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China-UK Young Scholar Workshop on Urban River Flood Control and Restoration

城市河流防洪与生态修复中英青年学者研讨会

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Supported by:

China-UK Young Scholar Workshop on Urban River Flood Control and Restoration

Luo-jia-shan-zhuang Hotel, Wuhan University, August 23-25, 2019

Workshop Convener

Dr. Shan Zheng, School of Water Resources and Hydropower Engineering, Wuhan University

Dr. Matthew Johnson, School of Geography, University of Nottingham

It is acknowledged that past management has not improved rivers, evidenced by the fact that management has caused substantial ecological detriment and the issues it aims to improve, such as drought, disease and flooding, still exist. Indeed, in many places management has increased risk of river hazards by fixing river channel geometry, resulting in rivers that are less resilient to future changes in land-use and climate. As such, traditional river and flood management techniques, such as levees, flood walls and dredging are seen as unsustainable, leading to a move towards slowing and storing the flow and restoring channels back to a more natural state. However, despite restoration science having positive hydrological and geomorphological impacts, the ecological benefits tend to be disappointing and the mutual benefits for water quality are rarely considered in cities. To maximise the benefits of restoration whilst maintaining the societal functions water resources must provide and minimising river hazards, new knowledge and interdisciplinary perspectives are required.

This workshop will bring together early career researchers from China and the UK to integrate knowledge of restoration, hydrological resilience, and urban flood planning. The new science developed during and subsequent to this workshop is necessary for sustainable urban water resource management and to improve declining water quality standards. It is also timely, coming at a moment when there is a desire to provide functioning green space in global metropolises. Therefore, the over-arching aims of the workshop are to develop position papers and a policy document promoting urban river restoration in China; to establish a strong international network focused on urban river restoration, and; to build capacity for early career researchers through networking, position papers and future grant applications.

List of Participants

Category	No.	Name	Organisation	Contact
Invited speakers	1	Guangming Tan	Wuhan University	tangm@163.vip.com
	2	Lihua Xiong	Wuhan University	xionglh@whu.edu.cn
	3	Rice Li	British Council	Rice.Li@britishcouncil.org.cn
	4	Colin Thorne	University of Nottingham	Colin.thorne@nottingham.ac.uk
	5	Dapeng Yu	Loughborough University	D.Yu2@lboro.ac.uk
	6	Xiaotao Cheng	China Institute of Water Resources and Hydropower Research	chengxt@iwhr.com
	7	Yuhong Zeng	Wuhan University	278358935@qq.com
UK delegates	8	Matthew Johnson	University of Nottingham	M.Johnson@nottingham.ac.uk
	9	Daniel Green	Newcastle University	danielgreen91@icloud.com
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	11	Liam Clark	University of Nottingham	liam.clark@nottingham.ac.uk
	12	Louise Slater	Oxford University	louise.slater@ouce.ox.ac.uk
	13	Muhammad Afzal	University of Cardiff	AfzalM8@cardiff.ac.uk
	14	Richard Boothroyd	University of Glasgow	Richard.boothroyd@glasgow.ac.uk
	15	Sangaralingam Ahilan	Exeter University	S.Ahilan@exeter.ac.uk
	16	Simon Dixon	University of Birmingham	s.j.dixon@bham.ac.uk
	17	Yu-ting Tang	University of Nottingham Ningbo	Yu- Ting.Tang@nottingham.edu.cn

List of Participants (continued)

Category	No.	Name	Organisation	Contact
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	20	Duan Chen	Changjiang River Scientific Research Institute	445350205@qq.com
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	30	Tingting Hao	Ewaters Environmental Science & Technology (Shanghai) Ltd.	elsiehao1120@gmail.com
	31	Wei Li	Zhejiang University	lw05@zju.edu.cn
	32	Xu Chen	China University of Geosciences (Wuhan)	xuchen@cug.edu.cn
	33	Yuyao Xu	University of Nottingham Ningbo Campus	2832647160@qq.com
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Workshop Agenda

Date		Chair	Time	Name	Presentation
Aug. 23rd	AM	Shan Zheng	09:00-09:05	Lihua Xiong	Welcome speech from Wuhan University
			09:05-09:10	Rice Li	Speech from British Council China office
			09:10-09:15	Matthew Johnson	Speech from UK delegates
			09:15-09:45	Xiaotao Cheng	Invited talk: Comprehensive Urban River Management: Multiple Choices
			09:45-10:15	Dapeng Yu	Invited talk: Surface Water Flood Forecasting and Emergency Response in a Changing Climate
			10:15-10:45	Break (+take group photo)	
			10:45-10:55	Matthew Johnson	Biomic River Restoration: A New Focus for River Management
			10:55-11:05	Wei Li	High-resolution and efficient modelling of urban flood based on porosity SWEs and LTS method
			11:05-11:15	Louise Slater	Understanding the drivers of flood nonstationarity
			11:15-11:25	Hongbin Shen	Analysis on rainfall-runoff control effects of Low Impact Development (LID) for urbanized area: Case study of Future Science & Technology Park in Beijing.
			11:25-11:35	Muhammad Afzal	Application of physical-based (DiCaSM) hydrological model to assess the impact of climate and land-use changes on water resources of an urbanized catchment in the UK
			11:35-11:45	Lei Li	Identifying enablers and barriers to the implementation of the Green Infrastructure for urban flood management: A comparative analysis in the UK and China
			12:00-	Lunch	
	PM	Matthew Johnson	02:00-02:10	Richard Boothroyd	The influence of riparian plants on river flow: implications for flow structures and drag
			02:10-02:20	Chao Liu	Interaction between flow and sedimentation in vegetated channels
			02:20-02:30	Liam Clark	Measuring river water surface width at the national scale using remote sensing and statistical modelling
			02:30-02:40	Renyi Xu	Solving the Step Riemann Problem with the L-M Iteration method
			02:40-03:00	Break	
			03:00-05:00	Structured discussion on perspective paper on flooding and river habitat in China [knowledge gaps; paper aim; key sections; task attribution]	
			6:00-	Dinner	

Workshop Agenda (continued)

Date		Chair	Time	Name	Presentation
Aug. 24th	AM	Shan Zheng	09:00-09:30	Yuhong Zeng	Invited talk: Hydrodynamic Characteristics Influence Swimming Behavior of Fish
			09:30-10:00	Colin Thorne	Invited talk: Blue-Green Cities: Restoring the Urban Water Cycle
			10:00-10:10	Duan Chen	Dynamic management of water storage for urban flood
			10:10-10:20	Simon Dixon	Interactions between hydrological and geomorphological processes and the built environment
			10:20-10:30	Niannian Fan	Paleo-floods and archaeological implications: What can we learn?
			10:30-10:50	Break	
		Matthew Johnson	10:50-11:00	Komali Kantamaneni	Natural disasters, risks and coastal vulnerability: A systematic study of the Indian Coast
			11:00-11:10	Qiang Zhong	Self-Forming longitudinal sediment streaks in open channel flows
			11:10-11:20	Yuyao Xu	Investigation of the urban fluvial microplastics: the case of Ningbo
			11:20-11:30	Lu Wang	Effects of upstream bridge piers on local scour at submerged weirs
			11:30-11:40	Daniel Green	Investigations into the application of urban green Infrastructure to manage flood risk within a specialised experimental facility
			11:40-11:50	Peng Zhang	Climate change and hydropower impacts on fish habitat in the Jinsha River downstream of the Panzhihua City
			11:50-12:00	Yu-ting Tang & Shan Zheng	The demographic implication for promoting Sponge City Initiatives in Wuhan and a reflection of methodology used in questionnaire
			12:00	Lunch	
	PM	Shan Zheng	02:30-06:00	Fieldtrip to Sponge City Projects in Wuhan	
			6:00	Dinner	
Aug. 25th	AM	Matthew Johnson	09:00-09:15	Recap of previous 2-day content and aims for today	
			09:15-12:00	Structured discussion of grant application [funding opportunities; research questions; contributors and work packages; methods]	
	PM		02:00-03:00	Continued discussion	
			03:30-05:00	Summarise - administer key tasks and timelines for review paper and grant proposal	

Abstracts of Presentations

Biomic River Restoration: A New Focus for River Management

Matthew JOHNSON, Colin THORNE

School of Geography, University of Nottingham, NG7 2RD, UK.

