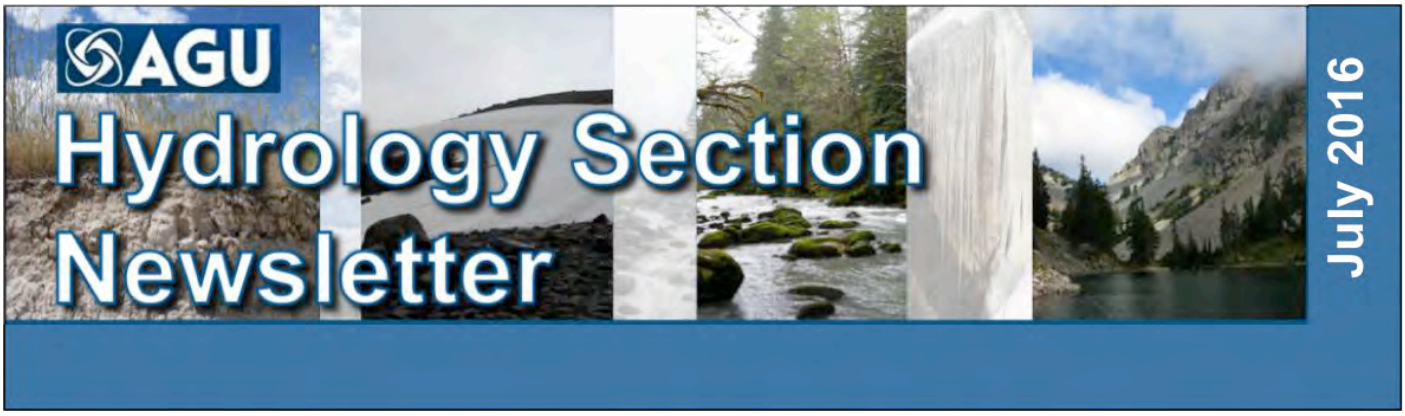


From the Section President

Efi Foufoula-Georgiou

Dear Colleagues, Dear Friends,

It is my pleasure to provide a midyear update on section accomplishments, new initiatives, and some thoughts for the year ahead. In this newsletter, please also find articles from our president-elect, section secretary, student leaders, Fall Meeting program chair, candidates for the 2016 leadership elections, *Water Resources Research* (*WRR*) editorial board, science highlights from past awardees, and also an obituary of a great hydrologist and past section president, Jim Wallis.

But, first, I want to thank the many volunteers who serve our section: elected officers, students, technical committees, awards committees, and all those who offer feedback and suggestions on initiatives. Your dedicated and proactive involvement keeps our section at the forefront of growth and service to our members. This year I especially want to thank a grassroots fund-raising committee for the newly established Paul A. Witherspoon Midcareer Lecture in Hydrologic Sciences. Establishing new awards requires a financial commitment from our section, and their efforts speak volumes for the commitment of our members to support and reward excellence in our midcareer scientists.

Congratulations to the 2016 awardees

Please join me in congratulating the 2016 section awardees: Amilcare Porporato, Duke University (Hydrologic Sciences Award); Ciaran Harman, Johns Hopkins University (Early Career Hydrologic Sciences Award); Jim Kirchner, ETH (Walter Langbein

In this Issue

2016 Hydrology Section Awardees

The Hydrology section has just announced its 2016 awardees. Please join me in congratulating:

Hydrologic Science Award
Amilcare Porporato, Duke University

Early Career Hydrologic Science Award
Ciaran Harman, Johns Hopkins University

Langbein Lecture
James (Jim) Kirchner, ETH Zurich

Witherspoon Lecture
Paolo D'Odorico, University of Virginia

Horton Research Grant Recipients
Hadley McIntosh, University of Maryland
Noah Jemison, University of Illinois, Urbana-Champaign
Katalyn Voss, University of California, Santa Barbara

Lecture); and Paolo D'Odorico, University of Virginia (inaugural Paul A. Witherspoon Midcareer Lecture in Hydrologic Sciences). Three students were selected for the Horton Research Grants: Hadley McIntosh (University of Maryland), Noah Jemison (University of Illinois, Urbana-Champaign), and Katalyn Voss (University of California, Santa Barbara). The Union awards will be announced in late July, and we look forward to celebrating the election of many Union Fellows and awardees from our section.

This year we had a healthy number of nominations across the board, and I thank all nominators and letter writers for this. A low number of nominations was a concern last year for all sections and focus groups, and it is great to see this trend reversed. Please do not get discouraged if your nomination was not successful—improve the package and persist next year, and please do not hesitate to request feedback from the chair of the respective committee. I sincerely thank the members of all awards committees for their hard work on behalf of the section—selection among excellent candidates is never easy.

Leadership elections coming up

The polls for election of new leadership open on 29 August and close on 27 September. The slate of 110 candidates was announced on 5 May 2016. I am pleased to announce the candidates for Hydrology section president: Hubert Savenije (Delft University of Technology) and Scott Tyler (University of Nevada, Reno); and for section secretary: John Bolten (NASA Goddard Space Flight Center) and Charles Luce (U.S. Forest Service). Please read their articles in this newsletter, and please make sure you cast your vote! Also, this year we have two students/early career scientists from the Hydrology section running for members of the AGU Council: Student Member Candidate: Tim H. M. van Emmerik (Delft University of Technology) and past-president of the Hydrology section Student Subcommittee; and Early Career Member Candidate: Catalina Oaida (Jet Propulsion Laboratory, California Institute of Technology). Please read their articles in this newsletter and support the representation of Hydrology young scientists at the Union level.

Honoring our past

This year our section introduced the "Virtual Hydrologists Project (VHP) ," aiming to establish a permanent and comprehensive e-repository of the scholarly work of past leaders in the field for easy access by young and older readers. Thank you for the positive feedback and the encouragement to grow this collection. In the course of this project, several other independent efforts emerged, such as the recently released wiki on the History of Hydrology—see the article by Keith Beven in this issue. We are in the process of examining how to best consolidate these efforts to create a rich and self-maintained repository. Your ideas and input are welcome. Steve Burges has been a huge resource in pointing out missing videos of interviews and past lectures in our "Lectures/Interviews" link. These are now updated with AGU's help, who embraced this effort as part of its 2019 Centennial Celebration projects.

Our NextGen is leading and thriving

We are lucky to have such an active, innovative, and committed young membership in Hydrology, a sign of a thriving field. Our students lead and innovate not only for our section but also for AGU as a whole, introducing the pre-AGU student conference, water pop-ups, meet the experts, Bingo, Young Hydrologists Society, and much more. Please read their activities on our website and the article of the Hydrologic Sciences Student Subcommittee (H3S) in this newsletter written by Evan Kipnis (chair) and Niels Claes (cochair). This year the students also played a vital role in helping our technical committees and FM Program officers with the new online interactive discussion of session proposals, which we introduced to assist in a bottom-up and more informative merging of sessions before the final step at AGU headquarters. Please read the article by the Hydrology FM program chair Bart Nijssen in this newsletter.

Hydrology Business Luncheon one more year!

In a previous newsletter I announced the intention to replace the section business luncheon with an evening social event to allow for more interaction among our members. This idea was received well…but I am sorry to report that I had to back off on it. This year, 2016, will be our last year in San Francisco for a while, and introducing this change would be unproductive and confusing to many. Next year in New Orleans and the year after that in Washington, D. C., will be the perfect time for such a change. Last year we sold 400 tickets to the luncheon, and I look forward to a similar attendance this year. Please buy your ticket early, as last year we had requests after the closing date that we could not accommodate.

Interested in helping with the JpGU-AGU joint meeting organization?

This year AGU had a presence at the JpGU meeting through session co-organization. I attended this meeting in Makuhari, Chiba, Japan, and really enjoyed the small size of it and the interactions it allowed. This year, the co-organization extends to the whole meeting (not only sessions), so if you are interested in being involved, please let me (efi@umn.edu) and Dr. Michiaki Sugita (sugita@geoenv.tsukuba.ac.jp) know. Session proposals are due 1 September through 13 October, and a lead from the Hydrology section as representative in the Program Committee is sought.

Some AGU pending changes in award eligibility

Pending approval by the Council at the December 2016 meeting, the following changes are to be implemented for the 2018 honors cycle: *Nominees* for all Union honors, with the exception of Fellows and the Climate Communications Prize, will not require AGU membership, as they did before. *Nominators*, however, for all Union honors (with the exception of a few prizes as per donor stipulation) will now require AGU membership.

More in this newsletter

The 2015 Horton medalist Günter Blöschl and elected Fellow Scott Tyler offer perspectives on their research. Alberto Montanari (editor in chief), Jean Bahr, Günter Blöschl, Ximing Cai, D. Scott Mackay, Anna Michalak, Harihar Rajaram, and Xavier Sanchez-Vila (editors) write on the role and identity of *WRR*. Our president-elect Jeff McDonnell writes about the increasingly young and international profile of our membership and urges involvement in section activities. The 2015 OSPA winners are announced—congratulations to all and thanks to section secretary Terri Hogue and the OSPA committee for their hard work. Please read Terri's article in this newsletter and offer your help as a judge for next year.

Please read the obituary in honor of James (Jim) Wallis, past section president, written by Dennis Lettenmaier, Enda O'Connell, Ezio Todini, and Eric Wood—it paints an insightful account of Jim's scientific contributions and admirable personal traits that left a deep mark on our community. I had the pleasure of knowing Jim and benefited from discussions with him at AGU meetings in the 1980s. If Jim managed to switch session rooms real-time during an AGU meeting, my experience was that I managed to pull together a Hydrology session composed of five invited tutorial lectures followed by research papers—no protocol to do this in 1991 but it was a very successful session! Which brings me to an important message…

Make your voice heard

AGU is a large and complex organization. It derives its "energy and knowledge" from its 60,000 members like you, worldwide. Please take an active stand in voicing your opinion and guiding its future—from membership issues you care about, to choosing the leadership, to journal publishing, to the recent debate on ExxonMobil's sponsorship. Your voice counts, but it has to be heard.

Warm regards and many thanks to all for keeping our section vibrant. Also thanks to Anthony Longjas in my group for maintaining the Hydrology website and overseeing the production of this newsletter.

