

The Society for Certification of Hydrology Professionals



AIH is here to serve the profession and the members

- AIH is the only organization that certifies professionals in the fields of surface water and groundwater hydrology, and water quality both nationally and internationally.
- AIH provides educational training venues to the professionals in the field of hydrologic sciences.
- AIH speaks to lawmakers on behalf of you and the profession as an advocacy



Guest Editorial

Ron St. John, PHG; St. John – Mittelhauser & Associates, Inc.

“If a tree falls in the forest and nobody is there to hear it, does it make a sound? (and was it global warming, was it preventable or was it a natural disaster?)”

I have to say that in recent years I have been equally amused and appalled by the number of “natural disasters” that have been attributed to global warming. Now before I go any further on this topic, I should disclose the fact that I have suspiciously viewed the predictions of global warming modelers since the early 1990’s when some modeling predictions forecast that much of coastal Florida was going to be inundated with oceanic water within the next 15 to 20 years. Additionally, after performing a significant amount of groundwater modeling during my 40-year career, I have come to embrace the modeling axiom “all models are wrong, some are just less wrong than others.” Given all that, I recently committed to buying a fully electric vehicle that would serve as my daily driver (because in my opinion, the dangers of global warming far outweigh any skepticism I might have about its scale). However, this changed when I learned from the USEPA web site that I live in an area where I would have a larger carbon footprint with an electric car due to my electricity originating from coal-fired power plants.

Back to global warming and natural disasters. In recent years, everything from California wild fires to the intensity of hurricane Harvey have been attributed to global warming. However, it does appear that other key factors can contribute to these “global warming” natural disasters; namely population

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President's Message

Dear AIH members:

Greetings! I hope you are enjoying a productive 2018.

I take this opportunity to bring you some updates about AIH. As you are aware, we transitioned to a professional management company, the Adept Group, LLC about a year ago. I feel that we in the executive committee are now better calibrated in terms of working with this group. The lingering items that needed to be resolved from our previous partnership with Southern Illinois University have all been addressed and our transition is indeed complete.

We have been reaching out to you with emails and communications and have also sought your input – most notably with a survey that was administered to establish a baseline and get a sense of what you expect from AIH. We got a very high response rate, with nearly 30% of the membership responding to the survey, and we are deeply appreciative. Later in this newsletter you will see more about your responses and some of the action items we have tasked ourselves based on what we learned from the survey.

Since the transition, we have made progress on several fronts, and I will mention a few here for brevity.

- Our annual membership renewal cycle in the November to January time frame seems to have worked well, and we were able to process renewals in a timely manner. We expect to continue the same cycle in the following years.
- We now have a very accurate view of our financials with more comprehensive monthly reporting from Adept, and the Executive Committee is kept current. This will allow us to plan new initiatives more confidently into the future while being fiscally responsible.

- We have increased our visibility with social media and messaging, and I see a distinct uptick in enquiries about AIH and partnering opportunities within the last year.

- We have established a new recertification schedule that can be viewed on the [website](#). Better guidelines are available for what needs to be accomplished for recertification.

- In the near future, we expect to implement electronic applications and a more efficient process of certification as we explore ways to use technology to conduct examinations. The pool of questions used in examinations is being reviewed and updated.

The executive committee has continued to hold monthly conference calls that allow us to keep on track. In addition, we expect to hold our annual in-person workshop in January of 2019 to discuss and decide on strategic directions for AIH. I urge you take interest in the activities of this organization, as that is crucial for AIH to succeed. Please consider serving AIH by taking on a leadership role within the organization. You may nominate yourself or colleagues for any open positions (that will be communicated to members via email when available) or [reach out to us](#) with an expression of interest. I am sure we can find a way to engage you. We also invite you to bring items of hydrologic interest to our attention that we can share with the membership through emails.

I want to take the opportunity to welcome Jolyne Lea to the position of Secretary on the AIH Executive Committee. Jolyne will fill the position vacated by Marc Horstman, who had to resign because of competing commitments. I sincerely thank Marc Horstman for his service to AIH.

