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Comment on acp-2021-158

Anonymous Referee #1

Referee comment on "Shift in seasonal snowpack melt-out date due to light-absorbing particles at a high-altitude site in Central Himalaya" by Johan Ström et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-158-RC1, 2021

This manuscript explores the shift in melt-out date due to deposited LAP at a Central Himalayan site using AWS data. The paper is fairly well written, and the results presented in the article are interesting. However, I have few minor questions before I can recommend it for publishing.

Question 1:

Page 3, Line 104: Authors mentioned that "data was screened for inconsistencies." However, no clear methodology has been provided on how the inconsistencies were screened. What makes a data point inconsistent?

Question 2:

Page 4, Line 106: Paper uses median for albedo and SD, while a daily average for other data. Why so? Does it create any impact on results if authors use the daily average for albedo and SD as well?

Question 3:

Page 4, Line110: Paper states, "Using a lower emissivity would result in higher Ts, but will not affect the interpretation of the data." Why so? Some explanation is needed.

Question 4:

Page 11, Line 309-310: "Compared to other reported values for snow these estimates are high, but are close to those reported for ice." This statement is not entirely clear and needs more explanation on why such a thing will happen if all parameters are used for snow? Also, provide some references for values reported for snow so that a fair comparison can be made.

Question 5:

Page 14, Line 383-385: Authors mentioned "an overestimation of the melting compared to pristine snow." How much overestimation and compared to which data? Provide some references for comparison and quantify the overestimation.

General comments:

Minimal references are provided in many places, especially in the Introduction. Including suitable and more recent references make it easier for comparison and improvement made from previous studies. Some references in the manuscript are quite old and do not reflect the current state of knowledge with associated research. Here are few key references, which authors should consider including in the manuscript (List is not exhaustive):

Bond, T. C., et al., (2013). Bounding the role of black carbon in the climate system: A scientific assessment. Journal of Geophysical Research: Atmospheres, 118(11), 5380–5552. https://doi.org/10.1002/jgrd.50171

Flanner, M. G., Zender, C. S., Hess, P. G., Mahowald, N. M., Painter, T. H., Ramanathan, V., & Rasch, P. J. (2009). Springtime warming and reduced snow cover from carbonaceous particles. Atmospheric Chemistry and Physics, 9(7), 2481–2497. https://doi.org/10.5194/acp-9-2481-2009

He, C., Takano, Y., & Liou, K.-N. (2017). Close packing effects on clean and dirty snow albedo and associated climatic implications. Geophysical Research Letters, 44(8), 3719–3727. https://doi.org/10.1002/2017GL072916

Lee, W.-L., Liou, K. N., He, C., Liang, H.-C., Wang, T.-C., Li, Q., Liu, Z., & Yue, Q. (2017). Impact of absorbing aerosol deposition on snow albedo reduction over the southern Tibetan plateau based on satellite observations. Theoretical and Applied Climatology, 129(3), 1373–1382. https://doi.org/10.1007/s00704-016-1860-4

Singh, D., Flanner, M. G., & Perket, J. (2015). The global land shortwave cryosphere radiative effect during the MODIS era. The Cryosphere, 9(6), 2057–2070. https://doi.org/10.5194/tc-9-2057-2015

Stephens, G. L., O'Brien, D., Webster, P. J., Pilewski, P., Kato, S., & Li, J. (2015). The albedo of Earth. Reviews of Geophysics, 53(1), 141–163. https://doi.org/10.1002/2014RG000449

Ward, J. L., Flanner, M. G., Bergin, M., Dibb, J. E., Polashenski, C. M., Soja, A. J., & Thomas, J. L. (2018). Modeled Response of Greenland Snowmelt to the Presence of Biomass Burning-Based Absorbing Aerosols in the Atmosphere and Snow. Journal of Geophysical Research: Atmospheres, 123(11), 6122–6141. https://doi.org/10.1029/2017JD027878