



PREDICTIONS IN UNGAUGED BASINS

Issue 1.1

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Newsletter



PUB is an IAHS initiative aimed at uncertainty reduction in hydrological practice
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IN THIS ISSUE:

MESSAGE FROM THE PUB CHAIR

PUB OFFICE AT THE INTERNATIONAL
WATER MANAGEMENT INSTITUTE

PROMISE, BACKGROUND, STRATEGIES AND
FUTURE PERSPECTIVES OF PUB

NEWS FROM PUB WORKING GROUPS

FORTHCOMING PUB EVENTS

PUBLICATIONS

blurred. PUB has already effected change in research approaches and direction as evidenced by the activities of, and participation in, the many PUB working groups and via their findings presented at recent international conferences and reported in recent international journals.

This newsletter marks yet another milestone for the PUB movement and begins a role for PUB in the extension and transference of knowledge to the developing world. The partnership with the International Water Management Institute (IWMI) provides a wonderful opportunity to connect PUB science and scientists to real-world problems in areas with scant data. We also hope that this newsletter helps PUB penetrate further to the international hydrological community and keep colleagues abreast of PUB science developments.

MESSAGE FROM THE PUB CHAIR

Welcome

On behalf of the PUB Science Steering Group, I welcome you to this first PUB Newsletter. PUB has made great strides forward since its inception in 2003. The PUB Science Plan, published in the December 2003 issue of the *Hydrological Sciences Journal* is a veritable manifesto for change in the hydrological sciences—one that calls for a movement away from reliance on calibration-based models to new process understanding and models applicable to regions with sparse data. This marks a turning point in hydrology where experimentalists are now talking to, and working with, modelers, where modelers are interacting with theoreticians, where engineers and scientists are beginning to better communicate and where the distinction between applied and basic research is

Current PUB Organization and Management

The PUB Decade was initiated by the then Science Steering Group Chair, Murugesu Sivapalan, and the then IAHS President, Kuniyoshi Takeuchi along with a PUB Science Steering Group and Science Advisory Group. A decision was made from the outset that the PUB would be a bottom-up movement with minimal bureaucracy. The leadership of PUB changes every 2 years. It is important to have, over PUB's 10-year life span, broad community involvement and a constant flow of new ideas. I lead the current PUB phase (the second PUB Biennium) and Chair the Science Steering Group. PUB has six major science themes, with each theme led by a troika (who also serves on the PUB Science Steering Group):

Theme 1. Basin intercomparison and classification
Marc Stieglitz, USA; Ross Woods, NZ; Günter Blöschl, Austria

Theme 2. Conceptualization of process heterogeneity
Stefan Uhlenbrook, The Netherlands; Chris Soulsby, UK;
Simon Lorentz, South Africa

Theme 3. Uncertainty analyses and model diagnostics
Thorsten Wagener, USA; Jim Freer, UK; Erwin Zehe,
Germany

Theme 4. Development and use of new data-collection
approaches
Witold Krajewski, USA; John Gibson, Canada; Hubert
Savenije, The Netherlands

Theme 5. New hydrological theory
Peter Troch, The Netherlands; Jim Kirchner, USA; Louise
Heathwaite, UK

Theme 6. New model approaches
Barry Croke, Australia; John Pomeroy, Canada; David
Post, Australia

In addition, a seventh Theme was added following the
IAHS 2005 conference in Brazil

Theme 7. National Working Groups (WGs) and PUB
Tech Transfer
Ian Littlewood, UK; Yasuto Tachikawa, Japan; Chris
Spence, Canada

Rounding off the new SSG are two additional key
members, Dawen Yang (China) and Vladimir Smakhtin
(Sri Lanka). Dawen leads PUB efforts in China and
Vladimir is spearheading technology transfer in South
Asia through his activities with the International Water
Management Institute.

How to Become Involved in PUB

The future of PUB is in your hands, the individual
scientist, researcher and/or graduate student. PUB
science is conducted by working groups of likeminded
individuals (often cutting across disciplinary and
geographical space). Starting a working group is easy.
The only prerequisite is to develop new approaches for
reducing model, data and process uncertainty in
ungauged basins – in line with a PUB Science Theme.
I hope this newsletter will convey the sense of
excitement with the PUB community. I encourage you
to become involved!

