

The Articles Published in IJSR in 2013

2013. No. 1

Lu, XX; Ran, LS ; Liu, S; Jiang, T; Zhang, SR; Wang, JJ. 2013, Sediment loads response to climate change: A preliminary study of eight large Chinese rivers. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 1-14.

**Abstract:** Climate change characterized by increasing temperature is able to affect precipitation regime and thus surface hydrology. However, the manner in which river sediment loads respond to climate change is not well understood, and related assessment regarding the effect of climate change on sediment loads is lacking. We present a quantitative estimate of changes in sediment loads (from 1.5 Gt yr<sup>-1</sup> pre-1990 to 0.6 Gt yr<sup>-1</sup> from 1991-2007) in response to climate change in eight large Chinese rivers. Over the past decades, precipitation change coupled with rising temperatures has played a significant role in influencing the sediment delivery dynamics, although human activities, such as reservoir construction, water diversion, sand mining and land cover change, are still the predominant forces. Lower precipitation coupled with rising temperatures has significantly reduced sediment loads delivered into the sea in semi-arid climates (4-61%). In contrast, increasingly warmer and wetter climates in subtropical zones has yielded more sediment (0.4-11%), although the increase was offset by human impact. Our results indicate that, compared with mechanical retention by reservoirs, water reduction caused by climate change or human withdrawals has contributed more sediment reduction for the rivers with abundant sediment supply but limited transport capacity (e. g., the Huanghe). Furthermore, our results indicate that every 1% change in precipitation has resulted in a 1.3% change in water discharge and a 2% change in sediment loads. In addition, every 1% change in water discharge caused by precipitation has led to a 1.6% change in sediment loads, but the same percentage of water discharge change caused largely by humans would only result in a 0.9% change in sediment loads. These figures can be used as a guideline for evaluating the responses of sediment loads to climate change in similar climate zones because future global warming will cause dramatic changes in water and sediment in river basins worldwide at rates previously unseen.

Dugue, V; Blanckaert, K ; Chen, QW ; Schleiss, AJ. 2013, Reduction of bend scour with an air-bubble screen - morphology and flow patterns. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 15-23.

**Abstract:** The interplay between streamwise flow, curvature-induced secondary flow, sediment transport and bed morphology leads to the formation of a typical bar-pool bed morphology in open-channel bends. The associated scour at the outer bank and deposition at the inner bank may endanger the outer bank's stability or reduce the navigable width of the channel. Previous preliminary laboratory experiments in a sharply curved flume with a fixed horizontal bed have shown that a bubble screen located near the outer bank can generate an additional secondary flow located between the outer bank and the curvature-induced secondary flow and with a sense of rotation opposite to the latter. This bubble-induced secondary flow redistributes velocities and bed shear stresses. The reported study investigates the implications of a bubble screen on the flow and the morphology in configurations with mobile bed. Velocity measurements show that the bubble-induced secondary flow shifts the curvature-induced secondary flow in inwards direction and reduces its strength. The bubble screen considerably reduces morphological gradients. Maximum bend scour is reduced by about 50% and occurs further away from the outer bank

where it does not endanger the bank stability anymore. The location of maximum scour coincides with the junction of the curvature-induced and bubble-induced secondary flows. At this same location, the maximum streamwise velocities and maximum vertical velocities impinging on the bed also occur, which indicates their importance with respect to the formation of bend scour. The bubble screen also substantially reduced deposition at the inner bank. These preliminary experiments show the potential of a bubble screen to influence and modify the bed morphology.

[Patel, SB; Patel, PL ; Porey, PD.](#) 2013, Threshold for initiation of motion of unimodal and bimodal sediments. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 24-33.

**Abstract:** Experimental data, obtained from previous studies, on Critical Tractive Stress (CTS) of non-uniform sediments, have been used to verify the adequacy of existing relationships for CTS of non-uniform bimodal sediments. Keeping in view the performance of such relationships, a new relationship for computation of dimensionless CTS of individual size fraction of non-uniform unimodal and bimodal sediments has been proposed in the form of power law. The coefficient and exponent of the proposed power law have been empirically correlated with sediment characteristics for available sediment data. The proposed relationship has been validated with independent flume and field data to assess their applicability for unimodal and bimodal sediments.

[Heiliger, C; Kaye, NB; Testik, FY.](#) 2013, A computational study of the role of particle size standard deviation on the collision frequency in differential settling. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 34-45.

**Abstract:** The results of a simple computational model for differential settling are presented illustrating the significant role that particle size distribution plays in collision frequency and sedimentation rate of particles in a quiescent environment. The model tracks a large number of particles (order  $10^5$ ) with log-normally distributed diameters, as they settle at their Stokes settling velocities. Particle collisions are detected and result in larger particles that fall more rapidly. A number of simplifying assumptions are made in the model in order to avoid empirical correlations for phenomena such as collision efficiency and particle shape. These simplifying assumptions were needed to isolate and quantify the role of the particle size distribution. Simulated concentration profiles indicate that, even in the absence of collisions, the standard deviation ( $\sigma(D)$ ) of the particle size strongly influences the bulk mass settling rate as, for larger  $\sigma(D)$ , more mass is concentrated in larger, faster falling particles. The collision frequency is also a strong function of  $\sigma(D)$ . For a given mass concentration the collision frequency first increases linearly with increasing  $\sigma(D)$  as greater variation in particle size leads to greater variation in particle velocity, and shorter times for particles to catch each other. For larger  $\sigma(D)$  more mass is concentrated in larger particles, so, for a given mass concentration, there are fewer particles per unit volume, increasing the mean distance between the particles and reducing the collision frequency. The implications of these results for sedimentation measurement using optical attenuation techniques are discussed.

[Haddadchi, A; Omid, MH; Sdehghani, AA.](#) 2013, Total load transport in gravel bed and sand bed rivers case study: Chelichay watershed. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 46-57

**Abstract:** Field experiments were conducted on total load transport in the Chelichay River Basin, a

mountainous catchment (1,400 km<sup>2</sup>) located in north eastern of Iran, to evaluate total load formulas including four gravel bed rivers and a sand bed river (Qaresoo River). Gravel bed rivers in Chelichay River Basin can be grouped into two types; steep slope rivers with high shear values (Chehelchay River and Khormaloo River) and mild slope rivers with low shear values (Narmab River and Soosara River). Two depth integrating suspended load samplers (DH-48 and D-49), and two bed load samplers (Helley-Smith and BLSH) were used to measure total load. The performance is tested of 8 total load transport formulae including 4 macroscopic and 4 microscopic methods. A systematic and thorough analysis of 59 sets of data collected from sand bed river indicate that Yang and Engelund and Hansen reach to the better results, and from four gravel bed rivers confirmed that the methods of Karim and Kennedy and Engelund and Hansen yields the best results for steep slope rivers, and the methods of Einstein and Bijker are ranked highest in gradual slope rivers.

[Huybrechts, N](#); [Zhang, YF](#); [Verbanck, MA](#). 2013, Coupled estimation of the energy slope and associated sand-silt transport during high stream power events in alluvial rivers. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 58-65

**Abstract:** A coupled routing for the transport capacity and the energy slope is introduced through the definition of the control factor  $m$  whose value is linked to the bed form configuration. The coupling aims to further incorporate the interactions occurring in alluvial rivers and thus enhance the prediction of the fine sediment fluxes, especially during high stream power events. Based on a predictive rule for the control factor  $m$  that only involves water depth, velocity and bedform constitutive texture, the novel method is confronted to observations collected in one of the most strongly dynamic alluvial river namely the Lower Yellow River. Comparisons between time series of measured and computed concentrations illustrate that during high velocity events the main dynamics of the sediment transport is correctly reproduced. The main advantage of the present approach is to supply consistent time evolutions of sediment concentrations without making use of any detailed shear information.

[Joshi, PN](#); [Maurya, DM](#); [Chamyal, LS](#). 2013, Tectonic and climatic controls on late Quaternary bajada sedimentation along Narmada-Son Fault (NSF), Gujarat, Western India. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 66-76.

**Abstract:** An alluvial bajada has been recognized along a part of the active Narmada-Son Fault (NSF) and confined by the Karjan River on the eastern side and by the Madhumati River on western side. The bajada sequence exposed along the incised cliffs of various north flowing parallel streams has been studied in their proximal, medial and distal part. The sediments are characterized on the basis of grain size, fabric, sedimentary structures, bed geometry and sorting, and lithologs prepared from the mapped cliff sections. Detailed study of sedimentary characteristics, lithofacies analysis and facies associations indicate that sediments are mainly of three types - sediments that were deposited by debris flows and sediment gravity flows, and as extensive bar deposits. Three major aggradational sequences are recognized. Each sequence is composed of coarsening-upward sequence of proximal facies overlain by fining-upward sequence of distal facies. Coarsening upward sequence record periods of tectonic activity related to uplift along the NSF and fan progradation, whereas fining-upward sequence results from tectonic quiescence periods. The presence of rhizocretions, calcium carbonate nodules and calcite sheets

within the basal debris flow and sediment gravity flow indicate semi-arid climate, whereas the formation of pedogenized paleosol indicate relatively wetter climate prevailing in the study area. Tectonic activity along the NSF has played dominant role by controlling the geometry and volume of bajada sediments. Climate is found to be responsible for compositional and temporal distribution of bajada sediments. OSL dating suggests that the bajada sediments were deposited during the later part of late Pleistocene. The incision of the sediments is attributed to uplift due to inversion of the lower Narmada basin during the early Holocene.