Abstract: River management based solely on engineering science has proven to be unsustainable and unsuccessful, evidenced by the fact that the problems this approach intended to solve (e.g. flood hazards, water scarcity, channel instability) have not been solved and long-term deterioration in river environments has reduced the capacity of rivers to continue meeting the needs of society. In response to this inconvenient truth, there has been a paradigm shift over the past few decades in management towards river restoration. But, the ecological, morphological and societal benefits of river restoration have, on the whole, been disappointing. We believe that this stems from the fact that restoration over-relies on the same applied engineering and management, with a focus on the power of flowing water as the primary driver of channel-forming processes. We argue that if river restoration is to reverse long-standing declines in river functions, it is necessary to recognise the influence of biology on river forms and processes and re-envisage what it means to restore a river (Figure 1). This entails shifting the focus of river restoration from designing natural channels to situating streams within balanced and healthy biomes, and, where appropriate, anthromes. We define this new approach as *Biomic River Restoration*.

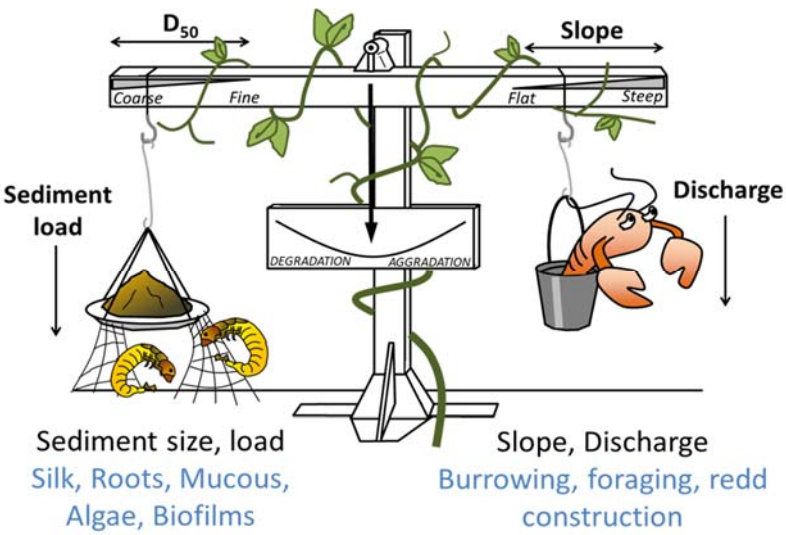

Figure 1 A reimagining of Lane's Balance, which has been used as a visual representation of the engineering paradigm of the equilibrium, stable river channel form for 60 years. Here, we propose an alteration, which represents the important role that the surrounding ecosystem also has in controlling stable channel form.

Key Words: River Restoration, Biogeomorphology, Freshwater Ecology, River Management, Wetlands

High-resolution and efficient modelling of urban flood based on porosity SWEs and LTS method

Wei LI, Ji Yu ZOU, Peng HU

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Abstract: For high-resolution reproduction of flood hydrodynamics, the shock-capturing finite volume method has been widely used to solve the shallow water equations (SWEs), though it is relatively time-consuming. To save computational cost for practical applications, this paper presents a high-resolution and efficient flood tracking model by combining the porosity method and the local time step (LTS) approach. The anisotropic porosity method prevents the grid refining around the buildings and the method of local time step avoids a small time step in relatively large grids resulting from global stability restriction. The application to classic idealized urban floods shows that the represent model can accurately and efficiently reproduce the complex hydrodynamics of urban floods: the anisotropic porosity method reduces the requirement of local grid refining and increases the computational efficiency by an order of magnitude; the LTS method reduces the temporal iteration of large grid update and saves the computation time for a couple of times. This work provides a new way for accurate and efficient modeling of urban floods.

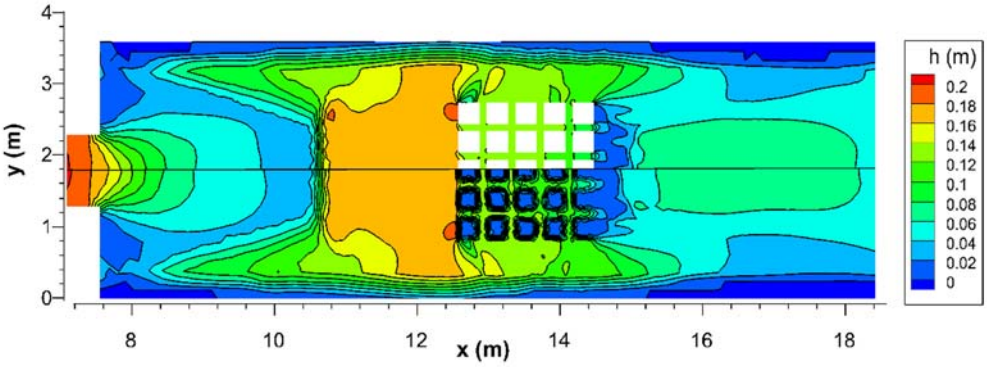

Figure 1 Contours of water depth for traditional SWEs (top) and Porosity SWEs (down)

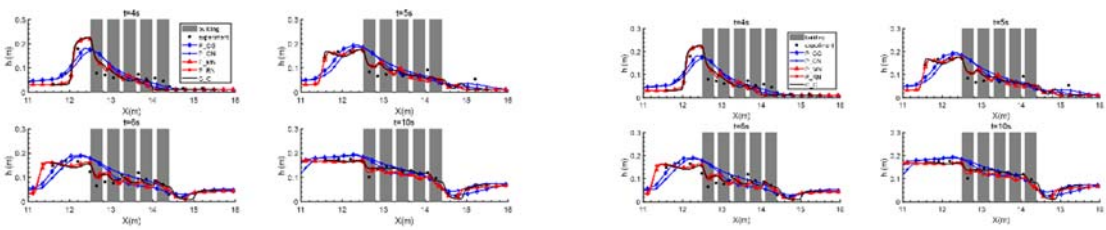

Figure 2 Water depth along central longitudinal street at distinct instants (C_C represents traditional SWEs, P_MN represents porosity SWEs with the same high accuracy as C_C, P_CG represents porosity SWEs with adequate accuracy using least grids

Key Words: anisotropic porosity, shallow-water equation, urban flood modelling, local time step, finite volume method

Understanding the drivers of flood nonstationary

Louise J. SLATER

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Abstract: Flooding is the world's greatest hazard in terms of population exposure, with over 900 million people affected every year. Yet despite decades of research developing the world's most sophisticated flood models, we still have limited understanding of the drivers that influence flood characteristics in different parts of the world. Astonishingly, most flood estimates and models still rely on a static description of the historical flood record and of the physical landscape, when in reality, flood characteristics are changing rapidly and dynamically – through an altered frequency of meteorological extremes, shifts in societal practices (such as urbanization, deforestation, and river management), and morphological changes in the ability of our rivers to hold and convey flood waters (the channel conveyance capacity). In this talk, I will provide an overview of my group's research, developing different approaches to understand and quantify the different drivers of flood nonstationary. This will include, for instance, (1) the influence of large-scale modes of climate variability and climate extremes, (2) the influence of land cover change effects, such as urbanization and deforestation, and (3) the influence of changes in channel conveyance capacity on the likelihood of flooding. I will discuss new approaches for identifying and quantifying the influence of these different flood drivers and for mitigating flood hazards in the future, including statistical methods, ensemble-based forecasting approaches, and the new understandings that emerge from big data and data science methods.

