UEL Research & Knowledge Exchange Conference 2012

Call for Abstracts

Name & Title of Presenter:	Dr Ravindra Jayaratne, Lecturer in Civil Engineering
School:	Architecture, Computing & Engineering
Co investigators:	-
Title of Abstract:	A Practical Computer Simulation Model for Two-Dimensional Beach Deformation (XBEACH Model)
Key Theme/ Key words:	Beach deformation, computer simulation model, coastal zone management, flood protection, practical engineers

Abstract (No more than 400 words):

To prevent the surrounding area from coastal flooding, protect economic activities such as commercial and fishery ports and harbours and further develop coastal areas for leisure, recreation and marine life, it is necessary to understand the morphological behaviour of coastal systems and to be able to predict under high waves and storm conditions. Moreover, prediction of suspended sediment concentration field and beach profile change is still subject to considerable uncertainty and developing such models to satisfactory levels is a challenging task.

The prediction of suspended sediment concentration and cross-shore beach deformation has been researched broadly over the last few decades. Good knowledge and a full description of sand transport mechanisms induced by vortex ripples, sheet flow condition, and wave breaking agitation is a prime requirement for this purpose (Jayaratne and Shibayama 2007, 2011). This is reflected in the inability of numerical simulation models to predict accurately the beach deformation under the above three suspension mechanisms. The present study leads on to develop a two dimensional beach deformation model with onshore sand bar formation and erosion under regular wave action based on the sediment concentration formulae of Jayaratne and Shibayama (2007, 2011). This model is named as XBEACH.

Figure 1 illustrates some examples of measured and predicted beach profiles from field-

scale studies obtained at the equilibrium state (Jayaratne, 2011). Predicted results show a good agreement with the measured profile data. The present model does not predict small fluctuations of beach profile change however the location of onshore sand bar formation due to wave breaking is clearly predicted in many test cases.

The key feature in XBEACH model is that it takes about 5 minutes to simulate a 2-3 days storm using a standard personal computer. The model is designed to be used as a practical engineering tool for the prediction of medium-term morphological changes and capable of analysing thousands of wave and tidal datasets. Therefore, this study is potentially beneficial to those who have responsibility for coastal zone management and flood protection such as Environment Agency, DEFRA, local councils with coastlines and engineering consultancies.

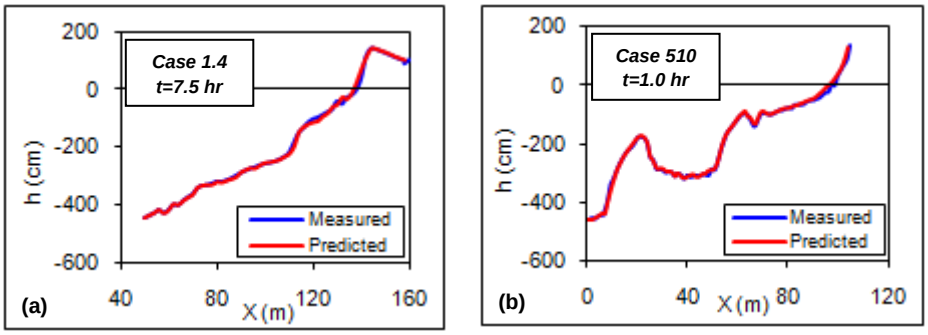

Figure 1. Examples of measured and predicted field-scale beach profiles, h indicates water depth and X indicates distance from the offshore [a) Kajima et al. (1983), b) Kraus & Larson (1988)]

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