Hu, DC ; Zhong, DY; Wang, GQ; Zhu, YH. 2013, A semi-implicit three-dimensional numerical model for non-hydrostatic pressure free-surface flows on an unstructured, sigma grid. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 77-89.

**Abstract:** A semi-implicit 3-D numerical formulation for solving non-hydrostatic pressure free-surface flows on an unstructured, sigma grid is proposed. Pressure-splitting and semi-implicit methods are inherited and reformed from Casulli's z-coordinate formulation. The non-orthogonal sigma-coordinate transformation leads to additional terms. The resulting linear system for the non-hydrostatic correction is diagonally dominant but unsymmetric, and it is solved by the BiCGstab method. In contrast with z-coordinate non-hydrostatic models, the new model fits vertical boundaries much better, which is important for the long-time simulation of sediment transport and riverbed deformation. A lock-exchange density flow is computed to determine whether the new scheme is able to simulate non-hydrostatic free-surface flows. The new model is further verified using the field data of a natural river bend of the lower Yangtze River. Good agreement between simulations and earlier research results, field data is obtained, indicating that the new model is applicable to hydraulic projects in real rivers.

Pedro, T ; Kimberley, S; Fernando, P. 2013, Dynamics of phosphorus in sediments of a naturally acidic lake. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 90-102.

**Abstract:** The mechanisms which controls the fixation and/or release of P in sediment of an extremely acidic lake (pH = 2.0 to 3.0) and its response to the influence of eutrophic urban waste water were investigated. The results, in the chemical composition, in the mineralogy of the sediment and in the material as obtained from sediment traps, show that the lake sediments are mainly volcanic material reflecting volcanic features of the basin. The sedimentation rate calculated for the lake ( $2.5 \times 10^{-2}$  mg m<sup>-2</sup> day<sup>-1</sup>) was higher than that observed in other similar glacial lakes in both Andean Patagonia and also elsewhere in the world. The Total Phosphorus concentration in sediments was higher than figures reported by other authors for mining acid lakes, and the main fraction of P was found associated with organic matter. There was no control by Fe or Al on P, because both are in solution at pH < 3.0. It was concluded that changes in the natural input of nutrients (derivatives of Copahue volcano fluid, the discharge of sewage, or basin run-off) are responsible for a high concentration of SRP and N-NH<sub>4</sub><sup>+</sup> in the lake. Laboratory experiments showed that sediments have no ability to retain phosphorus and a continuous release of P from the sediments into the water column was observed. The assays where the pH was artificially increased showed that the P still remains in solution until at least pH 7.0. It was concluded that changes in the natural input of nutrients due to: 1) the volcanic fluids, 2) the increase in sewage charges, or 3) surface runoff upstream, maintain a high trophic state with high concentrations of dissolved P and N-NH<sub>4</sub><sup>+</sup>, although the threshold of neutral pH in the lake is

exceeded. This study will enable a better understanding about of the mechanism of release/fixation of phosphorus in acidic sediments in order to assist in making decisions regarding the conservation and management of this natural environment.

Li, DX ; Zhong, Q; Yu, MZ; Wang, XK. 2013, Large-scale particle tracking velocimetry with multi-channel CCD cameras. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 103-110.

**Abstract:** This paper presents a large-scale particle tracking velocimetry (LSPTV) system for measuring surface velocity in vast unsteady flows. The system consists of a flexible number of one-computer-six-camera working units connected via local network or the internet. Multiple zero-tilting cameras are used to increase the field of view with minimum perspective distortions. External synchronization of video outputs of all cameras facilitates uninterrupted image acquisition within the system. Effectiveness and efficiency of the multi-channel LSPTV are enhanced by optimizing illumination, flow seeding, image acquisition and correction, tracer identification, particle matching, and post-processing. The capacity of the LSPTV was demonstrated in the measurement of physical model flows for the Three Gorges Project.

Dong, YF; Wu, YQ ; Zhang, TY; Yang, W; Liu, BY. 2013, The sediment delivery ratio in a small catchment in the black soil region of Northeast China. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 111-117.

**Abstract:** The black soil region of northeast China, which covers the Provinces of Heilongjiang, Jilin and the Inner Mongolia autonomous region with black soil, chernozem and meadow soil, has experienced soil erosion since intense agricultural reclamation began approximately 100 years ago. However, the sediment delivery ratio, defined as the fraction of gross erosion that is transported from a given area in a given time interval, is still unclear. In this study, we calculated the delivery ratio and analysed changes in erosive processes within Hebei catchment from 1977 to 2007 based on an analysis of sediments of the Liudui reservoir. The original vegetation layer clearly identified the bottom of the reservoir when it was constructed in 1977; thus, the reservoir sediments could be precisely dated. The delivery ratio, calculated by comparing the sediment deposition in the reservoir with the total soil erosion in the upstream catchment, was found to be exponentially correlated ( $r^2 = 0.95$ ,  $P < 0.01$ ) with decreasing grain size, except for the fraction  $< 0.002$  mm. The delivery ratio for the clays ( $< 0.002$  mm) was low, averaging 0.10 during the study period, which indicated partial removal of clays from the reservoir. The changes in the reservoir deposition rate reflected the temporal changes in the erosion processes. The exceptionally high rainfall in 1998 was confirmed by the distributions of Cs-137, Pb-210, and the grain-size of the sediments. Beginning from the position of the original grass layer, we defined three periods from 1977 to 2007 based on deposition rates: 2.40 cm year<sup>-1</sup> from 1977 to 1997, 5.60 cm year<sup>-1</sup> in 1998 due to unusually high rainfall, and 1.55 cm year<sup>-1</sup> from 1999 to 2007. The overall average deposition rate for the entire period was 2.26 cm year<sup>-1</sup>. Precipitation was found to be the main factor affecting the soil erosion of the study area.

Cheng, DH; Chen, XH ; Huo, AD ; Gao, M ; Wang, WK. 2013, Influence of bedding orientation on the anisotropy of hydraulic conductivity in a well-sorted fluvial sediment. *International Journal of Sediment Research*, Vol. 28, No. 1, pp. 118-125.

**Abstract:** The paper describes a permeameter test method for determination of the hydraulic conductivity (K) along multi-directions in fluvial sediments with cross beddings. Unlike existing in-situ permeameter methods that determine hydraulic conductivity for submerged streambeds, our method was intended to measure hydraulic conductivity of exposed streambeds or fluvial sediments. The method was applied to the Wei River, Shaanxi Province, Central China for characterization of the anisotropy of K in a well-sorted fluvial sediment. The results illustrated that even in well-sorted sediments, cross-bedding and sediment fabrication (or texture) can lead to varied K values along different measurement directions. The K value was the largest along the dip direction (or the major direction) that is parallel to the orientation of cross bedding and the smallest in the direction perpendicular to the bedding (or the minor direction). The K value in a given direction between the major and minor direction often fell in the range bounded by the K values in the major and minor directions. The anisotropy ratio of K (the ratio of K value between the major and minor directions) in two trenches for this well-sorted fluvial sediment was up to 1.14 to 1.23, respectively. Our results also demonstrated that even for well-sorted sediments, the K values between two sampling points only about 10 cm apart can differ. It is clear that the K distribution strongly correlates to the bedding orientation.

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[Sloff, K; Van Spijk, A; Stouthamer, E; Sieben, A.](#) 2013, Understanding and managing the morphology of branches incising into sand-clay deposits in the Dutch Rhine Delta. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 127-138.

**Abstract:** In the Rhine-Meuse delta in the south-western part of the Netherlands, the morphology of the river branches is highly dependent on the erodibility of the subsoil. Erosion processes that were initiated after closure of the Haringvliet estuary branch by a dam (in 1970), caused a strong incision of several connecting branches. Due to the geological evolution of this area the lithology of the subsoil shows large variations in highly erodible sand and poorly erodible peat and clay layers. This study shows how the geological information can be used to create 3D maps of the erodibility of the sub-soil, and how this information can be used to schematize the sub-soil in computational models for morphological simulations. Local incisement of sand patches between areas with poorly erodible bed causes deep scour holes, hence increasing the risk on river-bank instability (flow slides) and damage to constructions such as groynes, quays, tunnels, and pipelines. Various types of mathematical models, ranging from 1D (SOBEK) to quasi-3D (Delft3D) have been applied to study the future development of the river bed and possible management options. The results of these approaches demonstrate that models require inclusion of a layer-bookkeeping approach for sub-soil schematization, non-uniform sediment fractions (sand-mud), tidal and river-discharge boundary conditions, and capacity-reduction transport modeling. For risk-reducing river management it has been shown how the development of the river bed can be addressed on a large scale and small scale. For instance, the use of sediment feeding and fixation of bed can be proposed for large-scale management, while monitoring and interventions at initiation of erosion can be proposed as response to small-scale developments that exceed predefined intervention levels.