Efi Foufoula-Georgiou
AGU Section President, Hydrology

Reminders

AGU abstract submission deadline is 3 August. This year a change was made to allow only two invited speakers per session (instead of four in previous years). A recent email was sent by Steve Holbrook asking participation in a survey on a potential national near-surface and critical-zone geophysics facility—please help in this effort.

From the Section President-Elect

Jeff McDonnell

The past year: I recently completed my stint on the HS Fellows Selection Committee, where I was chair for the past 2 years and a committee member for a few years before. I want to thank this year's committee for their hard work: Hoshin Gupta (University of Arizona), Harry Vereecken (Forschungszentrum Juelich GmbH), Bridget Scanlon (University of Texas, Austin), Larry Band (University of North Carolina, Chapel Hill), Praveen Kumar (University of Illinois), and Georgia Destouni (Stockholm University). As always, selection is incredibly difficult. Fellow allocation is set at 0.1% of our HS membership; as a committee, we forward a list of double this number to the second Union committee, which makes the final selection (with some nominations cosponsored between sections and focus groups).

As past chair, I have lots of suggestions for my successor, which according to our bylaws will be our new president-elect. But in the meantime, I want to reflect and encourage our section to consider the following criteria used in the Fellow selection process for those considering making a nomination for next year. The committee has three factors for Fellow selection: (1) breakthrough or discovery, (2) innovation in disciplinary science, cross-disciplinary science, and (3) instrument development or methods development sustained scientific impact.

I would like to remind everyone of the excellent piece in the July 2011 newsletter by Andrew Barry and Eric Wood on the Fellows selection process and how to craft a compelling nomination letter and package. Also, I want to note that while the members of the HS Fellows Selection Committee are all Fellows, those who would like to nominate a candidate or write letters of support do not have to be. This year we had 33 submissions (quite similar to last year). Notably, 12 of the nominations were from outside the United States from 10 different countries.

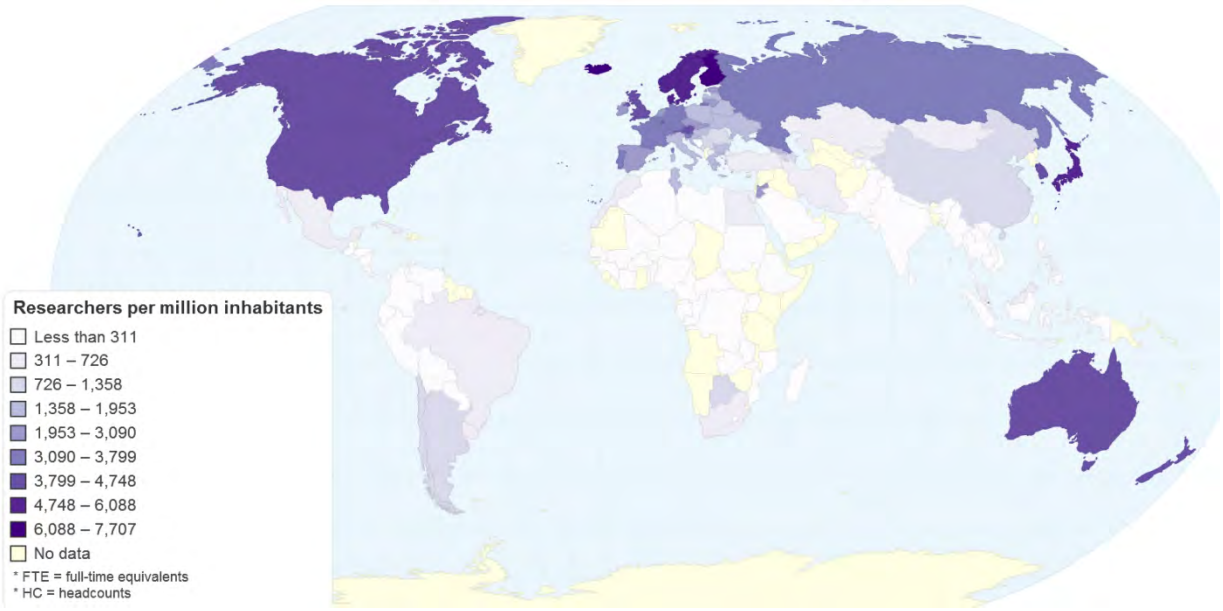
Looking ahead: To date, the HS is now at approximately 13,000 members with primary or secondary affiliation to Hydrology; as the Fellows statistics show, our section is highly international. Our members come from more than 100 different countries, with about 63% from the United States. Europe accounts for ~14%, Asia and the Western Pacific another 14%, Canada's is 5%, Central and South America represent 2%, and the Middle East and Africa are also 2%.

I know in Canada there are more members of AGU than there are of the Canadian Geophysical Union. I suspect that this may be true for other countries. Therefore international focus is an important component of our AGU mandate. One way of bridging between countries and with other groups via AGU is the Chapman Conferences. I recently returned from an AGU Chapman Conference held in Ecuador in June 2016, which focused on "Emerging issues in tropical ecohydrology," organized by Brad Wilcox and colleagues. The meeting was one of the best I've attended. The conference had great international diversity, great interdisciplinarity, and many newcomers to the AGU scene. Chapman meetings like this are extraordinarily useful for engaging students and early career scientists and pay dividends for the development of future sessions and regroupings at our Fall Meeting. The Chapman Conferences can also be a way to engage with colleagues from regions where science capacity is low but the needs are high. With half the world's population expected to live in the tropics by 2050, we have a pressing need to build capacity there and elsewhere. As the figure below shows, the distribution of "researchers per million inhabitants" is extremely skewed and places like the tropics are in desperate need of hydrological focus.

If our section is broadly international, it is also broadly young. We have more than 3500 students with primary or secondary affiliation to hydrology. In addition, about 30% of our section is between the ages of 30 and 39. I will close with a few thoughts for our young members. The Fall Meeting can be an overwhelming scene. When I attended my first meeting in 1987, there were fewer than 5000 participants and it was held at the much smaller and intimate Civic Center. Our goal now within the HS Executive Committee is to create a level of intimacy within the context of (what is now) a huge meeting. How to do this? One possible way is for researchers to host social events outside of the conference. I have for years run a Monday night

gathering for my past and present lab members at a nearby pub, where I pay for the first couple of hours' worth of beer. Another way that many research groups create more intimacy is to use the AGU Fall Meeting for side meetings. As a young scientist, be proactive with these side meetings and arrange them many months in advance. Develop your own networks. I would also urge young HS members to get involved in leadership activities. Our HS president, Efi Foufoula-Georgiou, has written in previous newsletters about the heroic efforts of the HS student chapter. If you are a student, contact them to get involved. If you are a young faculty member, be proactive in session development. Join a technical committee. Propose a Chapman Conference. These early leadership experiences will benefit you and the section.

Wishing everyone an enjoyable summer. —Jeff McDonnell, HS President-Elect



Source: http://chartsbin.com/view/1124 and UNESCO statistics.

OSPA Updates and News

Terri Hogue, Colorado School of Mines, Hydrology Section Secretary

The Hydrology Section Outstanding Student Paper Awards (OSPA) Committee includes Kolja Rotzoll (U.S. Geological Survey), Laurel Saito (University of Nevada, Reno), Rolf Hut (Delft University), Alicia Kinoshita (San Diego State University), and myself as chair. At the 2015 Fall Meeting, 424 student presentations were assessed and the section gave out 20 awards. As always, OSPA is extremely competitive, and the average winning score last fall was 42.4 out of 45 (or 94%). Winners for the Fall Meeting can be found here (search using the Hydrology section link): https://membership.agu.org/ospa-winners.

In addition to high numerical scores, winning students must also have outstanding comments specific to their presentation. These written comments are weighted heavily, so please, when you judge a student take a minute or two to add comments reflective of your scores and what stood out (good or bad) on the presentation. This year we expect to judge a similar number of presentations at the Fall Meeting, which will require approximately 1500 assessments for the Hydrology section. Please take the time to provide feedback to our early career members by signing up to be an OSPA judge and helping us attain 100% judging and score submission. We also ask that you encourage your students to confirm their participation if they signed up for OSPA (an email reminder is sent to each

student prior to Fall Meeting) and to be present at their posters for the times they have listed. One of the biggest complaints we hear from our judges is that students are not present when they come around to review a poster.

The OSPA team also helps organize and evaluate the Hydrology section student travel grants that are submitted to AGU. We average around 150 grants each year that require our review and selection of travel grant awards. If you are interested in helping on either OSPA or travel grant review, please get in touch! We value and appreciate the work our members do to support our students.

Fall Meeting Updates

Bart Nijssen, University of Washington, Hydrology Section Fall Meeting Committee Chair

With nearly 3000 abstracts in 2015 and more than 100 individual sessions, the AGU Fall Meeting continues to be the largest single gathering for hydrologists. Now that the abstract submission website for the 2016 AGU Fall Meeting is open, I have been asked to provide some background on how the Fall Meeting is organized, the role of the various actors, and any changes that are being made to the format of the Fall Meeting.

Perhaps the biggest change for the Fall Meeting will be a temporary relocation in 2017 and 2018. After nearly 50 years in San Francisco, the meeting will move to New Orleans in 2017 and Washington, D. C., in 2018 to accommodate renovation plans in the Moscone Center. The meeting will return to an expanded Moscone Center in 2019, just in time to celebrate AGU's centennial. To be sure, this year's Fall Meeting will still be held in San Francisco, from 12 to 16 December.

The Fall Meeting Program Committee (FMPC) consists of representatives from each of the AGU sections and is chaired by the Fall Meeting Program chair, currently Denis-Didier Rousseau. The FMPC is responsible for the scientific program, while most of the day-to-day logistics and venue details are managed by AGU staff. Each section has its own Fall Meeting Committee and is free to set its own rules within the overall constraints from AGU. For Hydrology, the committee consists of three members, who each serve for a 3-year term and who chair the committee during the final year of his or her term. This year the Hydrology Fall Meeting Committee consists of Megan M. Smith (2016–2018), Casey Brown (2015–2017), and me, Bart Nijssen (2014–2016).

