THE NEWSLETTER OF THE BRITISH HYDROLOGICAL SOCIETY

Circulation

No. 2 May 1984

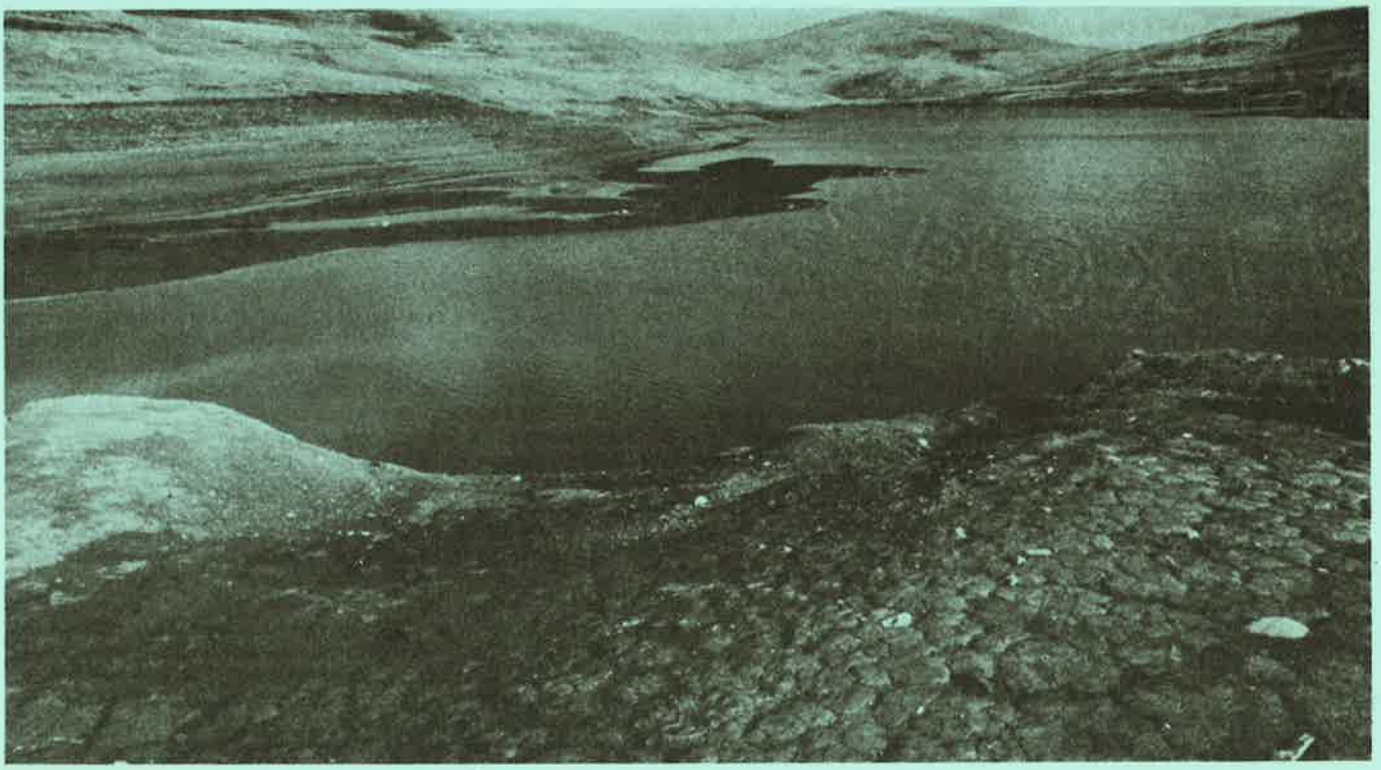
From the Editor:

This edition of *Circulation* is a bit meatier than the last, with reports of no less than five meetings of concern to BHS members held since our last issue.

These reports caused some editorial head-scratching: should I put them all in this issue or hold some over to the next? I decided on the former course because *Circulation* needs to be as topical as possible if it is to carry out its communication role effectively.

The reports themselves are quite detailed and I personally congratulate the individual reporters for their diligent note-taking. However, I was struck by the repeated reference to the adequacy of refreshments provided at each venue. I am sure that Hydrologists are not particularly gastronomically aware and would members please note, therefore, that in future I shall delete all reference to food to conserve space for the science.

TOO LOW, TOO SOON?



This low water level, photographed recently at Nant-y-Moch, mid-Wales, looks very like the mid-70s drought pictures. After the driest spring since 1938 in parts of Wales, reservoir storage is reckoned to be much the same as in 1975. Still, as I write this caption (on 16.5.84) a nice gentle rain is falling so there is probably no need to take all those alarmist press articles seriously as yet.

Diary

15 June
BHS Meeting: 'Advances in statistical flood estimation' — Dr J. Wallis, IBM, and Prof E.F. Wood, Princeton University.
Dept of Civil Engineering, University of Newcastle.
Contact: British Hydrological Society (Prof P.E. O'Connell).

2 July
BHS Meeting, Southern Region: 'Practical river flood studies' — G. Thompson, Binnie & Partners, M. Baghirathan, Halcrows, and M. Lindley & J. Smith, Rofe Kennard & Lapworth.
Dept of Civil Engineering, Imperial College.
Contact: British Hydrological Society, Southern Section (H.S. Wheater, Imperial College and D. Lerner, Binnie & Partners).

23-27 July
'Challenges in African Hydrology'.
IAHS/Unesco/WMO International Symposium, Harare, Zimbabwe.
Contact: Zimbabwe Conference Board, PO Box A585, Avondale Harare, Zimbabwe.

29 July-4 August
Eurogeophysics Assembly.
Louvain-la-Neuve, Belgium.
Contact: European Geophysical Society (G.M. Brown, Dept of Physics, University College of Wales, Aberystwyth).

25 August-7 September
Seventh Session WMO Commission for Hydrology, Geneva — contains Technical Conference on use of microprocessors and minicomputers in hydrology on 4/5 September.
Contact: Secretary General, WMO.

10-14 September
'Hydrochemical balances of freshwater systems'.
Uppsala, Sweden.
International Symposium Swedish National Science Research Council/IAHS/Unesco.
Contact: Stockholm Convention Bureau, Jakobs Torg 3, s-111 52 Stockholm.
Note: Canterbury Travel Ltd., 248 Streatfield Road, Harrow and American Express, 19-20 Berners Street, London, W.1., are arranging special package deals for this event.

11-14 September
University of Dundee

Annual meetings of University and Polytechnic Water Specialists (Public Health Engineering, Hydrology, Hydraulics)

Contact: W. McNicholl, Dept of Civil Engineering

Meetings of special interest to hydrologists are on Wednesday, 12 September, p.m. (John Mawdsley on the value of stream flow data and Ted Hollis on modelling the hydrology of a Tunisian wetland) and Thursday, 13 September, a.m. (Chris Pratt on Urban hydrology)

15-16 September
'Hydrological and hydrogeochemical mechanisms and model approaches to the acidification of ecological systems' — IHP Workshop to be held immediately after the Uppsala Symposium.
Contact: Ingrid Fagerström, Upsala University, Box 256, S-751 05 Uppsala.

24 September
'Snow and snowmelt'.
Edinburgh University.
Contact: ICE Scottish Hydrological Group (R. Sargent, Forth RPB).

Main Committee's Activities

Since the last Newsletter two meetings of the Main Committee have been held; in Swindon and Reading, by the kindness of NERC and the Thames Water Authority respectively. Both meetings were attended by **Dr Peter Walsh** and **Bob Sargent,** the recently co-opted representatives of the ICE's Pennines and Scottish Hydrological Groups. They are already playing a valuable part in the Committee. The many topics discussed and activities taking place have included:

- the planning of meetings for the remainder of the 1983/84 programme and the initial planning for 1984/85.
- the preparation of notes for speakers and reporters at the Society's meetings and separate notes on the organisation of meetings. The aim of these is to achieve as high a standard as possible at meetings.
- the preparation of a small leaflet on the Society, which outlines its aims and activities and includes a membership application form. This will be printed shortly.
- consideration of how the Society should respond to the view expressed by one-third of those who replied to the Initial Planning Group's questionnaire (October 1982) that the Society should aim to further the professional standing of hydrologists. In order to obtain a better idea of members' views and wishes on this topic a questionnaire is being prepared for circulation to all members.
- the possible preparation of a small 'Hydrologists Directory', which might be in a loose-leaf format so that additions and changes could be made readily. This idea is only in an embryonic stage and the scope of the contents is being discussed.
- support for the organisation of regional meetings in the Midlands and South by the local volunteers who are planning these. Reports on the two first meetings appear elsewhere in the Newsletter.

In addition, correspondence with national and international organisations and societies has been proceeding as part of the policy to establish a wide range of links and contacts. Similarly, the regular interchange of publications and newsletters with other organisations has been started. At the invitation of the Institution of Civil Engineers an article on the Society was prepared by the President and was published in the April issue of the Institution's monthly 'Group Focus'.

COMMITTEE MEMBERSHIP

The Society's Main Committee recently invited the Institution of Civil Engineer's Scottish and Pennines Hydrological Groups to propose members for co-option on to the Committee. Both Groups responded to this and we are pleased to welcome Bob Sargent (Forth River Purification Board) and Dr Peter Walsh (North West Water Authority) respectively.