[Wu, TF; Qin, BQ; Zhu, GW; Zhu, MY; Li, W; Luan, CM.](#) 2013, Modeling of turbidity dynamics caused by wind-induced waves and current in the Taihu Lake. *International Journal of Sediment*



Research, Vol. 28, No. 2, pp. 139-148.

**Abstract:** A simple turbidity model was developed with a sound physical basis based on in situ high-frequency observations of short-term, strong wind-induced sediment suspension in Taihu Lake, China. The validation results show that the model could successfully simulate turbidity caused by strong wind events, despite the relatively poor simulation accuracy for high values of turbidity caused by the entrainment of cyanobacteria by turbulence. The in situ observations and model simulation results indicate that the wind waves were within a narrow spectral band, with spectral energy mainly distributed within the 0.28-0.75 Hz band on opposite sides of the peak frequency. These high-frequency and low-energy wind waves are sensitive to depth filtering. However, the average depth of the lake is only 1.9 m, and wind waves still represent the main force of sediment suspension at the sediment-water interface. Moreover, lake currents were of significance to the maintenance of background turbidity in calm waves or ripples and in the determination of critical shear stress. By considering the spatial distribution of hydrodynamics and sediment, the model can be used to simulate the turbidity of the entire lake as well as boundary conditions for three-dimensional numerical models.

**Reid, HE; Brierley, GJ; Mcfarlane, K; Coleman, SE; Trowsdale, S.** 2013, The role of landscape setting in minimizing hydrogeomorphic impacts of flow regulation. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 149-161.

**Abstract:** The Tongariro Power Development Scheme ( TPDS) is used to regulate flow in the headwaters of the largest catchment on the North Island of New Zealand ( the Waikato). Two small dams, the Rangipo Dam and the Poutu Intake Dam, were constructed in 1973 and 1983. The flow regime of the river is managed to divert freshes into the power scheme, but allows flows larger than  $100 \text{ m}^3 \text{ s}^{-1}$  to be released, to rework and transport sediment through the catchment. Analysis of aerial photos and maps spanning 1928 to 2007, alongside field measurements, show that there have been few hydrogeomorphic adjustments since dam construction. This includes limited changes to channel geometry, channel planform and bed material organization immediately downstream of the dams. In addition, offsite effects are minimal, both 500 m downstream of each dam, and in the more sensitive, less confined reaches in the lower catchment (11 km downstream of the Poutu Intake dam). The limited changes can be attributed to the locations of the dams within reaches characterised by bedrock gorges and confined within terraces. These locations act to flush sediments and impose margins that allow minimal adjustment of the channel. Bed material within this reach is characterised by the presence of a boulder lag. This is sourced from long-term incision into lahar deposits, and acts to limit the rate of incision, creating a steep and stable base upon which active fractions are transported. Just as importantly, significant storage in the low-relief volcanic plateau located in the upper catchment acts to disconnect and store the high sediment yields generated by active volcanic cones in the western sub-catchment upstream of the dams. This limits the rate of sediment supply to regulated reaches. Findings from this study show that analysis of reach-scale controls is essential in framing dam site locations in relation to the distribution of reaches and landscape units across the catchment. In this instance, tributary inputs downstream of the dams do not replenish the sediment and flow removed at the dam locations, as has been observed in other regulated systems. Rather, the river itself is resilient to change and flow variability is well managed allowing geomorphically effective floods to occur. Landscape setting is a key consideration in determining the hydrogeomorphic impact of flow

regulation.

Wang, ZB; Vroom, J ; van Prooijen, BC; Labeur, RJ ; Stive, MJF. 2013, Movement of tidal watersheds in the Wadden Sea and its consequences on the morphological development. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 162-171.

**Abstract:** The Wadden Sea consists of a series of tidal lagoons which are connected to the North Sea by tidal inlets. Boundaries of each lagoon are the mainland coast, the barrier islands on both sides of the tidal inlet, and the tidal watersheds behind the two barrier islands. Behind each Wadden Island there is a tidal watershed separating two adjacent tidal lagoons. The locations of the tidal watersheds in the Wadden Sea are not fixed. Especially after a human interference in one of the tidal lagoons, a tidal watershed can move and thereby influence the distribution of area between the lagoons. This appears to be important for the morphological development in not only the basin in which the interference takes place, but also in the adjacent basins. This paper describes theoretical analyses and numerical modelling aimed at improving the insights into the location of the tidal watersheds, their movements, and the impact of the movements of tidal watersheds on the morphological development of a multi-basin system like the Wadden Sea.

Zeng, SY; Dong, X; Chen, JN. 2013, Toxicity assessment of metals in sediment from the lower reaches of the Haihe River Basin in China. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 172-181.

**Abstract:** The aqueous environmental quality of the Haihe River Basin is crucial for the ecological health of local catchments and the Bohai Sea. For the routine management neglected sediment tests and no legitimate tool supported the toxicity evaluation yet, one supplementary monitoring was implemented to examine the occurrence and toxic level of sediment metals in the lower reaches of the Haihe River Basin in 2009. Both world-widely used consensus-based sediment quality guidelines and China's environmental quality standard for soils (EQSS) were used as assessment tools. Cu, Zn, As, Hg, Cd, and Pb were detected in all 24 samples, while Cr was detected in 18 samples. Assessment results showed 9 samples were toxic and the most dominant toxic element was As. Although the river water quality is getting better, sediment metals have accumulated over thirty years due to continuous industrial development, with toxicity far beyond safety limitations. The highest toxicity levels were encountered in Binhai New Area, suggesting three rivers should be given priority for restoration. It is found that EQSS is also applicable for sediment toxicity assessment until a dedicated tool for Haihe River Basin is available, except for that EQSS is too conservative for Pb.

Ahn, J ; Yang, CT ; Boyd, PM ; Pridal, DB ; Remus, JI. 2013, Numerical modeling of sediment flushing from Lewis and Clark Lake. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 182-193.

**Abstract:** Lewis and Clark Lake is located on the main stream of the Missouri River. The reservoir is formed behind Gavins Point dam near Yankton, South Dakota, U. S. A. The Lewis and Clark Lake reach extends about 40 km from the Gavins Point dam. The reservoir delta has been growing since the closure of Gavins Point dam in 1955 and has resulted in a 21% reduction of storage within the maximum pool of the reservoir. Among several sediment management methods, drawdown flushing has been recommended as a possible management technique. The engineering



viability of removing sediments deposited in the lake should be examined by numerical modeling before implementing a drawdown flushing. GSTARS4 was used for this study and calibrated by using measured data from 1975 to 1995. Channel cross-section changes and amount of flushed sediment were predicted with four hypothetical flow scenarios. The flushing efficiencies of all scenarios were estimated by comparing the ratios between water consumption and flushed sediment during flushing.

[Ghoshal, K; Mazumder, R; Chakraborty, C ; Mazumder, BS. 2013, Turbulence, suspension and downstream fining over a sand-gravel mixture bed. \*International Journal of Sediment Research\*, Vol. 28, No. 2, pp. 194-209.](#)

**Abstract:** Flume experiments were carried out to study the turbulence and its impact on suspension and segregation of grain-sizes under unidirectional flow conditions over the sand-gravel mixture bed. The components of fluid velocity with fluctuations were measured vertically using 3-D Micro-acoustic Doppler velocimeter (ADV). The theoretical models for velocity and sediment suspension have been developed based on the concept of mixing length that includes the damping effect of turbulence due to sediment suspension in the flow over the sand-gravel mixture bed. Statistical analysis of segregation of grain-sizes along downstream of the bed has been performed using the principle of unsupervised learning or clustering problem. Exploratory data analysis suggests that there is a progressive downstream fining of sediment sizes with selective depositions of gravels, sand-gravels and sand materials along the stream, which may be segmented into three regions such as, the upstream, the transitional and the downstream respectively. This contribution is relevant to understand the direction of ancient rivers, the bed material character in the river form, sorting process and its role in controlling the sediment flux through landscape.

[Khullar, NK ; Kothiyari, UC; Raju, KGR. 2013, Study of deposition of fine sediment within the pores of a coarse sediment bed stream. \*International Journal of Sediment Research\*, Vol. 28, No. 2, pp. 210-219.](#)

**Abstract:** Elaborate experiments were performed in a 30 m long, 0.5 m deep and 0.2 m wide laboratory flume to study the process of infiltration of fine sediment into the pores of coarse sediment forming the channel bed material. Different concentrations of suspended load of fine sediment of size 0.064 mm were passed over the channel bed made up of three different types of coarse sediments; two uniform and one nonuniform. The proportion of fine sediment infiltrated into the pores of bed material for each equilibrium concentration of suspended load of fine sediment in the flow was studied during several experimental runs. The proportion of fine sediment within the pores of bed material increased with an increase in the equilibrium concentration of suspended load of fine sediment in the flow. This process continued till the pores within the coarse sediment bed were filled up to the capacity with the fine sediment transported by the flow in suspension. The theoretical value was identified for limit for maximum proportion of fine sediment that can be present within the pores of bed material. On further increase in the concentration of suspended load of fine sediment in the flow, deposition of fine sediment occurs on the surface of the flume bed in the form of ripples of the fine sediment. This condition is defined as 'depositional condition'. Experimental observations on these and related aspects are presented herein.