Key Words: Flood nonstationary, Flood drivers, Channel conveyance capacity, Urbanization, Statistical modelling, Flood forecasting

Monitoring and Simulation on Rainfall-runoff Control Effects of Low Impact Development for the Future Science & Technology Park in Beijing

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Abstract: The complete procedure of LID (Low Impact Development) planning includes: goads determination, facility allocation design, scheme optimization, construction, operation-maintenance, effects monitoring, assessment and improvement. For the large scale LID area, the overall goal can be divided into different sub regions, facilities should be allocated by considering the type of land block. The Future Science & Technology Park in Beijing was selected for case study, the decomposition allocation method for LID facilities was introduced. Rainfall-runoff monitoring and effectiveness analysis was carried out in order to establish the mechanism of "construction-monitoring- assessment-improvement". The results showed that the runoff coefficient of annual rainfall is less than 0.15 and the utilization ratio of annual rainwater is greater than 85%. Based on Clark linear distributed unit hydrograph model, the road network confluence in North Zone of Future Science & Technology Park was simulated and model performance evaluations were carried out by correlation coefficient (R2), Nash-Sutcliffe efficiency (NSE) and relative error of total runoff (RE), in order to comprehensively test the linear effect of road network confluence. The evaluations results showed that the average value of correlation coefficient is 0.73 which varies from 0.4 to 0.89, the average value of Nash-Sutcliffe efficiency is 0.26 which varies from -0.77 to 0.87, the average value of relative error of total runoff is -0.18 which varies from -0.77 to 0.36. The variation rules of different evaluation indexes are closely related to the rainfall intensity for individual rainfall, in which with the increase of rainfall intensity, the correlation coefficient and Nash-Sutcliffe efficiency increase toward 1.0, the relative error of total runoff approaches 0. This indicated that the simulation effect of Clark unit hydrograph model trends to optimize as the linear effect of road network confluence process increases continuously with larger rainfall intensity.

Key Words: Low Impact Development, Facility Allocation, Effects Monitoring, Clark Unit Hydrograph, Model Performance Evaluations

Application of physical-based (DiCaSM) hydrological model to assess the impact of climate and land-use changes on water resources of an urbanized catchment in the UK

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Abstract: This study applied a physically based distributed catchment-scale (DiCaSM) model to assess the impacts of climate and land-use changes on the hydrology of Don Catchment in Yorkshire, UK. In addition to the surface runoff, a number of other hydrological variables as groundwater recharge and drought indicators such as soil moisture deficit and wetness index of the root zone were simulated. Model efficiency measured using the Nash-Sutcliffe Efficiency factor was above 90% during the calibration period and above 83% during the validation period. The impacts of climate change on the streamflow and the groundwater recharge were studied using the UK Climate Projections (UKCP09). Under different climate scenarios, the greatest decrease in streamflow and groundwater recharge is projected under medium and high emission scenarios. To study the impact of land-use changes on water balance, different possible scenarios were applied, which showed varying impacts but the magnitude of the impact of the climate change was much more significant than the land-use change on the streamflow and the groundwater recharge. Findings of the study are of great importance in future planning of water resources management in the studied catchment.

Key Words: Hydrological modelling; Streamflow; Groundwater Recharge; Climate change; Land use-changes

Identifying Enablers and Barriers To The Implementation Of The Green Infrastructure For Utban Flood Management: A Comparative Analysis In The UK And China

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Abstract: Climate change and urbanization are causing the frequency and distribution of flood risks to rise, with increasing risk to human life, economic losses and environmental and human health. The ability of Green Infrastructure (GI) to reduce storm-water runoff, improving water quality and quantity and provide multiple benefits to improve sustainability and social well-being is becoming recognized. This is acknowledged in both the United Kingdom (UK) through the promotion of *Sustainable Urban Drainage Systems* (SUDS) and in China through the *Sponge Cities Program* (SCP). However, the large scale uptake of GI for urban flood risk management has been slow and the implementation has not reached its full potential. Therefore, this study aims to identify the barriers and enablers to GI approaches to urban flood management by investigating SUDS in the UK and SCP in China, in order to improve effectiveness of delivery and implementation of these practices. First a background of GI and its functions in urban flood management across UK and China is provided; then the enablers and barriers of GI application are identified through in-depth semi-structured interviews with stakeholders and experts. Our results found that, despite the political, cultural and social difference between China and the UK there are a number of similarities in reported enablers and barriers to implementation of GI. Multi-functionality was identified as the main enabler in both countries, with storm-water runoff reduction to mitigate urban flood risk prioritized for both SUDS and SPC but social and climate adaptation is also valued. Another shared enabler was the identified need for high level political buy-in. Identified barriers to GI implementation span the financial, biophysical and socio-political spheres in both countries. Therefore, despite the difference between the countries this paper has identified a number of shared research priorities, including; research into the monetization of the benefits of GI and identification of additional finance streams implementation, the long term monitoring and demonstration of the benefits of GI, along with knowledge exchange between researchers, developers and policy and practice decision makers. We therefore conclude that there are opportunities to share lessons learnt between the countries and for joint research and knowledge exchange.

Key Words: Green infrastructure, Stormwater management, Sponge city, Sustainable urban drainage systems

The influence of riparian plants on river flow: implications for flow structures and drag

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Abstract: Vegetation is abundant in rivers and has a significant influence on their hydraulic, geomorphological and ecological functioning. Here we present a novel numerical representation of flow-vegetation interactions at the plant-scale, with a focus on riparian vegetation. The three-dimensional spatial distribution of vegetal elements, or plant volumetric canopy morphology, is accurately captured using Terrestrial Laser Scanning (TLS, Fig. 1a). The plant representation is then incorporated into a Computational Fluid Dynamics (CFD) model used to predict river flow, with vegetation conceptualized as a porous blockage. Model predictions are validated against laboratory flume experiments and analysis is extended to consider turbulent flow structures and the plant drag response.Results demonstrate the spatially heterogeneous velocity fields that are associated with the plant volumetric canopy morphology (Fig. 1b). The presence of leaves, in addition to the posture of the plant, substantially modifies the flow field dynamics. New insights into flow-vegetation interactions include the control of plant porosity, influencing 'bleed-flow' through the plant body, and the control of plant orientation on the flow structures that are present. Species-dependent drag coefficients are quantified; these are shown to be dynamic as the plant reconfigures and differ from the commonly assigned value of unity. The drag coefficients are used to re-evaluate vegetative flow resistance, with physically-determined Manning's *n* values applicable to conveyance estimators and industry-standard hydraulic models used for river corridor management. It is suggested that this improved process-understanding of flow-vegetation interactions at the plant-scale can help inform future river management practices.

Key Words: Eco hydraulics; riparian vegetation; flow-vegetation interactions; Computational Fluid Dynamics (CFD); drag coefficient.

Interaction between flow and sedimentation in vegetated channels

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Abstract: Vegetation is often observed on floodplains of mountainous rivers in Sichuan Province. The vegetation can locally change bed morphology and also reduce the conveyance capacity of rivers. Understanding the interaction between flow, vegetation and sedimentation is important for river restores and disaster prevention. The goal of this study is to investigate: (1) how channel velocity and stem-generated turbulence impact the deposition within and around an emergent vegetation patch, (2) how the height (h) and width (D) of a submerged patch of vegetation with high stem density influence the wake vortex structures and their impact on the deposition of suspended sediment, and (3) whether, or not, the presence of flexible trailing leaves enhances deposition. The velocity, turbulence and sediment deposition measurements were performed in an experimental flume to illustrate the influence of vegetation patch on flow, vortex and sediment deposition. The experimental results are given below. The Reynolds number threshold for stem-scale turbulence generation was determined as Re_d = 120 using velocity spectra and flow visualization. At high channel velocity resuspension occurred in the bare regions of the channel and a nonuniform spatial distribution of net deposition was observed around and within the patch. In contrast, at low channel velocity there was no (or limited) resuspension and a uniform distribution of net deposition was observed around and within the patch. The deposition inside the patch was enhanced, relative to a bare-channel control, only when the following two criteria were met: (1) the absence of stem turbulence, and (2) the presence of sediment resuspension in the bare channel. For a submerged patch of finite-width vegetation with high cylinder density, vortex structures in both the vertical and horizontal planes may occur in the patch wake. The distance over which deposition was enhanced (L_{Dep}) was strongly correlated with the distance over which velocity remained depressed within the wake (L_w), which in turn depended on the wake vortex structures. The aspect ratio $D = h$ determined the orientation of the vortices formed in the wake. For $h < D$, a vortex in the vertical plane occurred within a few patch heights downstream from the patch. If present, the horizontal von Karman vortex was initiated at the same position. The Karman vortex was absent for $h/D < 0.7$. For these cases ($h < D$), L_{Dep} scaled on the patch height. Specifically, L_{Dep} = (2.3 13$\pm$ 0.5) h. For $h > D$, the vortex in the horizontal plane formed first (closer to the patch) and controlled the velocity recovery within the wake. For these cases ($h > D$), L_{Dep} = (2.1 $\pm$ 0.4) D. In field studies, these relations can be used to predict the length of the region favoring deposition (L_{Dep}) from measured patch diameter (D) and height (h). For submerged vegetation patch with model flexible trailing leaves, the presence of the flexible leaves extended the wake length, which in turn increased the length of the deposition region.

