THE NEWSLETTER OF THE BRITISH HYDROLOGICAL SOCIETY

Circulation

No. 13 February 1987

INTERNATIONAL HYDROLOGY – INFORMATION

As your President, I attend meetings of the Royal Society Sub-Committee on Hydrology. This sub-committee was set up by the British National Committee for the International Union of Geodesy and Geophysics to consider British involvement in international non-governmental activities. It is this country's national link with the International Association of Hydrological Sciences (IAHS), the main body for co-operation in international symposia and for international hydrological publications.

At a recent meeting of the Sub-Committee on Hydrology, individual membership of IAHS was discussed. I also discussed the possibility of all BHS members being better informed of international activities in hydrology, especially those of IAHS. In the near future I will be discussing this with your main committee. My hope is that we will be able to make arrangements with IAHS for regular updates on international hydrology. News of this may be made available in the next edition of *Circulation.*

P. Johnson

The first flood warning service in Britain?

The Newcastle Chronicle of November 17th 1770 contains a letter from an inhabitant of the town of Yarm, then a thriving port on the River Tees, referring to a flood on November 8th. "The late rains swelled the Tees so that it entered the town and was two feet deep in many houses and would have done great damage had it not been for the Rev. Bramwell of Hurworth who is so happily situated on the said river, that he knows with exactness by the rising of the water when there is danger and to what height it will arrive in Yarm; and is able by sending express to give the inhabitants six or eight hours notice. This is the third time that Yarm is obliged to this gentleman for his kind intelligence".

The following year in the great flood of November 1771 a messenger was sent off again but this time the trades people of Yarm suffered badly as they only moved their goods about a foot above the watermark of the February 1753 flood which was "not as high as 1771 by five foot eight inches".

BRITISH DIRECTORY OF HYDROLOGY

This Directory is now ready to go for printing and will be available in the early spring. It is to be issued free to members but will be on sale at BHS meetings and on application to the Society.

We hope we have included all the appropriate reference information for practising hydrologists but fully expect you, the users, to have ideas for other items in future editions.

The updating of the Membership Directory is also in hand and members should note that those who have still not paid their subscriptions by the end of January will not be included in the printed register.

Geomorphology and Hydrology

BHS Midlands Section Meeting
12 November 1986

This small informal meeting included three presentations illustrating the contributions of geomorphologists to hydrology. All three speakers came from the 'Gregory and Walling' stable and the presentations had a similar approach. Maybe a speaker from another region (e.g. Yorkshire!) could have been invited to illustrate contributions by geomorphologists to theoretical hydrology. Nevertheless the meeting showed how geomorphologists have contributed to hydrology through:

- **the application of basin morphometry to flood studies;**
- **studies of lake sediments for environmental reconstruction; and**
- **integrated hydrological-geomorphological-ecological studies of regulated rivers leading to environmentally sound river/water management.**

Dr. V. Gardiner (Geography Department, Leicester University) demonstrated that the extent of overlap between hydrology and geomorphology was small and there appeared to be a decline in the geomorphological input into hydrological literature. Dr. Gardiner outlined several themes where geomorphologists had provided major inputs into integrated hydrological/geomorphological studies. These included: channel processes; sediment yield and transport; drainage basin and runoff studies; hydrochemistry; and karst hydrology.

The application of basin morphometry to flood studies was then discussed. Part of the presentation had a palaeohydrological slant. Drainage basin characteristics were related to hydrological processes and the understanding of these relations was used to determine how 'fossil' drainage networks (as indicated by present day dry valley networks) were formed.

Dr. I.D.L. Foster (Geography Department, Lanchester Polytechnic, Coventry) illustrated what hydrologists could learn from a geomorphological approach to the study of lake and reservoir sediment dynamics. The problem of reservoir sedimentation is important from a management viewpoint and the presentation described how geomorphologists could provide hydrologists with information on dam sediment trap efficiency.

The first part of the presentation described how several geomorphological techniques (e.g. Mackereth coring, frozen ground coring and echo sounding) could be used to provide details on sediment distribution within lakes, from which hydrologists could calculate actual sediment yields from catchments. Sediment cores may be cross-correlated using a range of properties (e.g. bulk density, ash content, diatom content and magnetic properties) in order to produce absolute chronologies for lakes. Such information may then be used to test hydrological models of sediment yield over various geomorphological timescales.

Secondly, he explained how sediments may be traced back to their sources within a catchment using magnetic susceptibility analysis. This was exemplified by a study of gully development in two different types of material which exhibited contrasting magnetic susceptibilities. Such information would be of assistance in testing hydrological models of gully erosion.

Thirdly Dr. Foster discussed how palaeo-processes could be reconstructed from sediment core data. The levels of heavy metals recorded within lake cores provides a means by which emissions of atmospheric pollutants may be quantified. Whilst within agricultural catchments sediment cores provide a record of the environmental impact of farming due to increased fertiliser loading.

The presentation clearly detailed how several areas of lake sediment study could contribute to hydrology and was followed by a lively discussion, which focussed upon sediment yield modelling especially sediment delivery.

