

EPSRC Centre for Doctoral Training in Water Informatics: Science and Engineering (WISE)



ANNUAL REPORT 2016/17

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“ WISE CDT provides a unique opportunity for students to participate in shaping their own research topic. This, coupled with the wide range of skills they will acquire by completing all that the postgraduate school offers, makes them very attractive prospective recruits for the Water industry. ”

David Evans,
Director,
Natural Energy Wyre



Foreword



We are pleased to present the third Annual Report for the Centre for Doctoral Training (CDT) in Water Informatics: Science and Engineering (WISE).

We have had another successful year. Currently we are finalising recruitment for our fourth cohort of students, who will embark on their programme in September 2017. Our Advisory Board has continued to guide the WISE CDT on its strategic development and direction. I am happy that we have had a positive review from our funder – the Engineering and Physical Sciences Research Council (EPSRC). Particular highlights for the EPSRC include our industrial engagement, the cohort development across all our partner institutions and the interaction with the STREAM IDC. This is gratifying, as we can see that our original aims for the WISE CDT are already being realised.

It is important for WISE CDT students to engage in their studies, but also engaging with industry means that they are fully prepared for the whole swathe of career paths an engineer can choose – in either academia or business. You can read about our Industry Day at HR Wallingford, visits to industrial sponsors by students and seminars from key figures in water engineering.

The cohort development is vital to the WISE CDT, as it gives our students the capacity to learn from and support each other. This structure is the start of a framework of working relationships that will be immensely useful for the whole of their careers. The best example of this way of learning is our annual Summer School, which is an enjoyable way of seeing the progress made over the year for the staff as much as for the students.

At the WISE CDT we think it is crucial for students to have some broader skills too. To further this there is Transferable Skills Training, part of which is run in conjunction with the STREAM IDC.



Across the world there are many challenges that relate to water, whether they be flooding, water scarcity or maintaining infrastructure. I am very proud of the achievements of our students, who give me much confidence that they will be central to many of the solutions for these societal problems.

PROFESSOR DRAGAN SAVIC
Director WISE CDT

Engagement

The WISE CDT engages with industry through sponsored studentships, visiting speakers and outreach events, such as our Industry Day. The benefit of a sponsored or co-sponsored PhD is that a topic can be tailored to meet the objectives of business, while helping to solve societal problems and forwarding the student's research interests. For industrial partners there is access to the agile minds of students, supervised by world-leading engineers and scientists. Often these projects lead to highly skilled recruitment opportunities for industrial partners. This year there have been new studentships secured with Bristol Water, Welsh Water, RPS, Wessex Water and South West Water.

Public engagement is becoming increasingly significant for those in academia, as the impact of research is increasingly being measured. As a consequence, WISE CDT students speak at conferences and other events; this year there has even been a primary school visit. We also engage with the public through social media channels on LinkedIn, Twitter and a newly created Facebook page.

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INDUSTRY DAY

On 17 March 2017, the WISE CDT held a successful event that brought together its students with major organisations from the water industry and hydraulic engineering. WISE CDT students met key figures from over a dozen national and international organisations, such as Arup, Natural England and Thames Water. The event was hosted by HR Wallingford, an independent engineering organisation that specialises in water-related challenges. Speaking at the event, WISE CDT Director Professor Dragan Savic said *"Partnerships formed here will pioneer innovative approaches to understanding diverse problems that relate to water – whether it's disease, flooding, or our use of it."*



Poster presentations at Industry Day

Discussions were held on potential research that will directly tackle the challenges that industry and society face. Students pitched potential projects to industry representatives. These covered a huge range of issues such as adapting to sea level rises, assessing the risk of liver fluke and modelling tidal energy in some of the country's largest estuaries.

After the event, Chris Hughes, Europe Water Sector Director at Amec Foster Wheeler, said *"From an industry sector perspective, the quality of applied research, innovation and excellent standard of individual presentations provided a huge degree of confidence and inspiration that the WISE CDT research agenda is being aligned with the challenges facing practitioners charged with developing solutions around global water management."*

Professor John Banyard, who chairs the WISE CDT Advisory Board, added *"It's immensely satisfying that WISE students continue to support the economic, environmental and social strategies of business with their cutting edge bespoke research"*.



BRISTOL WATER STUDENTSHIP

Damian Staszek has an industry-sponsored place on the WISE CDT with Bristol Water and divides his time between the company and the University of Exeter. In his second year, Damian's project is on 'Optimisation of Supply Demand Balance Model under Uncertainty'. Damian explained his work "My work is involved with data delivery, completion and dissemination of data. I spend a significant amount of time working with the consultants who deliver the data input for my model. The current progress of the model is shared with Bristol Water during frequent team meetings."

In the last year Damian has spoken at two conferences – the First WIRC Water Science and Engineering in July 2016 at the University of Bath and at MaRIUS Drought Science and Management in September 2016 at the University of Oxford.

BRITISH WATER: OFF-MAINS SEWERAGE WORKSHOP

In March 2017, Olivia Bailey and Ioannis Markidis attended a workshop run by British Water to find out more about challenges for off-mains sewerage in the UK. There were thoughtful discussions with many in the water industry. The Environment Agency gave a useful overview of legislation regarding wastewater discharge in rural communities, and the approaches to tackling catchment pollution. Treatment consultants made the case for the good design and installation of septic tanks, as well as outlining the need for package treatment plants. There was a healthy diversity of organisations present; a representative for the National Trust spoke to Olivia and Ioannis about the responsibilities that come with managing the sewage from its historic properties. Quote of the day? Well, one speaker said that 'mankind has come so far with technology over the years, but still we are content to flush our toilets into a leaky trench'. It was an educational day for the WISE CDT students, who saw those from many organisations committed to working towards a common goal – the safe disposal of our sewage.

