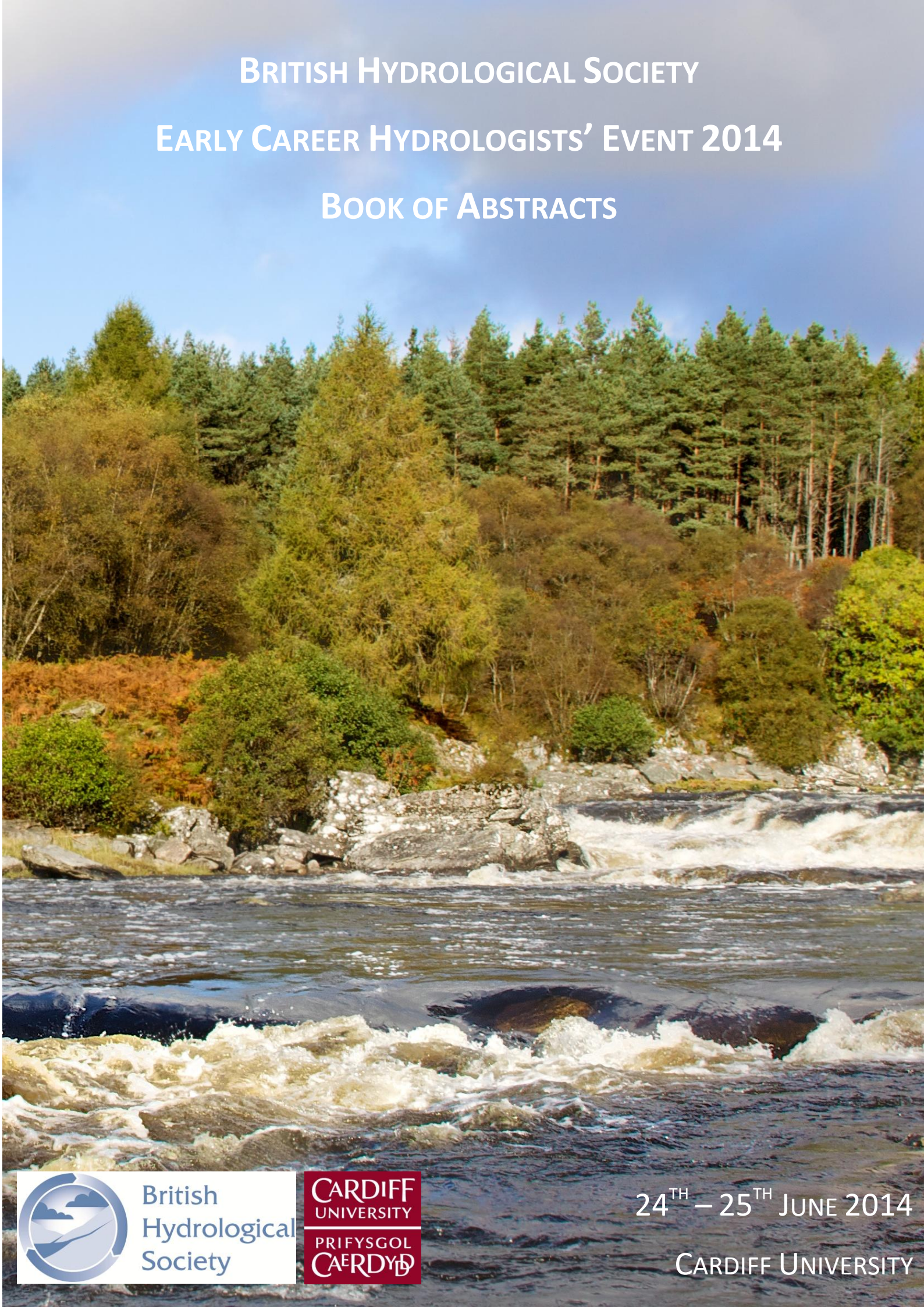
British Hydrological Society

Early Career Hydrologists' Event 2014

Book of Abstracts



British Hydrological Society

Cardiff University
Prifysgol Caerdydd

24th – 25th June 2014

Cardiff University

Welcome

We are delighted to host this year's British Hydrological Society Peter Wolf Early Career Hydrologist's Event, here in Cardiff.

This annual symposium brings together early career researchers and practitioners from a broad range of hydrology related areas, providing participants an opportunity to discuss and present their work and build collaborative links. Both the oral and poster presentations demonstrate the wide range of work which is being carried out across the UK and beyond. In addition to the formal elements of the meeting, there is also opportunity to socialise and network during the conference dinner and during the field trip to the Elan Valley Dams.

This year's invited speakers are Professors Jim Freer and Thorsten Wagener from the University of Bristol, and Mr Murray Dale from CH2M Hill. We also welcome to Cardiff the President of The British Hydrological Society, Mr Nigel Goody from SEPA. We are very happy that they could take some time from their busy schedules to share their insights and perspectives with us.

We hope that you find the programme interesting and enjoyable. Have a great meeting and a delightful stay in Cardiff!

Organising Committee

Dr Michaela Bray, Prof. Roger Falconer, Dr Shunqi Pan, Prof. Thorsten Stoesser,
Mr. Ali Abdulhamza, Mr. Jie Shi, *(Hydro-environment Research Centre, Cardiff University)*
Mr. Owain Sheppard, Ms Tracey Dunford *(Natural Resources Wales)*
Mr Glyn Webster *(Welsh Water)*

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Programme

Tuesday 24th June 2014 :

Seminar Rooms 1 &2, Trevithick Building

9.30 - 9.45	Registration Presentation Upload and Poster Preparation
9.55 -10:00	Welcome and Housekeeping
10:00 - 11:30	**Session 1 Chair: Prof. Jim Freer (University of Bristol)**
	Keynote: Prof. Jim Freer - Hydrology, uncertainty and improving model diagnostics
	Gemma Coxon - A Generalised Framework for Large-scale Evaluation of Discharge Uncertainties across England and Wales
	Valentina Noacco -What controlled Dissolved Organic Carbon export in the Thames Basin over the past 130 years?
	Lu Zhuo - Develop a Matching System for Better Hydrological Model Selection, Based on Catchment Conditions.
11.14 – 11.45	**Tea & Coffee /Posters**
11.45 – 13.00	**Session 2 Chair: Mr Murray Dale (CH2M Hill)**
	Invited Industrial Presentation: Mr Murray Dale – Hydrometeorology an Industry Perspective
	Hesbon Otieno - Comparison of Rainfall Datasets at Regional and Catchment Scale in Africa.
	Thomas Redfern - The Mitigation of Hydrological Challenges in the Peri-Urban Landscape.
	Emma Bullen - Water Act 2003: Effect on Canal & River Trust.
13.00 - 14:00	**Lunch**
14.00 - 15:30	**Session 3 Chair Mr Nigel Goody (BHS President)**
	Ali Abdulhamza - Water Balance Studies over Mega Semi-Arid Catchment – Tigris River.
	Renji Remesan - Modelling of Discharge and Crop Yields in the Glacier-Dominated Beas River Basin, India.
	Guoxian Huang - Modelling Large River Networks in the Middle and Lower Yangtze River Using a Linked Hydrodynamic and Hydrological Model.
	Hongbin Zhang - Urban Flood Simulations by Coupling Hydrological and Hydraulic Models'
	James Savage - The Impact of Scale on Probabilistic Flood Inundation Maps Using a 2D Hydraulic Model with Uncertain Boundary Conditions.
15:30 - 16:00	**Tea & Coffee /Posters**

16:00 -17:30	**Session 4 Chair: Dr Michaela Bray (Cardiff University)**
	Christopher Kiiza - Development of a Linked Hydrologic Model-Constructed Wetland System for Lake Restoration.
	Andrew House- Using Temperature, Electrical Resistivity Tomography and Botanical Indicators to Understand Groundwater Discharge in a Riparian Wetland.
	Ademola Agunbiade **-** Modelling the Taff River and Its Potential for Constructed Wetlands
	Joost Iwema **-** Investigating Field Sampling Strategies for Parameter Calibration of Three "Neutron Count to Soil Moisture Content" Models
	Jo Matthews - Investigating the Trigger Mechanisms for Suspended Sediment "Red Events" in the Brecon Beacons
17:30 – 17:35	**Closing Address: Mr Nigel Goody**
17: 35 – 18:00	**Tour of hydro laboratory**
19:00 -	**Conference Dinner: Mercure Hotel, Brecon Suite 2nd Floor**
	After Dinner Talk: Prof. Thorsten Wagener (University of Bristol)
	Presentation of Prizes: Mr Nigel Goody

Wednesday 25th June 2014:

8.45	Depart from Porters Lodge Trevithick Building
11.15	Arrive at Elan Valley Visitor Centre
	Technical Talk: Mr Owain Sheppard (Natural Resources Wales)
	The effects of the Elan Valley reservoirs on the hydrological regime of the upper Wye catchment
12.00	Lunch
12.30	**Tour of Site: Mr Glyn Webster (Welsh Water)**
	Walk through Dam
14.30	Leave Elan Valley
16.30	Arrive at Cardiff Central Railway Station

Keynote Speaker

Hydrology, uncertainty and improving model diagnostics

Jim Freer: Professor of Hydrology, Dept. Geographical Sciences, University of Bristol

Hydrology, like many natural sciences, is an inexact science. Meaning we do not have perfect knowledge or understanding about hydrological behaviour at various scales, especially those scales that are most useful, such as the catchment scale. This should have implications for the way we treat the limited, sparse and uncertain data and hence how we confront a computer model with such data when trying to formalise our understanding. Professor Freer will reflect on the challenges of using imperfect data and models to predict and understand hydrological systems and what therefore might be pragmatic solutions and appropriate frameworks when making predictions and developing approaches to model diagnostics.



