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Enhanced MODIS-derived ice physical properties within the Common Land Model (CoLM) revealing bare-ice–snow albedo feedback over Greenland

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For each GrIS bare ice grid cell, we evaluated the correlation, RMSE, and linear trend between MODIS-observed and model-simulated (CoLM-SNICAR-AD/ SNICAR-ADv4) albedo time series (21 summer values, 2000-2020). The bottom-right of each panel shows the regional mean (correlation/RMSE/trend).

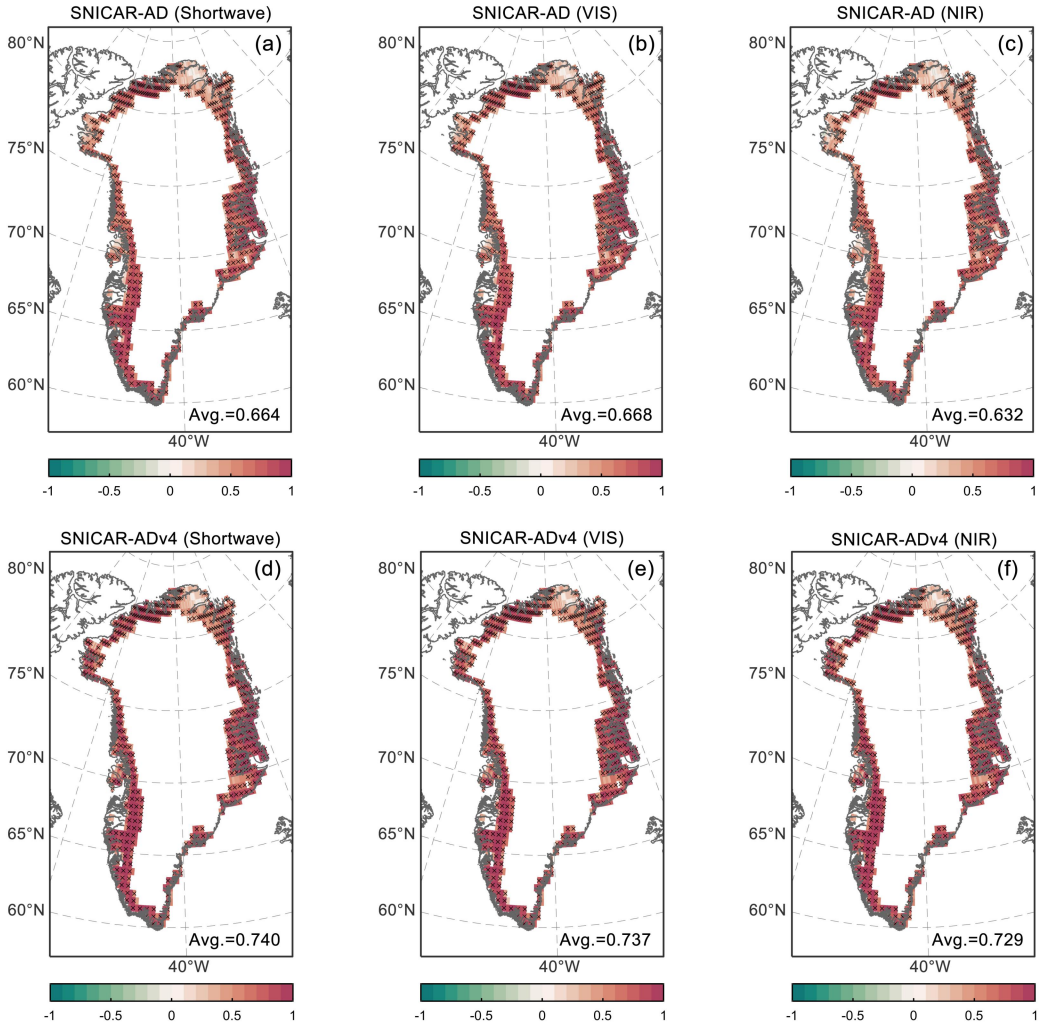

Figure S1. Spatial patterns of correlation coefficients between simulated and observed albedo during JJA (2000-2020) for (a-c) CoLM-SNICAR-AD and (d-f) CoLM-SNICAR-ADv4 simulations: (a, d) shortwave (0.3-5.0 μm), (b, e) visible (0.3-0.7 μm), and (c, f) near-infrared (0.7-5.0 μm) bands. Crosses indicate correlations significant at the 95% confidence level ($p < 0.05$).

