AGU
Hydrology Section Newsletter
July 2013

From the Section President

Eric F. Wood (Princeton University)

On January 1, 2013 Dennis Lettenmaier's term as section president and Martha Conklin's term as the section's secretary came to an end. I would like to thanks them for their outstanding work on behalf of the section. During their terms, AGU realigned the election cycles for officers that resulted in their serving for an additional 6 months. While this may not seem like a big deal, this included another Fall Meeting, and for Martha coordinating the judging for the Outstanding Student Paper Awards (OSPA), which is a huge task. Martha was instrumental in helping reform the Union's judging process. There were over 360 Hydrology section students who requested that their presentations be judged as part of the OSPA process and something like 99% of the presentations were judged, with 11 students being selected for an award. Our congratulations to these awardees, who are listed later in the newsletter. I would also like to recognize and thank the section's OSPA Committee for their hard work. At the 2013 Fall Meeting the need to OSPA judges will again be significant and I ask you to please step forward and help with the judging if asked by session OSPA liaisons and OSPA Committee members. Each session must have an OSPA liaison whose responsibility is to arrange the judges for that session. This Fall we will ask the liaisons to start identifying the judges as soon as the scientific program is published in late September.

Speaking of the FM13, the Hydrology Section Fall Meeting chair, Stefan Kollet (University of Bonn, Germany) reports that there were 134 proposed hydrology sessions and that was reduced to approximately 98 session by the merging of similar topics. Abstracts will be due approximately August 6. The number of sessions promises that the FM13 will be another robust meeting with lots of exciting sessions and presentations.

On January 1 Efi Foufoula-Georgiou (*University of Minnesota*) began her term as the President-elect of the section, and Terri Hogue (*Colorado School of Mines*) as section Secretary. Earlier this spring the AGU Council elected Efi to the Council Leadership Team (CLT), which is the body that handles all council business between their meetings.

She discusses her goals for the next two years as President-elect and council member later in this newsletter.

The start of 2013 began a new phase with *Water Resources Research* with the Praveen Kumar's tenure as Editor-in-Chief ending after 4 years (March 2009-13). The section thanks Praveen for his hard work and dedication with *WRR* and in assuring that it kept its preeminent position as the top journal in hydrology and water resources. Alberto Montanari (University of Bologna, Italy) is the new Editor-in-Chief. The other major change is AGU's decision to have Wiley-Blackwell publish its journals. Alberto and his new editorial board talks about these changes later in this newsletter.

The changing of the guard at the section executive level also occurs at the technical committee level, since the section by-laws specify that the committee member terms coincide with the section president's term. The technical committees serve a critical role for organizing and guiding our science at the section level. They also offer a great opportunity for our members, particularly our younger colleagues, to become involved in the section. Usually the chair and about 1/3 of the committee members rotate off every two years, and I've just finished appointing new chairs and appointing/reappointing committee members. The technical committees and the members are listed on the section's web site (http://hydrology.agu.org/index.html). The section's technical committees date back at least 80 years and at that time provided reports on the state of their fields and emerging new developments. Over the last two years, the section newsletter has tried to re-capture this by having committee members prepare short articles on such developments. These articles are not restricted to only technical committee members, and other section colleagues can certainly contribute. In this newsletter there are two such articles: One on the wrap-up of the IAHS decadal research initiative *Predictions in Ungauged Basins* (PUB) by Markus Hrachowitz and Hubert Savenije, and the second by Antarpreet Jutla and Ali Shafqat Akanda on linking hydroclimatology with human health. This is an emerging research area and a session on this topic is planned for FM13.

Technical committees also fulfill their role of covering their science by identifying and proposing sessions for the Fall meetings and organizing smaller, specialized conferences, such as Chapman Conferences. These smaller meetings serve an important function in that they allow for more focused, in-depth meetings. Currently there are three Chapman Conferences of directly related to the scientific interests of the section: **AGU Chapman Conference on Seasonal to Interannual Hydroclimate Forecasts and Water Management** (28–31 July 2013, Portland, Oregon, USA); **Synthesizing Empirical Results to Improve Predictions of Post-wildfire Runoff and Erosion Response** (25–30 August 2013, Estes Park, CO, USA); and **AGU Chapman Conference on Soil-mediated Drivers of Coupled Biogeochemical and Hydrological Processes Across Scales** (21–24 October 2013,Tucson, AZ, USA). Details for these meetings can be found at http://chapman.agu.org/ The chair of AGU's Chapman Conference committee is Venkat Lakshmi who has provided an article later in the newsletter on how best to organize such a conference. Additionally, there is another specialty conference, co-sponsored by AGU, that should be of interest: the SSSA's **Soil's Role in Restoring Ecosystem Services** (March 6-9, 2014, Sacramento, CA). Details can be found at https://www.soils.org/meetings/specialized/ecosystem-services

The realignment of AGU's election cycle also affected the dates for the submission and election of Union Fellows and medalists. These announcements haven't yet been made. Therefore, the popular "Fellows Speak" newsletter articles, where new fellows from the section share some of their research perspectives with us, will start again with the December 2013 newsletter – you've heard from all of the fellows who were honored last December!

At the 2012 Fall Meeting several colleagues were recognized for section awards. These include Garrison Sposito for the Langbein Lecture, (*The Soil Underfoot: Green Water and Global Food*

Security. The lecture can be seen at http://fallmeeting.agu.org/2012/events/langbein-lecture-h22a-the-soil-underfoot-green-water-and-global-food-security-video-on-demand/); Giuliano di Baldassarre (*UNESCO-IHE Delft*) for the Hydrologic Science Early Career Award; and for the Robert Horton Graduate Fellowships Jesus Gomez (*New Mexico Technological University*) working on "Using synthetic watersheds to understand deep groundwater contributions to watershed response" (advisor: John Wilson); Claire Lukens (*University of Wyoming*) working on "Sediment origins and grain-size evolution in steep mountain catchments" (advisor: Cliff Riebe) and Yoshihide Wada (*Utrecht University*, The Netherlands) working on "Assessment of the future sustainability of global food production" (advisor: Marc Bierkens).

You'll find articles by di Baldassarre and Wada on their research later in this newsletter, and in the December 2013 newsletter we expect to hear from Gomez and Lukens. Currently the Horton Research Grants provide $10,000 in support that goes directly to the students. It is a highly competitive program with between 40 and 80 applicants each year. I'm sure that you'll find their research interesting and informative.

Faisal Hossain, whose primary AGU affiliation is the Hydrology Section, received the *Charles Falkenberg Award*, which is a Union award to an individual "under 45 years of age who has contributed to the quality of life, economic opportunities, and stewardship of the planet through the use of Earth science information and to the public awareness of the importance of understanding our planet". Faisal has focused tremendous time and energy in capacity building in less-developed countries to utilize remote sensing products – particularly ones related to flood forecasting. He shares these challenges with us in an article later in the newsletter. We at Princeton are involved in delivering drought monitoring, in partnership with UNESCO, to sub-Saharan African institutes, and I can relate the challenges (and frustrations) Faisal shares. For colleagues who are interested in making their research "societally relevant" on the world stage, I think you'll find Faisal's article insightful.

In closing, 2013 looks like another great year for the section: *WRR* has successfully transitioned to a new editorial board and publication system, and FM13 looks like it's shaping up to be another great meeting. I want to thank all the members of the technical committees whose work is so critical to our great sessions. I hope to see many of you this Fall in San Francisco. I wish you all a great summer.

From the Section President-Elect

Efi Foufoula-Georgiou (*University of Minnesota*)

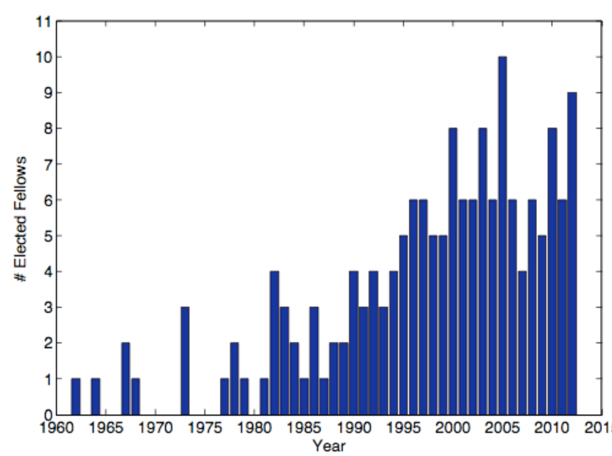
My term as President-Elect started on January 1, 2013. The more I "get into the job" the more I realize how much we owe to all our previous presidents and Section volunteers -- between the technical and award committee members and meeting organizers there are more than 200 colleagues that work hard to keep our section running. In my election ballot, I listed three priorities that I want to pursue as your President-Elect: (1) enhance the excellence and impact of our research and its dissemination via our AGU meetings and journals, (2) increase the participation of our young colleagues into Section activities and provide mentorship and opportunities for growth, and (3) increase the visibility of our Section within AGU and the world.