There were several aims in mind. Firstly, the Society is keen to foster close liaison with the ICE's Regional Hydrological Groups so that open cooperation amongst all those interested in Hydrology is developed. Some joint meetings will be one way of doing this. Secondly, the representation on the Main Committee of the interests of the Society's members living in the north of England and in Scotland has been improved. Both new Committee members are very active, practising hydrologists known to large numbers of members and we are very glad that they have agreed to take on this valuable co-ordinating role. Logan Jack, an elected member of the Main Committee, is also the Chairman of the Welsh Hydrological Group and so the Society now has close links with all three Hydrological Groups of the ICE.

REGIONAL SECTIONS

In the first issue of *Circulation* it was reported that a questionnaire had been distributed to members in the 'Midlands' seeking their views on the formation of a Midlands Section and, if in favour, on the type of meetings wanted. 68 forms were sent out, 37 replies were received and all except two members supported the idea. The first meeting was held successfully on 14th March and a report on it is in the Newsletter. A total of 37 people attended, although only 17 of these were members of the Society. Many of the guests were local post-graduate students.

Following these activities it has been decided that in the immediate future a formal elected, local committee is not needed and a more informal arrangement is appropriate. Accordingly **Dr Richard Wood** (STWA) has kindly agreed to act as the initial Co-ordinator for a Midlands Section. He will ensure that at least two regional meetings are held in the Midlands each year and notices of these will appear in *Circulation*. He will be the link with the Society's Main Committee, whose meetings he will be invited to attend. The way in which the Section then develops will depend on the enthusiasm and numbers of those who support the meetings, which will be open to all members and those interested. Present plans are to hold the next meeting in the autumn.

The questionnaire sent out to all the BHS members registered in the southern part of the British Isles to assess support for a regional Southern Section produced 69 replies, of which 63 were in favour.

The majority of the replies suggested that the Southern Section should meet 4 times a year, that the number of National meetings attended per year would probably only be about 2, while attendance at Southern Section meetings would be in the range 2-4. The majority suggested London as the venue but there was quite a strong desire for some meetings to be held further afield (e.g. Home Counties, Wallingford and around the section). However, if meetings were to be held in Central London, 29 replied that this would encourage attendance, 29 replied that this would have no effect while 9 said that this would discourage attendance. The most popular time for meetings was 6-8 p.m. and a wide variety of future topics and comments was supplied.

A Southern Section Committee has now been formed of **Jane Bliss** (CEGB), **David Lerner** (Binnie & Partners), **Mark Robinson** (IH) and **Howard Wheater** (Imperial College).

Floods Workshop

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Professor **M. Hamlin**, host for the workshop, opened the proceedings and welcomed the participants. **Max Beran** listed important issues relating to regionalising floods to guide the workshop in useful directions. The list was extensive and the two days was not enough to go deep into all aspects of floods. During the two days the discussions should concentrate on the following topics: choice of distributions and estimation procedure, pooling of frequency distributions, mixed distributions, historical flood data, asymptotic behaviour of distributions tails, and the use of catchment characteristics to determine regional and hydrological homogeneous subsets.

C. Cunnane discussed the problem of choosing a distribution for analysing flood series. A basic assumption is that a series of flood peaks is a random sample from a stationary population. Many problems may arise from the fact that these assumptions are not fully met. A simple type of non-stationarity is offered by mixture distributions. Questions were raised as to what extent the method of parameter estimation affects our ability to identify the form of parent distribution, and of the existence of upper bounds. The latter gave rise to intense discussions. There were, as expected, no easy answers to either of the two questions.

J. Wallis and **E. Wood** presented the application of regional estimation with probability weighted moment using the five parameter Wakeby-distribution.

Monte Carlo simulation was used to compare that approach with a computerised version of the method used in the Flood Studies Report. Data sets were created that were similar to those used in the Flood Studies Report and which permitted a geographical variation in mean values. The comparison gave regional flood frequency curves with their new approach that were significantly lower than the traditional one especially for large return periods.

However the simulation showed that the new procedure yielded regional frequency curves which were unbiased. They also pointed to the difficulty of incorporating historic flood information into regional analysis.

The problem of uncertainty in the tail shape of the parent distribution was extensively treated in contributions from the Italian participants. **E. Todini's** suggested analysis made use of annual maximum, two year maximum, three year maximum, etc., values for the analysis of the upper tail behaviour. All presentations stressed the danger of taking for granted that a good fit in the central part of the distribution also give indication that the upper tail behaviour is acceptable.

Up till now all contributions had dealt with annual maximum series. **F. Rossi** and **P. Versace** fitted partial duration series to a compound Poisson process coupled with a mixture of two exponential distributions for flood magnitudes. Their model has a total of four parameters but does not demand any external categorisation of peaks into the two classes. The derived distribution accounted for the high variability in the skewness coefficient. Two of the parameters could be given regional values. It had not yet been possible to relate the other two parameters to at site climatic and geomorphic characteristics.

A good perspective on the use of historical flood information was given by **S. Dyck.** Plötsch, a German citizen, living at the beginning of the last century, collated valuable observation material for the Elbe river and some other German rivers from medieval time up to his day. The plots shown, comparing the short series of modern data with the extended series with historical data, all seemed to indicate that the shorter series overestimated floods with high recurrence intervals. In discussion it was claimed that the deviation can be in both directions.

Finally the problem of grouping data in accordance with geographical location and catchment factors was discussed by **L. Gottschalk** and **S. Wiltshire.** Only a small part of the total regional variability in flood distribution parameters can be reduced by grouping. Gottschalk presented a geographical subdivision of seventeen based initially on statistical treatment of flood parameters and basin characteristics. Wiltshire showed preliminary findings on a scheme for providing optimal subsets based on measurable catchment characteristics. Test statistics were presented for defining optimal splits and their significance.

Prepared contributions to the Workshop were given by Max Beran, Institute of Hydrology, Dr. C. Cunnane, University College Galway, Professor S. Dyck, Technical University of Dresden, Professor L.T. Gottschalk, University of Oslo, Dr **P.E. O'Connell**, Institute of Hydrology, Professor R. Rossi, University of Napoli, Dr. **R. Rosso**, University of Genoa, Professor E. Todini, Univeristy of Bologna, Dr J. Wallis, IBM Center, New York, Professor P. Versace, Univeristy of Calabria, S.E. Wiltshire, Institute of Hydrology, and Dr E.F. Wood, Princeton University.

Advances in Hydrological Instrumentation

A report of the BHS meeting held at the Institution of Civil Engineers, on 13th February.

The Society's President opened the meeting, which was attended by about 110 people, including two visitors from China. He asked the five speakers to discuss the limitations of instruments, as well as their advantages, and suggested that non-technical factors could be important, for example, the need to provide employment in developing countries.

Dr R.W. Herschey (Department of the Environment) said that, in the UK, hydrology is going through difficult times, with pressure for cuts and reductions, particularly now that it is the responsibility of authorities whose fundamental objective is to supply water. The situation is now blurred as to how many streamflow, rainfall and groundwater stations are still producing records. The outstanding ommission in the water resources network is continuous measurement of sediment transport.

Reg Herschy described and illustrated a variety of methods of data capture. In stream gauging, innovations of the past 10 years include the moving-boat method, development of ultrasonic and electromagnetic flow measurement, and the rising air float method which is still being evaluated.

He raised the problem of replacing punched tape water level recorders used since 1963. He discussed methods of returning data to a collecting centre, ranging from physical collection to transmission by satellite. Receiving dishes (1.5 metre diameter) enable data to be received directly, rather than via landline from Darmstadt in Germany through the Meteorological Office. Meteosat images, received half hourly, have potential for areal measurement of snow cover, rainfall and soil moisture.

In conclusion, he said that hydrologists must consider what data is needed, in what form, and how fast. The form of the data collection system required until the end of the century, and the need for further research, must be considered.

The discussion ranged from sediment sampling to the role of the Department of the Environment in hydrometry. It was suggested that national data collection might be too important to be left to individual water authorities, particularly in view of the disruption caused by almost continuous reorganisations.

Some members took advantage of the very adequte buffet luncheon available in the building, before the afternoon session which was chaired by **Dr J.C. Rodda.**

Mr I. Strangeways (Institute of Hydrology) had been involved with automatic weather stations (AWS) for about 20 years. He described the development of both loggers

and sensors for these stations. The Microdata M200 logger provides a good general purpose tool even today. Sensors have been improved as technology advanced. Maps and slides of AWS throughout the world were shown, with sites ranging from the Amazon to the Antarctic to the Sahara.

For data transport, Ian Strangeways likes the magnetic tape cassette because it is cheap, easy to transport from sites all over the world, and needs no power to retain the memory. Solid state loggers are an expensive option for multi-channel use. Satellite telemetry is being tried out for data transmission from the Cairngorms AWS.

He described an experimental AWS for remote sites which experience low temperatures. Pneumatic shock, combined with flexing, is used to prevent ice build-up on the supports. Low cost sensors are being developed for wind speed and direction, and solar radiation, and an in-line AWS with electronics below ground.

The relative merits of magnetic tape cassettes and solid state logging were discussed. Concern was expressed about AWS maintenance in developing countries. Ian Strangeways said IH were not happy about providing expensive equipment to developing countries unless they could visit it regularly — hence the development of the low cost throw-away instrumentation.

Dr Stewart Walker (Severn-Trent Water Authority) said that new technology could make existing tasks cheaper and new things possible. An example is the tipping bucket raingauge, compared to the Dines tilting syphon, and the relative ease of obtaining data for computer analysis.

He described and illustrated the use of solid state loggers of varying complexity in different applications across the water cycle in STWA.

