

**Comments:**

One major issue raised, which was also pointed out by Reviewer 2 during the first review round, is that the observed changes in Noah-MP snow model performance cannot be clearly attributed to the inclusion of snow-vegetation interactions alone. While I appreciate the use of model experiments comparing static versus dynamically derived LAI and GVF, these experiments are performed in parallel with simulations using different meteorological forcings (NLDAS versus AORC), and the effects are evaluated jointly. Based on Figures 4-6, the largest changes appear to result from the downscaled forcings, whereas the differences associated with static versus dynamic LAI/GVF are comparatively smaller. As a side note, I suggest considering normalization of interception rates by their respective precipitation forcing, which may help make the simulated basin-scale rates more directly comparable (Fig. 8).

**Reply:**

Dear Editor, thank you very much for your additional comments and suggestions. We have carefully considered these comments and revised the manuscript accordingly. We believe these revisions help clarify the objectives of the study and make the interpretation of the results more transparent. Overall, the revised manuscript more clearly distinguishes the two sources of variability considered in this study: (1) differences associated with meteorological forcing, assessed by comparing NLDAS-2 and AORC, and (2) differences associated with vegetation representation, assessed through the paired DynVeg\_Off–DynVeg\_Pred experiments within each forcing dataset. We have revised the manuscript throughout to make this distinction explicit and to avoid over-attributing the simulated changes to vegetation processes alone.

We have also incorporated your suggestion regarding canopy interception. In the revised Figure 8, canopy-intercepted snowfall is normalized by the corresponding snowfall forcing and is presented as the fraction of snowfall intercepted by the canopy. This normalization minimizes the direct influence of differences in snowfall magnitude between NLDAS-2 and AORC, allowing the

effects of vegetation representation on canopy interception to be compared more directly within and across the two forcing datasets. The revised Figure 8 is provided below:

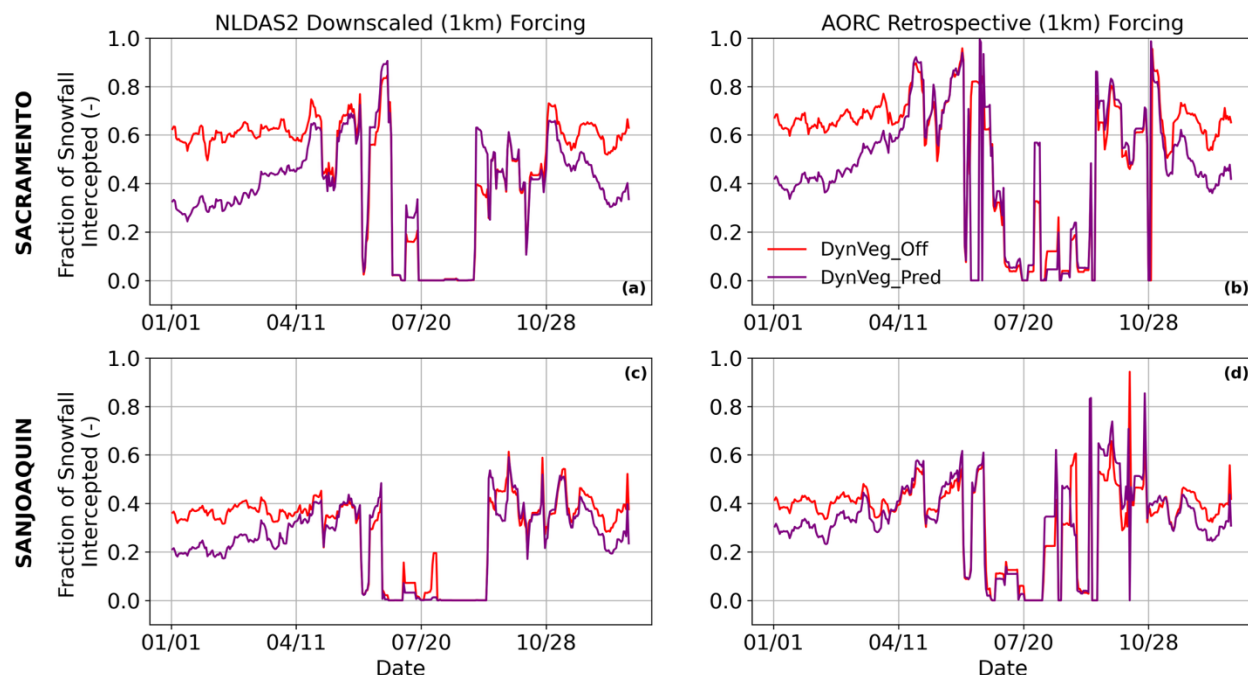


**Figure 8.** Modeled (normalised) canopy intercepted snow rate using different atmospheric forcing data (left panels: NLDAS-2; right panels: AORC) under prescribed vegetation (DynVeg\_Off) and dynamic vegetation (DynVeg\_Pred) in the Sacramento (upper two panels) and San Joaquin (lower two panels) River Basins. The intercepted snow was normalised using the snowfall from each forcing datasets. A SWE threshold of 0.1 mm has been applied to mask the region and perform spatial average.

#### Comment:

As Referee 3 noted, the manuscript currently conflates the effects of different forcing at the large scale of the Sacramento-San Joaquin River basins with the interaction of snow and vegetation. Although the authors present evaluations at CDWR stations in addition to the basin-wide analyses, the discussion could better connect simulated SWE changes to local-scale processes in order to both quantify the improvements associated with dynamic LAI and more clearly attribute those improvements to vegetation-related processes. For example, sorting stations by observed or modeled LAI/GVF rather than elevation, and discussing performance differences among nearby stations that may share similar 1 km forcing and vegetation characteristics, could provide additional insight into the spatial pattern of described snow-vegetation effects.

#### Reply:

We thank the reviewer for this important comment. We agree that the effects of meteorological forcing and vegetation representation need to be more clearly distinguished, and we have revised

the manuscript accordingly. In particular, we now evaluate the effect of dynamic vegetation separately within each meteorological forcing by comparing DynVeg\_Pred against DynVeg\_Off under NLDAS-2 and AORC independently. This paired comparison keeps the meteorological forcing unchanged and therefore provides a more direct assessment of the changes associated with the LAI/GVF representation, rather than attributing differences between the NLDAS-2 and AORC simulations to vegetation processes.

To strengthen the station-scale analysis, we have revised Figures 5 and 6 so that the CDWR stations are now ordered according to the magnitude of the mean LAI difference ( $\Delta\text{LAI}$ ) between DynVeg\_Pred and DynVeg\_Off rather than by elevation. We additionally report the change in SWE performance at each station as  $R^2$  ( $\Delta R^2 = R^2_{\text{DynVeg\_Pred}} - R^2_{\text{DynVeg\_Off}}$ ) separately for NLDAS-2 and AORC. This analysis shows that the vegetation effect is spatially heterogeneous and forcing dependent. Under NLDAS-2, several stations with substantial LAI changes show improved SWE performance, whereas comparable LAI changes do not consistently lead to improvements under AORC. We have revised the discussion to explicitly acknowledge this behavior and to avoid implying that all differences between the simulations can be attributed solely to improved snow–vegetation interactions.

Here are the revised figures:

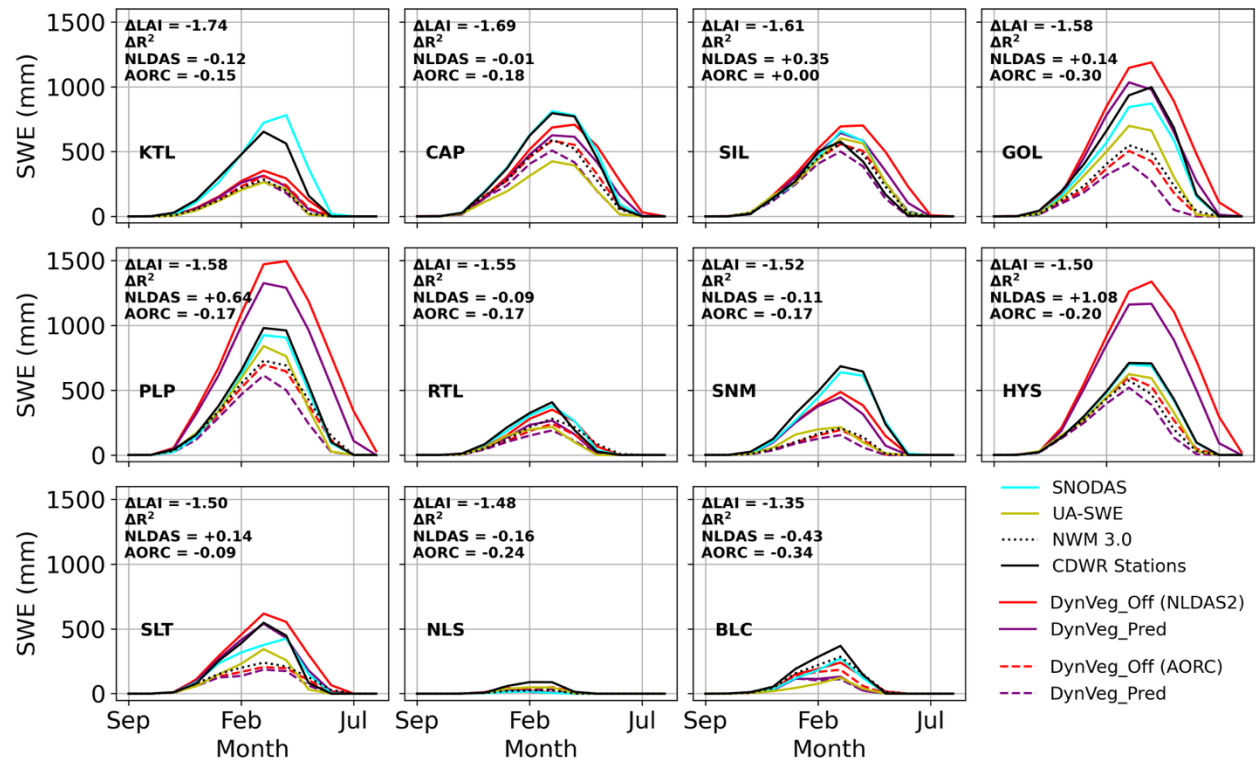


**Figure 5:** Snow water equivalent (SWE) comparison at CDWR stations in the Sacramento River Basin as represented in study area figure (Fig. 1). Monthly mean of control and dynamic vegetation modeled SWE with NLDAS-2 (solid lines) and AORC (dotted lines) forcing are plotted against the gridded observation (UA-SWE,

SNODAS and NWM 3.0), and CDWR station (solid black line). The stations are sorted according to the difference in the LAI between both simulations, improvement in  $R^2$  is also reported for each plot.