Jim Freer is an international expert in catchment scale hydrological model development and the quantification and reduction of prediction uncertainties in hydrology and water quality. Jim also leads research on detailed field experiments across multiple spatial scales. His work provides a unique perspective and range of expertise to integrate field experimentation with appropriate model design and evaluation techniques to iteratively learn and improve model predictions for a range of catchment scale processes.

Jim has organised a number of international workshops; convened special sessions and presented over 22 invited talks since 2001. He has over 57 refereed paper publications (44 in international journals – the citation total for these papers is over 1,480). He is also an editor of the EGU journal Hydrology and Earth System Science (HESS).

Guest Speakers



Murray Dale: Associate Director CH2M Hill

Murray Dale is a hydrometeorologist with CH2M HILL. He has 20 years' international experience in hydrology, water management, climate change and flood forecasting. Murray has a keen interest in meteorology and particularly in the coupling of the disciplines of meteorology and hydrology. He was formerly Hydrology Team Leader at the UK Met Office. He is especially interested the practical applications of hydrometeorology; flood forecasting, warning and emergency response as well as seasonal forecasting and longer term climate change projections that affect rainfall quantities and intensities. Murray is a BHS member and sits on the BHS South West Section Committee.



Thorsten Wagener: Professor of Water and Environmental Engineering, Dept. Civil Engineering, University of Bristol

Thorsten Wagener joined the University of Bristol in 2012 after holding research and academic positions at Imperial College London, the University of Arizona and the Pennsylvania State University. Thorsten is interested in systems methods to advance hydrologic theory, and to build and evaluate predictive models for sustainable water management. He is internationally renowned for his work covering predictions in ungauged basins, uncertainty and sensitivity analysis, catchment classification, and the integrated assessment of change impacts.



Nigel Goody: President British Hydrological Society; Hydrometry Unit Manager, Scottish Environment Protection Agency

Nigel Goody is a hydrologist with over 38 years experience who has been on the BHS Committee for seven years, including four as Hon. Treasurer, before being elected President in September 2013. He started his career as a field technician in East Anglia before moving to Scotland in 1985. Always working in environmental protection, his career has spanned hydrometry, flood risk assessment, and water resources management, including the implementation of first-time comprehensive abstraction control in Scotland following the implementation of the Water Framework Directive. He currently manages c.45 staff operating the Scottish hydrometric network.

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Water Balance Studies over Mega Semi-Arid Catchment – Tigris River

Ali Abdulhamza*, Bettina Bockalmann-Evans, Michaela Bray

Hydro-environmental Research Centre, School of Engineering, Cardiff University,

The Parade, Cardiff, CF24 3AA, UK

*AbdulhamzaA@cf.ac.uk

Keywords: Envapotranspiration, River Tigris, Semi-Arid, SDSM, ISIS

Abstract:

Evapotranspiration (ET) is a major element in the water cycle, and formed by several complex processes. Significant water losses can occur in large drainage basins under semi-arid climate conditions, moreover there is a lack of observed data, thus making the exact ET losses hard to quantify. Well-known models (Priestley-Taylor, McNaughton-Black, PM-FAO56, Surface Evaporation and Shuttleworth) to calculate potential evapotranspiration against observed data for the period from 1969 and 1970 were discussed in this study in order to evaluate each and every one of these models against observed ET data, in the other hand, add more highlighting on that basin area in particular as it has been under evaluated and under estimated for a long time according to the political, social and economic situations of that part of the world.

It has been found that the surface evaporation model significantly over-predicted evaporation, whereas the other models produced satisfactory results. A bigger data set has been acquired from the Iraqi water resources ministry which spans over 40 years (1970 – 2011) which used to assess past evapotranspiration trends, and provide an indication of possible future evaporation rates. However, there are some gaps in the data which cannot be neglected. To overcome this problem, an investigation of statistical downscaling techniques to fill these gaps has been implemented.

A river model has been built for the Tigris using ISIS. For that, the model is run, firstly, to include the model's current evaporation scheme, then again with the evaporation scheme turned off. Using these two simulations to provide a benchmark, this study seeks to develop a refined evaporation scheme which will be more effective for semi-arid catchments. Several terrain visualisation tools such as RBT and 3d River Builder are used to generate a high resolution river profile.

This work provides a valuable opportunity to estimate the actual evapotranspiration as a major element of the water balance components and to establish a watershed-wide water management plan for the Tigris River as one of the major fresh water rivers in the world.

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Modelling the Taff River and Its Potential for Constructed Wetlands

Ademola Agunbiade *, Bettina Bockalmann-Evans, Akin Babatunde

Hydro-environmental Research Centre, School of Engineering, Cardiff University,

The Parade, Cardiff, CF24 3AA, UK

*agunsky@yahoo.co.uk

Abstract:

This research focuses on modelling the Taff River and its potential for constructed wetlands. Water security, hydrological and hydrodynamic modelling are considered as the main objectives of this research.

The research is about assessing water storage potential of constructed wetlands. In this research the numerical modelling software package ISIS will be applied to the Taff including potential constructed wetland sites with the aim being to investigate changes to the runoff, flow pattern and storage capability.

Hence, to achieve the research goal above and to determine the wetland's location along the Taff River, flow rates including flood and dry events, river cross-sections, rainfall and discharge data were requested from Natural Resources Wales (NRW). River cross-sections particularly from Merthyr Vale to Cardiff Bay have also been requested in order to build the river model

The purpose of getting data from NWR is to build the numerical model which is based on the ISIS software which calculates the discharge and stage processes for the studied river together with constructed wetlands, as well as fulfilling the water demand of the local cities in the future.

The outcome of the research results will aid future-decision making and scenario planning for water security/flood prevention that can also assist NRW in developing future monitoring programmes for the Taff River and water management in general.

British Hydrological Society

Urban Stormwater Management under Climate Change

Sherien Al-Zerji*, Dawei Han

Department of Civil Engineering, University of Bristol, UK

*s912372@bristol.ac.uk,

Abstract:

For more than 150 years, urban drainage systems have been established in many cities around the world with two distinct types, combined and separate systems. The objective of the two systems is to minimize the contamination effect in receiving water coming from urban drainage system and as a result guarantee people's health. However, the urban drainage system is sensitive to some factors which can boost the problem of sewer inundation and urban flood. Climate parameter changes such as the increasing tendency of temperature and extreme rainfall are considered as the main driver for urban flooding. In addition, the urban drainage system is affected by the changes of urban land use due to social and economical modifications. Also urbanization and population increase lead to raising the percentage of impervious areas which in turn increase the problem of sewer surcharge and floods of urban areas. Consequently the designers and managers of these systems should address the factors which create the flooding problem and evaluate the situation, then try to find and adopt sustainable solutions to mitigate the above problem in the future.

Although many previous studies addressed the problem of flooding of urban areas due to the impact of climate change, but the uncertainty resulted from these studies were considerable. The sources of uncertainty related to climate change impact studies start from choosing the climate forcing scenario in the climate model, and this preliminary uncertainty is augmented during the variable modeling until it ends with urban model outputs. However, the uncertainty resulted from downscaling methods is of great concern since it affects the characteristics of rainfall which is the main driver of urban inundation. Thus, the objective of this study is to investigate and propose a new framework which assesses and reduces the uncertainty in the downscaling rainfall and hydrological impact model.

It is worth mentioning that all the previous studies have adopted climate forcing scenarios which don't take into account future mitigation, however in this research new scenarios in addition to old scenarios will be adopted and their results will be compared in order to study all the probabilities of future climate change and how it affect urban sewer system.

