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UNIVERSITY RESEARCH ...Part X

Department of Geography, Polytechnic South West

Geography has been taught at degree level in Plymouth Polytechnic since 1970, although the Department of Geographical Sciences only came into being in 1981, as a result of the reorganisation of the previous School of Environmental Sciences and the establishment of a faculty and departmental structure within the Polytechnic. Geography at Plymouth is distinctive in being one of four departments within the Faculty of Science. The physical geography team at Plymouth currently consists of seven members of academic staff, one part-time and three full-time research students, and four technicians, out of the Department's complement of 21 academics, seven research students and seven technicians.

Research covers a broad field based around both team efforts and individual interest. The theme of catchment hydrology was established in the early 1970s, complemented by studies in the natural vegetation of Dartmoor and glaciological studies in Iceland, Spitsbergen and Norway. More recently themes relating to applied aspects of coastal geomorphology and ecology have emerged, aided by the appointment of a specialist in remote sensing and the establishment of an NERC image analysing facility within the Polytechnic. Collaborative research takes place not only between departments and faculties within the Polytechnic but also with external organisations such as the Institute of Hydrology, Institute of Terrestrial Ecology, public bodies such as National Power (CEGB) and universities, both in this country and in the USA.

Since April 1989, with the incorporation of additional institutions of higher education within the South West and the subsequent formation of Polytechnic South West, strong links have developed with the former Seale Hayne College of Agriculture (now the PSW Faculty of Agriculture).

Plymouth Polytechnic was formed in 1970 together with 29 other polytechnics in England and Wales. These new institutions of higher education, founded on the former colleges of technology, had an applied emphasis and consequently strong links with local industry and organisations working in pure and applied science and technology. Geography at Plymouth began in the Department of Mathematics and Physics, but rapidly established itself as a growing area offering external BSc and BA degree courses of the University of London.

The next decade saw a very rapid expansion of geography as a cohesive group within the School of Environmental Sciences, and by the mid 1970s CNAA BSc degree courses had been established in Geography and Environmental Science. Physical geography research was established in fluvial geomorphology and hydrology (**Les Ternan** and **Peter Sims**), Quaternary studies and biogeography (**Dave Gilbertson** and **Martin Kent**) and glaciology (**Dave Croot**). Further appointments gave rise to research developments in soil water and water chemistry relationships on hillslopes (**Andrew Williams**) and other aspects of Quaternary studies, especially climatic change (**Anne Gellatly**). Most recent has been the development of remote sensing techniques for vegetation mapping and applied coastal studies (**Ruth Weaver**).

A key theme that has emerged in relation to much of the research in physical geography is the link between land use, particularly afforestation, and hydrological pathways within catchments.

Catchment Studies

An instrumented catchment was set up in 1973-74 on southwest Dartmoor on land owned by South West Water. The stream concerned was the Narrator Brook and this small (4.75 km²) river basin became an important focus of undergraduate practical classes as well as providing a suitable field site, close to Plymouth, for more extensive project work by students as well as for research. The catchment, which feeds into Burrator Reservoir (a main water supply source for the City of Plymouth), is distinctive in that it incorporates three varieties of landuse: *Calluna* moorland, typical of much of the upland of Dartmoor; degraded farmland with old pasture being invaded by bracken, and, in the lowest section, a coniferous forest plantation (Sitka Spruce) established in the 1920s and now at maturity (Kent and Wathern, 1980).

Initially the catchment simply monitored hydrological inputs and outputs (as a basis of fluvial geomorphology), which led to investigations into variations in rainfall catch (Sims, 1981; Fig. 1), and the effects of differing land uses and vegetation on channel form (Murgatroyd and Ternan, 1983). Discharge variations and observations on the nature and origin of overbank deposits were investigated by Gomez and Sims (1981); this linked with work undertaken by Alexander (1983) on the nature of valley gravel infills and their hydrogeological significance and resource potential (Fig. 2).

The groundwater work undertaken by **Jean Alexander** further elaborated on the complex hydrological pathways which exist in granite-based catchments. Continued research in the Narrator basin has focused on the nature of contemporary chemical weathering processes (Williams, Ternan and Kent, 1986), the determination of the geochemical budget (Williams, Ternan and Kent, 1983; 1984; Fig. 3), and the effects of different vegetation types on soil and stream water chemistry (Williams, Kent and Ternan, 1987).

Current work in the Narrator catchment on southwest Dartmoor is continuing the basic monitoring set up in the 1970s and the site is currently providing information for the Department of the Environment's UK acid waters monitoring network. Monthly sampling of stream water for a variety of ions provides data on the 'background' level of acidification for this part of upland Britain.

The team-based research on hydrological pathways and water quality under differing land uses, together with natural vegetation studies, laid the foundation for a series of other studies which have been based on catchments elsewhere in Britain and overseas.

Nick Chappell, working at the Institute of Hydrology's Plynlimon catchments in conjunction with **Brian Reynolds** (Institute of Terrestrial Ecology, Bangor) and **Kevin Gilman** (Institute of Hydrology), investigated the hydrological basis of ITE's acid waters studies in central Wales, with comparative studies under mature coniferous forest and a control based on adjacent acidic grassland (Chappell *et al.*, in press).

Julia Hodgkins, based at the ITE site at Beddgelert in North Wales, is working in conjunction with ITE and National Power in further acid waters studies, looking particularly into the hydrological impacts of whole tree harvesting. She is comparing effects under mature coniferous forest with sites that have been clear felled. This work is being supervised by **Richard Skeffington** (Head of Terrestrial Ecology at National Power, formerly CEGB) and by Brian Reynolds.

Both the above NERC-funded studentships utilise automated tensiometer and piezometer networks (Fig. 4) in conjunction with a 'Wallingford' soil moisture neutron probe and TDR (time domain reflectrometry). The research also links with the hydrological modelling interests of **Andrew Williams** who is developing computer based models in conjunction with **John Dowd** of the University of Georgia and the Coweeta Catchment in Carolina, USA.

MAFF have also recently funded another studentship: **Paula Addison** is investigating water movement in drained and undrained soils under pasture in connection with nitrogen movement and the effects of soil cracking. The research is based at North Wyke in mid-Devon on the Institute of Grassland and Animal Production experimental site. **David Scholefield** of IGAP is the external supervisor.

Research by **Les Ternan** and Andrew Williams has also been undertaken overseas, in Grenada, into management of tropical forest in work funded by the Commonwealth Foundation and the Grenadine Ministry of Agriculture. (Ternan, Williams and Solman, 1987). Les Ternan has also investigated the effects of tropical rain forest deforestation on soil erodibility in Papua New Guinea.

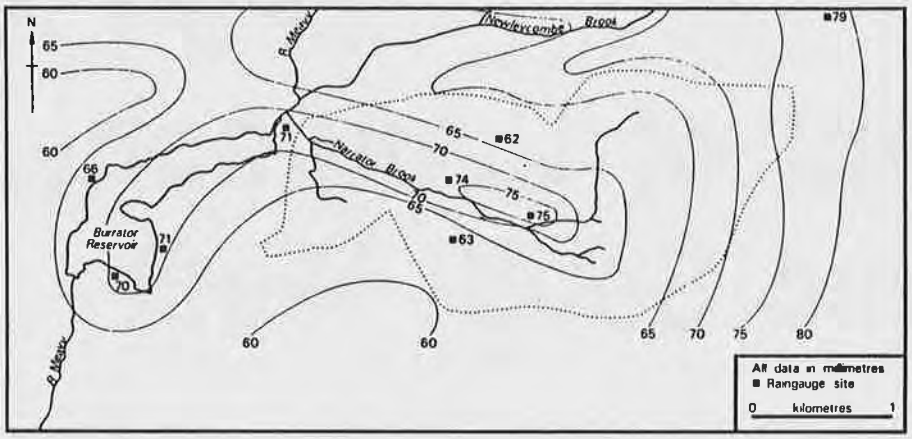


Figure 1. A typical isohyetal plot of rainfall catch in the Narrator and Burrator areas.

