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Cover Photo: A River of Sand on the Sinai Peninsula, Egypt

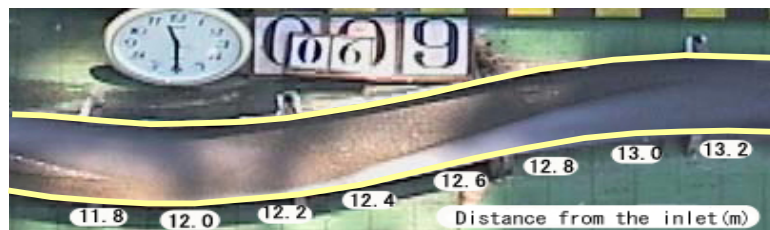
# EXPERIMENTAL STUDY ON THE RELATION OF BED MORPHOLOGY WITH SURFACE FLOW IN MEANDER CHANNELS

Heqing DU<sup>1</sup> and Hajime MIWA<sup>2</sup>

## ABSTRACT

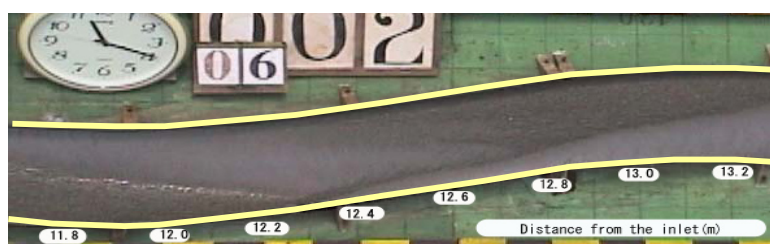
Alternate bars have the property that they migrate downstream whenever floods occur. However, in meander channels whose bend angles are larger than a critical value, the migration of bars can be suppressed, and the positions of bank erosion and flood attack also will be steady. In this study, the bed morphology in flume channels with bends of various lengths and angles is investigated at various flow discharges, and the relation of bed morphology to surface flow is investigated in detail using fluid measuring software. An effort is made to obtain guidelines for the plane shape design of meander channels. Based on the experimental results of bed topography and measurement of surface flow direction and velocity distribution, from the viewpoint of bank erosion and the concentration and dispersion of flood flow the most suitable plane shape for meandering channels is suggested through which the migration of alternate bars is suppressed.

**Key Words:** Meander channel, Alternate bars, Particle Tracking Velocimetry (PTV), Particle Image Velocimetry (PIV)



**Fig. 3(a)** Photograph of bed topography in CASEVII

**Fig. 3(b)** Bed elevations in CASEVII ( $\omega = 17.5^\circ$ ,  $\lambda = 260$  cm,  $t = 8$ -minute-flow repeated 6 times)



**Fig. 4(a)** Photograph of Bed Topography in CASEIII

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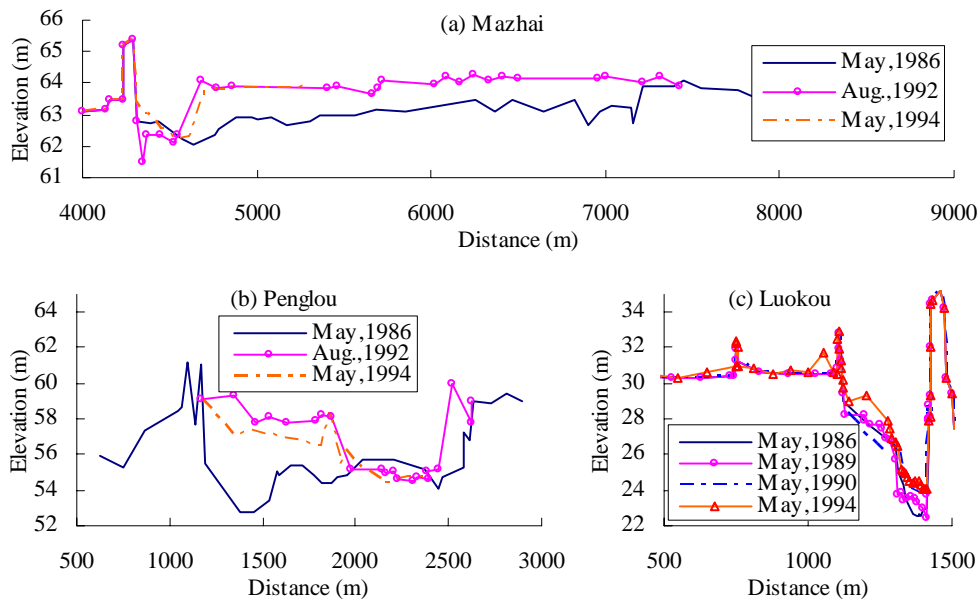
# CHANNEL SHRINKAGE AND ITS INSTABILITY IN THE LOWER YELLOW RIVER<sup>1</sup>