Dr. G.E. Petts (Geography Department, Loughborough University of Technology) introduced an ecological component into the discussion of how geomorphology and hydrology 'interact'. The presentation centred on how ecosystems respond to hydrological changes over varying timescales (i.e. from hours to decades). The effects of how so-called 'first order' hydrological and geomorphological impacts (e.g. 'flow regime' and 'sediment load') interact to influence invertebrates, fishes and their habitats were discussed with reference to a series of case studies. These included studies on the impact of reservoirs on downstream water quality, (which showed quality variation was often due largely to hydrological factors rather than actual impoundment) and siltation of river beds including problems of heavy metal enrichment.

A secondary focus of attention was how one could manipulate the hydrological components of regulated rivers to actually improve river ecology. A proposed study of 'reservoir cleaning operations' on the R. Rhone, France, emphasised the need for integrated hydrological, geomorphological and ecological studies to produce a coherent management framework.

The presentations clearly emphasised that geomorphologists provide an evidently underutilised yet essential input to hydrological studies and that there is a need for integrated hydrological-geomorphological and ecological studies.

Vince Gardiner was thanked for organising the facilities and a vote of thanks was addressed to Richard Wood who is handing over his duties to Will Bradford. The meeting was then formerly closed.

Paul José

MORECS Climatology

The Meteorological Office Rainfall and Evaporation Calculation System (MORECS) is a method of providing weekly, near real time information about hydrometeorological and water balance variables for 40 km × 40 km squares covering Great Britain. Weekly totals of rainfall and sunshine, together with averages of daily temperature, vapour pressure and 10 metre windspeed are determined and potential evapotranspiration (PE), actual evaporation (AE), soil moisture deficit (SMD) and hydrologically effective rainfall (HER) for grass and real land use are computed. The current operational model has been in its present form for approximately four years and although the output is of considerable benefit on its own, its value could be improved by placing present values in a historical perspective to allow users to make informed decisions based upon their previous experiences. A climatology of MORECS was therefore begun by the Met Office using carefully monitored data extending back to 1961, thus providing a 25-year history of the important variables.

The climatology is now complete and data for each square can be made available either in graphical form giving, for example, the average monthly values of SMD, PE, AE and rainfall or in tabular form detailing the year by year monthly values for a range of variables together with means, standard deviations, maxima and minima. Further details can be obtained from Mr. J. Fullwood, Room 228, Meteorological Office, Bracknell, Berkshire RG12 2SZ. Telephone 0344 420242 extn 2411.

M.S. Shawyer
Meteorological Office, Bracknell

MICRO-COMPUTERS IN HYDROLOGY

BHS National Meeting
1 December 1986

The National Meeting followed the third AGM of the Society held at the Institution of Civil Engineers. The meeting generated a great deal of interest and was attended by some 80 members. The potential for the application of microcomputers in hydrology was amply demonstrated by the six models on display.

Four of the models may be classified as data processing and storage models. The HYDATA package developed by the Institute of Hydrology is designed to support the processing, storage and presentation of hydrological data. **Frank Farquharson** and **Jeremy Meigh** demonstrated the relative ease with which it can be used on an IBM-PC AT micro computer. The package, which is menu driven, allows for the storage of six types of daily data: river stage or level, discharge measurement (for rating curves), flow, rainfall, reservoir/lake storage and general daily data (e.g. evaporation, catchment rainfall). The system includes analysis programs for the derivation of rating equations, flow duration curves and baseflow index (BFI). Both on screen and plotter graphics aid data interpretation. Year book style printouts may be produced, making it an ideal package for hydrometric organisations. Its particular application in developing countries is demonstrated by the fact that IH have used it in Somalia, Fiji, Honduras and the Ivory Coast.

Thames Water's river level and data processing package showed the versatility of a microcomputer model In handling data from a number of different sources. **Cathy Glenny** and **Jane Allam** gave a demonstration of the model's capabilities on a Hewlett Packard microcomputer. The model is used to process data from 16 track paper tapes, radio telemetered data, Technology Tinylog loggers and DRS loggers. The menu driven package converts the different data types to a common format for processing. A feature of the model is the graphical editor. The processed flow data may be presented as daily or as recorded time interval values (e.g. 15 minutes). Graphical plots from one day to three months may also be obtained. The data files may be converted to a form suitable for transfer to a mainframe computer for long term archiving.

Rod Hawnt of Hydro-Logic Limited demonstrated an interesting groundwater data logging and processing system called GROWLOG. The model presently developed for an Apricot micro computer is able to read and process data from data loggers used in monitoring wells and boreholes. Data are retrieved from loggers using either a portable memory module or a data retriever. Alternatively, a hand held micro such as the Husky Hunter can be used to retrieve and inspect data on site before interfacing with an office-based micro computer. The data which are archived on diskettes can be displayed, edited and output in digital or graphical format. Options are available to analyse pumping test data using a finite difference radial flow model or by a standard curve fitting method.

