MESSAGE FROM THE PUB CHAIR

PUB is now making detailed plans for its third biennium. Among numerous other activities, PUB will be involved in four sessions at the 8th IAHS Scientific Assembly to be held in Hyderabad, India during 7-12 September, 2009.

- S.5 New approaches to hydrological prediction in data sparse regions
- S.6 Hydrological theory and limits to hydrological predictability
- W.1 Regionalization of models for operational purposes in developing countries
- W.9 Predictions in ungauged basins - a benchmark report

The first two of these are symposia with red books being produced out of them, the other two are workshops that allow for more discussion time during the meeting. The session topics promise an exciting and stimulating exchange of ideas – please consider to contribute a paper to one or more of these sessions! The session descriptions will soon be published on the IAHS web site.

To discuss some of the issues facing PUB in the third biennium, a PUB meeting was held on Dec. 12, 2007 during the AGU Fall Meeting in San Francisco. As discussed in Perugia, we will maintain the six Key Themes – they have become a brand identity of PUB. I am pleased that the following people have agreed to coordinate the themes in the third biennium (what is left of 2007 to 2009 Hyderabad).

- KT1: Basin inter-comparison and classification (Ross Woods, r.woods@niwa.co.nz)
- KT2: Conceptualization of process heterogeneity (Doerthe Tetzlaff, d.tetzlaff@abdn.ac.uk)
As discussed during the PUB meeting in San Francisco, each of the theme coordinators is now forming a small group (a theme-team) to assist in specific tasks of the coordination process.

The Benchmark Assessment of Predictions in Ungauged Catchments was of course the main topic of the San Francisco Meeting. What will be the target group of that report, what will it contain, what is the format and what is the most efficient process of making it happen?

The target group would mainly be scientists, but it was felt that, if we make an effort to be explicit in terms of the methods and recommendations, the report will eventually become useful for practitioners at a national level. Ideally, it would be pitched to start from an undergraduate level to make the report also a useful learning aid for undergraduates – a next generation of PUBers.

It will contain a review of the current state of hydrological predictions in the absence of data, addressing where we are now, what we have achieved in the past 4 years, and what are the challenges for the remaining years. It should be a consensus report that reflects the judgement and experience of more than just a small group of people, perhaps along the lines of the idea of the IPCC report. And it should be quantitative in actually giving numbers on the predictive performance that can be achieved for a given type of hydrological process in a given hydrological setting for a given degree of data availability. Clearly, there will be no one-fits-all answer to the question of what is the predictive performance of hydrological methods in ungauged basins.

The format of the PUB report was discussed at length at the San Francisco PUB meeting. There was general consensus that the PUB-report needs to be coherent, going beyond a collection of papers. A monograph would hence be preferred over a set of papers in a special journal issue, although hybrid formats may also be possible.

In terms of the process there were numerous suggestions that were in line with the grassroots nature of the PUB initiative. It was felt by most that discussing a detailed outline first on the internet, perhaps by blog or discussion forum, would assist in obtaining a widely accepted structure and that could then be detailed by dedicated workshops, and writing groups.

It is important to have, over PUB's 10-year life span, broad community involvement and a constant flow of new ideas. I am hence keen to attract new people to PUB but, at the same time, maintain continuity and take advantage of the superb work that has been done so far within PUB. Current working group members would, I believe, be naturals for joining in the author teams, and it will be valuable to involve additional people from the community.

As a final note, let me thank all of you for your varied and fantastic contributions to PUB, in particular the troika members of the second biennium and the working group members, and I hope that you will continue to be involved in PUB in one or the other way. There are, in fact, at least four ways of getting formally involved in PUB – through joining one of the working groups; through forming your own topical or national working group (see www.pub.iwmi.org for more details); through organizing any other PUB related activity such as a workshop; and as an author of the PUB-report. Please let me know what your preferences are. And there is of course an infinity of opportunities in contributing to PUB in an informal way – by doing research to improve hydrological predictions in the absence of data!

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GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS)/ AWCI (ASIAN WATER CYCLE INITIATIVE) AND PUB

Many international initiatives dealing with water-related issues share overlapping goals and complement each other. The GEOSS (Global Earth Observation System of Systems)/ AWCI (Asian Water Cycle Initiative) and PUB have intersecting activities with the goals to improve sustainable basin water resources management.