This is likely the last time I will be reaching

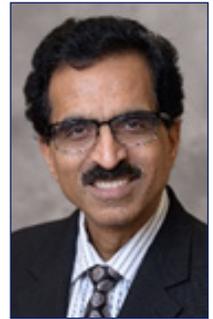
out to you as president. It is difficult to imagine that my two-year term went by so fast. I have had the privilege of working with a dynamic team whose members have gone above and beyond for AIH. Transitioning to a new management organization was an important step for us. While we have been catching up with day-to-day operations, we still need to ramp up in terms of new initiatives. I am sure the executive committee will do well under leadership of John Nieber. John has been with AIH for a long time and we have worked together closely the last few years. I expect this transition to be seamless as he takes over the reins of this organization. Going forward, I am confident we are in good hands.

For the next two years (2019-2020), I will assume the role of past president on the executive committee of AIH. I expect to continue to be actively involved with the executive committee and serve in various capacities. While we have made some progress since the transition, we still have many opportunities to streamline operations and further our organization.

Along with members of the executive committee, I look forward to hearing from you with comments and suggestions. ■

Warm regards.

Rao S. Govindaraju
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CALL FOR CONTRIBUTIONS

AIH invites members to contribute original articles for publication in the Bulletin as well as tips about news that may interest fellow hydrologists. Original articles must be between 800 - 1,200 words and be relevant to the practice or science of hydrology. News may be any development of interest to hydrologists such as policy or legislative changes that impact the profession, new scientific advances, open positions (professional/academic) for hydrologists or awards or recognition for hydrologists. Send contributions to Nicole Singleton, Executive Director, at admin@aihydrology.org.

Guest Editorial (continued)

growth and a lack of urban planning. For instance, it seems like there will be a greater probability of wild fire interaction with homes and urban areas in southern California where the population centers keep growing in what is predominantly an arid to semi-arid environment already prone to drought. Population growth factors into this problem in two ways; one due to sprawl creating a greater probability of interaction with the fire, and the second being the greater population increasing the probability of starting the fire (because most of California's fires are not so "wild").

On the planning side, California seems to go through this cyclical process every few years when the winter snows in the Sierra Nevada Mountains are not sufficient to sustain the reservoirs that supply the urban centers with water. They then go through their cyclical process of drought drama. When the Sierra Nevada's get plenty of snow and the reservoirs are full they make no provisions for storing more of that water for a "not so rainy day" in the future (the provisions for which in today's political/legislative climate would likely take 20 years to enact).

Turning our attention away from California to our second most populated state, Texas, the August 2017 devastation of hurricane Harvey on the Houston area is likely only rivaled by that of hurricane Katrina on New Orleans in 2005. I mention this because, but for the meteorological conditions that caused Katrina to turn north and hit New Orleans in 2005, it could have stayed a course to the west to hit Houston at that time and Houston had the

12 intervening years to think about that potential. What happened to Houston during Harvey is nearly unimaginable, a four-day period where many areas received more than 40-inches of rain causing unprecedented flooding. However, what happened during Harvey was in some ways predictable.

For years, the local Houston authorities turned a blind eye to development (in 1950, with a population of about 600,000 most of the City was located within what is now the I-610 beltway loop). As the urban area grew, thousands of homes were built adjacent to and inside the boundaries of two large reservoirs constructed by the Army Corp of Engineers in the 1940s (west of the I-610 loop). In 2017, these reservoirs protected an urban population of six million. Many of the people living in and around these reservoirs did not know they even existed. In addition to this, Houston had two, 500-year precipitation events in 2015 and 2016 leading up to Harvey, and should have understood the potential for serious consequences from a future hurricane.

As Harvey stalled and produced record rainfall, releasing water from the reservoirs remained the only rational choice despite the potential for devastating downstream consequences – the risk of failure, however, was too great. Houston's unregulated and unchecked urban sprawl which included building new shopping malls and subdivisions within the 100-year floodplain had predictably run its course. Due to this growth, the tree was no longer falling alone in the forest for nobody

to hear. Due to population growth, global warming, and poor civic planning/infrastructure, it was falling in their backyard and about to hit the house.