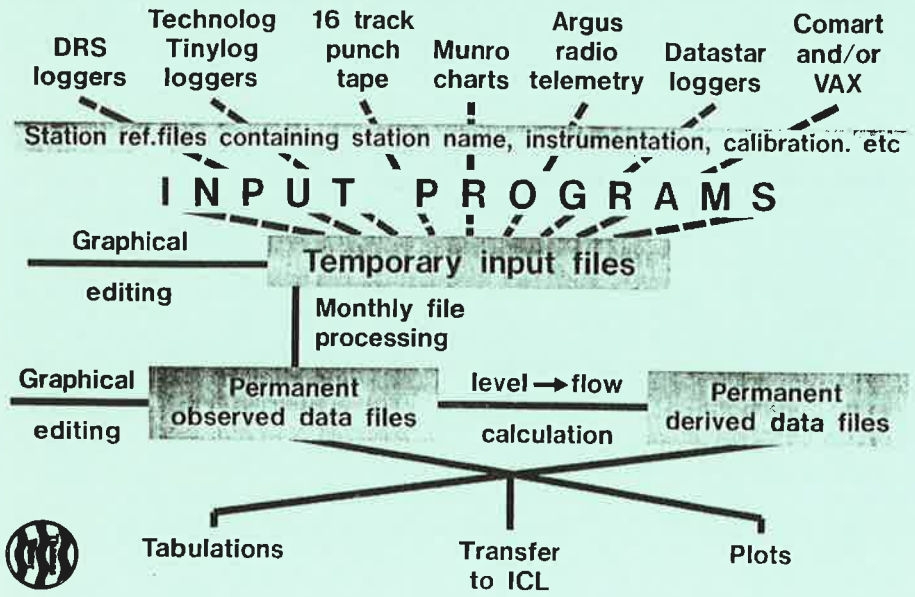
The data processing models were completed by a graph plotting and distribution fitting package developed by **Derek Clarke** for a BBC micro computer. The package carries out many of the conventional (and often tedious) hydrological data analyses with surprising flexibility and also provides good graphics. It comprises a data base program called SCIGRAF, and a curve and distribution fitting program called REGRES. The SCIGRAF module is used to create and edit the database and to calculate plotting positions using four well known formulae. The transformed data can then be plotted on six different graph types including linear plots, normal, and lognormal probability plots. Best fit curves and distributions can be fitted using the REGRES package. Four curve fitting techniques are available including polynomial curve fitting up to tenth order.

The demonstrations also included two forecasting models, one of which was a flood model developed by Thames Water. This model provides forecasts of flood flows for sub-catchments of the River Thames based on forecast rainfall. The rainfall run-off model is based on a soil moisture/catchment storage representation, and is run initially for an antecedent period with known rainfall in order to bring it up-to-date with respect to soil moisture deficit. Having thus calibrated the model, it can be used as a forecasting tool based upon rainfall forecasts.

The second forecasting model was the Dee Time of Travel model demonstrated by **Alan Weston** of Welsh Water Authority. The development of the model was prompted by a serious pollution incident during 1984 on the River Dee in North Wales. The model, which was developed in collaboration with Lancaster University, was demonstrated on an IBM PC, and provides a forecast of the time of travel of pollutants using conventional methods. The attraction of the model is its ease of use, and the minimum data requirements which consist of date, time, position of pollution peak and three levels from the main gauging stations. The model also allows for tidal effects.

Hydraulic Research Limited provided the only example of a catchment simulation model, termed RIBAMAN. In its present form the model is based on a conventional catchment distribution model. The model will simulate runoff, flood routing and flood storage in a catchment or sub-catchment and routing reaches. An application of the model for the River Ray Catchment Study in Swindon was demonstrated by **Roland Price** and **Ian Gardiner**. The catchment runoff computations are based on the Flood Studies Report unit hydrograph approach, and flood routing is based on an earlier HR package called FLOUT — a one dimensional unsteady river flow model. The routing package in RIBAMAN includes a routine to simulate on- and off-line storage ponds. HR expect to develop

Thames Water's data retrieval and processing package.



the model further as a river basin management package capable of addressing problems of water quality, flow forecasting and water resources allocation.

The micro computer demonstrations were interspersed by two entertaining lecturettes. **Tom Chidley** described the use of Tutored Video Instruction (TVI) for introduction of hydrologists to micro computers. The basic concept of TVI is to record a lecture given to a live audience on a video tape. This is achieved by using a special lecture theatre equipped with television cameras, microphones and lighting. The tape may then be used in a remote site together with supporting lecture notes, texts or Computer Aided Instruction materials. The video lecture takes the place of the conventional lecture while retaining much of its value. The ability to replay sections of the lecture is an added benefit of this mode of instruction. An attraction of TVI is that material can be produced at reasonable cost. Marginal costs are estimated as £300 to £800 per produced hour depending on the editing required, cost of lecturer, amount of outside filming required (e.g. in a laboratory) etc. Dr. Chidley has used the system to prepare material to teach professional engineers the use of micro computers. The material includes an introduction to micros, operating systems, use of spreadsheet programs, data base management systems, word processing and project management. Sir William Halcrow and Partners have used this material successfully as a training course for their professional staff.

