**Multi-Method Study of a Sharp, Macroscopic Interface Separating Homogeneous Media**

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**ABSTRACT:** Utilizing theoretical, numerical, and experiment methods, we study the effect a sharp macroscopic interface between two homogeneous media has on fluid mixing and transport. This 1D experiment is conducted using a symmetric system consisting of coarse and fine media separated by a thin interface. Contrary to the results predicted by the traditional ADE, several authors have shown that break through curves of contaminants injected and advected through such a system depend on both flow direction and rate, with large asymmetries related to flow direction developing in the curves at lower flow rates. Through carefully derived experimental methods, we are able to perform a direct comparison between the theoretical, numerical, and experimental results to identify phenomena that are not captured by the ADE. By employing high definition imaging and sophisticated image processing, contaminant concentration and gradients are fully resolved throughout the entire flow cell at all times providing us with the physical basis necessary to refine current upscaled models to more accurately predict transport behavior through heterogeneous media.