Jianguo CHEN<sup>2</sup>, Wenhao ZHOU<sup>3</sup> and Anjun DENG<sup>4</sup>

## ABSTRACT

From the mid 1980s through the late 1990s, the channel of the lower Yellow River experienced serious shrinkage, which has decreased the flood conveyance of the channel and the sediment carrying capacity of the flow, raised the water levels of floods, and, thus, severely threatened the safety of flood control along the river. The completion of Xiaolangdi Dam in 1999 could help mitigate the channel shrinkage problem, but the situation has not changed yet. This paper analyses the characteristics, mechanisms, and conditions resulting in channel shrinkage, points out channel instabilities, and puts forward approaches of channel rehabilitation.

**Key Words:** Channel shrinkage, Main channel, Hydrological condition, Regulation of water and sediment



**Fig. 3** Changes of typical cross sections during the channel shrinkage period

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# RHEOLOGICAL PROPERTIES OF SEDIMENT SUSPENSIONS FROM ECKERNFÖRDE AND KIELER FÖRDE BAYS, WESTERN BALTIC SEA

Richard W. FAAS<sup>3</sup> and Stanislas I. WARTEL<sup>4</sup>

## ABSTRACT

Local areas of fine-grained organic-rich sediments in Eckernförde and Kieler Förde Bays may experience disturbances which cause fluidization of the substrate and create a dense suspension (fluid mud) which exists temporarily as a component of the benthic boundary layer before becoming incorporated into the permanent bottom. Laboratory studies indicate this material behaves rheologically as a non-Newtonian substance, and both shear thinning (pseudoplastic) and shear thickening (dilatant) flow behavior can occur (often within the same sample) under low to intermediate shear stresses (2 - 40 Pa) and shear rates (0.46 - 122.49 s<sup>-1</sup>).

Detailed granulometric analyses (1/4 phi intervals) of the fraction <63 µm show differences in the silt/clay ratio (clay <2 µm) between the two environments. Little change in the silt/clay ratio is seen in the Kieler Förde sediments (from 0.74 to 0.95); however, at Eckernförde, the ratio changed from 0.73 to 2.19. Fine silt particles are lacking or were removed from the 4 to 16 µm fraction of the Eckernförde but not from the Kieler Förde sediments. Both shear thickening and shear thinning flow was observed in the Eckernförde sediments. Shear thickening flow behavior was not observed in the Kieler Förde sediments.

Samples of organic-rich (10 to 20%) interface sediments from both areas were analyzed rheologically prior to, and after removal of organic matter by H<sub>2</sub>O<sub>2</sub> treatment. Reduction in 'apparent' viscosity occurred through the entire range of shear rates and stresses, shear thickening behavior was reduced or became nonexistent, and yield stress decreased significantly compared to the natural samples. The differences in yield stress and flow behavior of dense suspensions result primarily from differences in grain size distributions but the role of organic matter on those properties is very significant and adds to the effects of the grain size distribution of the sediment.

