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THE NEWSLETTER OF THE BRITISH HYDROLOGICAL SOCIETY

Circulation

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Flood Estimation Handbook

Institution of Civil Engineers, London
3 November 1999

The large number of delegates at the ICE marked the importance of this main technical launch of the *Flood Estimation Handbook*, the successor to the *Flood Studies Report*. The proceedings were introduced by Professor Howard Wheater, David Richardson (Chairman of the Advisory Group) and Duncan Reed (Research Team Leader).

Sponsored principally by MAFF, the research which led to the FEH began some six years ago. It was undertaken by staff at the Institute of Hydrology and guided by a Technical Advisory Group. MAFF's purpose in instigating the research was to consolidate the advice embodied in the FSR with the knowledge subsequently accrued, and to present guidance in a form which would encourage the best efforts in quantifying flood risk and thus minimise the national uncertainty about the risk of flooding.

Completion of the FEH comes at a time when flood defence is in the public eye as a result of the Bye report into the April 1998 flooding and the Environment Agency's flood awareness campaign.

The FEH embodies the same event-based approach to flood estimation that was advanced by the FSR. The research emphasis was statistical, so the statistical method is extensively revised whereas the rainfall-runoff method is essentially restated, but for a revised statistical summary of rainfall. The form of the FEH meets the urge to realise the potentials of recent digital technology. The mapped catchment characteristics of the FSR are replaced

by descriptors derived from a digital terrain model and presented on a CD-ROM. A new WINFAP program is provided for the statistical analysis of flood peaks. The five volumes are:

1 Overview
2 Rainfall frequency estimation
3 Statistical procedures for flood frequency estimation
4 Restatement and application of the FSR rainfall-runoff method
5 Catchment Descriptors

Software will become available in December, with the handbook volumes following at the end of January.

Setting the FEH in the historical context of the succession of flood studies that began with the Interim Report of 1933, **Professor Peter Wolf** saw the FEH as a polishing of the methods of the FSR. He urged MAFF to continue sponsoring research into flood estimation, expecting future research to consider the thermodynamics of the processes which lead to flooding. This recorder hopes that he will be able to hear Professor Wolf's perspective on UK flood hydrology when the revision to the FEH is reviewed at the ICE in, maybe, another 25 years.

There followed a series of presentations by those involved in the research and writing of the FEH, who were all on the staff of the Institute of Hydrology at the time the work was done.

Science underpinning the FEH

The morning session was devoted to aspects of the science underpinning the handbook.

Christel Prudhomme described the method of mapping the index of maximum rainfall. By incorporating topographical information into the interpolation procedure, this produces mapping that reflects the topography more strongly than spatial mapping alone. To a question from **Elizabeth Shaw**, Christel explained that the two-day rainfall had also been mapped.

Duncan Faulkner described rainfall growth estimation using growth curves focused on the subject site and based on raingauge networks which grow with increasing values of return period. This method is likely to detect departures from the more generalised methods of the FSR. It introduces the idea of the equivalent number of independent sites. Rainfall is summarised in a segmented set of depth-duration-frequency curves with confidence limits. Duncan explained, in answer to **Ben Piper**, that rainfall predicted by the focused rainfall method (known as FORGEX) and the generalised FSR method differed: the difference noted at Bridgwater was an extreme example. Responding to **Frank Law**, Duncan referred to evidence of the effect of distance from the continent on rainfall of about one hour duration.

Adrian Bayliss explained the use of the Institute of Hydrology Digital Terrain Model (IHDTM) in defining catchment boundaries and in obtaining more descriptive hydrological parameters than can be got from mapping (as used in the FSR). The IHDTM nodes are connected by drainage paths to rivers, which are used to define valley floors. An important revision from the catchment characteristics of the FSR is the FEH urban descriptor, based on the ITE Land Cover Map of 1990. The FEH CD-ROM holds a database of descriptors derived from the IHDTM for sites that drain an area of at least 0.5km^2. In answer to **Steven Dunthorne**, Adrian explained that there is an adjustment to predict future urban development.

Practical application of the FEH

The afternoon session concerned the practical application of the handbook.

Helen Houghton-Carr described the two approaches to flood estimation – the statistical and rainfall-runoff methods – which are familiar to FSR users and are preserved in the FEH. The FEH emphasises the value of incorporating local data into flood estimation and of reconciling estimates from both methods. The index flood used in the statistical method is now the median annual maximum flood. The regional growth curves of the FSR are replaced in the FEH by growth curves based on pooling groups – a dataset drawn from gauge sites similar to the subject site. The FEH has guidance on its use with the current version of MicroFSR: a revised version of the program is intended.

Dörte Jakob described the use of the WINFAP-FEH software to produce frequency analyses based on pooling groups of gauging stations. The software offers tests to determine the eligibility of a gauging station for use in a pooling group and helps determine the size required for the pooling group (related to the frequency of the flood estimate required). To a question from **Laura Baird**, Dörte explained that the user should expect to reject and resample entries in the pooling group that is initially offered by WINFAP-FEH.

Duncan Reed demonstrated the WINFAP-FEH software. The generalised logistic distribution is now preferred for use in extreme value analysis. Confidence limits of the flood estimates were shown to reduce as at-site data was replaced by data from a pooling group. The program is not entirely prescriptive: the user may intervene in the selecting of stations in the pooling group, accepting (for example) some heterogeneity in the data in order to extract more information from the dataset about extreme floods.

Anna Wesselink raised the issue of the inadequacy of many gauge ratings. Duncan explained that the FEH index flood is robust, but there might be a case for adjusting the method of pooling if ratings were updated.

Alice Robson introduced the concepts of trend and non-stationarity in data and the statistical tests that can be used to test for change. In a major study of the UK flood series, it became clear that the trend in flood series is associated with climatic variability, not necessarily climate change. Short flood records may accordingly show trend that is not apparent in a longer record. **Andrew Black** noted the possibility of climate change being detected in Scotland and asked to what part of the record the index flood was adjusted. Alice explained the procedure for obtaining the long-term measure of the index.

Discussion

Con Cunnane's views of the FEH, with which he introduced the discussion, were that it serves both as a handbook and a text book, strong on advice and technical background. Its methods present a good balance between the need for precision in estimation and the need to extract information from data. In a discussion of the rainfall aspects, Duncan Faulkner and Duncan Reed explained that the method of pooling should smooth the effects of climatic variability and that estimates of extremes are more likely to increase than to decrease. The transformation of point rainfall to areal rainfall was not re-examined in the research for the FEH, but there is a case for doing so with the data available now. There was some discussion about relating short-duration rainfall to the origin of storms, something now being researched at the Institute of Hydrology.

Frank Law enquired about the use of long series of historical data and the relevance of ice and snow to the prediction of water level. The FEH is concerned with the analysis of peak flows, not their causation, but Duncan Reed felt that the answers to such questions may come through research into the synthesis of flood flows by simulation modelling, rather than from the event-based approach that the FEH preserves.

There is scope for taking the FEH methodology to an international audience. In particular, a generalised overseas version of the WINFAP-FEH program for the statistical method could be envisaged.

In closing the discussion, Professor Con Cunnane spoke of the scope for continuing research, identifying as an example the re-analysis of the rainfall/runoff method. One felt compelled by this stimulating meeting to follow David Richardson's appeal to read the FEH, '... at least Volume 1'.

