

The Cryosphere Discuss., referee comment RC2
<https://doi.org/10.5194/tc-2021-56-RC2>, 2021
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Comment on tc-2021-56

P.A.B. Bartlett (Referee)

Referee comment on "Evaluating a prediction system for snow management" by Pirmin Philipp Ebner et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-56-RC2>, 2021

The authors have produced a novel study, applying snow models with modules for management and grooming to simulate snow depth at nine European ski resorts, evaluating errors in simulated snow depth and persistence. I believe this work is original and potentially useful. I do have some suggestions for improving the manuscript prior to eventual acceptance.

Some things that I was wondering throughout the paper: What sort of accuracy or error range is required in order for these models to be useful to the ski resorts? What snow depths are required for viable and for optimal ski conditions? The simulation mean deviations should ideally be smaller than this value. Does the availability and rate of production of artificial snow at the resorts affect this?

While MD is not incorrect as it has been calculated, I prefer all metrics comparing simulated values against observed values to be with respect to simulated minus observed, such that positive differences are overestimation and negative differences are underestimation.

Minor points or suggested corrections:

- Line 32-34: Have any authors or ski resorts conducted a cost-benefit analysis for making snow that melts over various periods of time? Early season production of artificial snow may very well melt, leading to loss of the snow-cover, but this is likely weighed against income derived by the resort being able to remain open for a period of time. I suspect many resorts have some criteria and that a decision to make artificial snow is based on the likelihood that it will last long enough to recoup the cost. I don't expect these questions to be answered in this paper, but I wonder if examples of such

information exists such that they might inform the discussion.

- Line 64: Change "snow-covered maps" to "snow-cover maps".
- Line 67: Change "unit" to "units".
- Line 88: Change "The used snow management configurations for" to "The snow management configurations employed for".
- Line 106: Aggregating as a post-processing step simplifies the presentation but not the computation. Has it been tested whether similar results are obtainable employing these aggregated areas for the simulations?
- Line 152: Change "This technique relies on differential GNSS signals and takes measurements without snow depth on the slopes as a reference into account." To "This technique relies on differential GNSS signals, comparing the snow-free (i.e. zero snow depth) reference signal with those obtained during the snow season, to obtain snow depth.
- Line 156: Snowsat and Leica are not defined.
- Line 169: Change "constrains" to "constraints".
- Line 187: Change "Additionally" to "In addition".
- Figure 4: Are the bold vertical lines in each plot of Figure 4 the intra-model means? This should be defined in the graph pane or in the caption.
- Line 278: Is this averaging effect desirable? Instead of "allows minimizing the error", would "tends to mask the error" be a more accurate description of what is happening? Later, it is discussed that there may be a benefit to this, but I would still use "mask" perhaps as "tends to mask the variability in the error".
- Why is Figure 7 presented before Figure 6? I would rename the figures.
- Line 309: Remove "it".
- Line 315: Change "use" to "uses".
- Line 321: Change "in average" to "on average".
- Line 325: Change "e.g., rapid snow melt inside the catchment are hardly to be matched correctly by the models" to "e.g., the ensuing rapid snow melt inside the catchment is difficult to simulate accurately".
- Line 337-338: This is not a sentence.
- Line 352-354: The authors should define some accuracy requirements for the snow models to meet the needs of the ski resorts.
- Line 357: I would not include the errors in the S and SW facing pistes with snow redistribution. These errors are caused by more rapid ablation because these pistes are exposed to high solar radiation during the warmest part of the day. I wouldn't classify that as redistribution although both are important.
- Line 393-394: I suspect that the ski resorts would know the minimum snow depth required. The research should attempt to determine whether the models can simulate snow depth with sufficient accuracy to enable the resort managers to maintain the optimum and minimum viable snow depth in a more efficient way.
- Overestimation of snow depth and S and SW facing pistes could be addressed by having the incoming radiation adjusted for slope and aspect. I am not asking for this to be done in this paper, but it would be an obvious improvement for the next paper.