

Review Chandler et al. Seasonal changes of ice surface characteristics and productivity in the ablation zone of the Greenland Ice Sheet.

This manuscript describes a field experiment during the summer 2012 in the western ablation zone of the Greenland ice sheet. Emphasis of the field work is the evolution of cryoconite holes over summer. Data are collected of the physical and biological processes taking place on the ice surface. Key parameters are surface type, surface ablation, biological oxygen demand, microbial activity. In addition albedo from AVHRR was retrieved. It was found that surface albedo changes over time with a rapid transition in the early season when snow disappears and a more gradual change during summer when the number of cryoconite holes increases. It is furthermore concluded that biological activity varies widely in space and time.

The paper is a careful description of what has been done and as such worth publishing as it is one of the first attempts to study the evolution of cryoconite holes over a full summer season. Unfortunately conclusions are limited. Is the key question not how evolves the dark zone over the season and should you not discuss this as such? I am a little confused whether your goal is to get information about albedo characteristics or about biological production.

Minor remarks

Page 1339 L1-10. I believe the paper by van de Wal and Oerlemans 1994 is the first paper mentioning the dark zone in the ablation zone I believe this should be mentioned somewhere.

Page 1339 L15. Very few data on seasonal changes in surface characteristics seems an under evaluation of the existing time series of albedo from automatic weather stations which are available.

Page 1340 L3 I suggest to add after surface observations “ of biological processes” to specify a little bit better what is added to the existing knowledge”

Page 1341 L19 Rephrase the turbulent fluxes are not always into the ice they may also be in the opposite direction.

Page 1343 L20-24 previously said

Page 1348 I don't understand why only the incoming radiation of AWS stations is used. It seems to me that the data set could be strengthened by using also albedo data from an AWS.

Page 1349 L 16-21 A link could be made to AWS6 data where I suppose melt is also available. Putting the exceptional high melt rates of summer 2012 is probably best placed in perspective of the data published by van de Wal et al 2012.

Page 1351. I am not convinced by the need of figure 8 and suggest to leave it out.

Page 1351. I am not sure whether all abbreviations are introduced adequately please check this and emphasize this more to increase the readability.

Page 1352. I am confused by the fact that CW is not significantly deviating from zero whereas it has the largest value.

Page 1354. I believe that AWS data do show higher albedo values closer to the margin and think you need to mention this check Van den Broeke et al. 2008 and references therein.

Page 1355. Line 17-20 to 1356 L6. I am not convinced about the re-emergence mechanism of superimposed ice at an elevation far below the equilibrium line altitude. Did you consider subsurface radiation penetration and the inclusion of Holocene dust as suggested by Wientjes et al. 2012.

Page 1356 Line 20. This is handwaving a pity you don't compare this with AWS data in more detail

Page 1356 Line 26 Again it would be usefule to compare it with AWS data either from IMAU or GEUS. I suggest to leave out the entire part on AVHRR you barely use it.

Page 1360 Line 10. Do I understand it correctly that you find rates which are an order of magnitude larger? If so why?

References

R S W van de Wal, W Boot, C J P P Smeets, H Snellen, M R van den Broeke, J Oerlemans. Twenty-one years of mass balance observations along the K-transect, West-Greenland, Earth Syst. Sci. Data, 4, 31-35, doi:10.5194/essd-4-31-2012.

I G M Wientjes, R S W van de Wal, M Schwikoski, A Zapf, S Fahrni, L Wacker. Carbonaceous particles indicate Holocene dust as cause for the dark region in the western ablation zone of the Greenland ice sheet. Journal of Glaciology, 58(210) doi:10.3189/2012JoGG11J165

M R v d Broeke, P Smeets, J Ettema, C v d Veen, R S W van de Wal, J Oerlemans. Partitioning of melt energy and meltwater fluxes in the ablation zone of the West Greenland ice sheet. The Cryosphere, 2, 179-189