EUROPEAN WATER INNOVATION LAB (WIL)

In April 2017 Olivia Bailey attended the European Water Innovation Lab (WIL) on the coast of the Netherlands. This inspirational workshop brought together 40 young professionals from a variety

of backgrounds and cultures. They were trained to think holistically, design innovatively, and communicate effectively across cultures – with the ambition to develop future water leaders. By uniting young researchers, innovators, inventors, and entrepreneurs, WIL creates a platform to build new relationships in order to develop solutions to water problems across the globe. It was a rewarding week where Olivia was empowered to share her ideas, alongside the acquisition of new technical skills from others. Olivia said 'I left WIL feeling inspired and motivated to continue my PhD research and I'm very excited for my future career in water'.



POST EVENT RESPONSE PLANNING FOR SMART WATER NETWORKS IN UNITED UTILITIES

Eirini Nikoloudi, supervised by Professors Kapelan and Memon, is working with Dr Michele Romano and Kevin Woodward on a WISE CDT project co-sponsored by United Utilities. The aim is to develop new technology to support decisions made by the control room operators when responding to various events, such as pipe bursts and equipment failures, in the water distribution system. The starting point is the existing Event Recognition System (ERS) developed previously in collaboration between United Utilities and the University of Exeter. The ERS is able to detect and approximately locate various events occurring in the water network in a fast and reliable manner. Technology that can use this information and other data to determine the most effective response to an event is currently missing. It would also be useful to prioritise operational responses, especially in the case of multiple events. As part of this work, Eirini visited United Utilities at their head office in Warrington and met with other PhD students sponsored by the company. Eirini said "The WISE CDT makes the life of PhD students easier by building strong connections between them and industry"

"The WISE CDT makes the life of PhD students easier by building strong connections between them and industry."

Eirini Nikoloudi,
WISE CDT student

Olivia Bailey at WIL



Engagement

NATIONAL SCIENCE AND ENGINEERING WEEK – WHAT LIVES IN A DROP OF WATER?

Students Olivia Cooke and Ioanna Stamataki represented the WISE CDT as part of National Science and Engineering Week in March 2017, which cultivates the awareness of science in the UK. Academics within universities are continually encouraged to think about the potential impact of their research. Sometimes this includes public engagement.

Their event was all about inspiring agile young minds in two primary schools, with an imaginative workshop called “What lives in a drop of water?” The pupils were introduced to freshwater microbiology by using microscopes to look at the zooplankton that are easily found in pond water.

Olivia explained the children’s reaction when she and Ioanna announced that they study ‘Water’ “This seemed to confuse them at first. We then each briefly introduced our own work in a slide to show the wide range of work we do within ‘water’. We found ourselves challenged trying to explain our work and engage a completely different audience, but that is what made it interesting!” The children were excited to discover what lies within pond water. “One child found a water flea trapped in an air bubble and another type of species of zooplankton we hadn’t seen before in the lake; we still need to research what it really was. All the kids felt like a “real scientist” and wanted to discover something new under the microscopes- they were even giving names to their new discoveries.”

The enthusiasm the children had for the activity reminded Olivia and Ioanna that while doing research is vital, it is also very important to promote work through outreach with different audiences. Ioanna said “It was interesting to show them that a scientist is not someone dressed in a white lab coat with crazy hair. At the end of the workshop we were happy to have a few converts to water research, with a few children declaring they wanted to do this when they grow up and come to the University of Bath!”

Following this, Olivia and Ioanna are planning more outreach activities at different events during the Festival of Nature in June, including an “augmented reality sandbox”. With this, they hope to teach different geographic and hydrologic concepts through topography models.

WISE CDT Director, Professor Savic, said “*This workshop was win-win: Olivia and Ioanna learnt at first-hand the importance of presenting their work in an engaging manner to the public, whilst it is invaluable for children at an early age to have role models in science and engineering*”.



NATIONAL SCIENCE AND ENGINEERING WEEK – BATH TAPS IN TO SCIENCE

On 17 March 2017 as part of National Science and Engineering week, Ioanna Stamataki and Olivia Cooke played a key role in the Bath Taps into Science event on the University of Bath campus, where they are based. It is a local science festival for Bath and the surrounding area. Groups of children from local schools came along. Stalls from many disciplines were erected in the sports hall, including one from the Department of Architecture and Civil Engineering, which was organised by Olivia and Ioanna. It had 5 different activities, including making a rain cloud with shaving cream and food colouring. The children enjoyed wandering around the exhibits, inspired by the broad range of activities that science has to offer. Ioanna explains “All the experiments on our stall were a big hit, with the activity to decide which substance was best at cleaning pennies bringing out the competitive side of the children! Who knew ketchup would do as well as it did? The water filter that cleaned muddy water also seemed to impress them; we tried to get across the message of the importance of clean water. We will definitely be there next year too!”

WETSKILLS WATER CHALLENGE

In March 2017 WISE CDT students took part in the first UK Wetskills Water Challenge organised by the University of Bath’s Water Innovation & Research Centre (WIRC@Bath), in collaboration with the Wetskills Foundation. The event was like a boiler room for students and early-career professionals with a passion for water. It aims to promote collaboration and foster new partnerships by placing knowledge and cultural exchange at the centre of activity.