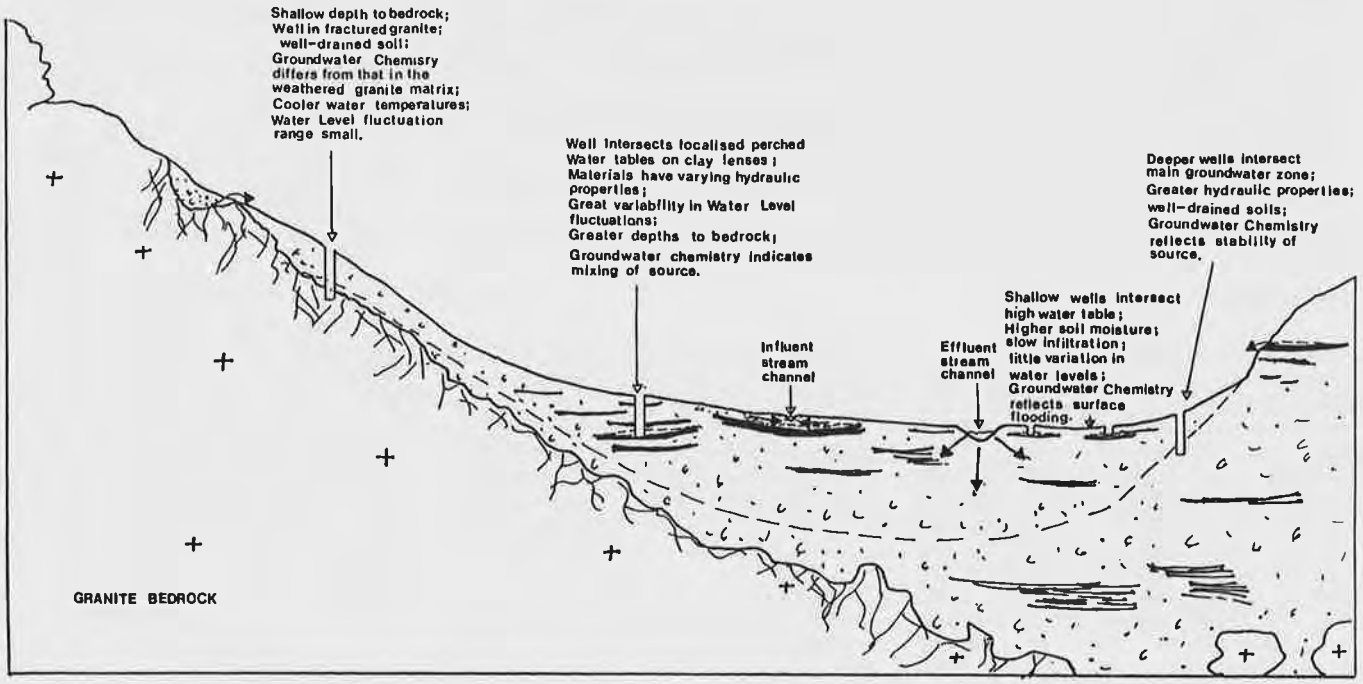


Figure 2. Cross-valley profile of a weathered granite aquifer illustrating the hydrogeological complexity of specific sites.

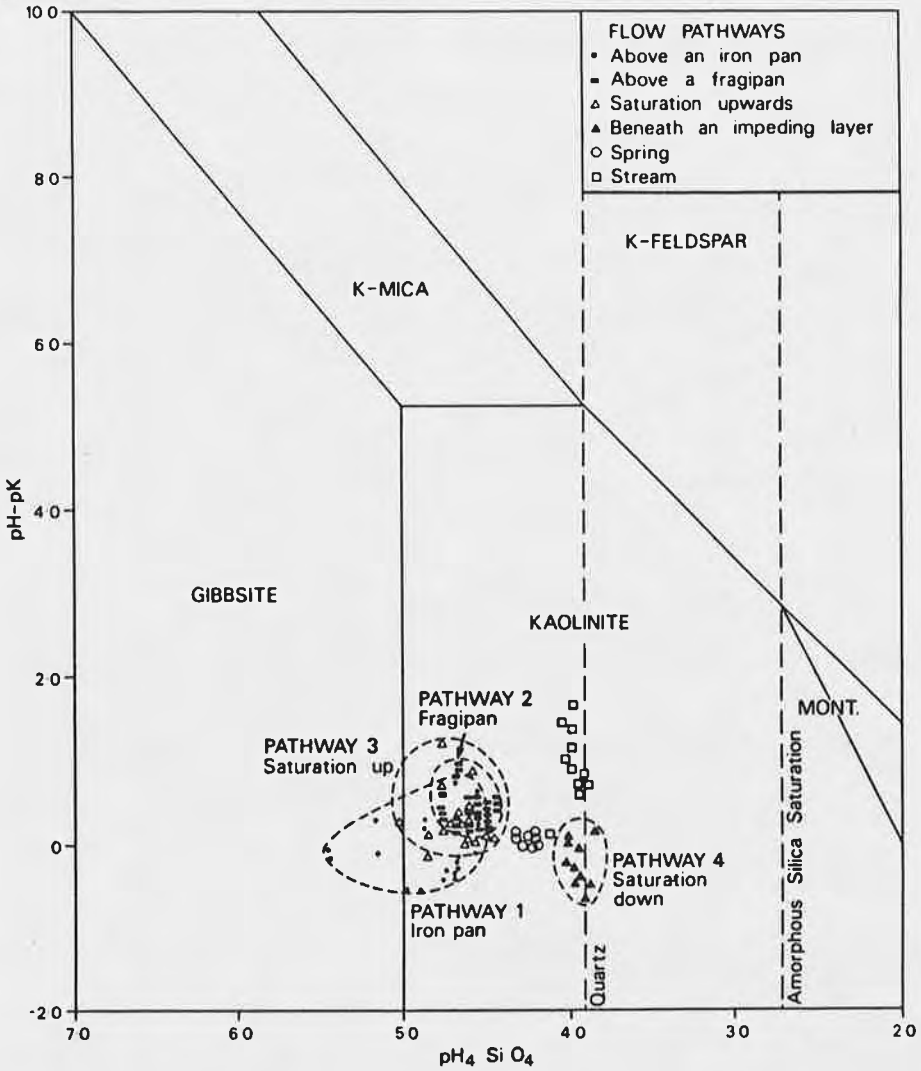


Figure 3. Stability diagram for water samples from soil water pathways within the grassland, springs and the river.

Studies in woodland ecology and forest management have been completed by **Marlene Harris** (Harris and Kent, 1987) based in the Tavistock Woodlands. More recently, vegetation studies and mapping are being undertaken by **Ruth Weaver** and **Martin Kent** on Dartmoor using remotely sensed data provided by NERC from their 1988 Airborne Thematic Mapper campaign. These academic staff are also involved with collaborative work in the outer Hebrides with personnel from the University of Sheffield and the University College of Wales, Aberystwyth.

Coastal and Estuarine Studies

The theme of water movement through soils has also featured in research by **Peter Sims** and Les Ternan into coastal landslides and marine erosion at Seaton and Downderry in southeast Cornwall (Coard, Sims and Ternan, 1987; Sims and Ternan, 1988). Here the instability caused by storm wave activity undercutting a terrace of coastal head deposits, leading to landslipping, aided by inadequate drainage of cliff materials, is causing concern for residents in the nearby cliff top properties. The work also reviews the efficacy of both public and private coastal defence schemes, particularly in relation to the overall stability of the head materials, beach sediment budgets and the 'natural' protection afforded by longshore sediment transport at the foot of the cliffs.

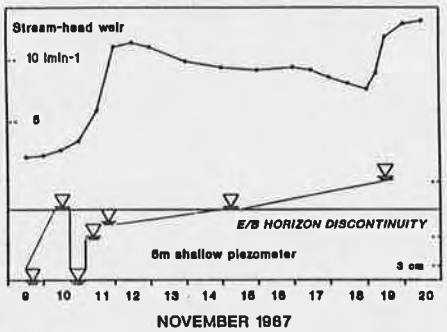


Figure 4. Example piezometer response versus hillslope discharge .

Work by Peter Sims and Ruth Weaver on nearshore sediment dynamics and coastal erosion in southeast Cornwall and at Dawlish Warren at the mouth of the River Exe in Devon is continuing using airborne thematic mapper data, flown in 1989.

Quaternary Studies

The link between terrestrial and marine deposits is being investigated by **David Croot** in collaboration with the Irish and British Geological Surveys. This work is essentially a re-evaluation of the Quaternary history of the Irish Sea using onshore and offshore sediment data and stratigraphic relationships. This follows earlier work by David Croot on the supposed till deposit at Freminton in North Devon and also studies of glaciotectonic phenomena in Iceland and Spitsbergen (Aber, Croot and Fenton, 1989).

Investigations by **Anne Gellatly** and others (1988) into the sensitivity and response of glaciers to recent historical fluctuations in climate form part of several long-term studies into environmental change in Western Europe. Detailed work on the Oksfjordjokelen Ice-cap in Arctic Norway has shown that, whilst valley glaciers have largely disappeared, the present ice-cap is particularly responsive to climatic warming at high latitudes since ca. 1950.

Historical records coupled with surveys of ice margins of selected Pyrenean glaciers have formed the focus of a current EEC-funded project which has been examining the longer-term impacts of climatic instability in the Western Mediterranean. The persistent downwasting of icefields throughout the Pyrenees is presenting several environmental dilemmas regarding snowmelt hydrology and the marginality of the winter tourist industry.

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BHS Annual General Meeting 4th December 1989

An official account of the AGM will be printed in Circulation in due course, but here is the Editor's informal note of the meeting for those who didn't manage to get there.

The Society's AGMs are usually held before the December National meeting, usually the last in the calendar year. This year we tried a slightly different formula and cunningly slipped in the official business just before the lunch slot in the meeting held at ICE on 'Computer simulation techniques in water management'.

The BHS has been structured so that Presidential and Hon Sec. two-yearly terms of office overlap to provide for continuity. This year's meeting - the seventh - marked the handing over of the Presidential reins from **Peter Wolf** to **Allan Lambert**.