For the first objective (research impact and excellence), a spirited and well designed AGU Fall meeting, innovative Chapman conferences, vibrant technical committees and an efficient high impact outlet of our work via AGU (mainly *WRR* and *JGR*) journals all play important roles. I will work closely with the new Editorial team of *WRR* and also the AGU Publications Committee (John Selker from the Hydrology section serves in that Union-level committee) to ensure that the recent changes in the publication model of AGU serve to enhance the impact of our research. The article from the new *WRR* editorial team, led by Editor-in-Chief Alberto Montanari, has some important messages and I am happy to see the progress and involvement of the whole editorial team not only in continuing the excellence of *WRR* but also taking it to new heights. In an increasingly interdisciplinary world and an era in which fundamental research on water and related fields is called upon to help guiding decisions and policy, fresh perspectives and new directions for our prime journal are needed.

For the second objective (mentoring and promoting our young), I want to work actively to engage and recruit. Please volunteer, provide names and/or submit ideas for increasing the pool of international emerging leaders in the field active within the AGU – there are many capacities in which young scientists can serve and, most importantly, their ideas are always fresh and valued and they should have an outlet to express them. We plan to host a reception Tuesday evening at the AGU Fall meeting for section students and post-doctoral scientists to bring together these younger researchers from across the hydrological sciences, and our student liaison on the section's executive committee, Rolf Hut, plans to develop a program for the reception that will encourage exchange. Many are fortunate to be in similar networks already, but others might benefit greatly from such an opportunity. Terri Hogue (our Section Secretary) and I recently organized the Hydrology program for the Meeting of the Americas and made critical connections with the corresponding elected leadership of the Mexican Geophysical Union and the Brazilian Geophysical Society. We are currently exploring opportunities to enhance collaboration and increase the opportunities for young scientist involvement. More on this to follow.

For the third objective (visibility), I believe that we have some work to do to make sure that our excellent and also societal-relevant research gets the spotlight through press releases and other media. We also have work to do to ensure that our deserving colleagues are properly acknowledged, and together with them, the science of our section. On that front, we need to continue investing time to nominate our most deserving colleagues (I was happy to see 39 Fellow nominations this year in our Section – recall than since 1 out of 1000 members is elected each year, election is a very competitive process but we are on the right track; see the figure below). We also need to increase the awards available for members of our section. The Hydrology Section currently has only 1 out of 18 Union named lectures (the Walter Langbein lecture), no section named lecture (there are 8 of those), and two section awards (Hydrologic Sciences award, and Early Career Hydrologic Sciences award – do these awards deserve a better name?).

As the President-Elect, I also serve on the AGU Council and I was elected this year to the Council Leadership Team (CLT). Having a voice from Hydrology in that executive AGU body is important and I look forward to learning more about the challenges and opportunities discussed in CLT and contributing in ways that reflect our Section and the Union as a whole.



In closing, I thank you again for entrusting me with this position. I am committed to working closely with our President Eric Wood, Secretary Terri Hogue, the technical committees, relevant focus groups, the *WRR* Editorial team, the AGU leadership, and most importantly with all the Hydrology section members that care to contribute, to achieve the 3 goals I set above and set new goals in the years ahead. Please do drop me a note with any ideas and feedback at any time.

From the Water Resources Research Editorial Board

Alberto Montanari (University of Bologna) Editor-in-Chief
Günter Blöschl, Ximing Cai, D. Scott Mackay, Anna M. Michalak, Harihar Rajaram, Graham Sander (Editorial Board)

"Everything flows", said Heraclitus of Ephesus (c. 535 BC - 475 BC) suggesting that the only permanent thing in life is change. Accordingly, on April 1st 2013 a new Editorial Board of *Water Resources Research (WRR)* was appointed to manage the journal for the next four years (see http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1944-7973/homepage/EditorialBoard.html. As the new team of Editors, we are excited to put our shoulders to the wheel to make *WRR* an even stronger journal to serve the international community of hydrologists. The former Editorial Board will continue to manage the papers submitted before April 1st to ensure a smooth transition.

The past editorial board has done a monumental job. Under the leadership of Praveen Kumar and his team, *WRR* has gone from strength to strength. They handed over a healthy journal that publishes an extremely balanced and high quality set of the best research contributions in water resources at the global level. We are watching in awe the flow of submissions of high quality and original manuscripts (more than two hundred papers in the first 45 days of our term!), and witnessing how popular the journal is among the top researchers across all sub-disciplines of hydrology and water resources management. It will indeed be a challenge to live up to the high standards set by Praveen and his team, a challenge to which we feel profoundly committed.

The future of scientific publishing is exciting and sophisticated. New journals and new means of communication are entering the market. The scientific community is steadily growing in size and the number of submissions is therefore increasing as well. As a consequence, the number of requests for refereeing is expanding tremendously and Editorial activities are becoming more demanding. While increased publication opportunities are certainly beneficial to the community, it adds new challenges to *WRR* in its quest to maintain its leadership role and visibility among a multitude of scientific communication outlets. Journals need to adapt with the evolving publishing marketplace, and need to adjust their pace to a world that is turning forever faster. They need to change their communication style and promote their visibility and impact in order to deliver their message globally. There is no doubt that our science is evolving and journals need to evolve as well.

To efficiently meet the above challenges, AGU recently decided to delegate the production and logistical portions of its scientific journals to Wiley-Blackwell, while maintaining their management in-house. On the one hand, the decision has been widely debated within our community, partly because of technical problems associated with the transition, some of which have not yet been fully resolved. On the other hand, being affiliated with a publisher of the scale of Wiley-Blackwell offers opportunities and efficiencies for the journal, and we are firmly committed to utilizing these. A professional, large-scale publisher is in a position to continuously develop new communication technologies and to pay attention to the scientific arena worldwide. This will enhance the visibility and impact of *WRR* beyond the geosciences. As Editors, we are committed to foster a close cooperation with Wiley-Blackwell to maximize the above opportunities, help minimize the risks involved, and establish a close dialogue with our community to make sure that the quality of *WRR* is reaches the highest possible standards. While the logistical aspects of publishing *WRR* have been taken on by Wiley-Blackwell, all scientific aspects remain the sole purview of AGU, including decisions about the journal scope, its direction, the editorial and peer review process, and decisions about content.

WRR is more than a flagship journal of the AGU hydrological community. *WRR* is the most prestigious publishing venue for water resources researchers worldwide. Its reputation has been built over almost 50 years of scientific publishing. The multitude of today's communication outlets creates a dichotomy between scientific quality and visibility. Visibility can be enhanced by targeting a more diverse audience, in terms of geographical coverage, background, and research interests. We believe that such diversity is an asset! On the other hand, quality must be based on a rigorous, yet constructive, review process that identifies the best science but avoids redundancy and repetition. Our science thrives on new ideas, results and forward looking visions. The role of journals and editors today, even more than in the past, is to promote such substance rather than the mere quantity of material. In our view, it is the duty of *WRR* to champion these concepts. We would like to ask the community to support our effort to keep the quality of *WRR* high: to make an effort to provide **timely**, **accurate** and **constructive reviews –** goals high on the agenda of the *WRR* Editorial Board and your efforts in helping us will be beneficial for the journal, its authors and readers, and the community.

We further believe that the hydrological community has a significant role in helping raise the impact of our journals. Increasing the impact of our research is a target that goes beyond promoting a single journal and must be pursued at the **community** level. Maximizing the impact means that a community of researchers is capable of promptly assimilating recent research results worldwide. An efficient action for promoting the impact of *WRR* is needed and we would like to encourage all readers and authors to participate in this dynamic process. Hydrology is an important science and plays a pivotal role for the future of society. It is our duty to raise the awareness of the excellent science we are doing among peers from other disciplines and the public at large. Promoting the quality and visibility of a journal in a dynamic world requires forward-looking editorial strategies. As editors, we are committed to promoting the communication among AGU, the Editorial Board, and all readers and authors, with the strong belief that *WRR* is a community asset.

