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THE NEWSLETTER OF THE BRITISH HYDROLOGICAL SOCIETY

Circulation

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BHS backs UN Year of Freshwater



WaterYear2003

H_2O03, the UK contribution to the United Nations International Year of Freshwater, was launched on 14th May at the London Wetlands Centre by naturalist and BBC presenter, Chris Packham.

The activities between May and September 2003 aim to increase public awareness of freshwater issues at a local, national and international level. This awareness will be stimulated by art and literary competitions and a challenge to the public to produce the first National Collection of Freshwater Sites. This on-line collection will demonstrate the diversity of fresh-water sites within the UK and will be a resource available for projects, research, virtual touring and as a first step to protecting our freshwater sites.

H_2O03 culminates in September with two days at CEH Wallingford. Day one (9th September) is entitled *Water for life – the UK working as one,* and intended for water professionals. It encourages the major players in water policy, supply, research and protection to state what they need from each other to achieve progress in sustainable freshwater management.

Day two (10th September) is for the general public and interest groups to view an exhibition of freshwater art, to honour prize winners and to see the National Collection go live.

H_2O03 is being organised by the Centre for Ecology and Hydrology, the Department for International Development (DFID) and the Environment Agency, with support from BHS, the Met Office, WaterAid and the Wildfowl and Wetlands Trust.

For details of H_2O03, see the enclosed flyer and visit *www.h2o03.org.uk*.

President's piece

The last quarter has been a hydrologically quiet period. After five years in which floods have been prominent, should our attention be turning to the other extreme of the hydrological spectrum? Where I live in Cumbria we have seen very little rain over the last two months, my garden is parched and my vegetable patch is healthy only because the sprinkler has been used regularly. Forecast rain has failed to materialise on a few occasions, until Easter Monday: hopefully visitors the Lake District had made the most of the early part of their holiday!

The Kyoto Water Summit might have been reported in the press, but events in Iraq pushed most other news out of papers and off TV and radio. What I wonder did it achieve? Searching for a succinct summary on the Internet produced little information – a Bulletin running to 14 pages of official protocol revealed nothing new. It appears to have been a big jamboree, full of fine words and aspirations. Only time will tell if politicians have the will to ensure water is to be better managed and the needs of many with inadequate supplies satisfied, pollution reduced and international tensions over water resolved.

The last issue of *Circulation* contained the first of a series on professional qualifications. Future editions will contain articles on routes to chartered membership in CIWEM, The Royal Meteorological Society and, when we know the outcome of changes under review at the present within ICE, we will also publish an article on the options available for the Institution of Civil Engineers. I know that for many of the younger members obtaining a recognised professional qualification is an important goal. The Society does not have the resources to develop and provide its own qualification, so we continue to liaise with and promote membership (in most cases Chartered Membership) in those bodies where there is an interface of appropriate disciplines.

One of our Past Presidents, who is also an Honorary Member, is very keen to encourage young members to develop both their careers in hydrology and their support for the Society by making a donation to pay the membership subscriptions of three young members. The Committee, after taking soundings, have selected for this award **Michael Cranston** (SEPA), **Hayley Fowler** (Newcastle University), and **Neil McIntyre** (Imperial College), who all play an active role in the Society. He also hopes that his precedent might encourage other senior members of the Society to support young hydrologists in a similar way and I would therefore be pleased to receive any ideas that members might wish to put forward. This would be in addition to the current travel fund.

The Land Use and Flood Management Conference in January, arranged by **John Lawson** on behalf of the ICE Water Board and supported by BHS, was attended by about 230 delegates from a wide range of backgrounds. The speakers demonstrated that inappropriate soil cultivation practices have a substantial effect on runoff and cause local flooding. They covered the whole range of issues surrounding land-use management and flooding. These included the influence of the soil and its condition on how rainfall is converted into runoff and addressing whether the findings of the field scale runoff trials can be scaled up to whole catchments. Speakers graphically illustrated the consequence of flooding and soil erosion produced by local runoff.

These events are more frequent than many of us realise, and can have a big, if very localised, impact. Case studies were presented of measures to change farming practices to reduce runoff, and with the Environment Agency's best farming practice guidelines they illustrated the importance of land management in reducing excessive runoff. The farmers' view of changing farming practices illustrated their dilemma between making improvements to the environment and the economic realities of making a living. There was widespread agreement that changes in farming practices over the past 30 years have aggravated soil erosion and local flooding and that measures to change farming practices are highly desirable.

Finally, I am pleased to report that **Peter Midgley** has agreed to take over the reins of the South East Section from **Adrian Butler**, who is standing down from the Chair, as I reported last time.

Peter D Walsh
walshpeter@aol.com

Travel grants

Travel grants are available to help BHS members whose travel expenses are not met by an employer to attend scientific meetings. The amount will depend on the nature and location of the meeting and the case put forward.

Grants are mainly intended to help younger members, but are open to all. Successful applicants will be expected to write a short report for *Circulation*.

The Exeter Fund, looked after by BHS, offers grants to help British hydrologists take part in IAHS events.