Alan Warren & Ian Rose

The FEH is now available from the IH library *(tel 01491 692266 — http://www.nwl.ac.uk/feh)*

President's Piece

It is slightly daunting to be writing the first President's Piece of a new millennium, but it seems that we have survived millennium bugs of various kinds (including flu) and that life in the 21st Century is perhaps not so very different from the late 20th!

Since my last piece in October, we have seen the inauguration of a hydrologist as President of the Institution of Civil Engineers. **George Fleming** gave an inspiring inaugural address in early November, with a strong message about the importance of environmental management in Civil Engineering and the need for breadth in the profession. The following day (3rd November), BHS held a one-day meeting at the ICE on the *Flood Estimation Handbook*, with a series of excellent presentations from the Institute of Hydrology team (see meeting report above). The FEH undoubtedly is a watershed in UK practice, and we all look forward to moving ahead with the new approach and software (available from IH now: see page 2).

Also in November, I attended my first meeting of the Inter-departmental Committee on Hydrology. This august body had been shrouded in mystery for me. However, it is simply a group that represents the various UK government departments and agencies involved in Hydrology (evolving in response to devolution), plus IH, BGS, the Met. Office, BHS and the UK IAHS Chairman, and meets annually to exchange news and views.

David Collins represented IAHS at that meeting, but the new year has seen **Bruce Webb** taking over as Chair of the UK IAHS Committee. This gives me an opportunity to thank David for his very considerable input to IAHS activities on behalf of the UK, and to welcome Bruce back onto the BHS committee wearing his new IAHS hat.

The recent BHS committee meeting also welcomed **Ian Littlewood** as the representative of the Institute of Hydrology. IH has given very considerable support to BHS since our inception, and continues to provide editorial assistance through **John Griffin**. We were very pleased to hear a message of continued support for the Society from the IH Director, **Jim Wallace**, at what is a time of change in NERC. Many of you will be aware that IH will become the *Centre for Ecology and Hydrology – Wallingford* in April this year.

I have resumed the practice of the BHS President's attendance at the CIWEM Water Resources Panel, which met in October and January. This is an expert group with wide industry membership, which runs its own programme of meetings and publications, including a series of *Policy Position Statements*. Like BHS, the Panel has been busy discussing the Environment Agency water resources consultation document. BHS is currently preparing a submission by the end of January, led by the Hon. Sec. If members are interested, a copy of the BHS response is available on our website, or from **Peter Walsh** for those without access to the internet.

Another personal first for me was attendance at the American Geophysical Union Fall Meeting in San Francisco in December. A slot as invited speaker gave me the luxury of a 20-minute talk (normal presentation length is 15 minutes, including questions). Despite the somewhat frenetic pace of presentations, the meeting was excellent, and very stimulating, with well-managed poster sessions a key vehicle for informal discussion. The meeting runs for five days, with five parallel sessions in hydrology each half-day plus associated 'Town Hall' meetings to discuss strategic initiatives, etc.

Andras Szöllösi-Nagy from UNESCO presented current international initiatives, with a very welcome acknowledgement of the role of BHS and the 'Exeter Statement' in providing the impetus for the new HELP initiative (Hydrology for Environment, Life and Policy). I also had friendly discussions with the Chair of the AGU Hydrology Section, with much goodwill for cooperation with BHS. I would certainly recommend those of you who can escape for a few days to San Francisco in December to consider attending. The British Airways return fare was just slightly greater than London-Edinburgh!

Finally, many thanks to those of you who took the time to email your thoughts on the future of BHS to me. I have not been overwhelmed by the number of responses, so please, if you would like to let me have your views, it is not too late to email ***now*** (h.wheater @ic.ac.uk) or over the next few weeks. Apart from a justified comment from our past Treasurer, **Rod Hawnt**, that it is good to receive meeting fliers before the meeting takes place, the main thrust of comments concerned the support from BHS for Hydrology as a profession. There were suggestions that we should revisit the role of ICE in accrediting hydrologists, or consider taking on this role as a Society, and that more could be done to provide meetings directly related to Continuing Professional Development needs, possibly within the framework of a structured training programme.

There was a call for BHS to be more proactive in terms of press visibility and strategic initiatives. A suggestion was also made that there could be a role for a journal aimed at British hydrological research, possibly internet-based. If these comments either strike a chord or provoke a response of outrage, please let me know. The BHS committee has set up a number of working groups (leader in brackets): Strategy (Howard Wheater), Policy Initiatives (Peter Walsh), Publications (Celia Kirby), the Internet (Matthew Lees), Education and Training (Peter Midgley), National/ Regional Structure (Roger Simpson), International Links (Bruce Webb) and Membership (Terry Evans). They will be working towards a report in the Autumn. If you would like to contribute, please contact me or the appropriate group leader.

Howard Wheater

New committee members

Welcome to new committee members **Chris Bradley** (Midlands Section), **Hayley Fowler** (Pennines Hydrological Group), **Claire Hammond** (Welsh Hydrological Group), **Ian Littlewood** (Institute of Hydrology), **Peter Midgley** (Environment Agency) and **Roger Simpson** (Simpson & Partners).

Some of the BHS committee introduce themselves here (more next time):

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Dr Chris Bradley (the Midlands Section representative) is a Lecturer in geography and environmental science at the School of Geography, University of Birmingham. His MSc was in glacial hydrology; his PhD on the hydrology of a floodplain wetland. His interests are monitoring and modelling of floodplains; wetland hydrology, including numerical analysis of water-table fluctuation and unsaturated water flow; experimental studies of hydrological properties; effects of climate change and river control on wetland hydrology. *(tel 0121 414 3878; email: C.Bradley@bham.ac.uk).*

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Dr Adrian Butler (who chairs the BHS Southern Section committee) represents

the region's interests on the national committee. He began his career at the Meteorological Office in Bracknell, but moved to Imperial College to study hydrology and now lecturers in sub-surface hydrology in the Department of Civil and Environmental Engineering there. He mainly teaches groundwater flow and contaminant transport to undergraduate and MSc students.

His research is in contaminant transport processes in sub-surface systems and their impact on the environment, including the application of stochastic modelling techniques to groundwater contaminant transport problems, modelling techniques for the movement and uptake of radionuclides in vegetated soils, and hydrological and biological controls on the transport and remediation of organic pollutants for contaminated land. He also models contaminant transport processes in landfill waste and liner systems.

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Dr Dawei Han moved from Salford to Bristol University about two years ago to help set up the Water and Environmental Management Research Centre with Professor Ian Cluckie. He ran the Postgraduate Symposium last year.

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Cliff Dobson is co-opted onto the BHS committee to provide a link with CIWEM's Water Resources Panel. He is Planning and Customer Services Manager in Upper Trent Area of the Environment Agency, a role which covers aspects of sustainable development in the built and natural environment. Previously he specialised in flood forecasting model developments and water resources management.

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Hayley Fowler, who has taken over from Kevin Tilford as the Pennines Group representative, graduated from Cambridge University with a 1st in Geography in 1996. She worked for Bechtel Water in Warrington for three months on control engineering projects, including the Shell Green Mersey Valley sludge pipeline link and leakage control on the Thirlmere aqueduct.

Moving to Newcastle University, she gained a distinction in her MSc in Water Resource Systems Engineering and is now in the 3rd year of a PhD at the Civil Engineering Department, looking at the vulnerability of water supply systems in Yorkshire to climate change, sponsored jointly by EPSRC and the Environment Agency.

