The Cryosphere Discuss., 9, C1891–C1893, 2015
www.the-cryosphere-discuss.net/9/C1891/2015/

The Cryosphere Discussions

TCD
9, C1891–C1893, 2015

Interactive Comment

Interactive comment on "Soot on snow experiment: bidirectional reflectance factor measurements of contaminated snow" *by* J. I. Peltoniemi et al.

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Received and published: 16 October 2015

Received and published: 24 September 2015 "The authors present the results of the experiments on depositing various contaminants on a snow cover surface and measuring resulting albedo. The contaminating parti- cles were found to sank into snow cover due to heating by sunlight and the resulting albedo of the snow cover was varying in dependence on viewing angle. Such evident behavior seems not to be accounted for in the previous snow albedo-related construc- tions (at least I am not aware on published results like those, presented in this paper). Probably not many were interested both in dependence of albedo on the viewing an- gle and the contaminants affecting the

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snow albedo. The described experimental data is interesting, though the figures are a bit confusing. In my view the following needs clear explanation: 1. At nadir the optics measure the properties of a 20 cm diameter round on the snow cover surface. With different view angle the optics see something else. How this can affect the results? “

Answer: The field of view elongates as the zenith angle increases. This affects the results, if the target or illumination are inhomogeneous. Under sunlight, the illumination is homogeneous, and we tried to select and contaminate the snow with impurities also as homogeneous as by naked eye possible. This may still cause uncertainties of 1-5%.

“2. Radiation of different wave length has different effect on the “black” particles heating and the snow melt. Basically the black particles should be heated above 0âŮę C to melt ice particles around them and to “sink”. Some calculations are possible and with data presented should be part of the paper.”

Answer: This is not as simple as it sounds. First, the particle may sink, even if temperature is not at zero. Second, I can easily calculate, how much an isolated non radiating particle would heat in the snow under sunlight (of the order of 1 degree/s), but I cannot now model, how much and how fast the heat is distributed away, in the confidence I could publish it. Also, there are other factors which could influence the sinking rate. As it was pointed out by the reviewer # 1, the amount of deposited impurity, i.e. its density distribution in the surface level, may also affect the sinking rate. Thus in order to avoid rough assumptions we have voted to leave this question as later more focused subject of investigations.

“3. The effect of such “sinking” (or better “the difference between contaminated and clean snow is largest from nadir”) 4. on the energy balance of snow cover should be quantified and compared with “no sinking” accounted for. I think it should be small, but it does not make the presented results less valuable. “

Answer: this is a good idea to continue, though it goes beyond the scope of this paper this paper. I don’t like left hand calculations, but want to see then an extensive analysis.

“From the technical side: There is word “metamorphosis” in the text. This term was, indeed, used in past in relation to snow metamorphism but it is not considered as a proper one by the present time snow community (please check the terminology in the International Classification of Seasonal Snow on the Ground, which is even cited). I also do not think the word “diffusion” is used properly. I would suggest “sinking”. Since the authors are not discussing the metamorphic processes around the contaminating particles and without them, it is better to minimize referring to this process. “. . . all other snowpack properties change” is probably exaggeration.”

Answer: thank you, we changed metamorphosis to metamorphism according to (Fierz, et al., 2009), and diffusion to sinking.

Reference Fierz, C., Armstrong, R.L., Durand, Y., Etchevers, P., Greene, E., McClung, D.M., Nishimura, K., Satyawali, P.K. and Sokratov, S.A. 2009. The International Classification for Seasonal Snow on the Ground. IHP-VII Technical Documents in Hydrology N°83, IACS Contribution N°1, UNESCO-IHP, Paris.

Interactive comment on The Cryosphere Discuss., 9, 3075, 2015.