

Volume 1, Issue 2

Nov 2018

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As with every year, the new YPN Cardiff committee has been elected and roles are as follow:

President

Stephanie Muller
MullerS1@cardiff.ac.uk

Vice-President

Jingjing Xue
XueJ7@Cardiff.ac.uk

Secretary

Bin Guo
GuoB2@cardiff.ac.uk

Social Secretary

Shahla Nassrullah
NassrullahSA@cardiff.ac.uk

Digital Content Manager

Catherine Leech
LeechC@cardiff.ac.uk

1. A Word From The New President

Another successful year is over and like every year we had to say goodbye to a lot of dear members. We wish every single one all the best for their future, no matter if they are writing up or starting a new chapter of their career. Every time students leave, new students also join our research group. We are happy to welcome all new research and visiting students to our network.

In this sense, we would like to say a “big thank you” to the old YPN committee who have done an amazing job in organising two mini-conferences and connecting the YPN further with the Water Research Institute. We are looking forward to maintaining and expanding this relationship further.

This year, an almost entirely new committee has taken over and we hope to bring a fresh wind into our network. Almost five years ago, the IAHR YPN was founded with the aim to strengthen academic and industry relationships. Since then, many links have been created which have been beneficial in creating contacts, and gaining and spreading knowledge. As a network in the broad field of hydro-environmental engineering we not only cover a wide range of research topics, we are all here to learn from each other and to help one another make the most out of our time here in Cardiff.

With this in mind, thank you to everyone who filled out our short survey to identify what our members are interested in and how we can support you. We are looking forward to a new year with opportunities to meet companies and researchers, visit field sites, and share our knowledge and experience; and of course a lot of social activities.

We wish everyone a Merry Christmas and a successful New Year!

-- Stephanie Muller

2. Events

Chartered Institution of Water and Environmental Management (CIWEM)

Welsh Branch

08/11/2018

The annual dinner of the CIWEM Welsh Branch was successfully organised in October, 2018 at The Royal Hotel, Cardiff. The dinner had great attendance as it brings together the representatives from corporate supporters as below:



Mott MacDonald

Arup

Atkins

JBA

As one of the key social events of the year, over 80 guests from industries or research institutions attended the event, which is the highlight of the institute's annual programme.

The evening commenced with a drinks reception which was then followed by the main event. People from different organizations all studying water engineering gathered together to share their experience and stories, with charming smiles on their faces. No boundary existed between students, researchers or consultants who came from prestigious universities and companies such as Atkins. It was an ideal opportunity to gain access to industry, ask any burning questions and even make friends with your future 'boss,' a rare opportunity on any other occasion.

Prof. Roger Falconer, Dr Michaela Bray and Jingjing Xue, as the representatives of Cardiff University attended this event and enjoyed a very pleasant evening, as shown in Figure 1.

A sumptuous three course dinner with tea and coffee served afterwards and a private bar throughout the evening, before the draw was made from the collection for WaterAid, to pick several winners from all of those who kindly donated. It showed a grand sum of more than £700 was made on the night, a fantastic effort.



Figure 1- CIWEM annual dinner. (Prof. Roger Falconer and Jingjing Xue)

The after dinner speaker, former Welsh Rugby Captain and British Lion, Rob Jones (MBE), then responded with a wonderful speech that included various highlights of his career with some insightful and humorous anecdotes, as well as some fast-paced quips that left many struggling to keep up before he finished!

It continued to flow until the early hours on what was a very enjoyable and successful evening.

A special mention to the sponsors of the dinner: Mott MacDonald, Arup, Atkins, JBA, without whom an event such as this would not be possible.

- Jingjing Xue

Hydro3D workshop

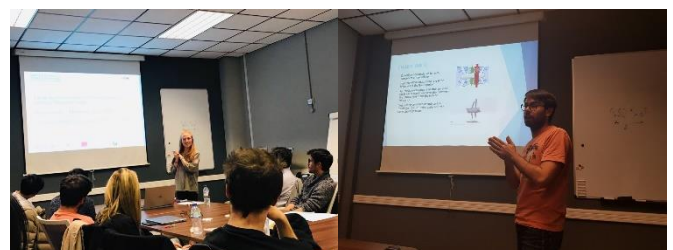
09/11/2018

Cardiff University was thrilled to host the first Hydro3D workshop on 9th November. The event gathered numerous PhD students, Research Associates and staff members spanning from Cardiff University, University College London, and Tsinghua and Hohai Universities in China. The main scope of the workshop were presentations from five current PhD students and the recently doctorated Dr. Ken Vui Chua all of whom work with the in-house large-eddy simulation code Hydro3D for their research. These presentations covered interesting topics ranging from bridge scour and sediment transport to fish behaviour in turbulent flows, which highlighted the variety of research fields of interest at the Hydro-environmental Research Centre. These were followed by an introduction to the capabilities of *LaTeX* and *Overleaf*, and updates of the *Slack* channel and *Github* repository by Dr. Pablo Ouro, Research Software Engineer of the Welsh Supercomputer.