Fall Meeting organization starts in the spring when session proposals are solicited from the AGU community. Any AGU member can submit a session proposal. This has not always been the case. In the not too distant past, session topics were decided by committee rather than proposed by the community at large. This has resulted in a broader range of topics, but also introduced some organizational and scheduling challenges, as Hydrology is fortunate to have a very active community. In effect, this means that the Hydrology Fall Meeting Committee receives far more session proposals than can be accommodated. For example, this year we received 165 individual session proposals. Given that we expect to receive approximately 3000 Hydrology abstracts, this would mean fewer than 20 abstracts, on average, per session. In practice, we would end up with many very small sessions and a few large ones. For this reason, the Fall Meeting Committee has actively pursued session mergers between the end of the session proposal period and the opening of the abstract submission website. The goals of this merger process are to reduce duplication, encourage larger sessions, and create a sufficiently diverse scientific program. The main advantage of merging before the abstract submission website opens is that there is more clarity about the final program for those submitting abstracts. In addition, because of scheduling constraints, there is much more time to pursue mergers in the spring than in the fall (after abstract submission closes). Finally, it is difficult to accommodate a large number of sessions, many of which would be too small to qualify for any oral segments.

One of the innovations in the session proposal and merging process this year was to involve the Hydrology technical committees (TCs) directly in the merger process. Each session proposer was asked to identify the TC most closely related to his or her proposed session, and the TCs then pursued mergers for sessions related to their TC. This TC designation was only used for organizational purposes and will not be shown in the final Fall Meeting program. Mergers were not limited to sessions associated with the same TC, but were also accomplished for sessions associated with different TCs. In the end, through a series of two-, three-, and even four-way mergers, the total number of sessions was reduced from 165 to 119. We would like to reduce this number to fewer than 100, so the Hydrology Fall Meeting Committee will pursue an additional (smaller) round of mergers following the abstract submission deadline on 3 August 2016.

Both session proposers and abstract submitters often ask about the number of abstract submissions that receive an oral presentation. In the past few years, slightly less than one third of the presentations have been oral, with the remaining two thirds designated as posters. This apportionment is dictated by the space constraints in the Moscone Center. The number of oral segments is allocated to each section by AGU based on the number of submitted abstracts. Oral segments are allocated in 2-hour blocks. In practice, this has meant that in past years a minimum of about 20 abstracts were required for a session to receive an oral segment. This number is not set in stone, as it depends on the distribution of submissions across sessions and the number of oral segments allocated by AGU, which varies by year. Sessions with fewer than the minimum number of required abstracts will be merged or designated as poster-only.

Other than the involvement of the TCs in session organization, there are some additional changes this year. The number of invited authors has been reduced from four to two (https://fallmeeting.agu.org/2016/convener-guidelines/invited-authors/).

This is an AGU-wide policy and has been motivated by the observation that late session mergers often result in sessions with eight or more invited authors. As in past years, being an invited author does not guarantee that that person will receive an oral presentation. New session formats will be introduced at the Fall Meeting (https://fallmeeting.agu.org/2016/alternate-session-formats/). It is now possible to have a formal panel discussion as part of a session and to have a series of lightning talks that accompany selected poster sessions and that allow a number of presenters to introduce their posters in rapid succession. In contrast to last year, it will now be possible to add your coauthors as part of the abstract submission process, but you have some extra time to finalize this step (until 17 August 2016, that is, within 2 weeks of the abstract submission deadline; https://fallmeeting.agu.org/2016/2016/06/20/abstract-guidelines/).

In addition to the AGU-wide changes, Hydrology will have its first Paul Witherspoon Lecture at the 2016 Fall Meeting. This new lecture is given in recognition of outstanding achievements by a midcareer scientist (within 10–20 years of granting of Ph.D.) in advancing the field of hydrologic sciences. The inaugural Paul Witherspoon Lecture will be given by Paolo D'Odorico from the University of Virginia.

All in all, the 2016 Fall Meeting promises to be an excellent meeting with a diverse program. As the chair of the Hydrology Fall Meeting Committee I would like to thank all the TCs and session proposers for their help during the session merger process, and I encourage everyone to submit their abstracts early but no later than 3 August 2016.

Report from the Hydrology Section Student Subcommittee

Evan Kipnis (Chair) and Niels Claes (Cochair)

The Hydrology section Student Subcommittee (H3S) represents the interests of the student members within AGU's Hydrology section. For our second year, we are composed of 11 members from five nationalities across 10 universities. We provide professional resources for student members beyond what is already offered by AGU, represent the interests of student members within AGU's organizational framework, and foster opportunities for students to connect with more established membership. If you wish to learn more about us, please view our web page: http://hydrology.agu.org/student/hydrology-student-subcommittee/ .

Our efforts took shape during the 2015 Fall Meeting as Student and Early Career Conference sessions, pop-up talks, and student mixers. We are very excited to continue developing programming for the 2016 Fall Meeting and expanding opportunities for student members within the Hydrology section. One of our major focuses this year is working with AGU to offer opportunities to connect undergraduate and graduate students with more senior members of the Hydrology section.

This fall we'll be asking interested membership to engage with the Hydrology section's students. Look for these upcoming volunteer opportunities to improve the meeting for student members, and contact us if you have an interest in participating.

- **Hydrologist Bingo:** This is a social opportunity for Hydrology section student members to meet well-established faculty and professional scientists within Hydrology throughout the Fall Meeting. Bingo sheets will be filled out with the names and headshots of section members who volunteer to participate in this activity. This past year we had more than 60 section members volunteer for this activity, and we thank all who did so. Prizes may be offered for student members participating in hydrologist bingo. We'll be asking faculty to once again participate in this great opportunity to meet with the student members of the Hydrology section.

- **Undergraduate Mentoring Program:** This program offers first-time undergraduate attendees the opportunity to meet with a faculty/professional mentor over 5 hours throughout the Fall Meeting. We will be asking for Hydrology section members to participate so that undergraduate attendees have the opportunity for an enhanced Fall Meeting experience.

- **Student Mentoring Sessions**: This is an opportunity for undergraduate and graduate students to meet one-on-one with a faculty/professional advisor for a short conversation regarding research, academic, and professional activities. We will be looking for Hydrology section members interested in volunteering up to 2 hours of their time to speak with students.

If you wish to follow our activity for 2016, follow us on Twitter @agu_h3s or contact us directly.

The Role and Identity of *Water Resources Research*

Alberto Montanari (Editor in Chief), Jean Bahr, Günter Blöschl, Ximing Cai, D. Scott Mackay, Anna Michalak, Harihar Rajaram, and Xavier Sanchez-Vila (Editors)

Change is the keyword of our era. We realize in our everyday life that the progress of technology and communications is changing societal dynamics at an unprecedented pace. Scientific research is changing even faster, and publications are developing accordingly. The most striking footprint of such development is the increasing number of journals, papers, and citations. A recent study by *Bornmann and Mutz* [2015] reported that publications and cited references are increasing at a rate of 8%–9% per year as of 2010, implying a doubling period of about 10 years. Furthermore, they concluded that Web of Science "only covered a small part of the total publications." The recent growth in the number of papers is shown in their Figure 1 (the published paper is available open-access).

Hydrology is experiencing a significant increase of publication venues as well. The availability of a large number of possible outlets for a scientific study may of course be a positive development, but there is concern that the growing number of publications may not necessarily imply that science is progressing as fast. In fact, the increase in number of outlets was partly triggered by pressure from universities and funding agencies to publish in journals—the "publish-or-perish" syndrome (see the joint editorial by *Koutsoyiannis et al*. [2016]). As a consequence, publishing may become the object of research rather than a means of disseminating research results as it should be. This situation raises suspicion that the average quality of scientific papers has declined, and consequently, requests for a more rigorous peer review process are frequently directed at editors and publishers. Another side effect is that researchers, especially those in early stages of their careers, may have a difficult time when trying to select the optimal publication venue for their contribution. Indeed they often need to seek a compromise between visibility, quality assurance, speed of publication, and other constraints that may be imposed by the rapidly evolving system.

We believe that the increasing opportunities for connections and visibility of researchers is a positive evolution, but its benefits can be fully realized only if publishers and scientific communities adopt innovative procedures for quality assurance. In fact, the peer review process must be rigorously monitored to make sure that the increasing load on editors and reviewers does not lead to a reduction in the quality of assessment of scientific impact. Furthermore, there is the need for each journal to develop its own scientific identity that goes beyond a simple definition of scope. Journals today should develop an individual character, to become distinguishable in a crowded publishing marketplace. Such journal branding is necessary to provide guidance to young researchers, namely, a clear picture of the available options and their focus. This cannot be achieved without the support of publishers and the initiative and dedication of authors, editors, and reviewers, namely, the entire research community. Rather than seeking competition, publishers should cooperate to offer to the scientific community a diversified panorama of scientific outlets, each one with its own unique identity.

As editors of *Water Resources Research* (*WRR*), we felt committed from the beginning of our term to providing our contribution to the evolution of the *WRR* identity. We were motivated to develop a vision, founded upon our personal view of the future evolution of scientific publishing, while recognizing that the character of a journal should be founded on its legacy. For *WRR* the legacy is 5 decades long!

We believe that the future of scientific publishing is open-access and relying on open information. For this reason, we worked with AGU to grant open-access to *WRR*. Today, all *WRR* papers are freely accessible after 2 years from publication, and can be made available in institutional repositories after just 6 months. These are important achievements, but we are still convinced that one more step is necessary, which is to make any paper free on the *WRR* website from the time of publication. We are also working with AGU on the application of

the AGU data policy (http://publications.agu.org/author-resource-center/publication-policies/data-policy/), which aims to make sure that "all data necessary to understand, evaluate, replicate, and build upon the reported research must be made available and accessible whenever possible."

Finally, and perhaps more important, what is the identity of *WRR*? We looked back at the history of the journal and recognized that *WRR* has been always considered by our community as a top-level publication venue, the ideal place to gain knowledge on cutting-edge research in hydrology and water resources management. Preserving such distinguishing behavior requires a joint effort by authors and editors. The key defining features from the editors' perspective are:

- Novelty—reporting on fundamental rather than incremental progress,
- Interdisciplinarity—embracing both the natural and social sciences of water,
- Global relevance—research of interest to an international rather than local readership.

