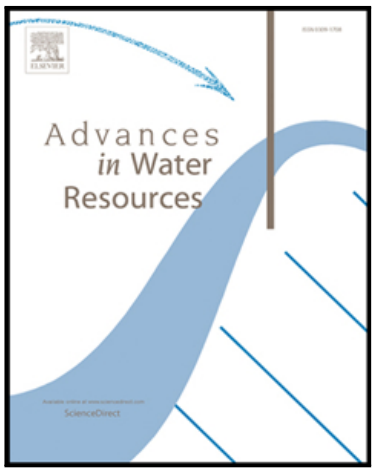

Outer Region Scaling Using the Freestream Velocity for Nonuniform Open Channel Flow Over Gravel

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Highlights

- The theoretical basis for outer region scaling using the freestream velocity for nonuniform open channel flows over gravel is derived
- Similarity solution findings support the nonuniform flows as equilibrium defined by the asymptotic invariance principle
- Experiment results further support the velocity defect collapse based on the freestream velocity as well as a constant energy gradient parameter