In reviewing his past two years Professor Wolf said that although he was pleased that much had been achieved, he had to acknowledge the pace of progress had at times been too slow for his liking. Particular items of success, however, were the progress made towards the recognition of a professional hydrological qualification and more links with European organisations and international bodies.

Frank Farquharson's Treasurer's report revealed a few matters which need attention such as high costs of postage and printing (more of this elsewhere in *Circulation*).

Because the Society's income is relatively static, a drive will be made during 1989/90 to attract new members, a point stressed by Allan Lambert as he addressed the meeting following his formal adoption as the new President. Allan had three themes to pursue: progress, enjoyment and continuity.

"Starting with progress," said Allan,"this relatively young society of ours has favourable conditions in which to continue its rate of growth because of three special situations pertaining at present. First, environmental issues are more prevalent than at any time since BHS was formed. Second, the formation of the NRA has meant that hydrological skills are more in demand than at any time since the formation of the original River Authorities some 25 years ago (and here I urge those with NRA contacts actively to promote BHS membership, awareness and involvement). Third, the pace of movement to European unity is accelerating and our society must be part of it if we are to achieve the aim of our Statutes to foster the involvement of our members in relevant international activities."

"Enjoyment comes next on my list,"he went on, "for if, like me, you are a member of more than one society, you probably find you prefer to be most involved in the one whose activities you enjoy most. For me, enjoyment goes hand-in-hand with participation and commitment, and I would hope that during my term of office each member will enjoy his or her membership of BHS so much that it shows, particularly to others who might then wish to join us."

Allan went on to say how much he looked forward to working with main BHS committee and that he hoped to visit each of the six regional sections and groups to meet members he didn't yet know and hear their views.

"Your committee members work hard to put together interesting and relevant programmes and meetings - do please support them to the greatest extent you can," he urged, "in particular for the two-day workshop for research students to be held at Loughborough in late March. Anyone with working experience will be welcomed, even if they can only attend for a short period."

"Finally, there is continuity. With the guidance of the main committee, I shall be seeking to continue and develop the initiatives of my distinguished predecessors, in particular in relation to professional qualifications, the development of links with related bodies in the UK and abroad, and increasing the national and international standing of BHS."

Celia Kirby

MONITORING AND PREDICTION OF SAHEL RAINFALL

EDITORIAL NOTE:
Apologies for the lateness of this article, but the report arrived too late for inclusion in Circulation 24.

BHS Southern Section Meeting 16 May 1989

Rainfall records show that from the 1970s there has been a succession of drier-than-average years in the narrow, semi-arid band of land to the south of the Sahara known as the Sahel (Fig. 1). This has contributed to the death or severe hardship of many people in the region. In two very informative talks at this evening meeting held at the Meteorological Office, *Neil Ward* and *Kathy Maskell*, of the synoptic climatology branch of the Met. Office, discussed links between worldwide sea surface temperature (SST) patterns and rainfall in sub-Saharan Africa and the possibility of using statistical or general circulation model techniques to provide forecasts of seasonal rainfall totals.

In his presentation, **Neil Ward** first established the characteristics of rainfall and atmospheric circulation that are typical of an 'average' wet season in the Sahel region. The wet season lasts generally from July to October, with most rain falling a few degrees south of the inter-tropical convergence zone which marks where moist, surface, warm South-Westerlies undercut the hot, dry North-East Trades that have blown across the Sahara desert. Mean August zonal winds for 1988 (an average year) and 1987 (a very dry year) were presented to illustrate the observations made by earlier authors that wetter years in the Sahel were accompanied by large atmospheric changes which include a strengthening and deepening of the surface monsoon flow and a strengthening of the upper-level tropical easterly jet.

A major question is what causes the changes in atmospheric circulation which accompany the rainfall changes. A possible candidate for causing large-scale atmospheric circulation and rainfall anomalies is variability in sea surface temperature (SST). A data set comprising shipboard observations of SST has been used to explore this hypothesis. It was demonstrated that in parts of the tropics the observed SST over a wide area can differ from its seasonal average typically by an amount that is similar to the range of the mean annual cycle of SST. Preliminary investigations revealed a significant negative correlation between tropical Atlantic summer sea-surface temperature and seasonal Sahel rainfall, and a positive correlation with North Atlantic summer temperature. Neil explained that eigenvector analysis of SST anomalies (SSTA) had now revealed three modes of SSTA that are linked with rainfall variations in Sub-Saharan Africa.

1) Positive SSTA in tropical Atlantic: associated with drought in the Sahel and above-average rainfall on the Guinea Coast.

2) Hemispheric dipole: northern hemisphere warm, southern hemisphere cool, associated with drought in the Sahel down to 10°N but having little association with Guinea coast precipitation.

3) El Niño: linked to negative rainfall anomalies - strongest in Sudan, weak across Sahel with little effect further south.

The possibility of using measures of SSTA modes in spring to forecast the broad character

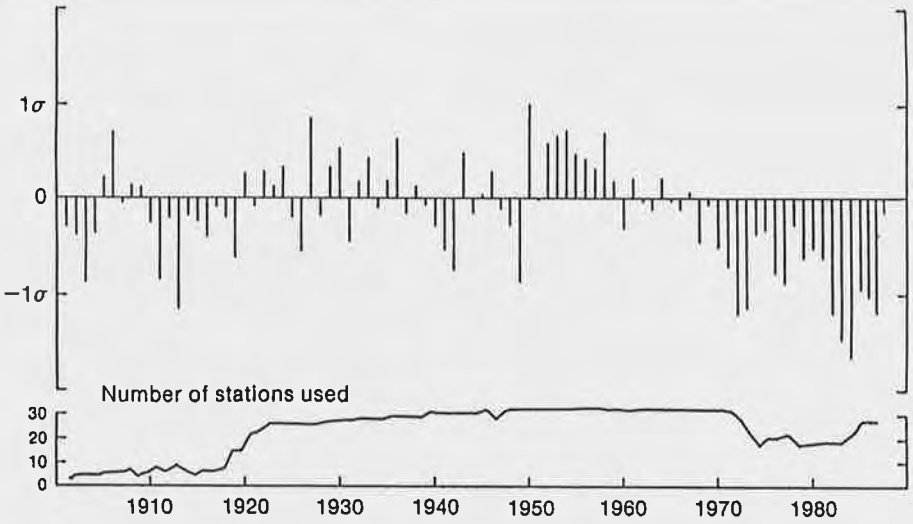


Figure 1. Standardised annual rainfall anomalies for the Sahel, 1901-1988. Values up to 1984 after Nicholson (1985); 1985-1988 estimated from CLIMAT reports.

of the coming summer rainfall season has been examined and tested with historical data for 1901 - 1988. The method was quite successful, with only about 20% probability of substantial error. The forecasts failed in years when the control of SST on the atmosphere was weak or different from that experienced in the historical data period, or when the observed SST modes changed in an unusual and rapid way between spring (when the forecast is made) and summer (the Sahel rainfall season).

In the second presentation **Kathy Maskell** demonstrated how a general circulation climate model (GCM) can be used, to help to verify links such as those identified in the first talk, to establish a physical basis and to suggest mechanisms behind the links; it can also be used as a rainfall forecasting tool. The major concepts behind the GCM were explained simply, without recourse to hundreds of formulae which so frequently bring 'glazed looks' onto the faces of the audience. Kathy showed how both physical and dynamic processes were accounted for in the basic equations. The 3-dimensional grid point model used for these experiments has 11 layers in the vertical and a horizontal resolution of 2.5° x 3.75° . The Sahel region is defined to include points between 12.5° N & 17.5° N and 10° W & 30° E.

The model had been used in simulation mode to test the sensitivity of model Sahel rainfall to SST. Using historical SST data, the model was run for the rainfall season April-October, with prescribed SST updated every five model days in accordance with observations for two wet Sahel rainfall years (1950 and 1958) and two dry ones (1983 and 1984). Comparison of simulated and observed rainfall for these years (Fig.2) showed that with observed SST prescribed throughout the wet season, the model is able to distinguish between wet and dry years. The geographical distribution of deficit or enhancement relative to normal is also simulated reasonably well, particularly in the north of the region. Both the strength and depth of the model monsoon circulation were shown to decrease in dry years in accordance with the observations described by Neil Ward. The model was also able to simulate reduced moisture flows into the Sahel and an increase in strength of dry winds over the Sahara in dry years. Comparison with other experiments suggests that the simulated Sahel rainfall is more sensitive to SST than to the supply of moisture from the land surface.

Finally Kathy considered the role of the GCM as a forecasting tool for wet season Sahel rainfall. Hindcast experiments were described in which the SSTA was calculated for a particular month and then the SSTA added to the prescribed climatological value throughout the Forecast integration. Using July SSTA there was shown to be good agreement between forecast and observed Sahel rainfall (Fig.2). However less success was achieved with SSTA taken from earlier months. This aspect of the topic was still being investigated.

This meeting, which was combined with a technical tour of the Met. Office, provided a very interesting insight into the meteorology of the Sahel region and into the potential for predicting wet season rainfall. The presentations were followed by a wide range of questions which served to highlight the interdisciplinary nature, involvement and interest of this topic.

