Numerical examination on the secondary-current effect for contaminant transport in curved channel

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Abstract: The purpose of this paper is to examine the effect of secondary current on contaminant transport in curved channel by using the 2D depth-averaged model. Two hypothetical cases are adopted. The results show that the secondary-current effect caused by flow is very limited and is reflected mainly from the circulatory transport term which is contained in the contaminant transport equation. A numerical experiment is carried out to judge the effect level of the secondary current. The results indicated that the maximum relative difference in concentration, MaxC*, obtained from the comparison of models with and without considering the secondary-current effect is mainly related to the relative strength of the secondary current SI and the relative length of the bend $\chi_b$. Empirical relations including the classification on effect level of secondary current and the MaxC*,-SI-$\chi_b$ relation have been tentatively established. The former relation can serve as a guideline for model users to judge how important the secondary-current effect is and when the effect should be included in the model. The later relation can be regarded as an auxiliary relationship for the former to quantify the deviation between models with and without considering the secondary-current effect. The field data reported by Lau and Krishnappan [J. Hydraul. Div. ASCE 107 (1981) 209] and Holley and Abraham [J. Hydraul. Div. ASCE 99 (1973) 2313] are adopted herein to verify the applicability and the accuracy of the proposed relations. © 2005 International Association of Hydraulic Engineering and Research. (26 refs.)