Key Words: Vegetation; Patch; Wake structure; Turbulence; Sediment deposition

Measuring river water surface width at the national scale using remote sensing and statistical modelling

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2 British Geological Survey, Keyworth

Abstract: Water surface width (WSW) is a critical component in monitoring the spatial and temporal distribution of water resources, flood mapping, and traditional hydraulic geometry equations. Derivatives of WSW, such as river surface area, also play a significant role in the vertical transfer of greenhouse gases from rivers the atmosphere. Extracting a complete dataset of WSW at the national scale is limited by the spatial resolution of remotely sensed imagery, with narrow first-order headwater streams in particular frequently overlooked. To address this, two methodologies were created. Firstly, a combination of remote sensing techniques, namely fuzzy classification, one-class classification, and contouring, was applied to high resolution (sub-1m) colour infrared aerial imagery to derive super-resolution maps of surface waters. The methodology produced maps of sufficient accuracy to capture a significant proportion of headwater streams across mainland England and Wales, which were then measured using a semi-automated GIS-driven technique to produce a dataset of WSW. Secondly, image-based WSW measurements were used to train a predictive model that utilised widely available or easily calculable landscape variables capable of estimating WSW independently of high-resolution aerial imagery, which can prove costly to acquire at the national scale, particularly for multiple time periods. The multiple linear regression model accounted for a high proportion of the variation in WSW (adjusted $R^2 = 0.75$, $p < 0.01$). The main explanatory variables included catchment area, hydrological source of flow, rainfall, relief, and a metric quantifying the extent to which the river channel had been modified. There is significant future potential for the use of both of the above methodologies for the spatial and temporal analysis of WSW, particularly in regions where extensive hydrological monitoring networks do not exist, when the scale of investigation makes fieldwork impractical, or where coarse resolution remotely-sensed imagery would ordinarily introduce a significant degree of uncertainty in width measurements.

Key Words: Water Surface Width (WSW), headwater streams, colour infrared aerial imagery, super-resolution mapping, multiple linear regression modelling

Solving the Step Riemann Problem with the L-M Iteration method

Renyi XU

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Abstract: Step Rieman Problem (SRP) is the model of discontinuous in one-dimensional, free-surface Shallow Equations with a bed step rather than Homogeneous Riemann Problems (HRP). HRP have been highly researched and discussed and then several schemes such as Roe, Osher ASUM, etc. have been developed. However, real rivers have bed slope and other source terms in equations. SRP is the model considering the source terms. In the SRP, the static shock spilits the middle state into 2 parts, and then 2 more equations governing this static shock need to be solved. Combined with shock or rarefaction waves on left or right side, there are 4 conditions in SRP just like HRP, but the governing equations are added to 4 to 6, rather than 2 to 4 in HRP. In HRP, simple iteration methods such as Newton-Raphson method can get the good result. This does not work well any more in SRP. In this paper, the L-M iteration method is used and 4 conditions are discussed separately.

Key Words: Step Riemann Problem (SRP), Exact Riemann Solver (ERS), L-M Iteration, Shallow Water Equations (SWE)

Dynamic Management of Water Storage for Urban Flood Control via an Engineered Wetland System

Duan CHEN

Changjiang River Scientific Research Institute of Changjiang Water Resources Commission

Abstract: In this study, we assess the costs and benefits of dynamic management of water storage to improve flood control in a system of wetlands. This management involves releasing water from wetlands ahead of (e.g., a few hours or days before) a rainfall event that is forecasted to produce flooding. Each project site may present different challenges and topographical conditions, however as long as there is a relatively small hydraulic gradient between the wetland water surface and the drainage ditch (e.g., >0.9 m), wetlands can be engineered for the purpose of flood control. We present a case study for a system comprised of four wetland areas encompassing 925 acres in the coastal plain south of Houston, Texas. The benefit–cost analysis shows that, in general, the benefits of wetland ecosystems far surpass the costs of construction and maintenance for all considered periods of analysis and assumed degrees of dynamic management of wetland storage.

Interactions between hydrological and geomorphological processes and the built environment

Simon J Dixon

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Abstract: We are currently living in the Anthropocene. Although debate continues about the geological foundation of this concept it is undeniable that the Earth's landscape and the processes operating on it are influenced by the activities of humans. It is expected that soon more than half the global population will be living in cities. As urban development spreads an increasing number of people are being exposed to flood risk due to housing and infrastructure being sited in floodplains. At the same time, landuse is changing, altering the runoff responses in wider catchments and changing flood hydrology and flood risk in downstream urban locations.

Examining urban hydrology through the lens of the Anthropocene offers several important angles for consideration. The first is the impact of urbanization and changing land-use on flood hydrology. Secondly, the potential to engineer or target landuse within a catchment in order to mitigate flood risk – often referred to as a catchment based approach or "natural flood management". Thirdly, the way that natural hydrological and geomorphological processes interact with the built environment and engineered river channels to potentially create unique hybrid forms.

These broad questions then open up potential research gaps; what are the social drivers and impact of managing land use for flood mitigation in urban areas – it may be hydrologically possible, but is it socially feasible? How does landuse in urban environments interact with pluvial flooding events, and how is this influenced by informal settlements? Can we recognize and predict where geomorphological processes will interact with engineered channels and so design more adaptive and less fixed urban river channels, potentially reducing risk and delivering additional ecosystem services?

In this talk I will present results from previous and on-going work in these areas, but focus on outlining potential areas of mutual interest and future collaborations.

Key Words: Anthropocene, Land use, urban hydrology, catchment based management, fluvial geomorphology

Paleo-floods and archaeological implications: What can we learn?

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Abstract: Most Neolithic archaeological sites located along rivers or lakes, understanding the relationship between paleo-floods and archaeological sites are critical for human-nature interactions and also have significances for current flood prevention. Here we review four Neolithic sites in China: Longshan culture sites in Shandong, Yingpanshan in Sichuan, Haimenkou in Yunnan and Sanxingdui in Sichuan. Firstly, Longshan culture sites in Shandong were highly possible declined by floods due to hurricane storms in about 4200 BP, which was a period of strong climate fluctuations. Secondly, in high relief areas such as Minjiang River, Sichuan, dam-break floods can be 10 times larger than the largest recorded meteorological flood, as a results, floods could not relate to climate. Dammed lake was flood threating, however, a persistent, long-lived dammed lake may provide an idea sites for human, such as Yingpanshan (~5000 BP) along Minjiang River in Sichuan. Thirdly, Haimenkou in Yunnan located along Jianhu Lake, the disappearing of Haimenkou was 2300 BP, which was in accordance with the date of the flood deposits we found in the outlet river of Jianhu Lake, indicating it was highly possible that Haimenkou was destroyed by flood. However, the flood was considered to result from a seiche of jianhu caused by earthquake, instead of storm. Lastly, disappearing of a human culture site may not be necessarily related to flood, such as Sanxingdui (~3000 BP) in Sichuan. We conclude that cautions are needed to determine whether the disappearing of human cultures were related to paleo-flood, and if yes, we also need to check the inducement, especially dam-break in high relief area or surge waves along broad water area.

Key Words: Paleo-flood, Neolithic archaeological site, climate fluctuation, dam break, surge wave

Natural disasters, risks and coastal vulnerability:

A systematic study of the Indian Coast

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Abstract: The research examines vulnerability to disasters along the Andhra Pradesh coastal region of Indian. Coastal Andhra Pradesh has a variety of geological, geographical and bathymetric features and is exposed to numerous meteorological and hydrological hazards resulting in varying degrees of vulnerability. Despite this vulnerability, there has not yet been a rigorous evaluation of the risk to this coastline. This research systematically examined the causes and impacts of vulnerabilities and hazards in this region. The findings highlight that urban areas are at a particularly high risk of floods and cyclone damage due to tectonic shifts, local topological features and population density. The findings are significant for stakeholders who wish to reduce the impacts of disasters on the economy, society and environment of coastal Andhra Pradesh.

Key Words: Keywords: Vulnerability, disasters, risk, coastal Andhra Pradesh (CAP), floods, cyclones.

