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The Cryosphere Discussions

Interactive comment on "Impact of dust deposition on the albedo of Vatnajökull ice cap, Iceland" *by* Monika Dragosics et al.

Anonymous Referee #2

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The main focus of this paper is on modelling dust deposition on the Vatnajökull ice cap and studying the effects of dust on the surface albedo and melting rates. Data from automatic weather stations (including albedo data) on Brúarjökull, a northern outlet from Vatnajökull, are used for control, as well as measurements of dust concentration in snow samples from 16 ice-cap sites and on two 8 m firn cores. The authors demonstrate that significant changes in albedo occur on Vatnajökull in connection with events of dust deposition. They calculate the effect of the albedo change on the energy balance on the glacier surface and conclude that the dust deposition during the summer 2012 enhanced melting by 60% as compared with (modelled) melting that would have occurred in the absence of dust. This paper is an important contribution to the study of factors affecting mass-balance of glaciers in Iceland. Publication can be recommended following amendments taking the following comments into account.

Specific comments and corrections:

Figure 2 and associated discussion on page 52: Neither the figure caption nor the text is clear on exactly which period is being displayed here for the modelling results: The glaciological year 2012-2013, the entire calendar year 2013 or the part of 2013 leading up to the sampling expedition in October 2013 (data from samples collected during that expedition are displayed along with the model results in the figure). It is probably the period JD 130-283, but this should be explicitly mentioned.

The two case studies on Dust events 1 and 2 (Figures 3-5) are well described and the authors present good reasons for focusing on those events, comparing measured albedo drops with modelled dust deposition. Since both are, however, spring events, it is a bit surprising that other events do not receive comparable scrutiny, like for example the summer event E5 during JD 220-227 (Fig. 3), or the September events after JD240.

The results presented in Fig. 8 are compelling and of great interest, indicating that the dust deposition at the two Brúarjökull sites enhances total summer melting by 60% during 2012.

L42-43 "The snow-albedo feedback, where radiation absorption is enhanced due to impurity content in snow and ice is indicated by complex processes. . ." Further clarification needed here, what is meant by "complex processes" ?

L64-66 "Iceland is one of the most active aeolian places on Earth, even though it is not situated in an arid climate (Arnalds et al., 2016). Due to the large area of sandur plains and strong winds resulting in numerous dust events."

"aeolian place" is not well put, and second sentence is subordinate, meaning that it shouldn′t stand on its own.

L212 Dynjgusandur → Dyngjusandur

L230-231 In Table 1, the measured and modelled dust deposition during the years 2012 and 2013 for stations on Brúarjökull, our main area of investigation, were reported. →

Table 1 gives the measured and modelled dust deposition during the years 2012 and 2013 for stations on Brúarjökull, our main area of investigation.

L338 “magnitude” should probably be “order of magnitude”

L350 which seems to be overestimated → which seems to be an overestimate in the light of results presented here.

L370 supper site → upper site

L390 and L606 Grímsvötn eruption → Gjálp eruption

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