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Numerical Study of Splash Detail Due to Grain Impact on Granular Bed

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Massive sediment transport phenomena, such as sand storm and drifting snow, pose a considerable threat to human life. Further, the formation of geomorphological patterns on sand-desert and snowfield surfaces as a result of sediment transport, such as dunes and ripples, is of considerable research interest. Because the major component of the grain entrainment into the air is caused by both the collision and ejection, it is necessary to focus on the collisions between wind-blown grains and surface of sand field along with the resultant ejection grains from the surfaces, which processes are, as a whole, called a splash process. However, because of complexity of jumping grains over the ground surface, detailed measurement is very hard. Therefore, to investigate the splash process, we simulate detailed process of splash caused by 1-grain impact onto a randomly packed granular bed using discrete element method.

As a result, we obtained good correspondence between our numerical results and the findings of previous experiments for the movement of ejected grains. Furthermore, the distributions of the ejection angle and the vertical ejection speed for individual grains vary depending on the relative timing at which the grains are ejected after the initial impact. Obvious differences are observed between the distributions of grains ejected during the earlier and later splash periods: the form of the vertical ejection-speed distribution varies from a power-law form to a lognormal form with time, and this difference is related to the grain trajectory after ejection [1]. In addition, we focus on the bulk dynamics inside the granular bed to relate the ejected grains behavior to the force propagations from the first impact to the ejection of each grain.

[1] T. Tanabe, T. Shimada, N. Ito, and, H. Nishimori, (submitted)