**Key Words:** Rheology, Shear strength, Yield stress, Sediment suspensions, Organic matter

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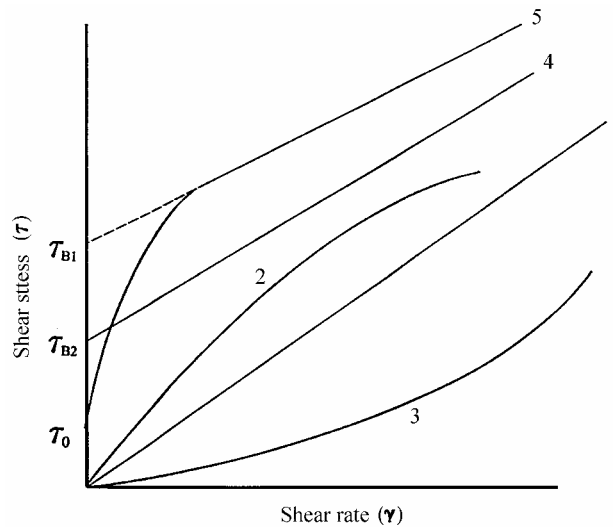


Fig. 4 Diagram showing various forms of flow behavior

## PERFORMANCE EVALUATION OF SUBMERGENCE RATIO OF A RECTANGULAR SUBMERGED VANE WITH A COLLAR

Umesh P. GUPTA<sup>5</sup>, Nayan SHARMA<sup>6</sup> and C. S. P. OJHA<sup>7</sup>

### ABSTRACT

The vane induced strength of secondary flow in terms of dimensionless moment of momentum is maximum in the case of a rectangular vane with a collar at angle of attack 400 at different degrees of submergence ( $T/d$ ) such as 0.60, 0.67 and 0.75. The same value of optimal angle of attack was found by Marelius and Sinha (1998) in the case of a rectangular vane without a collar. The vane induced strength of a vortex is insensitive to the submergence ratio ( $T/d$ ). The vane induced strength of a vortex in terms of moment of momentum (MOM) depends on a wide range of variables, such as angle of attack, vane height, vane length, vane thickness flow depth, water density, median sediment size, velocity vector, acceleration due to gravity, water dynamic viscosity, vane shape, taper angle, etc. The optimal angle of attack is very close to 400. A dimensionless moment of momentum parameter has also been identified. Vane induced secondary flow is also related to linear momentum. The graphical plot of moment of momentum vs. different angle of attack shows a similar trend as that of the plot of dimensionless MOM such as MOM made non-dimensional by flow depth or by vane height vs. angle of attack.

**Key Words:** Vane, Secondary flow, Moment of momentum, Optimal angle of attack, Submergence ratio, Dimensionless moment of momentum, Linear Momentum

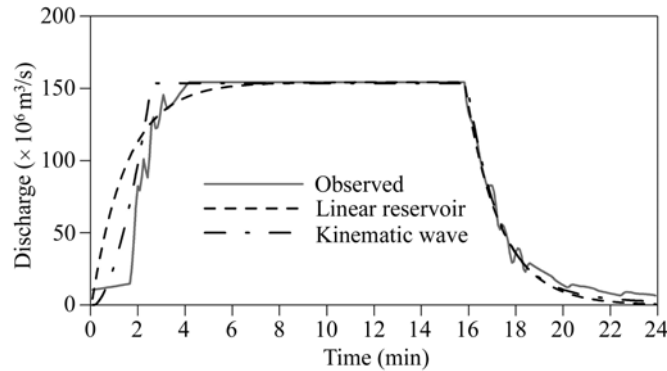
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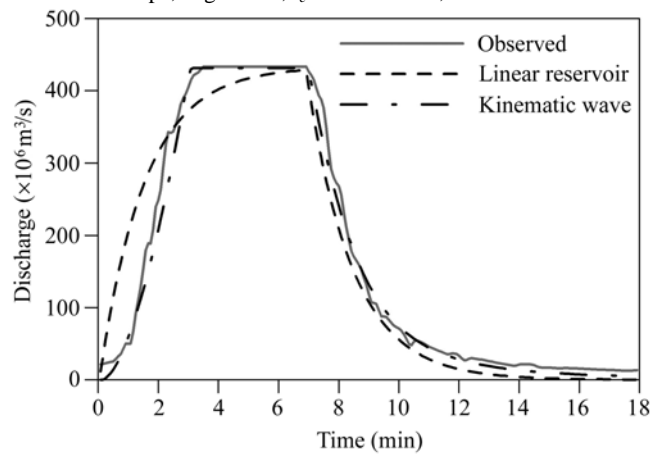
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**Fig. 2** Hydrographs obtained and simulated with the linear reservoir and kinematic wave models for an experiment with bare slope, angle =  $5^\circ$ ,  $i_e = 27.9$  mm/hr, and a rainfall duration of 16 min