This workshop was a fantastic experience for the early career researchers both to show their areas of expertise as well as to practice their presentation skills for future conferences opportunities. Future workshops will be organised by members of the Hydro-environmental Research Centre supported by IAHR Cardiff YPN on a 6-month basis, with the next workshop to be held in the Spring of 2019. We also hope to attract the attendance of professional organisations such as CIWEM and ICE in order to share the high-quality research carried out at Cardiff University.

The list of presenters and title of their work is as follows:

- 1 – Dr. Ken Vui Chua: “Large Eddy Simulation of Flow around Bridge Abutments”
- 2 – Valentine Muhawenimana: “Hydrodynamics of a cylinder wake with close boundary proximity”
- 3 – Filipa Adzic: “Large Eddy Simulation of a backward-facing step with synthetic eddy method”
- 4 – Chenwei Zhao: “Numerical Study of Saltating Mode of Bedload Transport in Turbulent Channel Flow Considering Shape Factors”
- 5 – Lucy Massie: “Large Eddy Simulation of Flow Around a Surface Mounted Cube”
- 6 – Arthur Hajaali: “Numerical CFD study on bulb turbine units”



- Pablo Ouro-Barba

3. New Members

01/11/2018

David Furnues



I chose to study at Cardiff University primarily because it offered me the chance to complete in-depth, independent research in the project I am interested in amongst leading researchers. It gave me the opportunity to study under one of the country's leading experts in my research field who could offer me sound advice and guidance. When I visited Cardiff University on an Open Day, I was greeted by friendly and approachable staff, willing to answer my questions. The university has a wealth of resources geared to my particular field of work, including its own departmental library. At Cardiff, research in my chosen field gives the opportunity to be involved in laboratory work and field work as well as working in partnership with Shropshire Council, Shropshire Wildlife Trust and the Environment Agency. Cardiff University has an excellent academic environment to provide me with the very best support to conduct my research and to acquire necessary skills and knowledge.

On arrival at Cardiff University, I learnt about the 'Doctoral Academy' and 'Languages for All' offering both day and evening courses, in order to improve upon my skills in other areas I am interested in. Facilities and learning resources provided by the university are second to none and if the university does not have what I am looking for, staff will go out of their way to help me find it. Cardiff University also offers many clubs and societies; I enjoy attending the Model United Nations society which has proven to be a good place to unwind and relax and to expand friendships.

01/11/2018

Chenwei Zhao



Hi, I am Chenwei Zhao, a PhD. student from State Key Laboratory of Hydro-Science and Engineering, Department of Hydraulic Engineering at Tsinghua University of China.

Now, as a joint PhD. student in support of China Scholarship Council, I will spend 6 months (from 3rd October, 2018 to 30th March, 2019) in the Hydro-environmental research centre (HRC) of Cardiff University under the host of Professor Thorsten Stoesser. Professor Stoesser is an expert in the research area of large eddy simulation who has published more than 80 papers in international scientific journals on field of computational fluid dynamics. Similar to him, my research uses the method of large eddy simulation to calculate the bed load transport. So I choose to join his team and come here to be a member of the HRC. I have been in Cardiff for nearly a month. The city is beautiful and I am attracted by the unique architectures here. Also, I am delighted to meet so many nice people here and become good friends with them. I hope that I can spend a wonderful time here during the following months. To learn, to improve, to enjoy!

4. Research Progress

Impacts of seasonal discharge variation and regulation by Three Gorges Reservoir on river-tide interactions in tidal river of the Yangtze Estuary

By Fanyi Zhang

Estuaries are transition regions between marine and inland rivers where hydrodynamic processes are controlled by oceanic tidal waves and fluvial discharges. Moreover, human activities, such as the growing number of water conservancy projects, have an increasing impact on estuarine hydrodynamics. However, these natural variations and anthropogenic impacts are not yet fully understood, especially for large estuaries.