The PDL5, and its successor the PDL7, from DRS Ltd, was initially used in raingauging. It was subsequently used to measure flows and pressure in pipelines for network modelling. Other applications include river level gauging using floats and a shaft encoder, and monitoring starting and stopping of pumps at an unmanned sewage pumping station.

The Microlog 2 from Spectroscan is about the size of a building brick and works underwater. It can be linked to a pressure transducer and insertion flowmeter and installed in a hydrant chamber.

The Husky field portable microcomputer is used on multipath ultrasonic and electromagnetic flow gauges. In current meter gauging it takes the operator through a complex logging application. It is being superceded by the Husky Hunter with twice the memory for half the price.

Stewart Walker felt that solid state logging would be routine in five years time, with perhaps only two or three manufacturers left in the field.

Dr Brian Ellis (Middlesex Polytechnic) described the history of automatic continuous water quality monitoring (ACWQMs) in the UK. In the early 1970's there were considerable problems with unreliable instrumentation and poor installations. The new generation of monitors is much better with genuine field instrumentation rather than laboratory instruments in a different environment.

He discussed the selection of sites and the parameters usually measured. Improvements to ACWQMs include enhanced purging, backflushing, and use of microfilters, to overcome sensor fouling and intake silting, enhanced electrodes to increase sensitivity, and dual point calibration systems to increase sensor specificity.

Brian Ellis showed how a small package system could now be built from off-the-shelf modules. It had full calibration and cleaning facilities and recorded on a Microdata logger. He went on to talk about on-line discrete samplers for small catchments.

Discussion covered problems of pH measurement and of representative sampling. Brian Ellis said that, with a fixed sampling position, manual tests should be carried out to ensure homogeneity across the section.

Dr P.W. Walsh (North West Water Authority) talked about his six week Churchill Fellowship tour in the USA. He discussed the role of the United States Geological Survey and of other bodies such as the National Weather Service.

Satellite telemetry is widely used, with a move towards local data capture using small dishes. A meteor-burst telemetry system is used for snow cover data and prediction of related run-off. A novel sensor — a raingauge 3m up a pole — was illustrated.

Peter Walsh described how a great deal of money is being put into research and development, with a major programme on data collection. The Hydrologic Instrumentation Facility has been set up by USGS to provide support. The AHDAS programme aims to produce a design, valid for 20 years, for a data collection system standard to as many processes and types of data as possible. AHDAS will be expandable and flexible and will link into the proposed Prime distributed computer processing network. It will replace PTRs at 8–10,000 river gauging stations.

The contract for development of an AHDAS prototype has been let but the design remains the property of the US Government and there is no guarantee of a follow-up for the contractor. Peter Walsh felt that, as AHDAS is to be a general purpose programmable instrument with common interfaces for sensors, it might also be useful in sewage works or water treatment works.

Asked about what the US were doing about improving quality of data and rationalising networks Peter Walsh said that satellite monitoring helps avoid data loss. There were attempts to balance the pay-off between collection costs and better records. Staff felt under pressure to rationalise, but there seemed to be more money available then in the UK.

Standardisation seemed to be the main theme of the general discussion **Mike Mansell-Moullin** contrasted the carefully researched developments in the US, intended to be applicable for 20 years, with the continuous development taking place in the UK. Consultants working abroad would be more interested in the former approach, and UK firms might miss out on overseas markets.

Ian Strangeways felt that this had been the situation for the past 20 years and would continue while the 'lowest tender' approach was adopted, and unless organisations co-operated to produce a standard approach. He liked diversity.

Stewart Walker said that there is already co-operation between Water Authorities but that total standardisation should not be an over-riding goal. It carries a risk of fossilising design and being unable to take advantage of new technology. Instruments in use in STWA for a year were a reasonable facsimile of AHDAS.

Reg Herschy felt that UK is losing out in spite of being ahead of the USA in many areas e.g. use of shaft encoders and solid state loggers. The USA are spending a lot, have a substantial home market and a desire to sell abroad.

Logan Jack (Welsh Water Authority) said that he is recommending that his authority equips half its gauging stations with dual purpose equipment for flood warning and archiving and the rest with solid state loggers. Some good loggers and telemetry systems had not been mentioned today.

Elisabeth Shaw (Imperial College) put in a plea for people outside Water Authorities facing difficulties caused by data from different sources not being compatible.

John Rodda closed the meeting and thanked the participants.

There was a tendency for some speakers to spend too long on history rather than on new developments. Overall the meeting seemed to be successful in updating the knowledge of people not currently active in hydrometry, as well as highlighting new developments and current problems.

Margaret Fallon

Rainfall-runoff Processes in Urban Areas

This first meeting of Midland members was held at Loughborough University, Department of Geography, on 14th March.
The first two papers described on-going research projects in the Midlands and the third paper assessed the needs as perceived by Water Authorities.

Chris Pratt (Trent Polytechnic) presented results of runoff measurements from small urban catchments in Nottingham. These showed that differences in the nature of materials, surface roughness and storage lead to significant variations in urban runoff. The 'contributing areas' of urban runoff like their rural counterparts vary in extent according to storm magnitude and type and to antecedent conditions. The development of a working model of rainfall runoff for the catchments involved, was shown to be a first step towards an investigation of pollutant sources through the additional measurements of water quality

and suspended solids.

Geoff Mortimer (Loughborough University) described problems of instrumenting sediment laden flows from a Nottinghamshire spoil tip (of undisclosed location!). A box-weir of unusual design proved ideally suited for flow gauging in this difficult environment. Traditional rainfall runoff techniques (the rational method) provided an accurate reflection of the data, with 36% of the storms having runoff coefficients of 0.4 to 0.5. Vehicular compaction of the surface inhibited infiltration and encouraged the rapid development of small gullies. The nature of the spoil tip material — generally unconsolidated crushed mudstones and siltstones — provided an easily tapped source for sediment erosion and transport. The high rates of erosion were highlighted by the severe scouring of the steep unlined outflow channel into the underlying parent clay. While bedload was thought to be perhaps of equal significance to suspended load (unusual in British rivers) it remained unmeasured due to lack of suitable techniques.

Richard Wood and **Will Bradford** (STWA) talked about the water authorities' need for adequate rainfall-runoff models in urban environments. They claimed that, relative to the expenditure invested in the development and maintenance of sewerage systems, the database upon which fundamental decisions of urban hydrological planning were made, was small and deficient. Cost efficiency depended on adequate and realistic design standards for sewerage systems. It was felt that perhaps the lack of understanding meant a degree of over-planning and increased costs. Two case studies illustrated both the lack of adequate working models and the deficiency of empirical data on the characteristics of the urban hydrological environment. The first study showed how flood peaks and runoff coefficients varied by 100% depending on whether the Wallingford Procedure or 'Packman' model (Flood Studies, Suppl. Report 5) was used. The former has been developed and tested only for small urban areas (< 1.5 sq.km.), drained by sewerage only, while the 'Packman' model, designed to predict hydrological changes in a river catchment following partial urbanisation. The differences between the two models might therefore be expected but it made life difficult for the engineer dealing with catchments in the intermediate (2-10 km^2) size range where there was an existing natural stream but a dominant region of sewered flows. A second case study showed how a lack of knowledge of the physical structure of the sewerage system could lead to erroneous predictions of peak discharge. Accurate data collection, with the ability to recognise the important variations of the urban surfaces and networks, is clearly a prime requisite for any further development of rainfall-runoff models.

J.D. Pratts
Loughborough, March 1984

BHS DOWN SOUTH

The inaugural meeting of the Southern Section of BHS was held at Imperial College on 30th April. In welcoming the 35 strong audience, Howard Wheater expressed the hope that this would be the first of many such meetings.

In his opening remarks the meeting's chairman **Mike Mansell-Moullin** (BHS President) echoed Dr Wheater's comments and added that since the Southern Section had the largest membership of the BHS regions the potential for thriving regional activities could be realised if the enthusiasm of the 'ghost' committee was matched by the support of members. This, he hoped would then encourage each region to commence their own programme. Mr Mansell-Moullin then introduced the first of the evening's two speakers, **Professor Michael Sklash** of the Department of Geology at the University of Windsor, Ontario.

Prof Sklash presented findings of work he had carried out in New Zealand in winter 1983 (our summer months!) under the title 'The Use of Natural Isotope Tracers in Storm Runoff Studies'. The work addressed itself to the question of whether storm runoff in small headwater catchments was from the rainfall (or snowmelt) occurring contemporaneously with the event, 'new water', or from 'old water' stored within the catchment in the form of groundwater, soil moisture, or surface storage.

Prof Sklash reviewed the three main storm runoff generation concepts; partial area, saturation leading to overland flow, and subsurface storm flow. The latter mechanism was that investigated in the presentation, with the aim of distinguishing macropore flow (new water) from flow within the soil matrix (old water). The use of naturally-occurring isotopes is preferred to use of chemical tracers from an environmental standpoint and to the use of other characteristics of the water (such as chloride content or electrical conductivity) which are subject to flushing, leading to difficulties with the interpretation of measurements. Tracers which may be used are oxygen 18 (^{18}O), deuterium (D) or tritium (T). In this study ^{18}O was used due to the ease of concentration assessment by mass spectrometer. In the study catchment old water was represented by groundwater, for which the isotope concentration was sensibly constant with time. However the value for new water (rainfall) showed variation with season and between individual storms. Thus it was likely that distinct values would be obtained for the storm rainfall, the groundwater and the resultant runoff, allowing calculation of the contribution of each type of water by simple mass balance at discrete points of the hydrograph.

