Response to Reviewers

Manuscript: *Long-term trends in daytime cirrus cloud radiative effects*

The authors thank the reviewers for their constructive feedback. In the following, we respond point-by-point. All new or revised text is incorporated into the manuscript and, where appropriate, highlighted in red in the tracked version.

Reviewer #1 (RC1)

Comment. Lines 57–59: Rephrase; unclear link of the cirrus to numerical weather modeling and day-to-day simulations.
Response. We rewrote the sentence to state the concrete connection: accurate cirrus representation reduces shortwave flux biases at the surface and TOA, improving *both* day-to-day NWP forecasts and long-term climate projections. (Introduction, opening section).

Comment. Lines 63–64: Typos.
Response. Corrected and standardized formatting (spacing, punctuation, units).

Comment. Lines 70–72: Clarify the link of NASA MPLNET with the Earth Observing System (EOS).
Response. We clarified that MPLNET is an EOS-affiliated ground-based lidar network that complements EOS satellites for validation and process studies. (Introduction; Sec. 2.1, "MPLNET lidar network").

Comment. Line 85: Replace "measurements" by "lidar measurements".
Response. Done in Sec. 2.1.

Comment. Sec. 2.1: Missing reference for the data. Are they publicly available?
Response. Added data availability statement and URL: MPLNET data are public at `https://mplnet.gsfc.nasa.gov/`. (Sec. 2.1 and Data Availability).

Comment. Line 106: Specify maximum signal attenuation.
Response. We state that returns are considered fully attenuated when the profile reaches background noise; practically this occurs for optically thick cirrus (COD 3). (Sec. 2.1).

Comment. Line 109: "reduce retrieval errors"—clarify.
Response. Rephrased to "reduce retrieval uncertainty," and explained how AERONET-constrained lidar ratios improve the inversion and separation of aerosol/cloud signal. (Sec. 2.1).

Comment. Lines 120–122: Use of CALIPSO data is unclear.
Response. Clarified that CALIPSO provides a *regional cirrus cloud fraction (CF)* used to scale instantaneous MPL-based CRE to representative daytime CRE (together with daylight fraction DF). Added limitations (regional, long-term mean). (Sec. 2.3/2.3.2).

Comment. Line 136: Clarify "uncertainties in lidar signals" and how used.
Response. Expanded UCDM description: detection thresholds are based on the statistical uncertainty of clear-sky background; these uncertainties set significance criteria for layer detection. (Sec. 2.3.1).

Comment. Lines 140–142: Add references for GCDM and COD detections; explain acronyms.
Response. Spelled out UCDM (uncertainty-based cloud detection method), GCDM (gradient-based), and COD (cloud optical depth), with appropriate citations. (Sec. 2.3.1).

Comment. Line 148: Multiple scattering is essential for cirrus characterization; add explanation/references.
Response. Added a short paragraph: multiple scattering is limited for MPL's narrow FOV; residual effects are captured via *effective* lidar ratios, with references. (Sec. 2.3.1).

Comment. Line 150: Add reference for previous validation studies.
Response. Added references to prior MPLNET cirrus and FLG applications that validate our approach. (Sec. 2.3 / 2.3.2).

Comment. Figure 1: "average of at least 1000 cloud samples (85%)" unclear.
Response. Caption rewritten: we plot the distribution of valid 1-min single-layer cirrus profiles per month and indicate that ≥85% of months include ≥1000 profiles; monthly CRE is the mean of all valid 1-min values. (Fig. 1 caption; Sec. 3.1 text).

Comment. Figure 3: What are histogram colors? Improve quality.
Response. Caption now explains color mapping to COD bins; figures regenerated at high resolution. (Fig. 3 caption).

Comment. Section 2.4 belongs to Results; consider moving.
Response. We reorganized: all methods (trend tests, uncertainty, SZA sensitivity) remain in Sec. 2; Sec. 3 presents results only. Section titles updated accordingly.

Comment. Section 3 "Long-Term Trend Analysis" should be a methods section (2.5).
Response. Implemented via the reorganization above (methods in Sec. 2; results in Sec. 3).

Comment. Line 253: Provide a reference for MTD.
Response. Added Weatherhead et al. (1998) as conceptual framing; our reported MDT_{95} values are obtained by AR(1) null simulations preserving seasonality. (Sec. 2.4.3).

Comment. Line 270: Briefly explain how monthly-averaged daytime CRE is computed.
Response. Added: monthly CRE is the average of all valid 1-min daytime single-layer cirrus CRE within the calendar month, prior to COD-binned aggregation and CF/DF scaling. (Sec. 2.3.2).

Comment. Table 1: What are Z-value and S-value?
Response. Caption now defines MK S (Kendall's S) and MK Z (standardized S). (Table 1 caption).

Comment. Lines 335–385: "Albedo" should be "albedo".
Response. Corrected throughout; lowercase in running text and tables.

We appreciate the helpful suggestions of the reviewers, which substantially improved the clarity and rigor of the manuscript.