John Elgy discussed Expert Systems and Artificial Intelligence as tools to assist the engineering hydrologist. An expert system comprises three components: knowledge base; inference machine; and user interface. The use of expert systems in medicine as a diagnostic tool provides a good example of these systems. The developments of expert systems over the last five years and the likely developments over the next ten years could have major effects on all professions including engineering hydrology. Of existing systems, Micro Expert and TIMM are examples relevant to resources development. The former is akin to a Prospector-like advising system and has been used in land use planning and design of wastewater treatment plants. TIMM which derives its rules by induction and analogy, has been used as a tool in the design of water resources systems. Expert systems are becoming more powerful with the continuing development in computer technology. Their application extends to micro computers. The future use in hydrology may include building up expert systems which encompass a wide spectrum of knowledge from publications. However, the use of expert systems in practical application in hydrological analysis seems a long way away.

Light relief was brought to the proceedings by several entertaining poster sessions, presented by Messrs Ede, Willis, Spink and Raefelt, with topics ranging from data bases for teaching applications to groundwater flow modelling.

V.R. Baghirathan

BHS Main Committee

President:	P. Johnson, Northumbrian Water Authority
Hon. Secretary:	Dr. B. Webb, University of Exeter (also representing BHS South West Section)
Hon. Treasurer:	Dr. H.S. Wheater, Imperial College (also representing BHS Southern Section)
Members:	W.T. Bradford, Severn Trent Water Authority (representing BHS Midlands Section)
	Dr. I.D. Cluckie, University of Birmingham
	T.E. Evans, Sir M. McDonald & Partners
	Dr. M.J. Lowing, Institute of Hydrology
	M. Mansell-Moullin
	R.J. Sargent, Forth River Purification Board (also representing Scottish Hydrological Group)
	Dr. R.H.J. Sellin, University of Bristol (representing Institution of Civil Engineers)
	Professor D.E. Walling, University of Exeter
	A. Weston, Welsh Water Authority (representing Pennines Hydrological Group)
Editor:	Mrs. C. Kirby (representing Institute of Hydrology)
Secretary:	N. Tyler, Institution of Civil Engineers

New Journal WATER RESOURCE MANAGEMENT

The publishers D. Reidel & Company are pleased to announce a new quarterly journal starting in spring 1987.

Aims and Scope

The journal is launched with the aim of becoming an international multidisciplinary forum for the presentation of original contributions and exchange of knowledge and experiences on water resources management. Contributions in the following areas are welcome:

(i) Water resources assessment, development, conservation, and control (with emphasis on the policies and strategies);
(ii) Planning and design of water resource systems, and
(iii) Operation, maintenance, and administration of water resource systems.

As closely related to the above, the following areas are also of interest to the Journal: hydrological and technological aspects; water demand and consumption; applied surface and groundwater hydrology; water management techniques; simulation and modelling of water resource systems; forecasting and control of quantity and quality of water: economic and social aspects of water use; legislation and water resources protection.

The Journal is supported scientifically by the European Committee for Water Resources Management, a scientific and technical committee working within the framework of the International Association of Hydrological Sciences (IAHS). Therefore, the Journal is expected to play a major role in achieving the purposes of the committee which are to promote the application of scientific knowledge to practical engineering activities, and enhance European and international cooperation of water resources management.

Several BHS members are on the Editorial board. Information for authors is available from: The Journals Office, D. Reidel Publishing Co., PO Box 17, 3300 AA Dordrecht, The Netherlands.

Physical, chemical and biological properties of South-West waters

BHS South-West Section Meeting
11 December 1986

A mixed bag of 25 biologists, chemists, engineers, geographers, hydrologists and statisticians attended the inaugural meeting of the BHS South-West Section. *Des Walling* opened the meeting by welcoming everyone to the Geography Department of Exeter University and thanked *Bruce Webb* for arranging the programme. He said that the three talks would be concerned with the interrelationships of physical, chemical and biological aspects of streams and rivers in the south-west and that after the three lectures there would be an opportunity to discuss the future development of the South-West Section of the BHS.

Des Walling then introduced **Mike Ladle** (Freshwater Biological Association) who talked about the physical and chemical influences on chalk stream ecology. The lecture covered a wide range of topics, ranging from patterns of sediment build-up and removal around weedbeds, to the rate of removal of suspended material by simulium larvae (calculations showed that all the suspended matter in a chalk stream could be filtered out by simulium larvae in a 400 m length of stream).

This was followed by the examples of the effects of extreme flow conditions, such as occur in winterbournes and during droughts and the species that are adapted to take advantage of such conditions. Because of the uncontrollable variations in flow that occur under natural conditions, a series of large artificial streams had been built at the River Laboratory of the FBA and these were being used to quantify interrelationships between water chemistry, algal growth and grazing by invertebrates. The effects of velocity on these interrelationships was also measured.

Zonation along a stream length was associated with large size differences in the same species of insect and significant variations in life cycles.

Finally the applied problems presented by the biting Blandford fly and the dependence of its unique life history on physical conditions were illustrated.

A lively discussion followed with questions asked about the Blandford fly, the effect of temperature on growth of larvae in relation to stream zonation and the use of the large artificial streams to find out the effects of increased nutrient levels on stream fauna and flora.