Bath hosted a group of 12 talented young water professionals from varied international and scientific backgrounds. Students from different disciplines worked together on potential solutions to real-world problems, tackling areas such as flood prevention, stakeholder engagement and resilient urban planning. WISE CDT research students Olivia Cooke and Olivia Bailey were heavily involved with the organisation of the Wetskills event, and they thoroughly enjoyed working with the students who attended the course.

“ WISE events throughout the year create a real family feeling across the CDT.”

Olivia Bailey,
WISE CDT student

The event was supported by high profile partners such as Wessex Water, the Water Authority of Delfland and the European Water Traineeships. Students on the programme benefitted from expert input from across the UK water sector, including Bath & North East Somerset Council, Wessex Water and the Environment Agency; this ensured their output was scientifically robust.

WISE CDT co-director Dr Tom Arnot said “It’s always satisfying for WISE CDT students to pull together with those from other backgrounds when solving problems. It’s something we encourage on the programme whenever possible, as it prepares them for both industry and academia where solutions are invariably collaborative.”

THE YOUNG WATER PROFESSIONALS CONFERENCE

The water sector recognised some years ago that it was ageing and that it needed fresh talent if it was going to solve future important challenges. With this in mind, the International Water Association (IWA), the largest international network of water professionals with members in 130 countries, began to actively push for higher visibility and empowerment of Young Water Professionals (YWP). The UK YWP Chapter is one of the strongest in the world. Its annual conference is one of the largest gatherings of YWPs, with around 180 attending the event which was hosted by WIRC@Bath, and it offers a tailored conference for professionals emerging in the water industry. In April 2017 WISE CDT students Olivia Bailey, Aidan Barry, Olivia Cooke, Barney Dobson, Ioannis Markidis, Mariano Marinari, Ioanna Stamataki and James Webber attended the IWA YWP event and either made oral presentations or displayed posters to showcase their research projects. In addition to the technical sessions, the students attended four workshops on career development, the power of data in the water sector, communication and public engagement, all facilitated by professionals in the water industry.

DEMAND FORECASTING WITH WESSEX WATER

Maria Xenochristou, supervised by Professors Kapelan and Keedwell, is working closely with Dr Chris Hutton from Wessex Water to develop improved demand forecasting methodology. Maria has used demand based data provided by Wessex Water from smart meters collected at half-hourly intervals for the period of several years from over 5,000 properties across the South West of England. It is particularly useful as the demand corresponds with household characteristics (garden size, rateable value, and council tax band), socio-economic data (ACORN groups and types) and weather data acquired from the Met Office (UK) and NOAA (National Oceanic and Atmospheric Administration – U.S. Department of Commerce). Maria is currently preparing a paper on a link between water demand and weather that will be presented at the CCWI conference in Sheffield in September 2017.



THE FUTURE OF UK COASTAL RESEARCH – 13TH UK YOUNG COASTAL SCIENTISTS AND ENGINEERS CONFERENCE

In April 2017 WISE CDT students Paul Bayle, Stephen Clee, Jonathan King and Laurence Hawker attended the 13th UK Young Coastal Scientists and Engineers Conference (YCSEC), which was also hosted by WIRC@Bath. The event provided a remarkable opportunity for the students to present their work to other leading scientists and engineers. Building on the success of previous conferences, this YCSEC brought together over 60 researchers from more than 30 UK and international institutions for two days of fascinating presentations and lively discussions.

Over the two day event, there were 27 outstanding presentations on topics including coastal tourism, beach morphology, wave processes, ocean engineering and port operations. Posters were displayed which facilitated thoughtful discussions during networking sessions. The WISE CDT students presented a mix of oral and poster presentations describing their work. The finale of the event combined business with pleasure at an entertaining conference dinner at the Tramshed in Bath.

EFFECTIVE BLOCKAGE MANAGEMENT WITH WELSH WATER

Sabrina Draude, supervised by Professors Kapelan and Keedwell, is working with Dr Emma Harris from Welsh Water who is co-sponsoring her studentship. The aim is to develop new cost-effective methodology for scheduling operational jetting of blockages, which will lead to reduction in blockage rates. The project will also improve the understanding of various factors impacting on blockage rates, including weather, customer behaviour and operational interventions undertaken, and develop new methodology for cost-effective scheduling of these interventions. This work represents a continuation of collaboration with Welsh Water on blockage detection and management, which started in a recently completed 2-year Knowledge Transfer Partnership between the two institutions. As part of the project, Sabrina and Professor Kapelan visited Dr Harris and her team in January 2017. Sabrina gained valuable insight into the current blockage reduction strategy at Welsh Water.

Student Experience



The experience of students on the WISE CDT programme is important for a holistic education. Studies on the programme are enhanced with foreign trips, conferences and our Summer School. There have been special seminars

with guest speakers from the water industry, which give WISE CDT students a valuable insight to how their research might apply to real-world problems. The Senior Management Team encourages feedback. In May 2017, Zoran Kapelan hosted a lunch for first year students on their completion of Postgraduate School, during which the year was reviewed in an informal context. The team is always pleased when students present at conferences.

SOUTH AFRICAN TRIP

Olivia Cooke travelled to South Africa in May 2016 to research storm run-off in an informal settlement. Enkanini, which lies just one mile outside Stellenbosch, was recognised as an informal settlement in 2006. A basic water and sewerage network was introduced in 2009. Since then, Enkanini's population has been increasing rapidly due to urbanisation in the area. The existing facilities of four toilet blocks and 36 taps are not enough to sustain the community. As the settlement grows, access to the facilities becomes more difficult. Residents use the local river for easy access to a water supply. Some residents far from the facilities also use the surrounding bush instead of going to the toilet blocks, which leads



to raw sewage being washed through the settlement by stormwater runoff and into the river. Olivia's research will analyse water chemistry and pathogen transport to help understand the circumstances that led to water contamination. Understanding the reasons behind water contamination during the wet season is the first step to developing preventative measures against the spread of disease. Olivia joined researchers from Stellenbosch University's Water Institute, working with Dr Wesaal Khan, a microbiologist at Stellenbosch University, to carry out microbial analyses. Olivia is furthering her research by undertaking a second visit to South Africa in May 2017.

