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1. Introduction

The newly-elected committee of the Cardiff IAHR Young Professional Network are very pleased to bring you the first of our quarterly newsletters, in which we aim to bring news of recent and upcoming YPN events, and give updates on recent work going on, both from the academic and industry YPN partners.

It was agreed in the recent election that one of the main focuses for the new committee should be to improve industry engagement and collaboration, which is reflected in our upcoming proposed events to visit our industry partners and open up discussion further regarding the crossover between current industry projects and research going on in the Hydro-environmental Research Centre.

In what has been a busy couple of months for the new committee, we are delighted with the success of recent events, namely a workshop with CIWEM which gave an overview of routes to Chartership, and a micro-presentation evening focussing on the real-world application of the current research of our PhD students and Research Associates.

We invite all those who have received this newsletter to share it amongst your peers and colleagues, and extend an invitation to all to get in touch if you have any suggestions for improving the success and productivity of the network.

We look forward to further interaction with our industry partners, both in social and professional capacities, and with a busy calendar of upcoming events, are sure that this year will be a great success for the YPN.

2. Description of the Cardiff YPN

The Cardiff Young Professionals Network is a subdivision of the International Association of Hydro-environment Engineering and Research (IAHR). The network includes researchers from Cardiff University's Hydro-environmental Research Centre and young professionals from local companies who specialise in hydro-environmental engineering.

The Young Professionals Network evolved from the Cardiff University IAHR Student Chapter, which originally consisted of PhD Students only from the Hydro-environmental Research Centre (HRC). There are many student chapters in universities all over the world, and they were set up to encourage students to be active in the international hydro-environmental community. This was carried out through conferences, trips, research seminars and academic events.

In October 2013 the decision was taken to transform the student chapter into the IAHR Young Professionals Network, to include Research Associates. Furthermore, a new initiative was spawned in Cardiff: to broaden the Network to include local companies who specialise in hydro-environmental engineering.

As students we see far more benefits to this setup in comparison to the previous incarnation of the Student Chapter, and we think those benefits are mutual. We believe that anything we can do to strengthen the crossover between industry and academia is extremely valuable.

As part of these mutual benefits, we feel that we can offer an insight into leading edge research both from our own experience here at Cardiff University and also through our contacts and experiences at international conferences. Also this setup allows us, as students, to improve our understanding and knowledge of the application of hydro-environmental engineering.

3. Members of the Cardiff YPN

Cardiff Young Professionals Network is a young yet well-established association with 45 official members from Cardiff University and industry. Our activities are regularly followed by more people belonging to academic staff of the University, industry or students. The following list includes all the current members and their contact details, starting by a brief description of the people on the YPN board:

- Samuel Bray is the President of the YPN Cardiff. As PhD candidate in Civil Engineering, his work is focused on marine renewable energies, with special focus on the Severn Barrage project. (BrayS@cardiff.ac.uk).
- Bruño Fraga is Vice-President of the YPN. He did his PhD in 3D Computational Fluid Dynamics applied to rivers and open-channels. As Research Assistant he studies now the fate and prediction of oil spills and bubble-driven flows. (FragaB@cardiff.ac.uk).
- Pablo Ouro is the YPN Secretary. As PhD candidate he is applying some of the newest computational techniques to the study of renewable marine energy devices, specially focused on Vertical Axis Turbines. (OuroBarbaP@cardiff.ac.uk).
- Ken Chua is the YPN Treasurer. His PhD is focused on the treatment of the free surface flows in engineering problems. (ChuaKV@cardiff.ac.uk).
- Fernando Álvarez Martínez. He is the YPN Webmaster, who is in charge of the online presence of the organization. His PhD utilizes a new state-of-the-art approach to analyse the impact of coastal structures and the evolution of the coastline. (AlvarezMartinezF@cardiff.ac.uk).
- Luis Priegue is the Social Secretary of the Cardiff YPN. As PhD candidate he is doing the experimental tests and the whole technical design of a fully functional Vertical Axis Turbine for marine energy generation. (PriegueL@cardiff.ac.uk).
- Athanasios Angeloudis is the RA representative. He completed his PhD in Numerical and Experimental Modelling of Flow and Kinetic Processes in Serpentine Disinfection Tanks at Cardiff University. He is currently RA developing numerical models for coastal tidal lagoons. (AngeloudisA@cardiff.ac.uk).

- Amyrhul Abu Bakar is the Academic coordinator of the Cardiff YPN. As PhD candidate he is studying the integrated flood risk in several locations of Wales. (AbuBakarA1@cardiff.ac.uk).

