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# *Interactive comment on* "Seasonal evolution of snow permeability under equi-temperature and temperature-gradient conditions" *by* F. Domine et al.
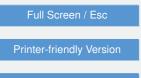
**F. Domine et al.**

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## 1   General comments

This is a very well designed study.   Three topics are addressed in this manuscript: 1) is the dependence of snow permeability (K) upon its meta-morphism process (under equi-temperature (ET) or temperature-gradient (TG) conditions) 2) an evaluation of the empirical equation for K using the specific surface area (SSA) and density (s) data; and 3) a model for K using the output from the detailed snowpack model.  The three topics are well organized.  The

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**manuscript is very well written, and I cannot see any problems with the analysis or presentation. I think it is worthy of publication in The Cryosphere after fairly minor edits. Below I give my specific editorial comments and suggestions for improvement of the arguments in the manuscript.**

We thank the reviewer for his/her very positive appreciation of our work. Detailed replies to specific points are given below.

## 2 Specific comments

**The modeling of SSA in Crocus is necessary to calculate K. There is no description of how to calculate SSA in Crocus, such as what parameters are used to calculate SSA in the model etc. A brief description of this would be very useful for readers to follow the discussion.**

Details pertaining to the description of SSA in Crocus were kept short in the original manuscript because such information is readily available in quoted articles. Nevertheless, additional details will be given in the revised manuscript.

**The definition of grain radius (r) in Eq. (2) is different from that in Eq. (3). Therefore, I think r in Eq. (2) should be replaced by another letter to avoid confusion. Additionally, although the authors were following the method of Calonne et al. (2012), Fig. 5 is misleading because of this confusion.**

Visually determined grain radius is now referred to as $r_{vis}$ in the text. The caption of Figure 5 was edited to remove any ambiguity.

## 3   Technical corrections

**P2739 L20.  I do not agree with the argument that "it aerodynamic drag will ..."
because K becomes larger as grain size increase according to Eq.  (2) or (3).
Please add more detailed discussion to explain your argument.**
More details will be provided in the revised manuscript. In particular, the fact that larger
grains will lead to lower premeability seems contradictory to equation (2).  However,
that equation only applies to spheres and can only be used to predict the effect of an
increase in sphere size.  Shape is another important factor that affects permeability
(Dullien, 1992).  Replacing small spheres of a given SSA with large hollow crystals of
the same SSA will decrease pore diameter and therefore restrict flow.

**Line 2 in the figure caption of Fig. 7 has a typing error: (a, c, d) should be (a, c,
e).**
This typo was fixed in the revised manuscript.

**The style of figure captions of Fig. 8 should be consistent with Fig. 7.**
The styles of Fig. 7 and Fig.8 are now harmonized in the revised manuscript.

**The scales of the X axes in Fig.  10 and 11 are difficult to understand.  Please
make these figures clearer.**
Figures 10 and 11 will be edited for improved clarity.

## References

Dullien, F. A. L.: Porous media: fluid transport and pore structure, Academic Press,
1992.

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