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Claire Hammond (the new representative of the Welsh Hydrological Group on the BHS Committee) has an MSc in Hydrology for Environmental Management. She works for SRK (UK) Ltd in Cardiff, where she has carried out a risk assessment for a tailings dam in Portugal, a water supply study and geotechnical investigation for proposed mines in West Africa, and has been involved in the consultation and technical study for the Independent Investigation into Flooding at Aberfan, South Wales. Before joining SRK, Claire worked for ARCADIS on the design of a wetland nature reserve, R&D projects for the Environment Agency, GPZ determinations, groundwater and surface water modelling. She was seconded to the Environment Agency as a hydrologist during the 1996/97 drought, has worked on groundwater models and supervised deep injection well drilling, installation and testing in Florida, and is a visiting lecturer in hydrogeology at Cardiff University.

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Dr Ian Littlewood is Celia Kirby's successor as Institute of Hydrology representative on the BHS Committee. Ian is a founding member of BHS and has contributed to the Society's events (and *Circulation*) over many years. Ian began his hydrological career at the Institute of Hydrology, took a first degree in Environmental Sciences at the University of Lancaster, and then worked as an engineering hydrologist – first in the Civil Service (Water Data Unit) and later at the Welsh Water Authority. He took part in the Llyn Brianne Acid Waters Project while undertaking his PhD research on acid runoff dynamics in the Geography



BHS Committee Members at the January meeting: from left to right (back row) Lisa Stafford (Secretary), Dr Andrew Black, Steve Parsons, Dr Chris Bradley, Dr Matthew Lees, Dr Ian Littlewood, Roger Simpson, Dr Dawei Han; (front row) Celia Kirby, Dr Peter Walsh (Hon. Sec.), Prof. Howard Wheater (President), Terry Evans (Hon. Treas.), Hayley Fowler. Committee members not pictured: Graeme Boyce, Dr Adrian Butler, Cliff Dobson, Claire Hammond, Dr Peter Midgley, Rob Scarrott, Prof. Bruce Webb.

Department at University College, Swansea. During this time he worked closely again with colleagues at the Institute of Hydrology, where he now works.

His research interests include: development and research applications of a unit hydrograph methodology (and associated PC software) for continuous streamflow simulation, and systematic estimation of river mass loads from national river flow and water quality databases. As well as co-supervision of students in the UK and France, Ian is UK National Correspondent of the European Network of Experimental and Representative Basins (ERB).

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Peter Midgley (a founder member of BHS) has been Sussex Area Manager for the Environment Agency (formerly NRA) since 1992. He has been a regular contributor to BHS Symposia as well as an active member of the Southern Section Committee. He has worked in the water and environmental industry since leaving university in the mid-1970s, mostly as an operational hydrologist in Hampshire, with particular interest in chalk hydrology, the response of chalk catchments to extreme rainfall, overabstraction, and groundwater quality. In his current work, Peter is responsible for flood defence, coastal processes, water resources, water quality, waste regulation, fisheries and ecology.

News from members

BHS President **Howard Wheater** has accepted an offer of life membership of the International Water Academy.

Based in Oslo, the Academy was founded in January 1998 and aims to improve knowledge about water and to facilitate peaceful resolution of water-related conflicts. Other academicians include Peter Eagleson, Gedeon Dagan, Refael Bras and Uri Shamir.

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Paul Webster will shortly be joining Hydro-Logic Ltd as Consultancy Services Manager, based in their Bromyard office. Working closely with **Stewart Child** (Consultancy Services Director) he will strengthen the firm's capability in the fields of water resources, flood studies, river modelling and urban drainage. Paul will take up his duties in June, but hopes to maintain close links with ongoing research at The University of Birmingham.

New members

We welcome the following members to the Society:

Miss S. Adair	Environment Agency, Lincoln
Mr A. Bilgi	Brown & Root, Leatherhead, Surrey
Mr B. Chea	Environment Agency, London
Mr J. Crabbe	Environment Agency, Tewkesbury, Gloucestershire
Miss R. Day	Environment Agency, Reading, Berkshire
Mr I. Knight	Parkman Ltd, Liverpool
Dr D. Koutsoyiannis	Dept of Water Resource, University of Athens
Mr S. Lau	Department of Geography, Cambridge University
Miss S. McCarthy	Environment Agency, Lichfield, Staffordshire
Miss A. Moreno	Bogota, Colombia
Miss H. Procter	Environment Agency, Hampshire & Isle of Wight Area
Mr A. Sincock	Dept of Civil & Environ. Engineering, Imperial College, London
Miss J. Pickles	Bullen Consultants, Bradford
Miss J. Soggee	St Neots, Cambridgeshire
Miss M. Timoncini	Queen Mary and Westfield College, London
Mr S. Underwood	Posford Duvivier, Peterborough
Mr A. Vairavamoothy	London
Miss L. Woolf	University of Hertfordshire

Coping with floods: lessons learned from recent experience

NATO advanced research workshop Malenovice, Czech Republic 16-21 May 1999

80 delegates gathered in Malenovice to discuss a wide range of flood related topics ranging from real-time forecasting to flood insurance. The workshop location was chosen because the Czech Republic suffered serious flooding in 1997 and 1998 and the Czech authorities are currently in the process of instigating improved flood forecasting and control measures. There were too many presentations to allow even a brief summary of each one, but papers will be appearing in a NATO publication (Marsalek, 2000), so this account is restricted to a summary of the presentations and discussions that I consider to be the most interesting in the context of the Easter 1998 floods.

A. Bronstert (Potsdam) presented the results of a workshop of the European Commission on the Oder flood in the summer of 1997, which suggested that the way forward in flood management is to concentrate not only on flood defence measures but also on the modification of susceptibility to losses (Bronstert *et al.*, 1997).

A number of speakers, including **Bob Moore** (CEH), **J. Host-Madsen** (DHI), and **E. Todini** (Bologna), suggested that closer integration of meteorological models, radar data and hydrological models should be sought in order to produce a more holistic approach to flood management. Todini presented an interesting method of short-term rainfall forecasting using local linear models. I presented a paper on advances in transfer function flood forecasting including real-time updating and production of probabilistic forecasts.

F. Sieker (Hannover) described methods of urban flood mitigation through stormwater management. He presented some impressive results for an infiltration system that reduced the five-year storm runoff by between 25 and 80 per cent. **M. Jak** (Department of Water Management) and **M. Kok** (HKV consultants) described flood management in the Netherlands, specifically the development of a national database of historical flood damage data and its potential use in a risk-based approach to design protection levels.

In discussion the following points were drawn out as important:

Significant advances have been made in flood forecasting methods, however take-up of improved methodologies is slow. The importance of selecting the right models for the right purpose was stressed, as was the need for the selection to be carried out by an engineer with a proper modelling background. Proper post-flood forecasting model performance analysis should be carried out.

Flood forecasts should be communicated with associated uncertainties. Further research is required to reliably estimate the uncertainties resulting from different data inputs and models.

Warning dissemination is an area that could be improved through the use of modern technology, such as the Internet, and by engaging social scientists to enhance communication with communities at risk. Communities should also be taught self-help.

I am grateful to BHS for the travel grant to attend this workshop.

