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Interactive comment on "Solving Richards Equation for snow improves snowpack meltwater runoff estimations" *by* N. Wever et al.

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We thank Florent Dominé for his encouraging comment. We would like to shortly address both issues below.

Regarding specific surface area (SSA): currently, the SNOWPACK model is centered around the grain size as defined as the average of the maximum extend of snow particles in a layer (Fierz et al., 2009). There are activities underway to change the microstructural functions of SNOWPACK to reflect recent advances using SSA. However, SSA, or more precisely the optical diameter r_opt (Morin et al., 2013), is currently only calculated as a postprocessing step. That means that we cannot investigate properly and straightforwardly the impact of a change to r_opt on our results. However, once the snowpack is isothermal and wet, classical grain size and r_opt are equal. So the

most important effect may be in the early stages where melt water percolates through an initially dry snowpack. It should be noted however, that many experimental studies are forming the foundation of the parameterizations in SNOWPACK, so although SSA may allow a better simulation of microstructural processes, it is in our opinion an unanswered question right now whether this will allow a significantly better simulation of water flow in snow. We are therefore not planning to address this issue in the revised version as we cannot provide the reader with useful information regarding this topic.

Regarding the permeability calculations by Calonne et al. (2012): this question is related with the previous one. The used equivalent sphere radius in the Calonne et al. (2012) formulation of permeability roughly corresponds to r_opt. Thus we tested the effect of Calonne vs Shimizu, using r_opt in Calonne's parameterization. We found a marginal (not significant) improvement in terms of NSE coefficient and r^2 value, mainly for simulations for Col de Porte. We think that the reason for this marginal improvement is due to Shimizu's and Calonne's formula differing especially for the low density, new snow crystals. But when liquid water is involved, the snow will compact rather quickly and grains will only stay in this regime for a short period of time. Nevertheless, we will provide the results using Calonne (2012) in the revised manuscript.

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