Accordingly, we review submitted papers by looking at their innovative content to make sure that it is fundamental. Such a strategy implies a concerted effort by the editorial board, editors, and associate editors, who make a preliminary and refined assessment of papers to make sure that only truly deserving ones are sent out for review. This approach reduces the workload for the reviewers, who in turn are usually happy to serve *WRR*, as they know that papers were preliminarily assessed and selected. Many of the manuscripts rejected by *WRR* find a home later in other journals, with a different character and role. Some of them turn out to be well cited. Indeed our experience suggests that highly cited papers are those that better match the scope and the identity of the journal. As editors, we feel that we better serve the community when we help direct publishable papers to their most appropriate outlet.

We are frequently approached by potential *WRR* authors who ask our opinion on the suitability of a manuscript for *WRR*. Besides making ourselves available for preliminary (presubmission) evaluations, we are motivated to offer advice to authors for self-evaluation of their manuscripts. We often suggest to the authors that they identify what they learned from their study and make an attempt to assess whether it is really fundamental and interesting for the global community of water scientists, rather than a limited set of researchers. We suggest evaluating whether the societal implications of the study are original and broadly relevant. Review papers should deal with broad topics and should provide a new benchmark for future research. *WRR* considers case studies, as long as they allow drawing conclusions of general validity and interest. The application of known methods to a case study, which may have important local implications but little innovative content, should go to more technical journals.

Once the authors are really convinced that the take-home message of the paper is relevant and innovative, an effort should be made to explain in the abstract and the concluding section what is new and what the implications are for the global community of scientists. Keywords are relevant for visibility purposes. Research highlights are also important; they should summarize what has been learned from the study rather than what has been done. Finally, authors should not forget to include in the final section the necessary information to gain access to data and any other information that may be useful to ensure reproducibility.

Promoting a clear vision for the role and the identity of *WRR* is a community effort, which we editors are fully committed to putting into practice. Any journal, and *WRR* in particular, given its long history, is an asset for the community, and an opportunity to address the relevant challenges that water science is required to face. As always, we welcome your feedback!

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President–Elect Candidate: Hubert H. G. Savenije

Delft University of Technology

It is a great honor for me to have been asked to be a candidate for president of the Hydrology section of AGU, the first time someone outside the United States is given such an opportunity. It reflects the breadth of vision of AGU, which I fully endorse. By way of introduction, I have held the chair of hydrology at Delft University of Technology since 2004. Before that I was professor of water resources at the UNESCO-IHE in Delft, where I started working in 1990 after having worked as a professional hydrologist for 12 years, mostly in Africa and Asia. In fact, I started my career as a hydrologist working for the Mozambican government over 1978–1985. I have always found my practical experience as a field hydrologist in a variety of (sub) tropical countries of great value for my present academic work.

In the past I have served the hydrology community in several ways. I am currently president of the IAHS (my term ends in summer 2017) and have been the president of the Hydrology Division of EGU. I am executive editor of *Hydrology and Earth System Sciences* and editor in chief of *Physics and Chemistry of the Earth*. Until 2004, I was also a member of the editorial board of the *Journal of Hydrology*. Through my academic and extensive consulting work I have amassed a large professional network of water scientists in Africa, Asia, Europe, and the Americas. If elected, one of my key tasks is to use this network to connect the Hydrology section of AGU even more strongly to the international community of hydrologists, not only in Europe, where connections are already strong, but also in the global South. In this way I hope to reinforce AGU as a global leader in hydrology, mobilizing the community to address the hydrology of all continents and start initiatives that involve hydrologists from all parts of the world.

In this ambition I would like to see stronger involvement of young scientists: I shall work closely with the Young Hydrologic Society and the Hydrology section Student Subcommittee to increase the diversity, inclusivity, and global outreach of the AGU Hydrology section. I would like to assist AGU in pushing forward the frontiers of open-access publishing, seeking efficiencies that will help reduce publication fees and make it attractive and accessible to all hydrologists in the world. I am also a proponent of open data: I have worked with editors of *WRR* and other hydrology journals to advance open data in all hydrological science publications. Finally, I would like to use the Hydrology section newsletter and social media to regularly seek feedback and generate debates on how the hydrology community can have a greater impact on society. I believe these efforts will keep the Hydrology section at the forefront and responsive to its members for years to come.

President–Elect Candidate: Scott W. Tyler

University of Nevada, Reno

The AGU Hydrology section has been my intellectual and professional home for almost 30 years. I am grateful to my early mentors, Don Nielsen, Dan Stephens, and Rien van Genuchten among others, who encouraged me to become involved with AGU. Ever since that time, I have worked closely with the section and the community, as editor of *Water Resources Research*, AGU technical committees, codirecting our community's first user-focused instrumentation center (CTEMPs), chairing the GSA's Hydrogeology Division, and, most recently, as the chair of the Board of Directors for the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI). As CUAHSI board chair, I focused both on bringing the Water Data Center to operational status and on leading the board of directors to begin the difficult task of recruiting our next

CUAHSI executive director. Both of these tasks are now well on the way to completion.

It is truly an honor to be considered to represent the membership as president of the section. AGU's Hydrology section is the leading professional organization for water in the world, and it is imperative that we bring this expertise to policy makers and the public. While our community has long championed the critical importance of water, we are now seeing governmental efforts around the world to bring advances in water research into practice. In a major breakthrough for our discipline, President Barack Obama recently held his first "Water Summit," in March. Among other changes, he announced an action plan for national drought resilience policies, along with the first "national" water model designed to improve our river forecasting capacity at almost 3 million stream reaches. This is national attention that our community has rarely received. Water quality and drought are now on the public's radar. Today, it is the responsibility of the Hydrology section and our collaborators such as CUAHSI to both proactively engage in leadership of water policy opportunities and supply the science and engineering needed. As your president, I will gladly take on the challenge of working with the section membership to engage you and AGU in these new opportunities.

Over the past 3 decades I have also witnessed significant change in AGU's structure, management, and leadership. What has enabled successful change within our organization has been the active engagement of the membership. It is always critical to keep the membership aware of and active in the decision-making process. As your president, I will bring my same engagement philosophy to bear on critical AGU issues and to always broadly solicit input. My style of leadership is to proactively, and often personally, seek advice from all of the ranks, from the most senior faculty to the graduate students and staff. I also have some experience in more modern communication methods, and we must now tap the power of social media to engage the next generation of members and to encourage participation.

For example, most of you know that we will be moving the Fall Meeting for 2 years to New Orleans (2017) and Washington, D. C. (2018), due to renovation of the Moscone Center. We plan to return to San Francisco for the AGU centennial celebration in 2019. I will make it a priority to keep our membership informed and engaged to make this rotation as productive and seamless as possible.

In closing, it is an honor and a privilege to be considered by the membership of the Hydrology section to serve as president-elect. I welcome the challenge to carry forward the support I have received from AGU to my colleagues and the next generation of hydrologists and to have the opportunity to bring our ever evolving science to the public.

Section Secretary Candidate: John D. Bolten

NASA Goddard Space Flight Center

In 1997 I was nearing the end of my broadly focused undergraduate studies at West Virginia University, during which I had taken a variety of courses from the schools of medicine, journalism, advertising, engineering, and geography. Then I stumbled upon a flyer offering a geology course studying the Grand Canyon, which included a weeklong camping trip to explore the canyon after a semester learning the geologic history and stratigraphy of the region. I was sold! When I was younger, my favorite trips had always included spelunking and rappelling with the Boy Scouts in the hills of West Virginia, Kentucky, and Pennsylvania. I always appreciated spending time outdoors, but my time in the canyon had a significant effect on me. From its raging waters to its tranquil quietness and beauty carved into the landscape, this amazing monument is a testament to the incredibly powerful nature of water and how it shapes our world. After an incredible trip to the canyon, I had a new appreciation for geology and hydrology. I wanted to learn more about water and land hydrology—the why, how, and where of water. More important, what would be my contribution to the field?

Eventually, I would decide to pursue my master's and doctorate degrees in hydrological sciences from the University of South Carolina. My advisor had several grants from NASA focusing on land surface modeling and satellite- and aircraft-based remote sensing of hydrology. As a result, I was given many opportunities to work on some of the most innovative and exciting projects regarding remote sensing of soil moisture. During my tenure at South Carolina, I spent time working at the Jet Propulsion Lab in Pasadena, Calif.; the Environmental Technology Lab in Boulder, Colo.; several large-scale soil moisture remote sensing field experiments in Iowa, Georgia, and Arizona; and a very memorable one in the Sonoran Desert, in Mexico. Luckily, in my first semester of graduate school in 1999, I was given an opportunity to present some work at my first AGU conference—an enlightening and slightly overwhelming experience! I have attended AGU every year since and have been lucky to build relationships and establish collaborations with conveners and friends through AGU.

Since earning my degrees, I have worked at the USDA Hydrology and Remote Sensing Lab in Beltsville, Md., and am currently a physical scientist at the NASA Goddard Space Flight Center Hydrological Sciences Lab in Greenbelt, Md. I have convened several AGU Hydrology sessions and often volunteer as a judge for student papers and posters. AGU has become my welcome annual weeklong work meeting—a time of intense learning, listening, talking, and fodder for ideas, papers, and friendships.

In the early 2000s I started attending the Hydrology Remote Sensing Technical Committee meetings, which usually require an early morning wake-up, but they entice you with a free breakfast! In 2010 I was asked to serve as the deputy chair of the Hydrology Remote Sensing Technical Committee, and I have since served as chair of the committee and have remained an active and engaged member and contributor to the Hydrology section newsletters and *Eos* articles.

It is an honor to be nominated to serve as secretary of the Hydrology Committee. As secretary of the AGU Hydrology section, a priority during my tenure will be to maintain and improve the communication of the section's progress, aims, and activities with the president and president-elect. My goal is to voice the objectives and exchange of ideas of the committees as effectively as possible and represent them to my best ability. I will carry out the traditional roles of section secretary such as preparing minutes of all meetings of the section and executive committee, but also I plan to leverage off of the recent progress AGU has made utilizing cloud-based communication and collaboration tools such as Google Groups and Slack.

I will approach my partnership with the members, president, and president-elect in the same way that I have approached my many collaborations and activities within AGU since 1999: with enthusiasm and sincerity. In my career I have found frequent communication effective for establishing partnerships, particularly through in-person discussions at committee meetings and Chapman Conferences, as well as through publishing in newsletters and *Eos*, and the AGU Water Resources Monograph series. To that end, I will make a significant impact on the section by establishing an early relationship with the members, president, and president-elect. While serving as secretary, I will seek feedback from members and ask for ideas for fostering a joint discussion and exchange of ideas regarding hydrology and water resources for the wider scientific community in an effort to best accomplish the goals of the AGU strategic plan and priority objectives.