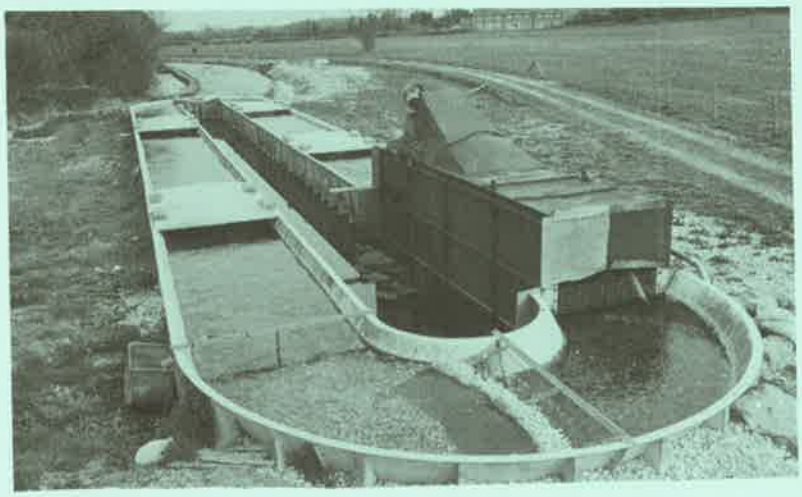
Tony Gower (Plymouth Polytechnic) then gave his lecture on the impact of copper in a contaminated stream ecosystem near Bodmin Moor. The Darley Brook originates as groundwater flow from an adit of an old copper mine. Because of the rapidly changing characteristics of the brook, three sampling sites were established in the first 250 m. Monthly measurements of discharge, water chemistry, sediment analysis and the biota were made during 1984-85.

Results showed that at station 1 (a riffle) the water was crystal clear, had a mean soluble copper concentration of 0.86 mg l^{-1} with a luxurious growth of algae but a reduced invertebrate community. At stations 1 and 2 discharge was negatively correlated with pH and positively correlated with copper and magnesium concentrations. Station 3 (a riffle) showed a significant reduction in copper and aluminium in the water. Sediment analysis from site 3 showed that the leachable copper concentration to be between 6700 and 7200 $\mu g\ g^{-1}$ whereas at sites 1 and 2 it was approximately 2000 $\mu g\ g^{-1}$.

Analysis of the three main plant species showed the concentrations of copper to be highest in the summer of each year.

The life cycle of *Plectrocnemia conspersa* (a net spinning caddis) at station 1 was compared with a clean tributary of the Darley Brook. Both stations showed a univoltine cycle but there was greater larval aggregation and a higher population density at station 1. Larvae at station 1 contained a much higher concentration of copper than the unpolluted site but larvae from both streams showed an exponential decrease in copper concentration with increasing body weight. Copper concentrations in all the larval instars exhibited a seasonal variation similar to that in the vegetation. The discussion included questions on methods of analysis, whether the seasonal variation in copper was related to food and if any other invertebrates lower down the food chain had been analysed.

The final speaker was **Bruce Webb** (Exeter University) who discussed the temperature characteristics of the streams and rivers of the Exe Basin in Devon. Spatial variation was attributed to the influence of elevation, drainage area and other factors. Maximum temperature values were associated with larger rather than smaller water courses unlike some other catchments in the UK. Temporal variations from a decade of continuous recorders revealed annual mean temperatures to be relatively stable but, within any one year, a marked seasonal cycle was apparent which could be described by simple harmonic curves. Maximum recorded daily temperature variation ranged from >9°C in a small northern tributary to <4.5°C at sites on larger rivers in the south of the catchment. The maximum daily water temperature lagged 1-2 hours after the daily maximum air temperature. The strong relationship between air and water temperatures allows predictive simulation of maximum, mean and minimum temperatures of watercourses. The influence of reservoir construction and river regulation on water temperatures was demonstrated. Finally, data on stream and river temperatures were applied to predict brown trout growth over a five year period at 17 different sites in the Exe catchment. The predicted growth rates not only showed large year to year variation at any one site but also large



Experimental recirculating streams at the FBA River Laboratory.

spatial differences, with the five year theoretical average weight varying between 117.1 g at Rewe up to 159.0 g at Pynes Cottage.

The discussion included questions on the effects of the following on water temperatures: suspended solids, residence times of the water, channel morphology, water velocities and depths, also the effects of silt and algal growth on the accuracy of the temperature measuring devices.

The chairman closed the discussion by thanking all the speakers and participants.

A short meeting was then held to decide on the future activities of the South-West area section of the BHS. It was decided not to have a committee but to elect Bruce Webb as official organiser for the present time. It was thought that possibly two meetings a year was sufficient, one similar to the present meeting and possibly a field trip.

H. Casey

BOOKS

SURFACE WATER vs GROUNDWATER

Groundwater Resource Development by L. Hamill and F.G. Bell. Butterworths, 1986, 344 pages, £37.50, HB, ISBN 0-408-01409-1.

It is more difficult to develop groundwater than surface water resources? In which category are there more failures? Groundwater engineering is simpler — there is no underground equivalent of a double curvature thin arch dam — but it is not usually the man-made parts that cause the problems (*pace* Carsington). The failure of a surface reservoir to give its design yield can usually be traced to a lack of knowledge about nature. For example, resource failures usually arise from lack of knowledge about sediment runoff, or the variability of rainfall and runoff. There have been plenty of resource failures among reservoirs, although not often in the UK. The same is true of groundwater — in fact all the large groundwater schemes that I know have yielded less water than suggested by their feasibility studies.