Matthew Lees, Imperial College

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Bronstert, A., Ghazi, A., Hladny, J., Kundzewicz, Z.W. and Menzel, L. (Eds.) 1998. The Odra/Oder flood in summer 1997, Proc. European expert meeting in Potsdam, PIK Report 48, Potsdam Institute for Climate Impact Research.

Marsalek, J. 2000. Coping with floods: lessons learned from recent experience, NATO ASI Series, Kluwer, Dordrecht.

Ingenious early soil warming in the Georgian era

"... A Mr Taylor, who once kept this [Matlock] bath, produced early vegetables by conveying a stream of [the mineral spring] water under a border of his garden ... ."

From 'The natural history of the Buxton and Matlock waters, in a letter from Dr Darwin, to Mr Pilkington'. First Volume of Pilkington's *View of the Present State of Derbyshire*, 1788.

Frank Law

Water specialists meet in Bristol

University of Bristol 14-17 September 1999

In the summer of 1962 **Professor Isaac** organised a meeting at the University of Newcastle for specialists from universities teaching Public Health Engineering. This expanded quite quickly to include Hydrology, and staff teaching Hydraulics later joined the group. A pattern of meetings emerged in which each subject was treated separately but on three successive days so that staff could attend one or more days and meet not only colleagues working in the same subject area but also those in cognate disciplines. These meetings continued until 1986, when through financial constraints, pressure on staff time, as well as a sense that perhaps the meetings had ceased to be relevant, they ceased.

In 1997 the British Hydrological Society discussed reviving the meetings for hydrologists working in universities, and **Professor Robert Sellin** approached the hydraulics specialists to see whether they should re-establish their meetings. From these discussions the concept of restarting the meetings was born. The first meeting in the new series took place between 14 and 17 September 1999 at Badock Hall, University of Bristol, attracting more than 80 academics from across the UK. It was organised by the newly-established Water and Environmental Management Research Centre in the Department of Civil Engineering, under the influence of **Professor Ian Cluckie**, WEMRC's founding Director.

As in previous years, the meeting covered the fields of Hydraulics, Hydrology and Public Health Engineering, the sessions being convened by Professor Robert Sellin (Bristol), **Professor Mike Hamlin** (Birmingham) and **Professor Kenneth Iwugo** (UWE) respectively, who organised the 40 speakers admirably. The format of afternoon, evening and morning sessions for each subject was retained, resulting in lively discussion of a wide range of topics and ample opportunity for people to meet former colleagues and collaborators.

The meeting opened with a keynote presentation by **Professor Roger Falconer** (Cardiff) on the modelling of hydrodynamics. Papers followed on mathematical modelling, and sessions on river engineering, hydroinformatics and coastal engineering brought the Hydraulics meeting to a close.

The Hydrology meeting began with **Professor Robert Gurney** (Reading) giving an overview of hydrological remote sensing, a theme that continued with papers on water quality management and hydraulic modelling (**Dr Andrew Folkard**, Lancaster) and radar hydrology (**Dr Dawei Han**, Bristol).

Professor Enda O'Connell (Newcastle) then outlined the aims and objectives of the recently funded CHASM and LOCAR catchment experiments. This proved to be a highly stimulating subject, provoking much after-dinner discussion. Other papers covered such diverse subjects as the influence of climatic variability on recent changes in precipitation and runoff in Scotland (**Professor Andrew Werritty**, Dundee), the regionalisation of rainfall runoff models (**Dr Matthew Lees**, Imperial College), sediment dynamics in the Tropics (**Dr Nick Chappell**, Lancaster) and the geographical context of river channel adjustments (**Professor Ken Gregory**, Southampton).

Sessions on Public Health Engineering (which renamed itself Water Quality Engineering during the course of the meeting) were led by **Professor Richard Ashley** (Abertay), who discussed the move from pollution control towards integrated pollution management; **Professor Paul Jowitt** (Heriot-Watt), who considered the future of environmental engineering education and training; **Professor Bob Andoh** (Hydro International plc) on urban drainage systems for the new Millennium and **Professor David Lerner** (Sheffield) who gave an overview of contaminated land and groundwater pollution.

At the close there was unanimous agreement that the revival of this meeting was a success, and provisional arrangements have been made to hold the next one in September 2001 at Birmingham University, with the 2003 meeting to be held at Cardiff.

Thanks are extended to all the staff of Badock Hall for the smooth running of on-site facilities, and to WEMRC staff, particularly **Lisa Collett**, for their assistance.

Richard Griffith & Lisa Collett
University of Bristol

Integrated catchment water quality modelling

BHS National Meeting
Imperial College, London
22 September 1999

This one-day meeting on recent developments and future directions in integrated catchment water quality modelling was organised by Matthew Lees. It brought together over 60 delegates with a wide variety of backgrounds, ranging from academics to consultants and regulators, all with an involvement or interest in integrated catchment water quality modelling. Speakers and audience took part in a stimulating discussion of recent model developments and identified needs for further research and technology transfer.

Professor Paul Whitehead (Reading University) welcomed the participants and introduced the morning session.

Research developments and directions

Matthew Lees (Imperial College) presented some advances in generic water quality modelling approaches, including recent work on methods of representing spatial heterogeneity using statistical distributions, and the development of non-steady flow solute transport models. Spatially and temporally averaged hydrochemical models are commonly used to assess the impact of acidic emissions on susceptible catchments. However, there is increasing evidence that aquatic ecology is affected by relatively short duration episodic events, which vary considerably in nature, even within small catchments. Work at Imperial College has led to the development of a new catchment acidification model, which can produce spatially distributed predictions of streamwater chemistry with an hourly temporal resolution. This dynamic episodic model is then linked to a long-term dynamic acidification model, such as MAGIC, to evaluate the impact of different emission scenarios.

Solute transport models form the core of most dynamic river water quality models and are usually based on the Advection Diffusion Equations (ADE) in the distributed case or Continuously Stirred Tank Reactors (CSTR) in the lumped case. Matthew described some limitations of these solute transport models when applied under non-steady flow conditions or where dead-zones significantly affect solute transport.

Two new models had been developed at Imperial: *1.* A physics-based model coupling the St Venant flow equations with the transient storage modification of the ADE model; 2. A non-steady-flow Aggregated Dead-Zone (ADZ) model. Since both models perform well in validation exercises, the appropriate choice in practice should be dictated by the application. However, the extended ADZ model is very parsimonious and because of its computational efficiency can be used to produce estimates of predictive uncertainty using Monte Carlo techniques.

Helen Jarvie (Institute of Hydrology) presented the results of an evaluation from the responses of the upper reaches of the River Kennet system to point-source reductions in phosphorus. This followed the introduction of phosphorus-treatment of sewage effluents at Marlborough wastewater treatment plant (WWTP) in August 1997. Using boron as a conservative tracer of sewage effluent, it can be demonstrated that phosphorus treatment at the WWTP has reduced in-stream soluble reactive phosphorus (SRP) concentrations by about 66%.

