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The Cryosphere Discussions

Interactive comment on "Summer valley-floor snowfall in Taylor Valley, Antarctica from 1995–2017" *by* Madeline E. Myers et al.

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AUTHOR RESPONSES TO REVIEWER 1 COMMENTARY ON MYERS ET AL MANUSCRIPT

This manuscript describes updated datasets on snow depth and snow cover in the Taylor Valley. The authors suggest these data may be used for trend analysis and to test hypotheses of weather patterns and forcing thereof. The manuscript is reasonably written and easy to follow, though further care and proof-reading to correct typographical errors would be useful. The dataset is certainly useful and analysis important for describing the snow patterns within the Taylor Valley. However, the manuscript lacks depth for publication as a research article. There is no clear objective other than to

use data to re-analyze trends previously observed in the data. While I certainly see the value of these data and the analysis, I think the manuscript would be more appropriate as a data paper in another journal (because The Cryosphere does not offer a data paper format). Below are minor comments.

[M, D, & M] We feel this paper is well suited for The Cryosphere with more attention given to the trend analysis and the uncertainty dependent upon the density used to convert depth to mm w.e. A more appropriate analysis for understanding the relationship of snow to sea ice extent and the position of the Amundsen Sea Low would be beneficial. The manuscript will be greatly improved by the comments from Reviewer 1.

Page 2 Line 9: Is this temperature supposed to be negative?

[M, D, & M] Yes, the temperature should be negative and will be reflected in the revised manuscript.

P3 L15-20: The specific objectives are not very clear. It could help a reader determine precisely what the paper is trying to accomplish if these are re-written for better clarity.

[M, D, & M] We agree and propose to replace the end of this paragraph beginning on line 17: ". . .temperature shift. First, we extend the record of snowfall from 1995 through 2017 from four valley-bottom AWS. We conduct a changepoint and trend analysis on the snowfall dataset to understand seasonal and annual variability in snowfall in the context of the climate shift described by Obryk et al. (2020). The snowfall record is augmented with a decade (2006 to 2017) of snow cover and persistence data derived from daily photographs taken in Taylor Valley. We focus on seasonal-scale trends to highlight climate variability which may depend on shorter-lived factors such as atmospheric oscillations. Finally, we reveal shortfalls of presently established methods for monitoring precipitation in polar deserts and highlight how daily photographs improve them."

P4 L11-12: This is the first time this is phrased as a hypothesis, please state this in the

introduction, this would help clarify objectives previously mentioned.

[M, D, & M] We agree with this comment. A sentence will be added to the end of the introduction to introduce the hypothesis of sea ice influencing snow in Taylor Valley.

P6 L22: r2

[M, D, & M] The manuscript will be updated.

P7 L15: What do you think the potential error in depth conversion to w.e. using a single density observation is? I understand the need for this method, but what magnitude of uncertainty does this bring with it?

[M, D, & M] Combined answers in next section

P8 L12-13: So how much does density vary in the available observations?

[M, D, & M] Snow density is infrequently observed and reported in the Dry Valleys, but reported average densities range from 80 to 100 kg m3 for the McMurdo area (Keys, 1980) and our field measurement was 83 kg m3. The use of 83 kg m3 in our calculations could result in an underestimation of snow volume by upwards of 20%. This could have implications for our changepoint and trend analysis. A sensitivity test of those results to snow density could benefit the paper in that respect. However, the sonic measurements generally agree with the weighing bucket measurements. Where annual measurements do overlap, the ultrasonic does tend to underestimate accumulation by $\sim$1 mm w.e. ($\sim$24%). Where the sonic ranger underestimated annual snowfall (Figure 8, BOYM), it was because snow persistence was so short that the event wasn't captured. These comments will be added to the manuscript's discussion.

P8 L28: How much do you think makes it to the valley floor from the mountain peaks? I would think that so much sublimation would occur in the dry air and high wind speeds that little to no snow would make it that far. Just a thought.

[M, D, & M] I would assume not much snow for the same reasons. Any perceived

"snow" by the instruments filtered out during strong winds is probably an artefact of instrument performance and supports our decision to filter them out. Perhaps that statement should read "snow could be conveyed. . ." and that will be updated. Conclusions: A lot of these conclusions read more like discussion points. I suggest simply stating the conclusions directly.

[M, D, & M] We agree, the conclusion should be updated to reflect the conclusions rather than discussion topics.

Figure 3: Could you use colors that contrast a little more, please? It is very difficult to see the differences between the line colors.

[M, D, & M] We agree and the figure will be updated.

Figure 4: It took me a bit to figure out the color symbology. A legend for the colors would be a great help.

[M, D, & M] We agree. The figure will be updated.

Figure 7: What is the r2 and p-value for? Can you show the line for the regression?

[M, D, & M] We wanted to show the goodness of fit. The regression line will be added to the plot.

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