

Final Summary of Implemented Changes

Manuscript:

Threshold Atmospheric Electric Fields for Initiating Relativistic Runaway Electron Avalanches: Theoretical Estimates and CORSIKA Simulations

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General Statement

All reviewer comments received during the discussion phase have been carefully considered, and all requested revisions have been implemented in the final manuscript.

ID	Referee / Editor Comment	Author Response	Author's Changes in Manuscript
RC1-1	“Stronger than what? What is the reference value?”	We agree with this comment	Section 1 (Introduction): the description of “stronger-than-threshold” electric fields was clarified by explicitly referencing the theoretical RREA threshold field.
RC1-2	“development by calculating the number of electrons and gamma rays at various stages within the AEF every 200 m.”	We agree with this comment	Section 2 (Simulation setup): clarification of the 200 m sampling interval used to track particle development within the AEF.
RC1-3	“Be consistent with spelling.”	We agree with this comment	were standardized throughout the manuscript. Throughout the manuscript: consistent spelling of station names and abbreviations (e.g., Lomnický Štít, LHAASO).
RC1-4	“Is this the previous acronym or a city?” (RRE avalanches)	We agree with this comment	Throughout the manuscript: all occurrences of “RRE avalanches” were replaced with “RREA.”
RC1-5	Figure captions should be shortened	We agree with this comment	Section 3 (Results): captions of Figures 2, 3 were shortened and streamlined.
RC1-6	Minor language issues	We agree with this comment	Introduction and Results sections: minor grammatical corrections were applied.
CC2-1	Units and consistency: mixed use of kV/m and kV/cm.	We agree with this comment	Throughout the manuscript (text, figures, tables): all electric field values were converted and presented exclusively in kV/cm.
CC2-2	Simulation setup and uncertainties: specify vertical extent of the uniform field, lateral extent assumptions, number of primaries, and statistical uncertainties.	We agree with this comment	Section 2 (Simulation setup): added explicit description of the 2000 m vertical extent of the uniform AEF, number of simulated events (1,000–10,000), and a clarification that each event corresponds to a single seed electron and a statement on statistical stability was added.

CC2-3	Seed spectrum sensitivity: add a short remark.	We agree with this comment	Section 2 (Simulation setup): added a short remark on seed spectrum sensitivity and its limited impact on threshold determination.
CC2-4	Link to observations: include qualitative comparison with inferred AEFs during TGEs and gamma glows.	We agree with this comment	Section 4 (Discussion and conclusions): added a qualitative comparison between simulated thresholds and the strongest AEFs inferred at high-mountain stations during TGEs.
CC2-5	Minor typographical issues (“Mendelay” vs “Mendeley”, duplicated DOI).	We agree with this comment	Throughout the manuscript: typographical corrections applied; references to Mendeley were removed and replaced by the Zenodo repository.
CC3-1	The influence of atmospheric temperature profile on air density and threshold fields is not considered; temperature gradients may modify the density profile under non-standard conditions.	We agree with this comment	Section 4 (Discussion and conclusions): added a remark noting that temperature gradients inside thunderclouds may modify the local density profile and, consequently, threshold estimates. It is clarified that such effects are beyond the scope of the present work but may be relevant for more refined, site-specific modeling.
RC2-1	Reference to Fig. 4 in Ambrožová et al. (2023) seems incorrect; relevant information is in Fig. 3.	We agree with this comment	Section 1 (Introduction): the reference to Fig. 4 in Ambrožová et al. (2023) was corrected to Fig. 3.
RC2-2	EXPACS is not a web calculator; citation is incorrect. Correct references should be Sato (2015) and Sato (2016).	We agree with this comment	Section 1 (Introduction): EXPACS is now correctly described as an Excel-based program. The incorrect citation (Sato, 2018) was removed, and the references Sato (2015) and Sato (2016) were added.
RC2-3	Use RREA consistently; “RRE avalanche” is not defined and may confuse readers.	We agree with this comment	Throughout the manuscript and figure captions: all occurrences of “RRE avalanche” were replaced with “RREA”.
RC2-4	Mixed use of kV/m and kV/cm for electric fields is inconsistent.	We agree with this comment	Throughout the manuscript (text, figures, tables): all electric field strengths are presented exclusively in kV/cm.
RC2-5	Figures 1–4 are very similar; suggest combining into a single multi-panel figure.	We agree with this comment	Figures 1–4 were combined into a single multi-panel figure (Fig. 1a–d) with a unified caption and panel-specific descriptions.
RC2-6	Subscripts (R _c , E _{th} , E _z , etc.) should be formatted consistently.	We agree with this comment	Throughout the manuscript: subscripts were consistently formatted in the text, equations, figures, and captions.
CEC1	Manuscript does not comply with the Code and Data Policy. Code and data must be archived in a suitable repository with a permanent identifier (DOI). Mendeley and yerphi.am are not acceptable.	We agree with this comment	Section “Code and Data Availability”: references to Mendeley and yerphi.am were removed and replaced with a Zenodo repository link and DOI.
CEC2	CORSIKA code is not openly archived. Please ensure compliance or provide a suitable solution.	We agree with this comment	Section “Code and Data Availability”: clarified that the Zenodo repository contains the complete simulation package required to reproduce the results presented in this study.
CEC3	Future promises are not	We agree	Section “Code and Data Availability”: final

	acceptable. A fully compliant Code and Data Availability section must be provided now, consistent with the archived materials.	with this comment	text added, including a structured description of archived materials (inputs/, code/, data/, tables/, figures/, documentation/) consistent with the Zenodo repository.
CEC4	Final compliance confirmation required.		No further changes required. The manuscript reflects the final, policy-compliant state.

Summary

All reviewer comments have been addressed in the revised version of the manuscript. The implemented changes improve the clarity, consistency, and technical quality of the paper while preserving and strengthening its original scientific scope and conclusions.