Camenen, B; Jodeau, M; Jaballah, M. 2013, Estimate of fine sediment deposit dynamics over a gravel bar using photography analysis. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 220-233.

**Abstract:** Three different methods to analyse fine sediment deposits on a gravel bar using pictures are presented in this paper. A manual digitization and deposits zone delineation are performed as well as two different automated procedures. The three methods are applied on aerial pictures taken in 2006 by a drone from a height around 150 m above the study site. Two other sets of pictures taken in 2010 are also studied: the first set was obtained from the left side bank of the river at approximately 15m above the gravel bar whereas the second one was taken from a helicopter flying 600 m above the ground. These methods were used to estimate the surface of fine sediment deposits before and after flushing events. They yield similar results even if the first automated procedure is able to capture smaller patches of fine sediments. The total surface of fine sediment deposits seems to be similar before and after a flushing event, but the distribution appears quite different. Before a flushing event, a significant amount of fine sediment deposits are mixed with coarser sediments. After the flushing event, one can observe more large fine sediment deposits located on the downstream part of the secondary channel and at the channel margin. Most of the small fine sediment deposit patches were washed out. A short discussion is provided on the possible dynamics of fine sediment deposits over the gravel bar.

Sakan, SM; Sakan, NM ; Dordevic, DS. 2013, Trace element study in Tisa River and Danube alluvial sediment in Serbia. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 234-245.

**Abstract:** The contaminated sediment serves as a long-term source of toxic elements, since that mobility and transport in the environment of these elements are strongly influenced to associated solid phase. In this study, the modified Tessier sequential extraction procedure was applied for the fractionation of Cd, As, Hg, Cu, Zn, Cr, Pb, Ni and V in the sediments (Tisa River and canal sediments - Danube alluvial formation), to obtain an overall classification of trace element pollution in these areas through its spatial distribution. Investigations of this region are important due to the widespread occurrence of metal mining activities throughout the Tisa and Danube drainage basins and possibilities of contamination with toxic elements at studies localities. Five steps of the sequential extraction procedure partitioned elements into CH<sub>3</sub>COONH<sub>4</sub> extractable (F1), NH<sub>2</sub>OH center dot HC carbonate extractable and easily reducible (F2), H<sub>2</sub>C<sub>2</sub>O<sub>4</sub>/(NH<sub>4</sub>)<sub>2</sub>C<sub>2</sub>O<sub>4</sub> moderately reducible (F3), H<sub>2</sub>O<sub>2</sub>-HNO<sub>3</sub> organic extractable (F4), and HCl acid soluble residue (F5). Analyses of the extracts were performed by flame atomic absorption spectrometry. To indicate the degree of risk of toxic elements, risk assessment code and contamination factor have been used. The results of partitioning study indicate that more easily mobilized forms (metals in adsorbed/exchangeable/carbonate forms or bound to amorphous Fe and Mn oxyhydroxides and Fe and Mn oxides) were predominant for copper, zinc, cadmium and lead, which can be used as indicators for input from anthropogenic source. In contrast, the largest amount of chromium and nickel were associated with the inert fraction, which reduced their solubility and rendered them immobile under natural conditions and indicative of natural origins. Most of remaining portion of metals was bound to ferromanganese oxides fraction. It is concluded that sequential extraction results proved useful to distinguish between anthropogenic and geochemical sources of elements in the sediments.

Fang, HW ; Chen, MH ; Chen, ZH; Zhao, HM; He, GJ. 2013, Effects of sediment particle morphology on adsorption of phosphorus elements. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 246-253.

**Abstract:** Sediment particle surface morphology affects phosphorus adsorption. This paper studied the phosphorus adsorption on sediment particle by using a Scanning Electron Microscope (SEM) and an Energy Dispersive X-ray Spectroscopy (EDS). Sediment samples from the Yangtze, Yellow and Yongding rivers in China were chosen to measure the particle surface morphology, surface gray scale and element distribution maps. These samples were firstly cleaned and put into phosphate solution for adsorption. Both the Langmuir equation and Freundlich equation were used for descriptions of adsorption-desorption isotherms for sediments. Particles were then dried and scanned. The results show that the adsorption of phosphorus depends on the surface morphology of particles. Phosphorus exists mostly in the ridges and channels, while a few exist in the slopes, and casually in the peaks, passes and pits.

Poudeh, HT; Emamgholizadeh, S; Fathi-Moghadam, M. 2013, Experimental study of the velocity of density currents in convergent and divergent channels. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 254-259.

**Abstract:** The head velocity of the density current in the convergent and divergent channel is a key parameter for evaluating the extent to which suspended material travels, and for determining the type and distribution of sediment in the water body. This study experimentally evaluated the effects of the reach degree of convergence and divergence on the head velocity of the density current. Experiments were conducted in the flume with 6.0 m long, 0.72 m width and 0.6 m height. The head velocity was measured at three convergent degrees (-8 degrees; -12 degrees; -26 degrees), at three divergent degrees (8 degrees; 12 degrees; 26 degrees) and two slopes (0.009, 0.016) for various discharges. The measured head velocity of the density current is compared with the head velocity of the density current in the constant cross section channel. Based on non-dimensional and statistical analysis, relations as linear multiple regression offered for prediction head velocity of the density current in the convergent, divergent and constant cross section channel. Also the results of this research show that for the same slope and discharge, the head velocity of the density current in the convergent and divergent channel are greater and less than the head velocity of the constant cross section, respectively.

Vermeulen, B; Hoitink, AJF; Sassi, MG. 2013, On the use of horizontal acoustic Doppler profilers for continuous bed shear stress monitoring. *International Journal of Sediment Research*, Vol. 28, No. 2, pp. 260-268.

**Abstract:** Continuous monitoring of bed shear stress in large river systems may serve to better estimate alluvial sediment transport to the coastal ocean. Here we explore the possibility of using a horizontally deployed acoustic Doppler current profiler (ADCP) to monitor bed shear stress, applying a prescribed boundary layer model, previously used for discharge estimation. The model parameters include the local roughness length and a dip correction factor to account for sidewall effects. Both these parameters depend on river stage and on the position in the cross-section, and were estimated from shipborne ADCP data. We applied the calibrated boundary layer model to obtain bed shear stress estimates over the measuring range of the HADCP. To validate the results,

co-located coupled ADCPs were used to infer bed shear stress, both from Reynolds stress profiles and from mean velocity profiles.

From HADCP data collected over a period of 1.5 years, a time series of width profiles of bed shear stress was obtained for a tidal reach of the Mahakam River, East Kalimantan, Indonesia. A smaller dataset covering 25 hours was used for comparison with results from the coupled ADCPs. The bed shear stress estimates derived from Reynolds stress profiles appeared to be strongly affected by local effects causing upflow and downflow, which are not included in the boundary layer model used to derive bed shear stress with the horizontal ADCP. Bed shear stresses from the coupled ADCP are representative of a much more localized flow, while those derived with the horizontal ADCP resemble the net effect of the flow over larger scales. Bed shear stresses obtained from mean velocity profiles from the coupled ADCPs show a good agreement between the two methods, and highlight the robustness of the method to uncertainty in the estimates of the roughness length.

2013. No. 3

[Evangelista, S](#); [Altinakar, MS](#) ; [Di Cristo, C](#); [Leopardi, A](#). 2013, Simulation of dam-break waves on movable beds using a multi-stage centered scheme. *International Journal of Sediment Research*, Vol. 28, No. 3, pp. 269-284.

**Abstract:** This paper presents the application of the multi-stage first-order centered scheme GMUSTA to solve a two-phase flow model with four equations for simulating dam-break floods without and with sediment transport. Computation of generalized Riemann invariants can be particularly complex and costly in simulating dam-break floods with sediment transport. GMUSTA numerical scheme, which does not require complete knowledge of the eigenstructure of the hyperbolic mathematical model, offers a suitable and attractive option. The quality of the dam-break flood simulations with GMUSTA scheme is verified by comparing the results against laboratory tests and some experimental data available in the literature, on fixed and mobile bed conditions, with different bed materials and flush or stepped bottoms. The numerical results reproduce quite well the experimental evidence, proving that the model is capable of predicting the temporal evolution of the free-surface and the bed. The GMUSTA scheme, which is not only simple to implement but also both accurate and computationally efficient, is proposed as an appropriate tool for integrating non-equilibrium sediment-transport models.

[Macaire, JJ](#); [Gay-Ovejero, I](#) ; [Bacchi, M](#); [Cocirta, C](#) ; [Patryl, L](#); [Rodrigues, S](#). 2013, *International Journal of Sediment Research*, Vol. 28, No. 3, pp. 285-303.

