Transient response in granular bounded heap flows[1] HONGYI XIAO, JULIO M. OTTINO, RICHARD M. LUEPTOW, PAUL B. UMBANHOWAR, Northwestern University — Heap formation, a canonical granular flow, is common in industry and is also found in nature. Here, we study the transition between steady flow states in quasi-2D bounded heaps by suddenly changing the feed rate from one fixed value to another. During the transition, in both experiments and discrete element method simulations, an additional wedge of flowing particles propagates over the rising free surface. The downstream edge of the wedge - the wedge front - moves downstream with velocity inversely proportional to the square root of time. An additional longer duration transient process continues after the wedge front reaches the downstream wall. The transient flux profile during the entire transition is well modeled by a diffusion-like equation derived from local mass balance and a local linear relation between the flux and the surface slope. Scalings for the transient kinematics during the flow transitions are developed based on the flux profiles.

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