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Becoming a member of the Cardiff YPN allows you to have updated information about our events and activities and news on Civil, Water and Environmental Engineering in Wales and South West England, plus a good networking environment. There are no liabilities, just the chance to join us whenever it fits your interests.

If you are interested in becoming a YPN member, just contact any of us. You can find information in our website (<http://hrc.engineering.cf.ac.uk/iahr-young-professionals-network>) and our Facebook or LinkedIn groups (IAHR YPN Cardiff).

4. Events

Among the recent activities we highlight the successful even co-organized with CIWEM:

CIWEM Micro-Presentation Evening

3rd December 2014

Faculty Lecture Theatre, Trevithick Building, The Parade, Cardiff, CF24 3AA

In collaboration with CIWEM Welsh Branch, the Cardiff Young Professionals Network (YPN) organised a micro-presentation event that allowed Ph.D. students and Research Associates from the Cardiff University Hydro-environmental Research Centre (HRC) to present part of their research in a 5-minute-'elevator-pitch' style.

There were in total 10 presenters, 7 Ph.D. students, 2 research associates and a visiting research associate from Tottori University, Japan. The event started with a welcome speech from the CIWEM Welsh Branch representative, Mr. Robert Keirle from

WRC plc. An event booklet, prepared by the Cardiff YPN was handed out to the attendees. Overall, this micro-presentation event was a huge success thanks to the attendance of over 40 audiences which consists of students, staffs and people from industrial partners, like Atkins and Celtic Technologies Ltd. Special thanks to Mr. Robert Keirle and the committee members of the Cardiff YPN for making this event happened.



Figure 1: Audiences filling up the lecture theatre.



Figure 2: Mr. Robert giving feedbacks and advices to the presenters after the presentations.



Figure 3: Picture of all presenters (from left to right): Ali Helu, Bruño Fraga, Rhodri Lucas, Pablo Ouro, Athanasios Angeloudis, Ademola Abigunbiade, Luis Priegue, Robert Keirle, Fernando Alvarez, Sam Bray, Sooyoul Kim, Amyrhul Abu Bakar and Reza Ahmadian

5. Research progress

In this section, the status of the research from two members of the Cardiff YPN or HRC is presented. In this first issue the Amyrhul Abu Bakar and Athanasios Angeloudis present the outcome of their research projects.

Model's tidal floodplain extensions – a better diffuse pollutants representation, *by Amyrhul Abu Bakar*

Water quality at recreational bathing and shellfish harvesting sites near coastal and estuaries are important to comply with the designated standard following the strict EU's water legislative published in December 2000. The failure of water quality to meet the design standard potentially causes pathogenic infections as human get contact to the water or consume shellfishes from it. In 19th century, more than quarter of the infected diseases were due to consumption of mussel bioaccumulated pathogens.

Pathogens entered the water system either through treatment outfalls or rivers as point sources, or from tidally inundated grazing saltmarshes as diffuse sources. Pathogens in the system will experience complex estuarine processes including particulate interactions, transports by hydrodynamic, and fates. As the pathogen loading from point sources especially outfalls can be accurately estimated, engineers facing difficulty in estimating accurate diffuse loading from tidal floodplains due to the complex entrainment process.

Loughor is a macro-tidal estuary located a part of the Bristol Channel with maximum spring tidal ranges up to 7.5 m near Burry Port. The area with the well-known shellfish harvesting and processing industries besides beaches and bathing waters, is preserved as the RAMSAR Special Protection Area including the Llanrhidian Marsh. This legally used saltmarsh for sheep grazing activities during low tides is suspected to cause pathogens dispersion from this animal faeces to surrounding waters when flooding, besides from Llanelli and Gowerton's water treatment plants.

A Bristol Channel and Severn Estuary hydrodynamic model was built and validated, then refined and extended over the highest spring tide covering floodplains at Loughor and surrounding waters. The aim is to have a better understanding in pathogens

transport and fate processes from diffuse sources with particulates interaction. The TELEMAC modelling system was used in driving model's hydrodynamics, with mass transport calibrations are conducted against measured bacteriophages that released at the study area.

The extension covering tidal floodplains at Loughor Estuary with multiple merging of bathymetry to the 2 m LiDAR digital terrain model (DTM). The grids refined to minimum of 20 m resolution for correctly capturing bottom elevations at difficult areas. The simulation with tracers released from Loughor Bridge indicate that the Llanrhidian Marsh will get flooded during high waters with the dispersed mass through the area. This work reported under the INTERREG 4A Smart Coasts and Sustainable Communities Projects.



