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Mechanics of fluid injection into a soft granular material
CHRISTOPHER MACMINN, ERIC DUFRESNE, JOHN WETTLAUFER, Yale University — Motivated by a range of problems in geophysics and biology where fluid injection drives the mechanical deformation of a porous solid, we perform laboratory experiments in a model system. We inject fluid into a packing of soft particles and measure the dynamic, flow-driven deformation of the packing at high spatial resolution. We show that the mean deformation and relaxation of the packing, as well as the buildup and dissipation of pressure, can be described by continuum poroelastic theory. We also find, in contrast, that the granular microstructure leads to the spontaneous emergence of heterogeneous mesoscale features such as shear bands that are absent from the continuum theory. We discuss the implications of these results.

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