YPN CONFERENCE IN CARDIFF

In May 2017 a team of WISE CDT students from Cardiff University helped organise a conference as part of an established project – the Cardiff Young Professionals Network, which is a subdivision of the International Association of Hydro-environment Engineering and Research (IAHR YPN). This year the 'micro-presentation' evening took place with the help of several high-profile figures from organisations in the water industry: Tracey Dunford (CIWEM), Gillian Steele (ICE Wales Graduates & Students) and the Institute of Water were all there. Not content with delivering the conference, WISE CDT students presented during the evening too.

The evening was a successful one, with 30 people from both industry and academia attending. There was a vast range of topics, including the areas of wastewater, sea level rises, weir removal and flood dynamics. 'Micro-presentations' at this event meant sticking closely to a 5 minute 'elevator-pitch' format – Dragon's Den style. This made for a dynamic and dramatic evening. Although daunting for students, it was useful preparation for the world of work where this format has become increasingly popular.



WISE presentation at the YPN Conference in Cardiff

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“It was a huge pleasure working with WISE students. They presented clearly and concisely, and plainly understand how to make their research relevant to industry.”

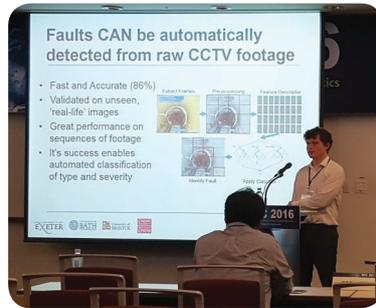
Tracey Dunford,
CIWEM





DETECTION OF STRUCTURAL FAULTS IN SEWER PIPES

Josh Myran's work, supervised by Professors Kapelan and Everson, concentrates on automating the detection of structural faults in wastewater networks. This work looks at how the current surveying techniques could be sped up, using computers to automate segments of the process assisting engineers in the field. Recently, the fault detection technology was successfully validated on CCTV footage provided by the City West Water in Australia and the Helsinki Region Environmental Services Authority HSY in Finland.



In August 2016, Josh attended the 12th International Conference on Hydroinformatics (HIC) in Incheon, South Korea where he presented an earlier version of his research to leading international experts. HIC focusses on the application of modern computing techniques to problems faced in the water industry. Over the course of the 4 day conference many academics and representatives from industry presented their work, covering a broad spectrum of water related issues. In November 2016 Josh presented his work at the 14th International Computing and Control for the Water Industry Conference (CCWI) held in Amsterdam, The Netherlands. The conference theme was 'water systems modelling and control with special attention to translating and applying the scientific work in practice'.

In April 2017, Professor Zoran Kapelan gave a talk at the SMi's 6th Annual Smart Water Systems conference in London. It was based on an ongoing research project with Josh Myrans. The team has been working closely with Julian Britton, Rehabilitation Manager at Wessex Water, to develop new technology for automated detection of structural faults in sewer pipes by using standard CCTV footage, image processing and artificial intelligence techniques. The same technology was also presented recently by Professor Kapelan at the Smart Water Network (SWAN) Forum in London in May 2017 and at the EWRI congress in Sacramento USA (May 2017), as part of respective smart water panels.

SUMMER SCHOOL

Students and staff enjoyed the second annual WISE CDT Summer School organised by the University of Bristol, which took place in June 2016 in the idyllic setting of Eastwood Park in Gloucestershire. Students from two years of intakes decamped to the countryside for a week of presentations, social activities, challenges and an eclectic programme of the best speakers from the water industry. Arthur Mynett (UNESCO IHE), Ian Law (Wessex Water) and Robert Muir-Wood (RMS) all spoke at the event. All the work and play were captured on a short film that was specially commissioned by the WISE CDT, which can be viewed at wisecd.org. WISE CDT student James Webber said "The annual residential summer schools are great. These are a brilliant opportunity for students and academics to get together and review the year."

One of the WISE CDT programme's great strengths is that it places emphasis on the value of collaborative working; with students from two cohorts and four institutions, the Summer School's 'Hackathon'



WISE CDT students enjoy a raft building challenge at Bristol Harbourside

Student Experience

Challenge is perhaps the best example. Students were tasked with developing a platform to solve a water-related problem currently being faced by wider society. This time the inspiration was from contemporary contamination incidents in the media at the time - water terrorism. All participants considered a number of questions, such as 'can companies use a smart sensing system to provide early warning of contamination?' And, 'how do we manage the trade-off between number of sensors, sensor location, cost and risk of contamination?' The winning group developed the application of a smart sensor network to provide near real time management of WDS contamination. The team - which was made up of James Webber, Stephen Clee, Ioanna Stamataki, Rosanna Lane and Ludovica Beltrame - were the proud recipients of the coveted WISE CDT trophy. The judging panel was impressed with a solution that was based on management approaches and a communication system between the water companies and their customers.

There was also a chance for students to present their research project idea to representatives from the water industry, some of whom were potential supervisors. Fun was had during a challenge at Bristol Harbour-side; students designed, constructed and sailed on a raft.

The week culminated with a special dinner, during which prizes were given for the best overall mark and most supportive student.