Figure 4: Loughor Estuary with related water pollution issues from point and diffuse sources

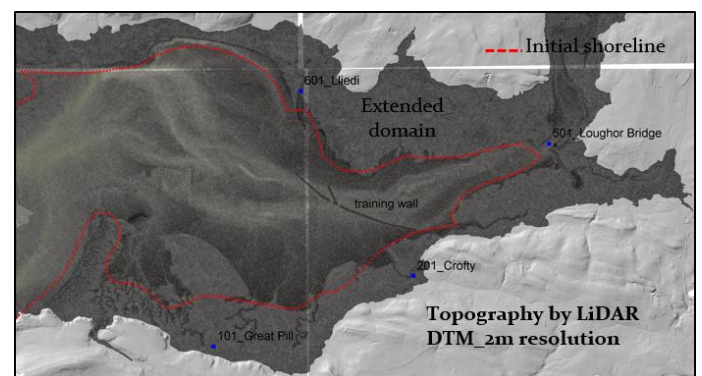


Figure 5: Tidal floodplain extensions with mapping to multiple bathymetry data sources

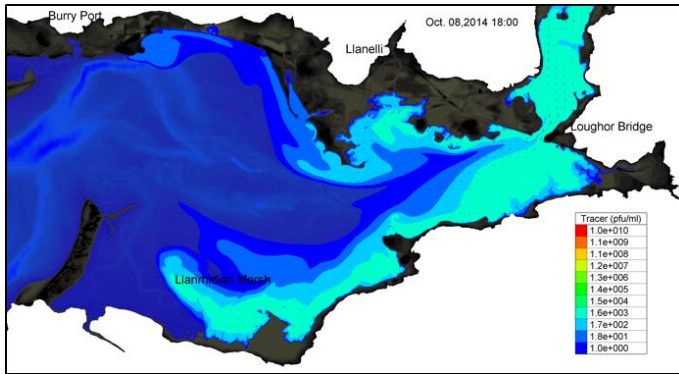


Figure 6: Wetted area during high water after 11 hours of tracers released from Loughor Bridge

Numerical Modelling of Coastally Attached Tidal Lagoons, by Athanasios Angeloudis

The UK has some of the largest tidal ranges in the world with the potential for extensive renewable electricity generation. In the light of commitments to meet EU renewable energy targets, there is an emerging interest towards marine renewable energy schemes, seeking to harness the energy resource available from the high tidal ranges recorded around certain locations of the Welsh coastline. The focus of this research examines (a) far- and near-field impacts of coastally attached tidal impoundments, (b) develops and refines tools for the assessment of their energy production as marine renewable energy devices and (c) examines the potential of this schemes to be used for flood risk mitigation. The research considers the introduction of four tidal lagoons along the North Wales Coast, and investigates the impact these might have on the established tidal flow conditions. The sample Fig. 7 below indicates how the flow pattern and the velocity magnitude near-field to the project site is altered within the presence of the lagoons.

In turn, according to the tidal flow conditions and the operation regime, the power harnessed from the turbines can be calculated according to their specifications, providing an indication of the energy generated over time as in Fig. 8, which considers a two-way generation regime.

Ultimately, an objective of this work is not specifically to suggest a particular lagoon design, but it is rather to inform future proposals in North Wales and beyond. Certain location characteristics are discussed with a view to demonstrate how they will

invariably dictate the lagoon impoundment shape and annual energy output and thus a framework can be developed that assesses hydro-environmental aspects of tidal range proposals.

The study is carried out as a part of MAREN2 project, which is part funded by the European Regional Development Fund (ERDF) through the Atlantic Area Transnational Programme (INTERREG).