There is a rapidly growing concern about the common water related issues, including floods, water scarcity, water pollution and environmental degradation in Asia accompanied with the rapid urbanizations and economic growth. Under the framework of the GEOSS 10-Year Implementation Plan, which was endorsed at the Third Earth Observation Summit held in Brussels, in February 2005, GEOSS/AWCI was established as a regionally cooperative among 18 countries in Asia in November 2005 based on the regionally common and sharable ideas on the water-related issues and their socio-economical backgrounds for improved sustainable water resources management. The GEOSS/AWCI directly contributes to one of the nine societal benefit areas of GEOSS which “Improving water resource management through better understanding of the water cycle”.

The GEOSS/AWCI develops an information system of systems for promoting the implementation of integrated water resources management through data integration and sharing and improvement of understanding and prediction of the water cycle variation as a basis for sound decision making of national water policies and management strategies. The objectives for GEOSS/AWCI are as follows:

- to develop integrated water resources management approaches;
- to share timely, quality, long-term information on water quantity and quality, and their variation as a basis for sound national and regional decision making;
- to construct a comprehensive, coordinated and sustained observational system of systems, such as prediction systems and decision support capabilities, under the GEOSS;
- to develop capacity building for making maximum use of globally integrated data and information for local purposes as well as for observation and collecting data.

![Demonstration basins in participating countries](image-url)
The GEOSS/AWCI is a new type of an integrated scientific challenge in cooperation with meteorological and hydrological bureaus and space agencies. Its uniqueness is described as follows:

- Effective combination of the architecture and data and the capacity building;
- Advanced data infrastructure availability including a river basin meta-data registration system, a data quality control interface, and data-integration and downscaling methods;
- A clearly described data sharing policy agreed among the participating countries;
- Strong linkage among science communities, space agencies, and decision makers;
- Coordination between the research communities and operational sectors with clear strategy for transferring scientific achievements to operational use;
- Effective cooperation with international projects and cooperative frameworks.

GEOSS/AWCI promotes observation convergence by making seamless access to the data from earth observation satellites, in-situ reference site networks, and operational observation systems, integrates the observed data, numerical weather prediction model outputs, geographical information, and socio-economic data, and disseminates usable information for sound decision making of water resources management against flood and landslide, drought and water scarcity, water pollution and ecosystem degradation, and impacts of the climate change on water.

GEOSS/AWCI enforces capacity for a broader community to generate, interpret and utilize value-added products from the observations, beyond training of qualified technical personnel to operate the observing instruments, by coordinating requests from participating countries and potential capabilities of supporting organizations and on-going and/or planned projects. GEOSS/AWCI International Coordination Group consisting of international science communities, space agencies, and water-related ministries and agencies of the participating countries takes a strategic demonstration approach. By showing success stories created through demonstration projects to decision makers, GEOSS/AWCI will shift the emphasis from scientific challenges to operational applications to yield the societal benefits. GEOSS/AWCI organizes three working groups for flood, drought, and water quality to coordinate capacity building in their areas and to address the issues in the demonstration river basins in a strategic way.

Many of the basins the Asian region are hydrologically ungauged, thus reducing predictive uncertainty in hydrological models applied to ungauged basins is a basic science need in planning for future sustainable water resource management projected by GEOSS/AWCI. On the other hand, sharing arrangements static and dynamic data which are locally and remotely sensed, timely and efficiently, and use of them data in the application of the new models developed for ungauged basins as envisaged by GEOSS/AWCI would make conducive environment for speedy development of PUB activities in the region.

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PUB SESSION AT THE 4TH ANNUAL MEETING OF ASIA OCEANIA GEOSCIENCES SOCIETY (AOGS) AND RESEARCH COOPERATION OF NATIONAL WORKING GROUPS IN ASIA

A PUB session was held at the 4th Annual Meeting of Asia Oceania Geosciences Society (AOGS) which took place at the Queen Sirikit National Convention Centre in Bangkok, Thailand on July 31, 2007. The session was organized by PUB NWGs of Japan, China, Nepal and Thailand. The aims of the session were to present and discuss:

- Progress in hydrological prediction research through the estimation / reduction of prediction uncertainty;
Transferability of various hydrological prediction models / methods across scales and regions; and

Exchange of data, information and techniques internationally in order to enhance the predictive ability.


