

BHS Third International Symposium

Role of Hydrology in Managing Consequences of a Changing Global Environment

19-23 July 2010

Newcastle University, Newcastle upon Tyne, United Kingdom

© **Copyright**

British Hydrological Society

ISBN 1 903741 17 3

British Hydrological Society's Third International Symposium, 'Role of Hydrology in Managing the Consequences of a Changing Global Environment', Newcastle University.

Produced by Celia Kirby on behalf of the British Hydrological Society

October 2010

Preface

The British Hydrological Society's Third International Symposium: 'Role of Hydrology in Managing Consequences of a Changing Global Environment' was held 19-23 July 2010 at Newcastle University. In an open call, 215 abstracts were received for the Symposium. Following review, 138 full papers have been submitted to the Proceedings and over 60 posters were on display during the event. We welcomed Professor Zbyszek Kundzewicz (Polish Academy of Sciences and Potsdam Institute for Climate Impact Research) to give the Penman Lecture and keynote addresses by Jamie Hannaford (CEH), Professor Shahbaz Khan (UNESCO) and Professor Enda O'Connell (Newcastle University). In addition to the technical programme, there was also an exhibition, field trips, social programme including the Symposium dinner and a 'Meet the Expert' event for early career hydrologists. The Symposium attracted over 240 delegates from 20 different countries from various university departments, research institutions, public sector agencies and consultants.

This volume contains the full set of papers accepted for presentation, all of which have been subject to external review and we thank both authors and reviewers in the preparation of manuscripts.

Papers are arranged according to the ten Symposium themes under which they were presented:

Climate Change and Hydrological Risk

Flood Risk Management

Groundwater Hydrology

Hydroecology and Ecohydrology

Hydrological Prediction, Forecasting and Uncertainty

Hydrological Processes

Hydrology and the Community

Integrated Catchment Science

Remote Sensing, Hydrometry and Data Assimilation

Water Resources Management

Claire Walsh

Chair, Main Organising Committee

Contents

Climate Change and Hydrological Risk

Applying historical information to flood risk assessment in northeast England

D. Archer

The CREW project: towards a toolkit for the use of probabilistic climate change projections

S. Blenkinsop, S. Hallett, I. Truckell, H.J. Fowler

Using reanalysis data to establish the precipitation and temperature regime of data poor areas: the Guianas of South America.

C.I. Bovolo, R. Pereira, G. Parkin, T. Wagner, C. Kilsby

Stochastic rainfall modelling for the assessment of urban flood hazard in a changing climate

A. Burton, V. Glenis, C.I. Bovolo, S. Blenkinsop, H.J. Fowler , A.S. Chen, S. Djordjevic,C.G. Kilsby

A regional assessment of climate change impact on water resources in the tropical Andes

W. Buytaert, C. Tovar Ingar, C.-A. Arnillas

Extreme precipitation and climate change: the potential impacts on flooding

A. Champion, K. Hodges, L. Bengtsson

Potential evaporation estimates for 25 stations in the UK under climate variability

K.P. Chun, H S. Wheater, C J. Onof

From sensitivity to scenarios: assessing future flood risk through the application of climate model output in operational hydrological-hydraulic models

G.J.C.Darch, P.D. Jones

Statistical trend analysis of River Rhine and Meuse discharges

F. Diermanse, J. Kwadijk, J. Beckers, J. Crebas

Assessment of climate pressures on glacier-melt and snowmelt-derived runoff in the Hindu Kush-Karakoram sector of the Upper Indus Basin

N. Forsythe, C. G. Kilsby, H. J. Fowler, D.R. Archer

Detecting changes in UK precipitation extremes using climate model projections: Implications for managing fluvial flood risk

H.J. Fowler, R. L. Wilby, D. Cooley, S. R. Sain, M. Thurston

UK seasonal river flow variability in near-natural catchments, regional outflows and long hydrometric records

J. Hannaford, C. Harvey ,

Modeling flow and nitrogen dynamics in the River Thames: implication of future climate induced water vulnerability in Southeast England

L.Jin, P.G. Whitehead, G. Chovelon

An updated regional frequency analysis of United Kingdom extreme rainfall from 1961–2009

M. Jones, C.G. Kilsby, H.J Fowler, S. Blenkinsop

Changing flood risk: longer-term flood patterns and generating characteristics in Scotland 1200 to present

L. McEwen

Changing water temperatures: a surface water archive for England and Wales

H.G. Orr, G. Simpson,S. des Clers, M. Hughes,M.D. Dunbar, J. Hannaford, C. Laize, G. Watts, R. Evans, R. Battarbee, R.L. Wilby

Examining the spatio-temporal evolution and characteristics of large-scale European droughts

S. Parry, C. Prudhomme, J. Hannaford, B. Lloyd-Hughes

Regionalisation of the impact of climate change on flood flows using a scenario-neutral approach: application in Great Britain

C. Prudhomme, R. Wilby, S. Crooks, A. Kay, N. Reynard

Are trends in flashiness evident in natural catchments in the United Kingdom?

