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Interactive comment on "Meteorological, elevation, and slope effects on surface hoar formation" *by* S. Horton et al.

Anonymous Referee #2

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General Comments: The authors of this work present research attempting to link weather, observation, and simulations for surface hoar formation. This is a very important endeavor. In general, I believe the methods to be poorly detailed and the results somewhat misleading. The authors collected a large set of field data as well as examined extensive weather data. The methods presented in section 2 are not detailed enough to reproduce the work. More importantly, the authors present the work as a sensitivity analysis, which given the information provided is not an accurate statement.

Additionally, there are various statements in the work that elude to the importance of influence of parameters, namely, the papers major finding: "moisture content of the air appears to have a larger impact" (1864:8). However, no mention to how this parameter was deemed important, this type of statement must be backed up by a quantitative

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rigorous statistical methodology.

1858:25 Vapor does not sublimate. Sublimation = solid to vapor, deposition = vapor to solid, evaporation = liquid to vapor, condensation = vapor to solid

1859:4 Slaughter also preformed field studies of surface hoar: http://www.ingentaconnect.com/content/igsoc/jog/2011/00000057/00000203/art00006

1860: Sec. 2.1 Where the specific locations, aspects, sky view, etc. recorded for each site? If so, this should at least be mentioned. However, it may be appropriate to build histograms of the data so the reader can understand the distribution of the observations sites. For example, slope angles ranged from 20 to 30 degrees, was the distribution of slopes uniform or does it favor certain values.

1861: 7 Where does 239,152 number come? You state the simulation occurs at 393 grid points (225+168) and that data was pooled for every hour for 26 days. If this was done for 12 virtual slopes, then the total number of simulations should be: (225+168)*(26*24)*12 = 2,942,784. This indicates that you are omitting a significant portion of the data, why?

1862:15 Should read "...added by deposition of water..."

1862:21 Why was the user-defined threshold of 3.5 m/s selected?

1862: 24 Why was the number 12 selected and what was different between the 12 runs?

1863:3 The paper mentions that the sensitivity of SNOWPACK was analyzed, although you fail to mention any specific method for the sensitivity analysis. Were the input parameters (i.e., the weather data) perturbed systematically or some sort of formal selectivity analysis performed on the model?

It seems that you generally ran the model with direct input from the weather data and then extracted each timestep to build up a dataset to perform an informal sensitivity

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analysis. Without defining the input parameter distributions it is not possible to determine the true sensitivity of the system. Thus, the word sensitivity should be avoided as it has a specific meaning. Also, the distribution of input parameters at an hourly rate used to formulate the model input should be reported.

Was any consideration given to the inaccuracies of the supplied weather data and how these inaccuracies impact SNOWPACK? For example, does the wind speed differing between 1 and 2 m/s produce drastically different growth rates?

You mention the importance of various results in the remaining portions of the paper; how as the importance of a factor determined?

1864: 3-4 It is stated that "longwave radiation was less prominent" and go on to discuss that the weather surrounding the study where generally clear during the entire study. This highlights a limitation of the analysis presented, without comparing weather conditions throughout a wide breath of conditions it is difficult to determine what conditions are the most influential, thus your results are limited and only apply to narrow set of input conditions.

1870: 6-7 "Surface hoar modeled with SNOWPACK was sensitive to the moisture content of the air, where warm and moist air produced the most surface hoar." This sentence is misleading; it implies that a complete sensitivity analysis was performed, which it was not. This conclusion is only for a very specific set of data using a sampling scheme that is biased to certain conditions given the supplied weather parameters.

Interactive comment on The Cryosphere Discuss., 9, 1857, 2015.