The Maimai catchment in New Zealand was selected for study for four major reasons: it had been the subject of a previous physical study, it allowed comparison between forested and deforested sub-catchments, background isotopic data had been collected since 1977, and the steep slopes (typically 36°) resulted in a very responsive catchment. The average annual rainfall over the catchment is 2610 mm and the soil depth to impermeable conglomerate ranged from 0.2 to 1.1 m. Throughflow collection pits used in the prior study were renovated and samples analysed for each storm. Prof Sklash reported in detail results from five such pits, a seep area, and a first order stream in a subcatchment of 1.6 ha and at the main catchment outlet (250 ha).

The results showed consistently, and at all scales (throughflow pits, first order stream and mainstream) that 75% of runoff resulted from old water, and that the 25% contribution from new water could be explained by the near stream area. Prof Sklash concluded that the macropore concept was not a necessity in explaining storm runoff generation in the catchment studied, and that if macropore flow took place it was limited, or of old water.

In the brief period possible for discussion Prof Sklash confirmed that ageing of bottled samples prior to analysis did not take place and that a 'piston' flow mechanism could explain his observations. In considering the question of how old is 'old' water he explained that there was no evidence to suggest that the observed runoff resulted from the preceding storm, and estimated two weeks as a reasonable age.

Mr Mansell-Moullin thanked Prof Sklash for a stimulating presentation which challenged conventional thinking in relation to the process of runoff generation. The chairman then called upon **Professor John Thornes**, head of the department of Geography at Bedford College, London, to give his presentation titled 'Runoff Studies and Modelling in Semi-Arid Zones'.

Prof Thornes began by explaining that the approach of the work described took a geomorphological and ecological rather than a strict hydrological/forecasting view. Problems exist with land use in marginal environments, where water is a scarce resource and flood flows in ephemeral streams can have a significant effect on channel morphology.

The region used for the extensive, and ongoing, study by Prof Thornes and his team is in the south-east of Spain, where annual rainfall is both low and subject to 35% inter-annual variability. Even so individual storms can be very intense, such as > 200 mm recorded in four hours in 1973. In winter main channels carry a baseflow on which is superimposed low peaks from westerly cyclonic storms originating over the Atlantic. In summer there is no constant baseflow and runoff hydrographs show very rapid rise and fall (time to peak of the order of 15-20 minutes). The mechanism of channel flow is either of the bore type (with a steepening of the wave front in the downstream direction) or initialised by small, sometimes braided, channels within the channel of the preceding event.

In this region Prof Thornes identified two types of infiltration curve. Type 1 in which there is significant storage demand to be satisfied before the infiltration rate settles to the limiting value, and type 2 in which the infiltration rate after 10 minutes is little different to the long term (in this context, 60 minutes) value. The soil profile in the area is shallow, with the result that storage is a limiting factor in the runoff process.

Use of percentage bare area together with the appropriate infiltration curve is a difficult means of predicting flow. This is because the vegetative cover exhibits considerable spatial variability, and produces a large quantity of surface litter which affects surface roughness

and transmissibility, as well as consumptive water use. A further complicating factor is surface crusting.

Channel bed infiltration (transmission loss) is related to the volume of tributary flow, the channel bed width and the nature of the gravel surface. The effect of these influences is reflected in the flow survival length in the downstream direction. Channel flow is further complicated by the fact that in ephemeral streams tributary input is often asynchronous. The transmission loss is found to be of the order of 70 mm/hr compared with the values of around 30 mm/*min* obtained from standard infiltrometer tests.

Channel flow may be straight, braided, or meandering, the particular type is strongly influenced by subsurface conditions prior to the storm, which can influence the channel roughness, (related to the sorting of bed material by the prior flow).

In summary Prof Thornes suggested that 'conventional' flow routing, for example the kinematic wave approximation, may be satisfactory in modelling, provided that the effects of subsurface storage are known. He illustrated his conclusions with the results of a similar study he had carried out in the Mohave area of Southern California.

Again, the time available for discussion was limited, but gave Prof Thornes the opportunity to clarify the apparent paradox that rapid response to rainfall is seen together with a high infiltration rate. This is due to the small amount of available storage to be satisfied. There was agreement from the floor about the need to recognise the interactions between surface and subsurface water in modelling, and in respect of the complicating effects of spatial variation of catchment characteristics. A question regarding differences between the flow regime found in south-east Spain and the emphemeral flows found in chalk areas of the UK suggested an interesting area for possible comparative work in the future.

Mr Mansell-Moullin thanked Prof Thornes for his interesting presentation which contrasted well with the first talk. The evening was concluded with Dr Wheater giving a brief summary of responses to the questionnaire pertaining to activities of the embryonic southern section, of which the majority had been positive. In this light the organising committee felt that it now had a mandate to produce a programme of about four meetings, which would aim to reflect the stated preferences of members, for the year beyond the next scheduled meeting in July 1984.

Following the formal close of the meeting many individuals took the opportunity to discuss the content of the two presentations with the speakers and to talk further about future directions for the Southern Section of the BHS. Following the interest shown at this inaugural meeting, it seems that the launch of the first regional section has been a success, and the section faces an active future with confidence.

N.C. Bell

Effects of Upland Development on River Runoff and Sediment Yields in the UK

It was highly appropriate that this third national meeting of the Society be devoted to the third of the country's land area which has traditionally received least hydrological attention, namely the British Uplands. The meeting, which was attended by nearly 80 members, saw the presentation of six papers arranged in three sessions to deal with a review of, current approaches to, and a perspective on the effects of upland development on river runoff and sediment yields in the U.K.

Dr Malcolm Newson (Institute of Hydrology) in an overview paper 'Upland Sediment, Then and Now' advocated a 'hydrological approach' which treats sediment in upland rivers on a catchment scale, investigates the effects of upstream events on downstream conditions and seeks to measure inputs, storages and outputs of sediment in the river system. Like the Welsh congregational minister, Malcolm delivered his 'sermon' eloquently, with passion and in three parts. The first addressed the erosivity and erodibility of the upland zone in Britain which was concluded in a global context to be a gentle environment generally characterized by relatively low intensity rainfall and intractable materials such as wet soggy peat and a blanket of sod. Certain parts of the uplands are associated with higher energy inputs, but it was shown that the potential for soil erosion is only significantly increased in restricted areas where upland ecosystems have been strongly disturbed by man. The importance of sediment storage in delaying and complicating transport of eroded material by upland rivers was also highlighted, and it was further argued that more attention needs to be given to 'event effectiveness' in an environment where there is a Pleistocene legacy of coarse deposits and bare rock (which is essentially out of equilibrium with the present process regime) and where features produced in rare storms may be 'repaired' in a relatively short time period.

The second part of the presentation considered the development pressures affecting upland regions and in particular the 'attack' by forestry. Ditching of hillsides in connection with afforestation appears not only to speed up flow response to rainfall but also to accelerate erosion of fine and coarse material. Increased turbidity below afforested areas was seen to require specific remedial measures in some situations where runoff supplies a reservoir, and evidence from the Institute of Hydrology catchments at Plynlimon revealed a five-fold increase of bedload transport in forested compared with grassland situations, and also a deepening of forest ditches by some 2 m which has produced a 'hidden' badland topography. The growing of sheep as well as trees in upland regions was also thought to generate erosion particularly in areas such as the Peak District National Park where some 'semi-quantitative' evidence relating to reservoir sedimentation may be interpreted to show a sediment problem.

The last third of this review illustrated the 'applicance of science' to studying upland sediment systems and their links with downstream piedmont and estuarine environments in a 'Davisian' or at least a 'Schummian' conceptual framework. Present techniques for collecting detailed information on sediment in upland rivers were described as being 'hair shirt' in comparison with methods available for flow measurement, but he also successfully used the results of existing studies to draw an interesting distinction between the small catchments of 'source areas' and the larger rivers of 'downstream areas' in terms of the range of specific yield (t km^{-2} a^{-1}) associated with different types of sediment transport (Table 1). The linkages, as well as the differences, between upland and piedmont zones were also stressed, and one example of interrelationship was cited from rivers of mid-Wales, where many channels in the piedmont zone have shown greater lateral mobility since the last World War. Increased sediment yields in the upland zone appear to be responsible for this recent activity by causing greater deposition in downstream reaches which in turn encourages erosion of river banks opposite to growing storage forms. The balance between storage and flux was emphasised as a factor crucial to the functioning of fluvial sediment systems and one sensitive to man's impact in the uplands — not only over the last 40 years but at least since forest clearance in Neolithic times.

In reply to a question raised on sediment delivery ratios by **Dr Walling**, Newson felt that flux is respectively only 10 and 1% of storage for sediment in the upland and piedmont zones. Later in discussion, it was agreed that the impact of a second rotation in afforested areas is likely to be less than that associated with the first planting, and **Mr Mansell-Moullin** also advocated greater use of reservoir surveys in Britain since they may provide an important source of control data on upland erosion rates.

Following a splendid buffet luncheon, the first afternoon session had three presentations illustrating different but complimentary approaches of current research to the theme of the meeting. **Dr Tim Burt** (Huddersfield Polytechnic), in a paper on 'Runoff and Sediment Yields from Moorland Catchments in the Southern Pennines', employed more than the 'bear'* minimum of illustrations to reinforce with specific examples many of the general points made in the morning session. His slides of tumbling trig-points dramatically demonstrated that parts of the southern Pennine Uplands have suffered

*Reference to a slide of a cartoon bear.