Maureen Mylne
Meteorological Office

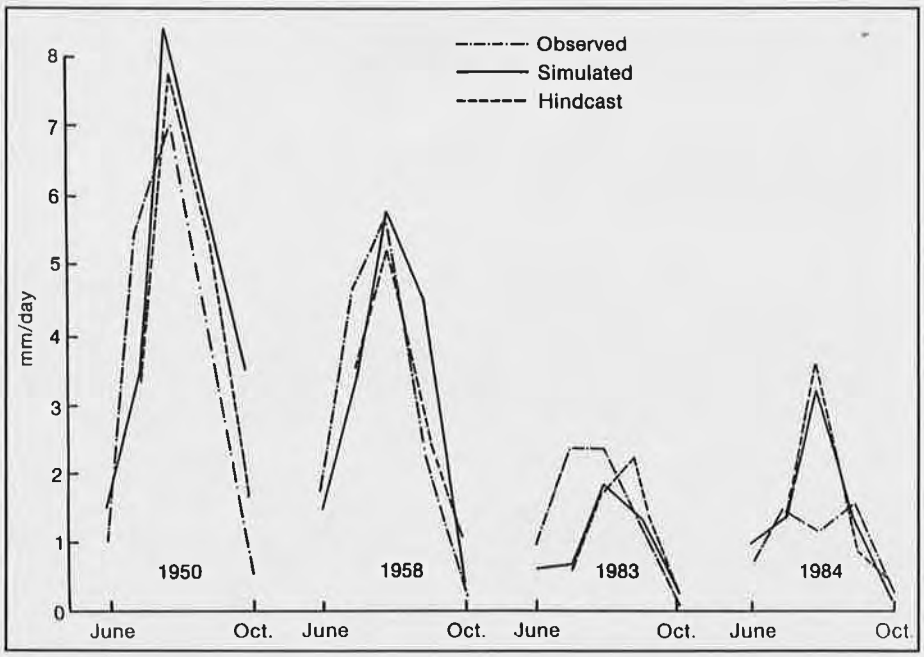


Figure 2. Comparison of observed, simulated and hindcast Sahel rainfall for two wet years and two dry years.

BHS / Welsh Water Hydrology Prizes

In order to support BHS activities and new membership, Welsh Water plc has suggested (and the main Committee of BHS agreed) that when Welsh Water's Water Resources staff (for example Allan Lambert, Logan Jack, Alan Weston) give invited lectures on hydrology or water resources at Universities, Polytechnics, etc., a fee will be charged. This lecture fee will be donated to BHS to fund up to 10 Annual Hydrology Prizes, consisting of 2-year membership of BHS for two students, to be named by the individual university. Three universities have already taken up this offer; any others interested please contact Allan Lambert as soon as possible at:
Welsh Water plc, Northern Division, Bangor, Gwynedd, LL57 2DJ. Tel: 0248 351144; Fax: 0248 355192.

NEW MEMBERS

We welcome the following new members to the Society:

Blogg, G.E.	Southsea, Hampshire
Bradley, D.(Ms)	Presteigne, Powys
Doyle, M.A.(Miss)	NRA Thames Region
Geraghty, M.M.(Miss)	Cheadle, Cheshire
Ingles, C.M.(Mrs)	Caversham, Reading
Lacey, K.P.(Ms)	Kingston Polytechnic
Lawler, D.M.	University of Birmingham
Lucas, H.C.(Miss)	Reading, Berks
McCartney, M.P.	Wallingford, Oxon
Moorehead, P.W.	Co.Antrim, N.Ireland
Polarski, M.(Ms)	Institute of Hydrology
Schofield, D.V.(Mrs)	Warrington, Cheshire
Skipper, C.W.(Dr)	Mott Macdonald
Smithson, S.(Miss)	Burgess Hill, Sussex
Thomas, M.K.	Mott Macdonald
Wackett, S.M.(Miss)	Waltham Cross, Herts
Webster,R.	Peckham, London

DILUTION GAUGING & TIME OF TRAVEL

The British Standards Institution (BSI) has a small working group engaged in preparing standards for dilution gauging and time of travel assessment. Whilst these techniques are useful to practising hydrologists, it is difficult to assess how often and effectively they are used in the British Water Industry. Consequently BSI would like to hear from members who use, or have developed, methods of dilution gauging and/or time of travel assessment. In the first instance please would interested parties contact **Dr J Birt**, Principal, Catchment Management, NRA, Lower Trent Area, Scarrington Road, West Bridgford, Nottingham NG2 5FA. Contact will not lead to further involvement in BSI activities unless specifically desired by the individual or organisation!

Soils, Water and Engineering

BHS South-West Section Meeting 29 November 1989

This meeting was held jointly with the South West England Soils Discussion Group and a sizeable audience assembled in the Lambert Lecture Theatre of Seale Hayne Faculty of Agriculture, Food and Land Use, Polytechnic South West, for an afternoon of papers devoted to pure and applied work at the interface of soils, water and engineering.

This theme gave scope for four presentations which differed considerably in purpose and perspective. In the first, **Malcolm Anderson** (University of Bristol) focused on problems of road construction; he discussed the coupling of hydrological research methods with standard engineering investigations in order to improve our understanding of instability phenomena and to enhance design criteria. Professor Anderson drew his examples from tropical areas, and illustrated how an understanding of slope instability can be complicated by scale factors which may lie beyond those considered in conventional analysis, as well as by political considerations which cause individuals to ignore instability hazards, and by vegetation cover which may affect resistance to failure in a non-linear way. The facts that slopes are 3-D rather than 2-D phenomena and that slope hydrology may be changed by landuse practice also introduce complexity into probability of failure at different depths within the soil body.

Professor Anderson showed how modelling could be used to develop a design chart for the stability of slopes under given conditions. He illustrated this approach with an example which suggested that variations in antecedent moisture influenced the factor of safety much more than differences in soil strength. He concluded that although this research had been undertaken mainly in tropical environments, it would be equally applicable to other climatic zones.

The second presentation was given by **Jim Pontin** (Soil Mechanics Limited) who used a number of very amusing visual aids to emphasise the engineering problems caused by water in soils. In this context, soil material was loosely interpreted to include geological strata, and examples were given to highlight the crucial importance of groundwater conditions in foundation engineering. Quoting Robert Stevenson and K. Terzaghi, Mr Pontin bemoaned the fact that although instability arising from waterlogged sediments has been both recognized and theoretically analysed for a long time, it continues to present problems to the civil engineer today. The principle of effective stress was seen as the key one in understanding the role of water in ground instability, and Jim Pontin's graphic demonstration of this concept using two vacuum-sealed packets of coffee and a safety pin will linger long in the memory of those who attended this meeting!

He went on to advocate the use of porosity measurements to estimate permeability values for incorporation in soil mechanical analysis, before reviewing a number of case studies in which groundwater conditions had posed problems for the foundation engineer. The latter included the construction of the portal of the Channel Tunnel and the analysis of instability phenomena. It was argued that shear strength properties of soils, the influence of geology on instability and methods of analysing slope stability are reasonably well, or well, known but that our knowledge of pore pressure in hillslope soils, which represents the major transient factor in the occurrence of instability, is at present rather poor. Manual and automatic methods exist for measuring pore pressure, but they may be limited by failing to account properly for flows in macropores, and by their cost of installation.

Pore-pressure data are an important component of slope stability models, which Professor Anderson suggested could be based on a single and static groundwater level in the soil, or could attempt to describe the physical processes involved, employing principles of soil physics. The latter approach was favoured, and 1-, 2-, and 3-dimensional models have been developed at Bristol University in which water is routed through a cell structure representing the soil mass on a hillslope. Although such hydrological simulations inevitably reflect the particular physical equations, discretization and numerical methods employed, they are very amenable to the development of search procedures which, in combination with standard engineering analysis, allow the worst possible stability conditions to be identified at a given time within a storm event. Such models can readily be applied to assess the success of concreting hillslope sections to prevent infiltration, to investigate the effectiveness of different vegetation cover in stabilising slopes and to predict the form of failure on hillsides of particular 3-D morphologies. By running models under a variety of different scenarios of rainfall intensity and duration, it is possible to predict a family of potential slip surfaces for a given slope and to forecast the design of motorway cuttings. Ways of ameliorating groundwater problems were reviewed: they varied according to the grain size of the geological strata involved. In coarse materials which are too permeable, sealing of pores may be effected through the introduction of grout, bentonite clays or calcium silicates, whereas medium-grained deposits might require evacuation of groundwater through drainage or pumping. Electro-osmosis was advocated as a method which could be applied to improve groundwater conditions in

fine-grained materials. The efficacy of this process was illustrated by a wide range of actual and potential applications which included the construction of U-boat pens in World War II, the reduction of energy needed to plough soils in Israel and a plan to free the Titanic from the sea bed.