Thank you for this opportunity!

Section Secretary Candidate: Charles H. Luce

U.S. Forest Service

Community is important to science. Through the processes of sharing and discussion, it promotes rigor, creativity, productivity, and relevance. Recruiting and retaining scientists with a mix of gender and ethnic backgrounds depend on a thriving and welcoming community as well. The vitality of our scientific community is sustained through a host of volunteers who organize sessions, create networking opportunities, and help recognize members. The Hydrology section officers coordinate and support the members and leaders of the various section committees. I am honored to have been nominated to run for section secretary and serve as a part of this team.

I joined AGU in 1989 at the urging of mentors who were then leaders at AGU. They encouraged me to actively participate in AGU, even as a student, and I attended Surface Water Technical Committee meetings starting early in my career. I warmly recall members of that committee supporting me and another early career scientist to convene what was a first session for both of us, in 1999. The lesson of how valuable their leadership was at that time in my career underpins my philosophy on how integral technical committees are to developing scientists. I was elected deputy chair of the Surface Water Committee from 2005 to 2007 and served as chair from 2007 to 2009. I served as the Hydrology section representative on the Fall Meeting Planning Committee for the 2012, 2013, and 2014 meetings. In 2015 I participated in an ad hoc committee led by Jeff McDonnell for improving technical committee involvement during Fall Meeting planning. I am currently serving a second term as an associate editor of *WRR*.

Three primary areas of work for the secretary are (1) ensuring adequate judging for the Outstanding Student Paper Awards, (2) coordinating the technical committees, and (3) recruiting new Chapman Conference proposals. I am committed to improving how we use these as opportunities to engage our newest scientists and to support the increasingly interdisciplinary nature of our science.

Recent Hydrology section secretaries Martha Conklin and Terri Hogue, along with members of the OSPA committee, have been leaders for the entire Union in improving the OSPA judging process over the past several years. I would continue their goals of improving judging participation and strengthening judging quality. I would also emphasize the value of the judging process for introducing developing scientists to senior scientists in the broader community.

The role of the technical committees has been shifting over the past decade. Because they were unique to the Hydrology section, they did not fit the new general processes set up by the Union in the early 2000s. Given the great diversity of research under the umbrella of Hydrology and the strong interdisciplinary ties to many of the other sections and focus groups, the expertise residing in the technical committees, and the early opportunity for volunteer service they represent, make them an invaluable resource that we need to engage with vigor. As a former technical committee chair, and as a Fall Meeting Program Committee member, I worked to involve the technical committees in the meeting planning process. As secretary, I will initiate implementation of the suggestions outlined by the ad hoc committee on the Fall Meeting and technical committees (see the July 2015 section newsletter).

Chapman Conferences are a valuable strategy for building communities around particular topics, encouraging in-depth interdisciplinary discussions, and creating a more conducive atmosphere for networking. Some topics have seen great success at AGU sessions in recent years, but only a few have spun off into organized Chapman Conferences. Perhaps a bit of encouragement and a little coordination could generate more proposals. In my tenure, I will work with TC chairs and other sections to identify three or four new potential conferences and support and encourage leaders to undertake the planning.

I've enjoyed my previous service to the hydrologic community and have learned much as a result. I will enjoy undertaking an office that is so central to encouraging community mentorship of newer scientists. I look forward to the opportunity to serve.

AGU Council Early Career Member Candidate: Catalina Oaida

Jet Propulsion Laboratory, California Institute of Technology

"Please declare your College of Engineering major," the form asked. I was at the beginning of my sophomore year at the University of Michigan in the fall of 2005, considering my options for a career path. The answer became obvious quicker than I had expected. All it took was thinking back to the great Indian Ocean earthquake and subsequent tsunami from a few months back, in December 2004, which shook the world, devastating hundreds of thousands of lives, or the recent landfall of Hurricane Katrina in August of 2005, one of the deadliest hurricanes in U.S. history. These events made a deep and lasting impression on me. It was the first time I really thought about the strength and power of nature, the implications to our lives, and our interactions with it. Then I remembered how fascinating each page of *The Earth System* book in one of my courses was, opening my eyes to the complexities and beauty of our planet. I looked back down at the form and checked the box "Earth System Science and Engineering, Department of Atmospheric, Oceanic, and Space Sciences."

Since then, over the course of the past decade, I have deepened my knowledge of Earth science, finding my niche in the land–atmosphere interactions discipline during my Ph.D., which brought to the forefront for me the importance of the water cycle, in the Earth system as well as to society. Currently I am a Caltech postdoc at NASA's Jet Propulsion Laboratory in the surface hydrology group, where I get to collaborate with a diverse team of scientists and engineers to improve the science and tools we use in exploring the water cycle and freshwater availability. Both the doctoral and postdoctoral experiences have highlighted for me the need for interdisciplinary collaborations, not only among scientists but also with stakeholders, politicians, and society at large. Having said that, I know firsthand how overwhelming or challenging it can be for younger scientists, or scientists-to-be, to make such connections and develop such partnerships.

Fortunately, AGU offers many avenues that encourage interdisciplinary and diverse teamwork. It also recognizes that students and early career members represent a large portion of the membership, and they offer a forward thinking perspective. The main responsibility of an early career representative on the AGU Council is to be an advocate to his or her peers from the organization, and vice versa, to bring forth issues or concerns of the younger constituency, to mobilize and engage them with the organization and the scientific community, and help make students and early career scientists feel included in, and supported by, AGU.

I am thrilled by the opportunity to serve on the AGU Council as an early career representative, and if elected I am committed to (1) making it easier for younger members to connect with a variety of people and activities, (2) ensuring that programs developed or offered by AGU effectively engage and benefit early career members, (3) fostering diversity and interdisciplinary collaborations, and (4) communicating ideas and concerns between early career members and the Council.

My past experiences have prepared me well in acting as early career representative. I have served on undergraduate and graduate student groups under many roles, from leadership positions like president of the Society of Undergraduate Earth System Science and Engineering (at University of Michigan) and vice president of Atmospheric and Oceanic Sciences' Graduate Student Organization (at UCLA), to recruitment chair and outreach board member of the latter, to advisory roles on the University of Michigan's Engineering Undergraduate Student Advisory Board. More recently, I have volunteered as an AGU OSPA judge and as an AGU Thriving Earth Exchange–Climate Colab fellow, providing feedback to a wide range of scientific projects. Being in my second year of a postdoc, I am still early in my career, and I believe this puts me in a good place to more easily relate to younger, newer members of this scientific community while being able to interact and connect with the more established constituency. As a member of the Council, I believe I can bring energetic, well-rounded, forward thinking input, based on interactions and feedback from students and early career members, as well as my own experiences. I am thankful for the opportunity to be one of the nominees, and it would be a great honor to be able to serve on the AGU Council as an early career representative. Thank you for your consideration.

AGU Council Student Member Candidate: Tim H. M. van Emmerik

Delft University of Technology

In 2013 I attended my first AGU Fall Meeting, and ever since I have been involved as a volunteer at AGU. In my daily life I am a Ph.D. student at Delft University of Technology (Netherlands), working on vegetation water stress detection using radar. During my years as Hydrology Student Representative my efforts focused on representing students and early career scientists within AGU, experimenting with new session formats, and empowering other young geoscientists to become actively involved at AGU. This year, I am running for AGU Council student member, a position in which I aim to further improve the student representation, involvement, and empowerment.

In case you're wondering what the AGU Council is, it works together with the Board, task forces, volunteers, and staff to advance AGU's strategic plans. The Council consists of a diverse group of people, among others the section and focus group presidents and presidents-elect, committee chairs, and six elected student and early career scientists. The Council has three main tasks: (1) forming science policy, (2) generating and discussing science-related ideas, and (3) advising on science and member issues. For more information, visit the Council website.

Communication with student and early career members is crucial for the mandate of the student members of the Council. Right now, I think there are two major points of improvement that can be made:

- First, the visibility of the student Council members among the AGU student and early career members can be improved. To aim my generation as well as possible, I will discuss, interact, and involve a broad range of the student members. As an active member of AGU, EGU, and the Young Hydrologic Society, I have always sought ways to stimulate interaction and solicit input. If elected, I will make sure to use both virtual and in-person options to involve students as much as possible. A similar strategy has been successful within hydrology, where we now have an active student committee, as well as many individual volunteers, active at various levels within AGU.

- Second, there should be more cohesion within AGU student leadership. At this moment, there are over 90 student members actively involved at AGU (at, e.g., council, committees, technical committees, student representatives). However, the student leadership does not yet function as a community. To genuinely give a voice to the new generation, to continue improving AGU, to actively involve the AGU student population, a strong student leadership is necessary.

Given my (to some extent successful) organizing activities in the AGU Hydrology section, my familiarity with the AGU organization, my involvement at various conferences, student bodies, and organizations, and my international experiences, I am convinced I would make a good Council student member. In the past years I've been part of a student movement that has made the Hydrology section an example for AGU, and now it is time to bring these initiatives to a higher level.

If you have any questions, suggestions, and comments, don't hesitate to contact me.

Learning from Patterns

Günter Blöschl, 2015 Robert E. Horton Medalist
Institute of Hydraulic Engineering and Water Resources Management, Vienna University of Technology, Vienna, Austria

In his citation, Upmanu Lall highlighted my work linking patterns to processes. I have always been fascinated by patterns of flowing water and how they come about. One of my favorite pastimes as a child was to sit and watch the flow of water and, where there was an opportunity, to build little dams in mountain creeks or at the beach to divert the water and shape its flow. This may well be the reason why, later in my career, the deductive approach to learning from patterns struck a chord with me. Quoting Sherlock Holmes, "The case is one where we have been compelled to reason backward from effects to causes." Perhaps we in hydrology too should give greater emphasis to deductions, as opposed to the usual practice of calibrating preconceived models to data, to parallel Sherlock Holmes's proverbial successes.