Self-Forming Longitudinal Sediment Streaks in Open Channel Flows

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Abstract: Bed load streaky structures is a common bed form at low or moderate flow magnitude. However, there is little research into their formation. Flume experiments were conducted to investigate low- and high-magnitude equilibrium transportation of uniform sediment under different flows. Image analysis techniques were used to identify the movement of sediment particles on the bed. The results show that low- and high-sediment movement is not uniform but alternates in the spanwise direction, and alternate lateral sedimentary ridges and troughs form in the spanwise direction when $0.048<\Theta<0.075$. These streaky structures are mainly located at the center of the tank and gradually diminish nearer to the side-walls. As Θ further increases ($\Theta>0.075$) or decreases ($\Theta<0.048$), the streaky structures gradually disappear. The spanwise distance between adjacent sediment ridges or troughs in different experimental conditions remains nearly constant and is equal to twice as the flow depth, which indicates that there is a close relationship between the streaky structures and large scale flow structures in open channel flows. Combing previous research with the results of our experiments, we suggest a sediment streak formation mechanism that draws on the theory of super streamwise vortices.

Key Words: open channel flow，sediment，coherent structures

Investigation of the urban fluvial microplastics:

A case of the Fenghua River Ningbo

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Abstract: Plastic fragments in microsize (<5mm) are known as microplastics. Nowadays, microplastics become an emerging type of contaminants in different environments. The abundances of microplastics have been well documented in marine systems, more research studies focusing on freshwater microplastics pollution lately. Human activities play a pivotal role on microplastics pollution. Such as, industries and factories are potentially contributing microplastics in urban environment, also a vast number of plastic products are consumed within the urban system. Whilst, cities often accommodate various sources of microplastics via industrial, agricultural, commercial and residential pathways. In this study, we focus the case in urban fluvial environment in China, which is the major source of microplastics in urban environment. Currently, it is not fully understood whether microplastics abundances may lead to negative influences on urban population and ecosystems, as there are only a few previous research studies have been devoted to the investigation of microplastics in the Chinese urban catchments. The study investigated the microplastics abundances in the case of Ningbo, and undertake a high spatial resolution investigation along the urban section on the Fenghua River, Ningbo. The results of this case will be influential via understanding the types of microplastics and their potential effects to aquatic environment. We will further investigate the conditions of microplastics and other pollutants in spatial and seasonal scenarios. The high-resolution microplastic occurrence data is expected to make a contribution to microplastics modelling in the future.

Key Words: Microplastics, Freshwater, Urban, River, Water Quality

Effects of Upstream Bridge Piers on Local Scour at Submerged Weir

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2 Department of Civil and Environmental Engineering, the University of Auckland

Abstract: River training structures are conventionally used to improve the river stability and ecological conditions, and protect the upstream instream infrastructures from being scoured and eroded. Submerged weir is a typical river training structure usually built downstream of bridges for grade control and the flow over which can cause local scour, destabilizing the structure and the trained river reach. Thus, for safe design, it is important to estimate the scour properly and understand the impacts of an upstream bridge pier on the local scour at submerged weirs. This paper experimentally studies the scour process at a submerged weir with an upstream bridge pier for different separation distances L. In this study, 49 experiments were conducted using uniform coarse sand with a median grain size d50 = 0.85 mm in a sediment-recirculating flume. The experimental results show that the pier-scour-induced bedform can create a scour-and-fill process upstream of the downstream submerged weir under clear-water scour conditions. The maximum upstream clear-water scour depth at the submerged weir increases with L for 2D ≤ L ≤ 12D, and decreases with L for 12D ≤ L ≤ 18D. Experimental results also indicate that the upstream pier can affect the downstream clear-water scour depth at the submerged weir through two mechanisms: (i) upstream sediment replenishment; (ii) flow section constriction. The mechanism (i) and (ii) can reduce and increase the downstream clear-water scour depth at the submerged weir, respectively. The reduction effectiveness of mechanism (i) increases with L for L < 6D and becomes zero at L = 6D. The increase effectiveness of mechanism (ii) decreases with L for L < 18D and becomes zero at L = 18D. For live-bed scour, the upstream pier can reduce the upstream scour depth at the submerged weir for L < 9D and becomes independent of the upstream pier at L = 9D. The upstream pier can also increase the downstream live-bed scour depth at the submerged weir; the increase effectiveness decreases with L for L < 6D and becomes zero at L = 6D.

Key Words: Bridge Pier, Experimental Study, Local Scour, River Training Structure, Submerged weir

Investigations into the application of urban Green Infrastructure to manage flood risk within a specialised experimental facility

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Abstract: The National Green Infrastructure Facility (NGIF) based at Newcastle University is a living laboratory with the core aim of demonstrating the value of Green Infrastructure and Sustainable Drainage Systems (SuDS) to offer multiple benefits to urban environments (*e.g.* flood risk mitigation, social amenities, improved air/water quality, *etc.*). The NGIF site consists of indoor SuDS laboratories and outdoor, fully-functional and heavily instrumented SuDS. This paper describes the on-going flood risk research activities conducted within NGIF, outlining experimental methodologies and results derived from the lysimeter setups, rain garden ensembles and large-scale urban swale which are based on-site. Methodologies and some preliminary results derived from the novel experimental facilities (lysimeters, rain garden ensembles and urban swale) are presented to aid in the understanding of soil-plant-atmosphere interactions and provide supporting evidence of the multiple benefits of urban Green Infrastructure derived from controlled experimental setups representative of field systems. Further, this paper discusses how historical and real-time experimental data (meteorological, hydrological and geochemical) can be accessed through the Urban Observatory portal.

Figure 1: (a) aerial view of lysimeter setups (bottom) and rain garden ensembles (top); (b) experimental testing of swale to high runoff volumes.

Key Words: Green Infrastructure, flood risk management, urban flooding, experimental modelling.

Climate change and hydropower impacts on fish habitat in the Jinsha River downstream of the Panzhihua City

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Abstract: Climate change and hydropower operations affect hydrological regimes at regional basin scales and impact hydrodynamics and habitat conditions for biota at the river reach scale. The middle Jinsha River is a crucial spawning site for Coreius guichenoti, an endemic and economically important fish. The spawning habitat has been influenced by dam construction and operation upstream and downstream of the river reach. The present study proposes a hierarchical modeling framework for modeling, predicting and analyzing the impacts of climate change and hydropower on fish habitats of Coreius guichenoti. The approach couples multi-scale climate, hydrological, water temperature, 1D/2D hydrodynamic and habitat suitability models and was applied to middle reach of the Jinsha River. First, the current impacts of hydropower construction and operation on spawning fish habitat were evaluated by a fuzzy-logic habitat model upon the modeling framework. Then, the future combined impact of climate change and hydropower operation on spawning and juvenile fish habitat were predicted. The results showed that (1) operation of constructed upstream dams have caused negative effects on spawning habitat suitability and produced temporal changes in the available suitable fish habitat area. The main spawning period may be delayed from May to June as a result, and variations in the water temperature regime were likely the main influential factor; (2) the impoundment of the under-construction Wudongde hydropower station downstream of the study area would increase the suitability of hydrodynamic factors. The suitable water discharge range would be extended the optimal water discharge for spawning would be decreased after the reservoir begins operation; (3) habitat suitability and available usable area for the fish is likely to increase due to climate change, and water temperature rising was the main influencing factor; (4) the negative impact of hydropower impact on fish habitat will be reduced by future climate warming, and the available habitat area for the fish would be expected to increase under the combined impacts of climate change and hydropower operation in the future. The present study provides a scheme to predict the impacts of climate change and hydropower on other organisms in river ecosystems. The results are beneficial for the development of long-term and adaptive conservation and restoration measures for aquatic ecosystems.

Key Words: fish habitat, hydropower impact, climate change, river restoration

The Demographic Implication for Promoting Sponge City Initiatives in Wuhan and a Reflection of Methodology used in Questionnaire

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Abstract: Urban surface water flooding (waterlogging) is an environmental issue exacerbated by urbanization and increasingly intensified rainstorms in Chinese cities such as Wuhan. In 2013, the Chinese government proposed a nationwide initiative, Sponge City, for managing the flood risk using the nature-based solution (NBS) approach. Wuhan has been selected as one of the thirty cities for implementing pilot projects. The effectiveness of implementing this policy relies on public participation.

