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Granular segregation in dense, layered, inclined flows of spheres

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We consider dry flows of two types of spheres in dense, inclined flows in which the particles translate in layers, whose existence may be promoted by the presence of a rigid base and/or sidewalls. In such flows, a sphere of a layer is forced up the back of a sphere of the layer below, lifting a column of spheres above it, and then falls down the front of the lower sphere, until it bumps against the preceding sphere of the lower layer [Jenkins & Larcher, Phys. Rev. Fluids 2, 124301, 2017]. The fall of a sphere and that of the column above it results in a linear increase in the magnitude of the velocity fluctuations with distance from the base of the flow, as shown in measured profiles of granular temperature obtained in some dense, inclined flows. This trend of velocity fluctuations and the application of the segregation theory by Arnarson & Jenkins [Phys. Fluids 16, 4543-4550, 2004] for a binary mixture of nearly elastic spheres that do not differ by much in their size or mass predicts a larger concentration of small particles at the top of the flow. It is less common to have small, rather than large, particles rise to the top of natural inclined flows.