Earth Surface Dynamics Discussions

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Comment on esurf-2020-107

Anonymous Referee #1

Referee comment on "Particle energy partitioning and transverse diffusion during rarefied travel on an experimental hillslope" by Sarah G. W. Williams and David J. Furbish, Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2020-107-RC1, 2021

Authors investigate particle motions when collide on rough hillslope surfaces; in particular the contribution of kinetic, rotational, and frictional energies during their travel going downslope using recent works from Furbish et al. (2020) . They analyzed from very interesting experiments the influence of the geometry particles on the energy conversion. The transverse spreading during the travel of particles on different rough surfaces is discussed.

- 1) Concerning the experiments: Could you describe more precisely what you call "a smooth slate surface "
- 2) Many authors suggest (Brach included) that a well determination of the coefficient of restitution, the energy relating to all six degrees of freedom (translational and rotational) should be obtained. The interesting discussion about the influence of the particle shape in the present work would be more fruitful if you discuss on the base of tangential and longitudinal coefficient of distribution and the collisions depending on the shope of the particle. I guess that you have all the data (after seeing your supplementary materials) to estimate tangential and longitudinal coefficients of restitution, which are related to the contact forces during the impact and then, the partition between energies. See for example, S. Dippel, G. G. Batrouni, D. E. Wolf, PRE 1997 and 1998; M. Louge et al 10.1103/PhysRevE.65.021303; Higham https://doi.org/10.1007/s10035-019-0871-0, and references therein. I think that authors con
- 3) Downslope travel distance

Henrique et al (PRE 1998 , 57, 4) report on an experimental, numerical, and theoretical study of the motion of a ball on a rough inclined surface. Among the control parameters, the initial kinetic energy is one of them. The authors analyze the dependence of the traveled distances on and the kinds of mechanism of dissipation depending on the initial kinetic energy which is a constant friction force or viscous for small initial energies. They showed that a ball that has a large enough initial kinetic energy first bounces on the rough surface and suffers a constant friction force and the ball could not be trapped if its velocity is larger than the crossover velocity. After this threshold, the friction force suddenly becomes viscous. In fact, they show the existence of two mechanisms of dissipation, i.e., friction forces, related to the difference in the nature of the collisions when the energy is below or above this threshold.

- How do you compare your results to those of Henrique et al in the particular case of rounded grains?
- What you can say about the stopping distance when grains are trapped by the surface?
- Did you find a threshold when varying the slope?and with the initial kinetic energy?
- Are the difference between the travel distances for angular and rounded particles launched on the roughened experimental surfaces due to different mechanisms of dissipation? Which are the origin of those mechanisms? Are only due to the impact?

4) Lateral spreading

- Authors said that they measured lateral position from experiments performed above. Did you vary the initial energy at which was launched each grain? It is known that in a system like Galton billiard model or random walk, particles, after several collisions, they lost their memory. Did you explore that typical distance for your grains of different geometries? Or the number of collisions? (Which is more difficult to measure in this case).
- b) the lateral variance indicates that when you increase the slope a constant value is reached with the downslope position which varies between 10d_p or 20_dp from their plots. It is not easy to find typical values in some curves over 1 decade. Did you have any explanation about those typical lengths? Those typical lengths are quite related to some velocity correlation length that you will serve to characterize the difference between rounded and angular grains and their random motion.

I think that it is a very nice and interesting work that can be published after revision. In particular, authors need to discuss comparing the present study to previous works, as I said before, in order to provide physical arguments for the mechanisms involved and observe y the experiments.