The flooding in Houston was predictable, but the potential for the occurrence was not as visually obvious as an old bridge or highway in disrepair. Whatever your political ideology, the current administration's focus on the funding of infrastructure projects is a good start. That being said, there is little mention of any of this stimulus money going to water/flooding projects. We have unparalleled resources through some of the government agencies in this country (the COE Hydrologic Engineering Center and USGS) to support water/flooding projects and avoid future disasters. Without due attention being paid to these water/flooding issues it really seems that we are engineering some of them. While this sounds extreme, many of these occurrences are not natural, per say. A natural disaster is what happened in the West African country of Cameroon in 1986 when a cloud of carbon dioxide erupted from Lake Nyos and blanketed nearby villages killing over 1,700 people. The point here is that some natural disasters aren't as naturally occurring as others, but the likelihood of them occurring more frequently in the future may be inevitably the result of increased urban sprawl, climate change and a lack of appropriate civic planning. ■

Views expressed in the guest opinion those of the author and not necessarily endorsed by AIH.

Membership News - Meet Your AIH Peers

Starting with this issue, the Bulletin will feature some AIH members to encourage members to connect with each other and to demonstrate the geographic, professional, and personal diversity in AIH's membership base.

Amy Kaarlela

(Freese & Nichols, Inc., Fort Worth, TX)

Amy Kaarlela received her B.S. in Hydrology and Water Resources in 1992 from Tarleton State University. After graduation she went



to work for Freese and Nichols, Inc. (FNI) in Fort Worth, Texas. Today she is a Hydrologist V with FNI and works in the Water Resources Planning Group. Amy was certified as a Professional Hydrologist by AIH in 2012.

Amy's primary role with FNI includes regional and Texas state water planning, long-

range water supply plans for cities/water districts/river authorities, conservation and drought planning, and financial analyses such as rate studies and impact fees.

The majority of Amy's work in recent years has been in regional water planning, which is an effort funded by the Texas Water Development Board and is updated every five years. Amy is the Project Manager for the Region C Water Plan. Region C covers the Dallas-Fort Worth

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Membership News - Meet Your AIH Peers (continued)

Metroplex, which has a current population of about 7 million and is projected to grow to about 14 million over the next 50 years. The area has an estimated 2020 dry-year demand of 1.5 million acre-feet (1,340 MGD) increasing to 2.7 million acre-feet (2,400 MGD) by 2070. Elements of the regional water plans are population and demand projections, analysis of existing water supplies, determining gaps in future water needs, evaluation (environmental, cost, quantity, feasibility, etc.) of various potential future water supplies (reuse, aquifer storage and recovery, new reservoirs, etc.), and recommendations of future supplies and strategies to meet water needs for the next 50 years.

Amy loves to bake, play golf with her husband, and hang out with her two teenage daughters. She's on the School Board of Trinity Christian Academy where her older daughter attends, and she's also active in her local church. Her favorite vacation spot is Banff, Alberta, Canada.

David Hansen (East Bay Municipal Utility District, Oakland, CA)

David Hansen is a Hydrographer III at the East

Bay Municipal Utility District (EBMUD) in Oakland, California. He received his B.A. (1999)



from San Diego State University and his M.S. (2002) from The University of Southern California, where he focused on physical geography, coastal, and estuarine geomorphology. Dave was certified as a Hydrologic Technician, Surface Water Level III, by AIH in 2017. Dave is an EBMUD disaster first responder.

As part of his work at EBMUD, Dave collects and analyzes river, reservoir, groundwater, and meteorological data to document current conditions of the District's raw water resources. This data is then used to forecast future conditions of those resources. Dave also manages station maintenance, instrumentation, and data logger program upgrades. He performs data analysis and quality control and maintains station ratings and hydrological databases, and produces USGS annual water summaries,

groundwater and river diversion reports, and compiles annual water production, gross consumption, and treated water loss audit reports in support of EBMUD's water rights and regulatory compliance. Dave also performs dam safety monitoring and reporting.