The future changes of climate variables especially rainfall and also other variables like temperature, wind, relative humidity, and evapotranspiration will be investigated for the period (2070-2100) benchmarked on the historical period (1961-1990), and the impact of the investigated climate variables on the urban drainage system for a small town located in west Yorkshire, in Northern England will be addressed.

In addition to the impact of climate change on the sewer system, the land use change due to population increase and its effect on inundation of urban drainage system will be explored in this research in order to investigate which factor has the large effect on flooding of urban areas.

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Water Act 2003: Effect on Canal & River Trust

E. Bullen

Water Management Team, Canal & River Trust, Canal Lane, Hatton, UK, CV35 7JL

emma.bullen@canalrivertrust.org.uk

Abstract:

The Canal & River Trust (the Trust) is a charity that has responsibility for 2,000 miles of canals, rivers, docks and reservoirs. Since the canals were first opened over 200 years ago they have needed a reliable water supply from surface water and ground water. The Trust (and its predecessor British Waterways), as a navigation authority have been exempt from abstraction licensing of surface water under the Water Resources Act 1991 (section 26).This act was updated by the Water Act 2003 (c. 37 section 5), the new changes in legislation will mean that the Trust is no longer exempt from abstraction licensing.

The new legislation will bring about a massive change to the way that the Trust manages water resources as we currently rely upon over 250 different sources across England and Wales. These currently exempt activities are to be brought into the licensing system, through Transitional Regulations. In order to prepare for this change the Trust has been collecting evidence from over 200 feeder channels and pumping stations where water is abstracted to supply the canal network; whether they are from other inland water bodies, reservoirs or through dry docks.

These changes in legislation will have many impacts on the Trust through increased costs due to licence application, increased monitoring and control, and potential reductions in water resource availability to secure environmental requirements. The biggest risk being that if we are not able to secure the water we need we will not be able to maintain navigation, to support the thriving ecology of the canals, to support water sales and to deliver all the aspects that the Trust aspires to in its vision of Living Waterways that Transform Places and Enrich Lives.

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A Generalised Framework for Large-scale Evaluation of Discharge Uncertainties across England and Wales

Gemma Coxon [1*], Jim Freer[1], Ida Westerberg[2], Thorsten Wagener[2], Ross Woods[2], Paul Smith[3]

[1]School of Geographical Sciences, University of Bristol, Bristol, UK

[2]Department of Civil Engineering, University of Bristol, Bristol, UK

[3]Lancaster Environment Centre, Lancaster University, Lancaster, UK

*Gemma.Coxon@bristol.ac.uk

Abstract:

In England and Wales, the gauging station network provides stream flow data for a diverse range of organisations and is utilised to make a number of important decisions for water planning, flood forecasting and drought analysis. At most gauging stations, estimates of river discharge rely on a time series of river water levels converted to discharge via a rating curve. This relationship is subject to substantial uncertainties and a major task for hydrologic science lies in assessing the quality and information content of this data.

This study presents a novel generalised framework for estimating discharge uncertainty at many gauging stations with different types of errors in the stage-discharge relationship. The methodology utilises a non-parametric lowess regression within a flexible framework that takes into account uncertainty in the stage-discharge measurements, time variable rating curves and scatter in the stage-discharge measurements. The framework is then applied to 500 gauging stations in England and Wales, which represent a diverse range of gauging stations and stage-discharge relationships. We investigated the relative discharge uncertainty at low, mean and high flows for these stations and demonstrate 1) how discharge uncertainty varies spatially for low, mean and high flows and 2) how the framework captures place-specific uncertainties for a number of case studies. By applying the methodology over a large number of gauging stations, we are able to benchmark the quality of discharge data in England and Wales for the first time. Finally, we discuss the significance of these results for national scale uncertainty analyses and comparative hydrological assessments. This methodology is applicable to any catchment with comparable stage-discharge information

Classification and correction of the radar bright band with polarimetric radar

Will Hall[1]*, Miguel Angel Rico-Ramirez[1], Stefan Kramer[2]

[1]Department of Civil Engineering, University of Bristol, Bristol, BS81TR, UK,

[2]Institut für technisch-wissenschaftliche Hydrologie GmbH, Hannover

*w.hall@bristol.ac.uk

Abstract:

The radar bright band occurs due to an enhancement of reflectivity returns from melting snow as the hydrometeors fall below the melting level into warmer temperatures. The reflectivity is then related to rainfall intensity through a power law equation which subsequently causes overestimation of precipitation by up to a factor of 5, so it is important to correct for this effect.

Hydrometeors can be calssified based on multiple characteristics through the use of dual-polarisation radar measurements. This can subsequently allow for the identification of the bright band if the region of melting snow is accurately classified. Research has shown that melting snow has a discernible signature when the linear depolarisation ration (LDR) and the horizontal reflectivity (Zh) are compared (Rico-Ramirez 2005). A clear minimum in the cross-correlation coefficient (□hv) and differential reflectivity (ZDR) maximum were found to coincide with localised areas along the 1oC isotherm (Ryzhkov and Zrnic 1998) which further aids the classification of melting snow.

The purpose of this project is to present an algorithm that will utilise measurements of □hv and LDR in order to identify areas of enhanced reflectivity due to the melting layer in plan position indicator (PPI) scans. Higher elevation scans will also be used to more accurately classify the bright band height. A model vertical profile of reflectivity (VPR) will be formed from the analysis of reflectivity scans from an operational C-band Polarimetric radar. Once the bright band region has been identified, an algorithm based on the modelled VPR will be used to reduce rainfall overestimation by the radar.

References:

Rico-Ramirez, M. A., I. D. Cluckie, and D. Han, 2005: Correction of the bright band using dual-polarisation radar. Atmos. Sci. Lett., 6, 40–46.

Ryzhkov, A. V., D. S. Zrnic, 1998: Discrimination between Rain and Snow with a Polarimetric Radar. J. Appl. Meteor., 37, 1228–1240.

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Using Temperature, Electrical Resistivity Tomography and Botanical Indicators to Understand Groundwater Discharge in a Riparian Wetland

A. House*, J.Sorensen, A. Newell, J. Chambers, P. Wilkinson, S. Uhlemann, D. Gooddy, J. Mountford, P. Scarlett, G. Old

Centre for Ecology & Hydrology, Crowmarsh Gifford, Wallingford, Oxfordshire OX10 8BB, United Kingdom

*andhou@ceh.ac.uk

Abstract:

Hydrology is the principal control on both wetland functioning and successful conservation management. Economical and sensitive techniques are required, able to capture processes at a high spatial resolution. Here, we demonstrate improved conceptual understanding of hydrology at a riparian wetland using 3D electrical resistivity tomography (ERT) to develop a geological model, and a high resolution 3D subsurface temperature model to delineate groundwater discharge. The ERT highlighted a high degree of variability in the peat, gravel and chalk subsurface architecture with implications for groundwater–surface water interaction. Notably, weathering on the chalk aquifer surface, which can seal it from overlying deposits, was highly spatially heterogeneous. The 3D temperature model revealed anomalous warm zones indicating distinct areas of groundwater upwelling. These were concomitant with infilled relic channel structures. Vertical temperature sections through the channels revealed highly varied discharge along their length. The strongest areas of discharge were concurrent to areas with coarse gravels and where weathering on the chalk aquifer surface was less evident. A vegetation survey demonstrated the control of groundwater on floral distribution, supported by hydrochemical analysis. Upwelling groundwater provides nitrate which supports spatially restricted growth of Carex paniculata (Greater Tussock Sedge) against a background of poor fen communities located in reducing, higher phosphate waters. Thus, in this setting, Carex paniculata, is considered an indicator of areas of groundwater discharge.

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Modelling Large River Networks in the Middle and Lower Yangtze River Using a Linked Hydrodynamic and Hydrological Model

Guoxian Huang[1,2,*], Jianjun Zhou[3], Binliang Linb[3], Qiuwen Chen[1] Roger Falconer[2]

[1]State Key Laboratory of Aquatic Chemistry, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing, 100085, China;

[2]Hydro-Environmental Research Centre, Cardiff School of Engineering, Cardiff University, Cardiff, CF24 3AA, UK

[3]Department of Hydraulic Engineering, State Key Laboratory of Hydro-science and Engineering, Tsinghua University, Beijing, 100084, China;

*hgx01@mails.tsinghua.edu.cn

Keywords: Yangtze River, River Networks, Hydrological and Hydrodynamics Model, Numerical Modelling, Large Reservoirs

Abstract:

The hydrodynamic processes in the Middle and Lower Yangtze River (MLYR) are very complex, with its main channel being connected with many lakes, reservoirs and flood diversion regions through the different branched channels. In the current study, an integrated river network model has been developed to simulate the hydrodynamic processes in the MLYR. A distributed hydrological model is used to determine the lateral inflows from the catchments located along the banks of main channel and lakes. All of the large and middle size reservoirs, lakes, flood diversion regions and open confluences in the MLYR catchment are coupled into the integrated model. The model has been calibrated against data measured during 1997-1999, with the representativeness of channel cross-sections being carefully checked. The model predicted water level and discharge agree closely with the data. The inclusion of the hydrological model has significantly increased model accuracy, particularly during large local flood events. A further calculation and related analysis shows that the model accuracy can be increased at some degree by considering the effects of dynamic storing and releasing processes of lakes and minor rivers. The results reveal the numerous local lakes near Yangtze banks play an important role on the harmonization of the large flood process in 1998.