The clue to these groundwater failures is in their size. Historically, groundwater was taken from individual, relatively small sources. Each appeared to have only local effects and only took a small fraction of the aquifer's yield. Aquifer development proceeded slowly. Little knowledge was needed about the aquifer except the best drilling method and possibly how to find a good site. The difficulty came with large schemes which are more than the sum of their components. When planning to take a large part of an aquifer's yield, we need to know how water moves about in that aquifer; we need to know about nature, as we do with surface schemes. But there are two dissimilarities. Runoff variability, for example, is measurable and quantifiable in a way that permeability heterogeneity is not. Secondly, hydrologists are often engineers, and so are not afraid of maths; hydrogeologists hate maths — a gross generalisation — and so appear incapable of groundwater resource analysis.

People with one of two backgrounds usually attempt groundwater resource analyses. Hydrogeologists, who should have an instinct for the geology of aquifers, can be prodded into developing good conceptual models of how water moves in aquifers. Engineers can thoroughly analyse the resources of their conceptual models, but know too little geology to conceive of a good model.

An example is needed to try and support these contentious and gross generalisations. An alluvial aquifer with a well mixed lithology exhibits a drawdown of only a few metres in its water table in response to a massive new wellfield. The engineer averages the lithology in the vertical (after all it's very variable with no obvious pattern) and builds a 2-D numerical model. This says drawdowns should be 20-30 m. Both drawdowns are correct because there is a huge vertical hydraulic gradient between the water table and the depth where the boreholes are extracting the water. The variable lithology, with some thin low permeability bands is responsible. The engineer hasn't understood the geological structure; the hydrogeologist hasn't analysed its hydraulic significance. If only they got together.

This book is out of the engineers' camp. The authors have worked hard, read widely, and written a well presented and illustrated volume and the book would make an adequate text for undergraduate teaching. There are almost no real aquifers in it, just undergraduate level conceptual models which have misled so many engineers into believing that groundwater resource analysis only needed some maths. The chapters on pumping test analysis, modelling, pollution and chemistry are elementary. I guess that the authors have no practical experience of either understanding aquifer-wide groundwater movement, or of actually developing any groundwater resources, and despite the cover blurb's claim, the book will be of little value to practitioners.

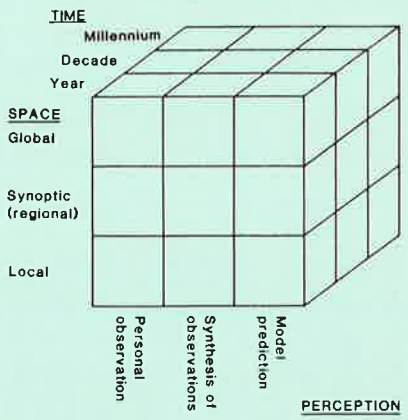
David Lerner

CLIMATOLOGY

Contemporary Climatology by Ann Henderson-Sellers and Peter J. Robinson. Published in the UK by Longman Scientific and Technical, 1986, 440 pages, paperback, price unknown, ISBN 0-582-30057-6.

What is climatology? What would one expect to find in a book entitled *Contemporary Climatology*? Any borderlines between atmospheric physics, applied meteorology, hydrology and climatology are very ill-defined. The authors aim to find ways to answer the more traditional problems of climatological understanding and prediction as well as covering the new space age climatology which deals with the Earth as a three-dimensional global entity. This comprehensive view is illustrated by the climate cube (see figure). The meteorological aspects can be thought of as dominating the area near the left front edge — the edge we know most about. The effort to extend understanding

THE CLIMATE CUBE



throughout the rest of the cube is the stated aim of the book, and it does go a significant way towards his goal.

The book is clearly printed and well set out with excellent chapter and sub-section deliniation. The main contents are divided into six chapters each about 60 pages long covering the following topics:

(a) Radiation Budget and Energy Systems of the Earth: A good general coverage with illustrations taken from many sources.

(b) The Hydrological Cycle: After a patchy coverage of evaporation the rest of the chapter goes on to give a good account of cloud climatology and precipitation on the local and global scale.

(c) General Circulation and Global Climate: Subjects ranging from basic information on atmospheric pressure to the general circulation of the atmosphere. The chapter includes topics such as ocean circulation, the cryosphere and climate zones.

(d) Regional Climates: Climate classifications of various areas from poles to tropics are described and well illustrated with example climate data and satellite pictures. Possible implications of changes in surface cover on regional climates as predicted by recent global climate models are also discussed.

(e) Local Climates: A wide ranging account giving a good introduction to surface wind and energy balances, urban and topographical effects, climate modification, pollution and climate hazards.

(f) The Future — Climate Change, Climate Models, Climate Impacts: Climate change and its mechanisms on all timescales including effects of and on man.

In addition there is a good glossary, units reference section and index. There is also a general further reading list, but apart from a very compressed acknowledgements list there are no references within the body of the text to original work for students to follow up.

All told this book is to be recommended and will provide a good basis for undergraduate study as well as being a useful addition to many public and private library shelves.

Modern climatology now goes some way towards an understanding of the hydrological cycle and climate of the Earth but, as the book emphasises, there is still plenty to learn. We are still only in the position "to 'warn' of possible climate changes and their potential effects".

