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Applicability of the Predictive Formulae for Suspended Sediment Concentration on Full-Scale Rippled Bed and Sheet Flow

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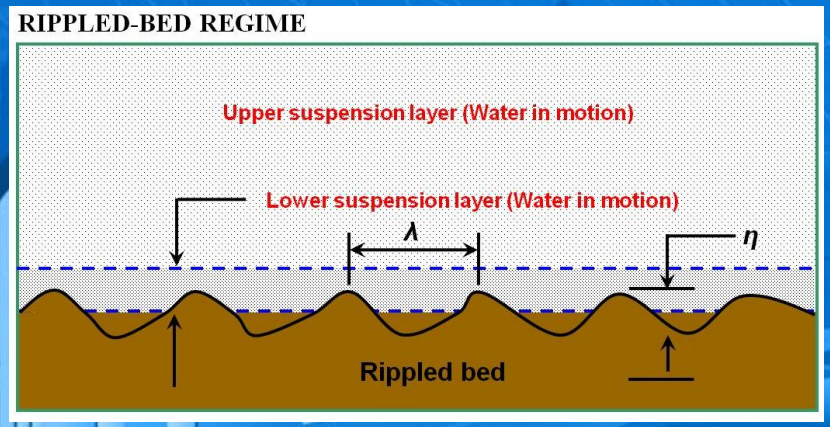
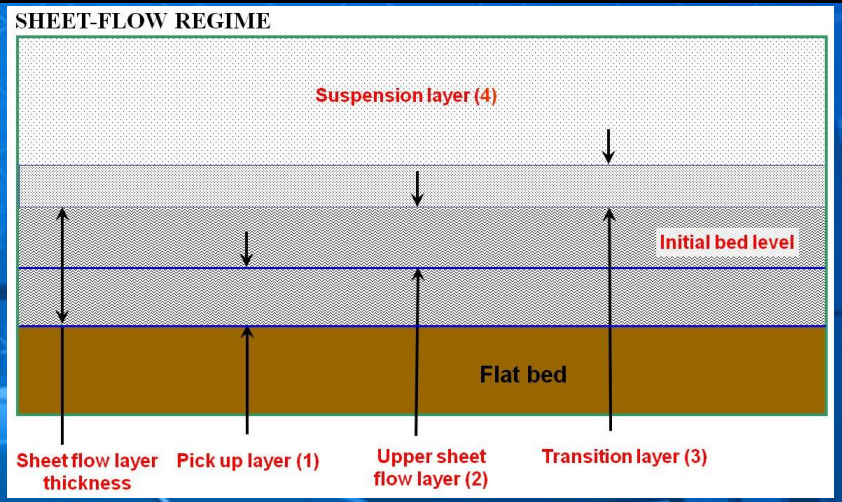
Introduction

- ***Purpose:*** To investigate the applicability of *Suspended Sediment Concentration Models of Jayaratne & Shibayama (2007)* on *full-scale* beaches using measured data in *SANTOSS database (Van der Werf et al., 2009).*
- ***Methodology:*** *Dimensional Analysis & Best-Fit Technique.*
- ***Innovative Points:*** Identified *2 suspension layers (Lower & Upper)* over rippled bed and *4 suspension layers (Pick-up layer, Upper sheet flow layer, Transition layer & Suspension layer)* over sheet flow.

