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**Hydraulic jumps with upstream shear** KELLY OGDEN, Physical Oceanography, MIT/WHOI, KARL HELFRICH, Physical Oceanography, WHOI — Hydraulic jumps in flows with background shear are investigated, motivated by applications such as the flow over sills in Knight Inlet and the Pre-Bosphorus Channel. The full solution space and allowable solutions to several two-layer theories for hydraulic jumps with upstream shear are identified. The two-layer theories considered, including a recent theory by Borden et al. (JFM, 2012), are distinguished by how dissipation is partitioned between the layers. It is found that upstream shear with a faster and thinner lower layer causes an increase in bore speed, for a given jump height. Further, these two-layer solutions only exist for a limited range of upstream shear. 2D numerical simulations are conducted, guided by the two-layer theory solution space, and the results are compared to the theories. The simulations show the qualitative types of hydraulic transitions that occur, including undular bores, fully turbulent jumps, and conjugate state-like solutions; the type depends on the jump height and upstream shear for fixed upstream layer depths. Numerical simulations are used to investigate the mixing. Finally, a few 3D numerical simulations were made and are found to be consistent with the 2D results.

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