## LANDFORM MORPHOLOGIC RELATIONS BETWEEN INTER-GULLIED AND GULLIED LAND AREAS —A CASE STUDY OF THE WANGJIAGOU WATERSHED IN THE WEST OF SHANXI PROVINCE

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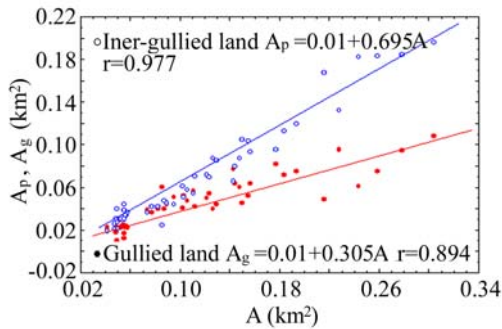
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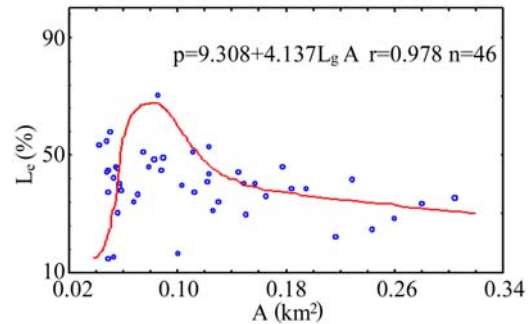
### ABSTRACT

Previous studies on erosional relations between inter-gullied and gullied lands have mainly concentrated on exploration of water and sediment relations, with few quantitative studies of evolution relations between inter-gullied land and gullied landform erosion in small catchments. This paper, using information from a 1:5000 digital orthophotomap (DOM), digital elevation model (DEM), and topographic map of the same period and of the same scale, quantitatively analyzes the impact and interactions of inter-gullied and gullied land geomorphologic characteristics on the dissected extent of a catchment using orthogonal polynomial regression analysis. Results indicate that gullies play a leading role in the catchment morphologic evolution and extent of cracked ground surface. When inter-gullied land areas are the same, a  $0.1 \text{ km}^2$  gullied land area has the maximum effect on the erosive evolution intensity of the catchment cracked degree. The smaller the catchment area is, the greater the extent of cracked ground surface and gully intensity would be. The geomorphologic evolution mechanism of gullied catchments can be explained as a function of geomorphologic indicators of inter-gullied and gullied land characteristics.

**Key Words:** Inter-gullied land erosion, Gully erosion, Small catchments, Gullied land area, Loess Plateau



**FIG. 7** Relations between total catchment area (A) and basin area (A) inter-gullied ( $A_p$ ) and gullied ( $A_g$ ) land areas



**Fig. 8** Relation between catchment and cracked degree ( $L_e$ , %)

## NUMERICAL SIMULATION OF SEDIMENT RELEASE FROM RESERVOIRS

A. KHOSROWNEJAD<sup>11\*</sup> and A. A. Salehi NEISHABORI<sup>12</sup>

### ABSTRACT

For the computation of the sediment quantity released from reservoirs, a vertical two-dimensional hydrodynamic model is combined with a sediment transport model. The hydrodynamic model is based on the equations of mass and momentum conservation along with a  $k-\varepsilon$  model for closure of the Reynolds stresses. The sediment transport model is based on the convection-diffusion equation of sediment concentration and the sediment continuity equation. Both the hydrodynamic and sediment transport models are developed in a boundary-fitted curvilinear co-ordinate system. Comparison of the

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predicted mean velocity field with laboratory results indicates that the present model captures most experimental trends with reasonable accuracy. Also good agreement is found in comparison of the sediment transport results for the numerical model and the experimental model.