Investigating Field Sampling Strategies for Parameter Calibration of Three "Neutron Count to Soil Moisture Content" Models

Joost Iwema*, Rafael Rosolem, Thorsten Wagener

Department of Civil Engineering, University of Bristol, UK

*Joost.Iwema@bristol.ac.uk

Abstract:

A scale gap in soil moisture measurement techniques exists across both space and time, especially at those scales most likely to characterise hydrologic processes well (10s-100s meters). Because this scale is of interest for environmental research and applications, a better understanding of soil moisture dynamics is needed. The novel Cosmic-Ray Neutron Sensor (CRS) technique can provide measurements at these scales and thereby help closing the gap. The CRS measures neutron intensity, which itself depends on the amount of hydrogen present within the sensor's support volume, is non-linearly related to soil moisture. However, the presence of other hydrogen sources and the CRS' variable measurement depth complicate the determination of site-specific parameter values of the models that translate neutron counts into soil moisture content profiles and vice versa. We test three currently models with different parameterisations. We investigate how often soil moisture samples should be obtained in order to reliably calibrate three "neutron count to soil moisture content" models. We investigate how this number of samples is affected by climate and land use by testing three distinct sites (arid, humid forest and humid grassland). We conclude by proposing robust sampling and calibration strategies as a function of model and site characteristics.

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Development of a Linked Hydrologic Model-Constructed Wetland System for Lake Restoration

Christopher John Kiiza*, Akintunde Babatunde, Bettina N. Bocklemann-Evans

Cardiff School of Engineering, Cardiff University

*KiizaCJ@cardiff.ac.uk

Key words: Urban Drainage, Hydrological Model, Constructed Wetland System, Water Quality, Emerging Contaminants, Wastewaters, Lake Victoria.

ABSTRACT:

Most human development manifests as urbanization and industrialization, largely linked to land-use practices. Both urbanization and industrialization even when managed, will generally disrupt the balance in the hydrological cycle. Disturbances on the hydrological cycle contribute to climate change, causing unpredictable weather and climatic patterns characterized by droughts, heavy rains, and overlapping seasons (Chang & Jung, 2010; Jung, Moradkhani, & Chang, 2012). Flooding incidences have increased especially in urban areas where there's a remarkable increase in the built environment- to provide accommodation for a high urban population. Furthermore, the UN projection is that 70% of the world's population will live in urban areas by 2050 – compared to over 50% now (UN, 2012). A combination of a high population, urbanization and climate change have inevitably led to high volumes of storm-water, sufficient to overwhelm a drainage system - as stormwater far exceeds the capacity of the drainage system (Blumensaat et al., 2012). Recent studies conducted on sanitation and drainage systems in developing countries concluded that there is sufficient literature about water supply and sanitation; and water supply, sanitation and hygiene. However, the studies were mostly concerned with provision of potable water and sanitation, and scarcely discussed urban drainage as a problem with often multiple negative consequences on receiving water bodies. For example, Uganda's Capital City, Kampala, has a dismal drainage infrastructure that was constructed in the 1900s, to serve a small urban population. This drainage system has not been appropriately upgraded to meet the demands of an urbanizing watershed, whose drainage sink is Lake Victoria, the world's second largest fresh water lake. It is probable that stormwater and the resultant flooding events could be exerting environmental and ecological threats to the Lake Victoria ecosystem. Flooding impacts on surface and ground water quality through mobilization of pollutants from roads, car parks, lawns and other surfaces. The resultant polluted run-off mixes with wastewaters from industries, hospitals, agricultural farmlands and gets drained into Lake Victoria. Pollutants commonly reported in surface run-off include: polyaromatic hydrocarbons (PAHs) like oil; persistent organic pollutants such as DDT pesticide; nitrogen and phosphorus, microbes (viruses and bacteria); domestic and sewerage wastewaters from homes and septic systems; as well as heavy metals from various non-point sources. Polluted stormwater can potentially affect public health, cause ecosystem disruption and subsequently ecosystem dysfunction. This can harm aquatic life

leading to loss of biodiversity; foul drinking water supplies, diminish aesthetic value of recreational waters making them unsafe for public enjoyment. This research proposes to use a physical hydrological model to quantify surface run-off, characterize pollutant loads in run-off, with particular interest on emerging contaminants specifically pharmaceuticals, personal care products, pesticides and herbicides. The selection of these pollutants is based on the fact that current wastewater treatment systems were designed without putting into consideration removal mechanisms for contaminants of emergent concern. The outputs of the hydrological model will be used to design a constructed wetland system for purposes of removing emerging contaminants in storm-water. Efficiency of the constructed wetland system to remove emerging pollutants will be assessed through chemical analyses involving SPE/LLE, LC-MS/MS & GC-MS/MS.

British Hydrological Society

Analysis of Drought Characteristics from 1900-2012 for Improved Understanding of a Water Resource System

Amy Lennard

School of Environmental Sciences, University of Liverpool, Liverpool, United Kingdom

a.lennard@liverpool.ac.uk

Abstract:

Droughts are a reoccurring feature of the European climate; recent drought events (2004-2006 & 2010-2012) in the UK have highlighted a continued vulnerability to this hazard. The period 2010-2012 was characterised by departures from typical seasonal climatic conditions, resulting in a severe drought which had a severe impact on water resources. This highlighted the need for further understanding of extreme drought events, particularly from a water resource perspective. A number of drought indices are available, which can help to improve our understanding of drought characteristics such as frequency, severity and duration. However, at present little of this is applied to water resource management in the water supply sector. Improved understanding of drought characteristics using indices can inform water resource management plans and enhance future drought resilience. The UK has a rich source of historical rainfall data that has been underutilised in the analysis of drought characteristics at a regional scale.

This study applies the standardised precipitation index (SPI) to a series of rainfall records (1900-2012) across the water supply region of a single utility provider. Key multi-year droughts within this period are analysed to develop an understanding of the meteorological characteristics that lead to, exist during and terminate drought events. The results of this analysis highlight how drought severity and duration can vary across a small-scale water supply region, indicating that the spatial coherence of drought events cannot be assumed. Variations in drought duration and severity across a region may have significant implications for water resource management during and after a drought event. A better understanding of regional drought characteristics is achievable by using historical data providing insight for the prediction of future of drought events.

British Hydrological Society

Investigating the Trigger Mechanisms for Suspended Sediment "Red Events" in the Brecon Beacons

Jo Matthews

DGES, Aberystwyth University

Jrm8@aber.ac.uk

Abstract:

The Cantref Reservoir in the Brecon Beacons is used by Dŵr Cymru Welsh Water for drinking water supply to the Welsh valleys and Cardiff. Sporadically, it receives high volumes of very fine, reddish suspended sediment from its Old Red Sandstone catchment during some, but not all, rainfall events. These 'red (water) events' become problematic at Dŵr Cymru Welsh Water's (DCWW) water treatment works (WTW) when raw water turbidity exceeds 10 NTU because the sediment removal system is designed for lower sediment loads. At present there is no warning of these 'red events' upstream of the point of abstraction which creates a 'point of weakness' in the operational management in the WTW.

This study present results from a detailed 2 year catchment/river/reservoir monitoring programme designed to investigate the hydrological and meteorological conditions responsible for triggering 'red events'. Turbidity data from a network of 11 water pressure and quality sondes, WTW sludge samples, 4 rain gauges and 20 soil moisture sensors are used to establish the rainfall-runoff relationship in the Cantref catchment. Furthermore, ten sediment cores have been recovered from the reservoir to establish long term sediment delivery to the water body.

Soil moisture responds very quickly to rainfall and the runoff generation is therefore rapid, resulting in a flashy river regime. The volume of runoff generated depends significantly on antecedent conditions. Suspended sediment mobilisation and transport are intermittent, but when occurring tend to show a clockwise hysteresis loop in the discharge-turbidity relationship. Evidence to date does not show any easily quantifiable threshold of precipitation volume, intensity or duration which is necessary to generate a 'red event'. This suggests that antecedent conditions are influential in preconditioning the susceptibility of the catchment to 'red events', triggered by additional rainfall. Slope failures are suspected to be the primary source of sediment for 'red events'.