N.W. Quinn

Impacts of a changing climate on hydrology and water supply in the Mgeni catchment, South Africa

M. Summerton, R. Schulze, L.P. Graham

Vulnerability of water resources under changing climate conditions in upper Mesopotamia

S. Topcu, B. Sen, B. Odemis, B. Sen

Assessing potential climate change impacts on the Shiyang River Basin in Northwest China

R. Wardlaw, S. Howarth, X. Yinlong, X. Wei, Y. Yonghui, Z. Yongyong

Paleo-hydrology and hydrogeology of the Upper Kennet at Silbury Hill in 4200 BP

P. Whitehead, M. Edmunds

Flood Risk Management

Hillslope hydrological processes and influence on runoff generation at the Borthwick Water, Scottish Borders

T. Ball, K. Reilly, J. Forsyth, K. Heal, M. Bonell

Regionalisation model for estimating peak flows accounting for local climatic conditions

A.S. Blatter

Fast solution of the Shallow Water Equations using GPU technology

A. Crossley, R. Lamb, S. Waller

How to calculate design inflows for catchment-wide flood studies

D. Faulkner, C. Keef

Future research needs in flood hydrology for flood risk management

E.Heron, R.Chadderton,

Farming floodplains for the future – promoting new approaches to flood risk management

M. Jones

A multivariate model for the broad scale spatial assessment of flood risk

C. Keef, R. Lamb, J. A. Tawn, S. Laeger

Urban flooding in the face of changing climate

S. Odunuga

Sensitivity of catchment flood management strategies for the River Parrett using a physically distributed model

J-S Park, D. Graham, M. Butts, I. Cluckie

Rural land management impacts on catchment scale flood risk

I. Pattison, S.N. Lane, R.J. Hardy, S.M. Reaney

An inland flood loss estimation model for Great Britain

Y. Qu, B. Dodov, V. Jain, T. Hautaniemi

Adding value to catastrophe models: a multi-site approach to risk assessment for the insurance industry

L. Speight, J. Hall, C. Kilsby, P. Kershaw

Extreme rainfall in Cumbria, November 2009 – an assessment of storm rarity

E.J. Stewart, D.G. Morris, D.A. Jones, P.S. Spencer

A joint probability approach to flood frequency estimation using Monte Carlo simulation

T. R. Kjeldsen, C. Svensson, D. A. Jones

Index flood estimation at ungauged catchments through cross validation

W.Z.B. Wan Jaafar, J. Liu and D. Han

Runoff management: mitigation measures for disconnecting flow pathways in the Belford Burn catchment to reduce flood risk.

M.E. Wilkinson, P.F. Quinn, I. Benson, P. Welton,

FEH pooling group approaches to hydrological regionalisation of time series rainfall-runoff models and flood frequency analysis with uncertainty

A. Wood, K. Beven

The estimation of continuous-time rainfall-flow models for flood risk management

P.C. Young

Groundwater Hydrology

Application of hydrogeological parameters for evaluating the thermal resource potential of deep groundwater systems

C.A. Adams, J.G. Gluyas, S.A. Mathias

Design of carbon dioxide storage

R. Qi, T. LaForce, M. Blunt

Late field life for oil reservoirs – a hydrogeological problem

J. Gluyas, T. Peters

The impact of natural heterogeneity on CO_2 migration in deep saline aquifers

P.A. Herrera, J.M. Nordbotten, B.F. El-Faour, E. Keilegavlen, H.K. Dahle

A model of long-term catchment-scale nitrate transport in a UK Chalk catchment

N. J. K. Howden, S. A. Mathias M. J. Whelan, T. P. Burt, F. Worrall

Preferential flow and apparent hysteresis in the chalk unsaturated zone

A.I. Ireson, A.B. Butler, H.S. Wheater

Nonlinear flow in multiple well systems

A. Mijic, S. A Mathias, T. C La Force

Temperature and electrical conductivity as indicators of stream-aquifer flow paths during an extreme rainfall event