Monitoring has also helped to understand phosphorus transport dynamics in the River Kennet system. SRP and particulate phosphorus (PP) concentrations and loading are affected by diffuse sources under high river flows. PP sensitivity under low river flows is also large, with concentrations mainly affected by in-channel sources. It had been possible to identify major net in-stream SRP losses under summer low flows and gains under winter high flows. The extensive monitoring has also helped to study the processes governing uptake of SRP by algal biofilms and uptake and release of phosphorus into bed sediments. Equilibrium phosphorus concentrations (EPC_0), used to calculate the flux of SRP to/from the river bed sediments, show that there is a potential for phosphorus release from sediment downstream of the WWTP. However, since sediments are heterogeneous and dead zones are present with very low EPC_0 values, uptake of phosphorus is also possible. The studies show that algal biofilms are removing SRP from river water into plant biomass and an inorganic acid-soluble component, and that $CaCO_3$-P co-precipitation is occurring on surfaces covered by algal bio-films. The rate of uptake of phosphorus is greater on surfaces in the mid-water column than on the riverbed.

Andrew Wade (Aquatic Environments Research Centre, Reading University) presented the INCA (Integrated Nitrogen in Catchments) model. Given the soil and water quality problems linked to nitrogen – such as acidification and eutrophication – models need to be capable of simulating the impact of multiple sources of nitrogen on river catchments. INCA is an attempt to produce such a model, as it simulates the hydrology and soil and streamwater nitrogen dynamics at scales appropriate for the study of large catchments.

Process equations, based on mass-balances, describe production of NO_3 and NH_4 within the soil of six different land-use groups and subsequent transfer to the stream. The nitrogen flux from each land-use group is combined; then after the instream processes have been taken into account, the output is routed down the main river channel. The model's potential as a management tool was discussed in the context of its application to the River Tywi.

INCA produces estimates of nitrogen process loads in the plant/soil system, simulates NO_3 and NH_4 concentrations at points along the river network, and computes summary statistics. The model is useful to formal-ise concepts of catchment behaviour and to test hypotheses about different processes; it also serves as a learning tool for examining the dynamics of water quality change, both in terms of hydrological events and annual changes in catchment nitrogen stores.

Its main limitations result from parameter and structural uncertainty. Difficulties arise because calibrated model parameters represent the rates and relative importance of catchment hydrological and biochemical processes, but the rates and the relative importance of the processes may change with changing land use, deposition or climate.

Questions arising from applications of the model can, however, help to focus field and laboratory studies on the key catchment factors and

processes that require greater understanding. The iterative procedure of data gathering, model creation and hypothesis testing is likely to increase process understanding, leading to a more structurally-sound model.

Andrew also introduced a new model of in-stream phosphorus dynamics processes, which is being developed for a 1.5 km reach of the River Kennet receiving phosphorus from Marlborough WWTP. It builds on the analysis of phosphorus dynamics conducted by Helen Jarvie and her colleagues at the Institute of Hydrology and includes representations of the processes of sorption and desorption from suspended and bed sediment and the uptake by macrophytes and epiphytes. Ultimately this model will form the instream component of the phosphorus version of INCA.

Peter Daldorph (Eastern Hydrology and Imperial College) presented a modelling approach to incorporate phosphorus export coefficients into a dynamic catchment model. The potential use of this model in eutrophication management was discussed for the case of the Rutland Water catchment (Rivers Nene and Welland) in Eastern England, where extensive monitoring sites and relevant data were available for analysis.

End-user requirements

The afternoon session started after a buffet lunch, which was combined with an interesting poster session.

Tony Warn (Environment Agency, Anglian Region) discussed the Agency's requirements for integrated water quality models as an aid to decision making. In particular they require models that are integrated with so-called ideal water quality standards. The ideal standard (5-point standard) is defined by the limit value, specification of how often the limit can be exceeded, specification of the time period over which the standard applies, the design risk (or return period), and the level of proof by which compliance with the standard must be demonstrated. The last leads to statements of the accepted risk that investment is followed by reports of non-compliance.

Modellers have to demonstrate that they are addressing the 5-point standard issues. For example, summary statistics should be produced, e.g. the 12-month 95 percentile; model parameters and state variable distributions should be identified using long time series in order to be able to estimate the design risk or return periods; the relative role of the various governing mechanisms should be identified; measures of uncertainty due to model and sampling errors should be included; and the concept of design return period of ecologically harmful events should be adopted. Since it is often impossible to simulate a complex model over a long (say 50-year) period, cross matching of complex models with simpler ones using specific representative events could allow the analysis of long-term time series with simpler models. Careful investigation, identification and use of a representative data input period for analysis is another possible alternative to using complex models. However, it is the modeller's responsibility to justify that the chosen input data period is representative of the long-term time series record.

A number of modelling research topics were suggested in the areas of conservation objectives, physical standards, 5-point ideal standard issues, and relative impacts of discharge, sources and sinks on eutrophication, ecology, nitrate, and chemical fate. Increased understanding is also required of cause-effect relationships between ecological, physical and chemical variables, and of the theory of errors (e.g. how errors combine).

Tony defined a good model as one that is easy to operate, shows consistency, is esteemed and used by regulators and regulated users, and does not require new monitoring.

K Guganesharajah (Mott MacDonald) summarised the modules that are required to predict water quality processes in water bodies, including selected case studies of projects in the UK and elsewhere. Some areas for further research were identified, such as the prediction of model errors. This presentation showed how the reliability of model predictions is often governed by: the accuracy of the prediction of hydraulic transport mechanisms; uncertainties associated with model coefficients; the accuracy of the equations used to represent governing processes; the chosen model dimension, and (of course) the accuracy of the data used for model calibration and prediction.

After the presentations, the delegates, led by Paul Whitehead, proceeded to identify research and end-user requirements for future work related to integrated catchment water quality modelling.

Summary of the discussion on research needs

Research is required to improve our understanding of important water quality processes, such as the nature of instream reactions at sediment/plant surfaces, transport of diffuse pollutants, and the effects of dead-zones in terms of both solute transport and chemical reactions. Issues of model complexity, identifiability, parameter estimation and uncertainty estimation should be addressed, and the additional data required to constrain model parameters and improve model identifiability should be defined. Methods for scaling up data and calibrated model parameters from the laboratory or small plot scale to the catchment is an important topic of investigation, which is required for the proper application of physics-based models.

The correct characterisation of flow and solute transport mechanisms underpins all water quality models and should not be neglected. Depending on data availability, models of different levels of complexity can be applied, but there is a need to investigate cost-benefit ratios and predictive abilities of the various types of flow and solute transport models available.

The relative impact of river flow, sources and sinks on eutrophication, enhanced nitrate levels and ecology needs to be quantified for a large number of sites nation-wide in order to identify dominant controls.

Since water quality standards are of strategic value for policy makers, there is a need to develop new standards (e.g. ecological quality), and to test existing standards using long-term time series that contain extreme events.

Summary of the discussion on end-user requirements

Research is required to develop ecological quality standards and to incorporate the concept of risk into ecological standards through the definition of return periods. This work could progress by linking historical biological knowledge with summary statistics of river flow. Improved understanding of water quality processes is need for design purposes. Detailed understanding of specific problem sites is required, but so is analysis of spatial variability leading to correlation with water quality determinands. Data mining is one technique that could be useful in this investigation. Water companies are interested in methods of pollution incident prediction with uncertainty. End users require models to be presented in user-friendly environments such as Excel and Windows.

Luis Camacho and Matthew Lees
Imperial College, London

Engineering award granted

Readers might be interested to know that the American Society of Civil Engineers has given its prestigious annual *Ven Te Chow Award* to **Professor Eamon Nash** (National University of Ireland). The citation is for *"groundbreaking investigations in hydrologic engineering and innovative solutions of hydrologic problems"*.