The results from this project will be used to inform the development of an early warning system for the water treatment works and to improve the response to, and decrease the costs incurred during, the 'red events'. Catchment management recommendations are proposed including strategic tree planting or facilitation of natural vegetation regeneration. This catchment study illustrates how catchment monitoring and management and industrial system adaptation can increase efficiency and sustainability in the water industry.

Assessment of the Potential Impact of Sea Level Rise on the Salinity Intrusion in the Lower Dee and the Consequences for Public Water Supply and the Ecology

Ruqayah K. Mohammed[1*], Michaela Bray[1] and Bettina Bockelmann-Evans[1], Zhong Zhang[2]

[1] Hydro-environmental Research Centre, School of Engineering, Cardiff University, The Parade, Cardiff, CF24 3AA, UK

2 Natural Resources Wales Tŷ Cambria, 29 Newport Road, Cardiff, CF24 0TP

*MohammedRK@cardiff.ac.uk

Abstract:

The Dee is a regulated river which supplies as much water every day as all the reservoirs of the English Lake District; with sophisticated control of flood waters from the hills above Bala so as to reduce the frequency of flooding of low-lying land alongside the river: with proper consideration towards the preservation of fisheries, and the careful development of other recreational activities in appropriate locations.

As water companies are asked to plan for the potential impacts of climate change on demand and water availability, another issue has arisen for the lower Dee which warrants some investigation. Around 90% of the public water supply licensed on the Dee is abstracted from the tidally influenced stretch between Chester and Farndon. With the potential for sea level rise over the next 100 years it is important to understand the potential threat to the viability of abstraction points in this lower Dee stretch as well understand the potential impacts on the environment of the river.

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Mass and Momentum Transfer in Compound Channel Flow

Saad Mulahasan*, Thorsten Stoesser

Hydro-environmental Research Centre, School of Engineering, Cardiff University,

The Parade, Cardiff, CF24 3AA, UK

*mulahasansh@cf.ac.uk

Abstract:

This research helps hydrologists and hydraulic river engineers to take into account the impact of vegetation for flood modelling. Experimental work has been achieved to study mass and momentum exchange between the main channel and the floodplain due to the impact of vegetation on a floodplain in compound channel flows on the stage discharge curve, water level and lateral velocity profiles that result in section capacity reduction. Experiments have been carried-out in 10m flume length and 1.2m width of compound channel section flow of vegetated floodplains with two different vegetation configurations, first; one line vegetation on the edge of the floodplain adjacent to the main channel flow of three selected rod sizes, D= 5.0cm, 2.5 cm and 1.25 cm. Secondly, wholly vegetated floodplain with dense, medium and sparse vegetation density cases. To account for shear layer generation at the main channel-floodplain interface a novel technique has been used i.e. thermal camera SC640 to predict and visualize the evolution of a mixing shear layer due to the velocity difference between the vegetated and un-vegetated zones in compound channel shallow uniform flows which is increased as the vegetation density increases. The mixing shear layers alongside the vegetative interface zone reveal the impact of the flow resistance relative to vegetation density that cussing section capacity reduction. In addition this poster reveals the impact of vegetated floodplain on the lateral velocity profiles that reflects the momentum exchange between compound channel sections. Results showed that approach very well describes the shear layer characteristics showing the two types of vortices induced. For wholly vegetated floodplain it shows that changing the vegetation density from medium density to dense, the graph shows that the same impact on the rating curve; and for sparse vegetation density the impact on the rating curve is very small in comparison with compound channel flows without vegetation on its floodplain. In conclusion, as the vegetation density increases the impact of such vegetation on the rating curve and water level is increased and it is explained by mixing layer evolution at the vegetation edge.

What controlled Dissolved Organic Carbon export in the Thames Basin over the past 130 years?

Valentina Noacco[1*], Nicholas Howden[1], Thorsten Wagener[1], Fred Worrall[2], Tim Burt[3]

[1]Civil Engineering, University of Bristol, UK

[2]Department of Earth Sciences, University of Durham, Durham, UK

[3]Department of Geography, University of Durham, Durham, UK

* Valentina.Noacco@bristol.ac.uk

Abstract:

This study presents an analysis of land use in the UK's River Thames basin between 1867 and 2010, to estimate the potential transfer of soil organic carbon to the atmosphere (as CO2), deeper soils and groundwater, or to the river (as dissolved organic carbon - DOC). We use a modelling approach to combine two elements: an estimate of carbon available for export due to land use and land use change; and, an algorithm to route this carbon through to surface runoff, subsoil or loss as CO2 emissions to the atmosphere.

Estimates of annual carbon loading use parish land use data, held in the UK's National Archives; National Inventories of Woodland and Trees; and Land Cover Maps for the last 25 years. Soil organic carbon (SOC) stocks for each year are calculated from a large database of typical SOC concentrations for land uses present in the Thames basin, and are combined with literature values of transition times for SOC to adjust to a new concentration after land use change occurs. Soil carbon fluxes are calculated as the inter-annual change in SOC, and then apportioned between losses to the atmosphere as CO2, DOC losses to surface waters or carbon leached into deeper soil layers. We use a 130 year record of DOC in the Thames, and parameters from previous long-term nitrate modelling, to constrain estimates of fluvial DOC rises caused by SOC losses.

Our results show that for the majority of years the main contribution to annual DOC load came from diffuse sources. Moreover there are many small inter-annual variations in DOC concentration, but the major change in both estimated SOC storage and fluvial DOC, occurred during the 1940s due to massive large-scale changes in land use, the effect of which continues to date.

Geophysical Investigation of the Fresh-Saline Water interface in the Coastal Area of Abergwygregyn

I. B. Obikoya[1]*, J.D. Bennell[2],

[1]Environmental Aesthetic and Associate Ltd, 18 Olatunde Olufemi Avenue, Igesu-Ayobo, Lagos, Nigeria

[2]School of Ocean Sciences, University of Wales, Bangor, Anglesey, LL57 5AB, United Kingdom

*[1]ismaila.obikoya@eaalimited.com , [2]j.d.bennell@bangor.ac.uk

Keywords: Fresh-Saline Water

Abstract:

The importance of the study of saline/fresh water incursion cannot be over-emphasized. Borehole sampling has been extensively used, but it is intrusive, quite expensive and time consuming. Electrical resistivity and electromagnetic techniques have proved successful in groundwater studies since geologic formation properties like porosity and permeability can be correlated with electrical conductivity signatures. Non-intrusive surface geophysical mapping comprising electrical resistivity and electromagnetic methods has been employed to investigate freshwater intrusion and delineate the fresh-saline water interface at the inter-tidal area of Abergwygregyn, North Wales, United Kingdom. Frequency Domain Electromagnetic Profiling and Constant Separation Traversing were used to produce 2-D images and contour plots enabling the identification of freshwater plumes onshore and in the central parts of the study area. Ground truth methods comprised chemical analyses and detailed, point specific information on the stratigraphy. The freshwater intruding from the coastal area appears to be pushing the saline-water further offshore due to the high piezometric head caused by the mountains and hills of Snowdonia adjacent to the study area. The fresh/saline water interface correlates quite well with previous studies carried out in the area. On the basis of the results of the resistivity and conductivity geophysical investigations the freshwater plumes and fresh/saline water interface in the study area were effectively identified and delineated.

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The Environmental Implications of Small Scale Low Head Hydropower

Laura O'Keefe

Lancaster Environment Centre, Lancaster University, UK

l.okeefe@lancaster.ac.uk

Abstract:

Despite vast potential from both technology and location for the installation of many small scale low head hydropower schemes on existing 'barriers' in British rivers it has become apparent that many schemes are struggling to develop from a planning to operational stage. One of the major barriers to this development is the potential environmental impact that could result from the construction and operation of a scheme and the lack of knowledge and uncertainty surrounding this impact. Very few in situ investigations have analysed the influence of small scale low head hydropower on the aquatic ecosystems and a great lack of post installation monitoring has been carried out on already existing schemes (Robson et al., 2011; EA, 2012). What's more, even though many studies suggest that small scale low head hydropower is in fact "environmentally benign", there appears to be a substantial lack of empirical evidence available to substantiate this claim (Copeman, 1997; EA, 2010; Abbassi and Abbassi, 2011; Robson et al., 2011). As a result environmental protection requirements have been described as unclear and ill-defined and it has even been suggested that the regulators are being too precautionary, are placing unjustified burdens on water users, struggling to judge permit applications, limiting the amount of water diverted for clean electricity generation and dramatically slowing the development process (Robson et al., 2011; Bradley et al., 2013). This project thus monitors the influence of a small scale low head hydropower scheme on the River Goyt, Stockport and a control weir without a hydropower scheme located in the same river reach. The null hypothesis suggests that the hydropower scheme will have no significant influence on the aquatic environment when compared to the weir without a hydropower scheme. The overarching aim of his study is to inform environmental monitoring strategies and improve our understanding of the influence of small scale low head hydropower on natural riverine processes by measuring flow velocity, phytobenthic communities and a number of water quality parameters. Advancements in our understanding will help to inform environmental monitoring strategies and encourage an increase in "environmentally friendly" hydropower schemes in future.