To apply for a grant, please contact the BHS Hon. Treasurer, **Steve Parsons**, Mott MacDonald Ltd, Demeter House, Station Road, Cambridge, CB1 2RS *(tel 01223 463926, email sbp@mm-camb.mottmac.com).*

New members

A warm welcome to the following people who have joined the Society:

Richard Austen	Ewan Associates Ltd, Leeds
Isabelle Beaudin	IWE, Cranfield University, Silsoe, Beds
Andrew S. Clifton	Coventry University
Amanda J Coffey	Entec UK Ltd, Shrewsbury
Geoff Darch	Atkins Water, Peterborough
Dr Caroline F. Dilks	The Macaulay Institute, Aberdeenshire
Anjila C. Finan	Entec UK Ltd, Shrewsbury
Christopher Gibson	Greenspan Europe, Hove, Sussex
Dr Andrew Howe	Environment Agency, Worthing
Dr Michael G Hutchins	CEH Wallingford
Valerie Ingram	Office of Public Works, Dublin
Jennine C. Jonczyk	University of Newcastle upon Tyne
Anne Jones	CEH Wallingford
Dr Bhon K. Koo	The Macaulay Institute, Aberdeenshire
Cedric Laize	CEH Wallingford
Hyosang Lee	Imperial College, London
Alexander MacRobert	Independent Consultant, Moray
Chris Paul	Environment Agency, Worthing
John Ravening	Hydro-Logic Ltd Thatcham, Berks
David A. Stewart	Environment Agency, Leeds
Victoria J. Townend	Environment Agency, York
Alice Varkala	Hove, Sussex
Susan Wade	RMC Aggregates (UK) Ltd, Solihull

AGU conference — hydrology sessions

San Francisco, California, USA
6 –10 December 2002

The American Geophysical Union Fall Meeting is one of the largest science conferences, with over 9000 presentations given in 2002. These covered most aspects of Earth and Planetary science, including subjects as diverse as seismology, climate change, human resources and biogeoscience. Because of the large number of presentations, even the huge Moscone Centre in San Francisco could not provide enough auditorium space, and some 70% of presentations were as posters, a proportion that increases each year as space constraints intensify.

I attended the AGU Fall Meeting to present my poster, entitled "The influence of high magnitude / low frequency flood events on the spawning habitat of Atlantic salmon in the headwaters of a Scottish stream". I am grateful to BHS for a travel grant, which part-funded my attendance. My presentation described how two extreme flood events (in September 2001 and July 2002) on the Allt a' Ghlinne Bhig (an upland tributary of the River Tay) resulted in large modifications to the channel in the headwaters, with implications for the Atlantic salmon spawning habitat. These events introduced large volumes of material to the channel, creating many accumulations of spawning-calibre sediment, which were used by fish in the following season. No spawning was observed in the same headwater areas before these two extreme events. However, the stability of these new areas of spawning habitat under more typical high flow events is uncertain, with the risk of scour and egg wash-out being potential problems. The broader issues relate to the influence of extreme events on the geomorphology and ecology of upland streams, and use of the bank-full 'dominant discharge' concept in such environments was questioned.

Within the hydrology sub-section alone there were over 1000 presentations in 62 sessions during the five days of the Fall Meeting. Each session had relatively few oral presentations, with a larger number of posters. Careful organisation and well-timed transit between sessions was needed in order to attend as many relevant presentations as possible! Even so, it was only feasible to attend a small proportion of the interesting topics on offer in a few of the sessions. Some of the key presentations are summarised here.

In the 'State of the Art in Eco-hydrology' session, **Dave Montgomery** (Dept. of Earth and Space Sciences, University of Washington) gave an excellent talk on the importance of 'hydro-geomorphic' variability in aquatic and riparian ecosystems. He described how geomorphic and hydrologic processes defined disturbance regimes that native species were adapted to, providing examples of how broad-scale geomorphic variables exerted important controls on habitats and in-stream animal communities. He stressed that the prescription of environmental flows in managed systems usually reflects the minimum flow requirements for the utilisation of specific habitats (usually by fish) and not the typically higher flows required for the formation, maintenance and evolution of the habitats themselves.

A particularly interesting (and UK-chaired) session was 'The Science and Uncertainty of River Engineering and Restoration'. **William Graf** (Dept. of Geography, University of South Carolina) opened with a talk highlighting sources of uncertainty in sustainable river restoration. He described uncertainty relating to the theory, research procedures and communication of fluvial geomorphology in river restoration programmes and how this should be quantified and reported to permit adaptive management. He stressed that fluvial geomorphologists must not only conduct good science but also useful science.

David Sear (Dept. of Geography, University of Southampton) described the UK experience of river restoration, stressing the differences from the Pacific North-West situation. River restoration in the UK has often been carried out without sufficient geomorphic and hydrological input and with limited quantification of uncertainty. Using a case study as an example (the River Cherwell, a typical British lowland stream), he described a sequence of steps in the restoration process that are designed to incorporate uncertainty. At the design and construction phases, uncertainty was quantified using modelling and sensitivity analyses. After construction, post-project appraisal and monitoring of the adjustment of the system permitted adaptive management.