**Abstract:** Four sample sets of the Upper and Middle Loire river sands were analyzed in order to study the impact of natural and anthropogenic factors on their petrographic composition in space (on an 800 km stretch) and time. Composition was determined by modal analysis of three sand-size fractions using a polarizing optical microscope and calculated for each sample ("standard sand" = Sst). The watershed is composed mainly of endogenic (Massif Central) and sedimentary (southern Parisian Basin) rocks. B-set sands collected in channels for different water flows in 1996 show that Sst compositions vary by only 5 %. Present-day sands in the Upper Loire and Middle Loire have very high petrographic immaturity comparing to others worldwide fluvial sands, although bio-climatic conditions favor sand maturation by source-rock weathering in the watershed. This shows the strong impact of the Massif Central on sediment yield due to relief

rejuvenation as a consequence of the formation of the Alps during the Quaternary. Fluvial sands stored during the Weichselian and the Holocene in the Middle Loire floodplain, although partly weathered since their deposition, show higher inputs from the endogenic rocks of the Massif Central than present-day deposits. This can be explained by Weichselian periglacial conditions and the development of crop farming since the Neolithic, which favored mechanical erosion, particularly in the Massif Central which is characterized by a cold, humid climate and steep slopes. The upstream-downstream change in the composition of presently deposited sand is low in the diked area. It shows however that basalt and some heavy mineral grains are vulnerable to abrasion during transport and indicates a marked sediment yield from ancient sediment stored in the floodplain. This is in line with the high incision of the river bed over the last 150 years partly due to dam construction and aggregate mining.

Hsieh, HM ; Luo, CR; Yang, JC ; Chen, RF. 2013, Numerical study of the effects of check dams on erosion and sedimentation in the Pachang River. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.304-315.

**Abstract:** Scouring and deposition processes resulting from variable rainfall and typhoon occurrence in tropical climatic conditions induce significant changes in the riverbeds of Taiwan. Along the Pachang River of western Taiwan, severe damage occurs during typhoons due to large and sudden variations in discharge, erosion, sediment transport and deposition. In order to simulate this process, the NETSTARS numerical modeling tool was used in the present paper. The influence of existing and planned check dam structures on flow control was also analyzed to determine their capacity to resist river erosion or to not be buried beneath sediments. Not only does the modeling tool allow calculation of the erosion-deposition behavior at the scale of the whole river, but it also provides local determination of the optimum location and characteristics such as foundation depth and lateral encroachment of future check dams. The results of a 10-year, long-term modeling simulation in terms of riverbed stability and scouring potential thus provide insights about unsafe future behavior at 4 sites. This numerical model provides a better general understanding and useful information for the optimal prevention of both the scouring damage and the burial related to sediment deposition with large changes in discharge and sediment transport.

Xie, DF; Gao, S; Wang, ZB; Pan, CH. 2013, Numerical modeling of tidal currents, sediment transport and morphological evolution in Hangzhou Bay, China. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.316-328.

**Abstract:** A 2D depth-averaged numerical model is set up to simulate the macro-scale hydrodynamic characteristics, sediment transport patterns and morphological evolution in Hangzhou Bay, a large macro-tidal estuary on the eastern coast of China. By incorporating the shallow water equations, the suspended sediment transport equation and the mass-balance equation for sediment; short-term hydrodynamics, sediment transport and long-term morphological evolution for Hangzhou Bay are simulated and the underlying physical mechanisms are analyzed. The model reproduces the spatial distribution patterns of suspended sediment concentration (SSC) in Hangzhou Bay, characterized by three high SSC zones and two low SSC zones. It also correctly simulates the residual flow, the residual sediment transport and the sediment accumulation patterns in Hangzhou Bay. The model results are in agreement with previous studies based on field measurements. The residual flow and the residual sediment

transport are landwards directed in the northern part of the bay and seawards directed in the southern part. Sediment accumulation takes place in most areas of the bay. Harmonic analysis revealed that the tide is flood-dominant in the northern part of the bay and ebb-dominant in the southern part of the bay. The strength of the flood-dominance increases landwards along the northern Hangzhou Bay. In turn sediment transport in Hangzhou Bay is controlled by this tidal asymmetry pattern. In addition, the direction of tidal propagation in the East China Sea, the presence of the archipelago in the southeast and the funnel-shaped geometry of the bay, play important roles for the patterns of sediment transport and sediment accumulation respectively.

**Balacco, G.** 2013, The interrill erosion for a sandy loam soil. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.329-337.

**Abstract:** This paper resumes a laboratory experience on a slope adjustable plot with the aim of examining the role of rainfall intensity and slope gradient for a sandy loam soil, typical of Southern Italy, with particular initial moisture content. The results of the simulations performed show that a rainfall reduction causes a corresponding percentage reduction of sediment output. A similar behaviour can be attributed to slope gradient, while runoff moderately increases with rainfall intensity but it is not sensitive to slope gradient. Data also highlight that the degree of saturation can affect runoff and soil loss values.

**Ribas, F; Falques, A; Van Den Berg, N; Caballeria, M.** 2013, Modeling shoreline sand waves on the coasts of Namibia and Angola. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.338-348.

**Abstract:** The southwestern (SW) coast of Africa (Namibia and Angola) features long sandy beaches and a wave climate dominated by energetic swells from the Southsouthwest (SSW), therefore approaching the coast with a very high obliquity. Satellite images reveal that along that coast there are many shoreline sand waves with wavelengths ranging from 2 to 8 km. A more detailed study, including a Fourier analysis of the shoreline position, yields the wavelengths (among this range) with the highest spectral density concentration. Also, it becomes apparent that at least some of the sand waves are dynamically active rather than being controlled by the geological setting. A morphodynamic model is used to test the hypothesis that these sand waves could emerge as free morphodynamic instabilities of the coastline due to the obliquity in wave incidence. It is found that the period of the incident water waves,  $T_p$ , is crucial to establish the tendency to stability or instability, instability increasing for decreasing period, whilst there is some discrepancy in the observed periods. Model results for  $T_p = 7-8$  s clearly show the tendency for the coast to develop free sand waves at about 4 km wavelength within a few years, which migrate to the north at rates of 0.2-0.6 km yr<sup>-1</sup>. For larger  $T_p$  or steeper profiles, the coast is stable but sand waves originated by other mechanisms can propagate downdrift with little decay.

**Kuhnle, R; Alonso, C.** 2013, Flow near a model spur dike with a fixed scoured bed. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.349-357.

**Abstract:** Three-dimensional flow velocities were measured using an acoustic Doppler velocimeter at a closely spaced grid over a fixed scoured bed with a submerged spur dike. Three-dimensional flow velocities were measured at 3,484 positions around the trapezoidal shaped submerged model spur dike. General velocity distributions and detailed near field flow structures were revealed by



the measurement. Clear differences were revealed between flow over fixed flat and scoured beds. Strong lateral flows were the dominant cause of the observed local scour. Shear stresses were higher for the scoured bed than in the flat bed case. Decreasing rates of scour as the scour hole developed were attributed to increases in critical shear stress in the scour holes caused by the increase in the length and magnitude of adverse slopes associated with the two main scour holes.

An, HP ; Chen, SC; Chan, HC; Hsu, Y. 2013, Dimension and frequency of bar formation in a braided river. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.358-367.

**Abstract:** This paper presents flume and field observations of a bank-confined braided river. Morphological features, including plan form configuration, channel width, and main channel migration, were examined by a series of experiments. Repeated measurements of channel morphology, provided a basis to estimate the relationship between noncumulative frequency of bars and bar area. Additional results from the Dajia River, located in Central Western Taiwan, were presented to provide a reference data set for comparing the laboratory and field data. The results indicate that the relationship between bar length and width can be predicted by a simple best-fit power function relating to self-similarity characteristics. The Hurst index by Walsh and Hicks ( 2002) provides acceptable predictions of the bar length and width observed in the experiments and confirmed by the field investigations. Experimental and field results both show that large river width yields a uniform distribution of bar areas with the similar discharge, leading to a large value of exponent (beta) in the model. The river width is confirmed to be a critical parameter in the main channel shift. A small increase in channel width likely increased rapidly the shift cycle.

Odongo, VO; Onyando, JO ; Mutua, BM ; van Oel, PR; Becht, R. 2013, Sensitivity analysis and calibration of the Modified Universal Soil Loss Equation (MUSLE) for the upper Malewa Catchment, Kenya. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.368-383.