There are important decisions to be made in the near future for *WRR*, and we believe that they should be discussed openly. A key issue is what role *WRR* should play in the open access publication process. *WRR* already offers the opportunity to make published papers freely available on the web but, currently, this is a rather expensive option which is adopted only by a limited number of authors. We are convinced that *WRR* would benefit and gain visibility if it were fully and freely accessible. At this time, this will probably entail a "fee-based open access" model (see https://en.wikipedia.org/wiki/Open_access_journal). This implies that the publishing costs would be subsidized by authors and funding institutions, making the business model an essential part of any open access policy. In fact, a nice current feature of *WRR* is its accessibility to authors at an affordable price. An open access policy could imply an increase in the costs for authors, but any details are unclear at this time. The business model, therefore, would need to be carefully designed on the basis of the specific needs of each journal's market. A potential open access decision is extremely important and we are committed to cooperating with AGU and all *WRR* readers and authors in identifying a suitable business model targeted to the journal and its community. *WRR* should not follow the mainstream into the open access market; rather, we need to be pro-active and play a leadership role by elaborating and developing new ideas with all of you. In this respect we welcome the views of the hydrologic community on *WRR* and the open access issue. Please feel free to email any member of the Editorial team with any concerns or comments that you may have.

We are aware that pursuing the above targets means addressing both strategic and technical questions related to the management of *WRR*. Further improving the quality of the journal through a high quality review process, enhancing the size of the audience and visibility of *WRR*, and meeting the expectations of the community in terms of timeliness, may look like an unattainable goal. While there is no universally valid recipe for it, we are willing to enthusiastically dedicate a significant part of our time, energy and resources to the journal, and we are motivated to communicate with all of you in a comprehensive, timely and transparent manner. Thanks to the support of AGU, we have already convened a meeting with the *WRR* authors at the EGU General Assembly in April 2013. We will be organizing a similar meeting at the 2013 Fall Meeting to provide opportunities to continue the conversation with you. *WRR* is our journal: an evolving journal in an evolving world.

A decade of Predictions in Ungauged Basins (PUB)

Markus Hrachowitz and Hubert Savenije (Delft University of Technology)

The *Predictions in Ungauged Basins* initiative (PUB), launched in 2003 and concluded by the PUB Symposium 2012 held in Delft (October 23-25, 2012), set out to shift the scientific culture of hydrology away from a reliance on calibration towards improved scientific understanding of hydrological processes and the development of models with increasing realism and reduced predictive uncertainty. The decade of worldwide research efforts has resulted in considerable advances for hydrology as a science. Recently a closure paper on the PUB outcomes and achievements was accepted in *Hydrological Sciences Journal* (Hrachowitz et al., 2013), while the PUB synthesis book, *Runoff Prediction in Ungauged Basins, Synthesis across Processes, Places and Scales*, which was recently published by Cambridge University Press (Blöschl et al., 2013), organised the findings of the PUB decade from the perspective of predicting runoff signatures. Here we briefly outline the achievements of the PUB decade and the challenges that still lie ahead for the hydrological sciences community.

Clearly, the PUB initiative was highly productive, judging by the large number of scientific publications that reported on PUB-related work during the last decade. At the core of the scientific progress were the following achievements:

1. The development of an improved understanding of the ensemble of processes underlying the basin rainfall-runoff and snowmelt-runoff responses and the increasing consensus on the importance of thresholds, feedback processes, and organizing principles that emerges from them.
2. The advances in process understanding have been instrumental for developing a better understanding of our models together with the associated uncertainties. This, in turn, facilitated the design of new modelling and uncertainty assessment strategies and paved the way for identifying and addressing the challenges that lie ahead – challenges that relate to understand the connection between catchment form and function, i.e. for strengthening the link between understanding our models and understanding our catchments, and the still-needed identification of suitable organization principles underlying the catchment response.
3. A relatively broad consensus emerged during the PUB decade that flexible approaches to modelling, that allow the adjustment of models to specific environmental conditions in different catchments, and model falsification, can be highly beneficial as the stronger focus on site specific dominant processes has shown to have the potential to reduce predictive uncertainty.
4. The potential of models as tools for learning about catchment function is now widely recognized and explored.
5. It is now commonly accepted that hydrology needs systematic and consistent uncertainty assessment, acknowledging and quantifying different sources of uncertainty as well as different types of errors, although no consensus has been reached as to how this is most adequately done.

6. The need and benefits of comparative hydrology to get a better understanding of emergent processes, eventually leading to the understanding of organizational principles underlying the catchment response, were recognized, making comparative hydrology an important tool that has made its way into mainstream hydrology.

7. The improved understanding of the links between catchment form and function, often based on emergent properties, i.e. catchment signatures, led to first promising steps towards functional catchment classification.

8. From a synthesis of data, process understanding, and the link between catchment form and function, possible ways towards identifying organizing principles and an eventual formulation of a unified theory were outlined, based on a combination of *Newtonian* and *Darwinian* approaches.

Apart from scientific advances, significant achievements were made in community building, which will be instrumental for ensuring future progress in the discipline. In particular, the PUB initiative has:

- Brought the global hydrology community closer in terms of communication and collaboration, thus gradually replacing mere information accumulation with new knowledge generation.
- Unified the field around core questions and it has provided common purpose to modellers, experimentalists, theoreticians, etc.
- Helped to create a common language between different research groups with different research foci, thus facilitating more collaboration.
- Provided a model for what community activities should be based on: grassroots, inclusivity, empowerment and plurality.

However, some challenges remain to be addressed:

1. There is still a long way to go in terms of achieving robust and reliable predictions. Much of the success so far has been in gauged rather than in ungauged basins, which has negative effects in particular for developing countries, where inabilities to make reliable predictions will continue to impede sustainable water resources management and the development of effective flood and drought mitigation strategies.
2. The progress made in the PUB decade has not led to the harmonization of modelling strategies that was hoped for.
3. Although there has been significant activity in transferring PUB findings into practice and the political decision-making process, more efforts are needed to ensure sustainable water resources management strategies at the beginning of the new Millennium.

These challenges must be addressed, especially in the context of non-stationarity resulting from both naturally occurring and anthropogenically triggered fluctuations of the system. Underpinning and emphasizing the importance of change has naturally led to the new hydrological science initiative for the upcoming decade being called *PANTA RHEI – Everything Flows* (Montanari et al., 2013).

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Hydroepidemiology: Linking hydroclimatology with human health

Antarpreet Jutla (West Virginia University) and
Ali Shafqat Akanda (University of Rhode Island)

"Whoever wishes to investigate medicine properly should proceed thus: in the first place to consider the seasons of the year, and what effects each of them produces for they are not at all alike, but differ much from themselves in regard to their changes. Then the winds, the hot and the cold, especially such as are common to all countries, and then such as are peculiar to each locality. We must also consider the qualities of the waters, for as they differ from one another in taste and weight, so also do they differ much in their qualities."

Hippocrates in his book "On Airs, Water and Places" suggested a strong role of regional climate and water on the occurrence of diseases. Several thousand years later, it is appropriate to ask what have we learned from such early revelations. Are we yet able to predict outbreak of diseases using hydroclimatic signatures? Have we been able to incorporate disease transmission modules into our sophisticated hydrological models? The aim of this article is to highlight how hydrologists can use their knowledge of large scale geophysical processes and technical skill-base to the benefit of human health with environmental surveillance techniques, early warning systems, and prediction of disease outbreaks. Before we begin, it is important to note that despite our efforts, we were able to locate only twelve studies published in three AGU Journals (*Water Resources Research, J. of Geophysical Research, and Geophysical Research Letters*) that have presented methodologies integrating hydroclimatological information with epidemiological understanding, thus showing the recent nature of the research and a promise of future opportunities.