Prior to his position at EBMUD, Dave was an Associate and the Field Services Manager for Philip Williams & Associates, in San Francisco, where he performed project management, lead field teams tasked with the collection of pre-construction and post-construction monitoring data, and production of project deliverables for major environmental restoration projects in and around the San Francisco Bay and Northern California region.

In his spare time, he enjoys his family (wife and 3 kids), friends, and is active in his local Scout Troop. He also enjoys cooking, jogging, road cycling, camping, occasionally SCUBA, and home brewing. He takes pride in his delicious "blood orange witbier", India Pale Ales, and wheats. ■

Technical Paper 1

Assessment of Uncertainty in Doppler Radar Estimated Precipitation

By T.V. Hromadka II, Professor, Department of Engineering-Mathematics, United States Military Academy, West Point, NY

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Abstract

With Doppler radar data being used in various applications of hydrometeorology and engineering as well as weather forecasting, the importance of data accuracy and accuracy in precipitation estimates continues to increase in importance. In this article, five types of Doppler radar systems are evaluated and thousands of published data pairs of actual Doppler radar precipitation estimates versus rain gauge precipitation readings are examined. Using standard data normalization techniques, the data for both the radar estimated precipitation estimates and the rain gauge measured precipitation are normalized, and then multiple gauge sets

and multiple radar sites of like type Doppler data sets are combined to produce populations of ordered pairs. The populations are then used to develop distributions of conditional estimates of gauge precipitation values given radar estimated precipitation values as obtained by the National Weather Service (NWS) data resources. The resulting distributions display a range of precipitation values associated with radar estimate precipitation values, and can be used in further assessment of Doppler radar estimated precipitation uncertainty in applications.

Introduction

Weather radar technology and the associat-

ed precipitation quantification algorithms are maturing towards reliably predicting hydro meteorological events. In the last century, the radar technology evolved from WR 66, WSR 57, C Band, WSR-88D (Doppler) to the current Dual Polarization Doppler. While each update improved the rainfall estimates by addressing limitations of the previous, the first major generational development came with the installation of NEXRAD network, also called WSR-88D radars, which is the corner stone in modern weather technology. The WSR-88D is an offshoot of the advances made in Doppler signal processing theory, scientific knowledge of precipi-

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tation characteristics, hardware capabilities, and visualization tools. The advances made in better understanding the science behind precipitation events has led to further upgrades of the WSR-88D radars to Dual Polarization Radars. The dual polarimetry allows for data quality enhancements. While WSR-88D radars transmit and receive radio waves along a single horizontal polarization, Dual Polarization radars transmit and receive radio signals across both horizontal and vertical polarizations to enable better precipitation estimates and differentiate between heavy rain, hail, snow, and sleet. By 2013, all 159 Doppler radars in United States had been upgraded to Dual Polarization.

Methods

Doppler technology relies on synthesizing the signal information that the radars receive back from the atmosphere. The post processing of the received signals requires using various relationships between several parameters and statistical regression equations to arrive at a rainfall estimate. By such regression data fits, estimates of precipitation quantities are possible and subsequently used for study purposes. The accuracy of such Doppler radar estimated precipitation is quantified by the frequency distribution of actual comparative gauge data versus the statistical fits. An indication of the estimation error is displayed by comparison of the frequency distribution of the source data against the regression equation predictors.

Table 1 summarizes the Radar data characteristics for the five radar types that were analyzed. Based on the published graphs/tables from the cited references, the radar

and gauge precipitation values were compiled for each radar type. While the analysis was done for all five radar types, the results are presented only for the Doppler radar. The statistical analysis was performed using Seaborn (<https://seaborn.pydata.org/>), a Python data visualization library based on matplotlib. The software provides a high-level interface for drawing attractive and informative statistical graphics.