S.J.Parker, AP.Butler, D.J.Allen, H.S.Wheater

Sensitivity analysis of pressure buildup as a failure criterion for CO2 geo-sequestration

M.R. Trudell, S. A. Mathias

CO_2 dissolution from inclined faults in saline aquifers

F.E. Watson, J. van Hunen, S.A. Mathias, R.R. Jones, S.E. Daniels

Extremes in groundwater-dominated catchments: insights from the Chalk of SE England

H.S. Wheater, A.I. Ireson, A.B. Butler, S. Parker, D. Peach, C. Jackson, A. Hughes, T. Vounaki, J. Finch

The groundwater hydrology of underground coal gasification coupled to carbon capture and storage

P.L. Younger, G. González

Hydroecology and Ecohydrology

Investigating periphyton biofilm response to changing phosphorus concentrations in UK rivers using within-river flumes.

M.J.Bowes, K. Lehmann, H. Jarvie, A.C. Singer

Measurement of soil hydraulic conductivity in relation with vegetation

Xi Chen, Qinbo Cheng, Zhicai Zhang

Climate change and the eco-hydrological implications for shallow freshwater systems in un-drained coastal areas.

D. Clarke, C. Stratford

Biotope mapping using combined LIDAR acoustic doppler velocity profiler survey.

N.S. Entwistle, D.J. Milan, G.L. Heritage

The assessment of fine sediment accumulation in rivers using macroinvertebrate community response

C.A. Extence, R.P. Chadd, J. England, M.J. Dunbar, E.D. Taylor, N.C. Everall

Evaluating the impact of projected climate change on water temperature and ecological health in Scottish rivers

R. Gosling, A. Tuhackova

Temporal change in hydraulic habitat inferred from a high resolution 2D flow modelling approach

G. L. Heritage, D. J. Milan, N.S. Entwistle

A method to assess the effect of public water supply abstraction on flow duration and winterbourne invertebrate communities

A. House, N. Punchard

Disturbance of fluvial gravel substrates by signal crayfish (*Pacifastacus leniusculus*)

M.F. Johnson, S.P. Rice, I.Reid

Reassessment eco-hydrological characteristics of the Malham Tarn Mires

A.H. Jones, R. Meade, S.C. Rose, S. Wagstaff

Monthly hydrological indicators to assess impact of change on river ecosystems at the pan-European scale

C. Laize, M. Acreman, M. Dunbar, H. Houghton-Carr

Modelling fixed plant and algal dynamics in rivers: an application to the River Frome

A. Lazar, A.J. Wade, P.G. Whitehead, C.M. Heppell

Contrasting use of hyporheic habitat by benthic invertebrates during spates and low flows

R. Stubbington, P.J. Wood, I. Reid

Hydrological Prediction, Forecasting and Uncertainty

Using uncertainty analysis to improve estimates of water availability for a regulated catchment in southern Australia

R. Adams, A.W. Western

Grey neural networks for estimating the confidence band of a real time forecasting model

S. Alvisi, A. Bernini, M. Franchini

Bayesian conditioning of a rainfall-runoff model for predicting flows in ungauged catchments and under land use changes

N. Bulygina, N. McIntyre, C. Ballard, H. Wheater

Application of a Bayesian processor for predictive uncertainty estimation in real time flood forecasting

G. Coccia, E. Todini

Exploring changes in catchment response characteristics: application of a generic filter for estimating the effective rainfall and unit hydrograph from an observed streamflow timeseries

B. Croke

Development of uncertainty techniques in weather and flood forecasting in The Environment Agency, Midlands Region

R. Cross, I. Clayton

Building a 'Virtual Hydrologist' into hydrological models to assess performance and confidence.

J. Ewen

Quantifying uncertainty in tide, surge and wave modelling during extreme storms

R. Hewston, Y. Chen, S. Pan, Q. Zou, D. Reeve, I.D. Cluckie

Identification of chaos in hydro-meteorological time series

A.W. Jayawardena

Probabilistic Flood Forecasting in England and Wales –can it give us what we crave?

