

## Response to Reviewer 1

We greatly appreciate the comments provided by the reviewer and have incorporated their feedback, as noted in each of the comments below. The Reviewer's comments appear in black below, and our responses follow in *italicized blue text*.

### Reviewer 1

Mallard et al. tackle a key practical issue in regional climate modeling: determining how long a model should be run to remove dependence on initial conditions. This is especially relevant for multi-decade simulations. The work uses a uniquely long reference run (20-year lead) to examine spin-up, extending beyond earlier studies that only looked at shorter lead times (weeks to 2 years). The results (e.g., the need for around a year or more for spin-up, particularly for soil moisture) are valuable for guiding modeling protocols and could influence future downscaling experiment design. The manuscript is well-written and logically organized. Overall, it is a very well-executed study, and I have only one minor point that I'd like addressed before publication.

*We appreciate this positive feedback on the value of the study and unique aspects of its design, as well as the comments on the organization of the manuscript. We have incorporated the feedback the reviewer gives below to further improve the manuscript.*

That is, that the abstract and conclusion note that the results support using at least one year of spin-up. This is accurate but overemphasizes the one-year period. Since this was insufficient in some cases, I suggest clearly quantifying it in some way, in the abstract in particular - for example, acknowledging that some regions may require more.

*We highlight the need for 1 year of spin-up time as a minimum to account for seasonal effects while considering common computational limitations, but we agree that use of multi-year spin-up periods is supported by our analysis of soil conditions over regions within the central CONUS. We appreciate the feedback that this result is underemphasized within the abstract and have revised the abstract to provide more clarity in summarizing our results. The revised abstract ends with the following sentence:*

*Results from some regions of the CONUS indicate that spin-up durations of 1-4 years are needed to exclude spurious behavior in top-layer soil moisture, which exhibit prolonged spin-up compared with other near-surface variables examined here.*

Also, at line 34, "Georgi" should be "Giorgi", but this barely warrants comment

*This typo has been fixed. Thank you for catching it.*