In this piece I would like to illustrate the pattern approach by a couple of examples from the research I have been involved in over the years, being well aware that this will be a déjà vu experience to some readers, but I do hope others will find it useful as context to their own research.

To illustrate the claim of the usual calibration practice, consider Figure 1 (shown during the Vienna Catchment Science Symposium on hypothesis testing in April 2016), which, admittedly, is a little provocative to drive the point home. The scientific method has an important creative element when moving from observations to the hypotheses that are intended to explain them. This creative element is sometimes lacking and replaced by optimizing preconceived models. I obviously see the merits of optimization schemes for practice (and have used them heavily in the past), but they are not necessarily helpful for understanding the world better. I will talk about this creative step here.

Consider Figure 2, which shows the snow cover pattern in an Alpine catchment on a spring day. We can observe a number of features in the photo, on the left.

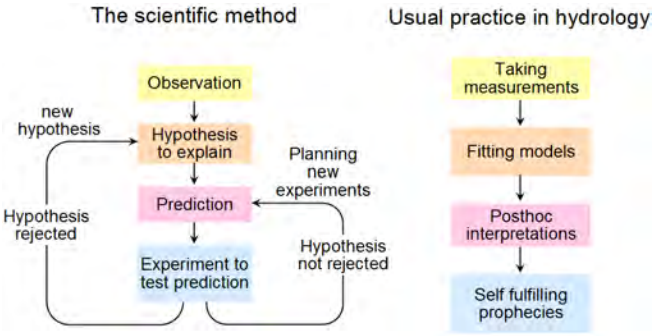

Figure 1. (left) The scientific method and (right) the approach often practiced in hydrology.

The topographic depressions are mostly filled with snow while the ridges are snow-free, so topographic curvature must be a relevant variable controlling snow distribution. This is pretty well borne out by the model, on the right. Another feature is the snow deposit below the steep cliff in the center of the photo. This is not captured by the model, as it does not include a snow sloughing mechanism.

Figure 2. Observed snow cover pattern in (left) Kühtai, Tirol, and (right) model simulations on the same day. From *Blöschl et al.* [1991].

The measured soil moisture patterns in Figure 3 are organized in (top) the wet season with high soil moisture (in blue) in the two main gullies, but more random in (bottom) the dry season. We can use these patterns to learn about moisture redistribution at the catchment scale. Much of the flow in the wet season is lateral (both surface and subsurface) and topographically driven, while in the dry season moisture mainly moves vertically and is controlled by both evaporation and local soil characteristics. Microtopography may play a key role, as illustrated in

the erosion patterns in Figure 4. Surface flow clearly follows the plowing grooves and, depending on agricultural practices, the flow paths—and even the catchment area—will change between seasons and years. Food for thought for small catchment modeling.

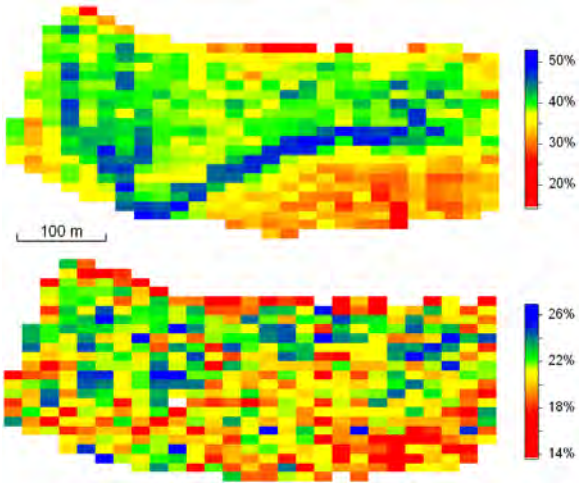

Figure 3. Observed soil moisture patterns in Tarrawarra, Australia, in the (top) wet and (bottom) dry seasons. From *Western et al.* [1999].

Figure 4. Erosion patterns in the Hydrological Open Air Laboratory (HOAL), Lower Austria. See *Blöschl et al.* [2016]. Photo courtesy of A. Eder.

The use of observed patterns for inferring processes is not necessarily confined to small experimental catchments. At larger scales, observed patterns may provide equally relevant insights. An example are the flood process types shown in Figure 5. Flash floods are predominant in the eastern, hilly part of Austria, and this is a reflection of the propensity for convective events. Rain-on-snow events are dominant in the north, often associated with winter storms that fall on saturated soils. These patterns shed light on the feedbacks between the atmospheric, land surface, and flood generation processes.

As part of the Prediction in Ungauged Basins initiative, comprehensive data sets were compiled to understand how well we can predict runoff in ungauged basins and what the controls are of the predictive performance. The performance patterns of flood runoff around the world have been evaluated in Figure 6 as a function of climate, something rarely done at smaller scales. As we move from arid to humid climates, the performance increases as runoff generation mechanisms tend to become more linear. Additional patterns are imposed by data availability (not shown here), as stream gauge density is often better in humid than in arid climates.

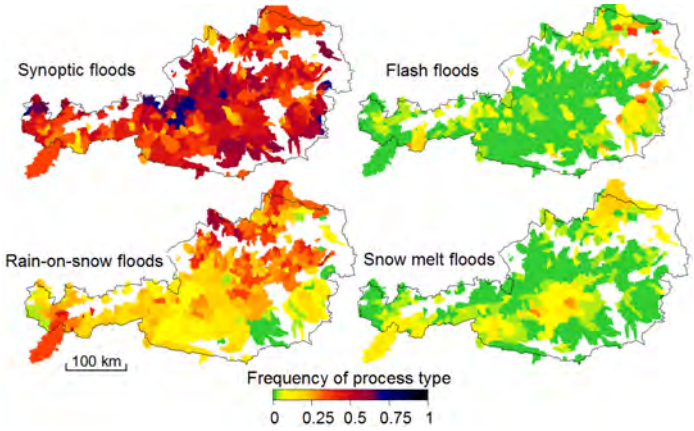

Figure 5. Frequency of process types of maximum annual floods in Austria (12,000 events). From *Merz and Blöschl* [2003].

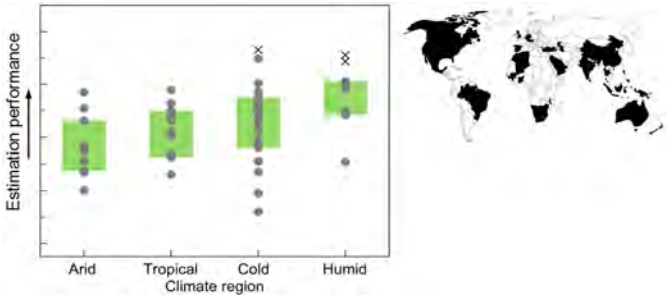

Figure 6. Performance of estimating floods in ungauged basins stratified by climate. Boxes show 25%–75% quantiles. From *Salinas et al.* [2013]; see *Blöschl et al.* [2015] for context. Map at right shows countries of origin of data (3000 catchments).

While the above examples have illustrated learning from *spatial* patterns, a similar reasoning can be adopted to the *time* domain. As the realization is growing that we are living in a changing world, learning from temporal patterns is becoming more important. It has been said that the past is no longer a guide to the future, but I do not concur with this assertion. The past is all we have, and there is no need

to throw the baby out with the bathwater. It is true that the implicit assumption of the future being identical to the past will no longer hold. The extrapolation to the future will involve more complex patterns. So we are back to patterns. Similar to the space domain, learning from observed temporal patterns may be more informative (and consistent with the scientific method) than model fitting and projections into the future (Figure 1, right), although, again, I can see the merits of projections for practical applications.

To illustrate the learning from space-time patterns, Figure 7 shows the time of the year (annual) floods occur along a transect, for 4 decades. As one moves from east to west (right to left in the figure), flood occurrence changes from winter (blue) to summer (red) with associated changes in the flood types. As one moves from the 1960s to 2000, the winter floods occur at increasingly higher elevations (indicated by the tilted gray line in the figure), clearly an indication of a warming climate.

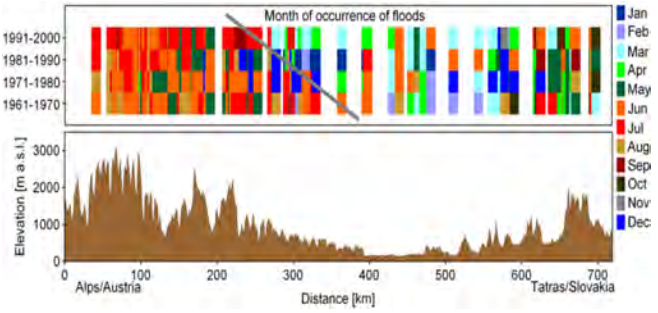

Figure 7. Season (month) of the occurrence of floods along a transect in Austria–Slovakia in decades of the period 1961–2000. Graph at bottom shows the elevations of the transect. From *Parajka et al.* [2009].

As a result of environmental change, the human footprint is becoming increasingly clear in observed hydrological patterns. As a consequence, it may no longer suffice to treat humans as boundary conditions in an isolated way, but rather as an integral part of the coupled human–nature system. Here we need to learn from observed sociohydrological patterns, to acquire an understanding of the feedbacks, and to meet the challenges of the Anthropocene.

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A Fellow Speaks: A Few Things Left to Do…

Scott W. Tyler
University of Nevada, Reno

It is an incredible honor to be recognized by my friends and colleagues for efforts in hydrology over my career. The truth is, my accomplishments have always been the products of collaboration and contributions from many of these same colleagues, students, and friends. Few of us work in a vacuum, and we are fortunate that our hydrology community has a long tradition of collegiality, collaboration, and mutual support.

Since first venturing into the field at New Mexico Tech for the first time more than 30 years ago, I have been a part of a tremendous revolution in both observational and computational sciences that continues to amaze me. As an example, Figure 1 documents fairly advanced vadose zone sampling for its time in 1995, with ~35 individual core measurements of soil moisture and soil water chloride combined with ~200 cuttings measurement from the deep profile in southern Nevada. Contrast that with Figure 2, generated less than 15 years later, consisting of over 3.5 million temperature measurements from within and below a floating ice shelf in the Antarctic. Not only have we been able to increase our measurement density more than 10^3-fold, but we have also done it at a cost of what was probably less than 1% of the cost of the 1995 data. Such increases in efficiency are also paralleled in simulation of our environment, with 3-D computational fluid dynamics simulations replacing 1-D, often unstable, PDE solvers available to us in the 1990s.

