al.; it appears inconsistent.
9. Line 433: “p were” should be “p was”.
10. Check DOI formatting throughout the reference list.
11. Figure captions should be made fully self-contained, including time, altitude, station, and symbol/color meanings where applicable.
12. Please carefully verify that the in-text citations are consistent with the reference list.