Key Words: Reservoir, Numerical modeling, Flow field, Sediment transport, Bed evolution

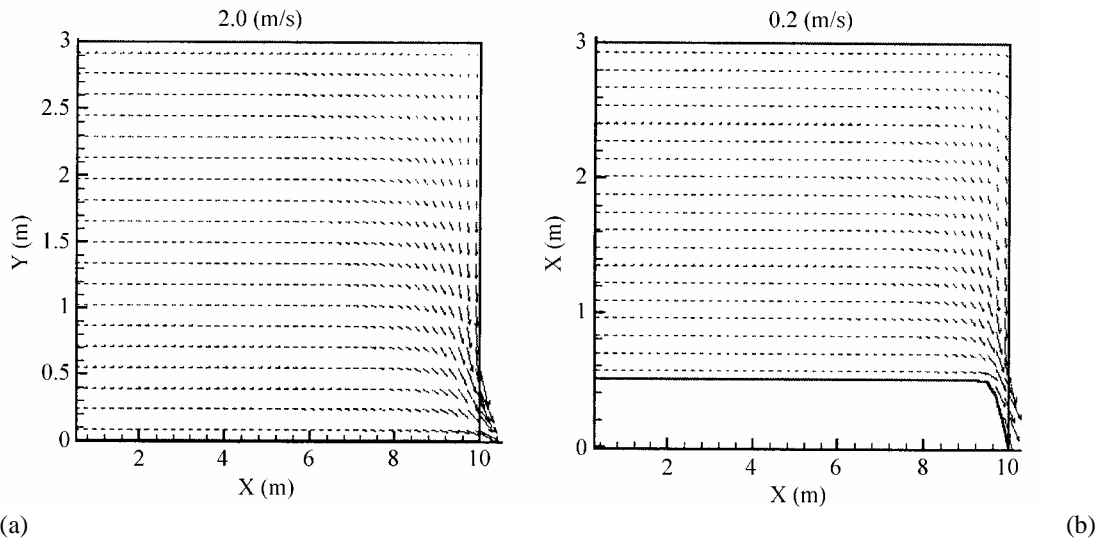


Fig. 6 Calculated flow fields for an opening ratio of 0.25: (a) Flat reservoir bed and (b) Non-flat reservoir bed

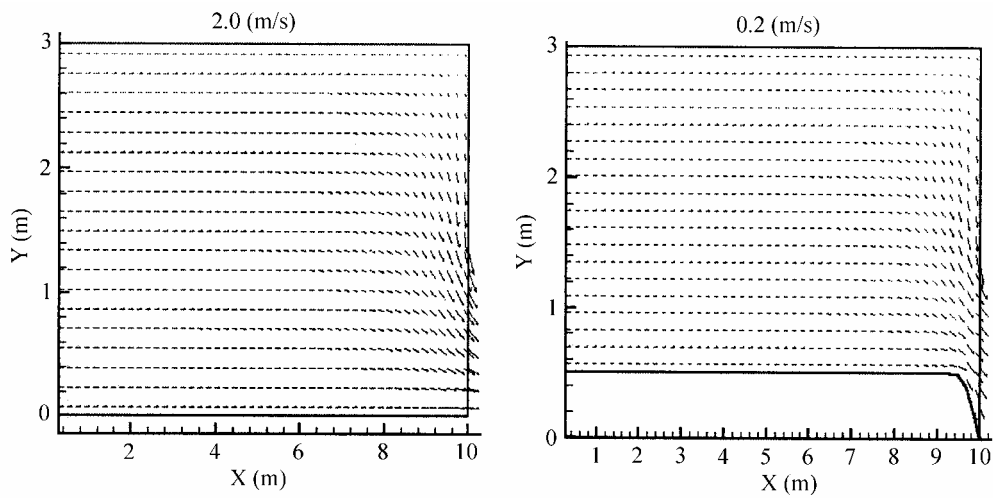


Fig. 7 Calculated flow fields for an opening ratio of 0.5 : (a) Flat reservoir bed and (b) Non-flat reservoir bed