Abstract Submitted
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On the physics of turbulent flows in natural meander bends: Insights gained by LES[1] FOTIS SOTIROPOULOS, SEOKKOO KANG, University of Minnesota — Turbulent flow in a natural meander bend with riffle-pool sequences and arbitrarily complex large-scale roughness elements is simulated using high-resolution LES. The complex stream bathymetry is handled with a new version of the curvilinear immersed boundary method capable of carrying out LES in arbitrarily complex geometries with the dynamic Smagorinsky model and wall modeling. The computational grid is sufficiently fine to resolve vortex shedding from cm-scale roughness elements in the riffles. The computed results are compared with experimental data and are shown to be in good overall agreement. The simulated flowfields are analyzed to provide new insights into the structure and driving mechanisms of the inner and outer bank secondary flow cells, the effects of large-scale roughness on turbulence anisotropy and anisotropy-driven secondary flows in the riffles, and the structure and impact of recirculation regions along the inner bank of the bend. The simulated flowfields also underscore and clarify previously hypothesized linkages between flow patterns and experimentally documented streambed morphodynamics.

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