Jeff McDonnell, Oregon State University, USA
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PUB OFFICE AT THE INTERNATIONAL WATER MANAGEMENT INSTITUTE

PUB has by now become a global activity and network.
To facilitate communication and information exchange
between growing number of PUB Working Groups and
interested individuals, and to expand PUB coverage to
practitioners and policymakers, particularly in
developing countries, the PUB Secretariat was
established at the headquarters of the International
Water Management Institute (IWMI) in Colombo, Sri
Lanka in January 2006. The activities of the Secretariat
include:

- Compiling and maintaining the comprehensive
PUB mailing list
- Setting up, building the content and regularly
updating the PUB web site at IWMI
- Producing the quarterly PUB Newsletter
- Regular communication with PUB theme leaders
and WG leaders
- Providing information on PUB-related events,
relevant funding opportunities, etc.
- Ensuring long-term funding of the Secretariat
- Organizing and facilitating PUB workshops and
expanding PUB outreach in developing countries

Vladimir Smakhtin leads the “PUB Project” at IWMI.
Saman Weerakoon, contracted by IWMI from the
University of Peradeniya, Sri Lanka is building the
content and is maintaining the new web site, newsletter
and mailing list during 2006. The support of IWMI’s
information and communication services is also
ensured. We are aiming to launch a new PUB web site
at the end of March or early April 2006. The PUB
mailing list is being compiled. Registered members of
the PUB WGs and many other individuals are already
in the PUB mailing list. New members who wish to
receive this Newsletter and other information from the
Secretariat may join the list by sending an email to
iwmi-pub-secretariat@cgiar.org or
s.weerakoon@cgiar.org. It will also be possible to join
the PUB mailing list on-line through the new web site.

IWMI is one of the 15 Research Centers supported by
the network of over 60 governments, national and
international organizations collectively known as
CGIAR – Consultative Group on International
Agricultural Research. IWMI is the lead Water Institute
within this system and one of the leading research and
knowledge centers in the water sector in the world
(<http://www.iwmi.cgiar.org/>). It has offices in many

countries in Africa and Asia and a mandate for improving water management in developing countries and globally. IWMI conducts hydrological research in the context of scaling-up water productivity from field to basin level, environmental flows, river and wetland modeling, etc. The Institute is well positioned in the South and has established networks which could be brought into the PUB orbit, thus expanding its coverage.

Director General of IWMI, Frank Rijsberman, explains: “IWMI sees a number of benefits from PUB development including better quantification of hydrological processes in poorly gauged basins where we operate, better awareness and use of the PUB-generated knowledge, tools and methods in IWMI’s future research, expanding our network and partnerships, highlighting bottlenecks of hydrological activities due to data limitations, working with relevant agencies to improve data access and sharing opportunities for hydrological analyses in the developing world”.



A bird’s-eye view of the International Water Management Institute (IWMI) in Colombo where the PUB Secretariat is housed.

The PUB Secretariat is supported entirely by IWMI at present but additional funding from international partners is being sought to expand the activities of the Secretariat and diversify its functions in the future.

The PUB mailing list, web site and this newsletter are the first outputs of the PUB Secretariat. We would like to make PUB communication products informal, novel and useful, and as is the case with everything new, we are experimenting. The PUB newsletter is, of course, not refereed, although it goes through the normal editing procedure at IWMI. We do not, at this stage, limit its size or the number of issues per year (although 3-4 issues a year should probably suffice). The design

of the Newsletter is also not cast in concrete. We encourage all PUB members to communicate information on PUB-related work and events for publication in the PUB Newsletter and/or the website. We also invite information on research highlights, commentaries on various thematic PUB issues, and provocative ideas. Through all this, we will try to make sure that there is a good balance of technical information and announcements. The newsletter, for now, will be distributed through the Internet only. Dispatching a hard copy newsletter may, in principle be possible in the future, subject to demand and additional funding.

As for the web site, for a start, it will, of course, have some background information on PUB, its history, status, organization and events. But we would like to take it much further in the near future and add sections such as a new ideas market place (or a dynamic storage, perhaps similar to Google Video), job announcements, donor information and calls for proposals, etc. All information received will be regularly placed on the web site through the web admin panel. We may consider developing a set of sub-admin panels, which would allow Theme troikas and/or WG leaders to add information and announcements to the PUB site, themselves. However, we need to know first, if there is a demand for this, so we request you to write to us.

We are looking for comments to all of the above and will consider any other ideas on how to make the most of the modern communication tools provided by the Internet, how to stimulate PUB discussions, information exchange, scientific innovation and outreach.