	Total range	Total range	Modal range	Studies
'Source Areas' (< 20 km²)				
Mineral bedload	.1-40,000		1-10	8
Peat	0-3,440		1-10	5
Mineral suspended	1-480		10-100	8
Reservoirs	23-177		10-100	5
Solutes	3.3-129		10-100	10
'Downstream Areas' (< 1000 km²)				
Mineral bedload	0.6-18		1-10	6
Suspended	9.1-250		10-100	12
Solutes	27.9-270		10-100	7

Yields are expressed as t km^{-2} a^{-1}

TABLE 1 (after Newson)

serious erosion in the present century, a consequence it is thought of several man-made impacts including atmospheric pollution, agriculture, forestry and to a lesser extent recreation. However, his three year study of Shiny Brook, conducted often in the face of hostile meteorological and human elements, has also revealed considerable spatial variation in the hydrological and associated sediment response characteristics of this region. A particular contrast was shown to exist between the blanket peat moorland and surrounding areas of cotton grass moor. The latter areas are relatively uneroded but fragile ecosystems where surface runoff, involving a mixture of saturation and infiltration-excess (Hortonian) overland flow, dominates storm events and the whole catchment area may contribute to runoff at rainfall intensities of 5 mm hr^{-1}. In contrast, areas of blanket peat are often highly dissected with the result that source zones for runoff and sediment production are more clearly centred on topographic hollows and the intervening mounds are relatively dry. Supplies of suspended sediment appear to be greater and more sustained in the eroded deep peat catchments than in the cotton grass areas where hysteresis in storm-period suspended sediment behaviour is more strongly developed.

Dr Burt described the moorland edge as a zone of conflict and showed how the effects of afforestation in this environment produced a dramatic (15-fold) but temporary increase in sediment levels at Hades Clough near Holmfirth in 'Compo Country'. In this example, accelerated erosion was exacerbated by the hydrological conditions of the affected slope and by the timing of ditching which took place shortly before the winter season. Future ploughing in this area it seems should be planned to follow the 'last of the winter rain'.

Dr James Bathurst (Institute of Hydrology) then showed with commendable clarity how a number of equations may be developed to deal with the processes and problems of 'Sediment Transport in Upland Rivers'. Conditions of coarse bed material, non-uniform particle size distributions, low flow depth to sediment size ratios, steep and irregular longitudinal profiles and infrequent bedload transport were seen to render traditional transport equations inapplicable for upland channels where sediment transport often takes place in waves and is further complicated by bed armouring or exhaustion of supply. Focussing on bedload transport rather than the movement of suspended sediment or bedforms, he demonstrated how the critical discharge approach, studied by Schoklitsch in the 1930s, may be further developed to predict both the initiation of motion and quantity of transport in upland rivers. On the basis of data from several flume studies (Fig. 1A), it appears that a relationship of the form:

$$\frac{q_c}{g^{1/2} D_{50}^{3/2}} = 0.15\, S^{-1.12}$$

where q_c = critical water discharge per unit width of channel;
g = acceleration due to gravity;
D_{50} = median size of bed material, and
S = slope;

can successfully predict conditions under which sediment transport begins. River data, however, plot in a field substantially below the relationship, and it was argued that this mismatch results from the effects of bed armouring, which might be accounted for by substituting the bed material size term in the equation with one that reflects either the D_{16} value of the surface layer or the D_{50} size of the subsurface materials.

In the case of sediment transport, the Schoklitsch equation:

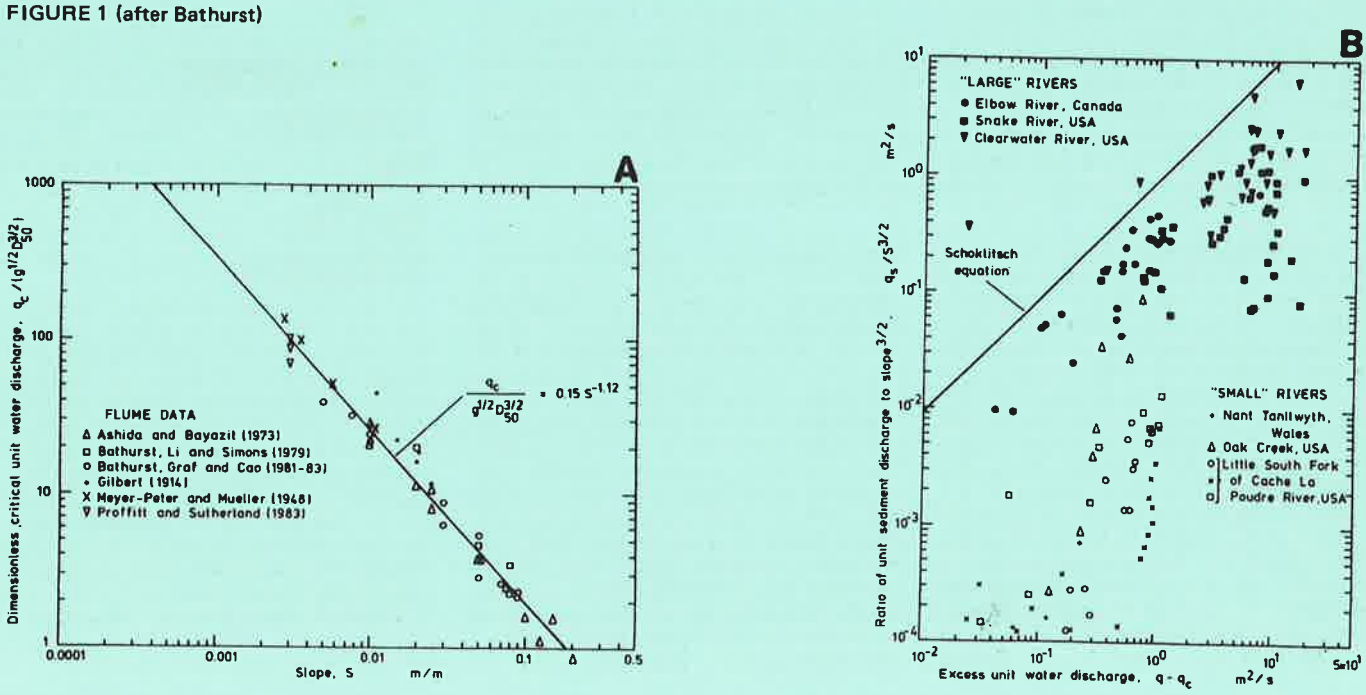
$$q_s = \frac{2500}{p_s} (q - q_c)\, S^{3/2}$$

where q_s = bedload discharge per unit width of channel, and
p_s = sediment density;

was found to be simpler and more satisfactory than several other sediment discharge equations when a comparison using flume data is made. However, field data (Fig. 1B) suggest this approach is more successful for large rivers with low slopes (< 1%) and large amounts of bed material than for small streams characterized by high slopes (> 1%) and small quantities of bed material, where the effects of bed armouring and limitation of supply cause the Schoklitsch equation to overestimate bedload transport.

In discussion, Dr Pratt wondered if the role of turbulence, generated by bedforms or at sites of sediment input, had been considered with respect to the initiation of motion. Dr Bathurst acknowledged that this factor may be influential but he also argued

FIGURE 1 (after Bathurst)

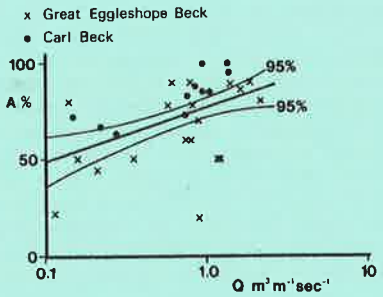


that any approach based on detailed analysis of hydraulics and fluid mechanics was not yet practical for the big boulder channels of the upland zone.

Dr Richard Hey (University of East Anglia) spoke next on 'Upland River Response to Catchment Development'. His central concern was the changes in the stability of upland rivers which may arise as the result of major programmes of river regulation, land drainage, flood alleviation and land use change, and he used the example of the Craig Goch scheme to illustrate lucidly how the potential impacts of such development may be evaluated. In this scheme, it was proposed to substantially extend an existing reservoir in order to regulate, and therefore dramatically change, the flow regimes of the Rivers Wye, Dulas and Severn. It was argued that insufficient knowledge regarding the mechanics of sediment transport in armoured gravel-bed rivers is available to allow formulation of an 'all singing, all dancing' physically-based deterministic mathematical model for predicting the consequences of flow regulation, and attention was therefore given to experimental procedures for predicting channel change based on the concept of critical threshold discharge for movement of surface bed material. Natural variability of gravel-bed channels made it necessary to determine the latter value for 22 sites, chosen to be representative of conditions along reaches which are at present eroding, stable or depositing, and these data were combined with simulated flow information to assess the consequences of river regulation for channel stability. He showed from this analysis that the proposed releases should have little effect on the River Wye, where regulated flows would be below the critical threshold discharge, but foresaw a different situation for the River Severn, where regulation would induce systematic erosion and deposition along the river requiring engineering maintenance work. Test releases from the Clywedog reservoir confirmed this scenario for the River Severn. In discussion of this paper, he elaborated on the 'shunting effect' in bedload movement through pool-riffle systems and also suggested that modifying the hydraulic characteristics of river reaches may sometimes be a better alternative to protective engineering works. In answer to points raised by **Professor Gregory**, he agreed that a return period of 1.5 years, appropriate for channel capacity discharges in the present investigation, did not apply in all rivers, and also stressed the association of bank erosion with gravel movement and accumulation.