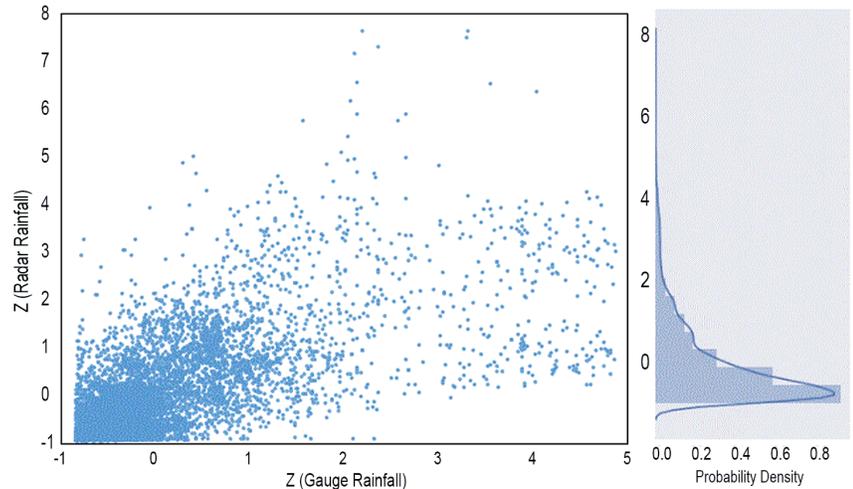
The raw input data file consisted of two columns of rainfall data (Gauge and Radar). The Gauge column included rainfall values (mm) as measured by recording gauge and the Radar column included radar estimated values (mm). Concatenating the two columns created an ordered pair, resulting in 8846 ordered pairs for the Doppler data file. The data in the two columns were normalized and analysis using Seaborn software was done on the normalized data.

Results

Visualizing the data of the two variables along the spectrum can offer many insights into their distribution trends. In the follow-

ing graphs, we fit a probability density function (PDF) to the data that corresponds to the data's density of a continuous random variable. Doing this will help one to interpret a value at any given point or sample within the sample space, i.e. the set of possible values taken via the random variable, and link the sample to a relative likelihood

Figure 1 – Spectrum of the normalized Doppler radar and Gauge values with the probability density plot



that the value of the random variable would equal that of the sample. In other words, the PDF here is used to specify the probability of the random variable that lies within the specified range of values. Figure 1 shows the spectrum of the normalized Doppler Gauge and radar together with the probability density plot. The seaborn.jointplot () function (Appendix 1) which creates a multi-panel figure that shows both the bivariate (or joint) relationship between the two variables, was used to generate the figure.

Table 1 – Summary of Radar data characteristics

Radar Type	Paper ID*	# of ordered pairs (N)	Radar Data		Gauge Data	
			Mean	SD	Mean	SD
WSR 57	3,12	123	5.3	2.7	5.4	3.3
WR 66	1	173	11.1	8.2	11.6	9.6
C-Band Doppler	5	1010	1.6	1.8	2.8	2.6
Doppler	2,6,7,8,9,10,11,13,14,15	8846	20.9	22.8	23.8	28.1
Dual Polarization	4,13,14	1588	44	39.9	42.6	45.2

*see **References** for corresponding paper

The Doppler radar data are analyzed by taking “cross-sections” of the data with respect to the independent variable, Doppler radar Estimated Rainfall (given in terms of “standard deviation” units (Figures 2 and 3). The data are presented in “standard deviation” units for both the Doppler radar Estimated Precipitation (independent variable) and the Rain Gauge Measured Precipitation (dependent

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variable). Then, the data are graphically described on a selected cross-section interval also called as 'range' basis.