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PROMISE, BACKGROUND, STRATEGIES AND FUTURE PERSPECTIVES OF PUB

The Promise of PUB

The establishment of the PUB Secretariat at IWMI Headquarters in Colombo, Sri Lanka, represents an important milestone in the evolution of the PUB movement. It indicates many things. First, it indicates stability and continuity, i.e., PUB is here to stay. Second, it is a sign of confidence in PUB. Third, it is an acknowledgement of the enthusiasm for PUB in Asia. Fourth, it will mean greater communication amongst the PUB community. It is a welcome development. I

congratulate IWMI and Jeff McDonnell, the Chair of the PUB SSG, for making this possible. For those not familiar with PUB, I give some background about its genesis and subsequent growth, and assess its future prospects.

Background to PUB

Hydrological prediction, where data are available, is relatively easily achieved albeit subject to significant uncertainties. However, the problem of ungauged basins presents considerable difficulties. Over recent decades there has been a continual decline in hydrological gauging networks, reducing the accuracy of hydrological predictions whilst increasing the uncertainty associated with predictions and management of water quantity and quality. The International Association of Hydrological Sciences (IAHS) has launched the Predictions in Ungauged Basins (PUB) (2003–2012) initiative with the aim of “formulating and implementing appropriate science programmes to engage and energize the scientific community, in a coordinated manner, towards achieving major advances in the capacity to make predictions in ungauged basins” (Sivapalan et al. 2003).

Recognizing the diversity of interests and expertise of hydrologists, and practical prediction needs, PUB has adopted a philosophy of plurality in terms of applications, hydro-climatic regions and prediction methods, yet converging with a single-minded focus on the assessment, and eventual reduction, of predictive uncertainty. The main engines of PUB activities are PUB Working Groups, formed in a self-organizing manner, and cutting across traditional boundaries of specialization.

PUB is a 10-year initiative, and 2005 represents the completion of Phase 1 (the preparation phase) of the initiative. In the 3 years since its launch, PUB has successfully achieved a number of significant milestones. First, the PUB Science and Implementation Plan was developed, discussed at length, and approved by the IAHS Bureau in July 2003. It was subsequently published in the *Hydrological Sciences Journal* (Sivapalan et al. 2003) and publicized through other scientific media (e.g., Wagener et al. 2004). PUB is seen by the hydrological community, both practitioners and researchers alike, as a challenging, exciting and multifaceted problem that will occupy the minds of hydrologists for a long time to come.

The PUB vision, objectives and activities have been propagated within the global hydrological community

through the organization of many national and international workshops (e.g., Perth, Yellowknife, Moscow, Menaggio, Kyoto, Foz do Iguaçu). Proceedings of some of these have now been published (Franks et al. 2005; Spence et al. 2005; Sivapalan et al. 2006). By now a large number of national and international PUB Working Groups (WGs) have been formed.

Strategies towards Integration

The common wisdom arising from the many conferences I have attended in various parts of the world in the past 5 years is summarized below. These are already outlined in the PUB Science and Implementation Plan, but deserve repeated emphasis.

Hydrological predictions would benefit from greater integration of current techniques. Individual hydrological studies tend to be somewhat ad hoc especially in the selection of specific models toward specific problems. Intercomparison of available techniques would provide valuable guidance on the performance of different approaches in different environments with different availability of data.

The intercomparison of alternative approaches, as well as the evaluation of the worth of integrating new technologies require a formal framework for fair comparison. This needs to be done within a robust and formal uncertainty estimation framework. Ultimately, the quantification of uncertainty provides a framework for assessing the worth of hydrological techniques in application.

Key to many existing methods for predictions in ungauged basins is the availability of data in nearby or similar catchments for regionalization-type approaches. Increasingly, there has been the recognition that ultimately we need to move from a reliance on data elsewhere and develop more process-based approaches that are based on greater understanding.

There should be a greater level of activity aimed at learning from observations, not only from place-based studies but from comparative studies. A comparative analysis of diverse basins located in different places, when guided by a robust classification system, is likely to lead to increased understanding of the differences and similarities between basins, and will inevitably lead to improved predictions.

New measurement technologies are increasingly available. However, these should not be seen as

replacing traditional gauging of basins. Greater emphasis needs to be placed on evaluating how these technologies could be integrated into existing methodologies and modelling strategies to increase the power of hydrological techniques for predicting in ungauged basins.