The RMSE for each cell is calculated as:

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(\alpha_{MODIS,\,i} - \alpha_{model,\,i})^2}$$

where n=21 (years), $\alpha_{modis,i}$ and $\alpha_{modis,i}$ are the MODIS and modeled albedo values for year i, respectively.

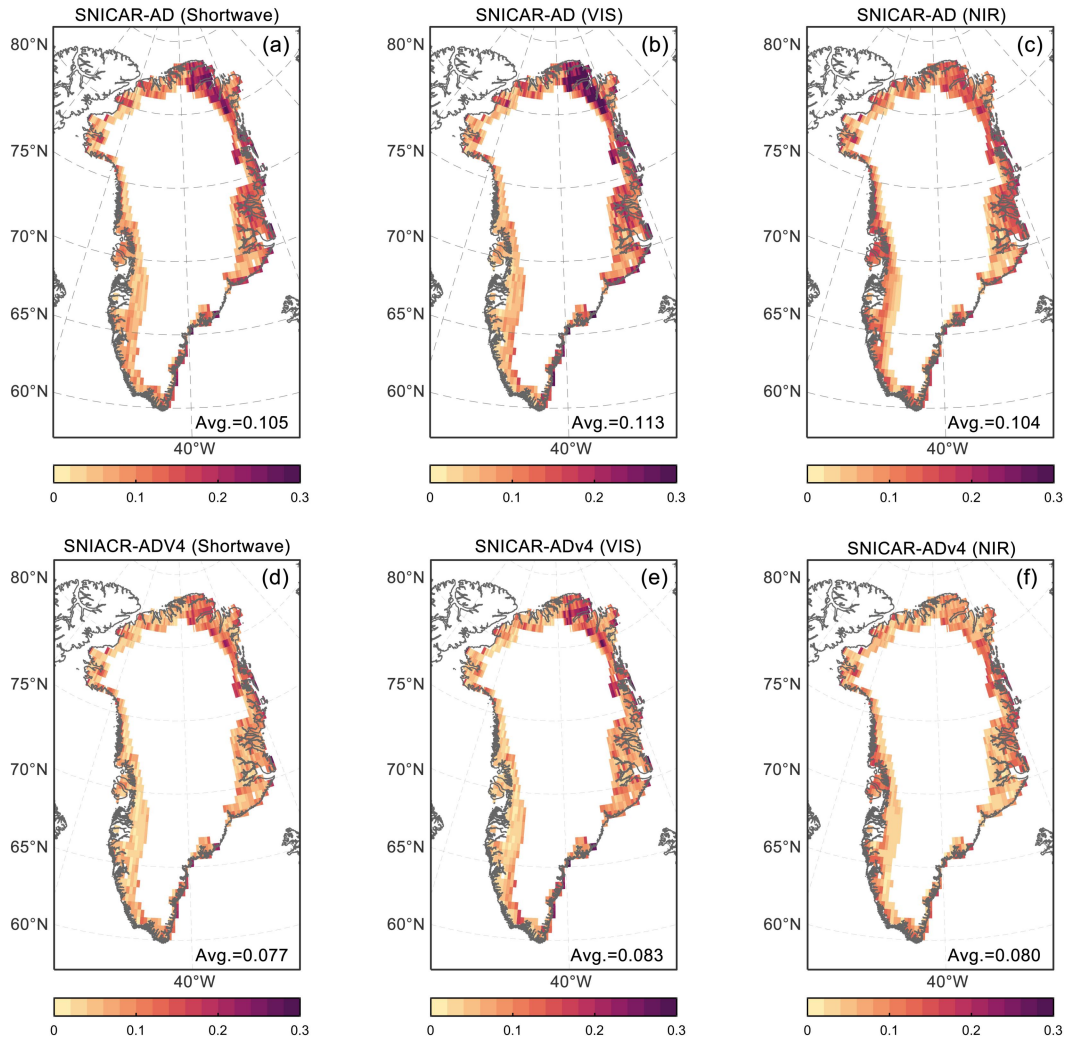

Figure S2. Spatial patterns of root-mean-square error (RMSE) between simulated and observed albedo during JJA (2000–2020) for (a–c) CoLM-SNICAR-AD and (d–f) CoLM-SNICAR-ADv4 simulations: (a, d) shortwave (0.3–5.0 μm), (b, e) visible (0.3–0.7 μm), and (c, f) near-infrared (0.7–5.0 μm) bands.

