Dear Editor,

We sincerely thank you and the reviewers for the constructive comments and helpful suggestions on our manuscript entitled "**Assessing the Impact of Solar Climate Intervention on Future U.S. Weather Using a Convection-Permitting WRF Model**" (Paper No. egusphere-2025-3490), submitted to *Geoscientific Model Development*. The thoughtful feedback has helped us improve the clarity and robustness of the study.

We have carefully revised the manuscript in response to all comments. A detailed point-by-point response is provided, with reviewers' comments reproduced in full and our replies shown in blue beneath them. Line numbers in the response refer to the revised clean version of the manuscript. Both a track-changes version and a clean version have been submitted.

Specifically, we have updated Figs. 6, 9, S4, and S5 and added additional discussion and clarifications where appropriate.

We appreciate the time and effort invested by the reviewers and thank you for considering our revised submission for publication in *Geoscientific Model Development*.

Sincerely,

Lantao Sun, James W. Hurrell, Kristen L. Rasmussen, Bali Summers, Erin A. Sherman, Ben Kravitz

Reviewer #2:

I am happy that the authors have responded to my review comments but would like the following minor issues addressed:

Response: We thank the reviewer for the constructive comments and for acknowledging our revisions. Below, we address the remaining minor issues in detail and describe the corresponding changes made in the manuscript.

Fig 6 - x-axis label says Temperature Anomaly (K) whereas caption says degrees C. Should be consistent wording

Response: Thank you for pointing this out. To ensure consistency with the caption and other figures, we have revised Fig. 6 and updated the x-axis label to "Temperature Anomaly (°C)".

Fig S4 better to plot PGW and PSAI on the same grid as ARISE and GLENS GW/SAI so it is easier to compare. Strictly this should also be done for the Fig 7 but as temperature is more uniform field it doesn't matter.

Response: We thank the reviewer for this helpful suggestion. We have replotted the PGW and PSAI simulations on the same grid as ARISE and GLENS GW/SAI to facilitate direct comparison.

Even after regridding to the lower-resolution CESM grid, the precipitation magnitudes in WRF remain larger than those in CESM. This behavior is consistent with previous studies showing that higher-resolution simulations tend to produce stronger precipitation extremes and larger magnitudes compared to lower-resolution models, even after regridding to a common grid (e.g., Herrington and Reed, 2020). In addition, the WRF results appear noisier, with more localized drying and wetting signals, which is expected given the higher resolution and single-realization framework.

We have replaced Fig. S4 with the updated version and added corresponding discussion in the manuscript (Lines 313-318).

Reference:

Herrington, A. R. and Reed, K. A.: On resolution sensitivity in the Community Atmosphere Model, *Q. J. R. Meteorol. Soc*., 146, 3789–3807, https://doi.org/10.1002/qj.3873, 2020.

Section 4.2 text related to Fig S4. It will be easier to compare effects when on same grid but it looks like although there is some mitigation of effects by SAI, there are still areas of drying/wetting and some areas have over mitigation of effects.

Response: We agree with the reviewer's observation. While SAI reduces the magnitude of the response in many regions, localized drying and wetting signals remain in Fig. S4, and some areas exhibit apparent over-mitigation.

We attribute this behavior to two main factors. First, WRF and CESM are distinct models with different physics and resolutions; therefore, the same large-scale environmental changes do not necessarily produce identical precipitation responses. Second, the WRF simulations consist of a single realization, even though they are forced by the CESM ensemble mean. In contrast, the CESM results shown are ensemble means, which naturally yield smoother and more spatially coherent anomaly patterns.

We have incorporated this clarification into Lines 313-318 of the revised manuscript.

Fig 9 - needs a colorbar. PSAI has as much blue as there is red for PGW for GLENS. So with PSAI you are getting reduced echo top heights compared to baseline of similar magnitude to the increased echo top heights under PGW. Yet the rainfall is better mitigated according to Fig 8.

Response: Thanks for pointing this out. We have added color bar in the revised manuscript.

We also agree with the reviewer that the mitigation of echo-top height does not necessarily correspond directly to precipitation changes. While echo-top height reflects storm vertical extent and updraft strength, precipitation intensity depends on additional microphysical and dynamical processes. This distinction underscores the complexity of convective storm responses and highlights the need for further investigation into the mesoscale processes governing severe convection under PGW and PSAI scenarios. We have added to the manuscript lines 354-357:

"*It is important to note that changes in echo-top height do not necessarily correspond directly to precipitation changes (Fig. S4). This distinction underscores the complexity of convective storm responses and highlights the need for further investigation into the mesoscale processes governing severe convection under PGW and PSAI scenarios*."

Fig S5 - can you use the same linestyles and colours as in Fig 11.

Response: We have revised updated Fig. S5 to have the same line styles and colors as in Fig. 11.

Just a thought but it may have been easier to interpret results if you had compared GLENS against 2015-2024 baseline and ARISE against 2030-2040 baseline as they are trying to achieve different targets. In the current manuscript you are always having to expect that the anomalies for ARISE will be positive still as temperature target is higher than that for GLENS.

Response: Thank you for raising this important point. We agree that using separate baselines for GLENS and ARISE could facilitate interpretation, since PSAI anomalies relative to each simulation's temperature target would ideally be close to zero.

However, adopting different baselines would make direct comparison across all simulations less straightforward. Our primary goal is to compare the relative responses among the five simulations under a consistent reference framework. Therefore, we use an identical baseline and future period for both GLENS and ARISE. This allows us to directly evaluate the ordering of responses within a unified reference frame. Although anomalies in the SAI/PSAI simulations are not zero under this

approach, the relative influence of SAI remains clearly represented and comparable across experiments.

We have clarified this in Lines 196-197:

"*For all simulations, the same baseline and future periods are adopted to facilitate consistent comparison across the five experiments listed in Table 2.*"