The World Health Organization (WHO) estimates that over three million people die as a result of water-related diseases every year (WHO, 2009). We define water-related diseases as those where the disease causing organism has some of its life or transmission cycle associated with water – for example, cholera through drinking water, malaria and West Nile virus through mosquito habitats in water, Schistosomiasis through snails in freshwater, and so on. Considerable attention has been given to the role of water as a medium for occurrence and outbreak of such diseases in the epidemiological literature. However, the functional form of the disease-causing organisms is generally broad and needs two distinct; macro- and micro-environmental processes for survival, growth, and proliferation. The challenge remains as to how to quantify, and establish physical linkages between the macro-and micro-environmental processes. Here, macro-environment is defined as the hydrological and climatic processes affecting the organism and its habitats and micro-environment encompass the biological processes within and surrounding the organism (Jutla et al., 2010). Current literature does not provide much information on how macro-environmental processes influence the micro-environment of disease causing pathogens. Part of the reason why epidemiological literature does not shed light on such linkages is because such studies primarily focus on the disease transmission pathway in the affected population after the outbreak of the disease, and not on the underlying large-scale hydrological or climatic controls that may affect or trigger the outbreak. Proper identification and quantification of these controls may provide important understanding on the disease dynamics, temporal and spatial variability of the severity and occurrence of disease, and development of appropriate prediction mechanisms that may provide an actionable lead-time to allow intervention efforts.

It is worth mentioning here that water-related diseases are unlikely to be eradicated, since the causative agents are able to live, adapt and survive in the environment. Consequently, such diseases cannot be defeated by medicine alone. Rather, we need an innovative approach – an early warning system with several months' lead time – to minimize the impact of devastating disease by predicting when and where it will occur and initiating effective intervention strategies. To successfully develop warning systems for disease outbreaks, we need to build a bridge between epidemiology and hydrology, which we refer to as "Hydroepidemiology". This term has been used by Kay and Falconer (2008), but in the limited context of fate-transport type experimentation. We define *hydroepidemiology* as the study of the role of hydroclimatological processes and events in endemic and epidemic water-related disease occurrences. The goal of this research paradigm is to shed light on the patterns, causes, and exposure of water-related disease conditions influenced by large scale geophysical processes, which encompass aspects of fate-transport of contaminants and effects on human populations. Figure 1 represents the core philosophy of *hydroepidemiology*; **Symptoms** – macro-environmental signatures that modulate conditions for relevant, **Causes** – the actual micro-environmental processes within the disease causing agent, resulting in **Effects** – disease outbreaks in a population.

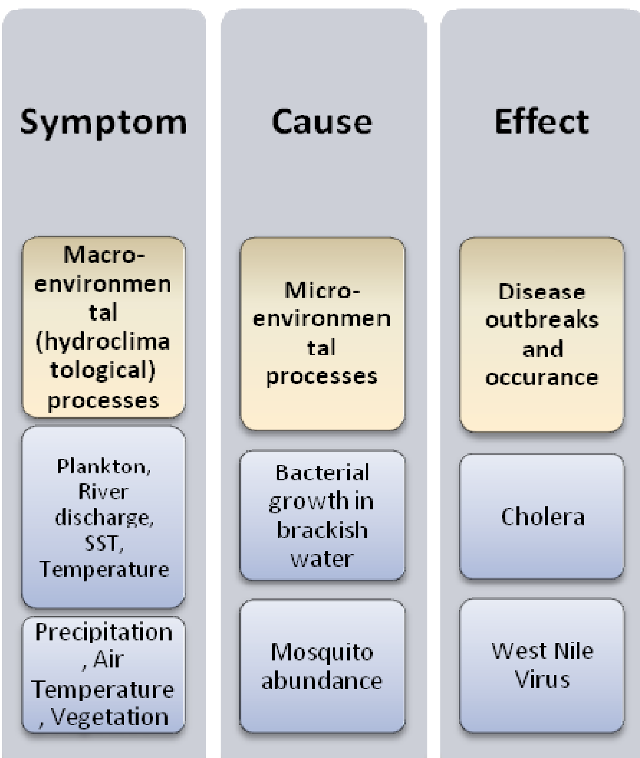

Figure 1: A pathway to understand symbiotic relationship between macro- and micro- environmental processes affecting water-related diseases outbreaks.

We explain how symptoms from Figures 1 and 2 can be diagnosed in reference to cholera, a dreaded water-borne diarrheal disease with an enormous global burden. The life cycle of the causative bacterium, *Vibrio cholerae*, is intricately linked to two vastly different spatial and temporal scales of interacting variables, *micro*- and *macro*-environmental processes (Jutla et al., 2012, Akanda et al., 2011). In the native homeland region of Bengal Delta, the disease cycle starts in the spring season when low discharge in the Ganges and Brahmaputra rivers helps in intrusion of bacteria laden coastal water to inland. Since vibrios are autochthonous to brackish coastal waters, they survive and multiply on different facets of zooplankton and phytoplankton under optimal spring season conditions, leading to outbreaks along coastal Bay of Bengal. The Fall cholera peak occurs after wide-spread monsoon flooding and subsequent breakdown of sanitary conditions in inland areas. Our studies on cholera (Jutla et al., 2012, 2013a; Akanda et al. 2009, 2011,) in the Bengal Delta show that inclusion of satellite remote sensing and hydroclimatic datasets would aid in developing predictive models for disease outbreaks. This result is particularly important for water resources as it pertains to the dry season flow conditions in the regional rivers, a pivotal policy discussion in the transboundary river water management issues between Bangladesh and India.

The recent outbreak of cholera in Haiti, which had a fatality rate of about 6%, caught the health authorities in North America by surprise. Yet, satellite remote sensing provides efficient and reliable information across various scales, which were not available a decade ago. As an example, satellite data provides reliable estimates of plankton abundance through chlorophyll, which can form the basis of a cholera prediction model, especially for coastal regions of Southeast Africa and the Caribbean. In a recent study, Jutla et al (2013a, 2013b) showed that two seasonal cholera occurrence in the Bengal Delta can be predicted two to three months in advance with an overall prediction accuracy exceeding 75% by using combination of satellite-derived chlorophyll and air temperature data. Such high prediction accuracy is achievable because two seasonal peaks of cholera are predicted using two separate models with distinctive macro-environmental processes. Figure

2 shows dominant macro-environmental processes (in blue color) affecting the two seasonal peaks of cholera in the Bengal Delta. The other boxes represent surrogate variables that can be used to revisit and revise the modeling strategies for development of the prediction of cholera.

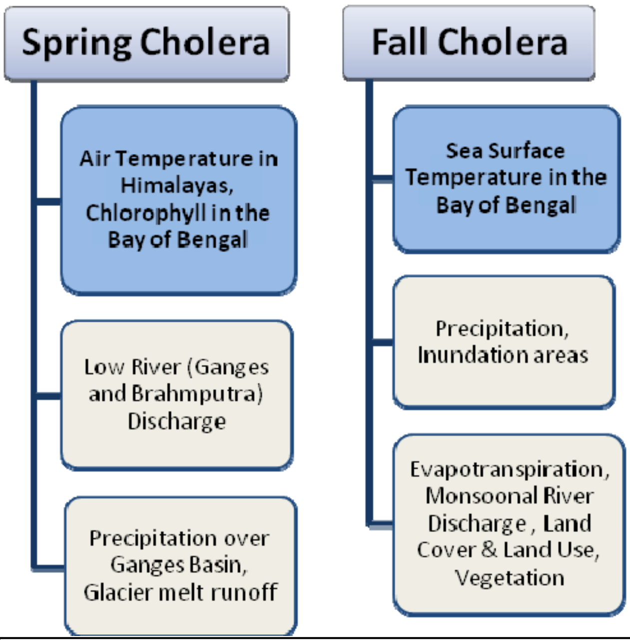

Figure 2: Macro-environmental variables for two seasonal peaks of cholera in Bengal Delta. Blue color represents variables used in several of our recent studies. Rest of the macro-environmental variables can be used to strengthen existing hypotheses and modeling strategies.

We argue that a paradigm change in thinking philosophy is needed in different domains related to *hydroepidemiology*. Hydroclimatology is about long term trends, physical processes and change, variations across scales, and development of statistical and probabilistic models. Microbiology primarily deals with short term trends and in-depth studies of the role of microbes in outbreaks of diseases. Epidemiology deals with developing transmission pathways and establishing generalized patterns behind disease outbreaks. For a microbiologist, symptoms would not play as important a role as the pathogen hosts in the outbreaks of the disease, such as the growth of pathogen, the virulence of difference serotypes, and the associated nutrients and biochemical conditions. An epidemiologist would focus on identifying the cause of the outbreak and the transmission pathway by linking the affected populace to the index cases. For a hydrologist, the threat essentially begins with bacterial contamination of water and subsequent physical spread though river flow (such as in Bertuzzo et al, 2011; 2012); but the microbiological processes affecting pathogen growth and survival may be ignored. In other words, an intellectual discourse between hydrologist, an epidemiologist and a microbiologist remains: Is the host environment (bacterial growth and proliferation) important? Is the physical environment (river flow) more important? Is the causal pathway dominated by primary (environmental) or secondary (human-to-human) transmission? A few recent studies on cholera (Jutla et al. 2012, 2013b; Akanda et al. 2012, 2013; Bertuzzo et al., 2011; Rinaldo et al., 2012) show that the inclusion of mathematical strengths of hydrology and biological information will lead to reductionism through inclusion of satellite remote sensing and hydroclimatic datasets. This would further aid in developing a simplistic approach to develop predictive models for disease outbreaks.