A broader perspective on river response to upland development was provided by papers on 'Riverbed Sediment Dynamics and Salmonid Fishes in the U.K. Uplands: An Over-view' by **Dr Paul Carling** (Freshwater Biological Association) and on 'Upland Development – A Water Authority Viewpoint' by **Dr Richard Wood** (Severn-Trent Water Authority). Dr Carling clearly demonstrated the ecological relevance of sediment conditions in the headwaters of gravel-bedded rivers where salmonid fishes spawn, and warned of detrimental but insidious changes to this environment caused by man in recent years. The development of fish eggs is directly influenced by the physical nature of the streambed and the flow hydraulics, and gravel movement may cause washing out or crushing of eggs and may allow predation or redeposition in unfavourable environments. He reported research in Teesdale catchments which used data from scour-chain grids to establish the percentage area of river bed subject to scour or fill at given discharges, and the results of this work (Fig. 2) indicate a threshold discharge below which there is no scouring but above which 50% of the bed becomes active. This proportion rises to 85% at discharges close to channel capacity, and under these conditions there is significant turnover and movement by streambed gravels in contrast to the surficial disturbance associated with flows above the threshold of motion but below bankfull discharges. By the ingenious method of extracting frozen cores of streambed materials (Carling White Label?), he was able to demonstrate that salmonid fish, especially the larger specimens, adjust to the hydraulic conditions by laying their eggs well below the maximum depth of scour in chalk bed streams. A certain amount of gravel movement, however, was shown to be essential in order to flush finer material from the streambed and maintain it as an healthy environment for fish spawning. Natural and especially man-induced silting of gravels, associated with land use changes in the uplands, can retard the velocity of intragravel water and reduce its oxygen content with detrimental effects on egg and fry development. Dr Carling argued that we should be vigilant of these effects and he reported recent studies of silt deposition, which varies from 50 to 21000 gm^{-2} $week^{-1}$ in Eggleshope Beck, Teesdale, and ongoing research (using computerised conductivity measurement) into oxygen depletion in naturally and artificially silted sediments.

FIGURE 2 (after Carling)



The main thrust of the argument presented by Richard Wood in his talk was somewhat at variance with many of the conclusions drawn in earlier papers, since he proposed that sediment yields from upland areas under natural *or* disturbed conditions do not constitute a major problem. From the perspective of the water manager concerned with major supply reservoirs, it was argued that increased interception losses associated with upland afforestation pose a far greater threat to reservoir yields than accelerated sedimentation generated by land use changes. In fact, he suggested from a careful analysis of existing and new data for 85 major reservoirs in the Severn-Trent area that the problem of moorland erosion in the Pennine region has been exaggerated, although these findings did not belie local difficulties associated with sediment infilling of small reservoirs and with contamination of water supplies by eroded, dessicated peat. Other sources of pollution were, however, of much greater concern to the Water Authority, which also viewed protection against increased flooding generated by upland development as having a much higher priority than any problems associated with larger amounts of sediment transport. Whilst agreeing that traditional measures taken to protect riverside settlements may in some cases involve a certain degree of 'over-engineering', he felt that in today's economic climate it can be difficult to justify the protection of farmland in upland areas. Dr Wood conceeded that fisheries may suffer adversely from changes in the sediment carried by rivers as a consequence of afforestation, but he also argued that other aspects such as river regulation may be equally influential and detrimental. It was suggested in conclusion that geomorphologists and others interested in river sediments should perhaps direct their attention to the lowland rather than the upland zone, since greater problems are associated with high suspended solids in urban areas and bank erosion along tidal reaches.

Following these last two presentations, there was considerable discussion of the changes in fish population recorded during the 1970s downstream from the Clywedog reservoir, and it also emerged that fish are sensitive to alteration in the chemical as well as physical condition of the river. In a different vein, **Dr Lewin** suggested that valuable suspended sediment trapped by upland reservoirs could reduce the agricultural potential of farmland in the piedmont zone. Dr Bathurst argued that sediment problems may be long- rather than short-term in nature, and Dr Hey, from his experience of Broadland rivers, suggested that bank erosion in downstream reaches may be caused by boat traffic. Like the meeting as a whole, the final discussion was one of wide scope and of considerable interest to more than just the committed 'sediment freak'. The standard of paper presentation throughout was very high, and the speakers and session chairmen (**Dr Walling, Professor Gregory** and **Dr Petts**) are to be applauded for almost perfect time-keeping.

Bruce Webb

GOVERNMENT SUPPORT FOR WATER RESEARCH

The DoE Committee on the Long Term Research Needs for Water, referred to in the last issue of *Circulation*, has been formally established and met for the first time on 9 May. The Chairman is DoE's Chief Scientist, Dr Martin Holdgate, and the membership is as follows: Prof R.J.H. Beverton (UWIST), Dr R.T. Clarke (FBA), Dr M.C. Dart (TWA), Dr A.L. Downing (Binnie & Partners), H. Fish (TWA), M.G. Healey (DoE), Prof P.C.G. Isaac (ex-University of Newcastle), E.H. Nicoll (SDD), M. Rouse (WRC), K.F. Roberts (WWA), Dr M. Waring (DHSS) and J.F. Bonsall (Secretary).

NEWS FROM MEMBERS

The hope that 'contributions would come flooding in' (*Circulation* No. 1, p. 5) was, as you might have guessed, ridiculously vain. Even our network of Water Industry moles has suffered a 50% drop in efficiency with half of them failing to report on schedule. We'll do our best with what we get but do remember that its *your* newsletter.

The problem of publishing news from consulting engineers attracted only one comment — from Frank Law of Binnie & Partners, writing from their Melbourne office: 'I believe news from consulting hydrologists can be given without offence in *Circulation* as common sense will prevail and the constraint of only one or two sentence mentions will prohibit anything too exhibitionist.' Thanks, Frank, we'll take it gently.

MEMBERS ON THE MOVE

Tim Burt (see account of BHS Meeting at Loughborough on 2 May) is moving from Huddersfield Polytechnic to a Fellowship at Keble College, University of Oxford.

Enda O'Connell has left the Institute of Hydrology and is now Professor of Water Resources Engineering at the University of Newcastle. An exciting time for Enda, with promise of support from NERC in establishing an NERC Unit of Hydrology within his department to concentrate on mathematical hydrology.

Terence O'Donnell has taken over from **Robin Clarke** as Editor of the IAHS Hydrological Sciences Journal. Terence also tells us that he is taking early retirement from the University of Lancaster in September but will continue teaching there part-time.

Chris Kidd has recently returned from Africa where he worked with the U.N. He is now operating as a freelance consulting engineer. **Ken Clarke** has left Anglian Water to become Chief Engineer of the Lee Valley Water Co. **Jim Davies** has left Binnie & Partners after completing the Avon (West Australia) Flood Study using their Australian version of the FLOUT model. He has joined the W.A. Department of Agriculture who have many hydrological problems, not least of which is salinising of land by rising water tables. [Partly blamed on deforestation, this topic has interested a number of IH staff and **John Stewart** was invited to Perth to discuss evaporation aspects.]

Jane Richardson has moved from Brathay Field Centre in Cumbria to Thames Water in Reading where she will work on the Lower Thames model (see last issue). **Nigel Hawkes** joined the Lee group on 1st March.

Reorganisations rumble on in the WAs. Thames Water have settled on a structure of three geographically-defined multifunctional Divisions and one HQ Division with overall responsibility for land drainage, river management, and a number of other authority-wide activities. There will also be four headquarters functions, namely Finance, Personnel, Support Services, and Technology & Development. The four Divisions and Support Services are to be run on 'profit and loss lines'. Visions of Thames hydrologists touting flood forecasts around the media come happily to mind. '30% off in August: order now to avoid disappointment!'

In Severn-Trent, the centralisation of the Severn and Trent Area Units (reported in *Circulation* No. 1) is unlikely to be completed until late this summer. A similar target date applies to the implementation of revised structures in South West where hydrological and hydrometric functions will be with the Department of Engineering and Operations whilst hydrogeological functions and water abstraction licencing will be in Environmental Services.

WATER RESOURCES

A numerical non-linear regional groundwater flow model of the Berkshire Downs is being developed by Birmingham University under contract to Thames Water. Thames have themselves started a study of the water resources of the North Downs.

The improved quality of the tidal Thames is offered — by the Authority — as one good reason why the flow constraint at Teddington Weir could now be dropped. A leaflet explaining the advantages of changing to a more efficient system of flow management has been produced and a public enquiry is to be held.

In Yorkshire, work is in hand on deriving operating rules associated with the operation of the new Grimwith Reservoir which is now substantially complete. Alternative ways of using Winscar Reservoir conjunctively with other reservoir sources are being examined in order to maximise the economic benefits from this source.

In the South West, further research work is being carried out on the correlation between reorganisations (see above) and major droughts. With unprecedented demand for water and rivers throughout the region at or below their 1976 levels, the hydrologists are looking forward to another busy summer. The first Drought Orders are being prepared and hosepipe bans are being imposed. Our correspondent advises against Devon and Cornwall as holiday venues for those members of BHS who enjoy water in their whisky or the occasional bath!

HYDROMETRY, INSTRUMENTATION, DATA

Rainfall: *Circulation* 1 described the English/Welsh standard raingauge trimming exercise. Our Thames correspondent tells us that the initial (computer derived) revised network in their region is now being considered; the review has aroused considerable local interest, particularly in the Oxford area. In Severn-Trent the reduction from 775 to 464 gauges is described as drastic although the loss is 'largely poor quality sites, and many weekly and monthly read gauges'. Thames have bought a Logica weather radar display system in anticipation of the London radar (at Chenies) being completed in June.

