

3D Numerical Modeling and Analysis of Bed Topography in a 180° Channel Bend

Novi Andriany Teguh

ABSTRACT

Flow characteristics in river bends and meandering channels require the use of three-dimensional numerical models because of their complexity. A model of a 180° channel bend is developed in this thesis using the SSIIM 2.0 program. The calibration of the model is done by using experimental data from Yen and Lee (1995). Simulations are carried out using two different discharges, the highest and the lowest from the experiment done by Yen and Lee (1995). The main objective of the study is to obtain an agreement between the results and experimental data by calibration. In the calibration process, the affecting parameters are modified and the bed profiles are evaluated. Simulations are executed using SSIIM 2.0 program with various grid sizes in order to obtain grid independent results. In the simulations, 9 parameters were calibrated and 5 affecting parameters were derived in the control file by calculating the correlation and RMSE values between results and experimental data. Those affecting parameters are the roughness coefficient, the transient sediment computation, the sediment transport formula, the roughness option, and the thickness of the upper active sediment layer. Comparisons between the simulated bed topography and experimental data are presented. The patterns of deposition and scour in the channel bend are also investigated in this study. The simulation yielded that deposition occurs near the inner bank while scour occurs near the outer bank. Additionally, deposition takes place in upstream and scour appears in downstream areas. It also shows that the higher discharge yields greater deposition and larger scour depths. The SSIIM 2.0 program is capable of simulating the bed topography in a channel bend with an acceptable degree of accuracy.

Keywords: 3D numerical modeling, SSIIM 2.0, channel bend, bed topography, deposition, scour, calibration, sensitivity analysis.