**Abstract:** Simulation models are widely used for studying physical processes such as surface runoff, sediment transport and sediment yield in catchments. Most models need case-specific empirical data for parameterization before being applied especially in regions other than the ones they have been developed. Sensitivity analysis is usually performed to determine the most influential factors of a model so that they can be prioritized for optimization. In this way uncertainties in model outputs can be reduced considerably. This study evaluates the commonly used modified universal soil loss equation (MUSLE) model used for sediment yield simulation for the case of the upper Malewa catchment in Kenya. The conceptual factors of the model are assessed relative to the hydrological factors in the model. Also, the sensitivity of the model to the choice of the objective function in calibration is tested. The Sobol' sensitivity analysis method was used for evaluating the degree of sensitivity of the conceptual and hydrological factors for sediment yield simulations using the MUSLE model. Nash-Sutcliffe Efficiency (NSE) and the modified Nash-Sutcliffe Efficiency (NSE<sub>m</sub>) are used to test the sensitivity of the model to the choice of the objective function and robustness of model performance with sediment data measured from upper Malewa catchment, Kenya. The results indicate that the conceptual factors are the most sensitive factors of the MUSLE model contributing about 66% of the variability in the output sediment yield. Increased variability of sediment yield output was also observed. This was attributed to interactions of input factors. For the upper Malewa catchment calibration of the

MUSLE model indicates that the use of NSEm as an objective function provides stable results, which indicates that the model can satisfactorily be applied for sediment yield simulations.

[Saravanan, S; Chandrasekar, N ; Jeevivek, V.](#) 2013, Temporal and spatial variation in the sediment volume along the beaches between Ovari and Kanyakumari (SE INDIA). *International Journal of Sediment Research*, Vol. 28, No. 3, pp.384-395.

**Abstract:** A 2-year set of profile data from Ovari to Kanyakumari Beach, SE India has been analysed by using empirical orthogonal function (EOF) techniques to identify characteristic patterns of temporal and spatial variation in the sediment volume of the beaches. The results show that variation in the sediment volume of the beach is determined by interaction between the biennial and seasonal exchanges. EOF analysis the pattern of alongshore sediment exchange along the study area. The method facilitated separation of onshore-offshore and alongshore modes of sediment transfer and identification of the patterns of alongshore sediment exchange. The eigenfunction modes confirm the dominance of biennial, annual, and biannual sediment transfers occurring on study area. The sediment movement along the shoreline of study area is mainly governed by the forces associated with the incoming waves and the availability of sediments within the area. The present investigation has been made as an attempt to appreciate the sediment movement in relation to wave activity along the coast. The longshore sediment transport is intensive in the northerly direction as compared to southerly direction. The normal condition is for and to be moved annually or more frequently in the shallows and on the beach. Waves and wave-driven currents cause longshore drift of sand along the beach and offshore.

[Liu, MY; Tuo, YC; An, RD; Li, J.](#) 2013, Numerical prediction of turbidity currents on unsteady sediment-supply. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.396-405.

**Abstract:** A three-dimensional (3D) numerical model of unstable turbidity currents is developed based on the mechanism of sediment transport and turbulence theory. In this model, numerical simulation of turbidity currents without subsequent supply of muddy water was conducted using the same parameters as were used in the flume experiments. The evolution process of turbidity currents of completely losing supplies observed in the experiment was simulated by the model; validation of the numerical model and the algorithm was conducted. If momentarily interrupted process is regarded as a special case of the gradually interrupted, based on the preceding numerical simulation validity, it is feasible to simulate the motion law of turbidity currents under losing gradually supplies. By this method in this article, the characteristic of sediment-laden flow of losing gradually supplies was obtained, as well as its relationship between front velocity and sediment concentration.

[Zheng, J ; Li, RJ ; Feng, Q; Lu, SS.](#) 2013, Vertical profiles of fluid velocity and suspended sediment concentration in nearshore. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.406-412.

**Abstract:** Based on the power function of velocity and the friction velocity, a velocity profile is obtained. By solving the Schmidt's diffusion equation, an equilibrium suspended sediment concentration profile is further deduced. The profiles of velocity and suspended sediment concentration agree well with the field data, and the profile of suspended sediment concentration avoids the unreasonableness of the classical Rouse profile such as a zero value at the water surface.

According to these profiles, an expression which is easy to use for calculating the suspended sediment transport rate is derived.

[Bialik, RJ](#); [Czermuszenko, W](#). 2013, On the numerical analysis of bed-load transport of saltating grains. *International Journal of Sediment Research*, Vol. 28, No. 3, pp.413-420.

**Abstract:** The focus of this paper is on the analysis of the influence of particles' velocity distribution and their concentration on the sediment transport rate in bed-load from the Lagrangian perspective. Such aims are addressed by use of the relevant Lagrangian model of spherical saltating particles in which turbulence plays a significant role. The Monte Carlo approach is employed in the simulations to obtain the velocity and concentration of the saltating particles. Numerical simulations using two saltating particle models: (1) with; and (2) without particle-particle collisions are carried out. Based on the numerical results, we address the hypothesis that instead of averaged characteristics, the distributions of particles' velocity and sediment concentration should be taken into account in the calculation of sediment transport rate. Moreover, our results also show that the interaction between particles during their collisions is the key for better understanding of the physics of sediment transport. All results are compared with well-known experimental formulae i.e. Meyer-Peter and Muller and Fernandez Luque and van Beek.

[Yi, YJ](#); [Zhang, SH](#); [Wang, ZY](#). 2013, The bedform morphology of Chinese sturgeon spawning sites in the Yangtze River. *International Journal of Sediment Research*, Vol. 28, No. 3, pp. 421-429.

**Abstract:** Quantitative measures of the relationships between channel morphology and the habitat use of Chinese sturgeon (*Acipenser sinensis*) can help management and regulatory agencies to quantify potential spawning habitats and develop recovery goals in view of the decreasing area of sturgeon spawning habitat. This study determined the specific bedform types at the pool-riffle scale and evaluated the slopes, aspects and bed load gradation composition of Chinese sturgeon spawning areas in the Yangtze River, China. A bedform differencing technique was used to objectively quantify the longitudinal riverbed profile into four distinct pool-riffle units that were independent of discharge. The vertical location of thalweg points within these units was quantified with a riffle proximity index. Chinese sturgeon spawning areas were mapped and correlated with the pool-riffle units, slopes and aspects. The results indicate that Chinese sturgeon spawning areas occur primarily in riffles. The majority of Chinese sturgeon spawning occurred at elevations greater than 75% of the difference in elevation between the nearest riffle crest and the pool bottom. The slope of spawning sites was distributed between 0.05 and 6.36, and the average aspects were 219.92 and 207.63, respectively. The bed load is mainly composed of gravel and pebble, sediment diameter concentrated on 50-500mm. These analyses of bedform morphology will assist regional fish managers in quantifying existing and potential Chinese sturgeon spawning habitats and will provide a quantitative framework for evaluating general ecological implications of channel morphology in the Yangtze River.

2014. No.4

[Die Moran, A](#); [El Kadi Abderrezzak, K](#); [Mosselman, E](#)<sup>1</sup>; [Habersack, H](#); [Lebert, F](#); [Aelbrecht, D](#) ; [Laperrousaz, E](#). 2013, Physical model experiments for sediment supply to the old Rhine through

induced bank erosion. *International Journal of Sediment Research*, Vol. 28, No. 4, pp. 431-447.

Abstract: A mobile-bed, undistorted physical model (1:40) has been used to investigate different sediment supply strategies to the Old Rhine through bank protection removal and modifications of groyne dimensions and configuration, which cause bank erosion. This trained channel was previously the main bed of the upper Rhine downstream of Basel (Switzerland), but it has an artificially low flow regime since the construction of the Grand Canal d'Alsace, a navigation canal, and a flow control dam at Kembs (France). Training works and subsequent channel incision have also greatly reduced sediment transport rates and created a heavily armoured bed. The modelled pilot site has a groyne field on the left bank. Results show that the currently existing groynes at the site are not effective in creating high bank-side velocities conducive to bank erosion, even for flow rates significantly higher than the mean annual flow rate. The river bank has also proved to be more resistant than previously thought, allowing long stretches of bank protection to be safely removed. The physical model testing process has produced a new configuration for the groyne field, where two higher, larger island groynes are placed further apart than the three existing attached groynes. This innovative approach has proved effective, causing bank erosion for flow rates below the mean annual flow rate, with consistent erosion being observed. It has also been found that such a configuration does not pose a hazard for the Grand Canal d'Alsace, which is situated next to the Old Rhine, through excessive bank erosion during high flow events.

Liu, JH; Wang, GQ; Li, HH ; Gong, JG; Han, JY. 2013, Water and sediment evolution in areas with high and coarse sediment yield of the Loess Plateau. *International Journal of Sediment Research*, Vol. 28, No. 4, pp. 448-457.

Abstract: In the past few years, the amount of sediment entering the Yellow River decreased significantly in areas with high and coarse sediment yield of the Loess Plateau. Some researchers considered that it was owing to the soil and water conservation project, while others believed that it was caused by the low precipitation. The observation data showed that the ultimate soil erosion modulus in 1960s could reach 150,000 t km<sup>-2</sup>. However some experts preferred to believe that the ultimate soil erosion modulus in 1960s was wrong due to some uncertain mistakes. This paper quantitatively analyzed the spatial-temporal evolution pattern of sediment yield in areas with high and coarse sediment yield of the Loess Plateau over the past 50 years, by simulating the precipitation-runoff and soil erosion in 12 sample years with the digital watershed model. Some preliminary conclusions have been drawn as following: since the 1960s and 1970s, the rainstorm center had moved southward and the intensity of rainfall center became weaker and spread into dispersed rainfall distribution in areas with high and coarse sediment yield; the decrease of the amount of sediment entering the Yellow River was caused by the changes of rainfall type in recent years; the rainstorm of 1967 was concentrated in the region nearby "Shenmu-Fugu" in Shaanxi Province, and the annual maximum transport modulus( 150,000 t km<sup>-2</sup>) measured in Bullpen Ditch of the left bank tributary between "Shenmu" and "Fugu" in 1967 is reasonable.