In this study, the interactions between tidal waves and riverine flows in the Yangtze Estuary were investigated using the methods of numerical modelling and harmonic analysis. The focus of this study is on the characteristics of tides in the coastal area, seasonal variations in hydrodynamic process and impacts of reservoir regulation on tidal constituents in the tidal river.

The results indicate that in the coastal area, semi-diurnal and diurnal tidal constituents propagate in different directions along the coast and that the tidal waves in the coastal area are stationary, i.e. the amplitude and phase do not change in time. However, in the tidal river, significant seasonal variations in the water surface slope, water level fluctuations and damping process can be identified. In the dry season, the tidal signal can reach Datong station, >600 km from the estuary mouth, whereas in the wet season, the signal's reach is approximately 350 km. From the dry to wet seasons, the maximum decrease in the amplitude of the dominant M2 tide is approximately 0.3 m. The amplitudes of the tidal constituents do not decrease monotonically because of the complex interactions among the bed friction, river discharge and channel width convergence as well as energy transmission between the tidal constituents. Because the Three Gorges Reservoir is used to regulate seasonal discharge, the increase in the accumulated amplitudes of the six major tides can reach up to 0.1m in the tidal river reach.

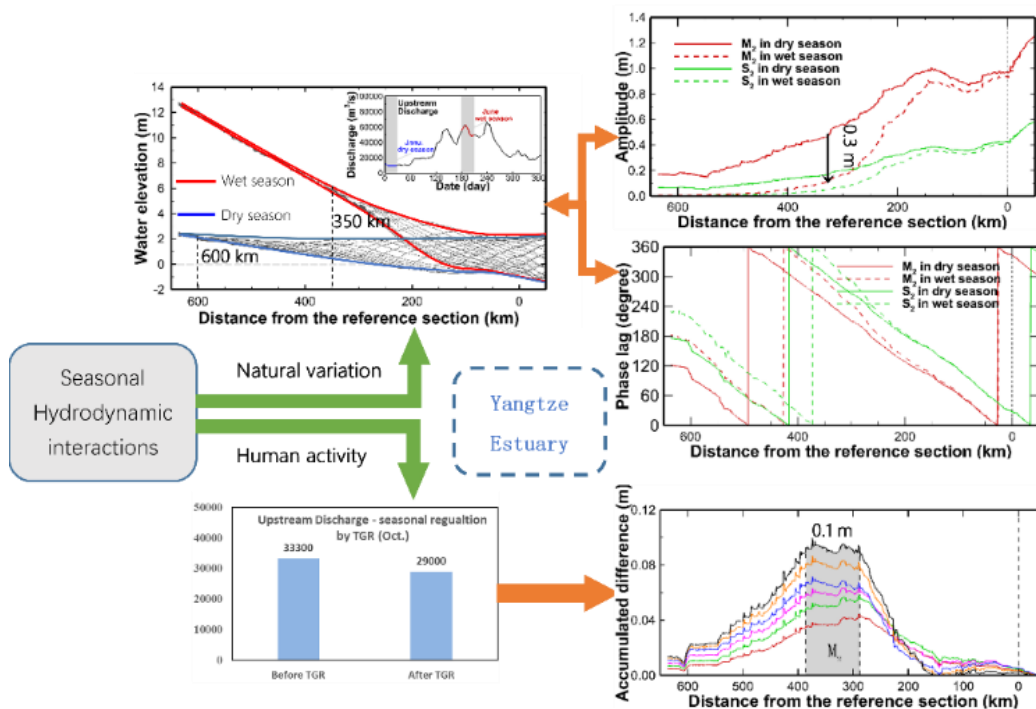


Figure 2- Seasonal hydrodynamic interactions between tidal waves and river flows in the Yangtze

Large eddy simulation of flow around bridge abutments

By Ken Chua

My PhD research project is motivated by the erosion phenomena around bridge structures which essentially leads to bridge failures, especially during extreme hydrological events. The objective is to elucidate the complex turbulent flow around these in-stream structures and attempt to resolve the turbulence structures within the flow field, which are highly energetic and possess high sediment entrainment capacity.

