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Interactive comment on "Subgrid snow depth coefficient of variation within complex mountainous terrain" *by* Graham A. Sexstone et al.

Anonymous Referee #2

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Comments:

The manuscript by Sexstone et al. sets out to examine how the coefficient of variability (CV) of snow depth varies over differing grid resolutions in their study area of the Front Ranges of the Colorado Rockies, based on a high resolution lidar-derived snow depth dataset obtained there. The study includes the additional objectives to evaluate how topographic and vegetation conditions influence the variability of CV at the sub-grid level, and to develop a methodology for parameterizing CV over complex mountain terrain. However, in the end, the study makes very little advancement in the field of snow hydrology and modelling, with most of the results serving only as a limited empirical case study, and it fails to deliver on its final objective (the parameterization of CV), which would have been its only real major new contribution. To fix this, I believe, would be beyond the scope of major revision, requiring substantial new analyses and a fun-

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damentally different approach. For these reasons I feel the paper should be rejected at this time.

With regard to the first objective (to determine the range of CV values that observed within varying grid resolutions throughout the study area), there is little purpose in examining the variation of CV of snow depth over varying grid resolutions. If the intention is to develop a means of parameterizing CV for mountain terrain, then the first step is to focus on objectively chosen landscape units (hydrological response units, grouped response units) over which to examine CV, or alternatively, use the information from the lidar snow depths to examine how the landscape could be disaggregated so as to minimize CV within the groups. This would make any parameterization more robust and potentially applicable beyond the limited conditions observed in this study. Making use of additional data from other sites or other years/seasons would greatly add to the value of this exercise.

As for the second objective (to evaluate the effects of mean snow depth, forest, and topography characteristics on subgrid CV), there is little here that is fundamentally new, and not enough of an advancement to warrant publication. Indeed the authors rightly point out that future research could investigate how the variability of snow depth varies across different geographic regions, snow regimes, snow seasons (particularly high and low snow years), and over time in a single season. This, together with the suggestions above, are what would make a more meaningful contribution. As it stands, the results add very little to what is already understood about snow accumulation in complex mountain terrain.

Finally, the third objective (to develop a methodology for parameterizing CV within complex mountainous terrain) is not achieved in this study. The manuscript describes an empirical study of the relationship between topographic and vegetation conditions for a single locale at a single point in time. It is not physically based (i.e. in the sense of utilizing known physics of snow accumulation, redistribution, and ablation based on meteorological conditions during the winter and spring), there is no basis for predicting

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CV outside of this area and time, and it offers little more than what is already known: that snow depth and its variability can be statistically related to physical and biological landscape elements.

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