Future Perspectives

It is increasingly felt that *hydrological change*, due to changes in land use and land cover, climate change, and human interference with the hydrological cycle, is threatening to overwhelm natural variability in many parts of the world. Predicting and managing such changes have become major challenges in almost all countries.

The nature of hydrological predictions is also changing rapidly. Whilst floods and droughts continue to be major concerns that need to be prevented or managed, degradation of land areas and deterioration of water quality are becoming major problems due to the scale of human impacts and the increased emphasis by society and governments on sustainable development. PUB must evolve to deliver the increased levels of predictive capability and sophistication needed to address these concerns.

Finally a negative consequence of the diversity of worldwide initiatives and activities under PUB may be a possible loss of focus and coherence. It is important to prioritize future PUB activities, including WG activities, around a small number of themes, in stages, so that progress can be achieved and demonstrated.

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- Murugesu Sivapalan,
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NEWS FROM PUB THEMES AND WORKING GROUPS

National (or multinational) Working Groups (NWGs) have been created in Japan, China, Southern Africa, Canada, United Kingdom, Nepal and Thailand. Establishment of a NWG in the Republic of Korea is under way.



Participants at the PUB Special Session “Consider, clarify and coordinate the role of PUB National Working Groups” held at Hohai University, Nanjing, China, October 30, 2005. From left to right in the front row, R. Len, I. Littlewood, Y. Tachikawa, and K. Takeuchi; in the second row, Z. Liu, S. Lee, S. Budhakoontharoen, H. Jee, R. Jha, T. Ao, D. Shen, and L. Wang.

To facilitate PUB activities in Asia, a PUB Special Session “Consider, clarify and coordinate the role of PUB National Working Groups” was held at Hohai University, Nanjing, China, October 30, 2005. The participants included Littlewood and representatives from China, Japan, Korea, Nepal and Thailand. In the meeting, the role of NWGs and cooperation between thematic and NWGs were discussed. Terms of

Reference of Theme 7 which defines the relationship between thematic and NWGs were discussed. The presentations and meeting agenda are available from the Japan PUB web site. Japan PUB will organize a PUB session at the 3rd AOGS Meeting at Singapore, July 10-14, 2006. Details are available at <http://www.asiaoceania-conference.org/>

Japan – The Japan PUB WG was restructured on September 28, 2005; six thematic WGs have been established and one national WG, which facilitates contributions to PUB research. Details are available at the Japan_WG website: <http://flood.dpri.kyoto-u.ac.jp/pub/japanPUB/index.html>.

China – A national committee for IAHS-PUB was established in 2004 jointly with the Chinese National Committee of IAHS, in which the main members are from the Ministry of Water Resources, universities and research institutes. Seven subgroups have been set up in the Chinese PUB WG, including:

- Hydrological modeling and water resources assessment in Northern China under high water stress
- Evaluation and prediction of the groundwater in northern China
- Flood forecasting and damage estimation in southern China
- Prediction of water resources and water consumption in the arid region of Northwest China
- Study on the ecologically vulnerable basins
- Development of a coupled model of hydrological cycle and water quality in urbanized river basins
- Use of new technology, theory and methods for hydrological prediction in the ungauged basins

The International PUB Symposium on Flood Forecasting and Water Resources Assessment is scheduled for September 2006 (<http://www.ChinaPub.org>). Its main themes are:

- Understanding of hydrologic processes and reduction of the uncertainties in their modeling
- New theories and methodologies for hydrological forecast
- New theories and methodologies for water resources assessment and prediction
- Impacts of climate change and human activities on the hydrological cycle and regional water resources
- Hydroinformatics and its application to flood forecasting and water resources assessment

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Southern Africa - WaterNet has taken on the role of a multinational WG for Southern Africa. WaterNet is a capacity building network of university departments, training and research institutes in southern and eastern Africa working to build and strengthen capacity in integrated water resources management (IWRM). As of September 13, 2005, WaterNet had 45 members from 14 countries. WaterNet supported discussions on PUB at their annual meeting in Ezulwini, Swaziland during November 2-4, 2005. Details of WaterNet are available at <http://www.waternetonline.ihe.nl/>

Canada – A Canadian National Committee for IAHS' PUB initiative (CNC-PUB) has been created as a joint committee of the Canadian Geophysical Union – Hydrology Section (CGU-HS) and the Canadian Society for Hydrological Sciences (CSHS). The roles of CNC-PUB are to liaise with Canadian water resource managers in the development of programs supportive of the PUB initiative, support WG implementation, funding and outreach in Canada and report to the CGU-HS, CSHS and IAHS on Canadian PUB activities. Members of CNC-PUB assisted in organizing a 'PUB in Mountainous Regions' Workshop, entitled "Hydrology for the Orographically Challenged," held in the Cascade Mountains of Southern British Columbia in November 2005 and focused on identifying key aspects of the predictability problem in this region (<http://scitech.pyr.ec.gc.ca/waterweb/pub>).