Peter Downs (Stillwater Sciences, Berkeley) described how high flows are increasingly regarded as important in creating and maintaining instream and riparian habitats. However, the levels of uncertainty associated with the prescription of high flows were much greater than those for minimum flow allocation. Sources of uncertainty included quantification of sediment transport rates, methods for describing high flows, procedures for predicting response (e.g. modelling) and problems of transferability between different systems. It was very important to define ecosystem objectives as they dictated high flow requirements. Maintenance of the bed, channel morphology and floodplain required progressively higher flows and associated increases in uncertainty.

Greg Pasternack (University of California, Davis) described a spawning gravel rehabilitation programme on the lower Mokelumne River in Central California, highlighting the benefit of using predictive conceptual models of geomorphic and ecological processes. The approach involved adding large volumes of spawning-calibre gravels, implementation being guided by integrating detailed topographic surveys and 2-dimensional modelling procedures with quantitative data on salmon spawning requirements and qualitative local knowledge. The need for post-construction monitoring to permit adaptive management was stressed. **Joe Wheaton** (University of California, Davis) gave an excellent complementary poster, describing the procedure in detail and highlighting the importance of incorporating spatial complexity into such designs.

The 'Steep Mountain Channels' session provided some very interesting presentations and was where my poster fitted in. **John Faustini** (Department of Fisheries and Wildlife, Oregon State University) described a technique for assessing streambed stability at the reach scale. He described how many land-use practices in the Pacific north-west lead to excess sediment supply to streams, resulting in a reduction in the mean substrate size and an associated increase risk of scour. The 'relative bed stability' (RBS) was calculated as the ratio of the geometric mean particle diameter to the estimated critical particle diameter at bankfull flow, based on reach-scale stream surveys of particle size and channel geometry. RBS values were then compared to levels of anthropogenic disturbance in study streams.

K. Bunte (Dept. of Civil Engineer-

ing, Colorado State University) described an empirical method to predict mean annual travel distances of sediment inputs from simple parameters such as stream type, gradient, width, catchment area and bed material size. She emphasised that this was an alternative approach to physically based modelling, whose application was limited by the need for detailed channel and discharge data. Regression of data from 55 studies revealed that mean annual travel distance decreased with increasing gradient and bed material size and increased with increasing catchment area.

Dr Hamish Moir, Dept of Geography and Environment, University of Aberdeen

Shreedhar Maskey & Vincent Guinot: *Improved first-order second moment method for uncertainty estimation in flood forecasting*

Paresh Deka & V. Chandramouli: *A fuzzy neural network model for deriving the river stage–discharge relationship*

Chen Shouyu & Fu Guangtao: *A DRASTIC-based fuzzy pattern recognition methodology for groundwater vulnerability evaluation*

Hugues Vanden Bossche, Chantal Gascuel-Odoux, Fabienne Trolard, Christian Plenchette & Guilhem Bourrié: *Impact of terrestrial sewage sludge disposal on dissolved and particulate phosphorus in surface runoff*

Benina Touaïbia & Mohamed Achite: *Contribution à la cartographie de l'érosion spécifique du bassin versant de l'Oued Mina en zone semi-aride de l'Algérie septentriennale*

Abdelkader Benkhaled & Boualem Remini: *Variabilité temporelle de la concentration en sédiments et phénomène d'hystérésis dans le bassin de l'Oued Wahrane (Algérie)*

Pratap Singh & S.K. Jain: *Modelling of streamflow and its components for a large Himalayan basin with predominant snowmelt yields*

Julia Shaw & John Sutcliffe: *Ancient dams, settlement archaeology and Buddhist propagation in central India: the hydrological background.*

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Members may use CEH Wallingford's Library by appointment to consult *HSJ* and other journals *(tel 01491 692266).*

President's Prize

Nominations are invited for the BHS **President's Prize** (worth £200). This is for services to hydrology, and can reflect either service through BHS or that which is delivered more directly. It is not an OBE, but it does enable the Society to recognise worthy work for the wider good through hydrology.

Nominations are acceptable in any form that will reach me by **Monday 14th July** by post or email (see below). There is no form or format for nomination: it should come from an individual member of BHS and give their reason for nominating *either* an individual BHS member *or* a team that includes a BHS member in a substantial role.

Peter Walsh, BHS President

The address for nominations is: Dr Peter Walsh, President, BHS, c/o Institution of Civil Engineers, 1-7 Great George Street, Westminster, London SW1P 3AA. *(email: walshpeter@aol.com)*

Publications

HSJ contents listing

IAHS's *Hydrological Sciences Journal* (***Vol. 48 No. 2, April 2003***) contains the following scientific papers:

Witold F. Krajewski, Grzegorz J. Ciach & Emad Habib: *An analysis of small-scale rainfall variability in different climatic regimes*

R.L. Wilby, R.J. Abrahart & C.W. Dawson: *Detection of conceptual model rainfall–runoff processes inside an artificial neural network*

Future estimates of extreme rainfall

Scottish Hydrological Group Meeting Edinburgh 19 February 2003

Dr Hayley Fowler (Newcastle University) presented a paper on 'Future Estimates of Extreme Rainfall' to a packed meeting of practising hydrologists from engineering consultancies, Scottish Water and SEPA, along with a handful of academics, students and (importantly) civil servants from the Scottish Executive. This reflects the wide spread concerns in Scotland about the effects that climate change is having on flooding and the desire amongst practitioners and politicians for techniques and strategies for dealing with future flood risk.