WISE CDT SEMINAR FROM WAGENINGEN PROFESSOR



In February 2017 Jan Vreeburg visited WISE CDT students in Exeter for a special seminar; he is Associate Professor at Wageningen University. Jan Vreeburg is an expert in the field of distribution of potable water, water quality in the networks, asset management and new concepts for design and operation of networks.

Professor Vreeburg spoke on his past, present and future work. In particular, on a theme he calls 'Water Out, Shit In'; originally sewers were designed to transport as quickly and as far away as possible, leading to large sewers. Now there are other requirements in resource recovery, demanding small concentrated flows that are treated for maximum recovery. He explained how this demands a paradigm shift and a gradual transition process. In each domain in the urban waste water cycle, adjustments and new techniques are being developed.

"Discussing with WISE students is a pleasure - they are curious, intelligent and full of passion for their subject. It was worth the trip from Holland."

Professor Jan Vreeburg



The winning team in the Summer School Hackathon

TRANSFERABLE SKILLS TRAINING



The WISE CDT helps students tackle workplace challenges that they could face as they enter their careers as engineers, with structured provision of transferable and leadership skills. For each of the four years there is a course held at each of the partner universities. These cover a wide variety of topics such as entrepreneurship, writing grant applications and

professional etiquette. For example, in April 2017 WISE CDT students in their first year joined up with another centre for doctoral training, STREAM IDC, for a special three day event at the University of Exeter. Experts from the University gave students of both programmes a lively balance of transferable and leadership skills. The topics were varied. Dr Neil Hayes spoke on Patenting and Intellectual Property – an area of interest to engineers facing a career in industry. Some areas of discussion were more general. For example Dr Caitlin Knight explained the usefulness of marketing and communications for those who work in science and engineering. After the event, the WISE CDT Director Professor Dragan Savic said “While it’s hugely important that WISE CDT students focus on their academic studies, we have always believed that preparation for the world of work is vital too. Skills in negotiation, commercialisation of research and developing a business model are useful for engineers in industry”.



“We have always believed that preparation for the world of work is vital.”

Professor Dragan Savic,
Director of WISE CDT



XP SOLUTIONS SEMINAR

David Fortune presented a seminar on Informatics in the Water Industry at the University of Exeter in February 2017. David is Director of Innovation at XP Solutions. He was formerly Director of Product Management at Wallingford Software. Part of his role is to manage the teams that design and deliver engineering software systems. He explained how his main speciality is in water management, including stormwater system design and modelling, asset management and telemetry. He looked at the scope of the water industry and considered some of the key problems that the industry needs to solve. David also considered where IT is used for engineering in the industry and, in particular, the role of mathematical modelling software. Students found his advice on career paths in Water Informatics particularly useful.

Student Case Studies



Lina Stein

UNIVERSITY OF BRISTOL

What makes the WISE CDT most interesting for me is the combination of a postgraduate school with a PhD. I had not planned on continuing with a PhD after my Masters, however the chance to expand my knowledge in the field of hydroinformatics, and then apply this in an in-depth research project was exactly what I was interested in. The particular advantage of the taught postgraduate school for me was that with my background in hydrology, my expertise in the water industry were limited and it was therefore good to get an insight into their working principles and methods. Even though the PhD topic itself is of course very specific, it is most helpful to learn about both the requirements of other fields in water science and their approaches to problem solving, as this drives the thought process towards potentially interdisciplinary solutions in my specialised research area of flood estimates. The skills acquired will surely also prove beneficial for a possible later career outside academia.

The interdisciplinary approach of the programme is supported by the diverse range of nationalities and backgrounds of the students. With geography, physics, hydrology, civil engineering and computer science and other disciplines represented in the cohort, there is a wide array of experiences and problem solving approaches. This creates an atmosphere of mutual help and a tight-knit group of friends. The close contact will hopefully persist in future years, spanning a research network over four universities as everyone is aware of each other's current research topic. I have chosen to focus on developing a global method to improve flood estimates in ungauged catchments, a topic which I have been continuously developing with support of my supervisors in Bristol, Ross Woods and Francesca Pianosi. Potential research outcomes could be of interest to a range of applications, one example being consultancies that develop global flood models. Being part of this network of contacts to companies and other research universities will hopefully advance my research. Everyone I talk to, be it industry representatives, researchers both in Exeter at the Centre for Water Systems, and at the other universities as well as the students from my cohort and other cohorts, teaches me something new and interesting. This is for me the real highlight of the WISE CDT.



James Webber

UNIVERSITY OF EXETER

James' work is associated with the EPSRC funded 'Safe&SuRe' project, which aims to promote and develop sustainable and resilient urban water management. His research project focuses on developing a decision support tool to manage performance, sustainability and cost when scoping flood management interventions. The framework uses accessible data, simplified representations of interventions and an efficient flood model to create a rapid assessment tool. The speed and simplicity of the tool lend itself to developing evidence for decision support prior to detailed design. The framework is currently being applied to real world case studies, and expanded to include resilience assessment and calculation of multiple benefits.

Over the last year James has forwarded his career by presenting whenever possible. He chaired discussions at the Young Water Professionals conference in Bath with participants from the water industry, academic institutions and European government organisations. Following a presentation at the Safe&SuRe Steering Group meeting, James was invited to present to Northumbrian Water. James is also keen to make the most of the WISE student experience “During each year of the CDT programme, students attend a Transferable Skills and Leadership module. These modules cover subjects from supervision skills and media relations to writing papers and publishing and from thesis writing and entrepreneurship to preparing for a viva. Last year, my course included a session on presenting skills from an acting coach, which gave us a completely different angle!”