British Hydrological Society

Comparison of Rainfall Datasets at Regional and Catchment Scale in Africa

Hesbon Otieno*, Dawei Han and Ross Woods

Department of Civil Engineering, University of Bristol

*otienohz@gmail.com

Abstract:

Rainfall data is a key input in nearly all water resources assessment studies. Various sources of rainfall data sets exists, however the primary source of this data is usually gauge observations over a catchment. Due to the high cost of instrumentation most vast catchments especially in the developing world are poorly gauged. Consequently the existing rainfall data is inadequate for hydrological studies. Data inadequacy is common in both gauged and ungauged catchments. Despite the fact that recorded data may be inadequate, hydrological studies for the purposes of furnishing information that aid in sound management of water resources is inevitable. Global gridded precipitation products from numerous platforms are alternative sources of rainfall data. Various global gridded datasets of monthly precipitation are available at diverse spatial resolutions. The current study evaluates three commonly used monthly gridded products over Africa and zooms in to a tropical catchment in Kenya. Climate Research Unit (CRU), Global Precipitation Climate Center (GPCC) and Tropical Rainfall Measurement Mission (TRMM) were used in conjunction with gauge data to establish the extent of similarities between them. The findings from the study are likely to be useful in offering guidance on the best dataset to apply for hydrological studies in Africa as a region as well as at catchment scale.

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Impact of Spatial Climate Variability on Catchment Streamflow Predictions

Sopan D. Patil*, Parker J. Wigington Jr., Scott G. Leibowitz, Eric A. Sproles, Randy L. Comeleo

Thoday Building, Deiniol Road, Bangor Road LL57 2UW

s.d.patil@bangor.ac.uk

Abstract:

The ability of hydrological models to predict a catchment's streamflow response serves several important needs of our society, such as flood protection, irrigation demand, domestic water supply, and preservation of fish habitat. However, spatial variability of climate within a catchment can negatively affect streamflow predictions if it is not explicitly accounted for in hydrological models. In this study, we examined the changes in streamflow predictability when a hydrological model is run with spatially variable (distributed) meteorological inputs instead of spatially uniform (lumped) meteorological inputs. Both lumped and distributed versions of the EXP-HYDRO model were implemented at 41 meso-scale (500 – 5000 km2) catchments in the Pacific Northwest region of USA (Oregon, Washington, and Idaho). We used two complementary metrics of long-term spatial climate variability, moisture homogeneity index (IM) and temperature variability index (ITV), to analyse the performance improvement with distributed model. Results showed that the distributed model performed better than the lumped model in 38 catchments, and noticeably better (>10% improvement) in 13 catchments. Furthermore, spatial variability of moisture distribution alone was insufficient to explain the observed patterns of model performance improvement. For catchments with low moisture homogeneity (IM < 80%), IM was a better predictor of model performance improvement than ITV; whereas for catchments with high moisture homogeneity (IM > 80%), ITV was a better predictor of performance improvement than IM. Based on the results, we conclude that: (1) catchments that have low homogeneity of moisture distribution are the obvious candidates for using spatially distributed meteorological inputs, and (2) catchments with homogeneous moisture distribution benefit from spatially distributed meteorological inputs if those catchments have high spatial variability of precipitation phase (rain vs. snow). Our use of spatially uniform model parameter values within a catchment ensured that any performance improvement obtained with the distributed model was solely based on the spatially distributed representation of meteorological inputs. However, this assumption will have to be relaxed for future investigations of the effects of spatially variable land use, soil types, and/or geology on catchment streamflow predictions.

The Mitigation of Hydrological Challenges in the Peri-Urban Landscape

Thomas Redfern

The Centre for Ecology and Hydrology, Maclean Building, Benson Lane, Crowmarsh Gifford, Wallingford.UK

thore@ceh.ac.uk

Abstract:

Small urban catchments with a mix of impermeable and permeable surfaces exhibit a variable and sometimes unexpected rainfall runoff response. This has led to difficulties in representing these types of catchments within hydrological models and uncertainty in how best to manage surface water flood risk. Opportunities for studying the hydrology of such catchments have been limited due to a small number of comparable datasets and a lack of understanding of the small scale processes that can influence the variation in hydrological behaviour.

The Haydon Wick river catchment (north Swindon, UK) has a number of residential developments built in different decades (1950s, 1960s, 1990s) with different arrangements of permeable and impermeable surfacing, all with similar gradients and soil types. This catchment therefore represents an opportunity to compare two residential developments of different designs to understand the controlling features of their hydrology. A hydrological monitoring campaign, geospatial analyses and hydrological modelling will investigate the interactions between soil moisture, rainfall characteristics and the layout of permeable and impermeable surfaces to explain the variation in hydrological behaviour.

Modelling of Discharge and Crop Yields in The Glacier-Dominated Beas River Basin, India

Renji Remesan*, Ian Holman

Cranfield Water Science Institute, Cranfield University, Cranfield, Bedfordshire MK43 0AL, UK

*r.remesan@cranfield.ac.uk

Abstract:

Himalayan valleys are confronting severe climate change relate issues (such as floods in summer, dry winters and spring low flows) because of their high reliance on fluctuating monsoon precipitation and increasing seasonal temperature. In this study, the daily Soil and Water Assessment Tool (SWAT) model is applied to the River Beas Basin in north west India, employing Tropical Rainfall Measuring Mission (TRMM) precipitation and NCEP Climate Forecast System Reanalysis (CFSR) meteorological data with an objective to model baseline river regime behaviour and crop yields. The hydrological behaviour of the Beas has great significance to the region as it contains two large reservoirs, one of which is intended to divert almost 5000 Mm3/yr of water to a neighbouring basin. We have applied Sequential Uncertainty Fitting Ver. 2 (SUFI-2) and Generalized Likelihood Uncertainty Estimation (GLUE) in combination with SWAT to quantify the parameter uncertainty of the stream flow modelling. The SWAT model evaluation statistics for daily river flows at the two discharge gauges shows that there is a good agreement between the measured and simulated flows as given by Nash Sutcliffe efficiency and PBIAS values. This study also examined crop yields for the dominant crops in the region, simulated under existing crop and irrigation management practices. The results showed that the model provides satisfactory simulated crops and vegetation biomass and yields (with some local exceptions in the marginal upper sub-catchments) when compared against local census data. The implemented SWAT model with calibrated parameters of SUFI-2 and GLUE provides a realistic simulation of the daily flows and the underlying vegetation behaviour and could successfully be applied for climate change impact studies in this glacier-influenced region.

Diurnal Variations in Ecosystem Respiration on Peatland Depositional Floodplains

Nathan Rickards

The Centre for Ecology and Hydrology, Maclean Building, Benson Lane, Crowmarsh Gifford, Wallingford.UK

natric@ceh.ac.uk

Abstract:

Peatlands are the UK's largest single store of carbon and are significant for the UK carbon inventory. Annual gaseous carbon fluxes from peatlands have previously been estimated using modelling approaches to assess the relative sink-source nature of these ecosystems. However, many of these models are parameterised using data collected during the daytime, with the dynamics and drivers of night time fluxes remaining relatively unknown.

During the summer of 2013, gaseous carbon flux measurements using six peat mesocosms, collected from a peatland floodplain at Upper North Grain, South Pennines, were taken over three full diurnal cycles. The use of mesocosms allowed for the simulation of a saturated floodplain, with a constant water level of 10-20mm below the peat surface maintained for the duration of the study. Particulate organic carbon (POC) was added to three of the mesocosms in order to assess its impact on gaseous carbon fluxes.

The findings indicate that models parameterised with daytime data alone may over-predict night time respiration values by up to 17%. The significant predictors of respiration also varied between day and night time data, indicating that night time flux is influenced by different variables to daytime flux. As a result, current models are found to over-estimate diurnal gaseous carbon losses by up to 4%. POC deposition has little effect on gaseous carbon fluxes, although this may be a result of the timing of the deposition i.e. at the height of the growing season.