I entered the field of hydrology in the 1980s when groundwater contamination and predicting transport was a major direction in our field. Stochastic transport theory was revolutionizing our concepts of dispersion, and we had great confidence that we were going to really clean up the industrial contamination from years of disposal. There were the days of large field experiments like Borden and MADE, where we were often surprised and frustrated that our models failed to represent. I was fortunate to be able to make some small advances in the concepts of long-range correlation in hydraulic conductivity, and we have now seen the development of much more complex yet geologically realistic models that can reproduce the behavior of these sites.

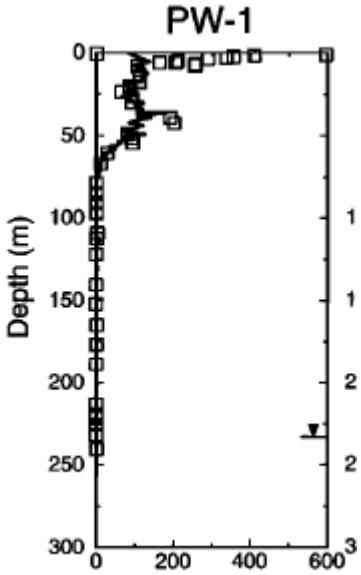

Figure 1. Soil water chloride concentrations from a 250-meter-deep vadose zone boring on the Nevada Test Site. The squares represent concentrations measured on core samples (~35 samples), while the solid line represents ~200 measurements of concentrations inferred at ~1-meter intervals from drill cuttings. From *Tyler et al.* [1996].

However, I would argue that while our field developed models capable of an a posteriori understanding of the transport, our colleagues in the trenches (and reactive barrier walls, etc.) became frustrated and eventually opted for a far more convenient solution: natural attenuation. The high cost of remediation, and our often overly optimistic predictions (using our models!) of the time needed to clean up aquifers, led to a general disillusionment with groundwater transport modeling by many in the regulatory and business community. Unfortunately, in this writer's opinion, the solution of natural attenuation in many aquifers is simply a case of "kicking the can down the road," or as *Fogg and Labolle* [2006] point out, a slow creep to acceptance of worsening conditions. There certainly are cases where in situ degradation is cost-effective and safe, but I would argue that it is time for our community to put our new models to real predictive tests, as we did at Borden and other sites. As shown above, our capacity

to measure and model has fundamentally advanced; perhaps it is time to propose new "Borden" and "MADE" sites that can prove that our models can be applied and used effectively. The advances we have made in hydrogeophysics, computational methods, and tracers all indicate that the time is ripe for a campaign back to the subsurface. In the long run, our natural attenuation sites are going to need us again.

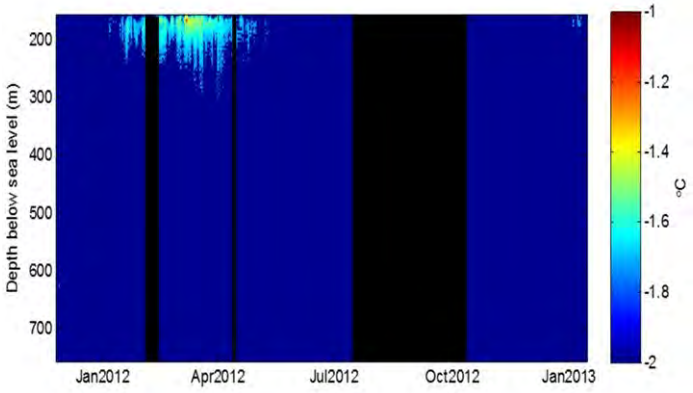

Figure 2. Daily ocean temperature evolution beneath the McMurdo Ice Shelf. These measurements represent 1-meter-depth average temperatures taken via fiber-optic distributed temperature sensing (DTS) from a mooring through the ~200-meter-thick ice shelf. The figure consists of ~3.5 million individual measurements. From *Kobs et al.* [2014].

There is at least one more bit of hydrocentric business that would benefit from a revisit with our new techniques and knowledge, one that shaped a portion of my career and continues to shape world energy policies. We watched as the proposed U.S. commercial nuclear waste site, Yucca Mountain, spent between $10 billion and $15 billion and became more and more "Dr. Strangelove," culminating in the rather ludicrous design to consume the world's supply of titanium to make underground umbrellas. And this was in a hydrologic environment that we thought was ideal! Today, issues of nuclear waste continue to be present, whether from the decommissioning of Fukushima to explosions at the Waste Isolation Pilot Plant (WIPP) from something as benign as kitty litter. I think we, as hydrologists, can do better if we take the initiative and use our knowledge of subsurface transport to choose appropriate storage facilities for this relatively small, but quite toxic problem. While the recent U.S. Blue Ribbon panel continued to stress deep geologic disposal as the solution, designing a "disposal" site for 10^6 years may not be possible or even responsible at this time. However, choosing a site with very little fluid and vapor transport is not that difficult, and we can engineer simple barrier and monitoring systems to safely pass this material on to the next generations. Our work, along with others working in the 1980s and 1990s on low-level radioactive waste, clearly showed that some desert alluvial systems had isolated water through major glacial cycles and could serve as very protective storage areas for waste. And I stress the term "storage" rather than disposal, as we must be humble about our ability to predict the future. Rather than try to walk away, we should ensure that they are monitored into the future, as nothing (even plutonium) lasts forever. Deep geologic disposal may sound easy, but based on our experience at Yucca Mountain and other sites around the world, it is very expensive and far more difficult to achieve than policy makers think. As hydrologists, we must be willing to speak up for a more rational and realistic nuclear waste storage program that does not break the bank, does not rely on untested engineering, safeguards the storage against human error, and finally provides the public with a realistic set of assurances about the safety of the system. My hydrologist's prayer, to paraphrase an old bumper sticker, is, "Please, Lord, give me one more chance; I promise I won't waste it this time."

To the next generation of subsurface hydrologists, I say you still have a wealth of interesting and societally relevant problems beyond those I have outlined above. Go out there and get to work; there are still important problems to solve!

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History of Hydrology Wiki

Keith Beven

Quite by chance (or rather somewhat coincident with my retirement from Lancaster University), at the same time that Efi was starting up the "Virtual Hydrologists" site for the AGU Hydrology section, I was starting a project on the History of Hydrology in the 20th Century. There is no readily available source of information about the history of hydrology and hydrologists. The book by Asit K. Biswas, *History of Hydrology* (North-Holland, 1971), provides a summary of developments up to 1900, and there is some overlap with the three remarkable books *Hydraulicians in Europe 1800–2000* and *Hydraulicians in the USA 1800–2000* by Willi Hager at ETH and the Hunter Rouse and Simon Ince book *History of Hydraulics* (Iowa Institute of Hydraulic Research, 1957).

There have also been some efforts to put some of the history of hydrology together, such as the AGU *History of Geophysics* Volume 3 of 1987, edited by Edward Landa and Simon Ince, and initiatives both by the AGU Hydrology section and the International Association of Hydrogeologists to record interviews with well-known researchers and practitioners in the relevant fields. The books of Benchmark Papers in the IAHS Series edited by Jeff McDonnell are also relevant. But the material is dispersed and not necessarily readily available.

One way of putting information together these days is through a wiki site. I have set up a site at www.history-of-hydrology.net and have started to populate it with biographies, the histories of institutions, and summaries of hydrological textbooks. As a wiki site, all hydrologists are welcome to contribute information about the development of the subject (and its overlaps with hydraulics, water resource engineering, geomorphology, ecohydrology, sociohydrology, hydrometeorology, water quality, etc.). The site is intended to provide information on hydrologists who are no longer active but who have made a valuable contribution to the history of hydrology.

Contributions can be made once you have registered as a user and have a log-in for the site. Anybody is welcome to write a new article or add to an existing article using the wiki editing functions. Templates are provided for each of the main categories of entry (currently biographies, experimental basins, institutions, and textbooks). Entries should be in English, but contributions that reflect the development of hydrology in all countries of the world are encouraged, particularly early history that did not make it into the Biswas book and later 20th-century contributions. Suggestions for other categories on the wiki are also welcome.

A section on the histories of experimental catchments has now been added. This is intended to be complementary to the Experimental Hydrology wiki (at http://experimental-hydrology.net/) maintained by Theresa Blume, where the details of many experimental catchments can be found. That site also serves as a useful source of information about instrumentation and experimental methods.

I have also started writing a text on the history of hydrology in the 20th century. This will try to summarize (as concisely as possible) the interaction between developments in fieldwork and of theories and models. From the work I did a few years ago on the Robert Horton papers [see *Beven,* 2004a, 2004b, 2004c], it is clear that there can be a real difference between what is presented in textbooks and what actually happened, as well as some very interesting international cross-fertilization of ideas, even early on. I do not know how far it will be possible to unravel the various strands of the story, but it will be interesting to try. Any suggestions for things that really should not be left out, particularly in parts of the world that I do not know so well, will be very welcome (to k.beven@lancaster.ac.uk). Even being optimistic, I think this might well take some time!