Hayley presented a very convincing and comprehensive piece of research, in which she quantified recent changes in rainfall extremes in the UK and made predictions of potential future changes, inferred from state-of-the-art climate models.

Rather than base her analysis on long records at single sites, as many researchers have done previously, Hayley produced regional growth curves for long return-period rainfall events by pooling data within nine climatically distinct regions. Using this novel approach she was able to estimate up to 50-year return period rainfalls for fixed decades from 1961-70, 1971-80, 1981-90 and 1991-2000.

Some of her results were startling. For example, in the North East of Scotland the 1-in-50-year 5-day duration event for the 1960s has now become a 1-in-8-year event. This backs up the experience of hydrologists working in the region who have been convinced that the frequency of floods, such as those seen in Elgin last year, is increasing.

Clearly, with such changes occurring, there is a desperate need to reassess current practice in environmental risk assessment and to have regional strategies to deal with the effects of climate change. A first step towards these is quantifying future extremes for meteorological variables. This requires recourse to climate model predictions, which have been criticised for their poor reproduction of extreme rainfall. Hayley analysed the representation of extreme rainfall in the HadRM2 and HadRM3 climate models by comparing them with observational data for the period 1961-2000. She also presented results for a future scenario from both models to compare the changes projected by them and new design estimates of extreme rainfall for different regions of the UK. She showed that the HadRM3 simulations showed a pattern of change in extremes similar to the observations.

Moreover, the two climate models predict quite different pattern and magnitude of change for future integrations.

Based on predictions from HadRM3, the most recent and comprehensive formulation, there will be increases of up to 20% in the threshold values of 1-day events across the UK during the period 2070-2100. The largest increases are over Scotland, Northern Ireland and southeast England, and the smallest over northeast England. For longer duration rainfall (10-day) the 50-year event threshold values show a larger increase of 20% in Scotland but a reduction of 10% in most of England.

The technical procedures Hayley used to estimate design storms undoubtedly stand up to close scrutiny, and her predictions of future design storms are probably the best currently available. However, she clearly drew attention to the uncertainties associated with the climate model predictions.

This point was echoed by **Dr Tim Jolley** (SEPA) in the debate that followed. At present, there is no credible alternative to the current crop of climate models for predicting future change, and therefore we have to live with the uncertainties whilst doing all we can to reduce them. Research like Hayley's, which analyses and presents the results of climate model predictions in a form that is easily interpreted by engineers and policy makers, is invaluable if we are to devise credible strategies for dealing with the impacts of climate change. Furthermore, her in-depth analysis of the ability of climate models to simulate key variables for impact assessment will inform the development of more representative climate models.

Hayley's research has been submitted to two separate journals for publication: I strongly advise you to keep your eyes peeled for her name in press and read her paper.

Bill Sloan, Glasgow University

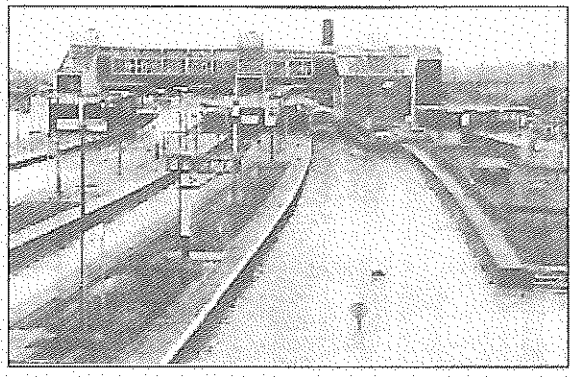
Prof. Eric Laurenson

Russell Mein (Monash University, Melbourne) has reported the sudden death on 22nd April of Australian hydrologist **Professor Eric Laurenson**. He had a long and distinguished academic career, making major contributions to engineering hydrology over this period. Perhaps he is best known for his role in the development of the RORB runoff routing model for flood estimation.

Eric Laurenson retired from Monash University in 1997 after 25 years as Professor, including many years as Head of the Civil Engineering Department, with which he kept an active association up to his untimely end. He is greatly missed.

FEH — initial experiences

BHS National Meeting
Institution of Civil Engineers, London
8 March 2002



Banbury railway station awash in April 1998

The large attendance at this one-day meeting at the ICE last year (over 90) confirmed the continuing interest in flooding in general and specifically in the experience gained since the Flood Estimation Handbook (FEH) was published in 1999.