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SECOND ANNUAL WORKSHOP ON IMPROVING PROCESSES AND PARAMETERIZATIONS FOR PREDICTION OF WATER RESOURCES IN COLD REGIONS (IP3)

The second annual IP3 Network workshop was hosted by the Cold Regions Research Centre of Wilfrid Laurier University in Waterloo Ontario, Canada from 8-10 November 2007. Over 88 people attended the workshop, including 27 students. The workshop involved three days with presentations from investigators in the IP3 network (Canada, UK, USA), discussions with a User’s Advisory Committee on how to better predict cold regions water resources with minimal stream flow and other information and lively discussions in the evenings. The event was also the launch of the Canadian component of the International Polar Year aspect of IP3 and related studies in the international Arctic Hydrological Observing System (Arctic Hydra). The workshop provides the first link between the IPY and the PUB (IAHS Predictions in Ungauged Basins) decade.

The workshop showed that IP3 has made good progress in its 16 months of existence. All eight research basins are fully instrumented and are producing a unique and valuable cold regions hydrometeorological dataset along transects from medium to high latitudes and low to high altitudes. This is leading to better process understanding and parameterization and hence improved landscape interactions in the coupled surface-hydrology-atmosphere models of Environment Canada that have been set up over the IP3 domains. These models are showing reduced reliance on calibration which will be necessary for operation in data sparse cold regions.

IP3 is proud to be Working Group 16 of PUB. It has collaborators throughout North America and Europe.
and hopes to expand this collaboration to those who wish to follow the path of the 3 P’s, processes and parameterizations for predictions so that we may reduce our predictive uncertainty based on a better understanding and more physically accurate description of hydrology. For further information contact Julie Friddell, Network Manager at ip3.network@usask.ca or visit www.usask.ca/ip3.

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A student’s view:
EFFECTIVELY TRANSFORMING DATA INTO INFORMATION

Having investigated the problem of hydrologic prediction in ungaged basins (PUB), I believe that a major breakthrough in PUB-related research will necessarily come from creative ways to transform data into hydrologically relevant information. We are not only challenged with scarce ground-based data networks throughout the world, but also overwhelmed by the massive amounts of spatio-temporal environmental datasets now available through, for example, remote sensing (e.g. rainfall estimates from satellite and ground-based radar) and experimental in-situ networks (e.g. soil moisture, tracers). To best use available data in our endeavor towards reducing predictive uncertainty, we need our science to

- blend these datasets from various sources together,
- detect or uncover embedded hydrologically relevant patterns,
- transform these patterns into information, and
- assimilate them into increasingly complex environmental models.

In the early stages of my Ph.D. work in the Department of Hydrology and Water Resources at the University of Arizona, I investigated the potential of remotely-sensed rainfall products to improve hydrologic predictions in poorly gauged/ungauged basins. This is often the only source of rainfall estimates in developing countries, such as my country of origin, Turkey. I tested the utility of the PERSIANN system (Sorooshian et al., 2000) for basin-scale hydrologic modeling of several basins in the Southeastern US, where comparisons to rain gauge and radar rainfall estimates can be made (Yilmaz et al., 2005). This research indicated that basin size and location were important factors controlling the quality of this product and hence the performance of the hydrologic model driven by this data. Furthermore, the availability of short-term stream flow observations for model calibration can significantly improve the model performance in large basins (~5000km²) because these basins filter out, to some extent, the error in rainfall dataset.

Another functional approach to improving hydrologic predictions in poorly gauged/ungauged basins is to exploit the “static” information contained in observed basin characteristic, such as topography, geology, land cover, and soils datasets and derive a priori parameter estimates for our models. However, scale issues and process interaction across scales will require adjustments to these a priori parameter estimates for proper integration into models. In this regard, I explored ways to merge the “static” information about model parameters given by a priori parameter estimates with “dynamic” information provided by short-term rainfall-stream flow time series datasets. Focusing on a distributed model (HL-DHM), I devised a multi-criteria penalty function framework that facilitates a trade-off analysis between the ability of the model to achieve reasonable performance while maintaining the parameters close to their a priori values. This framework is useful for highlighting those parameters with optimal values extremely different from a priori values, which is valuable for guiding corrective measures in the model setup and design.