The study highlights the need for the collection of carbon flux data over a full diurnal cycle in order to improve parameterisation of current soil respiration models. Further research also needs to determine the significant predictors of diurnal peatland respiration over a variety of climatic and seasonally variable conditions. This, in turn, will allow for more accurate estimations of annual carbon losses from UK peatlands and help refine current greenhouse gas budget inventories.

No Land Consumption in Lombardy River Floodplains between 1999 and 2007?

Fanny Sarrazin*, Paolo Pileri, Francesca Pianosi, Simone Bizzi

School of Civil Environmental and Land Management Engineering, Politecnico di Milano, Milano, Italy

*fanny.sarrazin@bristol.ac.uk

Abstract:

It is critical to adopt effective land use management strategies in river floodplains so as to limit exposed value and to preserve flood discharge conditions and natural flood retention areas.

The aim of this study was to investigate land use changes between 1999 and 2007 in Lombardy along river floodplains defined by the Hydrogeological Setting Plan (HSP). We tried to discuss these changes in relation to normative context and territorial morphology. The study focuses on the modifications in urbanized areas, namely urban fabric and industrial, commercial and transport units, as these land covers have a strong effect on flood risk. Spatial analysis techniques with Geographical Information Systems (GIS) were used.

An overall assessment of the changes in urbanized land cover showed that natural parks did not have noticeable impacts in terms of limiting urbanized areas expansion in Lombardy river floodplains.

The case of the River Po was examined closely with a methodology defined in this project. Elementary territorial units were delimited to compute the different indicators for land use and analyze their trend along river corridors.

However, errors and uncertainties in the database affect the results that were obtained. Nevertheless, actual increases in urbanized areas were identified in the high hazard areas.

The study highlights the fact that the HSP did not succeed in stopping land consumption in Lombardy river floodplains, with a consequent increase in flood risk. Furthermore it reveals a lack of suitable tools to efficiently monitor the implementation of the HSP.

British Hydrological Society

The Impact of Scale on Probabilistic Flood Inundation Maps Using a 2D Hydraulic Model with Uncertain Boundary Conditions

James Savage[1]*, Paul Bates[1], Jim Freer[1], Jeffrey Neal[1] and Giuseppe Aronica[2]

[1]Geographical Sciences, University of Bristol, Bristol, United Kingdom;

[2]Department of Civil Engineering, University of Messina, Italy.

*James.Savage@bristol.ac.uk

Keywords: Hydraulic modelling, uncertainty, scale, flood inundation, probabilistic, epistemic errors.

Abstract:

Recent flood events internationally have demonstrated the large damages and potential loss of life that flooding can cause. In order to accurately quantify flood risk and how it may change in the future we need to improve our understanding of the uncertainties of making such predictions. Advances in remote sensing have facilitated the use of high resolution models; however these models have significantly longer run times which reduce the ability to carry out a full uncertainty analysis, potentially resulting in spuriously precise predictions. Furthermore it may be unnecessary to use such high resolution models given the inherent uncertainties of the modelling process. This study assesses how changing the resolution of a hydraulic model impacts on probabilistic flood inundation and flood hazard maps for the Imera basin, Sicily given uncertainties in the model parameters and boundary conditions. The inertial formulation of the hydraulic model LISFLOOD-FP is utilised to model the extremely large 1991 flood event using multiple Digital Elevation Models (DEMs) resampled from 2 m Light Detection and Ranging (LiDAR) data. The Generalised Likelihood Uncertainty Estimation (GLUE) methodology is then applied to run multiple simulations with uncertain friction parameters and boundary conditions to produce weighted conditional probabilities of inundation and flood hazard maps. We find that coarse scale models can perform as well as fine scale models and produce similar water depths at key control points in the domain, however there are differences in the predicted probabilistic inundation and flood hazard maps produced. These results highlight the uncertainty associated with flood inundation predictions and the need to consider these uncertainties when performing flood risk analysis.

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Integrated Modelling of Flow and Faecal Coliform in the Watershed and Estuary

Jie Shi*, Roger A Falconer, Michaela T J Bray

Hydro-environment Research Centre, School of Engineering, Cardiff University, the Parade, Cardiff, UK CF24 3AA

*ShiJ2@cardiff.ac.uk

Abstract:

Climate change is expected to have a significant impact on flooding in the UK, inducing more intense and prolonged storms. Floods such as Boscastle 2004, Carlisle 2005, the summer Floods of 2007 and more recently in North Wales in June 2012 have been associated with unusual weather patterns. Such frequent flooding is already having an impact on catchment water quality. Flooding increases the quantity and transit time of contaminants and sediments entering the water course. Frequent flooding, due to climate change, will therefore exacerbate catchment water quality. Land use is also a contributing factor; For example, the move to more intensive farming could cause an increase in faecal coliforms, nitrates and other pollutants entering the water courses via catchment runoff.

In an effort to understand better the effects on water quality from the combination of both land use and climate change, the hydrological and estuarine processes are being modelled using SWAT (Soil and Water Assessment Tool), linked to the Hydro-environmental Research Centre's 2-D DIVAST model (Falconer et al, 1999). The focus of the current work is centred on the transportation and decay of coliforms from agricultural runoff into the rivers Frome and Piddle in the UK. The nitrate concentrations and river flows are already modelled in a six years period between 1996 and 2001. By linking the 2-D DIVAST model with SWAT, it is possible to quantify how much of each pollutant reaches the harbour and the impact this has on water quality within the harbour. The other Welsh catchment will be undertaken which will incorporate the coupled SWAT-DIVAST model system. In undertaking these linkages refinements from parallel research, studies will also be made to the kinetics for coliforms and possibly nitrates in the hourly time step. Catchment processes are linked to the weather and climate. The use of atmospheric models linked to this integrated system will provide an added novel research element to this research (Bray et al, 2010).

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British Hydrological Society

Impact of Wind Farms on Weather Radar Rainfall Measurements

Tanu Singh*, Miguel Angel Rico-Ramirez

Department of Civil Engineering, University of Bristol, Bristol, BS81TR, UK,

*ts13823.2013@my.bristol.ac.uk

Abstract:

The wind energy is an important form of renewable energy which is used to generate electricity. In the UK and rest of the countries, the wind industry has tremendously grown over the past decade. Ideal locations for wind farms and the arrangement of the turbines in the farm are determined after extensive climatological studies evaluating factors such as wind speed and direction. But the impact on the nearby radar sites is often not being considered. These wind farms are now a major threat to weather radar network as they block the radar signals, produce clutter and give inaccurate Doppler velocity measurements mainly caused by the rotating blades of the wind turbines. All these result in misinterpretation of rainfall measurements therefore giving false weather warnings and forecasts. This constitutes danger to the air safety and prediction of disasters such as floods, droughts, storms, etc. and also the trajectory of pollutants resulting from industrial or nuclear incidents. Current radars are not designed to identify and filter out signals from wind turbines as the blades are continuously rotating. Hence it is very important to quantify the effect and impact of existing wind turbines on weather radar rainfall and develop strategies how to mitigate the impact of future installations

Modelling Adaptation Scenarios Designed to Mitigate The Impacts of Agricultural Diffuse Water Pollution on Catchment Water Quality

Sam Taylor[1], Yi He[2], and Kevin Hiscock[1]

[1] School of Environmental Sciences, University of East Anglia, Norwich Research Park, Norwich, NR4 7TJ, United Kingdom

[2] Tyndall Centre for Climate Change Research, University of East Anglia, Norwich Research Park, Norwich, NR4 7TJ, United Kingdom

*sam.taylor@uea.ac.uk

Abstract:

Increasing human pressures on the natural environment through the demand for increased agricultural productivity have deteriorated water quality conditions within many environments due to an unbalancing of the nutrient cycle. As a consequence, the increase in agricultural diffuse water pollution has resulted in elevated nutrient concentrations within surface water and groundwater bodies throughout the United Kingdom. This deterioration in water quality has direct consequences for the health of aquatic ecosystems and biodiversity, human health and the use of water as a resource for public water supply and recreation. To mitigate these impacts, and to meet commitments under the EU Water Framework and Drinking Water Directives, there is a need to improve our understanding of the impacts of agricultural land use and management practices on water quality. Water quality models allow a variety of scenarios to be simulated within a catchment including changes in land use and management practices, allowing for an assessment to be made of the effectiveness of these measures in improving conditions. Water quality models therefore provide a valuable tool in assisting the development of our understanding of the impacts of agriculture on water quality.

The aim of this research is to apply the Soil and Water Assessment Tool (SWAT) water quality model to the River Wensum catchment, situated in Norfolk in the East of England, to develop predictions of the impacts of potential changes in land use and management practices on water quality as part of a process to identify those measures that in combination will have the greatest potential to improve water quality.