This study aimed at investigating the viewpoints and knowledge of people in Wuhan on urban flood and Sponge City initiative. The Chi-square analyses of association revealed the demographic background of the participant, especially the education levels and residence time, affected significantly the understanding of the water environment and the governmental water management in Wuhan. Therefore, it is suggested that local government may need to work on educating the public about the objectives and expected outcomes of the initiatives. We also observed that factors such as age dictated the ways people accessing the information about environmental policies. Thus, the content and the advertising tools for promoting Sponge City may need to be mindfully selected to suit the dominant or targeted demographic groups in Wuhan to optimize effectiveness in promoting the policy and public participation.

Furthermore, the demographic characteristics in our survey samples may not completely reflect that in Wuhan. We propose applying the approach of weighted average to reconstruct the opinion pool to represent the overall understanding of Sponge City in Wuhan. The uncertainty of using the approach is also discussed.

Key Words: Sponge City, nature-based solution, urban flooding, public participation, environmental perception

Introduction of Delegates

Dr. Matthew JOHNSON

Matt is a fluvial geomorphologist with an interest in how aquatic organisms occupy, utilise and modify environments. He is currently working on projects focused on: The ability of animals to alter physical processes, such as sediment transport, in rivers; The sensitivity of river reaches to temperature change, with implications for the growth and development of aquatic animals, and; Identifying and quantifying the physical processes that partially control the distribution and activity of animals in rivers. Matt has expertise in the use of large laboratory flumes and has written European guidelines for the use of living organisms in hydraulic facilities. Matt's research also involves substantial field-based research, in addition to statistical and landscape modelling, and he currently maintains water temperature networks in the Peak District, Exmoor National Park and tributaries of the River Welland, UK. Matt also collated and now maintains an online database of published work on aquatic invertebrate-environment interactions as part of the EC-funded HYDRALAB IV project. He also sits on the technical advisory panel of the national climate adaptation program, Keeping Rivers Cool.

Dr. Wei LI

Wei Li is an Associate Professor in the Institute of Port, Coastal, Offshore Engineering, Ocean College at Zhejiang University, where she has been a faculty member since 2014. She got her bachelor degree at Wuhan University in 2007 and was a PhD candidate at Tsinghua University from 2007-2008. Due to China-Dutch international co-project, she continued PhD study in Professor Huib J. deVriend and Z.B. Wang's group in Delft University of Technology (the Netherlands) after 2008 and obtained her PhD degree at TU Delft in 2014. Her work ranges from theory to mathematical modelling to practical application. Her recent research interests are the hyperconcentrated flow in the Yellow River (especially the mechanisms of peak discharge increase in the lower reach and coupled modelling of flood processes in channel-floodplain reaches), interactions of flow, sediment and morphology in estuaries and tidal flats under intensive human interventions (e.g., Qiantang Estuary and Hangzhou Bay, Yellow River Deltaic Lobes), and numerical simulation of urban floods, etc.

Dr. Louise SLATER

Dr. Louise Slater is an Associate Professor in the School of Geography and the Environment, University of Oxford. She obtained her doctorate in Earth and environmental sciences (hydrology and fluvial geomorphology) from the University of St Andrews, UK. She was a lecturer at Queen Mary University of London and at Loughborough University before joining the University of Oxford in 2018. Louise's research interests are flood nonstationarity, statistical modelling and forecasting, fluvial geomorphology, and data science and big data approaches. She is particularly interested in (1) developing statistical methods to quantify changes in flood characteristics (nonstationarity); (2)

attribution of changes in flood characteristics (frequency, magnitude, extent) to changes in climate, land cover, and anthropogenic influences in the past and future; (4) the morphological adjustment of rivers in response to these same drivers; (4) developing statistical and machine learning flood forecasting tools for both hydrology and fluvial geomorphology (e.g. predicting change in channel conveyance and morphology). Louise's research has focused largely on rivers of the USA, but she is keen to work in other parts of the world. She cooperates with scholars from worldwide institutions including Switzerland (ETH Zurich), the UK (Loughborough), New Zealand (NIWA), the USA (University of Iowa, University of Connecticut, U.S. Geological Survey), Ireland (Maynooth, UCD), France (ENS-Lyon), and the European Centre for Medium-range Weather Forecasting (ECMWF).

Dr. Hongbin SHEN

Dr. Hongbin SHEN is a lecturer in the North China University of Water Resources and Electric Power. He received his doctorate in Hydraulic Engineering from Wuhan University in 2011 and carried out the post-doctoral research in Tsinghua University and Beijing Water Science and Technology Institute & Beijing Normal University from 2011 to 2013, and 2014 to 2016. Since 2017, he has been working in North China University of Water Resources and Electric Power. His research interests are sediment transport, fluvial geomorphology, urban hydrology and water resources, low impact development on urbanized area, environmental science and engineering. He is particularly interested in the variation of hydrological processes and morphological adjustment of rivers impacted by the climate change and human activities.

Dr. Muhammad AFZAL

Dr Muhammad Afzal is a hydro climatologist by training, recently joined a teaching position at Cardiff University Wales, UK. Before joining the current position, Muhammad Afzal worked at the Centre for Ecology and Hydrology Wallingford Oxfordshire as a "Hydrological Modeller and Water Resources Management Scientist". He has been involved in a number of research projects including NERC "Drought Risk and You", Newton Fund Project "Climate Change, Water Resources and Food Security in Kazakhstan" and EU "Water4Crops". His research specializes in the analysis of the impacts of climate change and variability on hydrological and water resource systems examining recent trends and future projections and their impacts on food security and drought risks using the hydrological & crop modelling approach. Muhammad Afzal completed his BSc and MSc from Pakistan in natural sciences and MSc in Environmental Management and PhD in hydro-climatology from Scotland. His PhD thesis was on "Changes in climate variability in Scotland and its effect on the reliability of water supply systems".

Ms. Lei LI

Lei Li is a PhD student at School of Geographical Sciences, University of Nottingham Ningbo China (UNNC). She completed the postgraduate study (MSc) at Imperial College London, at the Centre for Environmental Policy, focusing on Water management. She is currently supervised by Dr Faith Chan, an associate professor at UNNC; Ali Cheshmehzangi, head of Architecture Department at UNNC, associate Professor & Director of CSET (Center for Sustainable Energy Technologies) and Urban Innovation Lab; Dr Christopher Ives, an assistant professor at, School of Geography, University of Nottingham UK. Her research foci is on investigating how policy is formed, how decision-making occurs, and how implementation is delivered especially related to Sponge City and Green Infrastructure (GI). Lei's work focusses on the role of perceptions in sustainable cities, and the influence of various actors on the decision-making process with a better understanding of how to transit a more sustainable Sponge City with the influence of GI and NBS. She conducted qualitative research such as interviews and surveys to identify enablers and barriers of GI application from different stakeholders' perspectives in China and UK. Aligning an understanding of these approaches to planning underpins Lei's work on the planning and evaluations of Sponge City, Green Infrastructure (GI) as well as Nature-based Solutions (NBS). This examines the relationship between policy and practice in the discussion, development and evaluation. It also allows provides scope to evaluate the changing planning policy and its impacts upon the delivery of sustainable or meaningful places. By comparing and evaluating indicators and assessor tools for Sponge City and GI, multi-functionality of GI, trade-offs between ecosystem services (e.g. stormwater management, green space accessibility, air purification, heat island mitigation, social vulnerability and landscape connectivity) during the planning, design, and management of GI will be quantified. Transforming and further developing a functional GI for the promotion of SCP in rapidly developing Chinese cities are one of the biggest challenges for urbanization. It is necessary and worthwhile to research how to better modify and create a new design framework that integrating leadership, government, legislation and institutions commitment for Sponge City management that is absent but crucial at the current stage.