The AGU Fall Meeting session 'Hydro-epidemiology: Understanding connections between Hydrology and Human health', has been held for the past three years consecutively, and has focused on understanding the relationships between water-related diseases and large-scale processes. The view that resonated across the participants was that it is becoming increasingly important to understand the hydrologic and climatic controls of seasonality and spatial variations of water-related diseases in a world under increasing water stress, urbanization and population pressure, as well as climate change. A special edition of *Water Resources Research* (WRR) will be dedicated on issues of water and health. Submissions to WRR will open on September 01, 2013 and will continue for three months.

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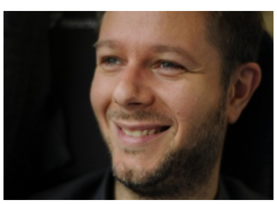
HS Early Career Awardee: Dynamics of floodplains as human-water systems

Giuliano Di Baldassarre, UNESCO-IHE Delft

I am deeply honored to have been the recipient of the AGU Hydrologic Sciences Early Career Award. I would like to thank my colleagues and friends that significantly contribute to my scientific results, and the AGU Hydrology president, Eric Wood, who gave me the opportunity to briefly present here my research work. One of my scientific interests is the interplay between hydrological and social processes. Along with many colleagues, I aim to understand how societies alter the hydrology of floods, while the hydrology of floods, in turn, shapes societies. Understanding the dynamics of floodplains as fully coupled human-water systems is not only a fascinating scientific issue, but also relevant from a more practical viewpoint given that flood risk is dramatically increasing in many regions of the world because of growing population in flood prone areas, sea level rise, as well as changes in land-use and climate.



Many human societies tend to settle in floodplains as they offer favorable conditions for economic development (Di Baldassarre et al., 2010). It is estimated that nowadays around one billion people live in flood prone areas and, as a result, flooding is one of the most damaging natural hazards as it causes about half of all deaths from weather-related disasters (Opperman et al., 2009). A number of hydrological studies have investigated the impact of human activities (such as flood control, land-use changes, and urbanization) on the frequency and severity of floods (Heine and Pinter, 2012). Meanwhile, various social scientists have showed that the severity and frequency of floods often shape patterns of human settlements as well as societal relations (Sultana, 2010). However, while societies influence the frequency of floods, the frequency of floods simultaneously shapes the development of societies, which (again) in turn determine future floodplain dynamics (Di

Baldassarre et al., 2013a). For instance, many communities build and raise levees to protect floodplain areas and therefore reduce the frequency of flooding (Figure 1). Then, because of the reduced frequency of flooding, people feel safer and economic development takes place in the floodplain.

This is an example of the so-call "levee effect" (White, 1945), whereby, paradoxically, flood control structures might even increase flood risk as protection from frequent flooding reduces perceptions of risk and encourages human settlements in floodplain areas, which are then vulnerable to high-consequence and low-probability events (Di Baldassarre et al., 2013a). Thus, the process of building and raising levees often leads to a shift from frequent flooding of rural areas to rare, but potentially catastrophic, flooding of urbanized or industrialized areas (Figure 1). Some societies have realized that this process of continuous levee heightening in no longer sustainable and have started to give back room to the river via floodplain reconnection (Opperman et al., 2009).

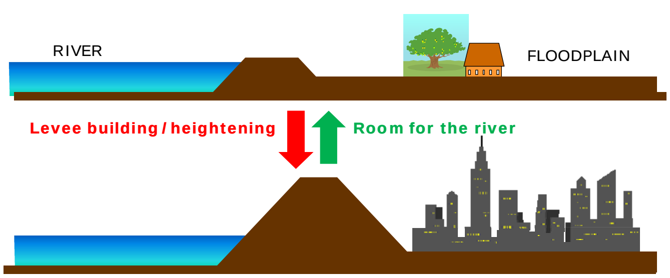


Figure 1: Schematic example of co-evolution and self-organization of floodplains as human-water systems (Di Baldassarre et al., 2013a)

Despite the lack of understanding of these dynamic interactions between floods and societies and the associated feedback mechanisms, the topic remains largely unexplored. In this context, Sivapalan et al. (2012) proposed the science of socio-hydrology, which deals with the two-way coupling of water and human systems. The interplay between hydrological and social processes will also have a crucial role in *Panta Rhei*, the upcoming scientific decade of the International Association of Hydrological Sciences (IAHS; Montanari et al., 2013). In the field of flood science, we recently proposed a conceptualization of the dynamics of human-flood systems to investigate how humans change the frequency of flooding, while the frequency of flooding in turn shapes patterns of human settlements (Di Baldassarre et al., 2013b). The conceptualization considers five different types of processes: hydrological, economical, political, technological, and social (Figure 2). These components are all interlinked and gradually co-evolve over time, while being abruptly altered by the sudden occurrence of flooding events.

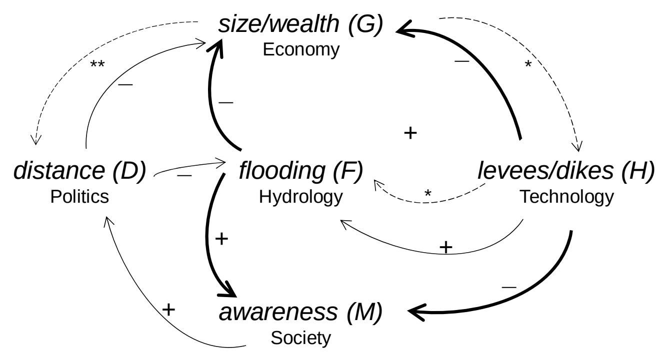


Figure 2: Loop diagram showing the interactions between hydrological, economical, political, technological, and social processes in a floodplain system (Di Baldassarre et al., 2013b)

This conceptualization allows, for instance, a comparison of different trajectories of economic development corresponding to scenarios where people deal with flooding by moving away from the river ("living with floods") versus scenarios where people build levees to protect floodplain areas ("fighting floods"). It also shows the emergence of typical patterns observed in many flood-shaped societies, such as the aforementioned shift from the occurrence of frequent, small flooding events to the occurrence of rare, but catastrophic, flood disasters (Di Baldassarre et al., 2013b).

The understanding of the dynamics of floodplain as human-water systems requires further investigation of the interplay between hydrological and social processes and the spatial heterogeneity of these interactions. This can be accomplished by combining the aforementioned process-based analyses with: (i) historical analysis of long time series of hydrological and social data to explore the feedbacks between human and water systems for a number of case studies, and (ii) comparative analysis of the behavior of floodplain systems and the human interactions with the environment across levels of human impact and different cultures.

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Horton Fellowship Awardee: Is nonsustainable groundwater use sustainable?

Yoshihide Wada (Utrecht University, The Netherlands)

The sustainable use of global water resources is a key issue to economic development and food production. However, in recent years many studies signal overuse of groundwater resources in various regions of the world. Notable examples include northwest India and northeast Pakistan (Rodell et al., 2009; Tiwari et al., 2009), the Ogallala aquifer in the central US (Scanlon et al., 2012a), California's Central Valley (Famiglietti et al., 2011), the North China Plain (Gao et al., 2013), and the Tigris-Euphrates (Voss et al., 2013). Recent studies (Konikow, 2011; Wada et al., 2012) suggest an increasing reliance of human water use on nonrenewable or nonsustainable groundwater resources, i.e. groundwater abstraction in excess of groundwater recharge, over time.

The dwindling groundwater resources occur primarily over intense irrigated regions; about 20% of global crop lands are irrigated, supporting ~40% of the food production worldwide (Abdullah, 2006). Irrigation uses by the largest amount of water among sectors and accounts for ~70% of the global water demands. For major irrigated countries, such as India, Pakistan, Iran, and Mexico, where irrigation sustains much of food production and the livelihood of millions of people, irrigation water demand even exceeds 90% of the total water demand.