S. Laeger, R. Cross, K. Sene, A. Weerts, K. Beven, D. Leedal, R. J. Moore, M. Vaughan, T. Harrison, C. Whitlow

A case study of tools for manipulating and visualising large flood risk management data *sources*

D. Leedal, N. Hunter, J. Neal, K. Beven

Preliminary comparison of two methods for identifying rainfall-streamflow model parameters insensitive to data time-step: the Wye at Cefn Brwyn, Plynlimon, Wales

I.G. Littlewood, P.C. Young and B.F.W. Croke

Impact of data time interval for real-time hydrological forecasting

J. Liu, D. Han

Evaluating strategies for adaptation investment in a highly variable climate

P. E. O'Connell, S. Blenkinsop, G. O'Donnell, J. Hall

Rural land use management effects in extreme floods

G. O'Donnell, J. Ewen, J. Geris, E. O'Connell

Forecasting river levels during flash floods using data based mechanistic models, online data assimilation and metrological forecasts

P.J. Smith, K.J. Beven

From deterministic to probabilistic thresholds: a better way to take advantage of predictive uncertainty in flood emergency management

E. Todini, G. Coccia

Some observations of optimality in stochastic rainfall-flow models used in flow forecasting

P. C. Young

Hydrology and the Community

Adaptive land use for flood alleviation – exploring the involvement of stakeholders in catchment management

L. Dugdale, I. Pattison, S.N. Lane

The role of local/lay flood knowledge in building community resilience: the case of the 2007 floods, Gloucestershire, UK

L. McEwen, O. Jones

Rivers in trust: the Tyne, its multiple stakeholder constituencies and their 'hold' on the river

M. Newson

Monitoring and evaluation strategy of the Living River Project

E. Stuetzenberger, J. Gough

Space for the river, space for diversity? Contest over multifunctional flood planning

J. Warner

Moving from 'participation' to 'collaboration' in integrated water resources management

N. Watson

Integrated Catchment Science

The effect of engineered features on sources and sinks of nutrients on a dairy farm in south-eastern Australia

R. Adams, L. Dowell, J.E. Lloyd, A.W.Weatherley, M.G. Grace, A.W.Western

Demonstration test catchments

S.P. Burke, D. Mc Gonigle, D. Barraclough S. Evans, B. Harris, N. Preedy

Effectiveness of constructed wetlands to mitigate diffuse pollution in agricultural catchments

C.Deasy, J.N.Quinton, C. Stoate

Understanding hydrological processes for predicting catchment recovery: a case study of a Nitrate Vulnerable Zone in Scotland

S.M. Dunn, C. Birkel, V. Fitzsimons, G. Darling, J.R. Bacon

Individual water security at the cost of common water scarcity: the role of farm dams in the Murray Darling Basin in Australia

L. Kuil, M. Winnubst, A. van Dijk

Hydrology and spatial planning

N. Macdonald, K. Potter, S. Ward

Catchment science and engineering

P. Quinn, S. Burke, M.E. Wilkinson, C. Hewett, J. Jonczyk

Energy crops on floodplains – flood risk or benefit?

Z. Rosolova, A. Baylis, S. Rose, A. Parrott

Approach to flood prevention in the Seine-Normandie catchment: is it primarily a water quality issue?

S. Tellier

Integrated catchment science: from rhetoric to reality in a Scottish HELP basin

A Werritty, C. Spray, T. Ball, M. Bonell, J. Rouillard, A. MacDonald, L. Comins, R. Richardson

Modelling sediment supply and transport in the River Lugg: strategies for controlling sediment loads

P. Whitehead, A. Lazar, M. Futter, L. Pope, A. Wade, R. Willows, C. Burgess

Hydrological Processes

Peatland drain blocking – Can it reduce flood risk?

C. Ballard, N. McIntyre, H.S. Wheater

Using stable isotopes to assess hydrological processes and underpin understanding of diffuse pollution transfer in a nested agricultural catchment system

C. Birkel, S.M. Dunn, D. Tetzlaff, C. Soulsby

Using temperature as a tracer to understand flow pathways in the Slapton Wood and Dunsop catchments

S. J. Birkinshaw, B. Webb

A novel application of a fractional order lag and route model to rainfall-streamflow modelling

M.F. Borthwick, M.Y. Rafiq, A.G. Williams

Scaling implications of a new multiple interacting pathways hillslope model

J. Davies, K .Beven

Hydroclimatological and anthropogenic influences on stream temperature dynamics of the Eisboden glacier-fed river, Austrian Alps

N. E. Dickson, L. E. Brown, J. L. Carrivick

Monitoring and modelling the pre- and post-blocking hydrological response of moorland drains

J. Geris, J. Ewen, G. O'Donnell, P. E. O'Connell

An evaluation of three lumped conceptual rainfall-runoff models at catchment scale

N.T. Lan Anh, J.B. Boxall, A.J. Saul, P. Willem

In-stream phosphorus dynamics from high temporal sampling in the River Leith, Cumbria, UK.

