General Comments:

The manuscript addresses an important problem and presents a potentially useful application of Sentinel-1 snow-depth assimilation for snowfall correction. However, major revisions are needed before the conclusions can be supported. The main scientific concern is that the study claims improved snowfall estimates without directly evaluating snowfall against independent snowfall, SWE, or snow-depth observations. The leave-one-out analysis evaluates total precipitation at gauge locations, while river discharge provides only indirect evidence because it is influenced by many model processes and parameters. The manuscript also needs a clearer separation between data used for assimilation, model calibration, validation, and fully independent evaluation.

Abstract:

The abstract is written more like an introduction. Clearly state the research gap, methods, evaluation data, main quantitative results, and limitations. Avoid paragraphing. The claim that snowfall estimates improved should be softened unless independent snow observations are used. Also explain clearly how improvements were found in years without data assimilation.

Introduction Comments:

Major revisions are needed. Many citations are missing, the research gap is not clearly identified, and there is little connection to previous Sentinel-1 studies.

Line 23 or 24: Also cite Günther et al. (2019), "Uncertainties in Snowpack Simulations—Assessing the Impact of Model Structure, Parameter Choice, and Forcing Data Error on Point-Scale Energy Balance Snow Model Performance."

Lines 28-30: Cite papers showing that kriging is commonly used and discuss its limitations in mountainous terrain with sparse gauges.

Line 35: Please provide a citation or evidence for this statement.

Lines 39-47: Please acknowledge that independent evaluations have found substantial and spatially varying biases in Sentinel-1 snow depth, especially in the western United States. Cite Hoppinen et al. (2024) and Mirza et al. (2025).

Lines 48-51: Previous work has already assimilated Sentinel-1 snow depth in the western United States and found high spatial errors. However, that work focused on snow depth rather than snowfall correction. This distinction should be used to define the research gap more clearly.

Study Area and Datasets Comments:

Why do the authors expect Sentinel-1 to work well in this region?

Figure 1: Use a different color for precipitation gauges because red is difficult to see and not color-blind friendly. I could not find the hydrometric stations. Since discharge is the main

evaluation dataset, these stations should be clearly shown. Use clearer colors for the study regions, increase the font size, and simplify the x-axis labels in panels b and c.

Line 87: Were the same discharge data used for both calibration and evaluation? Would this not bias the evaluation, or am I missing something? Please clearly state which years and stations were used for calibration, validation, and independent evaluation. Also, was Sentinel-1 snow depth evaluated before being assimilated?

Lines 93-94: This is a good place to acknowledge that Sentinel-1 performance varies between mountain regions, such as the European Alps and the western United States. Cite Hoppinen et al. and Mirza et al.

Figure 2: Make the color bar larger. Snow depth in millimeters is difficult to read at this scale, so meters or centimeters may be clearer. Add stronger boundary lines between the Aosta and Piemonte regions. Also clarify whether glaciers are present, remove unnecessary grid lines, and explain why January-April mean snow depth is shown.

Methods Comments:

Please provide more details about the model setup, including spatial resolution and interpolation methods.

The assumption that snowfall bias is the main source of snow-depth error is too strong. Snow-depth errors may also come from snow density, rain-snow partitioning, melt, wind redistribution, vegetation, terrain, and Sentinel-1 retrieval errors. The snowfall correction factor may therefore compensate for several unrelated model errors.

Line 185: Define HRUs and explain how they are created. Also explain how Sentinel-1 pixels are averaged within each HRU and whether forest, glacier, radar shadow, layover, or steep terrain pixels are removed.

Line 191: What are the exact assimilation dates? Please add a table or figure showing how many Sentinel-1 observations were used in each year. Also explain how storm events are identified, why only post-storm observations are used, whether a wet-snow mask is applied, and why assimilation begins in January rather than earlier in the accumulation season.

Results:

Result section needs major revisions. It should clearly focus on the finding, not explaining the methods. Evaluations and validation should be clearly defined before starting the result section.

Please include uncertainty ranges in the major results. Since the method produces an ensemble posterior, presenting only deterministic estimates removes important information about uncertainty.

Figure 5: Please calculate and report CRPS to evaluate the full ensemble distribution. From the figure, many ensemble members appear to fall well below the Sentinel-1 observations, and the ensemble may not adequately represent the observation uncertainty. There may also be particle degeneracy, with only a small number of ensemble members receiving meaningful posterior weights. Please report the effective sample size or another diagnostic of particle degeneracy and consider regenerating or expanding the ensemble to provide a wider and more representative range of possible snow states.

Also, Sentinel-1 snow depth appears to show limited interannual variability and nearly the same seasonal pattern each year. Please discuss whether this is expected or may be related to the retrieval method or spatial averaging. Please exclude 2021 from the figure if it is not used in the analysis. Finally, add posterior uncertainty ranges, such as the 5th–95th or 25th–75th percentiles, rather than showing only the posterior mean.

Line 213-215: It belongs to method section

Line 27-218: The increase in snowfall correction factor with elevation may result from several factors other than underestimated snowfall including Sentinel-1 retrieval bias, snow-density errors, and spatial averaging. Please acknowledge and support statement with further evaluation.

Line 221-222: It belongs to method section.

Line 240: The leave one out framework should be discussed in method section not in results.

Figure 8: Please test whether the difference between kriging and data-assimilation results is statistically significant. Also show how many gauges improve and how many become worse after correction, rather than presenting only the overall improvement.

IT-SNOW comparison: Please explain whether IT-SNOW is independent of the meteorological observations, model inputs, or assumptions used in this study. Correlation alone is not enough because two datasets can be highly correlated while having substantial bias. Please also report RMSE, bias, and differences in seasonal magnitude. Importantly, Please don't bring new information directly in result section which has not been defined in method or earlier sections.

Figure 9 is very hard to read.

Did you account for area impact on these results?

Conclusion:

The conclusions overstate the evidence by saying that snowfall estimates are more accurate. The leave-one-out test evaluates total precipitation at gauges, while the discharge analysis provides only indirect evidence. Please distinguish clearly between improved precipitation interpolation, altered snowfall estimates, and improved discharge simulation.