Dr. Rich BOOTHROYD

Dr. Rich Boothroyd is a Fluvial Geomorphology Research Associate in the School of Geographical and Earth Sciences at the University of Glasgow. He received his Bachelor's degree from Durham University in 2013 and his doctorate from Durham University in 2017. Since 2017, he has worked as a Hydraulic Modeller for an international flood-risk consultancy and as a Lecturer in Physical Geography at the University of Manchester. His research interests include fluvial geomorphology, ecohydraulics, remote sensing and numerical modelling. He is particularly interested in improving the process-understanding of flow-vegetation interactions in rivers, through application of Computational Fluid Dynamics (CFD) modelling and laboratory flume experimentation. This includes improving the representation of river vegetation (in-channel, floodplain and riparian) in numerical models and moving towards using vegetation as a tool for river management. More

recently, his attention has shifted towards tropical river systems. He is currently working on a Natural Environment Research Council (NERC) funded project: "Catchment susceptibility to hydrometeorological events: sediment flux and geomorphic change as drivers of flood risk in the Philippines". The project aims to: (i) develop a national-scale catchment characteristics database, and associated river geometry relations, to assess the susceptibility of different catchments to morphological change impacts on flood hazard; and (ii) assess flood hazards arising from morphological change associated with variations in sediment supply and the influence of lateral constraints on channel morphological adjustment.

Dr. Chao LIU

Dr. Chao Liu is an Associate Professor and a Doctoral Supervisor in State Key Laboratory of Hydraulics and Mountain River Engineering at Sichuan University. He is a Specially Recruited Expert of 1000 Talents Plan in Sichuan Province. He is a Vice Secretary General of 14th International Symposium on River Sediment. He was awarded the Robert Alfred Carr Prize from the Institution of Civil Engineers (UK). He won the First Class Prize for Scientific and Technology Progress of Chongqing. He completed his Ph.D. and undergraduate studies at Sichuan University between 2006 and 2015. Between 2014 and 2015, he was a joint program Ph.D. student in Massachusetts Institute of Technology. Between 2017 and 2019, he was a Visiting Professor in MIT. As a first or corresponding author, he has published 23 peer-review technical papers and 11 of which have been published in Water Resources Research, Journal of Hydrology and Advances in Water Resources. One paper was selected as the Cover Story of Volume 52, Issue 1 in Water Resources Research. He was invited to publish a paper in the 40th Anniversary Issue (2017) in Advances in Water Resources. He is the reviewer for more than 30 international SCI journals. He is the PI of 7 national and provincial research projects and the amount of those research fund is more than 3 million Yuan. He participates in 6 national projects and those research fund is more than 16 million Yuan. He has been invited to give 9 plenary and keynote speeches at International Conferences. He was invited to give an academic report in the University of Birmingham in 2017. His recent research interests are the interaction between flow, sediment and bed morphology in vegetated channels and the flow patterns and modeling in mountainous rivers with overbank flows. He investigated the complex wake vortex structure behind vegetation patches and proposed the critical stem Reynolds number for evaluating the presence or absence of stem-scale turbulence inside a vegetation patch. He also proposed analytical models for modeling velocity, bed shear stress and stage-discharge relation in mountainous rivers.

Dr. Liam CLARK

Dr. Liam Clark is a Teaching Associate in the School of Geography at the University of Nottingham, where he completed his doctorate in mid-2019. He also holds a BA in Geography and an MSc in GIS from the same university. Liam is a physical geographer with broad interests in remote sensing, GIS, fluvial geomorphology, and environmental modelling. His current research focuses on the

estimation of CO2 evasion from rivers to the atmosphere across England and Wales, using aerial imagery to capture a high-resolution representation of surface waters to help improve the parameterization of CO2 evasion models. Additional research interests include the spatial and temporal analysis of river width, using a combination of remote sensing and environmental models to analyse the causes and effects of width adjustment at the cross-section, reach, and catchment scale. His research also involves an appraisal of 'stage zero' river restoration projects, including an ongoing collaboration with researchers in Oregon and Washington state examining work undertaken at Whychus Creek near Sisters, Oregon.

Dr. Duan CHEN

Dr. Duan Chen is professor at Changjiang River Scientific Research Institute (CRSRI), a national non-profit research body affiliated to China's Ministry of Water Resources. He serves as vice director of International Cooperation Department of CRSRI and is responsible for promoting international collaboration for the institute. He is an associate editor of *International Journal of River Basin Management* and a member of editorial board for Water and Environmental Journal. He also serves in IWA/IAHR joint Committee on Hydroinformatics and EWRI-ASCE Committee on Environmental and Water Resources Systems. Dr. Duan Chen specializes in hydro-informatics and water resources system analysis. Over the years, he has applied and developed innovative approaches for efficient optimization on complex water resources and environmental systems under uncertainties. His experience include 13 years of hydraulic modelling, 6 years of environmental impact assessment, 6 years of reservoir operation modelling and 2 years of system dynamics and uncertainty analysis. He has published 50+ peer reviewed papers and co-authored three books. He has developed a computational framework and software for short-time control of multi-objective and multi-reservoir system under uncertainty. The software has been successfully applied to the Federal Columbia River Power System (FCRPS) in the United States.

Dr. Simon J DIXON

Dr. Simon J Dixon is a Lecturer (Assistant Professor) in the School of Geography, Earth and Environmental Sciences, University of Birmingham. He received an MSc in River Environmental Management from University of Birmingham in 2009 and a doctorate in Fluvial Geomorphology from University of Southampton in 2014. He completed two post-doctoral research fellow positions in morphodynamics and sedimentology of large river confluences and in the ecohydrology of boreal wetlands. His two key research areas are i) the interdisciplinary interface between ecology, hydrology, geomorphology and social science and ii) the interactions between humans activities and the landscapes of the Anthropocene, particularly the urban landscape. He is particularly interested in the system/basin scale flood hydrology and how land use and human activities can alter flood responses. In addition, how these changes in flood hydrology may be manipulated for flood mitigation, and the social drivers and barriers of land use change for flood management. His other main research area is in the movement of waste plastic in the urban environment through urban

drainage pathways. He is part of the recently established interdisciplinary working group “Plastic Encounters” – bringing together researchers from the Philippines, Indonesia, Australia and the UK to develop a programme of research in this area. He was a recent recipient of the Royal Geographical Society’s Area Prize at their annual awards for the paper “Ozymandias in the Anthropocene: The city as an emerging landform” which proposes an interdisciplinary model for researchers to collaborate on the interactions between the built urban environment and natural processes.

Dr. Niannian FAN

I am an associate professor in Sichuan University, China. I finished my undergraduate and PhD in 2009 from Sichuan University and 2014 from Tsinghua University, respectively. My research interest focuses on rivers, covers a wide scope from individual sediment particle motion to river evolution in tectonic scale, employing both flume experiment and field survey. I conducted field surveys from the high-relief upstream of major rivers to the coastal alluvial plain, from arid desert and Loess Plateau to humid sub-tropical forest. Specifically, I focus on the river and human interactions. I reported a typical ~30 ka old river capture event in Yimeng Mountains, China, which is in my hometown and I noticed there when I was a middle-school student. The capture event was published in *Nature Communications* (Fan Niannian, Chu Zhongxin, Jiang Luguang, Marwan Hassan, Lamb P. Micheal and Liu Xingnian. Abrupt drainage basin reorganization following a Pleistocene river capture. *Nature Communications*. 2018.9, 3756), and provide an ideal sites for both education and research.

Dr. Komali KANTAMANENI

Dr Komali Kantamaneni is a Research Fellow at Solent University. She completed her PhD at the University of Wales Trinity St David, entitled Assessing coastal vulnerability: development of a combined physical and economic index. Her research produced, for the first time, a combined vulnerability assessment based on physical science parameters and economic drivers. Komali holds an MBA in Business Studies from Cardiff Metropolitan University, and MSc in Environmental Sciences and a BSc in Biology from Acharya Nagarjuna University, India. Her varied academic background gives her a range of perspectives, and she engages with interdisciplinary and multidisciplinary projects such as coastal and water infrastructures, natural disasters, risk assessment and management.

Dr. Qiang ZHONG

I am an associate professor at College of Water Resources and Civil Engineering, China Agricultural University. He was educated at Sichuan University (B.E. 2008) and at Tsinghua University (Ph.D. 2014). He has done postdoctoral research in Tsinghua University and University of Notre Dame during 2014 to 2017. His research interests are the coherent structures in turbulence and the

interactions between them and environmental processes, and also the development of techniques, both experimental and analytical, to explore these structures. He published more than 30 papers in peer review journals, such as Journal of Fluid Mechanics, Water Resources Research, Physics of Fluids, Journal of Hydraulic Engineering-ASCE and Journal of Hydraulic Research.