Currently, large fractions of water are supplied from nonrenewable groundwater (dark blue) over various countries (Figure 1). Over the Middle East and Northern Africa, more than half of irrigation water comes from groundwater abstraction in excess of recharge in many countries (e.g., Saudi Arabia, Libya, Qatar, UAE). Groundwater recharge is often restricted to episodic rainfall events over these regions where annual average potential evapotranspiration exceeds annual average rainfall due to extremely low precipitation. Over major irrigated countries, the contribution of nonrenewable groundwater abstraction to irrigation is still substantial and supplies ~20% for India, ~15% for China, ~25% for the USA, Pakistan, and Mexico, and ~40% for Iran. Over the globe,

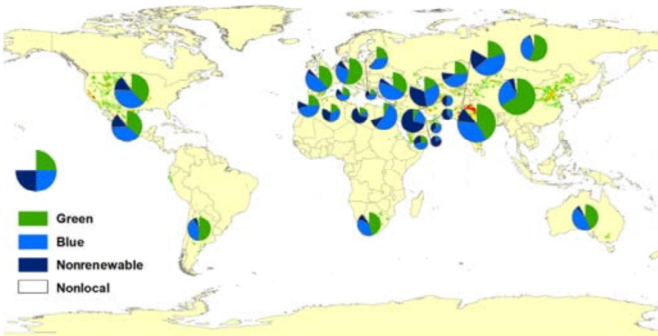

Figure 1. Current contribution (%) per water resource to water used for irrigated crops (crop water demand over irrigated areas) (Wada et al., 2012). Green, blue, nonrenewable and nonlocal denote green water (precipitation stored in the soil), blue water (water in rivers, lakes, reservoirs), nonrenewable (nonrenewable groundwater), and nonlocal (e.g., desalination, aqueducts). Background shows a map of nonrenewable groundwater abstraction for irrigation. Sizes of pie charts are relative to amounts of crop water demand in irrigated areas among the countries shown

nonrenewable groundwater abstraction contributes nearly 20% to irrigation water demand and has more than tripled in size for the past five decades.

Much of current irrigation in many intense irrigated regions is sustained by nonsustainable groundwater. It overshadows the supply from sustainable resources and plays a key role in global food security. Groundwater is also an obvious resource to turn to and meet any outstanding demand. For most countries irrigation water demand is not fully covered by the sum of green water, blue water and nonrenewable groundwater. Alternative resources can be found in desalination or nonlocal water supplied from long-distance or cross-basin water diversions. Overestimation in simulated irrigation water demand also likely contributes to close the gap as it is common that farmers irrigate less than optimally because of persistent water scarcity or to minimize costs.

The expansion of irrigated areas occurred rapidly at a rate of nearly 5% per year during the period 1950s-1980s, but it has slowed down since the late 1990s when the growth rate decreased to <1% per year. For the coming decades, the global area of irrigated land is not expected to expand dramatically due to limited land and water available (Turral et al., 2011). However, future irrigation water demand is subject to large uncertainties due to anticipated climate change (e.g., increasing temperature and changing precipitation pattern), in many regions of the world.

Figure 2 shows the relative change of projected irrigation water demand by the end of century (2080s: mean of 2069-2099), compared to the present (2000s: mean of 1980-2010) for two RCPs (Representative Concentration Pathways). The simulations are forced by the areas currently equipped for irrigation (no socio-economic change)

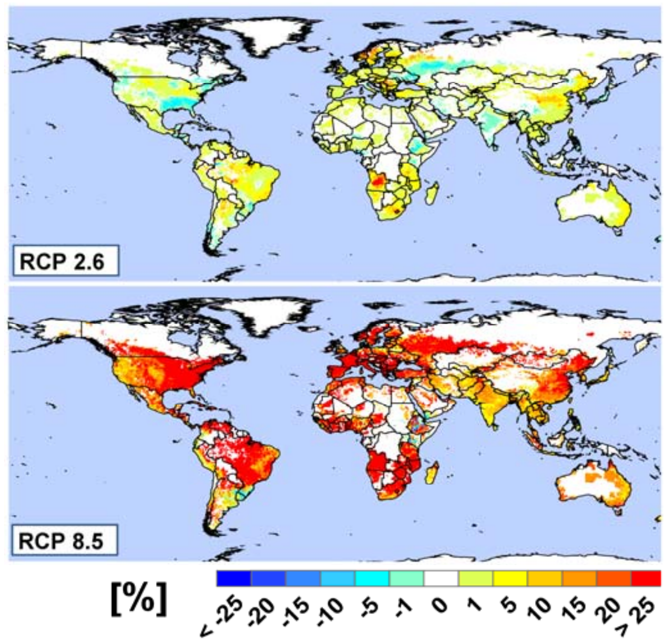

Figure 2. Relative change (%) of simulated irrigation water demand by the end of this century (2080s), compared to the present (2000s) (Wada et al., 2013). The results of the ensemble mean for RCP 2.6 and 8.5 are provided. The simulation was conducted under the framework of ISI-MIP (http://www.isi-mip.org/) and is based on an ensemble of seven state-of-the-art global hydrological models: H08, LPJmL, MPI-HM, PCR-GLOBWB, VIC, WaterGAP, and WBMplus.

and changes in projected irrigation water demand reflect projected climate change only. RCP 2.6 aims to limit the increase of global mean temperature to less than 2 °C by 2100, while under RCP 8.5, global mean temperature increases nearly 6 °C by the end of this century. Under RCP 2.6, irrigation water demand on average decreases over South Asia including the Indus and the Ganges, Eastern Europe, Southeastern USA, and parts of the Middle East and Africa by 2080s, but increases slightly over other regions of the world (<5%).

However, due to pronounced warming under RCP 8.5, the increase in irrigation water demand is projected to be substantial for many heavily irrigated regions including the USA, China, Southern Europe, and Southern Africa, where the increase exceeds 25%. Projected global irrigation water demand is projected to increase by ~12% by the 2050s and by ~21% by the 2080s under RCP8.5. The potential net increase in irrigation water demand likely has an adverse effect over many heavily irrigated regions where freshwater resources are presently under considerable stress. Over these regions, future surface water availability may be even less due to higher evaporative demand and changing precipitation patterns. In such regions, this will bring a further challenge for local farmers to cope with larger irrigation water demand with less water availability.

The sustainability of global food production largely relies on available surface freshwater and groundwater resources. Due to growing water demands and competition among water use sectors, surface freshwater is more and more stressed. In the coming decades, the surface freshwater availability is subject to large uncertainties due to climate change (Tang and Lettenmaier, 2012). One may need to rely more on groundwater resources to supplement the surface water deficit, and to feed rapidly growing global population. Groundwater can increase the resilience of human water use in the face of climate variability and change as the only perennial source of freshwater in many regions (Taylor et al., 2013). The value of groundwater likely increase in coming decades as anticipated climate change is projected to bring more frequent and intense climate extremes. Groundwater can serve as a temporary source of irrigation water during a persistent drought, buffering against such climate extremes and contributing to regional food security. However, this may result in larger nonrenewable groundwater abstraction, which will worsen progressive depletion of groundwater resources (Scanlon et al., 2012b) and overshadow the sustainable water supply and associated food production.

There is a growing concern whether future global food production and associated water use are sustainable to support rising population and their standards of living under climate change in the coming decades and beyond. To alleviate water scarcity and groundwater depletion, one can improve water productivity for food production, i.e. more crop per drop, or increase rain-fed crop production over (sub-)humid regions. In some regions, water productivity and crop yield may be improved due to increased renewable surface or groundwater resources due to change in temperature and precipitation patterns (Portmann et al., 2013). Conjunctive use of groundwater and surface water for irrigation has a potential to alleviate progressive groundwater depletion (Wada and Heinrich, 2013). Technological improvements also have the potential to reduce water demands in many rapidly developing countries where water is scarce. However, improving technology may require a substantial amount of economic investment that may not be easily realized for developing countries with limited financial and technological resources. Nevertheless, alternative options may substantially improve the sustainability of regional food production.

