

Response to Reviewers

We sincerely thank the reviewer for the detailed and constructive comments. We have carefully revised and improved the manuscript accordingly. Our point-by-point responses are provided below.

Comment 1: Improve the caption of Figure 1 and remove redundancy (e.g., describe the panels from top to bottom).

Response and revision: Thank you for the suggestion. We have rewritten the caption of Figure 1 to remove redundant descriptions and to clearly explain each panel in a top-to-bottom order.

Comment 2: Remove “after” in “before and after seismic activity”.

Response and revision: We have removed “after” to make the statement consistent with the earthquake early-warning context.

Comment 3: Briefly introduce the term “C-value” in the abstract (currently placed at the end and may feel abrupt).

Response and revision: Thank you for the reminder. We added a brief definition of the C-value after the second sentence of the abstract so that readers can understand the metric immediately and avoid an abrupt introduction at the end.

Comment 4: Review Equations (3) and (4), and the notations.

Response and revision: We have carefully checked Equations (3) and (4) and their accompanying explanations. In particular, we corrected the inconsistency between the denominators in the equations and the textual definitions, and we standardized the notations and formatting.

Comment 5: Distinguish between descriptive statistics/decomposition and physical interpretation/partition.

Response and revision: We strongly agree. We added an explicit statement in the Discussion to clarify that the decomposition and related metrics provide a descriptive, data-driven partition of the observations, while the physical interpretations are tentative and require further validation.

Comment 6: Discuss the possibility that the threshold is ad hoc.

Response and revision: Thank you for this important comment. We have added relevant discussion in the manuscript. We acknowledge that, in a single-earthquake case study, the anomaly threshold may appear somewhat ad hoc. In this work, the

threshold is mainly used as an operational criterion to screen and label candidate anomalies; therefore, the number of detected peaks and some details may vary with the threshold choice. Establishing an objective and generalizable threshold requires systematic statistical validation based on multiple earthquake events and control periods. Future work will evaluate the robustness and generalizability of the thresholding strategy within a multi-event framework.

Comment 7: Discuss the possibility that the V-shape may be caused by geometry artifacts.

Response and revision: We appreciate this insightful suggestion and have carefully assessed the possibility of geometry artifacts. Based on the following reasons, we consider the V-shaped trend unlikely to be solely caused by geometry artifacts and more likely to reflect stable background structural features of the ionospheric field:

- **Data processing:** We analyze the original along-track observations directly, without gridding, interpolation, or smoothing.
- **Spatiotemporal consistency:** The V-shaped feature remains consistent in both ascending and descending single-orbit data and across different revisit cycles.
- **Physical correspondence:** The turning points of the structure show good correspondence with regions near the magnetic equator and at high latitudes, which is consistent with known ionospheric electrodynamic structures.

At the same time, we agree that using geographic coordinates and UTC time-tagging may introduce some geometry-related effects. Although we cannot completely exclude a minor contribution from coordinate representation, the STL decomposition tends to capture such stable and repeatable background variations mainly in the seasonal/trend components, thereby reducing their impact on identifying earthquake-related anomalies in the residual component. We have added a brief discussion in the manuscript and plan to further examine this feature using geomagnetic coordinates in future work to strengthen the robustness of the interpretation.

Comment 8: Figure 7 “cle.(E” – add a space.

Response and revision: Corrected. We revised “cle.(E” to “cle. (E ...)” (space added).

Comment 9: Figure 8 – add centered general x and y labels.

Response and revision: We followed the suggestion and added centered global x- and y-axis labels to Figure 8 to improve readability of the multi-panel figure.

Comment 10: Missing final dot in some figures.

Response and revision: Thank you for pointing this out. We checked all figure captions and in-figure annotations, added missing final periods where needed, and standardized punctuation style.

Comment 11: In Conclusions, emphasize the method’s “capability” and the case observations (only one earthquake studied), and reduce non-formal language.

Response and revision: We agree. We added an explicit description of the STL–C method’s capability at the beginning of the Conclusions and stated clearly at the end that this study is based on a single earthquake case and requires further validation using multiple events and control periods. We also revised the wording to reduce non-formal language.