Model calibration and validation is conducted at four sites within the catchment against observations of river discharge and sediment, nitrate and total phosphorus loads at a monthly time-step using the optimisation algorithm SUFI-2 (Sequential Uncertainty Fitting Version 2) within the program SWAT-CUP (SWAT Calibration and Uncertainty Programs). Model performance is assessed against various statistical measures including the Nash-Sutcliffe efficiency coefficient (NSE) and percentage bias (PBIAS).

A variety of mitigation scenarios are modelled within the catchment, including changes to land use in areas considered to be at high-risk to surface runoff and the introduction of different tillage techniques and cover crop regimes. The impacts of the applied measures on water quality are assessed and recommendations made on which measures have the greatest potential to be applied

within the catchment to improve water quality. This study reports the findings of that analysis and presents techniques by which agricultural diffuse water pollution can be reduced within catchments through the implementation of on-farm measures. The methodology presented has the potential to be applied within other catchments, allowing tailored mitigation strategies to be developed. Ultimately, this research provides tested mitigation options that can be applied within the River Wensum catchment and other similar catchments to improve water quality and to ensure that statutory water quality standards are achieved.

Quantifying Flood Areas in a Large-Scale: Usumacinta River, Mexico

Pedro Noe Paredes Victoria

Department of Civil Engineering, University of Bristol, Bristol, BS81TR, UK,

pp14005@bristol.ac.uk

Abstract:

In recent years (2008 and 2011), catastrophic flood events due to heavy rainfall periods were observed in the Usumacinta river, the river and catchment largest in Mexico (45,443 Km^2). The difficulty for assessing flood impacts in this area is particularly due to the spatial dimensions for being analysed and even, for evaluating inundation impacts in recent approaches is necessary also to consider the uncertainty added in the results by modelling prediction. This work provides an approach of analysis with coupled and simplified models, proving a robust analysis aimed to better decision making criteria designed to consider one of the more relevant uncertainties (hydrological uncertainty in this case). The numerical tools are complemented by integrating high-quality measurements (e.g. by hydrologic and hydraulic records) and LiDAR data for the digital elevation modelling. The hydrological assessment is made by simulations in a parameters-distributed modelling where is possible set up the initial conditions in order to evaluate the hydrological uncertainty, getting so a vast range of sceneries that are used into a quasi-2D hydrodynamic model. Finally, this study is validated with satellite images from the RadarSAT mission. The results between observed and modelled inundation areas shows that high quality input data in simplified hydrologic and hydrodynamic modelling tools can improve flood assessment in large river catchments.

Uncertainty in Hydrological Signatures for Characterising Rainfall-Runoff Processes

I. K. Westerberg[1,2]*, H. K. McMillan[3]

[1] Department of Civil Engineering, University of Bristol, Bristol, UK, BS8 1TR

[2] IVL Swedish Environmental Research Institute, Stockholm, Sweden.

[3] National Institute of Water and Atmospheric Research, Christchurch, New Zealand

*ida.westerberg@bristol.ac.uk, Hilary.McMillan@niwa.co.nz

Abstract:

Information about the characteristics of the runoff processes in a catchment is essential for most hydrological analyses, modelling and water-management applications. Such information derived from observed data is known as a hydrological or diagnostic signature, and have been used in a variety of studies for e.g. catchment classification, model-structural identification, model calibration and regionalisation – and in particular when using large hydrological datasets. Different sources of uncertainty in the observed data – including measurement error and representativeness as well as errors relating to data processing and management – propagate to the values of the derived signatures and reduce their information content. Subjective choices in the method used to calculate the signatures create a further source of uncertainty.

The aim of this study was to contribute to the community's awareness and knowledge of observational uncertainty in hydrological signatures, including typical sources, magnitude and methods for its assessment. We first reviewed the sources and nature of uncertainties relevant to the calculation of different signatures based on rainfall and flow data. We then proposed a generally applicable method to calculate these uncertainties based on Monte Carlo sampling and demonstrated it for a number of commonly used signatures including thresholds in rainfall-runoff response, recession analysis and basic descriptive signatures such as total runoff ratio, and high/low flow statistics.

The study was made for two data rich catchments, the 135 km2 Brue catchment in the UK and the 50 km^2 Mahurangi catchment in New Zealand that are both densely monitored. For rainfall data the uncertainty sources included point measurement uncertainty, the number of gauges used in calculation of the catchment areal average, and epistemic uncertainties relating to lack of quality control. For flow data the uncertainty sources included uncertainties in stage/discharge measurement and in the approximation of the true stage-discharge relation by a rating curve. The resulting uncertainties were compared across the different signatures and catchments to understand how the uncertainties may change with the sources of the uncertainty in the observed data and the active runoff processes.

Urban Flood Simulations by Coupling Hydrological and Hydraulic Models'

H. Zhang

Newcastle University UK

h.zhang3@newcastle.ac.uk

Abstract

This work introduces a new integrated flood modelling tool in urban areas by coupling a hydrodynamic model with a hydrological model in order to overcome the drawbacks of each individual modelling approach, i.e. high computational costs usually associated with hydrodynamic models and less detailed physical representations of the underlying flow processes corresponding to hydrological models.

During a simulation, a catchment is first divided into hydrological and hydraulic zones, where the corresponding model is then applied. In hydrological zones that have more homogeneous land cover and relatively simple topography, a conceptual lumped model is applied to obtain the runoff which is then routed by a group of pre-acquired 'unit hydrographs' to the zone border, for high-resolution hydraulic flood routing thereafter. In hydraulic zones with complex topographic features, including roads, buildings, etc. a full 2D hydrodynamic model is applied to provide more detailed flooding information e.g. water depth, flow velocity and arrival time.

The new integrated flood modelling tool is validated in Morpeth, northeast England by reproducing the September 2008 flood event during which the town was severely inundated following an intense rainfall event. Moreover, the modelling tool is investigated and evaluated according to the effects from temporal and spatial resolutions, bed friction, rainfall, infiltration, buildings and coupling methods. In addition, the coupled model is also employed to implement flood damage estimations under different scenarios of the upstream dam and flood walls in the town centre.

Whilst producing similar results, the new modelling tool is shown to be much more efficient compared with the hydrodynamic model depending on the hydrological zone percentage. These encouraging results indicate that the new modelling tool could be robust and efficient for practitioners to perform flood modelling, damage estimation, risk assessment and flood management in urban areas and large-scale catchments.

British Hydrological Society

Develop a Matching System for Better Hydrological Model Selection, Based on Catchment Conditions

L. Zhuo* and D. Han

Department of Civil Engineering, University of Bristol, BS8 1TR, UK

*lz7913@bristol.ac.uk

Abstract:

Hydrological models play a significant role in water engineering and flood risk management. However, there is a lack of comparative study on the performance of those models to guide hydrologists to choose suitable models for the individual catchment conditions. This paper describes a two-level meta-analysis to build a matching system between catchment complexity (based on catchment significant features CSFs) and model complexity (based on model types). The objective is to use the available CSFs information for selecting the most suitable model type for a given catchment. In this study, the CSFs include the elements of climate, soil type, land cover and catchment scale. Through the literature review, 119 assessments of flow model simulations based on 28 papers are chosen, with a total of 76 catchments. Specific choices of model and model types in small, medium and large catchments are explored. In particular, it is interesting to find that semi-distributed models are the most suitable model type for catchments with the area over 3000km^2.

Notes

General Information

Taxi

There is a taxi rank outside Cardiff Central Station which you can use to take you to your accommodation. The fare to the Trevithick Building, The Parade (where the symposium will take place) will be approximately £6.00 from Central Station and takes about 10 minutes, traffic permitting. If you wish to book a taxi in advance please call 029 2087 3333. Please ask them to take you to the TREVITHICK BUILDING in the PARADE CF24 3AA. If you just ask to be taken to Cardiff University, you are likely to be taken to the wrong campus.

Venues

Presentations and poster displays will be held in Seminar Rooms 1 &2

The evening dinner will be held at the Mercure Hotel, Brecon suite (2nd floor)

Internet

We have arranged wi-fi access. If you are coming from another academic venue you will need to ensure you have registered for EUDOROAM at your home institution. All venues are wi-fi enabled.

Medical Facilities

The University Health Centre is situated at 47 Park Place, and is open from 9.00 – 16.30 Monday – Friday. Please note that the Health Centre is to be used in an Emergency Only. The Health Centre telephone number is 02920874819. Information o local doctors and dental surgeries can be obtained from the Health Centre.

Smoking

Please note that there is no smoking allowed in any enclosed public area in Wales