Workshop: hydrology of waterways

A very successful Workshop on the Historical Hydrology of Inland Waterways was held at the Institute of Hydrology on 27 November 1999. An important outcome of the day was the establishment of an Inland Waterways Hydrology Study Group.

Frank Law (IH Deputy Director) began the day by answering the question, "Why is there renewed water resource planning interest in canal and river navigation records?" Historical records could assist understanding of the canal system, hydrological (and climatic) variability over the past 200 years, and flood and reservoir dam safety. They also highlighted the work of innovative hydrometrists, and were valuable in the contexts of water quality, dredging and revision of legislation.

Henry Gunston (IH) then outlined his research into the record of flows from the springs that feed the Tring Summit and the Wendover Arm of the Grand Junction (now the Grand Union) Canal. A long 19th Century record dates back to 1841, making it one of the earliest sustained water flow records.

Alan Richardson, a member of the Railway and Canal Historical Society (RCHS) and a former water supply engineer with British Waterways, gave a presentation on the water supply at Crofton, which feeds the summit levels of the Kennet and Avon Canal. He showed that adequate springflow was available to feed the long pound to Devizes, with its large storage capacity.

The final speaker of the morning was **Professor John Sheail** (Institute of Terrestrial Ecology), who is working on the history of bodies with a role in river navigation control. He highlighted the Tyne Improvement Commission of 1850 and the 1702 Act, which created the River Cam Board of Conservators.

After lunch, participants visited the IH library, which now holds the Rofe Collection of parliamentary acts, committee evidence and reports relating to water in Britain. Although many only cover water supply, others made specific reference to canals and river navigations. A list is available from Henry Gunston at IH (see below).

Contributors to a valuable round table discussion on historical inland waterways water resources records came from a range of backgrounds: there were engineering consultants, university researchers, representatives of British Waterways and of the Waterways Trust. As well as members of BHS and the RCHS, others had links with the Association for Industrial Archaeology, CIWEM and the Panel for Historical Engineering Works of the Institution of Civil Engineers.

The President of the RCHS and the Heads of Water Resources of British Waterways and the Environment Agency had sent messages of goodwill for the Workshop.

After a typical historical *tour-de force* on early inland waterways water resources records and some notable canal floods, Frank Law introduced the BHS *Chronology of British Hydrological Events*. An important conclusion of the Workshop was to establish a new Inland Waterways Hydrology Study Group, for which Frank Law and Henry Gunston are providing the secretariat to start with.

For further details of this Group, please contact Henry Gunston, Institute of Hydrology, Crowmarsh Gifford, Wallingford, Oxon. OX10 8BB *(Tel 01491 692452; Fax: 692424; email: hmgu@ceh.ac.uk)*.

A fuller report is proposed for the next issue.

Henry Gunston
Institute of Hydrology



The Wendover Arm, Grand Union Canal (gauging station out of the picture to the right)

New UK IAHS Committee

The membership of the UK Committee for the International Association of Hydrological Sciences (IAHS) has changed, following the Assembly of the International Union of Geodesy and Geophysics (IUGG) held in Birmingham during July 1999. By convention, the Committee consists of the national correspondents for each of the IAHS Commissions, and any serving British Presidents of the Association, together with the BHS President.

The new Chairman, Prof. Bruce Webb, takes over from Prof. David Collins as the representative on the BHS Committee. The membership is:

International Commission on Surface Water – **Dr Alan Gustard**[2], Institute of Hydrology (agu@ceh.ac.uk)

International Commission on Groundwater – **Dr Stephen Foster**, British Geological Survey (s.foster@bgs.ac.uk)

International Commission on Continental Erosion – **Prof. Des Walling**, University of Exeter (D.E.Walling@exeter.ac.uk)

International Commission on Snow and Ice – **Prof. David Collins**, University of Salford (d.n.collins@salford.ac.uk)

International Commission on Water Quality – **Prof. Bruce Webb**[1], University of Exeter (B.W.Webb@exeter.ac.uk)

International Commission on Water Resources Systems – **Prof. Enda O'Connell**, University of Newcastle-upon-Tyne (p.e.o'connell@ncl.ac.uk)

International Commission on Remote Sensing – **Prof. Ian Cluckie**, University of Bristol (I.D.Cluckie@bristol.ac.uk)

International Commission on Atmosphere-Soil-Vegetation Relations – **Prof. Jim Wallace**, Institute of Hydrology (jsw@ceh.ac.uk)

International Commission on Tracers – **Dr Colin Neal**, Institute of Hydrology (cn@ceh.ac.uk)

IAHS President – **Dr John Rodda** (106201.1774@compuserve.com)

BHS President – **Prof. Howard Wheater**, Imperial College of Science, Technology & Medicine (h.wheater@ic.ac.uk)

[1] Committee Chair and IAHS National Representative – now on BHS Committee
[2] Deputy Committee Chair

A field campaign in the Pang catchment

12-17 September 1999

A joint field campaign was carried out in the Pang catchment, near Reading, within the framework of the ARIDE project (Assessment of the Regional Impact of Droughts in Europe). This international hydrology research project is funded by the EC and co-ordinated by the Hydrology Institute at the University of Freiburg, Germany.

The three participants in this field campaign were the University of Freiburg, the Agricultural University of Wageningen (The Netherlands) and the Institute of Hydrology (Wallingford). The research basin is close to Wallingford and is part of the LOCAR research programme in the UK.

The field activities took place in the period 12-17 September 1999; it formed part of the hydrology curriculum at the University of Freiburg. The Institute of Hydrology hosted the group during the course of the week and provided a staff member, a car and the necessary permissions from local authorities and farmers to carry out the fieldwork.

The objective of the field campaign included two different aspects. The first focused on data acquisition in the field to support the research on groundwater modelling in the Pang catchment. Groundwater modelling is part of Work Package 4 of the ARIDE project and is carried out by the Agricultural University of Wageningen.

The second aspect focused on the education of students. A group of 12 students from the University of Freiburg took part in the field measurements. They were trained to improve their fieldworking skills. First, the students had to carry out a field survey to evaluate the hydrological behaviour of the catchment.

In a second phase experiments were carried out to support the findings of the evaluation. The field programme was designed to study the hydrological processes in the Pang catchment, with special emphasis on the groundwater aspect. Another aspect dealt with the flow behaviour along the river Pang and the assessment of the response time due to different geology and coverage features. Readings and samples from deep and shallow wells were carried on a daily base. The chemical analysis of groundwater and surface water helped to understand the contributing area in the catchment.

Augering and permeability tests at a cross-section at Frilsham meadow in the upper part of the catchment, together with a soil description, geo-electrical and flow measurements, added to the understanding of the stream-aquifer interaction.

The techniques the students were taught included different methods of flow measurements, e.g. inductive method (Flo-Mate), current metering, slope area method. Augering, inverse augering, soil description and geo-electrical measurements supported the understanding of the stream-aquifer-interaction. The fieldwork culminated in a final half-day workshop, held at the Institute of Hydrology. There the students presented their results and findings to each other.

This joint field trip was a good example of the educational potential of an EC-project in general, where researchers from different countries work together, giving students the opportunity to be taught in a foreign language and experience different teaching styles. Furthermore, it shows besides the research which is carried out at a PhD level the training potential of an EC-project.