The crucial question is how long nonrenewable groundwater can still sustain current irrigation practices. Presently, this question can only be answered regionally. For instance, a vast amount of fossil groundwater in the Nubian Aquifer System will likely remain as a reliable water source for various human activities in the coming decades. This does not necessarily lead to an exploration of the alternative solutions that were discussed earlier. Assessments of nonsutainable groundwater use and the dwindling groundwater resources remain difficult. Lack of ground-based observations hampers direct observations of groundwater depletion. Since 2002, GRACE satellite observations have opened a new path to monitor groundwater storage changes in data scarce regions and provided valuable information on recent groundwater storage changes at basin scales (Strassberg et al., 2007). Integrated modeling framework that is able to assess the wide range of interactions and impacts among surface water, groundwater, climate, and human activity can also be useful. Globally, reliable information of human water use, surface water availability, and readily accessible groundwater resources that are sustainable is still limited, such that solutions are not easily addressed. The current degree of nonsustainable use may compromise the future livelihoods of millions of people and their living standards. In order to turn around the unsustainable use to create a long-term sustainable, resilient water-food nexus, further investigations are urgently required.

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Falkenberg Awardee: Making Hydrologic Remote Sensing Work for the Developing World

Faisal Hossain (*Tennessee Technological University*)

The Application Value of Hydrologic Remote Sensing

Most aspects of a hydrological study and its findings have a clear societal value in terms of applications. Whether it is floods, droughts, climate change, eco-system impacts, land use management or agriculture, the importance of knowing the hydrological mechanisms for better prediction, forecasting and decision making has always been obvious. In this regard, the remote sensing of hydrology, particularly from space-borne platforms, has particularly great value for society if we consider the logistical challenges we face today.

The traditional approach to measuring water by placing a probe on the ground will likely never be adequate or affordable in most parts of the world. Fortunately, satellites today provide a continuous global bird's-eye view of water processes (above ground) at any given location. Future NASA satellite missions such as the Global Precipitation Measurement (GPM), Soil Moisture Active and Passive (SMAP) and Surface Water and Ocean Topography (SWOT), focused specifically on hydrologic observations, will lead to an explosion of hydrologic data streaming at rates of 1 Terabyte (TB) per day.

Such widespread availability of hydrologic data is likely to benefit many regions of the world. Take for example the case of flood-prone downstream nations in international river basins. A challenge faced by such nations is the unavailability of in-situ hydrologic data from upstream nations for issuing early flood warnings. It is estimated that about 33 downstream countries have more than 95% of their territory locked within such basins and are therefore 'blind' to what is happening to the water flowing from upstream nations (Wolf et al., 1999; Hossain and Katiyar, 2006). Many of these 'blind' nations cannot prepare ahead for the impending flood due to the lack of data from conventional sources. Given the vantage of space that is unique to satellites (unlike ground-based systems), hydrologic data from satellites, such as rainfall, soil moisture, water body extent, elevations and stream flow, over the entire international river basin, is a key solution to overcoming this transboundary hurdle.

Despite this obvious knowledge and our frequent statements we often make championing the use of satellite hydrologic data, what does it really take to make stakeholders in the developing world truly benefit from it? Do we know enough to 'hit the ground running' and positively impact that stakeholder group desperately in need of guidance on current and future satellite hydrologic missions? It is no surprise that a National Research Council report popularized the term "Valley of Death" almost 10 years ago to describe the region where research on weather satellites had struggled to reach maturity for societal applications. And sadly, the term "Valley of Death" survives among the satellite application community.

Crossing the Valley of Death

In this article, I would like to share what some of us have learned (the hard way) trying to cross this valley of death for a flood prone country and stakeholder nation, Bangladesh. This country is home to 160 million people whose lives could be improved significantly with early information on the transboundary flooding from upstream nations (Figure 1). Bangladesh does not receive any upstream river flow and rainfall information in real time from India during the critical monsoon season. Bangladeshi authorities, therefore, measure river flow at staging points where the two major rivers enter Bangladesh (Ganges and Brahmaputra) and at other points downstream. On the basis of these data, it is possible to forecast flood levels in the interior and the south of Bangladesh with only two to three days lead time (Flood Forecasting and Warning Center, Bangladesh: www.ffwc.gov.bd; Figure 1). The need to extend forecasting lead time beyond 3 days has a strong motivation from the standpoint of preventing loss of life and economic damages. Studies have shown that a 14-21 day forecast is ideal for Bangladesh given paddy-intensive agriculture requires a longer time for a decision on delayed sowing or an early harvest. Also, any improvement in capacity to handle transboundary flooding is known to significantly reduce population vulnerability (Bakker, 2009).

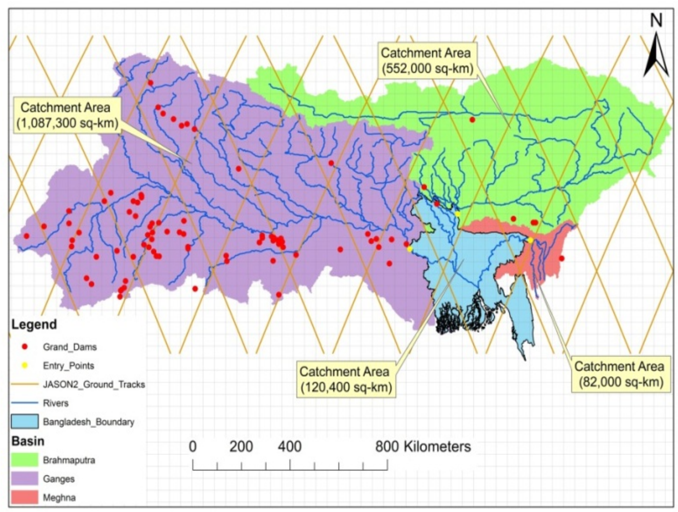

Figure 1: The Ganges Brahmaputra Meghna basin and location of Bangladesh as the smallest and most flood prone and downstream nation. The yellow lines indicate the tracks for the JASON-2 satellite altimeter. The red circles indicate the location of major dams.

Recent work by Biancamaria et al. (2011) has shown the potential of satellite altimetry to forecast incoming transboundary flow for downstream nations by detecting river levels at locations in upstream nations (Figure 1). Using TOPEX/Poseidon (T/P) satellite altimetry measurements of water levels in India, Biancamaria et al. (2011) have recently demonstrated in theory the feasibility of extending the forecasting lead time from 3 days to 8-10 days with no additional overhead costs. The T/P-based forecasting scheme reported an RMSE of about 0.40 m (0.6-0.8m) for lead times up to 5 days (10 days) without having to rely on any upstream in-situ (gauge) river level data.

Armed with this knowledge of 'theoretical feasibility', we recently embarked on making satellite-based altimetry for river flow monitoring known and embraced by the Bangladesh authorities. Our approach involved a two-way education process. We conducted frequent hands-on training workshop for Institute of Water Modeling (IWM)-Bangladesh, and International Center for Integrated Mountain Development (ICIMOD) (Nepal) since 2010. In these workshops, water resources staff (managers, engineers and scientists), who are conventionally trained in planning and disaster management were taught to handle emerging hydrologic remote sensing technology in anticipation of future missions like GPM and SWOT. Each staff was immersed in an intensive continuing education and hands-on program to help them grasp inductively the fundamentals of application for water resources monitoring (Figure 2).

Figure 2. A typical capacity building workshop in Bangladesh hosted by the author (on left) to train staff on hydrologic remote sensing concepts and the hands-on use of satellite data to produce operational river flood forecasts

In our first such education effort in 2010, we opened the floor for 'honest' and candid feedback from the end users, stakeholders and engineering staff (i.e., those who would be responsible to modifying the decision making tools for handling satellite data). We expected to receive a wholehearted endorsement of the great value satellites would have for flood forecasting or other applications. Instead, we received very humbling feedback that made us realize that there is more work to be done. The logistical challenges to making hydrologic remote sensing work in the developing world will take more time and effort. Some examples of the feedback we received are summarized below

The Humbling Feedback on Satellite Hydrologic Data from Stakeholders

- *"The remotely sensed discharge using satellite data has very high errors even during dry season. Why bother to use them? "*
- *"The method of satellite based discharge estimation still requires in-situ bathymetry which means you still need to go to the field. So it's not as useful and cannot replace in-situ measurements."*
- *"We have pressure transducers now that can measure water level every minute and relay the information real-time. Why bother to use a SWOT-like mission that will only cross a river section a few times a week or less?"*
- *"The scatter in elevation data across a river cross section is too much. What should be the 'standard' elevation of the water level at a given river cross section? "*
- *"Effective use of Landsat data to classify a flooding river of land and water areas will depend on the unlikely chance of the region being cloud-free during the Monsoon season."*

Most of the feedback above could have been robustly rebutted with recent research that has been done to overcome many of the practical hurdles and skepticism. However, the unexpectedness of such humbling feedback made us realize that the 'preaching to the choir' (i.e., to our community) needed to be complemented with more listening to the needs of those who stand to benefit more than the scientific community. In essence, the proverbial saying summed it up all, '*if you want someone to learn how to fish, don't just give them the fishing rod, teach them how to fish.*'

