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HOMOGENIZATION AND UPSCALING OF FLOW THROUGH VEGETATION

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Summary. Vegetation can significantly complicate modeling efforts in applications where depth and flow velocity vary significantly, such as in modeling coastal inundation, levee overtopping, and morphological change. Due primarily to computational constraints, the effect of vegetation must be incorporated into depth-integrated flow models through empirical or theoretical resistance models that are closely related to the classical Chezy, Manning, and Darcy laws for surface roughness and porous media. In this work we investigate the use of homogenization techniques and multiscale numerical modeling to represent the effect of vegetation on overland flow. In particular, we use highly resolved two- and three-dimensional numerical models of flow through computer-generated ”vegetated” flow domains along with modern volume averaging and homogenization techniques to better understand flow resistance in various flow regimes. The numerical models use unstructured meshes to resolve complex geometry, and the variational multiscale (finite element) method to resolve steady and unsteady, low and high Reynolds number flows