Siegfried Demuth (University of Freiburg)
Roel Dijksma, Henny van Lanen and Lies Peters (University of Wageningen)
Dick Bradford (Institute of Hydrology)

Changes at the GRDC in Germany

Dr Néstor R. Correa has taken over as Head of the Global Runoff Data Centre (GRDC), run under the auspices of the World Meteorological Organization.

The former Head of the GRDC, **Dr Wolfgang Grabs**, has moved to be Head of Water Resources, Hydrology and Water Resources Department, at WMO headquarters in Geneva.

The GRDC offices have moved to new premises in Koblenz: Global Runoff Data Centre, Federal Institute of Hydrology (BfG), Am Mainzer Tor 1, D-56068 Koblenz, PO Box 20 02 53, D-56002 Koblenz, Germany. Tel +49 261 1306 5224; fax +49 261 1306 5280; email correa@bafg.de; web site http://www.bafg.de/grdc.htm

Travel grants

Travel grants are available to help members whose travel expenses are not met by an employer to attend scientific meetings. There is no limit on the amount of an award, but it will normally depend on the nature and location of the meeting and the case put forward by the applicant.

The scheme is primarily intended to help younger members, who will be given priority, but it is open to all. Successful applicants will be expected to write a short report for *Circulation*.

The Exeter Fund, looked after by BHS, also pays travel grants. These are specifically to help British hydrologists (living in the UK) to participate in the activities of IAHS and its related organisations in the UK and abroad.

Anyone wishing to apply for money from the Exeter Fund or a BHS travel grant should contact the Hon. Treasurer, **Terry Evans** at 107 Ely Road, Littleport, Ely, Cambridgeshire, CB6 1HJ *(Tel. 01353 862723, email TEEVANS100@AOL.com).*

Publications from other organisations

Two new publications have appeared in the IAHS 'Red Book' Series:

Regionalization in hydrology *Edited by Bernd Diekkrüger, Mike J. Kirkby & Ulrich Schröder,* IAHS Publ. no. **254**, Oct. 1999, price £41.50, 260+xii pp, ISBN 1-901502-80-5

Interdisciplinary perspectives on drinking water risk assessment and management *Edited by Eric G. Reichard, Fred S. Hauchman & Ana Maria Sancha,* IAHS Publ. no. **260**, Jan. 2000, price £33, 178+xiv pp, ISBN 1-901502-11-2

Order either volume from Mrs Jill Gash, IAHS Press, Institute of Hydrology, Wallingford, Oxon, OX10 8BB *(tel 01491 692442; fax 692448/692424; e-mail jilly@iahs.demon.co.uk).*

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Two new IHP-V Technical Documents in Hydrology from UNESCO are in the National Hydrosciences Library at IH:

Flash floods in arid and semi-arid zones *Prepared by the working group of Project H-5-2, Coordinator Xiao Lin,* No. **23**, 1999.

Will water be enough, will food be enough? *By P. Vakkilainen & O. Varis,* No. **24**, IHP-V Project 4.2, 1999.

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Other publications received include:

Stromingen Vol. 5, No. 4 from the Dutch Hydrological Society (NHV), containing an article (in Dutch) about

water in the poetry of Ida Gerhardt.

The Annual Report of the Middle East Desalination Research Center, an international non-profit institute based in Muscat, Oman.

Mainstreaming gender in water resources management – why and how, a background paper from the World Water Vision Unit, World Water Council, c/o UNESCO (contact Malia Bouayad-Agha, *email m.bouayad@unesco.org, http://watervision.org*).

Journal of Hydrology (New Zealand), Vol. 38 No. 2, which includes their first 'data note', a concept started by *Water Resources Research* to record the existence and attributes of datasets available to other researchers: the data here were collected to test channel network and river basin heterogeneity.

FORTHCOMING EVENTS

Hydrology in Scotland 2000

World Water Day 2000 is 22nd March, and in Scotland the occasion is being marked with the start of a 2-day Symposium, *Hydrology in Scotland 2000*, to be held at Dundee University. The symposium will bring together scientists, engineers, environmental and resource managers and policy makers, and aims to review progress in key areas of hydrology. The second day includes a strong policy emphasis, and with a plenary session aimed at identifying research and wider priorities for the decade ahead.

Much has happened in recent years to emphasise a distinctive character to hydrology in Scotland. Rainfall over the past decade has been substantially above normal in many areas, associated with a series of damaging floods, while in dry eastern areas, concern has been rising over the effects of unregulated abstractions. Climate change threatens rare habitats in high montane areas, while changes in land use already underway are leading to new challenges in water quality hydrology. Meanwhile, Scotland has a new environmental regulator, new water supply authorities and (since last year) a new Parliament. Each of these changes has implications for the science and application of hydrology.

If you have connections with Scottish hydrology, or an interest in developments north of the border, the organisers very much hope you will be able to attend. We expect this will be a seminal meeting, with long-lasting benefits. Full details are on the symposium website – http://www.dundee.ac.uk/geography/hydrolinscot/ – this issue of *Circulation* also includes a short flier with further information. Standard registration is open until **29th February**.

Dr Andrew Black
Dundee University

Meetings

BHS Midlands Section Site Visit
TAMING THE TAME:
THE REHABILITATION OF URBAN RIVERS
Wednesday 24 May 2000
Minworth Works

Research at the Schools of Geography and Civil Engineering, University of Birmingham, and the Institute of Hydrology (CEH), into rehabilitation of urban rivers has been funded by NERC under the thematic programme URGENT, with additional support from the Environment Agency.

This visit to the Minworth Works of Severn Trent Water will look at some of the key locations in the catchment and discuss the progress of the research. There will be presentations by Professors Geoff Petts and Angela Gurnell (School of Geography and Environmental Sciences), Dr Paul Webster and Dr John West (School of Civil Engineering) and Dr Conor Linstead (Institute of Hydrology).

Numbers will probably have to be limited. If interested, contact Paul Webster (P.Webster@bham.ac.uk) or Chris Bradley (C.Bradley@bham.ac.uk) by **30 April**. A £10 charge will be made to cover transport costs. Meet at 13:00 at Birmingham University or at 13:30 at Minworth Works, on the A4097 between the villages of Minworth and Curdworth, north-east of Birmingham.

The organisers are grateful to Severn Trent Water Ltd for making their facilities available for this visit.

Call for participation
5th IHP/IAHS GEORGE KOVACS COLLOQUIUM
Hydrology for the Environment, Life and Policy (HELP)
2–3 June 2000
UNESCO, Paris

This Colloquium is the latest in a series of biannual international scientific meetings in the most challenging fields of water resources research. Like its predecessors it celebrates the life of George Kovacs, who was Chairman of the IHP Intergovernmental Council and IAHS Secretary-General and President.

The topic is HELP, a new field-oriented catchment hydrology initiative, which aims to make researchers responsive to policy and development issues such as water use in food production, conflicts and competition for water, water quality and human health, environmental water needs, and climate change impacts. It also addresses communication between scientists and society and will provide the basis for improved land and water management through a global network of experimental basins.

The meeting will be based on invited presentations and open discussion. There is no registration fee, and extended abstracts will be available to participants at the colloquium.