There is still a great deal for students and researchers to do in this field for many years to come and it will be a very long time before all the intricacies of our climate are fully understood.

H.R. Oliver

SALT WATER IN THE USA

Salt Water Intrusion: Status and Potential in the Contiguous United States, by S.F. Atkinson, G.D. Miller, D.S. Curry and S.B. Lee. Lewis Publishers, Inc., Michigan, USA, 1986, 390 pages, £45.95, HB, ISBN 0-87371-054-1, available through John Wiley and Sons Limited.

The contamination of fresh water aquifers by the intrusion of saline water is a widespread problem. In coastal areas either increased abstraction rates or a decrease in groundwater recharge may cause a significant decrease in the seaward flow of fresh groundwater and thereby enable sea water to intrude and contaminate the aquifer. In inland areas where saline water is present in aquifers beneath fresh water, overpumping may lead to up-coning of the saline water and a consequent deterioration in water quality. The problem is aggravated by poorly constructed boreholes which allow mixing of groundwaters from different aquifers.

This book attempts to summarize the status and potential for salt water intrusion into groundwater in the contiguous United States of America where we are told an estimated two-thirds is underlain by saline ground waters.

It is not clear who the book is aimed at nor what purpose it aims to fulfill. The 76 pages of the main text present a hotch-potch of information, ranging from plant response to saline irrigation water to desalinisation to legal aspects: in this context there are some notable omissions, such as the effect of saline water on soil structure and the design and operation of wells to skim fresh water from above saline water.

The text however does little more than skim the surface and makes uncritical reference to random published work. The only conclusion is that groundwater must be viewed as "a national resource which crosses state boundaries"! Ironically the bulk of the book reinforces the contrary by itemising salinity problems for each county and state in turn, in a National Salinity Survey. An annotated bibliography of 125 references is potentially more useful but like the rest of this book is poorly presented.

Indeed it is difficult to find anything complimentary to say about this book. It is badly written and poorly presented; it includes inaccurate, often illegible figures; its errors and omissions make it a book I cannot recommend.

Catherine Ward

ALSO RECEIVED

The International Drinking Water Supply and Sanitation Decade: Review of Regional and Global Data. Offset Publication 92, World Health Organisation, Geneva, 1986, 30 pages, Sw.fr.6. Available through HMSO.

Tables of statistics for 1970-1983 by continent or for the whole world. They show that the politicians' dream for the decade of water supply and sanitation is not going to be reached.

Methods of measurement and estimation of discharges at hydraulic structures by O.A. Tilrem. Operational Hydrology Report 25, World Meteorological Organisation, Geneva, 1986, 38 pages, Sw.fr.10 (surface mail). Available from WMO, PO Box 5, CH-1211 Geneva 20 if payment enclosed (Sw.fr.19 for airmail).

The stated objective is sound. Précised, the argument is that measuring flow at canal structures, spill ways and the like is often adequate and usually cheaper than using purpose-built structures, so the book sets out to review the methods available. The contents list is comprehensive, but the text is of little practical use. Nowhere is enough information given to calculate flow through any structure, nor details about how to estimate the missing parameters. All is outlined and then referred to other texts. Thus the book is of little use in developing countries where textbooks and journals are difficult to obtain, and is too simple to be of use to a competent consultant.

UNESCO sponsored international postgraduate courses in hydrology (7th edition). SC-86/WS/21, UNESCO, Paris, 1986, 76 pages, free from UNESCO.

Details of 32 courses ranging from MSc to three weeks at the Institute of Hydrology, Wallingford.

Hydrology in the 1990s

BHS has been invited by the Royal Society to assist in a "Survey of UK Priorities in the Earth Sciences in the 1990s". BHS is naturally keen to accept such an invitation and has responded accordingly. We are currently seeking clarification on several aspects of the survey and information will be given to members as soon as our role is made clear.

MEMBERS ON THE MOVE

Dr. Paul Jowitt has left Imperial College and has taken up the position of Professor of Civil Engineering Systems at Heriot-Watt University, with effect from 1st January.

From the Editor

When putting together the material for this issue, I noticed that we have very little information on "academic" hydrology. If you remember, earlier issues of *Circulation* often had summaries of PhD theses and notes on grant awards, as well as movements of individual BHS members.

We have a pretty good network of contacts within the water industry which forms the basis of the "News from Members" items but, sadly, I have let the equivalent academic system fall by the wayside. I hesitate to select "key" hydrological departments within the universities and polytechnics which could be asked to provide correspondents and therefore simply ask any of you to let us know — however belatedly — about major grants, new pieces of research and publications which add to the sum total of hydrological progress.

