

Answer to RC2 (Ingrid Reiweger)

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General comment

The paper “Can Saharan dust deposition impact snowpack stability in the French Alps?” deals with the question on how Saharan dust deposition influence snowpack stability with respect to avalanche release. To investigate the subject, the authors use both real and simulated snowpacks with and without dust and calculate stability indices for both snowpacks (dust vs. no dust). These stability indices are then compared to estimate the dust’s influence on snowpack stability. The short answer to the initial question is, not surprisingly, found to be “it depends”. Nevertheless, the paper provides interesting insights, cool modelling chains with ensemble modelling, as well as splendid presentation of the resulting statistics, and I would certainly recommend publication, taking into consideration the detailed comments below.

We are really thankful to Ingrid Reiweger for providing very useful feedback on this paper. We answer, in black, to the detailed comments below. Quotations from the paper are in italic font and proposed changes in purple italic font.

Detailed comments

2.3 Here suddenly you change to present tense!

p.6 l. 24 are not

Corrected.

p.6 l. 26 The stresses due to a skier or due to the load of the overlying snow layers?

We now precise in the text that both contributions are taken into account: *Level 3, the highest level, on the other hand, corresponds to pronounced instability where the stress in this layer, due to the weight of overlying layers and additional load, is close to layer strength.*

p.23 l. 13: had not

Corrected.

Formula 1: I guess $i = 1 \dots i_{\max}$ What is i_{\max} ?

We now precise in the introductory sentence of this equation that we consider 35 members.

p.6. 1.28 What about surface hoar as a weak layer?

Moreover, I really wonder whether dust inhibits growth of surface hoar and this increases snowpack stability for this particular case?

Crocus snow cover model is not able to represent surface hoar (SH) layers. Although the mass deposition is represented, the model is not designed to track these layers and not have a specific representation of surface hoar as SNOWPACK model have. SH layers are a significant concern in many regions [e.g. Hageli et al., 2013], and reviewer’s question is therefore highly relevant. The interaction of surface hoar formation and evolution with dusts largely remains to be studied. We added a paragraph in the discussion to underline this limitation:

The snow cover model Crocus comes with some limitations. Although the mass of deposition is computed by the Crocus snow cover model, it is aggregated to the snow surface layers without modification of microstructure properties so that surface hoar can no longer be tracked as a weak layer in the model. It is not yet clear how dust deposition

might affect the surface hoar formation as different processes might be involved. The presence of dust near the surface of snowpack modifies the surface temperature of snow. The dust particles may modify the condensation of ice at the surface of snow as this is the case for snow flakes in the atmosphere [Mohler et al., 2006].