Teaching Stakeholders How to Fish

Humbled by the feedback from stakeholders, last year we embarked on making JASON-2 altimetry operational for extended flood forecasting in Bangladesh (up to 8 day lead time). We engaged the stakeholders and staff from the Flood Forecasting Division of Bangladesh over a period of 4months to ensure the 'teaching' happened. In the process, we listened carefully to their feedback and seek acceptable ways to overcome the constraints they face day to day. Unexpectedly, more practical hurdles were identified at the last moments, and we realized the importance of keeping an open mind to such unexpected technical challenges. One classic example was the realization that the JASON-2 data on river height that is available with the shortest latency had the data structure format and content (radar backscatter) that only the trained experts on altimetry could handle. An intermediate set of tools needed to be developed rapidly to extract information in the manner that would be convenient for the users. In overcoming many of these challenges (which is still a work in progress), we would like to share a few tips for our colleagues who wish to embark on a similar journey to cross the valley of death and make hydrologic remote sensing work for stakeholders:

- Provide full ownership to stakeholders (seek 2-way feedback).
- Keep the proposed idea/model involving satellite data as simple as possible in the beginning.
- Train staff ground up through hands-on tasks. True capacity is built from individual staffs up.
- Customize solutions within constraints of existing systems used by users.
- Leverage free tools as much as possible.
- Utilize 'volunteer' experts for rapid re-tailoring of research tools for operational delivery.

In closing, let us remember what Benjamin Franklin, Confucius and many Chinese Fortune Cookies have repeated for centuries:
"Tell me and I forget.
Teach me and I remember.
Involve me and I learn."
With this involvement and the feeling of true ownership, where the scientific community listens more to user needs then only preach solutions, hydrologic remote sensing data is likely to work much better in future for the developing world.

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Planning a Chapman Conference

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Chapman conferences (http://chapman.agu.org) are designed to be small meetings that help facilitate in-depth discussion and exchange of ideas. The American Geophysical Union meetings, specifically the fall meeting has become very large with many parallel sessions that do not offer much opportunity for in-depth discussions. The Chapman conferences can be organized around specific topics as well as topics of current interest. There are certain aspects that will be useful for planning a successful Chapman conference

Topic

The topic of the Chapman conference should not be very narrow but at the same time should not be too broad. Topics that have been addressed in other conferences should be avoided. A list of past Chapman Conference topics can be found at http://chapman.agu.org/past-chapman-conferences/ and the upcoming conferences are listed on the main page.

Participation

Chapman conferences should include a diverse audience from students to senior scientists as well as a diversity of professional affiliations – university, research organizations, funding agencies and private sector. Every attempt must be made to have broad international participation. The optimal number of participants is around 100.

Location and Time of year

The choice of location is quite important. This should be decided by consensus in your scientific community. Having an attractive location (for example, Hawaii) can be very expensive so the registration fee will be higher than if the meeting was being held in the Washington DC area. A warm location in winter or a cooler location in summer or a location easily accessible to a sizeable portion of international community is always welcomed. Scheduling the conference requires some thought so as avoid conflicts with other major conferences or academic schedules for university faculty and students. Generally, February and March serve as good months for Chapman conferences in the Spring and September and October in the Fall. Summer is often an option even though many people are often away during August.

Budget

The budget needs to be balanced between registration fees and expenses. The conveners should write proposals for travel support for graduate students and young professionals, and scholars from developing countries. Additionally, funding can be sought from private corporations for supporting other aspects at the conference such as the icebreaker or the dinner.

Schedule

Chapman conferences are usually organized to provide longer presentations and significant time for discussion. Ultimately, the conveners decide on the mix and schedule, but one model that has shown to be successful is to have plenary sessions in the morning with substantial talks – say 30 minutes plus ample time for questions – and smaller breakout sessions in the afternoon that can be more focused. Such breakout sessions are most successful when the sessions include discussion leaders and topics selected prior to the conference. Given the limited number of plenary and breakout presentation, other participants will have poster presentations, which need to be scheduled so all participants have an opportunity to discus the work. Additionally a field trip may be a welcome addition to the schedule, but its placement within the schedule requires some thought. Often it precedes a conference dinner, especially if the dinner is away from the main venue. The length of the conference is an important variable. Conference longer than 3 days may result in attendees leaving before the conference ends because many people feel that their time is limited. For longer conferences the organizers need to carefully schedule the topics and sessions for maximum interest and retention for the whole period.

Timeline

A comfortable timeline is provided below. However for topics of current interest for which the Chapman conference needs to be held quickly the timeline can be shortened.

Year 1

Initial discussions are usually started in the Technical Committees (TCs) at the Fall Meeting. These usually consist of a (draft) conference theme, topics and potential TCs – the community you expect to participate. It is important to identify the lead conveners and a conference organizing committee at this stage so they can work on the conference theme and detailed topics, and work with the appropriate TCs (and community) for feedback as there may be more than one TC interested.) The organizers should distribute drafts of the themes and topics to the appropriate technical committees via their chairs, and the chairs should ask their TC members for feedback. One a mature draft is available, it is helpful to communicate it to the section leadership so that they are fully informed. Finalize the person(s) who will serve as the convener(s) and create the organizing committee. It expedites the organizing if this can happen within four or five months.

After finalizing the themes/topics, the conveners need to write a Chapman Conference proposal. The proposal needs to follow the checklist on the AGU Chapman Conference homepage (http://chapman.agu.org/propose/proposals-checklist/) and be submitted to Brenda Weaver (bweaver@agu.org) and/or Venkat Lakshmi (vlakshmi@geol.sc.edu).

The AGU Chapman Conference Committee will review the proposal, including outside reviews, and a decision regarding conference will be communicated to the conveners. By the AGU Fall meeting you will have a decision and the planning can begin

Year 2

Planning for the Chapman meeting includes selection of the venue, inviting speakers and soliciting abstracts, deciding the budget and the schedule. It is critical that conveners develop a strategy for publicizing the conference to reach your desired audience. Planning may also include writing a funding proposal to agencies that could support the conference and thus could off-set some of the costs (i.e. lower the registration fees) and/or provide travel support for students. This phase usually takes a year.

Year 3

This will be the year that the conference would be held.

If the first year activities get off to a slow start, then the schedule gets stretched out. But to have timely themes and topics, the conveners should work hard to finalize the first phase and write their conference proposal. Having an active organizing committee with members who can take on major tasks (e.g. writing funding proposals for student travel, identifying invited speakers and structuring breakout sessions) is critical and speeds organizing the conference and spreads the work around.

2012 FM Outstanding Student Paper Award Winners

Sanyogita Andriyas	Bayesian Belief Networks Approach for Modeling Irrigation Behavior	Utah State University	Mac McKee
David Cameron	Closed-loop Aquifer Management for Geological Carbon Sequestration	Stanford University	Louis Durlofsky
Jane Chui	The Three Regimes of Miscible Viscous Fingering	MIT	Ruben Juanes
Jake Diamond	Concentration-discharge relationships for variably sized streams in Florida: Patterns and drivers in long-term catchment studies	University of Florida	Matt Cohen
James Dietrich	Mapping Land and Water Surface Topography with instantaneous Structure from Motion	University of Oregon	Mark Fonstad
Xue Feng	Changes in rainfall seasonality in the tropics	Duke University	Amilcare Porporato
David Hochstetler	Impact of Compound-Specific Transverse Mixing on Steady-State Reactive Plumes	Stanford University	Peter K. Kitanidis
Dan Li	Hydro-meteorological and micro-climatic impacts of urbanization	Princeton University	Elie Bou-Zeid
Franziska Moebius	Pore invasion dynamics during fluid front displacement in porous media determine functional pore size distribution and phase entrapment	ETH Zurich	Dani Or

Phu Nguyen	Improving flash flood forecasting through coupling of a distributed hydrologic rainfall-runoff model (HL-RDHM) with a hydraulic model (BreZo)	UC Irvine	Soroosh Sorooshian
Nicole Rudolph	Highly resolved imaging at the soil - plant root interface: A combination of fluorescence imaging and neutron radiography	University Potsdam, Germany	S. E. Oswald

2013 MoA Outstanding Student Paper Award Winner

Conrado Rudorff	Flooding dynamics on the lower Amazon floodplain	UC Santa Barbara	John Melack