David MacDonald (Black & Veatch - BV) presented the first paper on design flood estimates for the River Cherwell. Flood studies had been carried out to reappraise the flood magnitude ' frequency characteristics of the river at Banbury. These had been evaluated before the publication of the FEH, and the BV flood studies compared the design flood estimates obtained from:

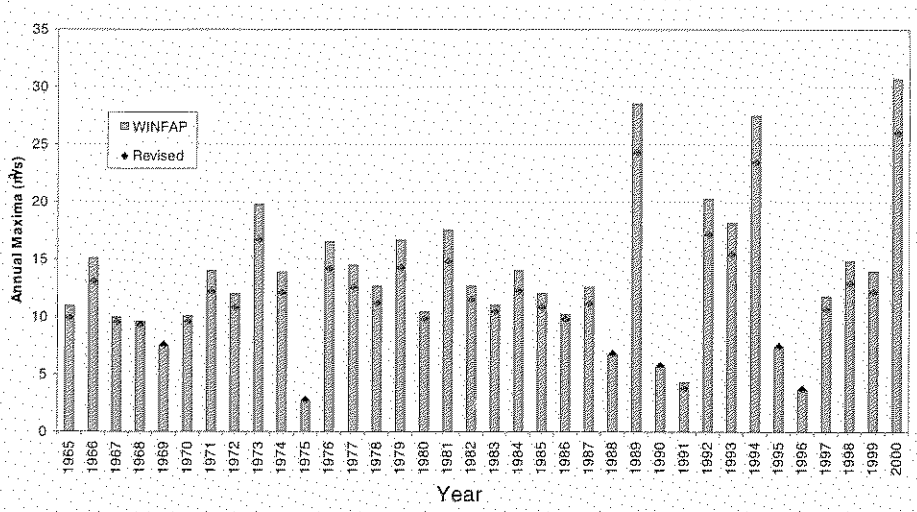
- Single station flood frequency analyses of annual maximum peak discharges;
- The index flood ("pooling group") method in Volume 3 of the FEH;
- The version of the Flood Studies Report (FSR) unit hydrograph rainfall-runoff and losses model described in Flood Studies Supplementary Report No.16; and
- The FEH version of the same method.

Based on these findings and other recent flood studies by BV staff, the author considered that:

- Design flood estimates provided by single station frequency analyses may, for long record sites, be more reliable than the corresponding estimates from other methods;
- Uncritical application of flood growth curves obtained from the Flood Estimation Handbook "pooling group" approach may lead to under-estimation of design flood events;
- The version of the unit hydrograph rainfall-runoff model in Volume 4 of the Flood Estimation Handbook is almost certainly giving overestimates.

These BV studies were triggered by the April 1998 floods in the Cherwell. Although many considered them "exceptional", David had obtained a sequence of photographs of the floods in October 1975, May 1932 and April 1998, which demonstrated clearly the benefits of researching archive material on flooding.

Ian Rose (Halcrow) presented a study of a permeable catchment based around Salisbury, in the permeable catchment of the upper Hampshire Avon, close to the confluence of four tributaries, each of which is gauged. The Agency's review of the gauge ratings led to significant changes in the data record (see example for the Avon at Amesbury), underscoring the importance of the updating of the FEH dataset being carried out jointly by the Environment Agency, SEPA and the Department of Agriculture and Rural Development, Northern Ireland. The FSR and its supplements has investigated permeable (specifically chalk) catchments but offered no specific procedures. Through pooling datasets of similar catchments, the FEH has introduced a more specific approach which is combined with an adjustment to avoid the influence of small annual maxima.



The River Avon at Amesbury, comparing WINFAP and revised Annual Maxima

The three highest ranking flood peaks occur in the last decade, pointing to a possible shift in the level of the series and an increased tendency in recent years for the coincidence of high groundwater level and storm rainfall. Ian questions whether the flood index, Qmed, should be estimated over the short term to reflect the shift in the series or over the long term to suppress climate variability. Different reviews of the pooling group lead to a wide range of estimates of extreme floods and question whether the fitting of a single distribution can be an adequate description of such a complex process. Flood frequency in Salisbury was eventually estimated through the analysis of a flood series derived at a point below the confluences by using a routing model to combine the gauged flow series. Ian offered the suggestion that continuous simulation may offer a more secure route for flood estimation in permeable catchments such as the Avon.

Peter Spencer (Environment Agency) described the estimation of low return period floods (< 1 year) for an ungauged, urban catchment with an area of about 30 km^2. The study involved estimation of growth curves and estimation of the index flood (QMED) The estimation of low return period floods is strictly outside the scope of FEH methods and required Peter to use a range of methods for estimating growth curves, each of which gave comparable solutions.

The index flood was based on QMED and was estimated by data transfer from two gauged stations, a donor and an analogue station on a neighbouring catchment. The two estimates of QMED were very close and consistent with the estimate from the bankfull channel width equation. Further, the estimates appear sensible when applied to a hydraulic model, in that bridges and culverts are surcharged and significantly higher flows could not be accommodated. However, very different results were obtained from the 14 rural catchments suggested for the pooling group by WINFAP-FEH. None of the individual stations in the pooling-group would have derived a flow as low as the value of QMED obtained from the donor and analogue, and an average of all estimates would have been more than twice the accepted value. Peter therefore cautions against the use of remote sites for QMED estimation where donor and analogue catchments are available.