In conclusion, Mr Pontin referred again to the problems associated with the present construction of the Channel Tunnel. Engineering difficulties with this venture could be traced back to the time of Thome de Gamund who had investigated the sea-bed geology on several occasions by being attached to a rope, weighted with stones and dropped to a depth of 33 m before deciding that a tunnel was not feasible! It was a surprise to the speaker, given the long-standing interest in this project and the body of mechanical theory available, that conditions encountered during the present phase of construction were a lot wetter than had been anticipated, and he suggested this was a good example of why further attention should be paid to groundwater mechanics.

In the third presentation, **Malcolm West** (NRA Wessex Region) turned from the fluvial to the marine environment and considered the engineering problems and solutions associated with coastal defence works in the Wessex region. A distinction was drawn between coast protection, where the need is to prevent cliff erosion, and sea defences, which are erected to stop inundation of coastal margins. The division of responsibility between different local and national authorities complicates the development of an overall strategy for protecting coastlines, and cost-benefit analysis has to be undertaken rigorously to assess properly the workability of any engineering schemes.

Classification of substantial tracts of the 'Wessex' coastline as Areas of Outstanding Natural Beauty or as Sites of Special Scientific Interest obviously constrains the engineering works which can be undertaken, and the difficulties of evaluating fully the loss of amenity from coastal erosion complicate a proper assessment of the benefits associated with coastal protection. Application of the Contingent Valuation Method, developed at The University of East Anglia, was seen as a way of overcoming the latter problem. Mr West highlighted the practical difficulties of coastal defence by indicating that 620 km² of land are protected from the sea in the Wessex area and without such defences, sea fishing would become possible from Glastonbury Tor! Protection is afforded in a number of different ways, including natural barriers such as shingle ridges and sand dunes, and artificial structures such as rock-armoured earthen embankments and vertical hard defences in the form of sea walls. The latter include the relatively old structure at Watchet and the modern wave return wall at Burnham, which is the largest of its kind in Europe. Natural barriers may require human assistance to maintain their protective capability: this may take the form of dozing back material displaced from shingle ridges in storm events or pumping material to reform beaches denuded by littoral drift.

Many of the problems of coastal defence in the Wessex region are encapsulated by the case of Chesil Beach. This unique natural structure can be overtopped by large storms as occurred in 1979 when 79 houses and many motor vehicles were seriously damaged in Portland. There is no gravel supply offshore and the shingle ridge is not accumulating at present, so that a problem exists of how to secure the ridge crest at an appropriate level to dissipate wave energy and to prevent flooding. The beach is an SSSI which constrains the engineering options available and a particular problem is that the three storm beaches usually present are removed in major events, making the structure very vulnerable to erosion by the occurrence of several storms in close succession. Mr West explained that erection of a hard defence at the Portland end of the structure could not be undertaken because of the difficulty in tying a sea wall to a flexible shingle ridge. Similarly, the introduction of new material to replenish the beach was ruled out by the Nature Conservancy Council because no source of sufficiently similar character could be found. The engineering solution adopted was to install a large interceptor drain to catch water infiltrating the ridge and discharge it to Portland Harbour. A trial length of ridge crest was also stabilized with a gabion cap. The special investigations required to establish the permeability of the ridge gravels were described, as were the design and installation of the large culvert structure for drainage.

In looking to the future of coastal protection in the Wessex region, Mr West stressed the need to clarify and co-ordinate the responsibilities of the various authorities involved and to take into account the impact of the greenhouse effect. A best estimate suggested that this phenomenon would raise sea levels in the next 50 years by 300 mm, and 400 mm of extra protection was being added to current designs in order to accommodate this effect.

Neil McKenzie (University of Exeter), in the last presentation, considered the advantages of estimating recharge to an aquifer in East Devon using the zero flux plane (ZFP) method. The aquifer under investigation was the Otter Sandstone (Upper Triassic), and the conventional approach to recharge estimation, employed by the Water Authority, is to construct a water balance. Neil McKenzie explained, however, that because of a 3-7% error associated with rainfall measurement and a 10-15% error associated with determining evapotranspiration, the estimate of recharge to the Otter Sandstone could vary by as much as 300 mm. It was therefore decided to instrument a site at Bicton College of Agriculture in order to monitor soil moisture conditions accurately and to determine more precisely the recharge to the Otter Sandstones. The instrumentation included six access tubes for neutron-probe determination of soil moisture content, three sets of tensiometers to establish soil moisture tension and two boreholes for measuring the height of the groundwater table. The meteorological station at the college provided the necessary information for a Penman estimate of evapotranspiration.

Drainage (recharge) was computed using the conventional water balance approach and the results were compared to estimates produced from the ZFP method, which is based on the application of Darcy's Law and the Continuity Equation to the detailed field measurements of soil moisture content and tension. Despite its limitations - the ZFP method cannot be applied to the winter period, when all water movement is downward in the soil profile, and it makes the assumption of a simple water table - Neil McKenzie was able to show the contrasting pattern of the ZFP's development in the summers of 1988 and 1989. In the summer of 1989 the ZFP was sustained and showed a steady increase in depth throughout the prolonged drought period, whereas in 1988 it appeared briefly in the late spring, showed three main periods of development in the summer which were interrupted by significant rainfall, and never exceeded one metre in depth. Estimates of drainage from the ZFP method for 1988 revealed significant recharge once the soils had wetted up at the end of 1987 and a rapid increase in drainage in the first three months of the year. Significantly, the ZFP method indicated that drainage continued to occur throughout the summer whereas the conventional water balance approach anticipated recharge would cease once a soil moisture deficit had been established in 1988 (Fig.1). Over 1988 as a whole, the ZFP method predicted 300 mm of drainage in comparison with 250 mm estimated by the water balance approach. Further analysis indicated that most of the discrepancy could be related to periods when a ZFP existed within the soil profile, and it

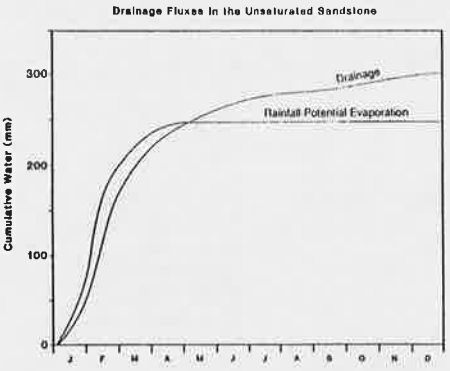


Figure 1. Comparison of recharge in 1988 calculated by the ZFP method (drainage) and the traditional approach (rainfall - potential evaporation).

was calculated for 1988 that 23% of the total drainage occurred at such times. Results for the first 235 days of 1988 suggested that nearly 40% of the recharge had taken place in ZFP periods.

The overall implications of Neil McKenzie's research are clearly that drainage does not cease at times of soil moisture deficit and that conventional methods of estimating recharge may underestimate the groundwater resources available in a region.

The wide range of topics covered in this meeting stimulated a lively and equally broad discussion, with questions being raised concerning the role of lateral flows in slope stability, the prospects for successful completion of the channel tunnel, the success of the gabion cap at Chesil Beach and the implications of 'summer' drainage to nitrate movement. At the end of an enjoyable afternoon, especial thanks were offered to **Andrew Williams** and **Rob Parkinson** for arranging and staging a successful joint meeting.

Bruce Webb
Exeter University

BHS Main Committee 1989/90

Elected Officers & Members

President:
Allan Lambert
Welsh Water
Penrhosgarnedd
Bangor
Gwynedd LL57 2DJ
Tel: 0248 351144
FAX: 0248 355192

Hon. Secretary
Prof Geoff Petts
Loughborough University
Dept of Geography
Loughborough
Leics LE11 3TU
Tel: 0509 222791
FAX: 0509 610813

Hon. Treasurer
Dr Susan Walker
North West Water
Dawson House
Liverpool Road
Great Sankey
Warrington WA5 3LW
Tel: 0925 724321
FAX: 0925 791247

Members

Dr John Mawdsley
University of Newcastle
Dept of Civil Engineering
Cassie Building
Newcastle upon Tyne
NE1 7RU
Tel: 091-222 6000
FAX: 091-222 6613

Dr Chris Collier
A.D. Met. O.(NS)
Meteorological Office
Met. O. 24
London Road
Bracknell
Berks RG12 2SZ
Tel: 0344 856244
FAX: 0344 854412

Max Beran
Institute of Hydrology
Wallingford
Oxon OX10 8BB
Tel: 0491 38800
FAX: 0491 32256

Dr David Boorman
Institute of Hydrology
Wallingford
Oxon OX10 8BB
Tel: 0491 38800
FAX: 0491 32256

Dr Richard Harpin
Sir William Halcrow
Burderop Park
Swindon
Wilts SN4 0QD
Tel: 0793 812479
FAX: 0793 812089

Co-opted member (for 1 year only)

Frank Farquharson
Institute of Hydrology
Wallingford
Oxon OX10 8BB
Tel: 0491 38800
FAX: 0491 32256

Nominated Members

Representing IH; also BHS Editor
Celia Kirby
Institute of Hydrology
Wallingford
Oxon OX10 8BB
Tel: 0491 38800
FAX: 0491 32256