The workshop gathered 75 academic, government and private-sector scientists and engineers for presentations and discussions covering the entire breadth of this topic. A commentary paper on the workshop and efforts on reducing predictive uncertainty in mountainous regions is expected in the June 2006 issue of the Canadian Water Resources Journal. The mountain workshop continues to build on the momentum of PUB in Canada generated by a similar workshop in northern Canada on prediction in cold regions. More details can be found at (http://www.cwra.org/Publications/CWRA_Bookstore/PUB_Workshop/pub_workshop.html).

United Kingdom - A UK Working Group (UKWG) met for the first time in November 2005 at the Natural Environment Research Council's Centre for Ecology and Hydrology (CEH), Wallingford, with Ian Littlewood in the Chair. The UKWG currently comprises 14 members from CEH and UK universities, and will seek to expand by inclusion of hydrologists from the environment agencies, other research institutes, etc. The UKWG meeting was followed by a well-attended seminar at CEH "The prediction in Ungauged Basins (PUB) Decade (2003-2012): How should it evolve?" presented by Robin Clarke of the Instituto de

Pesquisas Hidraulicas, Porto Alegre, Brazil. The seminar was based on Prof. Clarke's Invited Commentary with a similar title in Hydrological Processes (2005, vol 19, p 2865-2869).

The next activity of the UKWG is convening a one-day national meeting of the British Hydrological Society, on 14 June 2006, to promote and discuss PUB within the UK context. The meeting will be in Westminster, London. This is a UK meeting but a limited number of PUB participants from other countries may attend at their own expense if they are in the UK at the time for other purposes (for details contact Ian Littlewood igl@ceh.ac.uk).

Nepal – Nepal PUB WG was created on 9th January 2005 to coordinate water resources activities of the Institute of Engineering and government departments. Two PUB research catchments have been selected. PUB Nepal wishes to discuss the possibility of establishing an MNWG with China, India and Bangladesh. PUB Nepal will host a PUB session at the Workshop on Flood Forecasting and Management in Mountainous Areas to be held in Pokhara, Nepal, April 17-19, 2006 (contact K. P. Sharma keshav@dhm.gov.np). Details are also available at <http://flood.dpri.kyoto-u.ac.jp/pub/japanPUB/activity/2006/nepal2006/Annncmnt2.pdf>

Thailand – PUB Thai was launched on September 9, 2004 to facilitate PUB activities at universities and governmental departments. Two WGs have been developed and a PUB Thai test basin has been established in the Yom river basin. Details are available at <http://www.sce.ait.ac.th/programs/wem/pubthai/default.asp>. Thai PUB will organize a PUB session in the 3rd Asia Pacific Association of Hydrology and Water Resources (APHW) Conference at Bangkok, October 16-18, 2006. Details are available at <http://www.thirdaphw.org/>

Republic of Korea – The first Korean PUB session was organized in the 2005 IHES International Symposium of Hydrological Environment held in Daegu, Korea, October 28, 2005. The Korean PUB will be organized under IHES and it will support WG activities.

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SLICE – a New Working Group

The Slope InterComparison Experiment (SLICE) is a newly-formed working group aligned with PUB Theme 1. Its 2-year target is to promote the improved understanding of regional hydrological characteristics via hillslope intercomparison studies and topdown re-analysis of data from international hillslope hydrological studies. The SLICE WG will establish key components of a catchment classification system. For details, visit <http://sinus.unibe.ch/boden/slice/index.html> or contact Jim Freer J.Freer@lancaster.ac.uk or Jeff McDonnell Jeffrey.McDonnell@oregonstate.edu. The SLICE WG poster will be available on the PUB web site soon.