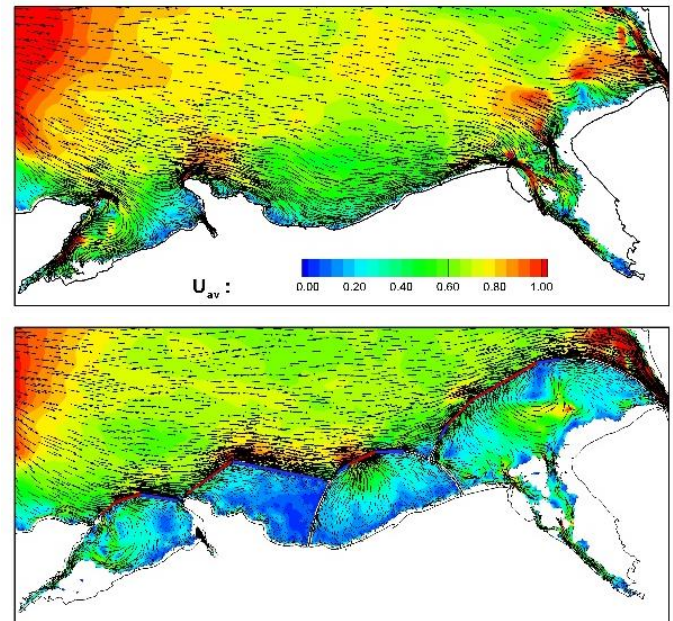


Figure 7: Velocity Magnitude and Flow Pattern without (top) and in the presence of the lagoons (bottom)

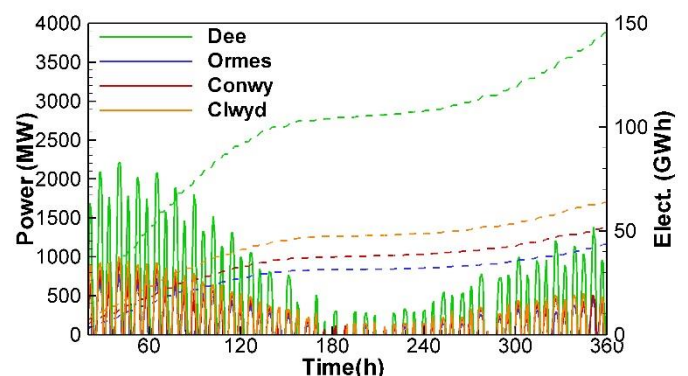


Figure 8: Power and electricity generation

6. Future activities.

As future activities that are undertaking in the following three months we can highlight:

Testing of a tidal turbine prototype

Tidal energy has become a very interesting power resource, although it is very complicated to test experimental modelling without the influence of the blockage effect. Aiming at a reliable source of information, a tidal turbine prototype designed at Cardiff University will be tested in a water sports centre at the Cardiff International White Water Centre. The white water rafting centre provides around ten meters of cross-section, enough to neglect any blockage effect and the flow speed can also be easily modified. The flow discharge can be varied from 4 to 10m³/s, with an estimation of flow velocities around 2m/s for the largest discharge. These facilities provide the unique chance of testing a tidal turbine in a very turbulent environment, in a similar way to the real world, but with the advantages of a complete control of the turbine deployment.

The prototype consisted of a vertical axis cross-flow turbine with three helical blades, 60 cm height and 40 cm of diameter. A 0.2KW generator was attached to the bottom of the turbine, generating real electricity that will be managed in an AC circuit where current and voltage will be measured. In addition to extract data from the electricity magnitude, a magnetic encoder was mounted on top of the shaft to enable the rotational speed record.

A concrete base was chosen to support the loads from the turbine and also to add stability to the structure. The base had an irregular octagonal shape, looking for structural support with independence of the forces summation, although the structure was designed to be more resistant in the flow direction.

These tests would be a crucial step for one of the most important projects for the Hydro-Environmental Research Department. If a high efficiency is achieved, the turbine would be scaled up and tested in a natural environment. In addition to this, new research studies would be required for future improvements.

These experiments will be carried out at the beginning of February, and everybody would be welcome to assist.

Industry visits

Two visits to the Cardiff offices of ARUP and CH2M HILL are planned. This meetings are meant to establish a stronger connection between academia

and industry, networking, discussing about project collaborations, etc.

Conferences assistance

Conferences where any of our members will be presenting their research are:

- 2015 Oil Spill and Ecosystem Science Conference. Houston, USA.
- 11th UK Young Coastal Scientists and Engineers Conference. Manchester, UK.
- 36th IAHR World Congress. The Hague, the Netherlands.

Social events

Several social events are planned for the following months such as: karting competitions, badminton and squash tournaments, etc.

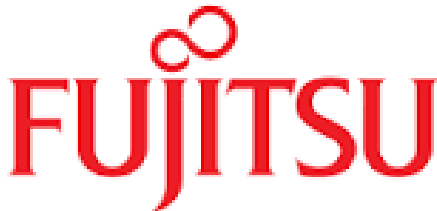
Annual CIWEM dinner

Members of the YPN will assist to the Annual CIWEM dinner on the 19th March at the Parc Plaza Hotel, Cardiff. This event help us to increase our presence in the CIWEM as well as strengthen our links with companies.