Guerrero, M; Lamberti, A. 2013, Bed-roughness investigation for a 2-D model calibration: the San Martin case study at Lower Parana. *International Journal of Sediment Research*, Vol. 28, No. 4, pp. 458-469.

Abstract: This paper illustrates how the acoustic Doppler current profiler (ADCP) and single-beam echo-sounder (SBES) recordings can be used for the calibration of existing software to assist in

generalizing the morphodynamic processes in large rivers at key sites such as bifurcations and confluences. Calibration of the MIKE21C numerical model by the Danish Hydraulic Institute at the 25-km-long reach of Lower Parana near Rosario (Argentina) is presented. This reach includes two downstream confluences and two bifurcations. The model simulates a 2-D depth-averaged flow velocity and the related sediment fluxes to predict the bifurcation morphodynamics that affects the Parana waterway. To investigate the river channel bathymetry, roughness, flow discharge allocation at bifurcations, suspended sediment concentration and grain size distributions, several instruments were used. These instruments included two ADCPs by Teledyne RDI working at frequencies of 600 and 1,200 kHz, a Sontek ADCP working at a frequency of 1,000 kHz and a SBES. The method to assess suspended sediment concentration and grain size distributions has been previously described. This paper focuses primarily on investigating dune morphology (by means of SBES depth measurements) and friction velocity (by means of ADCP profiling) to determine the river channel bed-roughness. The 2-D model results agree with observed values of bed-roughness, flow velocity and suspended sediment concentration distributions at the investigated sections, known data of water slope and total load of bed sediment are in good agreement with model results.

[Babic Mladenovic, M; Kolarov, V ; Damjanovic, V.](#) 2013, Sediment regime of the Danube River in Serbia. *International Journal of Sediment Research*, Vol. 28, No. 4, pp. 470-485.

**Abstract:** The total length of the Danube section in Serbia is 587.5 km, and it has three specific sections: (1) Pannonian Plain Danube (or the Middle Danube) has all characteristics of lowland rivers. The stretch downstream of Novi Sad is under the influence of the Iron Gate 1 backwater during low water flows; (2) Iron Gate Danube, where the river is confined in the gorge. Now it is a reservoir, with completely altered natural characteristics. (3) Western Pontic Danube (or the Lower Danube), downstream of the gorge. This paper presents the sediment regime in the Serbian sector of the Danube River, both upstream and within the Iron Gate Reservoir. Extensive field investigation data were used to describe the most important parameters of sediment transport and deposition processes, including riverbed composition and suspended sediment characteristics (grain size and concentration). The influence of large tributaries of the Danube (the Tisza, the Sava, and the Velika Morava) is also addressed. Activities conducted in the Iron Gate 1 reservoir under the Sediment Regime and Morphological Changes Monitoring Program is also described. Data obtained during implementation of the Program form the basis for the description of changes in the Danube sediment regime that occurred following erection of the Iron Gate Dam. It revealed that the most important consequence of the Iron Gate 1 HPNS Dam is permanent deposition of sediment in the Iron Gate Gorge portion of the reservoir, the water and environmental management implications of which are becoming increasingly important. However, upstream stretches of the reservoir are not subject to uniform sedimentation processes; instead, the sediment regime depends on current hydrologic and hydraulic conditions within the watercourse and/or the hydro-power plant operating mode.

[Liu, C; Sui, JY; He, Y; Hirshfield, F.](#) 2013, Changes in runoff and sediment load from major Chinese rivers to the Pacific Ocean over the period 1955-2010. *International Journal of Sediment Research*, Vol. 28, No. 4, pp. 486-495.

**Abstract:** Changes in runoff and sediment loads to the Pacific Ocean from 10 major Chinese rivers

are presented in this paper. To quantitatively assess trends in runoff and sediment loads, a parameter called the "Trend Ratio T" has been defined in this paper. To summarize total runoff and sediment load from these rivers, data from 17 gauging stations for the duration 1955 to 2010 has been standardized, and the missing data have been interpolated by different approaches according to specific conditions. Over the observed 56-year study period, there is a quite stable change in total runoff. Results show that the mean annual runoff flux entering the Pacific Ocean from these rivers is approximately 1,425 billion cubic meters. It is found that all northern rivers within semi-arid and transitional zones including the Songhua, Liaohe, Haihe, Yellow and Huaihe rivers present declining trends in water discharge. Annual runoff in all southern rivers within humid zones including the Yangtze, Qiantang, Minjiang, Pearl and Lancang rivers does not change much, except for the Qiantang River whose annual runoff slightly increases. The annual sediment loads of all rivers show significant declining trends; the exceptions are the Songhua and Lancang rivers whose annual sediment loads have increasing trends. However, the mean annual sediment flux carried into the Pacific Ocean decreased from 2,026 million tonnes to 499 million tonnes over the 56-year period. During this time there were 4 distinct decreasing phases. The decrease in annual sediment flux is due to the integrated effects of human activity and climate change. The reduction in sediment flux makes it easy for reservoir operation; however, the decrease in sediment flux also creates problems, such as channel erosion, river bank collapse and the retreat of the delta area.

Zhang, YY ; Zhong, DY; Wu, BS. 2013, Multiple temporal scale relationships of bankfull discharge with streamflow and sediment transport in the Yellow River in China. *International Journal of Sediment Research*, Vol. 28, No. 4, pp. 496-510.

**Abstract:** This paper presents a study on the characteristics of multiple time scales of bankfull discharge and its delayed response to changes of flow conditions using continuous wavelet analysis for data from selected hydrological stations in the Yellow River basin. Results showed that bankfull discharge series had one or two dominant time scales. For example, the Huayuankou station in the lower reach of the Yellow River had two dominant time scales of 19-20 years and 5-6 years. The dominant time scales of the bankfull discharge series were generally consistent with the dominant time scales of water discharge and sediment concentration series, indicating that the channel morphology inherits the characteristics of the hydrological system in terms of multiple time scales. In addition, the wavelet coefficients of the bankfull discharge series had a phase difference in relation to those of the sediment concentration series, with a delay time that varied from 3 to 16 years at different sites. This delay time or relaxation time is a result of the delayed response of bankfull discharge to flow conditions, which was significant for channel adjustments in response to changes of flow conditions. The findings of the multiple time scales and the delayed response are of importance for further study of channel morphology of fluvial systems.

Itoh, T; Horiuchi, S; Mizuyama, T; Kaitsuka, K. 2013, Hydraulic model tests for evaluating sediment control function with a grid-type Sabo dam in mountainous torrents. *International Journal of Sediment Research*, Vol. 28, No. 4, pp.511-522.

**Abstract:** There are two kinds of Sabo dams in order to control sediment transport by debris flow and flash floods in mountainous area, which are closed and open-type's dams. In Japan, open-type's Sabo dams are constructed taking into account the continuity of sediment routing from



upstream to downstream reach in a basin. A plan to construct a 20 m high grid-type Sabo dam which can capture a sediment volume of 400,000 m<sup>3</sup> is proposed in the Amahata river basin in Japan. Hydraulic model tests are conducted to decide on the section for a dam (Section A, B) and the grid size such as clearance of vertical/horizontal bars for evaluating the plan. Several runs of flume tests are conducted and the sediment control function of the Sabo dam is discussed using several experimental data such as dimensionless sediment runoff rate from Sabo dam, temporal changes of bed profile and mean diameter and so on. It was found that sediment deposition in sediment storage area of Sabo dam was affected by curved channel, and that next the grid size of steel bars and thirdly the section of a dam was able to capture sediment in storage area of Sabo dam. Sediment was controlled well in the section B and in the grid size of 1.0xd(95), and the problems related to sediment runoff after sediment capturing in Sabo dam are pointed out.

