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Streamwise transport in multi-component granular flows CHRIS JOHNSON, Univ of Manchester, ANDREW HOGG, JEREMY PHILLIPS, Univ of Bristol — Thin free-surface avalanches of granular material occur widely in nature and industry. In these contexts the flows often contain particles of a wide range of sizes, which separate from one another due to particle size segregation. This segregation is troublesome in industry (where a well-mixed state is usually desired) and is an important mechanism for determining the runout and morphology of natural avalanches and debris flows. In this talk we develop a model for the spatial and temporal evolution of the particle size distribution in a granular flow, due to particle segregation, diffusion and advection processes. We use asymptotic solutions of this model to formulate equations governing the depth-integrated particle size distribution. These equations naturally extend the shallow-water models often used to predict the dynamics of monodisperse avalanches. Our modelling shows that particles in granular avalanches may strongly segregate in the direction of flow, even when the segregation is relatively weak compared to diffusive mixing and the avalanche is nearly homogeneous throughout its depth. We demonstrate this surprising phenomenon through comparison with discrete particle simulations.

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