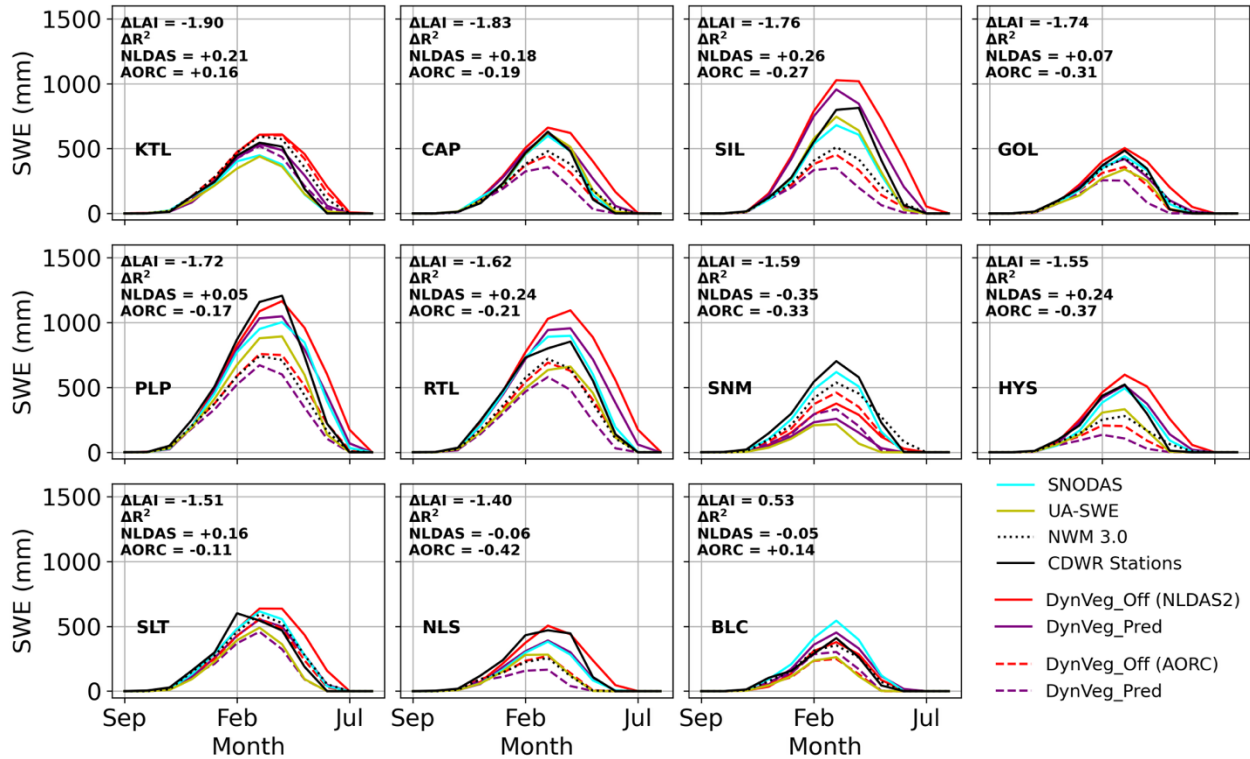


**Figure 1:** Snow water equivalent (SWE) comparison at CDWR stations in the San Joaquin River Basin as represented in study area figure (Fig. 1). Monthly mean of control and dynamic vegetation modeled SWE with NLDAS-2 (solid lines) and AORC (dotted lines) forcing are plotted against the gridded observation (UA-SWE, SNODAS and NWM 3.0), and CDWR station (solid black line). The stations are sorted according to the difference in the LAI between both simulations, improvement in  $R^2$  is also reported for each plot.

#### Comment:

A further major concern, raised across the referee reports, is that claims made in the manuscript are not adequately supported by the results presented. For example, the discussion states that "In our simulations, canopy-intercepted snow decreases incoming radiation due to increased albedo and decreases the overall melting energy at the snow surface." However, the connection between the presented results and this conclusion would benefit from further clarification. While Figure 9 shows basin-wide changes in modeled snow-surface energy flux components under different LAI and forcing configurations, analyses at specific station locations could provide a more direct demonstration of the proposed mechanism. As Referee 1 noted, such analyses would be particularly valuable at stations that are not located in open areas.

#### Reply:

Finally, we agree with the Editor that the previous statement regarding the snow-surface energy balance implied a stronger causal relationship than could be directly supported by the analyses

presented in the manuscript. Specifically, the statement “In our simulations, canopy-intercepted snow decreases incoming radiation due to increased albedo and decreases the overall melting energy at the snow surface” was not sufficiently supported by the basin-scale energy-flux analysis. We have therefore completely removed this statement from the revised manuscript rather than making a causal attribution that cannot be directly demonstrated by the current analysis.