The final paper of the morning, presented by **Dave Morris** (CEH Wallingford), concerned the automated application of the FEH statistical method of flood frequency estimation. The analysis has involved the derivation of flood peaks for DEM grid locations coincident with the river network with for seven exceedance probabilities from 50% (the median annual flood) to 0.5% (200 years). The results have been compared with those produced by experienced users of the FEH statistical procedures. The performance of the method was assessed by searching for internal inconsistencies within the network-wide FEH estimates. A comparison with other methods of flood estimation has been undertaken but was not presented in the paper.

The procedures were modified during the development of the automated method in order to reduce the inconsistencies that would have been generated by adhering to the FEH guidelines. These primarily affect the selection and weighting of donor and analogue gauges and the selection and weighting of pooling-group members. Refinements to later releases of the FEH will incorporate some of these adjustments.

Analysis of the results shows that the 'modified' FEH method performs well in most places from the aspect of spatial coherence. Problems occur at a minority of confluences, usually where catchments of very different permeability converge or where there is a change in the set of donor gauges being used. The datasets of automatically produced estimates, are not everywhere as reliable as those that could be made by an experienced manual user of the FEH. However, they are still of value for a number of applications, particularly where estimates are required throughout a region.

In the first afternoon paper, **Christian Lomax** (WS Atkins) described the application of the FEH method to urban catchments, and in particular the apparent inconsistency that an urban catchment (URBEXT ⊕ 0.025) is excluded from its own default pooling group. This derives from the FEH approach of developing 'as-rural' growth curves. The work has looked at alternative approaches of capturing data from a partially urbanised target so that it can still contribute to the estimation of flood frequency. The Harford Hill gauge on the River Salwarpe is used as a case study where techniques of adjusting the AMAX data were reviewed to allow the urban influence to be removed from the data (effectively naturalising the AMAX). These results have been compared against those arising from a manual adjustment of URBEXT in the catchment descriptors FEH data files, that ensures WINFAP includes the site in the pooling group.

Brian Darling continued the presentation by describing a case study for the River Aire in Yorkshire. This has involved the derivation of flood hydrographs for various locations, obtained using distributed rainfall-runoff and routing models for the catchment. For locations where there is reasonable gauged data, comparisons have been made of the typical hydrograph shape for various return periods. The comparison of shapes has shown that there is consistency amongst the observed hydrograph shapes for a given return period. Furthermore, the hydrographs produced using distributed models (in conjunction with design rainfall inputs) leads to a lower flood volumes when compared with observed hydrographs. Brian's presentation reviewed ways of solving this problem.

The problems of catchment-wide flood estimation were further described by **Duncan Faulkner** and **Paul Wass** (JBA Consulting). In work on the Don catchment in South Yorkshire, complexities of the catchment militated against the application of both the statistical and FEH methods. In order to overcome these problems, continuous simulation has been used to simulate the hourly catchment flows. A 1000-year series of stochastic hourly rainfall was generated and used as an input to a PDM (Probability Distributed Moisture) rainfall-runoff model representing each major sub-catchment. Generation of 1000 years of flow data allowed comparison of flood frequency distributions fitted to observed and simulated data.

Modelled and observed behaviour were compared, highlighting some of the difficulties inherent in the methodology, such as data requirements and calibration. Subsequent aspects of the modelling will involve running the largest simulated events through the hydraulic model of the Don washlands system. The required flow and level frequency estimates at Doncaster and other sites of interest will be obtained by frequency analysis of the hydraulic model results from these events. Flood estimation by continuous simulation might prove to be applicable to other current studies, particularly on large or complex catchments, or in solving joint probability problems. However, its use by practitioners is currently restricted to catchments with sufficient flow and rainfall data to calibrate a rainfall-runoff model.

Alistair Cargill (SEPA) and **Andrew Black** (University of Dundee) refocused attention on data by reviewing the issue of Peaks-over-Threshold (POT) data sites. The collation of POT series was a major focus of data collection in support of the FSR studies. The updating of series for the FEH concentrated on the collation of annual maximum series with relatively little effort devoted to collation of POT data.

They presented arguments for the continuing routine collection and use of POT data. For flood frequency estimation, they can be used for flood risk estimation at sites with only short records. In addition, the inferences from seasonal POT data can be used to establish pooling groups as an aid to use of the FEH methods. Furthermore, new approaches to risk estimation using disaggregated POT series have been presented recently and the continued use of seasonal flood information will benefit an understanding of the changes in flood behaviour associated with climatic change.

David Price (Babtie Group) presented the findings of a DETR-funded study in association with CEH Wallingford and Rodney Bridle Ltd to compare FSR and FEH rainfall estimates. This had been motivated by marked differences that had been noted between FSR and FEH rainfalls, especially for reservoir flood studies, so the study was done for return periods used in standard reservoir flood studies: 193, 1000 and 10,000 years. The findings were that the FEH design depths were on average between 10% and 40% higher than those of the FSR for rainfall return periods of 193 years; 20% to 50% higher for 1000-year events, and 30% to 75% higher for 10,000-year events. However some dependence on storm duration was evident, and the average values mask considerable spatial variability.