The resulting frequency-distribution of

value is developed based entirely on the measured data. Therefore, for any selected value of Doppler radar Estimated Precipitation, an outcome of a frequency-distribution of dependent variable

Figure 2 – Spectrum of the normalized Doppler radar (Range is 0 to 1) and Gauge Values

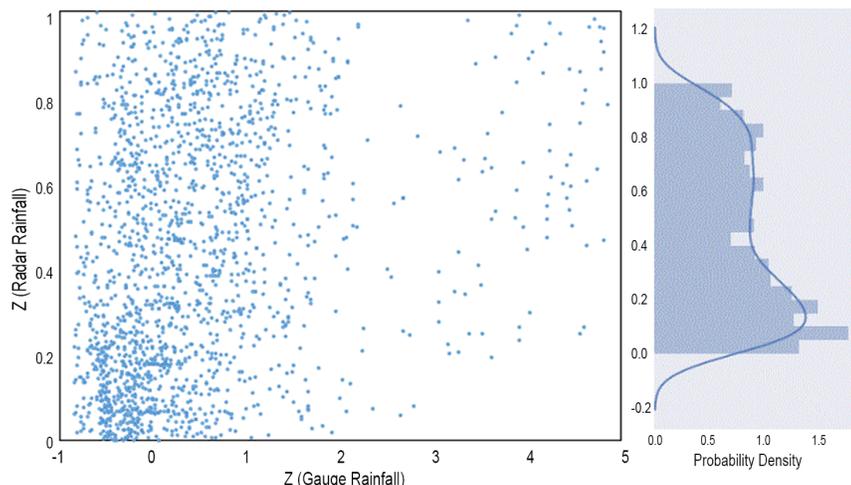
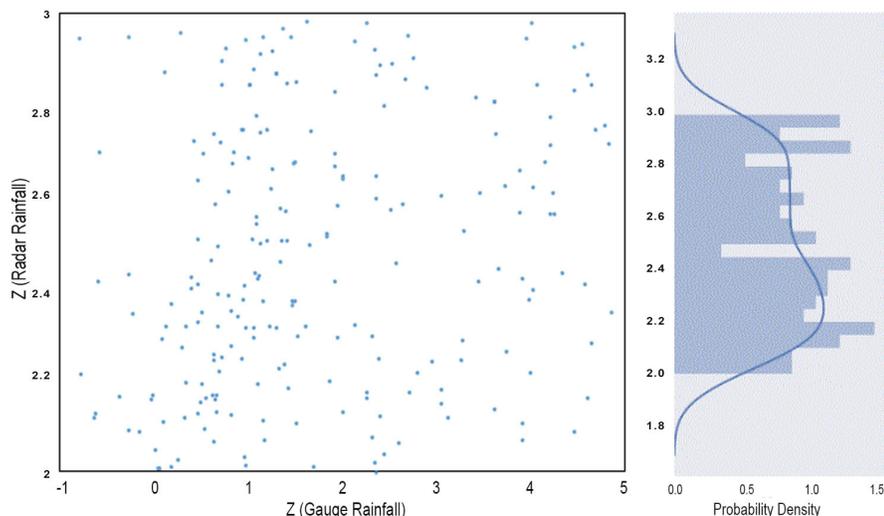


Figure 3 – Spectrum of the normalized Doppler radar (Range is 2 to 3) and Gauge values



the data, located within a selected neighborhood of the selected cross section independent variable value, provide the backdrop for development of a conditional frequency-distribution, given the selected value for the independent variable. As such, a result, a frequency-distribution of dependent values corresponding to the selected independent variable

precipitation can be determined. Using the frequency distributions defined by the normalized data analysis conducted for this study, Radar estimated precipitation may be encapsulated into a probabilistic distribution of likely values that can then be cascaded into other uses such as estimation of uncertainty in runoff predictions.

Conclusions

The assessment of uncertainty associated with modern Doppler-Radar measurements of precipitation have several important sources of uncertainty. For example, variable Z-R relationships, radar miscalibration, clutter, attenuation, and an inaccurate understanding of the physics behind precipitation along with instrumentation related factors can all contribute to uncertainty. Additionally, uncertainty exists in the operation of the Radar type as well as mathematical prediction equations as applied to the collected data under investigation.