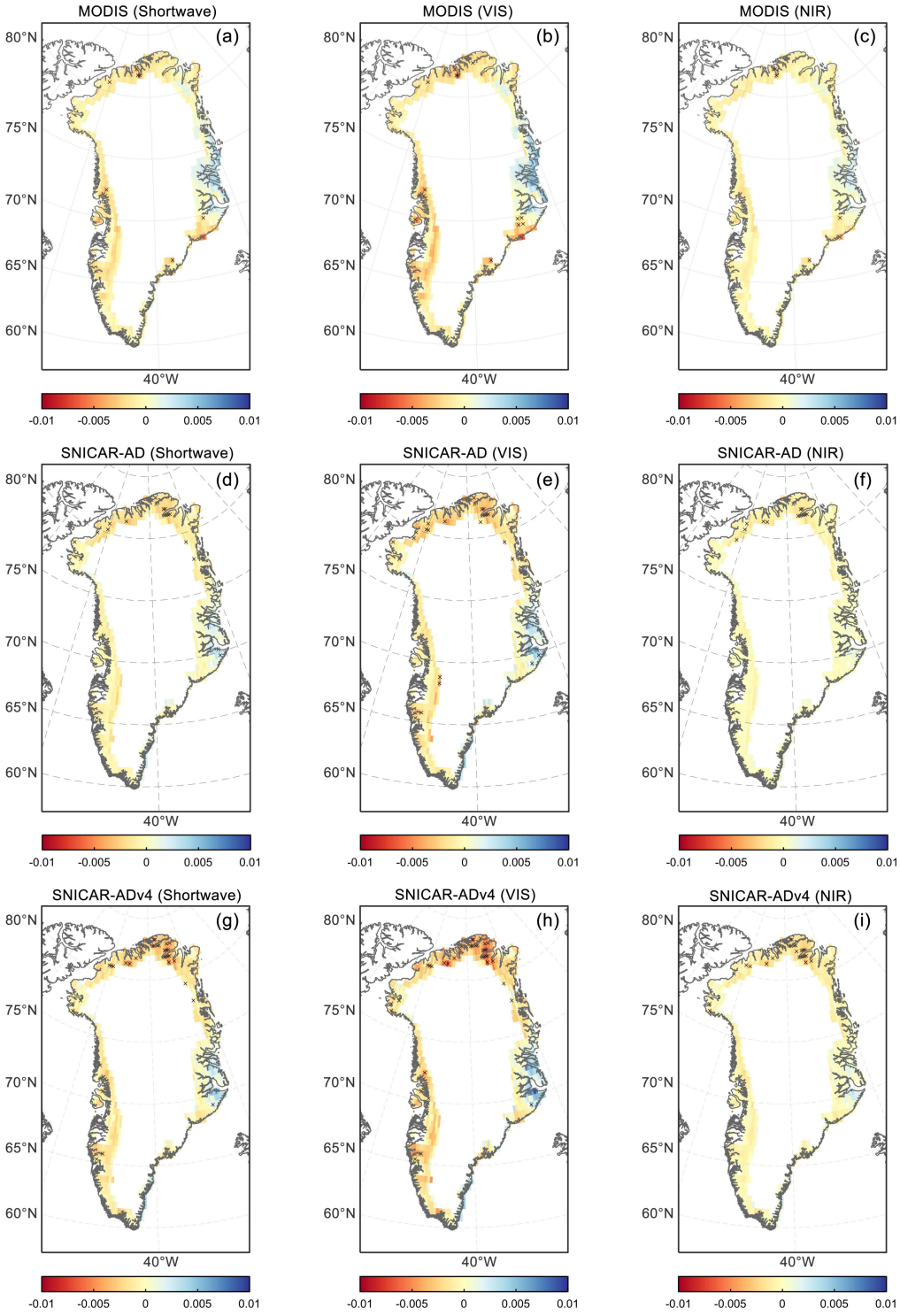

Figure S3. Spatial patterns of linear trends (units: yr^{-1}) in albedo during JJA (2000–2020) for (a, d, g) shortwave (0.3–5.0 μm), (b, e, h) visible (0.3–0.7 μm), and (c, f, i) near-infrared (0.7–5.0 μm) bands: (a–c) MCD43C4 observations, (d–f) CoLM-SNICAR-AD and (g–i) CoLM-SNICAR-ADv4 simulations. Crosses denote trends significant at the 95% confidence level ($p < 0.05$).