

This author response to comments from Referee #2 (Becky Ball) is structured as follows:

#### Referee comments

#### Author response

Changes in manuscript or references to “tc-2019-8\_MSchanges.pdf” where these changes can be found

The authors present a succinct, clearly written analysis of energy fluxes from water tracks in the McMurdo Dry Valleys of Antarctica, in comparison to dry soils that cover most of the landscape, in an effort to foreshadow future changes that might come with increased frequency or extent of water tracks. The methodology used to measure energy balance appears justified and sound.

5 My expertise does not lie in eddy covariance, so I will leave analysis of that aspect to other reviewers. From the perspective of an ecosystem ecologist/biogeochemist who has previously worked on these ecosystems, the manuscript currently reads as one that will be of interest to other scientists studying either the impacts that water tracks can have on their surrounding ecosystem, or the overall energy balance of this dry valley ecosystem. That makes the publication as-is a  
10 very useful publication to a particular audience.

Many thanks to Becky Ball for her appreciation of our methodology. Like we have already responded to referee #1, we agree that our focus in the discussion paper is very narrow. This could possibly prevent scientists working in other fields such as biogeochemistry, hydrology and geomorphology from noting the probable implications of our results for their own research.

15 The authors might care to think about how they could broaden its impact by either applying their results to an improved understanding of the water track as an ecosystem, or perhaps by proposing some testable hypotheses that could follow from the differences measured in the relative importance of particular energy fluxes. For example, the ground measurements are a snapshot during a field season, so are there hypotheses that could be posed about how this  
20 would scale up to more frequent or new or larger water tracks that could then be tested? How might the energy balance difference relate to differences measured in the biologic/geochemistry of water tracks? That might extend beyond the reach of the data presented, but perhaps it could be also be posed in the form of hypotheses. Even my published work with co-author Levy is now old enough to be beyond TCs definition of conflict of interest, so it could be interesting  
25 to have continued thought put towards the connections between the physical and biological characteristics of water tracks, which tend to be studied and reported separately to different scientific audiences.

The suggestions you made were very helpful and inspiring for our manuscript revision. We broadened the discussion of our results with regard to implications to hydrological, biogeochem-  
30 ical and biological processes, and posed suggestions and hypotheses for the interacting effects between these processes and SEB and hydrology of water tracks. For example, we considered seasonal effects(p.13, l.16–20) and habitat suitability changes resulting from the observed prop-

erties of water tracks and the increase in spatial extent they are anticipated to have in the future (p.20, section 3.6). We hope that this broadening of focus and discussion will show the relevance of our findings to researchers working in polar deserts and especially in the MDV and help improve the understanding of biogeochemical and hydrologic processes in polar desert landscapes and ecosystems.

## Minor Comments

In the last paragraph of section 4, a 10m width for water tracks and 20 m width for streams is specified. Is there by chance published data that could be cited to bolster this? I don't really argue the size classifications, but a justification might be useful.

- 10 Water track widths reported in the literature vary from very small (1-3 m) (*Levy et al.*, 2011) to large enough to be observed and distinguished in meter scale satellite observations – implying widths of meters to 10s of meters (*Langford et al.*, 2015). The water tracks at the study site are typically 5-15 m wide. We added some of this information in the introduction (p.3, 1.5–6).

In the last sentence of the conclusion: I assume you mean “either” not “ither”.

- 15 Yes, we changed this (p.21, 1.24).

## References

- Langford, Z. L., M. N. Gooseff, and D. J. Lampkin, Spatiotemporal dynamics of wetted soils across a polar desert landscape, *Antarct. Sci.*, 27(02), 197–209, doi:10.1017/S0954102014000601, 2015.
- 20 Levy, J. S., A. G. Fountain, M. N. Gooseff, K. A. Welch, and W. B. Lyons, Water tracks and permafrost in Taylor Valley, Antarctica: Extensive and shallow groundwater connectivity in a cold desert ecosystem, *Geol. Soc. Am. Bull.*, 123(11-12), 2295–2311, doi:10.1130/B30436.1, 2011.