

ERROR ANALYSIS OF HYDRAULIC RADIUS EVALUATION IN OPEN CHANNEL FLOW HYDRAULIC CALCULATION

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BACKGROUND

- There are more than 80,000 reservoirs in China, sedimentation and submerged area are key issues in reservoir planning.
- We have to use numerical model(usually 1D flow and sediment transport model) to predict the sedimentation process and the submerged area when sediment deposition arrives equilibrium.
- But there is no commonly used commercial software to do this work and researchers developed different versions of numerical model based on non-equilibrium sediment transport theory founded by a Chinese scientist, which is proved to be more accurate than equilibrium theory in sediment transport calculation.



The Three Gorges Reservoir in Yangtze River



The Xiaolangdi Reservoir in Yellow River

PROBLEM AND CONCLUSION

- In some previous models they takes water depth instead of hydraulic radius in solving the Saint-Venant equations, that is considered proper.
- In this work we analyzed calculation error in different cross-sections and show a case study, finally the conclusion is clear that taking water depth instead of hydraulic radius may cause obvious error.
- The problem is quite simple and traditional in hydraulic calculation, but it may bring error in water level calculation, may be tens of centimeters while that may cause miscalculation of submerged area and many people living upstream will suffer.

$$B \frac{\partial z}{\partial t} + \frac{\partial Q}{\partial x} = q_l$$

$$\frac{\partial Q}{\partial t} + 2 \frac{Q}{A} \frac{\partial Q}{\partial x} - \frac{BQ^2}{A^2} \frac{\partial z}{\partial x} - \frac{Q^2}{A^2} \frac{\partial A}{\partial x} \Big|_z = -gA \frac{\partial z}{\partial x} - \frac{gn^2 |Q| Q}{A(A/B)^{4/3}}$$

THANKS
FOR YOUR
ATTENTION!

