# Large Eddy Simulation for Conveyance Estimation

Faye Beaman, Hervé P. Morvan and Nigel G. Wright

CFD Group, School of Civil Engineering,
The University of Nottingham, Nottingham, NG7 2RD, UK
Herve.Morvan@Nottingham.ac.uk

The UK Environment Agency (EA) has recently been promoting a novel Conveyance Estimation System (CES) framework to reduce uncertainty in the prediction of flood levels. The implementation of the CES is underway and is favouring the use of enhanced 1-D models such as the Shiono and Knight Method [1], SKM, and its extension by Ervine [2]. The advantages of 1-D modelling for flood flow predictions are well known; the method is simple, fast and efficient; it can be operated with minimum input and training by practitioners on a standard desk-top PC. In addition to the standard roughness parameter, the latest extended models can account for secondary exchanges due to the interaction between channel and floodplain and the effect of the channel meander, both of which potentially leading to significant energy losses. These methods introduce more accuracy but require the definition of extra terms in the 1-D equation for the flow, all of which are characterised by coefficients, f for the friction factor, $\lambda$ for dimensionless eddy viscosity (in fact turbulence effects), $\Gamma$ the secondary flow terms and, in Ervine's method, $C_{uv}$ the depth average cross flow coefficient.

This paper describes detailed Large Eddy Simulation (LES) work carried out for various prismatic channels with the objective to investigate 3D turbulent flow structures as well as secondary currents. The first aim is for the authors to replicate experimental observations showing complex 3-D flow patterns in the vertical cross-sectional plane and in the horizontal one, in particular at the interface between main channel and floodplain. These results are reported in the present paper.

Although some preliminary analytical work has been carried out to characterise the parameters necessary for the extended 1-D methods described above, based on experimental data for straight and meandering compound channel and also on little field data [3], no comprehensive fluid mechanics work exists to date to inform these parameters fully. The authors' second and main aim is therefore to employ the results from their detailed simulations to compute these parameters and offer a practical characterisation for their behaviour. Early work in that direction is presented here.

**References**

[1] K.Shiono and D.W. Knight, "Turbulent Open Channel Flow with a Variable Depth across the Channel", *J. F. Mech.*, **222**, 617-646, 1991.
[2] D.A. Ervine, K. Babaeyan-Koopaei and R. H.J. Sellin, "Two-Dimensional Solution for Straight and Meandering Overbank Flows", *J. Hydr. Eng.*, **126**, 653-668, 2000.
[3] C. McGahey and P. G. Samules, "Methodology for Conveyance estimation in Two-Stage Straight, Skewed and Meandering Channels", http://www.river-conveyance.net/documents/IAHRXXXCongresspaper.pdf, last accessed Jan. 2006.

**Keywords:** Channel, Conveyance, Large Eddy Simulation, LES