The contact for further information is Mr Lalji Mandalia, UNESCO Division of Water Science, 1 rue Miollis, 75732 Paris Cedex 15, France *(tel: +33 1 45 68 40 54, fax: +33 1 45 68 58 11, email: ihp@unesco.org).*

First announcement and call for papers
3rd International Conference on Future groundwater resources at risk
25–27 June 2001
Lisbon, Portugal

FGR'01 is organised by CVRM Geosystems Centre of the Instituto Superior Técnico, Lisbon, and is a contribution to UNESCO's International Hydrological Program (IHP).

Like its predecessors in Finland (1994) and China (1998), the conference will focus on groundwater risk assessment as an important component in water resources management.

In spite of its invisibility, pollution

and over-exploitation constantly threaten groundwater resources, usually as a consequence of human activities at the land surface.

The full range of issues imposed on groundwater systems will be discussed in the context of the sustainable development of water resources.

Participants intending to present a paper are requested to send a 1-2 page abstract in English to the Conference Secretariat by **31 July, 2000**. Accepted papers will be published in a proceedings volume, and there will also be poster sessions.

A 2-3 day groundwater fieldtrip will follow the conference. Details and further information will be given in the 2nd announcement in November.

Contact for further information: Maria João Albernaz, Secretariat FGR'01, CVRM-Geosystems Centre, Instituto Superior Técnico, Av. Rovisco Pais, 1049-001 Lisboa, Portugal *(Tel: +351-21-841 72 47, Fax: +351-21-841 74 42, e-mail: fgr@alfa.ist.utl.pt, web http://alfa.ist.utl.pt/~cvrm/FGR)*

ERB 2000: MONITORING AND MODELLING CATCHMENT WATER QUANTITY AND QUALITY
8th Biennial Conference and General Assembly of the European Network of Experimental and Representative Basins (ERB)
Ghent, Belgium
27–29 September 2000

Country-membership of ERB is growing rapidly and currently includes Belgium, Czech Republic, Finland, France, Germany, Italy, Poland, Romania, Russia, Spain, Slovakia, Switzerland, The Netherlands and the UK. Each country has an ERB National Correspondent nominated by the relevant national IHP (UNESCO International Hydrology Programme) Committee.

The founding ERB Conference was held in Aix-en-Provence, France, in 1986. Subsequent conferences have been in Padova, Italy (1988), on erosion and sediment transport; Wageningen, The Netherlands (1990), on hydrological research basins and the environment; Oxford, UK (1992), on methods of hydrological basin comparison; Barcelona, Spain (1994), on assessment of hydrological temporal variability and changes; Strasbourg, France (1996), on ecohydrological processes in small basins, and Liblice, Czech Republic (1998), on catchment hydrological and biogeochemical processes in a changing environment.

The ERB publishes a periodic Newsletter and there is a register of ERB catchments on http://erb.lyon.cemagref.fr, maintained by CEMAGREF, France.

The First Announcement and Call for Papers is available from Ian Littlewood, who also has a few copies of the Strasbourg Proceedings left (free on a first-come-first-served basis)

For full details, contact Dr Ian Littlewood, ERB National Correspondent (UK), Institute of Hydrology, Crowmarsh Gifford, Wallingford, Oxon, OX10 8BB *(Tel 01491 838800, Fax 01491 692424, Email igl@ceh.ac.uk)*

Diary

15th February 2000
Welsh Hydrological Group meeting
"Hydrological research in Welsh universities"
Contact: Steve Taylor *(tel 01222 770088, fax 01222 362094, email steve.taylor@environment-agency.gov.uk)*

17th February 2000
Scottish Hydrological Group meeting
"North-east Scotland water resource study and yield assessment framework"
Venue: Edinburgh University
Time: 18.00 for 18.30
Contact: Tim Jolley *(tel 01355 574213, fax 01355 574688, email tim.jolley@sepa. org.uk)*

15th March 2000
BHS Southern Section and CIWEM
"Water resource – visions for the future"
**Changed venue:* now at HR Wallingford
Contact: Dr Adrian Butler, Dept of Civil Engineering, Imperial College, London *(Tel 0171 594 6122, Fax 0171 594 6124, e-mail a.butler@ic.ac.uk)*

22nd–23rd March 2000
Scottish Hydrological Group Conference
"Hydrology in Scotland 2000"
Venue: University of Dundee
Contact: Dr Andrew Black *(tel 01382 344433, fax 01382 344434, email a.z.black@dundee.ac.uk, http://www.dundee.ac.uk/geography/hydrolinscot)*

28th March 2000
BHS National meeting
"Flood forecasting"
Venue: Bristol
Contact: Dr Peter Walsh *(tel & fax 01228 710510, email Walshpeter@cs.com)*

25th–29th April 2000
25th EGS General Assembly
Venue: Nice, France
Details: http://www.copernicus.org/EGS/egsga/nice00/nice00.htm

3rd May 2000
BHS Southern Section meeting
"Applications of risk management in hydrological protection"
Venue: Imperial College, London
Time: 17.30 (tea at 17.00)
Contact: Dr Adrian Butler *(see above)*

17th May 2000
BHS National Meeting (full day)
"Catchment management and process studies" *(and PHG AGM: see below)*
Venue: Manchester University
Contact: Prof David Collins *(tel 0161 295 4519, email davidncollins@hotmail. com)*

17th May 2000
BHS Pennines Hydrological Group AGM
Venue: Manchester University *(during BHS National meeting – see above)*
Contact: Owen Wedgwood *(Tel 01925 653999, Fax 01925 415961, email owen.wedgwood@environment-agency.gov.uk)*

24th May 2000
BHS Midlands Section
Afternoon field visit, Minworth Works
"Taming the Tame – rehabilitating urban rivers"
Contacts: Paul Webster/Chris Bradley, Birmingham University *(see page 11)*

14th June 2000
BHS Southern Section meeting
"Rehabilitation of the Rivers Darent and Kennet"
Venue: Imperial College, London
Time: 17.30 (tea at 17.00)
Contact: Dr Adrian Butler *(see above)*

21st June 2000
BHS Southern Section
Field visit to the River Darent
Contact: Dr Adrian Butler *(see above)*

27th June 2000
BHS National Meeting (full day)
"Water resources plans"
Venue: ICE, London
Contact: Prof. Sue Walker *(tel/fax 013397 41619, email susan.walker@abdn.ac.uk)*

3rd–7th July 2000
IAHS/BHS 2nd Inter-Celtic Colloquium
"Water in the Celtic world: managing resources for the 21st Century"
Venue: University of Wales, Aberystwyth
Contact: Dr J.A.A. Jones, *(tel 01970 622595, fax 01970 622659, email jaj@aber.ac.uk)*

4th–5th September 2000
Tenth BHS Postgraduate Symposium
Venue: Newcastle University
Contact: Dr Geoff Parkin, WRSRL, Cassie Building, University of Newcastle upon Tyne, NE1 7RU *(tel 0191 222 6146, fax 0191 222 6502, email: geoff.parkin@ncl.ac.uk)*

6th–8th September 2000
7th National Hydrology Symposium
Venue: Newcastle University
Contact: Prof. Ian Calder, Hydrology Symposium Office, Centre for Land Use and Water Resources Research, Porter Building, St Thomas Street, Newcastle upon Tyne NE1 7RU *(tel/fax 0191 222 6563, email cluwrr@ncl.ac.uk)*

Copy deadline for *Circulation* No. 65
20th March 2000