The method of Large Eddy Simulation (LES) is employed to simulate the flow mechanisms around bridge abutments in changing conditions. The level set method (LSM) is adopted in LES code to predict the complex water surface profiles. A straight natural river is faithfully represented in this study, which consists of an asymmetrical compound channel with a parabolic main channel and two variable-length abutments with sloped sidewalls and rounded corners, and a bridge deck.

The LES code is used to analyse the effect of bridge abutment length on the turbulence structure and flow field through the bridge opening. Extensive analysis by means of streamwise velocity contours, 2D and 3D streamlines, isosurfaces of Q-criterion, contours of wall-normal vorticity, probability density functions, quadrant analysis, power density spectra, and water surface elevation contours has been carried out and have shown significant differences between the different abutment lengths.

The findings attempt to contribute to the design of resilient hydraulic structures especially on considering the shape and size of an abutment.

The other part of the research is the investigation of flow mechanisms around bridge abutments under different scour conditions (i.e. pre-scour and equilibrium scour). Through 3D streamlines and contours of vertical velocity and turbulent kinetic energy, the equilibrium scour case reveals an increase in the three-dimensionality of the flow around the abutment in the scour region when compared with the flat bed case. Focusing on the near bed quantities, i.e. bed shear stress and near bed turbulent kinetic energy, the equilibrium scour case shows a significant relaxation at the vicinity of the abutment, indicating a drastic reduction in sediment activities.

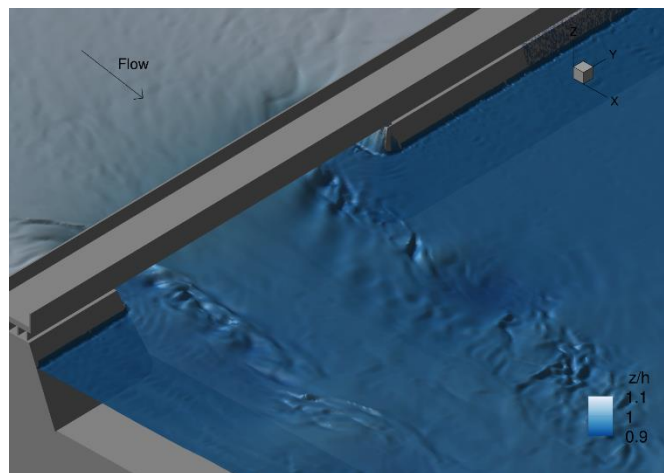


Figure 3: Simulated free surface deformations of flow through bridge opening.

5. Our Alumni

Ken Chua

A big thank you to the YPN committees for once again inviting me to contribute to the YPN newsletter. The YPN society provided a great platform for students in the HRC to learn about their fellow colleagues' respective research projects. The annual micro-presentation event has been very successful for students to share their research progress and at the same time practicing presentation skills for attending future conferences. The involvement from industrial partners like Atkins and Wallingford Hydro solution in these events has given meaningful insights of real-life engineering projects to the students. Apart from the academic benefits, the occasional social events organised by the YPN has undoubtedly contributed to a healthier work-life balance. I would like to take this opportunity to congratulate the newly elected YPN committees and wish them the very best for the following academic year.



Figure 4: A picture of Ken (middle) with his PhD viva examiners: (left) Dr. Catherine Wilson of Cardiff University, (right) Prof. Slobodan Djordjevic of University of Exeter.

- Ken Chua

Fanyi Zhang

I have been working in the HRC for almost one year since last November. People here are quite friendly and helpful. Although there were not many chances for deep research cooperation with my colleagues, I really learned a lot from the workshops, seminars and interesting chitchats with these cute guys. Thanks to Professor Falconer and my friends. I hope to see you in China in the near future.



Figure 5- Fanyi Zhang in main building, Cardiff University

- Fanyi Zhang

6. Future Events

3rd Dec 2018 **The Drought and Water Scarcity Programme**
The programme's research is UK-focused, and contributes to NERC's natural hazards and climate system strategic science themes.

12th Dec 2018 **HRC Christmas Dinner 2018**
The annual Christmas dinner of the Hydro-environmental Research Centre of Cardiff University will be organised at Y Dosbarth by the YPN committee.