The CDT also offers a great opportunity to travel, explains James “I’ve had the chance to take part in a research exchange visit to the National Taiwan University in Taipei, undertaking research into typhoons and flood risk. I’ve also visited the Indian Institute of Science in Bangalore and Lyon to attend a conference.”



Dolores Gonzalez

UNIVERSITY OF BATH

Dolores has experience working in wastewater treatment, in both industry and academia. As an undergraduate she studied at Complutense University of Madrid (Spain) and at DTU (Denmark) where she specialised in biotechnology and electrochemistry. Her Master’s thesis focused on using electrochemistry and bioelectricity to improve waste water treatment. It was published as a paper in Water Science and Technology as ‘Submersible microbial fuel cells for electricity production from sewage sludge’.

The adaptability and student experience attracted her to the WISE CDT “The projects are flexible and take into account prior study interests. The taught programme is varied; the learning is helped by the international reputation of the Professors. I was attracted to the city of Bath and the stipend provides me with stability” she said “The diversity of the students means that we learn a lot from each other – some have had professional experience and others haven’t”. All students spend the first year in Exeter “It’s awesome. There are many resources at the university. It’s a cosy city and is very convenient. It’s in the prettiest area of the UK”.

It’s important to Dolores to be able to develop her final project in a real-life context; that’s because she has an established background in industry. On graduation, Dolores worked in the gas and oil industry at Repsol in Spain. Her work involved the improvement of the effluent quality at a treatment plant and the recovery of hard-metals by chemical means. Dolores has built upon this experience with new skills learnt through the WISE CDT for her main project. It is focused on the development of continuous, real time and autonomous biosensors for water quality monitoring. “I have introduced hydro-informatic tools into pre-existing ideas. These tools are so useful for future careers in water. The weekly seminars have also been very useful for developing work”.

Student Case Studies



Olivia Bailey

UNIVERSITY OF BATH

The cohort structure of the course is an attraction for Olivia Bailey “WISE events throughout the year create a real family feeling across the CDT and I’ve really enjoyed the connections I’ve made with students across cohorts”. It has helped her to develop her main project “The postgraduate school in Exeter helped to broaden my knowledge of the water world and gave me confidence to get out of my comfort zone and develop my PhD work in a direction that straddles multiple engineering disciplines. “Her research is about developing a sustainable design for future sewer systems. It is focused on opportunities for water conservation and wastewater concentration and their consequences for the sewerage system. Olivia’s background is in chemical engineering; she graduated in this subject in 2015 with a First Class MEng. In her masters’ thesis Olivia designed a small-scale bio-refinery to recover potable water, energy and nutrients from wastewater.

Olivia’s work has often been informed by an abiding interest in sustainability. Last summer Olivia ran an off-grid camp for youngsters “I was able to take the time to organise and run a 6-week camp for 24 young people from across Europe and North America. The camp took place on the outskirts of Exeter and centred on philosophies of simple living and building sustainable communities... Installing the water supply was luckily rather simple as the site is relatively close to civilisation so potable water was easily piped down from a nearby house... We built composting toilets that we emptied every day into a heap that can eventually be used to fertilise the garden once the solids are stable” The experience links in with Olivia’s main project “My PhD work will focus on integrated sewer systems for the future and my involvement with this project has given me a deeper feeling of how we could live in a less wasteful way. Hopefully this experience will aid me in working towards a more sustainable, circular future.”



Ludovica Beltrame

UNIVERSITY OF BRISTOL

My PhD project is at the interface between hydrology and infectious disease. In my first year, I developed understanding of the environmental and epidemiological processes relevant for my project and worked on a model to represent these. In my second year, I have been using the model we built on two case studies, testing it using different methods and datasets, and working at the manuscript for a paper presenting my results, which is to be submitted to a journal by the next couple months.

I had the chance to attend and present my work at interesting conferences, both in the UK and abroad. Two of these were very large conferences with researchers from different backgrounds within the geosciences, and have been useful for collecting ideas and feedback on my research from different perspectives. One of them was a smaller conference that was very focused on topics relevant for my project. It has been valuable to meet and discuss with researchers with similar interests.

The highlight of the WISE CDT for me has been joining a group of inspiring researchers and people here at Bristol, whilst having the opportunity of adopting a broader perspective by being involved in a group of colleagues and friends that cope with similar problems related to water.



David Glover

CARDIFF UNIVERSITY

David has used regional water problems in the South-West as the starting point for his work here at the WISE CDT. The Somerset Levels suffered severe storms in 2013. Persistent rainfall led to the flooding of over 600 houses and 17,000 acres of agricultural land. A robust and advanced modelling framework based on the TELEMAC suite is being developed by David. The aim is to model the flood dynamics of the Somerset Levels, specifically the River Parrett.

David was attracted to the WISE CDT because of the blend of academia and industry “The taught programme was fantastically tailored to give us the knowledge of several different disciplines, but was focused and relevant to Water Informatics. This is shown through the breadth of students within our cohort, from engineers to computer scientists. The summer school is great to round the taught programme off before we split off to our home universities” said David. On the WISE CDT there are students from the GW4 universities at Bath, Cardiff, Exeter and Bristol. “It has been extremely useful to have developed close relationships with the other GW4 universities for collaborations on conferences.” David has presented twice this year already – at the IWA conference in Bath in April, and the IAHR YPN conference in Cardiff.