FORTHCOMING PUB EVENTS

USA PUB Workshop From PUB Implementation to Community Science Questions October 16-19, 2006 Oregon State University

The **National Science Foundation** and the **Consortium of Universities for the Advancement of Hydrologic Science, Inc.** are sponsoring this workshop where experience gleaned from the International Association of Hydrological Sciences' Predictions in Ungauged Basins (PUB) program will be used to catalyze identification of community science questions by the USA hydrologic community. Attendees will:

- Be introduced to PUB science objectives and approaches
- Evaluate PUB approaches as a potential template for USA community science questions
- Critically discuss open questions in hydrology, especially as they pertain to hydrologic observatories
- Identify the most promising avenues for efficient development of community science questions

The workshop will be organized around PUB's six science themes:

- Watershed classification
- Conceptualization of process heterogeneity
- Uncertainty estimation and model diagnostics
- Development and use of new data collection approaches
- New hydrological theory
- New modeling approaches



Registration deadline:
June 15, 2006
More information available at:
www.cuahsi.org/



CUAHSI

European Geosciences Union-EGU-General Assembly. **HS6 Experimental river basins**, 2006, Vienna, Austria, 02 – 07 April 2006.

<http://meetings.copernicus.org/egu2006>

PUB Session in **Workshop on Flood Forecasting Management in Mountainous Areas** at Pokhara, Nepal. April 17-19, 2006.

<http://www.dhm.gov.np/workshop/flood2006/flood2006.pdf>

International Conference on Hydrological Sciences for Managing Water Resources in the Asian Developing World, Guangzhou, China, June 8-10 2006;

<http://cwre.zsu.edu.cn/mwra/workshop.doc>

3rd Biennial Meeting of the International Environmental Modelling and Software Society (iEMSs), July 9-12, 2006 The Wyndham Hotel, Burlington, Vermont, USA, Session 12: Developing New Hydrological Models – Towards Merging Top-down and Bottom-up Approaches. Contact: Barry Croke or David Post

<http://www.iemss.org/iemss2006/>

The Asia Oceania Geosciences Society (AOGS 2006) 3rd Annual Meeting. 10-14 July 2006 at the Singapore International Convention & Exhibition Centre: **HS11** Session on PUB <http://www.asiaoceania-conference.org>. Contact Y.Tachikawa, tachikawa@flood.dpri.kyoto-u.ac.jp

International Symposium on Flood Forecasting and Water Resources Assessment for IAHS-PUB, September 28-30, Beijing, China, 2006

<http://www.ChinaPUB.org>

Third Asia Pacific Association of Hydrology and Water Resources (APHW) Conference. Session 7: Predictions in Ungauged Basins, Bangkok, Thailand, October 16-18, 2006. Contact: Shinjiro Kanae, kanae@chikyu.ac.jp

<http://www.thirdaphw.org>

Vth World FRIEND Conference: Water Resources Variability -Processes, Analysis and Impacts, Havana, Cuba, 27 November -1 December 2006

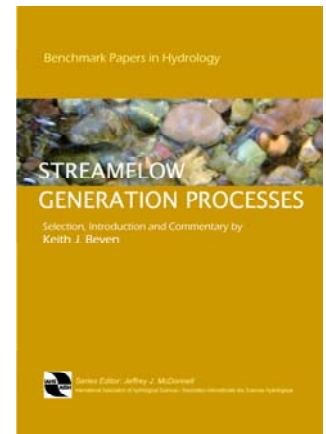
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PUBLICATIONS

New IAHS Series: Benchmark Papers in Hydrology

IAHS has embarked on a new book series entitled Benchmark Papers in Hydrology. The series defines, publishes and distills the key papers that contributed to the current thinking of the sub-fields of the hydrological sciences. Each volume in the series will contain an Introduction prepared by the specialist volume editor. Articles are reproduced from the key

papers (mostly of the last century) to recent works. The first volume in this series is very much related to PUB. The selection of papers spans the period from 1933 to 1984, commencing with Horton's early papers. "Streamflow Generation Processes" is edited by Keith Beven from Lancaster University and synthesizes the major conceptual developments in runoff generation research.



New Database to Create Digital River and Watershed Maps - HydroSHEDS

World Wildlife Fund (WWF)'s Conservation Science Program provides a global hydrological database, termed HydroSHEDS. HydroSHEDS is based on high-resolution elevation data obtained during a Space Shuttle flight for NASA's Shuttle Radar Topography Mission (SRTM). HydroSHEDS will allow scientists to create digital river and watershed maps. These maps can then be coupled with a variety of other geo-spatial datasets or applied in computer simulations, such as hydrologic models, in order to estimate flow regimes. www.worldwildlife.org/hydrosheds, or <http://hydrosheds.cr.usgs.gov>

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