A 3D FLOW, SEDIMENT TRANSPORT AND BED TOPOGRAPHY MODEL FOR OPEN CHANNELS

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In this paper, the development and validation of a general propose of 3D flow and bed load sediment transport numerical model is presented. This model solves 3D incompressible, Reynolds-averaged Navier-Stokes equations with non-hydrostatic assumption in a curvilinear coordinates. Both Low-Reynolds-version of Spalart-Allmaras (*SA*) and kω turbulence model, in conjunction with near-wall model, are used for the turbulence closure. Surface tracking method, with special treatment to the near wall region, is used for water surface elevation calculation. Nonequilibrium bed load sediment transport model and bed morphology model, with the introduction of down-slope gravitational force calibration parameter, are implemented for calculating the changes of bed topography. Run#3 of Yen's (1965) experiment was used to validate for hydrodynamic and water surface elevation calculation in the model. Test#1 experiment performed by Odgaard and Bergs (1988) was used for flow and bed load sediment transport validation. Both numerical simulation results get good agreement with the experimental measurement results.

Keywords: 3D; Model, flow; Sediment transport

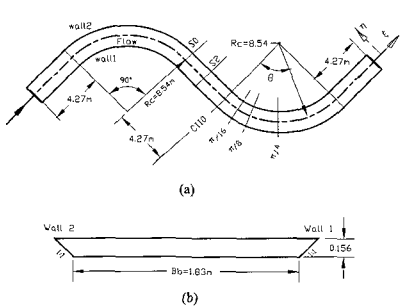

Fig. 1 (a) General layout of the experiment (b) Cross-section of the channel

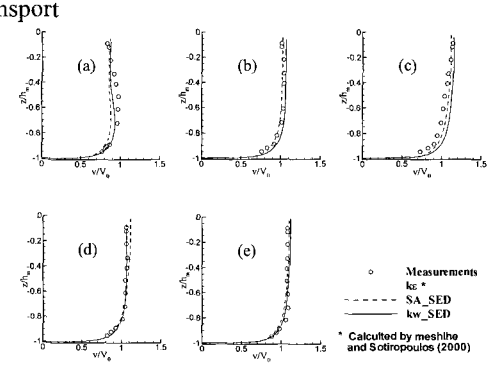

Fig. 2 Mean velocity at section S0
(a) η/B_b=-0.461 (b) η/B_b=-0.307
(c) η/B_b=0.0 (d) η/B_b= 0.307 (e) η/B_b= 0.461

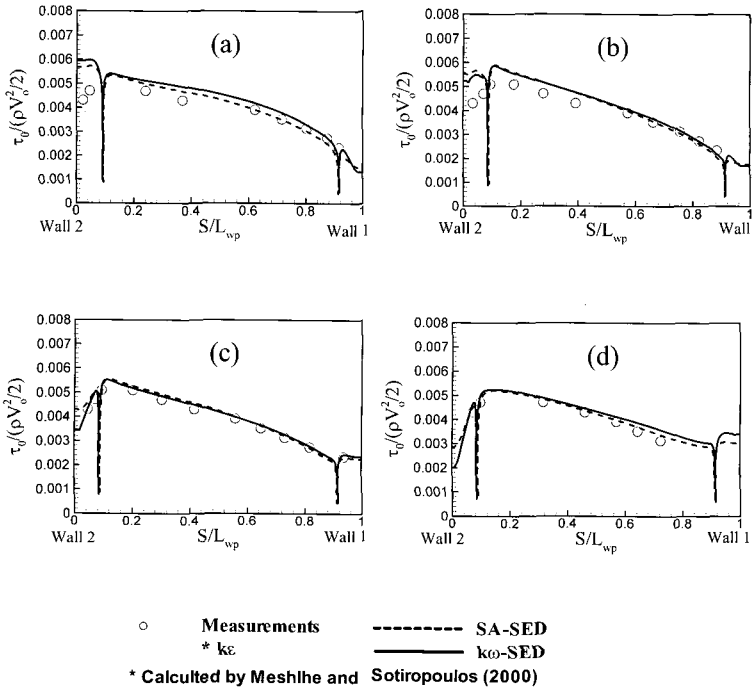

Fig. 5 Transverse wall shear stress
(a) section CII0 (b) section π/16
(c) section π/8 (d) section π/4