Case studies were also presented for two river flood studies: one in Scotland and the other in southern England. Both showed FEH design rainfall depths to be 20% to 25% higher for return period between 50 and 100 years. Similar differences are transferred in to the related flood estimates. David strongly recommended further study into design rainfall depths for events rarer than 1000 years. Furthermore, re-calibration of the FSR/FEH rainfall-runoff model is required that is consistent with these rainfalls. Such a project is under way and was briefly described in a subsequent presentation by **John Packman.**

Damien Crawford and **Amy Hensler** (WS Atkins) presented the findings of two recent case studies for establishing flood frequency estimates based upon the FEH tools for problem catchments. The first investigated the estimation of design baseflows for the River Wye, Buckinghamshire, a predominantly Chalk catchment. The results compared the FEH rainfall runoff method, the FEH Statistical method, and a technique based on at-site frequency analysis of baseflows. The second case study investigated the design flood estimation for the River Ash, Middlesex. The River Ash is a small predominantly urban catchment in west London. Flooding in the catchment may be influenced by flood transfers from the River Colne and therefore the flooding of the catchment may arise due to short intensity summer storms or more prolonged winter storms which cause the River Colne influence the flood flow regime. The analysis considered a simplistic joint probability approach in conjunction with FEH techniques to investigate this problem.

Finally **John Packman** and **Lisa Stewart** (CEH Wallingford) described the application of the FEH rainfall-runoff method for catchment flood management. The Environment Agency's programme of Catchment Flood Management Plans (CFMPs) seeks to identify a strategy for managing flood runoff throughout large basin areas (approximately 10,000 km^2), allowing for likely future changes in climate and land use. A broad-scale catchment and river modelling approach is required to assess the downstream impacts of different strategies on flood levels throughout the area. A bespoke modelling approach is considered unnecessary for such strategic studies: instead the FEH rainfall-runoff model is preferred for estimating subcatchment hydrographs, which are then input to an iSIS routing model. Much of the development is sponsored by Defra under a Modelling and Decision Support Framework (MDSF). While the MDSF provides a GIS framework for modelling flood extents and damages, all hydrological (and hydraulic) calculations are performed off-line and supplied as imported information. The rainfall-runoff method is included as an iSIS 'unit', but initial calculations to try and resolve differences between the statistical and rainfall-runoff method can be made using a spreadsheet implementation of the FEH rainfall-runoff method (FEHCAL).

The rainfall-runoff model used in the current CFMP procedures is as described in the FEH. Although the model was unaltered from its original FSR form, there was scope to update certain aspects. A two-year Defra-funded project is under way to revitalise the basic model form, reassessing the design storm definition, but also updating some of the obsolete components of the model itself. The revitalised method should be available for future CFMP studies.

Questions and discussion focused on issues such as the quality of data (especially at high flows), problems of permeable catchments, the formation of pooling groups and rainfall frequency studies for use with the rainfall-runoff method. **Chris Binnie** was concerned about the impact of uncertainties in rainfall frequency estimation on reservoir studies. David MacDonald cautioned strongly against using FEH rainfall values to estimate design floods for return periods greater than 0.05% (2000 years), based on his experience of comparing FSR and FEH rainfalls, published in *Dams and Reservoirs* in October 2001. **Howard Wheater** (Imperial College) sought information on likely research funding targeted on flooding. **Mervyn Bramley** (Environment Agency) said that funding was being put in place in response to recent flooding events.

Peter Walsh closed the meeting by thanking the presenters for their contributions to a highly relevant and successful meeting.

Paul Webster, Hydro-Logic

The rapporteur apologises for the late report of this important meeting and for any resultant inaccuracies in reporting.

Nice presentation on climate variability

***Dr Tim Harrold** (Research Institute for Humanity and Nature, 335 Takashima cho, Kamigyo ku, Kyoto 602 0878, Japan) recommends a presentation on **"Hydrological statistics for engineering design in a varying climate"**, which was given by **Prof. Koutsoyiannis** at the EGU/AGU conference at Nice in April.*

*It raises some interesting points about climate variability, and argues that the use of classical statistics in a variable climate can seriously underestimate the underlying risks. The presentation is available on the Internet at **http://www.itia.ntua.gr/e/docinfo/565**.*

International prize for British hydrologist

Congratulations to **Dr Alan Gustard** (deputy director at CEH Wallingford) on winning the 2003 International Hydrology Prize. Alan is only the second UK recipient of this IAHS award for an outstanding contribution to international hydrology. It recognises Alan's long-standing contribution to the development of water resources research, especially his leading role in the UNESCO IHP FRIEND programme.

We can often deliver information to BHS members more efficiently by email. If you are willing for your email address to be used to recieve BHS information, please contact Tim Fuller (bhs@ice.org.uk).