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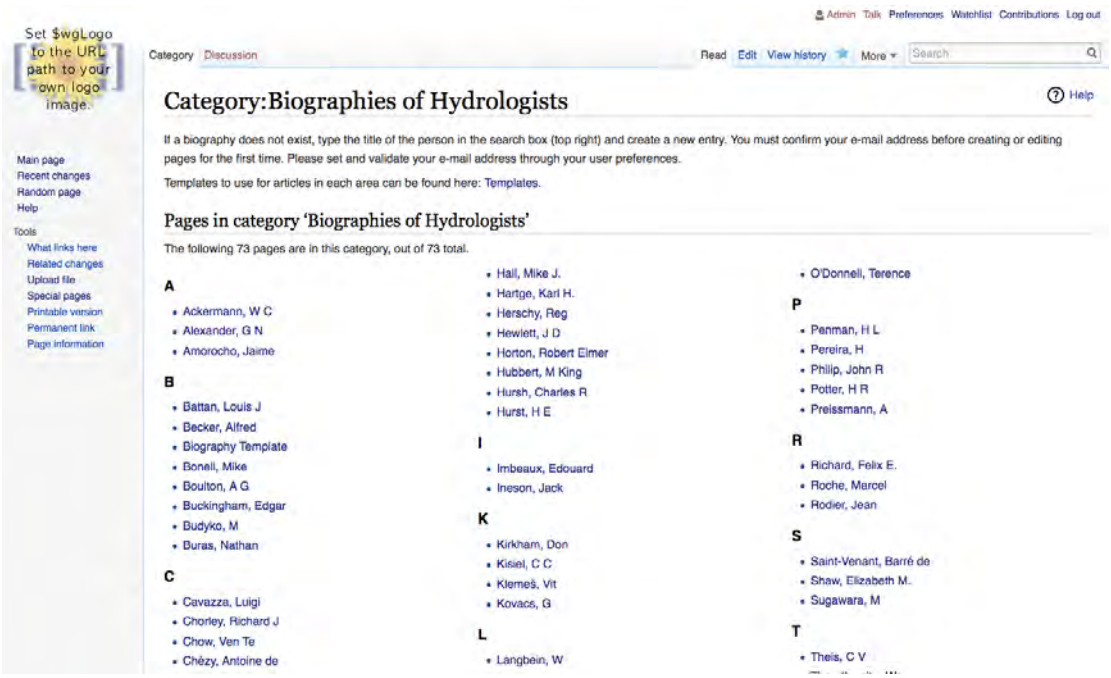

Figure 1. Illustration of the current History of Hydrology biographies index page.

Obituary of James R. Wallis, 1928–2016

Jim Wallis, former Hydrology section president, AGU Fellow, and the force behind foundational work in synthetic hydrology and flood frequency analysis (most of which appeared in *WRR*), passed away in Florida on 13 February 2016. Jim was born of English parents in Montreal. His family moved back to England in the 1930s, where he grew up in wartime London before being evacuated to the countryside during the Blitz in the early 1940s. He returned to Canada in 1946 to pursue an interest in forestry, which he studied at the University of New Brunswick, graduating in 1950. In the early 1950s he worked as a logger in the Queen Charlotte Islands of British Columbia (there being no jobs for degreed foresters). In 1953 he entered the M.S. program in forestry at Oregon State University and went on to do his Ph.D. studies at University of California, Berkeley from 1958 to 1965, working on the side at Pacific Gas and Electric in San Francisco, where he was motivated to learn about operations research and the use of digital computers. He became interested in the erodibility of forest soils (J. R. Wallis and L. J. Stevan, "Erodibility of some California wildland soils related to their metallic cation exchange capacity, *J. Geophys. Res.*, *66*, doi:10.1029/JZ066i004p01225, 1961), which became his dissertation topic. Following completion of his Ph.D., he was awarded a Bullard Fellowship at Harvard University (a postdoc in today's terms) from 1965 to 1966 with Harold E. Thomas. He then joined IBM's Thomas J. Watson Research Center in Yorktown Heights, N.Y., in 1966 as part of its nascent Environmental Sciences Program.

At IBM, where Jim spent most of his career, he was essentially given the charge, "do something interesting, ideally having to do with water and/or the environment, and that uses IBM computing." That was basically the extent of the constraint, hard that it is to believe in today's world, where even at centrally funded government research labs, there is a fair amount of top-down imposition of "priorities." Notwithstanding that his Ph.D. research had dealt with forest erosion, shortly after joining IBM he began to interact with Benoit Mandelbrot, who had been working on a theory of fractals. His interest was piqued by H. E. Hurst's work on the Nile River and his book, which came out in

1965. Hurst's work showed that the rescaled range of cumulative departures from the mean of annual Nile flows exhibited a fundamental behavior different than what would be expected from a purely random sequence of flows, or sequences coming from other models (like a low lag Markov) that exhibited "short term memory." In a seminal 1968 *WRR* paper, "Noah, Joseph, and operational hydrology" (*4*(5), doi:10.1029/WR004i005p00909), Mandelbrot and Wallis showed why the synthetic streamflow models then in use (largely as an outcome of the Harvard Water Project) were unable to reproduce Hurst-type behaviors. They went on to develop a class of self-similar models that they termed Fractional Gaussian Noise, which reproduced Hurst-type behavior in synthetic computer experiments. In another seminal *WRR* paper, "Some long-run properties of geophysical records" (*5*(2), doi:10.1029/WR005i002p00321, 1969), they showed that the Hurst-type behavior was present not only in streamflow sequences but also in many other geophysical records. Their work remains important today (although largely unrecognized in the climate community)—current generation global climate models are unable to reproduce long-term persistence of the type exhibited by key geophysical observations such as precipitation and streamflow.

In 1973, Jim Wallis took a position as advisor at the IBM Scientific Center of Pisa in Italy. In the 2 years he was at Pisa, he dealt with rainfall-runoff modeling as part of the River Arno hydrological model, and later assumed a major role in a WMO intercomparison of hydrological conceptual models (published in 1976).

In the mid-1970s he turned his attention to flood frequency estimation. A 1975 *WRR* paper, "Regional skew in search of a parent" with USGS scientists Nick Matalas and Jim Slack (*11*(6), doi:10.1029/WR011i006p00815), showed that the relationship between the mean and standard deviation of regional estimates of skewness for annual maximum streamflow data from the western United States could not be explained by corresponding relationships for the conventional frequency distributions. Instead, the relationships for the observations exhibited what they termed the Condition of Separation, a characteristic of heavy tailed behavior. He investigated the behavior of the Wakeby distribution (a new distribution suggested by Harvard's Harold Thomas) that could mimic the Condition of Separation. The Wakeby distribution is expressed in inverse form and hence does not lend itself to parameter estimation using conventional moments or maximum likelihood methods. Jim worked with statistician J. A. Greenwood, as well as Matalas and USGS scientist J. M. Landwehr, to develop the method of Probability Weighted Moments (PWMs), which was attractive in that the fitting method was based on order statistics, and had good small sample properties, as demonstrated in two 1979 *WRR* papers with Landwehr and Matalas. The Generalized Extreme Value (GEV) distribution, then in use in the United Kingdom, conveniently also lent itself well to PWM estimates, and working with J. R. M. Hosking at the U.K. Institute of Hydrology in the mid-1980s (and later at IBM T. J. Watson Research Center, to which Hosking moved), they developed regional estimation procedures based on *L* moments, which are linear combinations of PWMs. Their work fundamentally changed the field of regional frequency analysis to the extent that a 1993 *WRR* paper by R. M. Vogel and N. M. Fennessey (*29*(6), doi:10.1029/93WR00341) was titled "*L* moment diagrams should replace product moment diagrams," on the basis that product moments were subject to substantial bias and variance. A 1997 book by Hosking and Wallis provides a complete treatise on regional frequency analysis that remains the key reference on the subject, both in research and practice. *L*-moment methods are now used in the United Kingdom (e.g., the Institute of Hydrology's 1999 *Flood Estimation Handbook*), by the U.S. Army Corps of Engineers in its *U.S. National Drought Atlas*, and by NOAA in its ongoing upgrade of U.S. precipitation intensity-duration-frequency relationships.

Not nearly as well known in hydrology was his early forest growth modeling work with Botkin (then at Yale). Yet his most cited paper (D. B. Botkin, J. F. Janak, and J. R. Wallis, "Some ecological consequences of a computer model of forest growth," *J. Ecol., 60*(3), doi.10.2307/2258570, 1972, cited over 800 times) was on that topic. The paper describes the first computer model to reproduce the population dynamics of trees in a mixed-species forest stand. A companion paper, also in 1972, also with Botkin and Janak, further described technical aspects of their forest growth model.

Jim was president of the Hydrology section from 1980 to 1982. Among his many contributions to the section, two stand out. The first relates to the Horton Research Grants. Jim was aware that on his death in 1945, Robert E Horton had made a substantial donation to AGU that was intended to promote hydrology interests. Yet AGU had essentially comingled the funds, which were not identified with the section. Spirited

discussions with then executive secretary Fred Spilhaus resulted in an agreement that if the section were to have a set of bylaws that directed how the money would be spent, AGU would separate out the Horton donation and designate it to the section. Jim and others set about to draft section bylaws (now posted on the section website) that included a provision for the Horton Research Grants, the first of which was awarded in 1983. A second area in which Jim made lasting contributions was to the protocols for selection of AGU Fellows. At the time, the election of Fellows was more or less that if Joe and Harry were sufficiently influential, and they said Sam was a good person, Sam was elected. Almost invariably, in addition to the fact that Harry, Sam, and Joe were all males, they came from areas other than hydrology. Jim was vociferous in his role as an AGU Council member that a more evenhanded process had to be implemented. The result of those efforts was a set of requirements for the nomination and consideration of Fellows that is the predecessor to those used today. In 1982, five hydrologists were elected as Fellows, in comparison with a cumulative total of 13 in all prior years!

To those of us who knew Jim, he certainly was a commanding presence. When he decided something needed to be done, it was hard to deny him. In one typical incident, at an AGU session during his tenure as section president, a Hydrology session had been assigned to a room that clearly was too small. The ensuing discussion with AGU staff went something like this: *Jim:* The room for Session X is too small. *AGU staff:* We see that, but there's nothing we can do. *Jim:* There's a bigger room just down the hall that's half full; just swap them at the break. *AGU staff:* Can't be done; the program was published long ago and lists the room for another session. *Jim:* Just put a note on the door. *AGU staff:* Can't be done; we have our rules, yada yada yada. The end result was, the rooms were swapped at the break.

Jim, thanks for all you did for the profession. We will miss you.

—Dennis P. Lettenmaier, P. Enda O'Connell, Ezio Todini, and Eric F. Wood

Outstanding Student Paper Award Winners 2015

Fall 2015	
Name	**Institution**
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Kevin Roche	Northwestern University
Zeinab Takbiri	University of Minnesota Twin Cities
Abby Frazier	University of Hawaii at Manoa
Gang Zhao	Texas A&M University
David Dralle	University of California Berkeley
Natalie Teale	State University of New Jersey
Danielle Grogan	University of New Hampshire
Scott Allen	Louisiana State University
Faye Jackson	University of Birmingham
Skuyler Herzog	Colorado School of Mines
Lauren Foster	Colorado School of Mines
Kathryn Wheeler	University of Delaware
Yumeng Tao	University of California Irvine
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