River flow: Welsh Water have installed optical shaft encoders (supplied by Delta Technical Services) at ten sites in the Usk catchment. The resolution is 1 mm over a 10 m range. Routine checks against gauged boards and PTR levels have produced no discrepancies so far. The Lee group at Thames are testing various combinations of encoders and loggers. Also in Thames, both the Sarasota multi-path ultrasonic gauging station on the River Stort at Glen Faba and their second electromagnetic station on the Pinn at Brunel University are soon to be commissioned.

Data logging, telmetry: Thames Water and Sarasota Automation have developed a solid state logger suitable for ultrasonic or electromagnetic gauges. Called the 'Datastar', it will replace PTR equipment at the various Thames sites. A McMichael satellite receiver processor has been installed on the roof of Nugent House, Reading. It receives data on rainfall from Shorncote and river levels from the electromagnetic station on the Swill Brook. Goldcrest loggers (see *Circulation* 1) have been bought by the Thames (Reading) group to join the ten already in use by the Lee group. The logger is being developed for use with water level sensors.

Data archiving: A new section has been set up within Technical Services at Severn-Trent. Headed by **Richard Wood** the aim is to provide an Integrated Database Management System. It is intended that there will be two databases, one of environmental data (quantity and quality data, including biological information), and the other of engineering and operational data.

HYDROLOGICAL MODELLING AND INVESTIGATIONS

Flood Studies: In Yorkshire, a consultancy service (for their Divisions) has been set up to service hydrological aspects of the 1975 Reservoirs Safety Act. As groups of reservoirs come up for inspection, an in-house assessment is carried out in parallel. A computer package based on the Flood Studies Report, developed by Northumbrian Water and further revised by YWA staff, is used. Where necessary, options for improvements needed to withstand the design flood are examined.

is hoped to include a review and demonition of some of the FSR packages in the t training course organised by IH.

Northumbrian WA have continued to develop methods of regional adjustment of Flood Studies techniques to provide improved estimates of discharges at ungauged, predominantly rural, sites. They have also worked with the FLUCOMP program to construct a synthetic flood frequency curve at a point some kilometres downstream from a gauging station.

Storm Sewers: In Severn-Trent, hydrological modellers are becoming increasingly involved with storm sewerage work in the Black Country and Birmingham areas. **Richard Douglas** is leading the modelling work required for the Tame Basin Integrated Management system. Inputs and flows through the Black Country Trunk Sewer are needed for design purposes, and ultimately for real-time operation and control.

Storm sewer surveys are now frequently carried out in the water industry. We hope to have a feature, in a later issue, on some of the flow measurement techniques currently available. Meanwhile, the importance of such surveys is highlighted by the letter in this issue from **Phil Johnson.** The Water Research Centre has produced a Manual of Procedures on Sewerage Rehabilitation which is designed to help establish effective and economic strategies. The Wallingford Storm Sewerage Package (WASSP) is now in general use as the tool for checking sewerage capacities. Although WASSP is partly intended as a design method for new systems, and therefore capable of working without any local measurements, it is providing increasingly relevant and beneficial to use it in conjunction with calibrating data obtained from a survey. WASSP is being discussed at a seminar at Dundee College of Technology on 21st June; it will be led by **David Williams** (WRC) and **Chris Pratt** (Trent Polytechnic). (Details from Mr R. Ashley on Dundee 27225 ext 278).

In the Lincoln Division of Anglian Water, field trials are planned this summer of a bubble curtain on the Ancholme to repel saline intrusion.

A nice little investigation is reported from Yorkshire. It concerns a production borehole in the Magnesian Limestone which was showing unacceptably high turbidity counts from time to time. They seemed to be associated either with rainfall events (cause — surface pollution) or high river flows (cause — pollution from river effluent flow). Flow gauging in the river showed a 20% transmission loss over the reach in question so a bacteriophage tracer was put in the river and the borehole output monitored. The tracer appeared in the borehole water after 9 hours (and peaked at 14 hours) indicating a fairly direct connection with the river. About 5% of the water pumped came from the rain.

Thanks to contributors Will Bradford (Severn-Trent), David Evans (Anglian) Margaret Fallon (Yorkshire), Cathy Glenny (Thames), and Neil White (South West).

Finally

A repeat of the message in Issue No 1 — if you like to read what other members are doing, what about letting the rest of us know what you're doing. We would particularly like some input from members outside the water industry but, wherever you work, try putting pen to paper for the next issue. If you want to expand beyond a brief note for this column, check with the Editor's notes on page 3 of Issue No 1 and send us something a little meatier.

The deadline for the next issue is **31st August.**

IAHS AND ALL THAT

To many members of the BHS the International Association of Hydrological Sciences must be a somewhat nebulous body that has little to do with their current scientific and professional activities. But to those who remember the Exeter Assembly in 1982, the Oxford Symposium on Hydrological Forecasting in 1980 and similar gatherings, the Association is something real and alive. Most of these hydrologists would agree that IAHS is a valuable forum for demonstrating ideas, measuring progress, comparing results and for providing a hydrological recharge to those who need it.

IAHS is the oldest and foremost of international bodies concerned with the field of hydrology and water resources, including glaciology. It was established in 1922 as one of the seven associations within the International Union of Geodesy and Geophysics, the others being responsible for meteorology, oceanography and the sciences of the solid earth.

The aims of the Association are stated in the statutes and bye-laws. Basically they are to promote the study of hydrology by provision of the means for discussion, comparison and publication of the results of research and the applications of research. To fulfil these aims the Association organizes general assemblies, symposia and workshops in various parts of the World and it publishes a quarterly scientific journal — the Hydrological Sciences Journal. With the publication of the proceedings of the International Symposium on Hydrochemical Balances of Fresh Water Systems to be held in Uppsala in September the series of proceedings will reach No. 150, the last 35 being produced since 1974. The Association also provides a contact with other water orientated international bodies.

The Association is headed by a President (currently Dr G. Kovacs of Hungary) who is supported by a Secretary General who manages the business of the Association from day to day. There are also three Vice Presidents, a Treasurer and an Editor (Prof T. O'Donnell) and these officers together with the Past President and the Presidents of the six commissions make up the Bureau of the Association. The Bureau is elected at General Assemblies held every four years and is responsible for the affairs of the Association in the intervening years. The Association's six commissions are concerned with surface water, groundwater, continental erosion, snow and ice, water quality and water resources systems. In addition there is a committee on remote sensing and data transmission. Each of these bodies is headed by a President and each has its own vice presidents and a secretary. Commissions usually organize symposia within their areas of interest, but some have other responsibilities. For example, the International Commission on Snow and Ice runs training courses on glaciology in developing countries.

Until 1983 affiliation to IAHS was entirely by country through payment of an annual subscription to IUGG on an agreed scale. In the case of the UK, payment is made by the Royal Society and by like bodies in the other 76 member countries, about half of the money subscribed in this way being channelled to Associations. However, at the Hamburg Assembly of IAHS in 1983 individual membership was agreed, the membership coming from hydrologists who are active in the Association and named by the National Committees of member countries. Thus members of BHS seeking membership of the Association should return the forms recently circulated by the Society for consideration by the Royal Society Hydrology Subcommittee. The approved names will be forwarded to IAHS for listing as members of the Association. There is no membership fee.

Each country that subscribes to IUGG is linked to IAHS through a national committee — in the UK this is the Royal Society Hydrology Subcommittee. The chairman or secretary of the national committee is usually the IAHS national representative. In addition each commission has its own series of national representatives.

The Association cooperates with a number of international intergovernmental organizations with responsibilities in water, but particularly with UNESCO and the World Meteorological Organization. Indeed IAHS was involved in the start of the IHD in UNESCO and has been intimately concerned with the different phases of the IHP. Likewise IAHS is involved with various non governmental bodies such as the International Association of Hydrologists and the International Glaciological Society.

For the future, the Association is planning a series of international gatherings and continuing its widening series of publications. In early July 1986 the 2nd Scientific Assembly will take place in Budapest to coincide with the 100th anniversary of the Hungarian Hydrological Society. Vancouver in August 1987 is the venue for the next General Assembly. For these and other forthcoming meetings there is every hope for a strong representation from the membership of the British Hydrological Society, a representation which will undoubtedly strengthen the Society in its role and responsibilities.

John C. Rodda
Secretary General, IAHS

THE GOOD, THE BAD AND THE WET



With loaded sediment samplers, a team from the IH Unit of Fluvial Geomorophology will be heading west in June to study sediment supply and transport processes in a mountain river in Colorado.

With travel and subsistence covered by a NATO scientific grant, the Magnificent Three (**James Bathurst, Graham Leeks** and **Malcolm Newson**) will be working on the Roaring River in the Rocky Mountain National Park along with Colorado State University, the U.S. Geological Survey and other agencies which include some of the fastest current meters in the West.

The aim is to collect field data for a study of the relationship between the supply of sediment to a river channel and the storage and unsteady movement of sediment within the channel. This relationship is important in determining sediment discharge in mountain rivers but so far it has received relatively little attention, partly because of the lack of suitable fieldwork sites. Along the Roaring River, though, the flood wave from a recent dam failure has created an almost ideal field site in the form of a short gorge with unstable sides which act as sources of sediment.

During the visit measurements of the sediment discharge along the river upstream and downstream of the gorge, the volumes of material falling into the river from the gorge sides and the amount stored in the channel are to be made so as to provide a sediment budget relating sediment discharge to supply. The study will be one of the first to attempt to quantify the amounts and rates of material involved and to identify in detail the processes of the supply/discharge relationship.

