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Interactive comment on "A new methodology to simulate subglacial deformation of water saturated granular material" *by* A. Damsgaard et al.

Anonymous Referee #2

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The authors describe an elegant numerical model of a deforming granular subglacial material. (I am not qualified to evaluate the numerical model.) It is satisfying that the results are consistent with laboratory experiments and well-understood physics. However, the conclusions are, I think, already pretty well-known, and in that respect the paper does not seem to provide much insight into subglacial processes. Perhaps the paper should be written as a model description and validation paper, as the title actually suggests. This would require minimal change. It would simply involve statements along the lines of, "See, the model does what we know it should do, so despite its short-comings (large grain size, no clay,...) it is reproducing nature." Alternatively, perhaps the authors can make some predictions using the model that are not already understood, but are supported by field evidence.

Under the best conditions modelled, deformation extended only two to three decimeters into the bed, yet it is known that deformation extends to greater depths in nature. Can the authors explain what is necessary to get deformation at greater depths? I don't think this is really understood, and it would be a nice contribution.

The "Results" section contains a lot of unsubstantiated statements and interpretation. Interpretation should be clearly distinguished from the "facts" that are evident in graphical (or numerical) results.

The changes in peak stress and mean fluid pressure from one experiment to another are very small and if they were based on physical experiments, most readers would consider them to be within the limits of uncertainty of the experiments. What happens if you repeat an experiment from the beginning, numerically dumping a new assemblage of particles (with the same particle size distribution) into your "dry, tall volume"? Are the results in Figures 4 and 7 reproducible to the degree that you can argue that the differences among panels of those figures are real?

Interactive comment on The Cryosphere Discuss., 9, 3617, 2015.