The ways we extract information from available data to evaluate/calibrate complex hydrological models determines the consistency of the model and the reliability of the predictions. Current classical model evaluation strategies that rely on a single statistical measure of performance (e.g. root mean square error) are weak at indicating which model components/parameters are responsible for model performance inadequacies and therefore lack diagnostic power (see Gupta et al., 2007). During my graduate work, I have worked on developing a diagnostic approach to model evaluation, based on a hierarchical conceptualization of the major functions of any watershed system: overall water balance, vertical, temporal and spatial moisture redistribution. I proposed several “signature” measures that effectively extract the information about these watershed functions contained in the stream flow observations (Yilmaz et al., 2007). This approach is valuable in constraining the range of parameter sets while maintaining conceptual consistency of the model.

In closing, an important key to improving hydrologic predictions in ungauged basins is to devise data-mining techniques that are capable of effectively extracting hydrologically relevant information from large spatio-
temporal datasets. Merging this information with hydrological models will revolutionize our understanding of the complex watershed systems and hence will decrease predictive uncertainty at ungauged sites.

References:

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PUBLICATIONS

METHODOLOGY IN HYDROLOGY
IAHS Publ. 311
IAHS members price £82.50

Edited by Lillian Ren, Qiongfang Li, Danrong Zhang & Jun Xia

The 97 papers give an insight into current hydrological science in China, detailing issues, approaches, innovations and achievements, with information about many drainage basins, especially the Yangtze and Yellow rivers, and engineering projects. Abstracts are available at www.iahs.info

GLACIER MASS BALANCE CHANGES AND MELTWATER DISCHARGE
IAHS Publ. 318
IAHS members price £34.50

Edited by P. Ginot & J. E. Sicart

Mountain snow cover and glaciers contribute considerably to stream flow in many parts of the world, and modify runoff in terms of quantity, timing and variability. The peer-reviewed papers consider glaciers located across the world. Abstracts are available at the IAHS website, www.iahs.info

REDUCING THE VULNERABILITY OF SOCIETIES TO WATER RELATED RISKS AT THE BASIN SCALE

Edited by Andreas Schumann & Markus Pahlow

This volume, comprised of peer-reviewed papers selected from the Third International Symposium on IWRM (September 2006, Ruhr-University Bochum, Germany), accounts for the heterogeneity of world water problems by addressing the following important questions: What has to be integrated? How can it be accomplished? What are the options to balance the different views? This symposium strived to not only identify problems, but to provide practical solutions. The subject of how to cope with water-related vulnerability of societies formed the overarching theme. Together, the papers provide an excellent overview of current IWRM research worldwide.

DRY LAND HYDROLOGY IN MEDITERRANEAN REGIONS

Special Section: Hydrological Sciences Journal
Vol. 52, No 6, Dec 2007

Eight papers in special section cover several aspects of the range of current quantitative hydrological issues in the Mediterranean and Middle-East in relation to water management.
FORTHCOMING PUB-RELATED EVENTS

Contact Attilio Castellarin at attilio.castellarin@mail.ing.unibo.it


Workshop on “Evaluating the information content of data for reducing uncertainty in hydrological models” at the biennial meeting of the International Environmental Modelling and Software Society, Barcelona, Spain, July 7-10, 2008. Website: [http://www.iemss.org/](http://www.iemss.org/) For details contact Barry Croke, barry.croke@anu.edu.au


International Conference on Implementing Environmental Water Allocations February 2009 : Port Elizabeth, South Africa [http://ewa.innercirclestudios.co.za](http://ewa.innercirclestudios.co.za)


Conference on the Use of Historical Data for Rainfall and Flood Forecasting organized by Hydro-GIS Ltd and the Dept. of Engineering Science, Oxford University with the support of the British Hydrological Society and the International Association of Hydrological Science. 8 January 2008, Exeter College, Oxford, England. [http://www.hydro-gis.co.uk/conference.htm](http://www.hydro-gis.co.uk/conference.htm)


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