Midlands Section
Dr John Pirt
NRA Severn Trent Region
Trentside Offices
Off Lady Bay Bridge
West Bridgford
Nottingham NG2 5FA
Tel: 0602 455722
FAX: 0602 608161

Southern Section
Dr Howard Wheater
Dept of Civil Engineering
Imperial College
London SW7 2BU
Tel: 01-589 5111
FAX: 01-823 8525

South-Western Section
Peter Sims
Dept Geographical Sciences
Polytechnic South West
Drake Circus
Plymouth PL4 8AA
Tel: 0752 233053
FAX: 0752 232293

Water Engineering Group, ICE
Dudley Williams
Howard Humphreys
Thorncroft Manor
Dorking Road
Leatherhead,
Surrey KT22 8JB
Tel: 0372 376190
FAX: 0372 377605

Co-opted Members

Welsh Hydrological Group
Logan Jack
Welsh Water
Plas-y-ffynon
Brecon, Powys LD3 7HP
Tel: 0874 3181
FAX: 0874 4167

Pennines Hydrological Group
Dr John Mawdsley
University of Newcastle
Dept of Civil Engineering
Cassie Building
Newcastle upon Tyne
NE1 7RU
Tel: 091-222 6000
FAX: 091-222 6613

Scottish Hydrological Group
Prof George Fleming
Dept of Civil Engineering
Strathclyde University
John Anderson Buildings
107 Rotton Row
Glasgow G4 0NG
Tel: 041-552 4400
FAX: 041-552 0775

Secretary & Treasurer to the Main Committee:

Norman Tyler
Instn. Civil Engineers
Tel: 01-630 0726
FAX: 01-630 9177

Miss M McBride
Tel: 01-987 6999
FAX: 01538 5746

HALCROW APPOINTED FOR AUSTRALIA'S LARGEST DAM

The Halcrow Group, through Australian associates, Kinhill Engineers, has been appointed to advise and assist the Water Authority of Western Australia in the detailed design of the Victoria Dam, Perth. This commission for Australia's largest roller-compacted concrete dam follows Halcrow's earlier investment in the Platanovryssi Dam project in Greece, Europe's largest roller-compacted dam.

Victoria Dam is a 50m-high gravity dam for water supply, 23km southeast of Perth. It will replace the existing structure built in 1891 which has reached the end of its serviceable life. The new dam is being constructed within the existing reservoir basin and, to limit disruption to the water supply system, the RCC method was chosen because of its rapid form of construction. The proposed scheme is intended to double the system yield to around 6 million cubic metres per annum.

Aspects of Flooding on the Thames

BHS Southern Section/IWEM
13 December 1989

This topic attracted a vast audience at the joint meeting of BHS Southern Section and the Metropolitan Branch of the Institution of Water and Environmental Management held at Imperial College, London.

The first talk on 'Historical floods in the River Thames' was given by **Frank Law** (Institute of Hydrology). A main theme was the nature of the weather conditions leading up to the major floods. The typical event of 1809 unfolded in the following way: rain falling in very low temperatures turned to ice on impact with the ground, forming a glazed surface, and snowfalls in the following days of January built up on top. Subsequently, a rapid thaw coupled with rainfall melted the snow. The huge reservoir of water ran off ground which was effectively 100% impermeable and flooded the Thames basin from Oxford through Maidenhead down to West London. With frozen ground, only about half the precipitation is required to produce the flood obtained under normal ground conditions. Frank quoted from diaries and used records unearthed from various sources to bring the flood events to life. His vivid descriptions left us in little doubt about the size and impact of these events, summarised in the Table.

The fear in Oxford of the impending flood in 1593 was well illustrated by the fact that many of the residents left the city before the thaw. Those who remained erected makeshift flood defence walls. Unfortunately this work was to no avail as the raised banks were swept away by the flood water: a 13 foot depth of water was recorded on Christ Church meadow. Surprisingly Henley, situated in the middle of the basin, does not seem to be disaster prone - the 1809 event was only 'waist high'. In recent years the Upper Thames has so far been spared a really big storm. It was suggested that some very large events be modelled with today's ground conditions to predict the flooding. We were reminded that it is 43 years since the last flood (in 1947), which is ranked sixth by level in the last 222 years. Frank closed on an ominous note by suggesting that we are overdue for another massive one!

Pam Naden delivered a postscript on flood estimation at Days weir and demonstrated how the maximum likelihood estimation fitting technique on censored data gives very consistent flood estimates compared to the recommended FSR methods. A riparian dweller in the audience gave a first-hand account of the 1947 flood near Chertsey. When the water had subsided he found a large amount of sand and mud deposited on his garden which subsequently proved to be very fertile. **Phil Johnson** informed us that the limitation on capacity for the Thames river network is due not to any structures but to the capacity of the channel. Phil gave us a few key facts about the current Maidenhead alleviation scheme which highlights the severity of the potential flooding. The size of flood channel required in order to provide a 70- to 80-year return period protection has a capacity of 250 cumecs - the size of the Thames itself. **Howard Wheater** suggested that climate change might have an impact on the occurrence of large (snowmelt) floods.

Having heard about the flooding problem, the second presentation "Land drainage and flood alleviation" by **Phil Johnson** and **Alan Wright** (Thames Region NRA) followed on naturally. In this talk a solution was sought for the River Wandle in south London (although of course nothing can be done to alleviate the effects of the really large floods described in the first talk). Phil introduced the new NRA and gave an overview of the scheme, known as the Beddington and Mitcham Area of Opportunity (BMAO), an integrated scheme involving many parties. He commented on the number of project management difficulties, caused mainly by the lack of an overall chief project manager to resolve conflict between the various groups. Gravel extraction over the next 15 years will create a lakeland area which will provide storage for the diverted peak flood flows.

Alan Wright then explained some of the channel works in more detail. The optimum return period for the benefit-cost ratio was found to be 100 years. A slide of the 100-year return period flood envelope superimposed on a map of the area showed 590 houses and 41 industrial units at risk. The need for the scheme to enhance the environment was stressed and we were shown how environmental consider-ations had influenced the design of the scheme. When the gravel extraction is completed the benefit-cost ratio will be 1.35. As it was getting late, Alan cut short his talk and opened up the meeting for discussion.

The benefit-cost analysis was taken up by the audience. We were told that the potential change in land use - i.e. more development as a result of the reduced flood risk - is not assessed as a benefit. The gravel extraction was not included as a benefit either. The high level of vandalism in the area was taken into account in the design of the overflow diversion structure: a design with moving parts was ruled out. A word of warning came from **Graham Thompson** about the need to avoid resuspension of solids as flow passes through the lakes.

Attendance at the meeting was much larger than expected: because a last-minute attempt to switch the venue to Wembley stadium was unsuccessful, many in the audience had to stand. Despite the over-crowding, however, we were well rewarded with two very stimulating talks.

David Hyde
NRA, Thames Region

Thames Flood Level Rankings from 1768
(developed from P P Griffiths "A Chronology of Thames Floods" 1983 Second Edition
Thames Water Engineering Directorate Report 73)

Location	Rank (1)	(2)	(3)	(4)	(5)	(6)	Data Start
St Johns	(1809?)	(1821?)	1903	1894	1947	1875 (=1774?) =1900/1968	1872
Clifton/Long Wittenham	1809	1821	1894	1774 =	1875	1947	1768
Days Lock	1809	1894	1821	(1774?)	1882	1947	1809
Shillingford Wharf	1809	1894	1821	1768	1947	1852	1768
Whitchurch	1774	1768	1809 =	1894	1770	1947	1768
Boulters Lock, Maidenhead	1809	1774	1795 =	1821	1894	1947	1774

All floods since 1894 are very thoroughly listed by head and tailwater levels at every Thames Lock in Thames Conservancy (1965) Statistics of Rainfall, Flow and Levels of the River Thames above Teddington for 82 years 1883-1964, Vol 1 (and subsequent annual appendices).

Earlier flood marks from 1821 were provided by Curtis and Holgate in the Report of the Select Committee on Thames Floods Prevention (Upland Waters) 1877, as updated in the 1885 Report of the Committee on Decrease of Water Supply.

BOOKS

Introductory text

Hydrology - An Introduction to Hydrologic Science, R. L. Bras, 1990. 643 pp. Addison-Wesley Publishing Company, Wokingham, UK. £16.95 Hardback. ISBN 0-201-05922-3

On first glancing through this book one has the impression that the approach and choice of subject matter lie somewhere between Eagleson's Dynamic Hydrology and a traditional engineering hydrology text: on reading the preface it appears that this was the author's intention. He has achieved his objective with, perhaps, more weight being given to Eagleson than to traditional engineering hydrology.