As the OK field site is at an altitude of 9,000 feet, special high-altitutde training is being carried out at the IH Plynlimon research catchment in Wales. Hydrologists must get used to all climates. Stomachs are being oriented towards ice-cold beer, grits and Rocky-Mountain 'oysters' (*not* a shellfish but the part that is missing from a bullock!).

For a Fistful of Sand Grains there is nothing a fluvial geomorphologist will not do!

LETTERS

Dear Editor,

I would like to identify a controversial subject for discussion through your pages and within BHS generally. The subject, professional qualification, is of particular interest to myself and, judging from responses to the initial planning questionnaire, to many other members and potential members of the Society. It is of particular interest to hydrologists who work in the water industry.

The only professional qualification applicable to hydrologists which is accepted as such within most Water Authorities is Membership of the Institution of the Civil Engineers, (MICE). While Membership of the Institution of Water Engineers and Scientists (MIWES), is acknowledged, MICE has more status.

The points which I would like to raise are:—

1. BHS should decide whether MICE or some other qualification is an acceptable qualification for hydrologists
2. If MICE is to continue as the only professional qualification for hydrologists BHS should stress with ICE the need to revise the current method of entry for hydrologists such that it is more objective and serves hydrologists and the Institution better than the current method.

Membership of the Institution of Civil Engineers is the traditional route to professional status for hydrologists partly because a large number of hydrologists have a first degree in Civil Engineering so this is the natural progression. Also hydrology has traditionally been carried out in engineering based departments in water authorities, so for comparability with engineering non hydrologists, this has been a useful measure of professional expertise.

More recently, many hydrologists have been entering the discipline from non-engineering background, e.g. geographers and environmental scientists, to name but two. Thus MICE would seem less relevant to those people with perhaps MIWES more suited to their academic background and indeed their experience in working for a water authority. However, as I have already mentioned, MIWES does not have the status with employers that MICE has. This I find surprising, particularly as MIWES emphasises both academic background and professional training in its entrance procedure and professional interviews are necessary to verify these if there is a question of candidate suitability. Perhaps the inferior regard in which MIWES is held by engineers stems from the fact that entry to the Institution of Water Engineers and Scientists is so easy for those who are already MICE and they do not appreciate the requirements for those who are not already Chartered Engineers.

It has been suggested that BHS should provide a professional qualification. Whilst I understand that people feel the need for a professional qualification in hydrology, I feel that there are two major reasons why this would not be a useful course of action. Firstly, an essential element of hydrological work is done in conjunction with or for other people, usually engineers or scientists. I do not feel it is of benefit to a young hydrologist to be isolated from either of these professional groups. Instead a group which brings together hydrologists with engineers and scientists would seem more acceptable. The second, and major point to those who are seeking professional status in the near future, is that a professional qualification is only useful if recognised as such by employers. MIWES still does not have the status of MICE even though the Institution of Water Engineers and its scientific partner have been established for many years. Thus a new hydrological qualification would take many years to become of acceptable status.

I would personally prefer the Society's efforts channelled towards acceptance by employers of the merits of MIWES for hydrologists, if need be, applying pressure in order to get the status of MIWES strengthened.

If MICE remains the only qualification to be recognised for hydrologists, I feel that BHS has a fundamental role to play in ensuring that the method of entry serves both the Institution and hydrologists better than the current situation which is inconsistent and unfair. Perhaps I should explain my academic background and experience in order to indicate some of the difficulties facing hydrologists attempting to gain entry to ICE.

I am a geography graduate with a Ph.D from a Civil Engineering department. I have been working as a hydrologist with a Water Authority for four years. My sphere of operation has been predominantly in water resources rather than hydrometric data collection. I am a MIWES and a Member of the Institute of British Geographers, British Geomorphological Research Group. As far as ICE is concerned this is the least acceptable background possible as I wish to enter Civils by the specialist route for hydrologists and I have a non-engineering first degree.

In order to become accepted for professional training and interview by ICE I have been asked to pass four of the Part II Engineering Council examinations from an unrestricted list.

The reason given for this is to bring my academic background up to standard. For someone entering as a specialist it is necessary to attain the academic requirements for any non-specialist candidate. Thus, the fact that I have studied more hydrology and related subjects in my first degree and other courses than many civil engineering undergraduates is irrelevant to the Institution. Some of the subjects on this list have been covered in much more depth in my degree courses than that required for the examinations. Yet my choice of subjects has not been limited either to these subjects in which I have a background – or perhaps more logically – to those in which I have not. Surprisingly, other candidates with similar backgrounds over the last few years have been accepted for training with either no requirement for examinations or requirement for a different number.

I can understand that the Institution will require candidates in the hydrology specialism to understand how hydrology fits into engineering generally. However, I feel that this will not be achieved by the in depth study of the various individual subjects of which I have a choice since these syllabuses are not directed in any way towards the specialist candidate. Besides, the role of hydrology within engineering is best covered at the professional training and interview stage.

I have heard the argument that the need to take the examination is so that I can become a general civil engineer first before becoming a specialist since after qualification I would be an Engineer. I would not insult the Institution, civil engineers, or myself by assuming that I could become a general civil engineer by taking 4 exams. I think BHS should press ICE to decide either that they do not want to give professional status to non-engineers or accept that those following the specialist route may well come from a non-engineering background which is equally or in some cases more appropriate to the specialist qualification than some graduate engineers. It is important that a hydrologist sits on the committee which assesses a candidates background and decides whether Engineering Council examinations are necessary. It is essential that comparability and objectivity prevail so that candidates from varied backgrounds can be compared effectively and consistently and that the current unfair situation is not repeated.

Having achieved success in the examinations, I will then be able to progress with professional training and finally take the professional interview. The rules outlining professional training requirements for specialist hydrologists have recently been reviewed. I welcome this and am very pleased that the new rules define in more rigorous terms than previous rules the type of experience that will be required. I would stress, however, that this alone is not enough. It is necessary to revise the method of assessment of academic backround, in addition to the training requirements.

In conclusion I would like to say that I would hope BHS would turn its attention to the question of professional qualification as soon as possible. I would welcome its efforts in two directions. Firstly, to strengthen the role of MIWES as a professional qualification for hydrologists and canvas for its acceptance as such amongst employers. If this cannot be achieved and MICE remains the professional qualification for hydrologists, BHS should direct its efforts to ensure that hydrologists are involved in both the committee which make decisions on the relevance of the background of the candidate and the panel at a specialist candidates' professional interview. It is important to remedy the current unacceptable situation in which candidates of similar background are treated inconsistently and unfairly. BHS should emphasise to ICE that specialists often have non-engineering background which are equally, and in some cases more appropriate to their specialism, than that of a graduate engineer.

I would like to emphasise that I am not advocating a reduction in standard of professional qualifications required of hydrologists, rather a route to qualification which is well defined and better suited to the academic background and industrial experience of all hydrologists, not just those who graduated in civil engineering.

Yours faithfully,
Dr. S. Walker,
Ivy Bank, 66 Kingsley Road,
Fivecrosses, Frodsham,
Cheshire, WA6 6SL. 3rd May 1984

Dear Editor,

In *Circulation* No 1 it was suggested that management sometimes regard hydrometry, data processing, and data archives as an area of lesser concern. There is a danger that this statement might be misunderstood by those outside the Water Industry. Within the British Water Industry there is today a management outlook which considers any activity requiring significant capital or revenue expenditure as being of major concern and for this reason any such activity is subject to periodical review to determine appropriate levels of service. Hydrometric work involves significant expenditure, it is therefore subject to review.

In 1978 Northumbrian Water carried out its first major review of streamflow gauging using a procedure called zero-based budgetting. As a result of that review there has since been a reduction in the number of operating gauging stations; eleven gauging stations no longer function but their historical data are preserved and from time to time provide useful information on water management. A more dramatic consequence of the review has been the streamlining of manpower resources. Today the Authority expends about 2.5 man-years of effort in managing its streamflow, rainfall and groundwater monitoring network. In 1975 the equivalent expenditure was 11 man-years.

In conjunction with this activity there has been another significant development in the monitoring of sewage discharge (*Circulation* No 1 did not mention this important and growing feature of all Regional Water Authorities). As early as 1975 it was apparent within the Northumbrian region that there was a serious dearth of good information on the flow of sewage. It was equally apparent that as a consequence problems of infiltration, illicit connections, operations of sewage treatment works, storm water overflow settings and storm sewerage design, were difficult to determine. Redirection of hydrometric staff activity within Northumbrian Water was therefore designed to overcome the apparent deficiency. At the present time staff, who in 1974 were dedicated to traditional River Authority hydrometric work, now spend some 47 per cent of their time on sewage gauging (and 5 per cent of their time on bulk supply water mains).

At the present time therefore hydrology and hydrometrics have special importance to the water industry in the area of storm sewerage. All management looks upon hydrometry, data processing and data archiving for sewerage with serious concern.

P. Johnson
Northumbrian Water Authority

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Lecturers: Prof Jacob Bear (Technion, Israel) and Dr Allen Shapiro (U.S. Geological Survey).

Contact: Prof P.E. O'Connell (0632 328511).

Circulation is the quarterly newsletter of the British Hydrological Society. It is issued free to members but is also available on an annual subscription of £10.00. Please address all correspondence to the Editor, Celia Kirby, Institute of Hydrology, Wallingford, OX10 8BB. Tel: 0491 38800 ext. 264.