NEW MEMBERS

We welcome the following new members to the Society:

M. Ahmed	Pakistan Water & Power Development
N.A. Chappell	Plymouth Polytechnic
Dr. S. Demuth	Institute of Hydrology (Visiting Scientist)
G.A. Hyett	Student
C. Lambert	Exeter University
P. Larentis	Student
R.H. Little	H.R.S. — River Eng. Dept.
D.P. Long	Hydrologist (Saudi Arabia)
H.S. Lumadfeng	Institute of Hydrology (Visiting Scientist)
J. Male	Consultant (New Zealand)
H.B. Onyekwere	Post Graduate Student
J.G. Pike	Consultant
R.K. Price	Hydraulics Research Ltd
I. Roald	Institute of Hydrology (Visiting Scientist)
M.S. Swann	Asst. Hydrologist Bahamas
G.R. Thorpe	Howard Humphreys & Partners
A.L. Warren	Hydrologist — Sir William Halcrow & Partners
Prof. E.M. Wilson	University of Salford
T. Yacine	Post Graduate Student

SITUATION VACANT

INSTITUTE OF HYDROLOGY
WALLINGFORD, OXFORDSHIRE

CHEMICAL HYDROLOGISTS

Two Scientific Officers are required to join the Chemical Hydrology Division at the Institute of Hydrology. The duties will include field work in Scotland and Wales, computing, data analysis and modelling support for projects investigating acidification in the British uplands. A good knowledge of computing and hydrology is essential and an understanding of environmental chemistry would be an advantage.

The appointments will be for a period of three years and the salary will be on a scale from £6,711 to £9,225 per annum.

The Institute of Hydrology is a component body of the Natural Environment Research Council which, whilst not part of the Civil Service, enjoys pay and conditions similar to those of the Civil Service.

Application forms may be obtained from the Institute of Hydrology, Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire OX10 8BB. Telephone 0491-38800. The closing date for receipt of applications is 20th February 1987.

FORTHCOMING EVENTS

JOINT BHS/ROYAL GEOGRAPHICAL SOCIETY MEETING
"WATER PROJECTS: ENVIRONMENTAL AND SOCIAL ASPECTS"
ROYAL GEOGRAPHICAL SOCIETY
LONDON SW7
9 April 1987

Introduction by M. Mansell-Moullin (Chairman). "Environmental management in the Norfolk Broads region" — R.K. Turner (University of East Anglia). "Public recreation in river catchments" — R.K. Stokes (Welsh Water Authority). "Environmental effects of river channel changes" — Prof. K.J. Gregory (University of Southampton). "Ecological management of regulated rivers" — Dr. G. Petts (University of Loughborough). "River corridor surveys" — N.T. Holmes (Nature Conservance Council). "The river communities project" — J. Wright (Freshwater Biological Association). "Summing-up" — P. Johnson (Northumbrian Water Authority).

1st INTERNATIONAL CONFERENCE ON LARGE SCALE SYSTEMS IN DEVELOPING COUNTRIES
BENIN CITY, NIGERIA
10-12 August 1987

A forum for presentation and discussion of problems associated with Large Scale Systems — of interest to computer scientists, operations researchers, systems engineers and analysists, applied pyschologists and public and private administrators.

Four main topics:

- Infrastructural systems — to include water resources.
- Service systems.
- Logistics support systems.
- Productive systems — to include agriculture.

Full texts of papers by 24th April 1987.

Further details: Dr. G.C. Ovuworie, Department of Production Engineering, University of Benin, PMB 1154, Benin City, Nigeria.

STOP PRESS

☆ **NATIONAL HYDROLOGY SYMPOSIUM**
14-16 September 1987* ☆

Please hurry up with your abstracts — full details given in the last issue of *Circulation.*

*Note change of date.

Diary

13 February 1987
Royal Meteorological Society.
"The meteorology and hydrology of extreme rainfall in Scotland" — Dr. A. Werrity (University of St. Andrews).
5.30 p.m., Department of Meteorology, University of Edinburgh, King's Buildings, Edinburgh EH9 3JZ.

17 February 1987
Royal Meteorological Society.
"Acid Rain" — A. Martin (Scientific Services, CEGB).
7.15 p.m., Coventry School, Bablake, Coventry.

3 March 1987
Royal Meteorological Society.
"The atmosphere — hazard or resource? How and when to decide" — P. Wenman (Environmental Resources Ltd.).
7.15 p.m., Department of Geography, University of Birmingham.

18 March 1987
Royal Meteorological Society.
"Long range forecasting and its physical basis" — Papers on recent developments in practice of long range forecasting and underlying theoretical basis.
2 p.m., Imperial College, Blackett Laboratory, South Kensington, London SW7.

29-30 April 1987
ICE Conference, Brighton.
"The marine treatment of sewage and sludge."
Details from: Conference Office, Institution of Civil Engineers.

*14-16 May 1987**
Joint BGRG/BHS/BSRG Workshop.
"The hydrology, sedimentology and geomorphic implications of floods."
University of Lancaster.

***Note change of date**

BHS MIDLAND SECTION

MODELLING DEVELOPMENTS IN THE UPPER TAME CATCHMENT

The Black Country Trunk Sewerage Scheme is now partially commissioned, and this meeting offers a chance to review the progress of one of the largest schemes of its type in Britain.

Speakers: Richard Douglas, John Martin and Bill Laight.

Department of Civil Engineering, University of Birmingham. 2.00 p.m.

Copy Deadline for Issue No. 14 — 6th April 1987

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 £12.00. Please address all correspondence to the Editor, Celia Kirby, Institute of Hydrology, Wallingford, OX10 8BB. Telephone: 0491 38800 extension 2224.