N.J. Mullinger, A.L. Heathwaite, P.O. Keenan, H. Zhang

The COsmic-ray Soil Moisture Observing System (COSMOS): a non-invasive, intermediate scale soil moisture measurement network.

W. J. Shuttleworth, M. Zreda, X. Zeng, C. Zweck, T. P.A. Ferré

The Data-Based Mechanistic Approach to the Emulation of large Hydrological Process Models

P.C. Young

Remote Sensing, Hydrometry and Data Assimilation

Demonstration of the use of remote sensing for discharge estimation at an ungauged site

S. J. Birkinshaw, P. Moore, G. O'Donnell , C. Kilsby, M. Williams

The effects of variation in snow properties on snow mass estimation using the Chang algorithm

I.J. Davenport, M.J. Sandells, R.J. Gurney

Evaluating the benefits of the hydrometric network in England and Wales

R. Davis, R. Grew, M. Zaidman, K. Garrett

Evaporation measurements at kilometre scales determined using two-wavelength scintillometry

J. G. Evans, D. D. McNeil, J. F. Finch, T. Murray, R. J. Harding and A. Verhoef

The 2009 Cumbrian Floods. Using acoustic doppler technology to rebuild a monitoring capability

N. Everard

Hydrological data management systems within a national river flow archive

M.J. Fry, O. Swain

Developing best practice for infilling daily river flow data

C. Harvey, H. Dixon, J. Hannaford.

Downscaling cumulative rainfall for comparison by four cumulus parameterization schemes in the Brue Catchment

A. Ishak, M. Bray, D. Han

Performance of satellite indices to assess agricultural drought risk

S. Morid, S. Arshad, M.R. Mobasheri, M. A. Alikhani

Observations of snowpack properties to evaluate ground-based microwave remote sensing

N. Rutter, H. Marshall, K. Tape, R. Essery

Physics-based modelling for remote sensing of snow

M. Sandells, G. Flerchinger, R. Gurney, D. Marks

Intercomparison of three satellite-based precipitation products at basin scale

B. Yong, L. Ren, Y. Hong, X. Chen, W. Wang, Q. Li, F. Yuan

Preliminary hydrological appraisal of dual polarisation radar rainfall data in the UK

D.Zhu, I.D.Cluckie

Water Resources Management

Water resources planning with limited data: use of Kohonen Self-Organising Map as data extension tool for Lagos water supply study

A. J. Adeloye, R. Rustum

Modelling water scarcity across Europe in terms of water quantity and quality

E. Dumont, R. Williams, V. Keller, S. Folwell

Time series flow modelling at ungauged sites: a simple transformation approach to aid water resources regulation

N. Goody, R. Gosling, P.Copestake

An integrated socio-technical framework for implementing the integrated water resources plan for Lake Urmia Basin, Iran

M. Hashemi, P.E. O'Connell, J.M. Amezaga, G. Parkin

Hydrological model and data analysis support for climate change adaptation strategies within a South African water board.

D. A. Hughes, W. J. Muller

Drying trend in the Volta Basin and policy implications for adaptation

R. Kasei, E. Derbile, B. Diekkrüger

Setting environmental flow needs for Zhangxi River, China

Z. Liu, M.C. Acreman, Y. Luo, F.J. Gong, M.R. Chen, X. Lin, P. Rameshwaran

Balancing water resource supply and demand - a minimum cost optimisation model for infrastructure systems

S. Padula, J. Harou, L. Papageorgiou, V. Viros

Challenges and adequacy of water resources management policies in Bangladesh

S.K. Pal, J. Adeloye

Challenges facing urban water sector in Libya

K. Rashed

Catching the release - some different approaches to water resource management

A. J. Tollow

Water resources and modelling in the Shiyang River Basin

J. van Wonderen, D. Moore, R. Wardlaw, W. Zhongjing, H. Litang, S. Qingling

The impact of climate change on the UK water industry's ability to deliver a water supply service to its customers.

R. Wilkinson

Environmental flows in reservoir design and operation

X. Yin, Z. Yang, G.E. Petts