Sometimes his work leads to travel “I attended the South Wales Flooding conference in 2016 coming third in the young person’s poster competition... In August I am off to present my research at the IAHR World Congress in Kuala Lumpur, Malaysia and I’m currently planning a research visit in China for the end of the year.” David has found that his supervisor’s contacts within the water industry have been invaluable to his work. “Dr Pan and I attended a CIWEM organised guided tour of the Currymoor pumping station in the Somerset Levels. This was especially useful to meet the relevant members of the Environment Agency and the Somerset Drainage Board, the latter of which I now regularly follow on Social Media through which I have acquired invaluable data.”

“It’s immensely satisfying that WISE CDT students continue to support the economic, environmental and social strategies of business with their cutting edge bespoke research.”

**Professor
John Banyard OBE**

Governance

Student representatives, the CDT Director, Centre Manager, co-directors and co-investigators meet quarterly to discuss the leadership and running of the WISE CDT – this is known as the Programme Management Group. Student representatives from all cohorts give valuable feedback on the course. The group is guided by the WISE CDT Advisory Board, which meets annually. Made up of key figures from academia and industry, the Advisory Board is an effective way to maintain the development and direction of the WISE CDT, engaging it directly with the communities that its members come from. Arthur

Mynett, from UNESCO-IHE, is the WISE CDT's external examiner – and also speaks at the Summer School.

RECRUITMENT AND STUDENT NUMBERS

The WISE CDT is expected to meet its target for 16 new students for September 2017. With over 45 students, we are pleased to attract a wide diversity of backgrounds; in particular there is a good gender balance with a third of female students compared with 26% in the HESA reported population for postgraduate engineering students.

The Students

Cohort 1

Josie Ashe, Exeter

Supervisors: Prof Richard Brazier, Prof Dragan Savic
Project: Using Continuous Multivariate Time-Series Data To Build A Real-Time Modelling Framework For Catchment Scale Water Resource Management.

Ludovica Beltrame, Bristol

Supervisors: Prof Thorsten Wagener, Dr Eric Morgan
Project: Simulating The Risk Of Liver Fluke Infection In The UK Through Integrated Mechanistic Hydrological-Epidemiological Modelling.

Olivia Cooke, Bath

Supervisors: Dr Lee Bryant, Dr Thomas Kjeldsen
Project: Assessment And Mitigation Of Storm Runoff Loads From An Informal Settlement (Slum).

Nejc Coz, Cardiff

Supervisors: Prof Roger Falconer, Dr Reza Ahmadian
Project: Modelling the impact of marine renewable energy structures and devices on flood risk and water quality.

Barney Dobson, Bristol

Supervisors: Dr Francesca Pianosi, Prof Thorsten Wagener
Project: Advancing Water Management Through Improved Decision Models.

David Glover, Cardiff

Supervisors: Dr Shunqi Pan, Prof Thorsten Stoesser
Project: Flood Dynamics of the Somerset Levels using Telemac2D.

Laurence Hawker, Bristol

Supervisors: Prof Paul Bates, Dr Jeffrey Neal
Project: Flood inundation modelling in data sparse deltas.

Jonathan King, Cardiff

Supervisors: Prof Roger Falconer, Dr Reza Ahmadian
Project: Modelling the decay and transport of pathogens using high performance computing.

Wouter Knoben, Bristol

Supervisors: Dr Ross Woods, Prof Jim Freer
Project: Formalizing Rainfall-Runoff Model Structure Development Through A Top-Down Approach.

Mariano Marinari, Bath

Supervisors: Dr Tom Arnot, Dr Marcelle McManus
Industrial Supervisor: Ian Law (Wessex Water)
Project: A New Ecosystem Service Approach For Nutrient, Energy, And Water Management At Catchment Scale.

Elli Mitrou, Cardiff

Supervisors: Dr Bettina Bockelmann-Evans, Prof Thorsten Stoesser
Project: The Effect Of Small-Scale Turbulence On Plume Dynamics.

Josh Myrans, Exeter

Supervisors: Prof Zoran Kapelan, Prof Richard Everson
Project: Automatically analysing faults in sewer networks using CCTV footage.

Ioanna Stamataki, Bath

Supervisors: Dr Jun Zang, Dr Thomas Kjeldsen
Project: Advanced Hydraulic Modeling For Flood Risk Analysis.

James Webber, Exeter

Supervisors: Prof David Butler, Prof Guangtao Fu
Project: Surface water flood resilience.

Cohort 2

Olivia Bailey, Bath

Supervisors: Prof Jan Hofman, Dr Tom Arnot
Project: Sewer Systems of the Future.

Aidan Barry, Bath

Supervisors: Prof Rod Scott, Dr Tom Arnot
Project: Algal reactors for nutrient recovery from waste water.

Stamatios Batelis, Bristol

Supervisors: Dr Rafael Rosolem, Prof Dawei Han
Project: Testing a Land Surface Model (JULES) as a flood forecasting tool.

Paul Bayle, Bath

Supervisors: Dr Christopher Blenkinsopp, Prof Gerd Masselink
Project: Coastal adaptation under sea level rise using soft engineering.

Stephen Clee, Cardiff

Supervisors: Dr Shunqi Pan, Dr Catherine Wilson

David Forber, Exeter

Supervisors: Prof Dragan Savic, Prof Raziye Farmani
Industrial Supervisor: Michael Butler (RPS)
Project: A Dynamic SELL Model and Decision Support Tool for Water Leakage Fusing Historic and Real-Time Data Sources.

Arthur Hajaali, Cardiff

Supervisors: Prof Thorsten Stoesser, Dr Shunqi Pan
Industrial Supervisor: Philippe Pepin (GE Hydro)
Project: Assessment of the Carno-Bordas losses within bulb-turbine diffuser coupling far-field and near-field CFD models.