7. Publications

1. Ouro Barba, P., Runge, S., Luo, Q. and Stoesser, T. (2019) "Three-dimensionality of the wake recovery behind a vertical axis turbine." *Renewable Energy*, 133, pp. 1066-1077, 10.1016/j.renene.2018.10.111
2. Alilou, H., Moghaddam Nia, A., Keshtkar, H., Han, D. and Bray, M. (2018) "A cost-effective and efficient framework to determine water quality monitoring network locations." *Science of the Total Environment*, 624, pp. 283-293, 10.1016/j.scitotenv.2017.12.121
3. Cevheri, M. and Stoesser, T. (2018) "Large-eddy simulation of a jet in crossflow using local mesh refinement." *Progress in Computational Fluid Dynamics, An International Journal*, 18 (3), pp. 137-149, 10.1504/PCFD.2018.091703
4. Chen, Q., Xia, J., Falconer, R. A. and Guo, P. (2018) "Further improvement in a criterion for human stability in floodwaters." *Journal of Flood Risk Management*, e12486, 10.1111/jfr3.12486
5. Chua, K. (2018) "Large Eddy Simulation of flow around bridge abutments." PhD Thesis, Cardiff University
6. Falconer, R. A., Angeloudis, A. and Ahmadian, R. (2018) "Modelling hydro-environmental impacts of tidal range renewable energy projects in coastal waters." In: Kim, Young C. ed. *Handbook of Coastal and Ocean Engineering*, World Scientific, pp. 1553-1576, 10.1142/9789813204027_0055
7. Fan, Y., Chen, S., Zhao, B., Pan, S., Jiang, C. and Ji, H. (2018) "Shoreline dynamics of the active Yellow River delta since the implementation of Water-Sediment Regulation Scheme: A remote-sensing and statistics-based approach." *Estuarine, Coastal and Shelf Science*, 200, pp. 406-419, 10.1016/j.ecss.2017.11.035
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12. Jiang, C., Chen, S., Pan, S., Fan, Y. and Ji, H. (2018) "Geomorphic evolution of the Yellow River Delta: Quantification of basin-scale natural and anthropogenic impacts." *CATENA* 163, pp. 361-377, 10.1016/j.catena.2017.12.041

13. Li, J., Pan, S., Chen, Y., Fan, Y.-M. and Pan, Y. (2018) "Numerical estimation of extreme waves and surges over the northwest Pacific Ocean." *Ocean Engineering*, 153, pp. 225-241, 10.1016/j.oceaneng.2018.01.076
14. McSherry, R., Chua, K., Stoesser, T. and Mulahasan, S. (2018) "Free surface flow over square bars at intermediate relative submergence." *Journal of Hydraulic Research*, 10.1080/00221686.2017.1413601
15. Muhawenimana, V., Wilson, C. A. M. E. and Cable, J. (2018) "Fish swimming kinematics in a turbulent wake: to spill or not to spill?" *E3S Web of Conferences*, 40, 03024. 10.1051/e3sconf/20184003024
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17. Ouro Barba, P., Fraga Bugallo, B., Lopez Novoa, U. and Stoesser, T. (2018) "Scalability of an Eulerian-Lagrangian large-eddy simulation solver with hybrid MPI/Open MP parallelisation." *Computers and Fluids*
18. Ouro Barba, P., Fraga Bugallo, B., Viti, N., Angeloudis, A., Stoesser, T. and Gualtieri, C. (2018) "Instantaneous transport of a passive scalar in a turbulent separated flow." *Environmental Fluid Mechanics*, 18 (2), pp. 487-513, 10.1007/s10652-017-9567-3
19. Ouro Barba, P. and Stoesser, T. (2018) "Impact of environmental turbulence on the performance and loadings of a tidal stream turbine." *Flow, Turbulence and Combustion*, 10.1007/s10494-018-9975-6
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21. Remesan, R., Bray, M. and Mathew, J. (2018) "Application of PCA and clustering methods in input selection of hybrid runoff models." *Journal of Environmental Informatics*, 31 (2), pp. 137-152
22. Zhang, F., Sun, J., Lin, B., and Huang, G. (2018) "Seasonal hydrodynamic interactions between tidal waves and river flows in the Yangtze Estuary." *Journal of Marine Systems*, 186

If you wish to request more information about the newsletter, please contact to:

- Stephanie Muller (President): MullerS1@cardiff.ac.uk
- Jingjing Xue (Vice president): XueJ7@Cardiff.ac.uk
- Bin Guo (Secretary): GuoB2@cardiff.ac.uk
- Shahla Nassrullah (Social Secretary): NassrullahSA@cardiff.ac.uk
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We're not that cool yet!

8. Spot the Difference

Can you find all 5 difference between the two pictures?