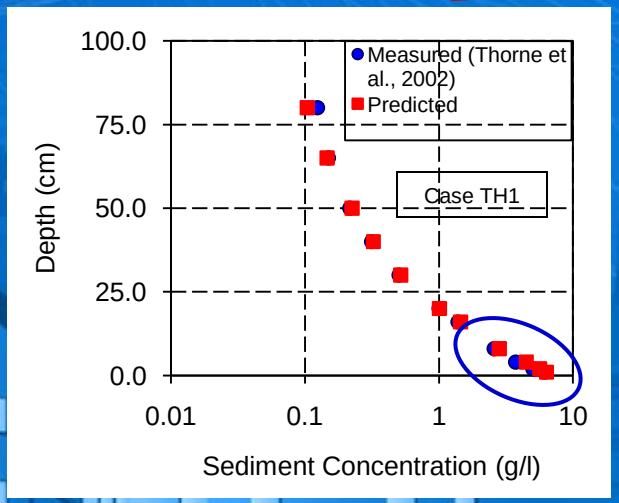


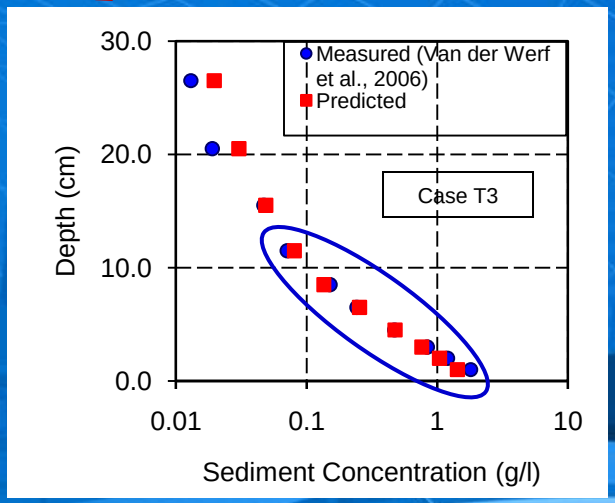


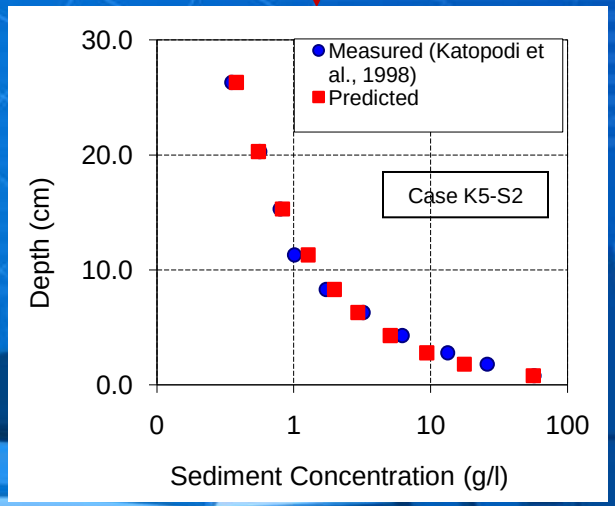
Revised Models & Results

FULL SCALE RIPPLED-BED (75 DATA SETS)		
	Lower Suspension Layer	Upper Suspension Layer
Reference concentration	$c_r = \frac{k_1 \psi \nu}{\sqrt{(s-1)gd}\,(\eta/2)}$	
Diffusion coefficient	$\varepsilon_r = k_2 u_{*wc} A_b \left(\frac{w_s}{u_{*wc}}\right)^2 \left(\frac{\eta}{d}\right)^{0.1} \left(\frac{\lambda}{d}\right)^{0.25} d_*^{-1.5}$	$M_r = k_3 \left(\frac{\eta}{d}\right)^{0.1} \left(\frac{\lambda}{d}\right)^{0.25} d_*^{-1.5}$
Sediment concentration profile	$c(z) = c_r \exp\left\{\frac{-w_s(z-r)}{\varepsilon_r}\right\}$	$c(z) = c_r \left(\frac{z_0}{z}\right)^{M_r}$

FULL SCALE SHEET-FLOW (80 DATA SETS)		
	Upper Sheet-Flow Layer	Suspension Layer
Reference concentration	$c_s = \frac{k_4 \psi \nu}{\sqrt{(s-1)gd}\;d}$	
Diffusion coefficient	$M_s = \left(\frac{w_s}{U_{*wc}}\right)^{k_5}$	
Sediment concentration profile	$c(z) = c_s \exp\left\{\frac{-(z-k_6 d)}{5M_s d}\right\}$	$c(z) = c_s \left(\frac{25d}{z}\right)^{M_s}$