Rosanna Lane, Bristol

Supervisors: Prof Jim Freer, Prof Thorsten Wagener
Project: National scale hydrological modelling of UK River flows and flood peaks under climate change, with uncertainty analysis.

Anna Lo Jacomo, Bristol

Supervisors: Prof Dawei Han, Prof Alan Champneys
Project: Planning resilient water systems in hazard regions.

Ioannis Markidis, Bath

Supervisors: Dr Tom Arnot, Dr Marta Coma
Project: Small scale anaerobic digestion modelling and economics.

Olivia Milton-Thompson, Exeter

Supervisors: Dr Diego Gomez, Prof Akbar Javadi
Project: Modelling Impacts of Fracking on Groundwater Contaminant Plumes and Mixtures.

Cain Moylan, Bristol

Supervisors: Dr Jeff Neal, Prof Jim Freer
Project: Sensitivity, uncertainty and refinement in a global flood model.

Joseph Shuttleworth, Cardiff

Supervisors: Prof Roger Falconer, Dr Reza Ahmadian
Project: Shock capturing methods in flood models: with application to steep catchments and natural flood management.

Damian Staszek, Exeter

Supervisors: Prof Dragan Savic, Prof Guangtao Fu
Industrial Supervisor: Richard Hill (Bristol Water)
Project: Optimisation of Supply Demand Balance Model under Uncertainty.

Alex Stubbs, Cardiff

Supervisors: Prof Thorsten Stoesser, Dr Bettina Bockelmann-Evans
Project: Computational Modelling of Hydrodynamic Processes in the Nearfield.

Maria Xenochristou, Exeter

Supervisors: Prof Zoran Kapelan, Prof Slobodan Djordjevic
Project: Extracting information from smart metering data for water demand forecasting.

Cohort 3

Benjamin Beylard, Cardiff

Supervisors: Dr Shunqi Pan, Prof Roger Falconer
Project: Soft artificial reefs and mega-nourishment in coastal protection's context: a global innovative approach.

Sabrina Draude, Exeter

Supervisors: Prof Zoran Kapelan, Prof Edward Keedwell
Industrial Supervisor: Dr Emma Harris (Welsh Water)
Project: Methodology for Effective Operational Blockage Reduction.

Sebastian Gnann, Bristol

Supervisors: Dr Nicholas Howden, Dr Ross Woods
Project: Groundwater Processes in Conceptual Hydrological Models.

Dolores Gonzalez, Bath

Supervisors: Dr Mirella Di Lorenzo, Dr Petra Cameron
Project: Biosensors for water quality monitoring: sensor development and signal processing.

Simbidzayi Hatchard, Bristol

Supervisors: Prof Paul Bates, Dr Sam Williamson;
Dr Francesca Pianosi. **Project:** Viability of Low Head Hydropower in Developing Countries under Current and Future Conditions.

Gwyn Hennessey, Bath

Supervisors: Dr Chris Blenkinsopp, Prof Ian Turner, Dr Eli Lazarus
Project: Beach Erosion and Recovery.

Giovanni Mosolino, Cardiff

Supervisors: Prof Roger Falconer, Dr Reza Ahmadian
Project: Flood Modelling and Hazard Assessment for Extreme Events in Riverine Basins.

Eirini Nikoloudi, Exeter

Supervisors: Prof Zoran Kapelan, Prof Fayyaz Memon
Industrial Supervisors: Kevin Woodward and
Dr Michele Romano (United Utilities)
Project: Event Management and Post Event Response Planning for Intelligent Water Networks.

Levke Ortlieb, Bath

Supervisors: Dr John Chew, Dr Jannis Wenk
Project: Understanding small scale bubble generation and their applications in water and wastewater treatment.

Richard Rees, Cardiff

Supervisors: Dr Shunqi Pan, Dr Michaela Bray
Project: Modelling of geotechnical instability within earthworks arising from coastal storm surges and prolonged flood inundation events.

Lina Stein, Bristol

Supervisors: Dr Ross Woods, Dr Francesca Pianosi
Project: A global approach to robust flood estimates in ungauged catchments using hydrological process knowledge.

Jack Waterhouse, Bath

Supervisors: Dr Thomas Kjeldson, Dr Lee Bryant
Project: Assessing risk to water security in complex coupled catchment-reservoir systems.

Charles West, Bristol

Supervisors: Prof Thorsten Wagener, Dr Rafael Rosolem
Project: Large-scale groundwater modelling in Africa and other data sparse regions.

Laura Wignall, Exeter

Supervisors: Prof Slobodan Djordjevic, Prof Zoran Kapelan
Project: Flood forecasting as a tool for flood management.

Paul Wills, Exeter

Supervisors: Prof Fayyaz Memon, Prof Dragan Savic
Industrial Supervisor: Paul Merchant (South West Water)
Project: Enhanced demand forecasting and leakage detection utilising high-resolution loggers.

The Management Team

The Senior Management Team of the CDT consists of the Director, five Co-Directors (supported by additional Co-Investigators from their institution), and a Centre Manager.



Professor Dragan Savic
CDT Director



Professor Zoran Kapelan
CDT Centre Manager

CDT Co-Directors:



Dr Tom Arnot
University of Bath



Professor Roger Falconer
Cardiff University



Professor David Butler
University of Exeter



Professor Thorsten Wagener
University of Bristol



Professor Jan Hofman
University of Bath

CDT Co-Investigators:



Professor Jonathan Dawes
University of Bath



Professor Thorsten Stoesser
Cardiff University



Professor Slobodan Djordjevic
University of Exeter



Dr Ross Woods
University of Bristol

CDT Administrator:



Debbie Ford



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