Mr. Yuyao XU

I am a first year PhD student at the School of Geographical Sciences, University of Nottingham Ningbo China (UNNC). My PhD research topic is the microplastics pollution in freshwater environment. The freshwater environment in Ningbo is my case study in the project, the field site locations are Fenghua River, Yuyao River, Yong River and Dongqian Lake. Microplastics abundance in those waterbodies are investigated by using advanced detection techniques in aquatic environments. Currently, I am aiming to present my pilot results of the project such as the measurement of microplastics abundances in Fenghua River's surface water, and the preliminary data in this project at this workshop. In fact, I am planning to investigate further on the microplastics abundance data, for building up a (tailor-made) hydrological model for microplastics in freshwaters in this case study, which will be useful for using at other cases of microplastics extensively in other locations. This research study also aims to produce further recommendations for stakeholders and decision makers to understand the current microplastics in fluvial environment (via the case in Ningbo), in prior to issue further legislative policy documents on controlling microplastics pollution.

Dr. Lu WANG

Dr. Lu Wang is an Associate Professor in the State Key Laboratory of Hydraulics and Mountain River Engineering, Sichuan University (2018-now), majored in hydraulics and river dynamics. He obtained his PhD degree from the University of Auckland (2014-2018), supervised by Prof. Bruce Melville. His PhD topic is "Local scour at submerged weirs", for which he has experimentally studied the local scour process at sloped submerged weirs, the temporal evolution of clear-water scour at submerged weirs and the impacts of a downstream submerge weir on the local scour at bridge piers. His research has been published in International leading journals such as Journal of Hydraulics Engineering, ASCE and Journal of Hydro-environmental Research, IAHR. He is also a reviewer for Journal of Hydraulic Engineering, ASCE, Journal of Hydraulic Research, IAHR, Journal of Drainage and Irrigation Engineering, ASCE. His recent research interests are the scour countermeasures for grade control structures and the impacts of in-stream river restoration structures on sediment transport and river dynamics.

Dr. Daniel GREEN

Dr. Daniel Green is a Postdoctoral Research Associate working on the Urban Green DaMS (Design and Modelling of SuDS) project and is based in the National Green Infrastructure Facility at Newcastle University, UK. Daniel completed his PhD at Loughborough University, which focused on urban rainfall-runoff responses using physical and numerical modelling approaches, and has worked

as a NERC-funded Research Associate focusing on emergency responder accessibility during flood events, as well as a Senior Lecturer in Flood Risk Management at the University of Chester before moving to Newcastle University in August 2019. Daniel's research interests can be divided into three main areas: (i) flood risk analysis and resilience assessment, exploring the impact of fluvial and surface water flood events on urban infrastructure; (ii) modelling of urban surface water flooding caused by intense precipitation events using numerical and experimental, rainfall simulator based approaches, and; (iii) quantifying the influence of blue-green infrastructure and nature-based solutions to mitigate and attenuate flood risk in urban areas. Daniel's current position focuses on addressing a set of critical research questions relating to the design and modelling of bioretention cells to optimise sustainable drainage systems (SuDS) design and to develop robust and practical design guidelines for sustainable stormwater management.

Dr. Peng ZHANG

Dr. Peng Zhang is an Associate Researcher in the School of Water Resources and Hydropower Engineering, Wuhan University. He received her doctoral degree from Wuhan University in 2014 in combined research on hydro-environmental modeling and RS/GIS. Since 2014, he has been working on research about protection and restoration of aquatic ecosystems and organisms. His research interests include eco-hydro-hydraulic modeling, fish behavior and their ecological water requirement, climate change and human activities impacts on lake and river ecosystem, structure and function restoration of aquatic ecosystem, protection of rare and endemic species and machine-learning based species distribution modeling. He has published over 20 SCI and EI indexed peer reviewed papers. He is the PI of National Science Foundation of China (NSFC), the Natural Science Foundation of Hubei Province, China and several other projects, and has participated the Sino-Swiss project "Jinsha River Basin (JRB): Integrated Water Resources and Risk Management under a Changing Climate" as a core technical expert.

Dr. Yu-Ting TANG

Dr. Yu-Ting TANG is an Assistant Professor at the University of Nottingham Ningbo China. The research interests of Dr. Tang cover sustainable use of land resources. Previous research focused on the effects of brownfield on environmental sustainability and socio-economic sustainability, and on the selecting often economic indicators to evaluate the potential of brownfield origination, most of which the indicators were relevant to deindustrialization. For Ningbo where here research is currently based, she addressed the implication of historical water construction in the Ningbo urban area to the modern water management of coastal cities, as well as the demographic distribution of China and the sustainability of the country. Her current research covers issues of sustainable urban development, primarily focusing on developing methods investigating the connection and interaction between environmental transition and human society. For example, the way of implementing nature-based solutions to mitigate environmental disasters can affect and be affected by the perception and experiences of local people.

Dr. Shan ZHENG

Dr. Shan Zheng is an Associate Professor in the School of Water Resources and Hydropower Engineering, Wuhan University. She received her Bachelor's degree from Wuhan University in 2008 and doctorate in Hydraulic Engineering from Tsinghua University in 2013. Since 2013, she has been working in Wuhan University. Her research interests are sediment transport, fluvial geomorphology, flood control and hydraulic engineering. She is particularly interested in the morphological adjustment of rivers in response to extreme natural and anthropogenic disruptions, such as volcanic eruption, dam construction, artificial/natural river avulsion. Her research covers different rivers, including the North Fork Toutle River in Washington State, which was disrupted by the catastrophic eruption of Mount St. Helens, the middle and lower Yellow River affected by the construction and operation of dams, the channels on the Yellow River Delta which have avulsed many times, and the channel reaches of the Yangtze River upstream and downstream of the Three Gorges Dams. She is the PI of three projects funded by the National Science Foundation of China (NSFC) and several other projects, and is participating in two National Key Research and Development Projects. She has cooperated with worldwide scholars from the University of Nottingham UK, U.S. Geological Survey, Indiana University, and the University of British Columbia, etc.

Dr. Tingting HAO

Dr. Tingting Hao now is working as a water resources engineer in the Ewaters Environmental Science & Technology (Shanghai) Ltd. Her current projects mainly about spongy city, ecosystem-based adaptation measures for climate risks, water resources informatization and smart water in China. She received her PhD from the University of Auckland and the research topic is measuring and estimating evapotranspiration in a raingarden.

Accommodation and Conference Centre

The workshop will be held at Luo-jia-shan-zhuang Hotel near the Administrative Building in Wuhan University. It is located at the foot of the Luo-jia Mountain and has an elegant environment. The address is No. 483 Bayi Road, Wuchang district, Wuhan city, Hubei province, China. Tel: (027) 68752935. You could show the following address to taxi drivers to travel to the hotel:

武汉大学珞珈山庄（校内武大行政楼旁），湖北省武汉市武昌区八一路483号

Figure. Luo-jia-shan-zhuang Hotel

Travel

The following table shows the cost and time needed for taking taxi from the Luo-jia-shan-zhuang Hotel to the airport and railway stations in Wuhan.

Table. Communication between the hotel and airport and stations

From	To	Cost	Time needed
Luo-jia-shan-zhuang Hotel	Wuhan International Airport	~130 RMB	~1 hour 15 minutes
	Wuhan Railway station	~35 RMB	~25 minutes
	Wuchang Railway station	~40 RMB	~30 minutes
	Hankou Railway station	~80 RMB	~50 minutes

Weather

According to the weather forecast, the temperature at Wuhan during Aug. 22-26 would be between 28-37℃, which is about 82-99℉. The weather would be extremely warm and humid. Fortunately, air-conditioners help us to survive in Wuhan!

Contact us

Should you have any queries, you could contact the workshop convener Dr. Shan Zheng at Email: zhengs@whu.edu.cn or behappyshan@163.com or Tel: 8613072786098.

We have fantastic volunteers, who are graduate and undergraduate students in the School of Water Resources and Hydropower Engineering, Wuhan University. Please feel free to ask them for help.

Volunteers:

1. Xin Xu 许 昕 Tel.15927215993
2. Simeng Yang 杨思盟 Tel.15927571981
3. Yihan Wang 王一涵 Tel.15071276792
4. Yalian Zheng 郑雅莲 Tel.18360856732
5. Yuliang Zhang 张誉靓 Tel.13647216120
6. Xinhao Pan 潘鑫豪 Tel.15737151865
7. Chunjiao Huang 黄春娇 Tel.18269371302

Note

Welcome to Wuhan University!