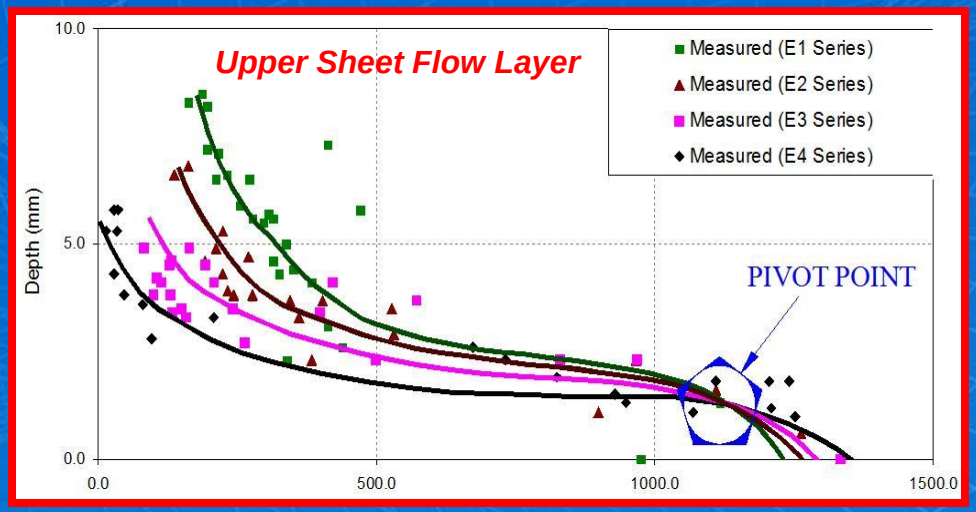


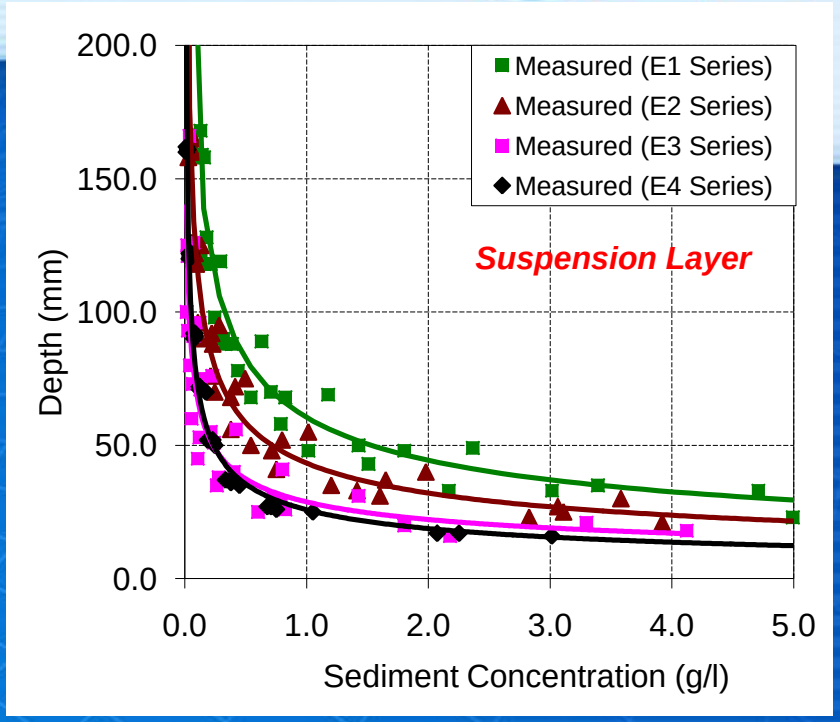




Results & Conclusions

From the measured data of Katopodi et al., 1994





- There is a close match between sediment concentration predicted by the revised rippled bed and sheet flow models and the measured data.
- From the measured data of Katopodi et al. (1994), in sheet flow regime, when the wave period remains constant, different combination of wave and net-current conditions acting on a particular sand form a Single Pivot Point on the curves of measured time-averaged concentration profiles.

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