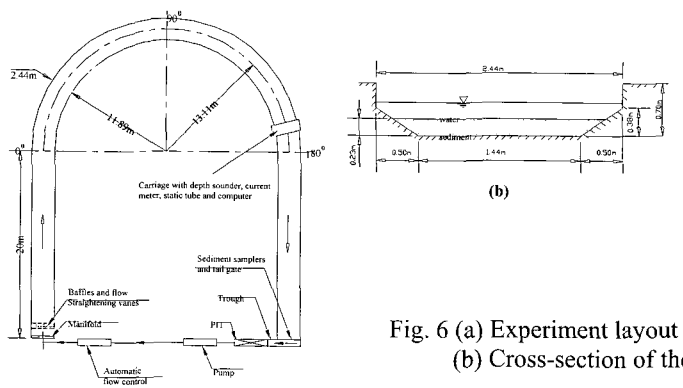

Fig. 6 (a) Experiment layout
(b) Cross-section of the flume

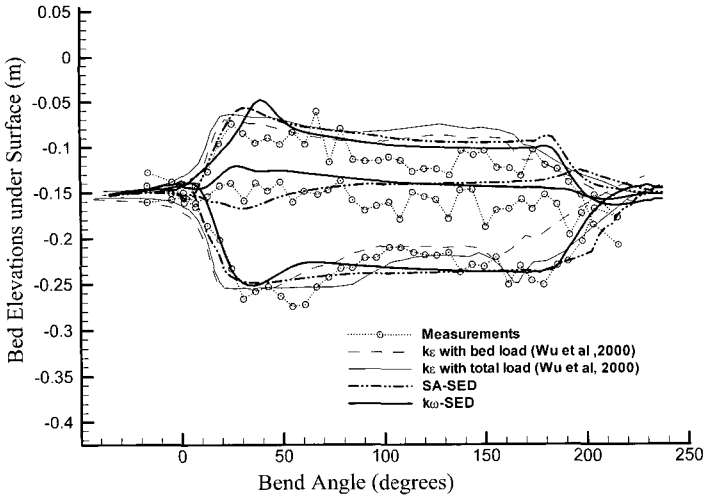

Fig. 7 Comparison of longitudinal water depth at three positions in the 180° channel bend (The upper lines are at -3b/8, the middle lines are at center line, and the lower line are at 3b/8)

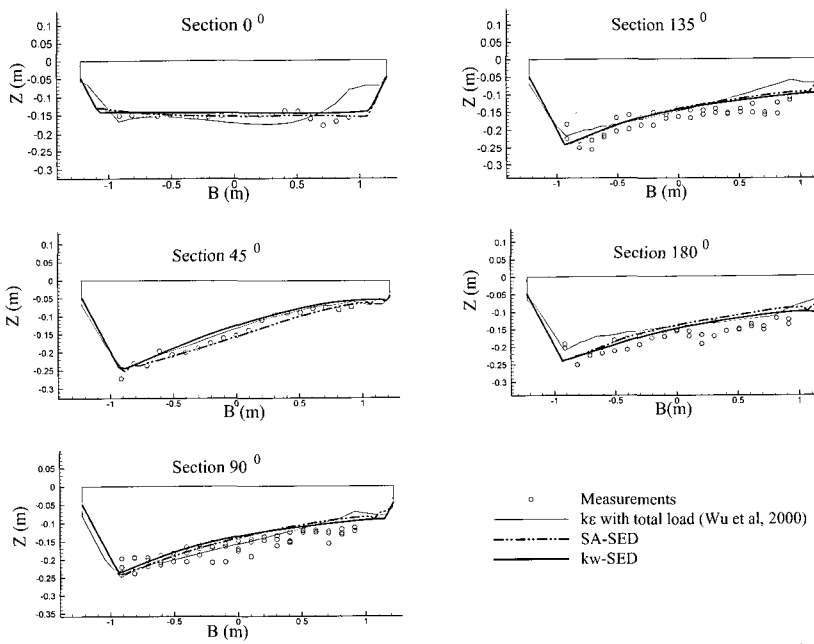

Fig. 8 Comparison of bed level between calculation and measurements result