The book is an introduction to hydrology with a strong emphasis on the fundamental principles underlying the subject. After a short introductory chapter there follow two well-written chapters describing the earth's energy balance and atmosphere. These are followed by chapters on precipitation, evaporation and snowmelt which are rigorous but not too much so. The chapter on groundwater is conventional and offers nothing new. A separate chapter is devoted to flow in the unsaturated zone. The underlying equation describing unsaturated flow is developed and various solutions, both analytical and empirical, are set out and discussed. The ever growing problem of soil and aquifer pollution, and consequent increased interest by many more hydrologists in the vadose zone make this chapter most welcome. A separate chapter is devoted to describing streamflow hydrographs: this includes a detailed, clear and well written section on unit hydrographs. The treatment of the theory underlying the International Unit Hydrograph is particularly well set out. Similar comments can be made about the chapter on flood routing, where a well balanced position has been taken between mathematical rigour and practical hydrology. The kinematic wave approximation and the diffusion analogy are well described and the implications arising from these simplified approaches clearly discussed. The remaining two chapters are concerned with probability and fluvial geomorphology. Both chapters are well written and start from first principles. The chapter on probability concludes with a section on future directions that probabilistic hydrology might take, and it includes a welcome sub-section on the oft neglected subject of palaeohydrology. Fluvial geomorphology is an area which hydrologists with a civil engineering background have tended to ignore: the inclusion of an introductory chapter in a text of this nature is therefore welcome. My overall impression of this book is that it is a well written text with carefully chosen subject matter which the great majority of hydrologists will find both useful and enjoyable to read.

Ian Goodwill
Leeds

Pereira's book in paperback

Sir Charles Pereira's book "Policy and Practice in the Management of Tropical Watersheds", reviewed in *Circulation 24*, is also printed in paperback form, not for public sale, but for distribution to colleges and libraries in developing countries by WINROCK, the Rockefeller agency; it is also being reprinted as a paperback in India.

EDUCATION AND TRAINING

The BHS Education and Training Subcommittee is continuing to have discussions with the Institution of Civil Engineers to ensure that the procedures which hydrologists have to follow in order to sit their Professional Examination become easier to understand and interpret.

ICE are currently defining a set of core objectives for all candidates. These are to be sufficiently generalised to cater for candidates from all backgrounds. The specialist hydrology route will be discontinued, but assurances have been given by ICE that candidates who would previously have gone through the specialist route will not be disadvantaged. Until the new core objectives are finalised, potential candidates are asked to refer to the requirements listed for hydrology specialists in ICE 43 (The Route to Corporate Membership).

As a result of discussions with BHS, ICE are taking steps to ensure that candidates with specialist hydrological experience are examined by an examiner who also has substantial experience in hydrology. This has not always been the case in the past.

Regional Training Advisers have been asked to refer potential candidates whose sole background is hydrology to **Sue Walker**, chairman of the BHS Education and Training Sub-committee.

Any BHS members considering Civils as a route to professional qualification who require advice are asked to contact Sue (at North West Water Ltd, Tel: 092572 4321) or other members of the E & T Sub-committee:

Terry Evans (Mott Macdonald, Cambridge Tel: 0223 460660);

Frank Farquharson (Institute of Hydrology, Tel: 0491 38800);

Howard Wheater (Imperial College, London, Tel: 01-589 5111).

Registration Fees for BHS NATIONAL MEETINGS

In line with a decision taken by the Main Committee in July 1989, the following minimum registration fees will apply to BHS National Meetings from 1st April 1990:

Members	£5
Student members	Nil
Non members	£10
Non members (students)	£5

It has been necessary to take this step in order to cover the increased costs associated with the Society's meetings.

Publications

HYDROLOGICAL DATA UK 1988 YEARBOOK

The 1988 Yearbook in the Hydrological data UK series was published in mid-December. This represents an important milestone for the Institute of Hydrology and the British Geological Survey - the joint publishers - since it is the first occasion for over 25 years that national hydrological data have been made available, in yearbook form, on a following-year basis.

The 1988 Yearbook brings together the principal data sets relating to areal rainfall, river flows and groundwater levels throughout the United Kingdom. Water quality data are also included for a small network of monitoring stations. A comprehensive review of hydrological conditions throughout 1988 is provided, with particular attention directed to the early development of the 1988/89 drought; the volatile climatic conditions over the recent past are also considered within the historical perspective provided by lengthy hydrometric records. Long river flow records are, unfortunately, rare in the UK and the use of historical information to complement gauged flow records - and thereby to provide improved estimates of return periods - is examined in a feature article devoted to two notable flood events in Truro.

Copies of the Yearbook may be obtained (price £15 bound, £12 loose leaf) from **Shirley Black** at the Institute of Hydrology. An order form is enclosed with this issue of *Circulation*.

Floods of the Garonne

The Institute of Hydrology has received a copy (in French) of a major two-volume work on the floods and floodplain of the Garonne from the Spanish border through Toulouse down to Bordeaux. Colour prints at 1:25 000 scale show the 10 and 100 year flood plains together with details of flood level record sites and much else besides.

The review of historic floods begins with 11 March 1281 (72 hours rain). The top-ranking flood in the upper river was in June 1875, a year of notable floods in Southern England too. However in mid-basin it would appear that October 1435 reached a level 0.8 m higher than the 1875 event. Lower down past Langon the March 1930 and April 1770 floods surpassed 1875.

Those interested in benefit/cost studies and flood hydraulics will also find sections of interest. Historians will enjoy the facsimile appendix of an original report of the flood of 7 June 1712; its style is similar to English equivalents of that era.

There are several sites with Gumbel distribution flood flow (and volume) plots, the longest of which are for St Beat (122 years), Toulouse (1827-1986), Agen (1852-1985) and Marmande (1846-1986). For Toulouse 1875 is plotted as a 2000-year flood at about 3.5 times the mean annual flood. By the time that flood reaches Marmande it is closer to a 100-year chance, which seems a more comfortable estimate, if that is a proper phrase for any flood.

The text contains a wealth of readable statistics, and **Frank Law** will be happy to provide the volumes on short loan to any BHS member. The authors are a regional syndicate of French companies and universities.

Catchment instrumentation

IH Report No. 105: *The instrumentation of flat low-lying catchments for hydrological research* by D C W Marshall. Price £6.00 from the Librarian, Institute of Hydrology, Wallingford, Oxon OX10 8BB.

This recent addition to the Institute of Hydrology Report series details experiences acquired on Newborough Fen (Cambs), Boy Grift (Lincs) and West Sedgemoor (Somerset) as part of a research contract for MAFF, Wessex Rivers and the Nature Conservancy Council.

The report concentrates on the practical aspects of the instrumentation of low-lying catchments for data collection. Among the topics covered are background catchment data, surveys, instrument deployment, measurement of drain level and flow, recording pumping station flow, water table measurement and problems originating from wind and drain weed. Actual experiences encountered are outlined and the report concludes with a look at problems of data storage and vandalism. An appendix summarises the extent and type of data collected from each of the three catchments.

NEWS FROM MEMBERS

New PhD in hydrology

We congratulate **David Boorman** not only on becoming a BHS committee member but also on receiving his doctorate from Lancaster University. This was the abstract of his thesis, "*A new approach to unit hydrograph modelling*":

Unit hydrograph based models of catchment response are well understood and widely used. Most studies of such models have concentrated on the derivation of a unit hydrograph from a single event. This thesis examines two other aspects of unit hydrograph modelling, namely the derivation of a catchment average unit hydrograph, and the choice and refinement of a rainfall separation model. The idea of superposing separated event data prior to unit hydrograph derivation is seen to be an acceptable and computationally efficient way of deriving a single unit hydrograph to represent typical catchment response. The choice of rainfall separation model is investigated using an iterative feedback technique in which the average unit hydrograph and separated flow data are used to give a 'detected' rainfall excess profile (i.e. the rainfall that, when convolved with the average unit hydrograph, best reproduces the response runoff). Problems such as the derivation of negative rainfalls are identified and solved in the process of developing a comprehensive package of detection routines. The detected rainfalls are used in a semi-objective way to refine the rainfall separation model. Examples are given using the catchment above St. Michael's on the River Wyre in northwest England.

United Nations post

John Rodda, Director of Hydrology and Water Resources at the World Meteorological Organization (WMO), was elected Chairman of the UNACC International Secretariat Group on Water Resources in October 1989. This group co-ordinates joint iniatives of the UN and those of its Agencies, e.g. FAO, WHO, and UNESCO, which have programmes in the field of water.

FORTHCOMING EVENTS

Meetings

BRITISH SOIL WATER PHYSICS GROUP
Application of Soil Physics to Environmental Problems
13 March 1990
Southampton University

This meeting to be held at the Institute of Irrigation Studies will convene with a buffet lunch (cost about £4.50) at 12.00; the discussion will be from 1.00 pm until around 5.30 pm.

Contributions on this theme are invited. If interested in attending and/or making a presentation please contact **Dr David Rycroft,** Institute of Irrigation Studies, The University, Southampton SO9 5NH, Tel:0703 592887, FAX 0703 593017. Please state whether you would like luncheon. A notice will be sent out with details of the arrangements.

ROYAL METEOROLOGICAL SOCIETY - BRITISH HYDROLOGICAL SOCIETY
Natural Disaster Reduction: How Meteorological and Hydrological Services can Help
28 March 1990
Royal Society, London

This meeting to mark World Meteorological Organization Day 1990 and the start of the United Nations International Decade for Natural Disaster Reduction (IDNDR) will be opened by **Dr K.A.Browning** (President FRS), Chairman of the morning session, at 10.00. Lunch is from 12.30 - 2.00 pm and the afternoon session will be chaired by **Prof P.O.Wolf** (F.Eng, Past President BHS). A full list of papers was given in *Circulation 24* : there will be five papers in the morning session, four in the afternoon.