7. Special acknowledgments

All the research and project done by the HRC group to which the research part of the YPN group belongs to cannot be done without the funding from public institutions as EPSRC or NERC as well as private companies as CH2M Hill, Arup, Fujitsu, BP, Repetitive Energy. Some of the researcher undertake his job into European Union projects such as EU LCRI, EU MAREN and EU SMART Coast. We would like to thank all of them for the support. We hope that this collaboration extend in the future as well as we welcome more companies to collaborate with us.





Since 2014, the Cardiff YPN become closer to the Welsh branch of the CIWEM with the organization of events to show the research from the YPN members to other local and regional institutions and companies.



Engineering and Physical Sciences
Research Council



8. Publications

The publications from the last 6 months are:



Book Chapter:

1. Ahmadian, R., Falconer, R. A. and Lejeune, A. 2014. Hydro Power - Introduction. In: *Reference Module in Earth Systems and Environmental Sciences*. Elsevier inc., Chapter 6, pp. 1-12.



International Journals:

1. Fairley, I., Ahmadian, R., Falconer, R. A., Willis, M. R. and Masters, I. 2014. The effects of a Severn Barrage on wave conditions in the Bristol Channel. *Renewable Energy*. 68, August, 428-442.
2. Liang, D., Xia, J., Falconer, R. A. and Zhang, J. 2014. On the refinement of a boundary-fitted shallow water model. *Coastal Engineering Journal (World Scientific)*, 56(1), March, 1-19.
3. Liang, D., Xia, J., Falconer, R. A. and Zhang, J. 2014. Study on tidal resonance in Severn Estuary and Bristol Channel. *Coastal Engineering Journal (World Scientific)*, 56(1), March, 1-18.
4. Angeloudis, A., Stoesser, T. and Falconer, R. A. 2014. Predicting the disinfection efficiency range in chlorine contact tanks through a CFD-based approach. *Water Research*. 60, September, 118-129.
5. Brammer, J., Falconer, R. A., Ellis, C. and Ahmadian, R. 2014. Physical and numerical modelling of the Severn Barrage. *Science China Technological Sciences*. 57(8), 1471-1481.



In addition we are also thankful to HPC Wales and ARCCA from Cardiff University for providing access to the High Performance Computing resources required to continue our research.

6. Angeloudis, A., Stoesser, T., Kim, D. and Falconer, R. A. 2014. Modelling of flow, transport and disinfection kinetics in contact tanks. *Proceedings of the Institution of Civil Engineers, Water Management*. 167(9), 532-546.
7. Kadir, M., Ahmadian, R., Bockelmann-Evans, B., Falconer, R. A. and Kay, D. 2014. An assessment of the impacts of a tidal renewable energy scheme on the eutrophication potential of the Severn Estuary, UK. *Computers and Geosciences*. 71, October, 3-10.
8. Ahmadian, R., Falconer, R. A. and Bockelmann-Evans, B. 2014. Comparison of hydro-environmental impacts for ebb-only and two-way generation for a Severn Barrage. *Computers and Geosciences*. 71, October, 11-19.
9. Zhou, J., Pan, S., Falconer, R. A. 2014. Optimization modelling of the impacts of a Severn Barrage for a two-way generation scheme using a Continental Shelf model. *Renewable Energy*. 72, December, 415-427.
10. Xie, Z., Lin, B. and Falconer, R. A. 2014. Turbulence characteristics of free-surface flow over two-dimensional dunes. *Journal of Hydro-environment Research*, 3, August, 200-209.
11. Osei-Twumasi, A. and Falconer, R. A. 2014. Diffuse source pollution studies in a physical model of the Severn Estuary, UK. *Journal of Water Resource and Protection*. 6(15), 1390-1403.
12. Kadir, M. O., Bockelmann-Evans B. N., Rauen, W. B. 2014. Assessing the susceptibility of two UK estuaries to nutrient enrichment. *Continental Shelf Research*, 88, 151-160
13. Evans, P.S., Allmark M., O'Doherty, T. 2014. Are energetic tidal straits suitable for power generation? In: *Proc. 13th World Renewable Energy Congress (WREC)*, 4 - 8th August, London, UK.
14. Frost, C., Evans, P.S., Morris, C.E., Mason-Jones, A., O'Doherty, T., O'Doherty, D. 2014. The effect of axial flow misalignment on tidal turbine performance. In: *Proc. 1st Int. Conf. on Renewable Energies Offshore*, 24th - 26th November, Lisbon, Portugal.