[Cheng, C ; Song, ZY ; Wang, YG ; Zhang, JS. 2013, Parameterized expressions for an improved Rouse equation. International Journal of Sediment Research, Vol. 28, No. 4, pp.523-534.](#)

**Abstract:** The equilibrium profile of suspended sediment concentration (SSC) in steady, uniform turbulent flow has been extensively studied since the proposition of Rouse equation (Rouse, 1937). Many researchers keep studying and attempting to improve the Rouse equation by modifying the mixing length concept. Bose and Dey (2009) improved Rouse equation based on the modified sediment diffusivity, however, their proposed sediment diffusivity has two parameters, the depth modification factor  $\alpha$  and the reciprocal of the sediment Schmidt number  $\beta = 1/S-c$ , and the corresponding expressions were not given properly in their paper. This paper aims to parameterize the relevant coefficients, the results shows: (1)  $\alpha$  is parameterized from a reasonable approximation by the analysis of surface boundary condition of SSC; (2) considering some effect factors on the settling velocity,  $\alpha$  can be expressed by an extended and modified Montes-Ippen formula, and its related parameters are calibrated by substantial data about the relationship between the primary Rouse parameter  $Z^* = \omega(s)/\kappa u^*$  and its counterpart  $Z'^* = \omega(s)/\beta \kappa u^*$ . Through verification with some experimental and field datasets, and comparison with related formula, the results show that the sediment diffusivity and SSC profiles have a good agreement with measured data used the present parameterized expressions of  $\alpha$  and  $\beta$ , so the present improved Rouse equation is reasonable, and can be applied in practical applications. Finally, an approximation and simplified expression of the improved Rouse equation is deduced by using the approach of perturbation, which can be applied easily for the estimation of suspended sediment transport rate.

[Behrends Kraemer, F; Chagas, CI; Cosentino, DJ ; Garibaldi, LA. 2013, Adsorption and affinity of Escherichia coli to different aggregate sizes of a silty clay soil. International Journal of Sediment Research, Vol. 28, No. 4, pp.535-543.](#)

**Abstract:** The sediments produced by water erosion are the main source of pollution of agricultural origin of surface water bodies. These sediments may be associated to bacteria, compromising the quality of nearby water bodies. Therefore, to understand this biological contamination, it is necessary to find out the adsorption capacity and bacterial affinity to aggregate sizes that may result in a differential sedimentation. To this end, in the present work, the distribution, adsorption capacity and affinity to different aggregate sizes of two strains of Escherichia coli in two liquid media of contrasting ionic strength were evaluated in a silty clay soil. The <2  $\mu$  m fraction

showed a higher proportion of bacteria than the other aggregate sizes (48%), whereas among the fractions  $>2$   $\mu\text{m}$ , the 20-50  $\mu\text{m}$  fraction was the one that showed the highest bacterial adsorption in both liquid media (37.9%). On the other hand, the highest values of bacterial affinity were found in the 20 to 50  $\mu\text{m}$  fraction (coarse silt) in the low ionic strength media and 20-50 and  $>50$   $\mu\text{m}$  in the high ionic strength media. However, the bacterial strains used revealed only some trends in the modification of these variables. This work contributes to the development and implementation of strategies to mitigate pollution, such as control of sediment generation and its subsequent capture in filter strips.

[Darwish, MAG](#), 2013, Geochemistry of the High Dam Lake sediments, south Egypt: implications for environmental significance. *International Journal of Sediment Research*, Vol. 28, No. 4, pp.544-559.

**Abstract:** The goal of the present work is to perform a geochemical assessment of High Dam Lake bottom sediments for determining the fate, dispersion and levels of trace elements causing environmental pollution, and provided an access to their probable sources. The sediment samples were analyzed using ICP-MS for 20 elements; Ag, Ba, Cr, Cu, Ga, Hf, Mn, Pb, Rb, Sc, Se, Sn, Sr, Ta Th Ti, Tl, U, V and Zr, and their obtained data were treated using statistical, graphical and mapping techniques. The results showed the data set of all analyzed elements affected by outliers and extreme values that caused deviation away from normality. Kruskal-Wallis test revealed that median of some trace element levels in Lake sediments, was not significantly different and other elements rejected the Null hypothesis. Most analyzed elements had high values of median and mean in sediments of Lake Nubia rather than Lake Nasser and their normalization gave the same results of calculated environment factors. Subsequently, Lake Nubia sediments possessed high combined EF levels of Th, Sc, Sn, Ag, Zr, Hf, Ta, Sr, U, Ti, V, Cr, and Mn, causing significant contamination, which was great potentially related to industrial, agricultural, urbanization and mining activities. Whereas, combined EF of Se, Cu, Ga, Pb, Ba, Rb, and Tl, which are highly elevated in southern Lake Nasser sediments owing to their source are great possibly derived from Lake Nubia and geogenic activities. With decreasing distance towards the High Dam body, the contaminant elements were diminished due to reduction in the environmental factors and Sudanese pollution sources leading to the northern Lake Nasser considered to be less contaminated. Overall, the present study is an environmental alert for contaminated sediments that carried contaminants and considered the secondary source of pollution impact on ecosystem, and subsequently, their environmental risk on Human health.

[Haddadchi, A; Ryder, DS ; Evrard, O ; Olley, J](#). 2013, Sediment fingerprinting in fluvial systems: review of tracers, sediment sources and mixing models. *International Journal of Sediment Research*, Vol. 28, No. 4, pp.560-578.

**Abstract:** Suspended sediments in fluvial systems originate from a myriad of diffuse and point sources, with the relative contribution from each source varying over time and space. The process of sediment fingerprinting focuses on developing methods that enable discrete sediment sources to be identified from a composite sample of suspended material. This review identifies existing methodological steps for sediment fingerprinting including fluvial and source sampling, and critically compares biogeochemical and physical tracers used in fingerprinting studies. Implications of applying different mixing models to the same source data are explored using data

from 41 catchments across Europe, Africa, Australia, Asia, and North and South America. The application of seven commonly used mixing models to two case studies from the US (North Fork Broad River watershed) and France (Bleone watershed) with local and global (genetic algorithm) optimization methods identified all outputs remained in the acceptable range of error defined by the original authors. We propose future sediment fingerprinting studies use models that combine the best explanatory parameters provided by the modified Collins (using correction factors) and Hughes (relying on iterations involving all data, and not only their mean values) models with optimization using genetic algorithms to best predict the relative contribution of sediment sources to fluvial systems.

Gu, ZJ ; Wu, XX; Wang, XL; Peng, SY ; Luo, H; Shi, XZ; Yu, DS. 2013, Using live vegetation volume to analyze the effects of plot *Pinus massoniana* Lamb on water and soil conservation under natural rainfall events. *International Journal of Sediment Research*, Vol. 28, No. 4, pp.579-587.

**Abstract:** The 3-D spatial distributions of vegetation are of great significance for water and soil conservation but are rarely concerned in literatures. The live vegetation volume (LVV) was used to relate to water/soil loss under 144 natural erosive rainfall events from 2007 to 2010 in a typical water-eroded area of southern China. Quadratic polynomial regression models were established for five pure tree (*Pinus massoniana* Lamb) plots between LVV and water (runoff)/soil conservation effects (RE/SE). RE/SE corresponds to the ratios of runoff depth/soil loss of the pure tree plots to that of the control plot under each rainfall event. Increasing LVV exhibits descending (DS), descending-ascending (DA), ascending-descending (AD), and ascending (AS) trends in the LVV-RE and LVV-SE curves. The effects of soil conservation on the plots were generally more noticeable than the effects of water conservation, and most of the RE and SE values reflected the positive effects of water and soil conservation. The effects were mainly positive under heavy rains (e. g., rainfall erosivity,  $R = 140 \text{ MJ mm ha}^{-1} \text{ h}$ , maximum 30 min intensity,  $I-30 = 16 \text{ mm h}^{-1}$ ), whereas the effects were mainly negative under light rains (e. g.,  $R = 45 \text{ MJ mm ha}^{-1} \text{ h}$ ,  $I-30 = 8 \text{ mm h}^{-1}$ ). The trees' water/soil conservation effects notably transformed when rainfall erosivity and intensity were lower than the positive or negative effects to a certain threshold. About 50% rainfall events led to obvious transform effects when LVVs were near 0.5 or 0.6. These results are able to aid in the decision making on the forest reconstruction in water-eroded areas.

Yang, WF; Chen, M; Zhang, XX; Guo, ZG; Li, GX; Ma, Q; Yang, JH; Huang, YP. 2013, Thorium isotopes (Th-228, Th-230, Th-232) and applications in reconstructing the Yangtze and Yellow River floods. *International Journal of Sediment Research*, Vol. 28, No. 4, pp.588-595.

**Abstract:** In the past decades, the floods of the Yangtze and Yellow River introduced unexpected changes of the ecological community and sedimentary dynamics in the East China Sea (ECS). To reconstruct the flood events in the ECS, Th-228, Th-230 and Th-232 have been examined in a sediment core. The specific activities of three thorium isotopes have good positive relations with fine fractions ( $<63 \mu \text{m}$ ), indicating that Th activity concentrations heavily depend upon the sediment grain size. The size-normalized activities of Th-228, Th-230 and Th-232 showed significant variations. Coincidences between the higher Th activities and historical floods of the Yangtze and Yellow River demonstrated that size-normalized Th recorded the two rivers' flood events. The activity ratios of thorium isotopes, i.e. Th-230/Th-232 and Th-228/Th-232, also

showed similar patterns to the historical river floods. In three periods (1740s, 1840-1860s and 1930-1960s), characterized by frequent floods, the thorium activity ratios were fairly low and close to the Yangtze and Yellow River estuary sediments, coinciding with the less oceanic Th-228 and Th-230 contributions during the flooding periods. Accordingly, these results support the size-normalized Th activity and thorium ratios as proxies of the river floods in coastal seas.