Anyone interested in registering should write to **Chris Collier** giving their name, address and affiliation and stating whether or not they would like lunch (at a cost of about £12). The registration fee is £3.00 for BHS Members or Fellows of the RMS, £6.00 for others. Cheques should be made payable to the Royal Meteorological Society.

For further details please contact Dr Chris Collier, Met. O. 24, Room 104f, Meteorological Office, London Road, Bracknell, Berks., RG1 2SZ. Telephone Tel.: 0344 420242 Ext 6244. Telex: 849801.

INTERNATIONAL CONFERENCE ON PUMPED STORAGE
2-4 April 1990
Imperial College, London

An International Conference, co-sponsored by the Institution of Civil Engineers and the Institution of Mechanical Engineeers, has been planned to cover subjects under three headings:

- Operational experience, including performance, maintenance and refurbishment of existing schemes;
- Latest developments in the design specification and construction of current or projected schemes;
- Evolving roles, other forms of pumped storage and their integration into power systems.

Papers will be presented by authors renowned in their field, both from the UK and overseas. Workshop sessions have been introduced to encourage discussion on special facets of pumped storage - hydraulic phenomena, use of remotely operated submarine vehicles (ROVs), tunnel linings, seals and bearings. A visit to Dinorwig, North Wales, the largest pumped storage scheme in Europe, with the fastest response of any system in the world, is being organised for April 4.

For further details please contact:
The Conference Office
Institution of Civil Engineers
1-7 Great George St
Westminster, London SW1P 3AA
Tel: 01-222 7722

EUROPEAN GEOPHYSICAL SOCIETY
XV GENERAL ASSEMBLY
23-27 April 1990
Copenhagen, Denmark

With an annual General Assembly attended at present by some 1200 scientists, the European Geophysical Society provides an excellent

opportunity for European hydrologists to interact as a group and with the larger community of geophysicists.

HYDROLOGY PROGRAMME:

Co-sponsored by the International Association of Hydrological Sciences, there will be a wide-ranging programme with six topics, a focus on climate change issues, interaction with meteorologists and climatologists, and *travel awards for young scientists.*

Topics in the open sessions:

- Predicting the impacts of climate change on water resources (April 24): Convenor **Prof W.B.Wilkinson**, Institute of Hydrology
- Present and future gaps in snowmelt measurement and modelling (April24): **Dr R.Lemmela,** Hydrological Office, Helsinki
- Physically based modelling of flow,sediments and solutes at the catchment scale (April 25): **Dr J.C.Refsgaard,** Danish Hydraulic Institute
- Theoretical basis for the estimation of extreme floods and droughts (April 25): **Prof E.Todini,** Instituto di Costruzioni Idrauliche, Italy

Topics for the symposia:

- Measurement, modelling and forecasting of rainfall in space and time (April 27): Convenors **Prof P.E. O'Connell**, University of Newcastle, and **Prof R.Rosser**, LAMP/OPGC, France
- Land surface-atmosphere processes (April 25-26): Convenors **Dr L. Dumenil,** Meteorologisches Institut, Hamburg, **Dr J.P. Goutorbe,** CNRM, France and **Dr J.P. O'Kane,** University College, Ireland

For further information please contact **Prof Enda O'Connell** at the Department of Civil Engineering, University of Newcastle-upon-Tyne, Claremont Road, Newcastle-upon-Tyne NE1 7RU. Tel: 091-222 6000. Fax: 222 6669.

BHS NATIONAL MEETING
The Future of Distributed Modelling
25 May 1990
University of Lancaster

Over the last 20 years physically-based distributed models have found increasing use in hydrological research in parallel with the rapid development in the availabity of powerful computers to the researcher. This meeting at the Centre for Research on Environmental Systems is intended to focus on the achievements, applications and problems of using distributed models with a view to clarifying some of the issues. To try to simulate discussion, a somewhat unorthodox framework will be used. Three speakers (**Enda O'Connell / James Bathurst,** University of Newcastle; **Karsten Högh-Jensen**, Technical University, Copen-hagen, and **Keith Beven**, University of Lancaster) have been given the identical task of trying to predict the future for distributed models. Current practice will be presented in a poster session. Coffee will be at 10.00 am, with two talks in the morning, followed by lunch at 1.00 pm. The poster session will be at 2.00 pm and the final talk at 4.00 pm.

Poster papers on any aspect of the use of distributed models are invited. Anyone interested in presenting a poster paper should contact **Keith Beven** at CRES, University of Lancaster, Lancaster LA1 4YQ (Tel: 0524 65201 Ext 4312). It is hoped to produce a special issue of *Hydrological Processes* devoted to this topic. Full papers should be prepared in time for the meeting and submitted to Keith Beven: they will be reviewed in the usual way.

First Announcement
ANNUAL CONFERENCE OF THE ASSOCIATION OF MUNICIPAL ENGINEEERS
25-29 June 1990
Harrogate

The theme of this conference will appeal to all who are keen to preserve and enhance the environment in the face of increasing demands made by today's consumer-oriented society. Such an objective will be achieved only by concerted action. We are all partners in the environment and our political representatives will be welcome at the conference to debate with professionals and others the way forward as partners.

The conference will be held at the Old Swan Hotel, near the centre of Harrogate. Visits will include the following: Preparations for the World Student Games in Sheffield - Construction of Europe's largest shopping centre - The Countryside Commission's Activities in the North York Moors - Road and bridge works in the West Yorkshire Metro-politan Area. The registration fee is £184 for corporate members of the Institution and £212 for non-members of the Institution.

Please address any queries to: The Conference Office, Institution of Civil Engineers, 1-7 Great George Street, London SW1P 3AA Tel:01-222 7722

First announcement
INSTITUTION OF CIVIL ENGINEERS CONFERENCE
Advanced Technology in Water Management
27-28 November1990
London Press Centre

The conference will review the state-of-the-art of advanced technology used in the water industry and will provide an opportunity to look ahead to the challenges of the future and their impact: case studies will be an important feature. It was 10 years ago that a National Steering Group reported on Instrumentation, Control and Automation in the Water Industry. Since then substantial changes have taken place in all aspects of advanced technology, and new factors have arisen such as water privatisation and a higher priority for environmental considerations.

There will be a small exhibition, and potential exhibitors should indicate their interest. For further details please write to: The Conference Office, Institution of Civil Engineers, 1-7 Great George Street, London SW1P 3AA. Tel:01-222 7722.

Copy Deadline for Issue No. 26
6th April 1990

First Announcement
INTERNATIONAL CONFERENCE
Slope Stability Engineering - Developments and Applications
15-19 April 1991
Shanklin, Isle of Wight

This Conference aims to present a "State-of-the-Art" of studies of natural slopes, highlighting recent developments. It will interest all those professionally involved with the behaviour of natural slopes of soil or rock. The Proceedings will feature papers and short "technical notes": case studies will be particularly welcome.

Topics are:

* Mechanics of landslides
* Environmental influences
* Planning aspects of slopes
* Investigation techniques
* Coastal slopes
* Remedial works

Prospective authors are invited to submit synopses of 300-400 words outlining the scope of the paper, the main topics and the conclusions reached by **no later than 1 March 1990.** Papers that are selected will be refereed. Final drafts of papers (approx. 5000 words or <2000 words for Notes) will be required by **1 August 1990** and the final versions (in camera-ready form) by **1 November 1990.** Pre-prints of the papers will be available prior to the conference; a bound copy of the proceedings, including discussion, will be sent to all delegates.

The Isle of Wight is a suitable venue, because of its varied geology, extensive coastline and many landslides, including the town of Ventnor. Co-sponsors are the Engineering Group of the Geological Society, the Institution of Civil Engineers and South Wight Borough Council. Programme and registration details may be obtained from the Conference Office, ICE, 1-7 Great George St, London SW1P 3AA.

Diary

28th February 1990
BHS Southern Section
"Operational water quality management"
Time: 5.30 pm
Venue: Imperial College, London
Contact: Nigel Arnell, Institute of Hydrology

9th March 1990
Scottish Hydrological Group
"Satellite remote sensing in hydrology" -
E. Barratt (Bristol University)
Time: 6.00 pm
Venue: No. 2 Lecture Theatre, University of Strathclyde, Glasgow.

25th April 1990
BHS Southern Section
"1989 and beyond: climate and water management"
Joint meeting with the Association of British Climatologists at the Institute of Hydrology, starting at 2.00 pm, followed by the BHS Southern Section AGM at 5.10 pm.
Contact: Nigel Arnell, 0491-38800.

25th May 1990
BHS National Meeting
"The future of distributed modelling"
Venue: University of Lancaster - details above.

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 £15 (£7.50 to students).Please address all correspondence to the Editor, Celia Kirby, Institute of Hydrology, Wallingford, OX10 8BB. Telephone: 0491-38800 extension 2360.