Student prize

If you are a student or a university supervisor, and have not considered an entry for the BHS Student Prize, please look at the previous issue of *Circulation* (back page) for details. If you missed it, contact Secretary Tim Fuller at the ICE *(tel 0207 665 2234, email bhs@ice.org.uk).* Entries are due in by **7 July 2003**.

Forthcoming events

Meetings

DIFFUSE GROUNDWATER POLLUTION
Geological Society (Hydrogeological Group) Meeting
Burlington House, London
12 June 2003

This one-day technical meeting will cover all aspects of diffuse groundwater pollution, including regulatory policy, issues affecting water companies and the latest research.

Please register in advance by contacting **Tim Besien** (see below). The registration fee is £20 (£10 for Members of the Geological Society), students being admitted free (on production of student card). Payment will be taken on the day. A wine reception will follow the meeting (£5 extra); coffee, tea and biscuits will be provided. The draft programme runs from 10.00 (registration from 09.30) to 17.00, with poster sessions at 11.00 and 15.20 and a break for lunch (not provided) between 12.55 and 14.00.

Topics include the Water Framework Directive, threats to groundwaters seen from a water company perspective, pesticides, risk to groundwater resources from farm waste, the impact of urban land use, the Nitrate Sensitive Areas Scheme, and bioremediation to reduce nitrate levels.

The list of posters is still in draft. If you would like to submit a poster, please contact Tim Besien or John Chilton. For details of the programme, including the latest list of posters, please look at the Geological Society web site at *www.geolsoc.org.uk*.

For a map of how to get to Burlington House please use the link: *www.streetmap.co.uk/streetmap.dll?postcode2map?W1J+0BG*.

For further details please contact Tim Besien *(tel 01452 624024, email tim.besien@environment-agency.gov.uk)* or John Chilton *(tel 01491 692284, email j.chilton@bgs.ac.uk).*

Sixth International Symposium on Hydrological Applications of Weather Radar
SUCCESS STORIES IN RADAR HYDROLOGY
Melbourne, Australia
2–4 February 2004

The major theme of this meeting is the successful implementation of radar technology for hydrological and quantitative rainfall applications. Papers are invited on operational experiences and techniques for practical use of weather radar data in flood forecasting, urban hydrology, hydrometeorology, managing risk and uncertainty, or any relevant topic.

Abstracts (maximum 500 words) are due by **16 June 2003**, by email (attached Word file) to *hawr2004@bom.gov.au*, or by post to: The Secretariat, HAWR2004, Bureau of Meteorology Research Centre, GPO Box 1289K, Melbourne 3001, Australia. Presenting authors must pre-register. Successful authors will be notified by **31 July** and must then submit a six-page extended abstract by **31 October**. Pre-prints of the proceedings will be published as a CD to be handed out on arrival, or downloaded from the web site a few weeks beforehand. Formal proceedings will be published in *Atmospheric Science Letters*, an electronic journal of the Royal Meteorological Society.

For details see the website *http://www.bom.gov.au/announcements/conferences/hawr2004/index.shtml.*

Diary

21st May 2003
BHS National Meeting with the BHS South West Section
"Hydrological uncertainty and risk"
Venue: Bristol University Time: 10.00
Contact: Dr Paul Bates *(tel 0117 928 9108, fax 0117 928 7878, email paul.bates@bristol.ac.uk)*

9th–10th September 2003 [see front page]
UN International Year of Freshwater H_2O03 event at CEH Wallingford
Contact: Rob Flavin *(tel 01491 692406, fax 01491 692424, email rwf@ceh.ac.uk)*

10th–12th September 2003
Aqua Enviro / CIWEM Conference
"The environment — vision, values and innovation"
Venue: Harrogate, Yorkshire
Contact: Alastair Chrisholm, CIWEM *(email alastair@ciwem.org.uk)*

12th** September 2003 **[not 17th]
BHS National Meeting and **AGM**
"Flow monitoring: can we improve quality *and* reduce costs?"
Note change of date and topic: replaces the advertised "Low flows" meeting
Venue: ICE, London Time: 10.00
Contact: Rod Hawnt, Hydro Logic Ltd *(tel 01885 483789, email hawnt@hydrologic.co.uk)*

12th November 2003
BHS National Meeting
"Water quality"
Venue: ICE, London Time: 10.00
Contact: Colin Neal *(tel 01491 838800, fax 01491 692424, email cn@ceh.ac.uk)*

31st March 2004
BHS National Meeting
"Integrating wetland hydrology and ecology"
Venue: ICE, London Time: 10.00
Contact: Mike Acreman *(tel 01491 838800, fax 01491 692424, email man@ceh.ac.uk)*

12th–16th July 2004
BHS International Conference on "Hydrology: science and practice for the 21st century"
Venue: Imperial College, London
Contact: Dr Adrian Butler, Dept of Civil & Environmental Engineering, Imperial College, London SW7 2BU *(tel 0207 594 6122, fax 0207 594 6124, email a.butler@ic.ac.uk, website www.hydrology.org.uk/bhs2004)*

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