

Water Resources Research

Supporting Information for

Emergence of unstable focused flow induced by variable-density flows in vertical fractures

Hongfan Cao^{1,2}, Seonkyoo Yoon¹, Zhenyu Xu³, Laura Pyrak-Nolte³, Etienne Bresciani⁴,
Peter K. Kang^{1,2*}

¹Department of Earth and Environmental Sciences, University of Minnesota, Twin Cities, Minnesota, USA.

²Saint Anthony Falls Laboratory, University of Minnesota, Minneapolis, Minnesota 55455, USA

³Department of Physics and Astronomy, Purdue University, West Lafayette, IN, United States

⁴University of O'Higgins, Rancagua, Chile

Contents of this file

Caption for supplementary video.

Supplementary videos showing the time evolution of concentration fields and streamlines of case 1 (with inertia), case 2 (without density difference), and case 10 (without inertia). In case 1 (reference case), vortices emerge near the inlet and move upwards along the runlet. The fluctuation of runlet is larger in the upper part compared to the lower part. In case 10, fewer vortices emerge, and the upward movement of vortices is limited compared to case 1. The vortices that emerge near the inlet affects the fluctuation of the entire runlet for case 10. No runlet forms in case 2 due to the lack of density difference.