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Modeling Depth averaged velocity and Boundary Shear Stress distribution with complex flows

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In the present study, the depth-averaged velocity and boundary shear stress in non-prismatic compound channels with three different converging floodplain angles ranging from 1.43□ to 7.59□ have been studied. The analytical solutions were derived by considering acting forces on the channel beds and walls. In the present study, five key parameters, i. e non-dimensional coefficient, secondary flow term, secondary flow coefficient, friction factor, and dimensionless eddy viscosity, were considered and discussed. A new expression for non-dimensional coefficient and integration constants were derived based on the novel boundary conditions. The model was applied to different data sets of the present experiments and experiments from other sources, respectively, to examine and analyse the influence of floodplain converging angles on depth-averaged velocity and boundary shear stress distributions. The results show that the non-dimensional parameter plays an important in portraying the variation of depth-averaged velocity and boundary shear stress distributions with different floodplain converging angles. Thus, the variation of the non-dimensional coefficient needs attention since it affects the secondary flow term and secondary flow coefficient in both the main channel and floodplains. The analysis shows that the depth-averaged velocities are sensitive to a shear stress-dependent model parameter non-dimensional coefficient, and the analytical solutions are well agreed with experimental data when five parameters are included. It is inferred that the developed model may facilitate the interest of others in complex flow modeling.
Keywords: Depth-average velocity, Converging floodplain angles, Non-dimensional coefficient, Non-prismatic compound Channels