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Interactive comment on "The mechanical origin of snow avalanche dynamics and flow regime transitions" *by* Xingyue Li et al.

Anonymous Referee #3

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The paper presents a systematic approach to evaluate the potential of the Material Point Method (MPM) for snow avalanches. The MPM method provides the possibility to account for different flow regimes of the avalanche flow in rather a novel approach.

In a first step the paper concerns avalanche on a selection of very simple geometries (At this point one could have considered a variety of parabolic track as this might be closer to Nature). The authors present a nice comparison of the influence of various parameters which would determine the flow regime.

I do have slight problems with section 3.3.2. First of all, the main idea behind so-called alpha-beta model (Lied and Bakkehoi, 1980) is that the runout angle alpha is proportional the the beta angle, which is a measure of the mean slope angle. Hence there is no dependency on a length scale in the runout. Furthermore, solely considering the

alpha angle involves little information without the corresponding beta angle. Having said that, Fig. 8 and Fig. 9 are not that easy to understand. For example, even though the velocities Fig. 9 seem to correspond somehow with the measurements, their origin (frictional behavior) might be rather different. E.g. the velocity of 70 m/s in the simulations correspond to nearly free fall velocity (2gH)ˆ.5 whereas as the measured one is close to (gH/2)ˆ.5. Hence there is a mix up in the comparison.

Finally, the authors present a promising comparison between simulations and real avalanche measurements.

It would be interesting to see how the model would behave when erosion and entertainment is also considered.

Some minor remarks can be found in the attachments.

Best regards

Please also note the supplement to this comment:
https://tc.copernicus.org/preprints/tc-2020-83/tc-2020-83-RC3-supplement.pdf

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