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Groundwater dynamics in a two-dimensional aquifer VALENTIN JULES, OLIVIER DEVAUCHELLE, ERIC LAJEUNESSE, Institut de Physique du Globe de Paris — During a rain event, water infiltrates into the ground where it flows slowly towards a river. The time scale and the geometry of this flow control the chemical composition and the discharge of the river. We use a tank filled with glass beads to simulate this process in a simplified laboratory experiment. A sprinkler pipe generates rain, which infiltrates into the porous material. Groundwater exits this laboratory aquifer through a side of the tank. Gurin et al. (2014) investigated the case of a quasi-horizontal flow. In nature, however, groundwater often follows non-horizontal flowlines. To create a vertical flow, we place the outlet of our experiment high above its bottom. We find that, during rainfall, the discharge Q increases as the rainfall rate R times the square root of time t ($Q \propto Rt^{1/2}$). This laboratory aquifer thus responds linearly to the forcing. However, long after the rain has stopped, the discharge decreases as the inverse square of time ($Q \propto t^{-2}$), although linear systems of finite size typically relax exponentially. We investigate this surprising behavior using a combination of complex analysis and numerical methods.

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