In the current research work, an attempt is made to quantify the uncertainty in the published data by use of statistical distributions fitted to the data pairs of Radar estimated precipitation versus precipitation gauge estimated precipitation. The analysis indicates that additional research is needed to better describe such uncertainty trends in order to cascade the resulting distributions into application models such as rainfall-runoff models. ■

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Appendix 1

The two columns in the input data file (Doppler) are labeled as Gauge and Radar. The python code, written for the analysis and visualization of the data as presented in Figure 1 is given below.

```
t = sns.jointplot (Ddoppler.Gauge, Doppler.Radar, space=0.2, size=10, ratio=2, kind="reg", marginal_kws=dict(bins=20));
```

```
plt.setp(t.ax_marg_x.get_yticklabels(), visible=True)
plt.setp(t.ax_marg_x.get_xticklabels(), visible=True)
plt.setp(t.ax_marg_x.set_xlabel('Probability Density'))
plt.setp(t.ax_marg_y.get_xticklabels(), visible=True)
plt.setp(t.ax_marg_y.get_yticklabels(), visible=True)
plt.setp(t.ax_marg_y.set_xlabel('Probability Density'))
```

Technical Paper 2

Hydrodynamic Modeling to Support the Design of a U-Shaped Weir in Central Florida

By Shabbir Ahmed, Civil Engineer, Hydrologic Modeling Section, U. S. Army Corps of Engineers (USACE), Jacksonville, FL
Russ Weeks, Chief, Hydrologic Modeling Section, USACE, Jacksonville, FL

Abstract

A numerical modeling analysis was performed to evaluate the hydraulic performance of a U-shaped weir. This weir was designated the S-69 structure to be constructed as part of the Kissimmee River Restoration (KRR) Project in Central Florida. An Adaptive Hydraulics (AdH) model code developed by the U. S. Army Corps of Engineers (USACE) Engineer Research and Development Center was used to represent the U-shaped weir and the hydraulic features in the Kissimmee River floodplain upstream and downstream

of the weir. The AdH model was used to evaluate the effects of different weir configurations (length and weir crest elevation) on water stages and velocities both upstream and downstream of the weir under a variety of flow conditions. The weir was analyzed for different flow events under the future full-restoration condition, during construction sequencing, and with a bypass channel to divert some flow around the weir site during construction. The modeling analysis for 100-year fully restored condition is presented in this paper.

Introduction

The Kissimmee River historically flowed in a 1-2 mile wide floodplain along a 103-mile meandering river course from Lake Kissimmee downstream to Lake Okeechobee. During the wet season, the river would often overtop its bank and inundate the adjacent riverine floodplain for periods ranging from days to several months. This prolonged floodplain inundation, while natural, impacted the ability of local landowners to farm and graze cattle in the floodplain,

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Hydrodynamic Modeling to Support the Design of a U-Shaped Weir in Central Florida

resulting in economic losses for these agriculture and cattle operations. To overcome prolonged flooding, the U. S. Army Corps of Engineers (USACE), with authorization from the U.S. Congress, implemented the Kissimmee flood control project from 1962-1971 with its centerpiece feature being a 300-foot wide by 30-foot deep by 56-mile long canal (C-38) constructed from Lake Kissimmee to Lake Okeechobee. While the C-38 was incredibly successful in providing flood control within the riverine

effects caused by the enhanced drainage of the Kissimmee flood control project (Koebel, 1995).

From the 1970's through the 1990's, the project cost-share sponsor, the South Florida Water Management District (SFWMD), acquired the necessary real estate interest in lands to support the implementation of the Kissimmee River Restoration (KRR) project. As a part of the KRR project, ecological (vegetative and faunal) monitoring

the backfilling of portions of the C-38 canal and the re-carving and reconnection of reaches of the historic Kissimmee River that had been obliterated by the flood control project back in the 1960's. Observers noted that the KRR Project authorized by the Congress in 1992 resulted in significant benefits (Stern, 2014). As of 2018, the KRR project is over 90 percent complete. As part of this restoration project, a 2,560-ft long U-shaped weir was designed to enable the transition of hydraulic energy from the overland flows in the restored floodplain across the weir and downstream into the remaining channelized reach of the C-38 canal. The weir is situated at the downstream terminus of backfill for the restoration project and will ensure that the larger and within-bank flows are diverted into the adjacent historic Kissimmee River.

The objectives of the modeling study were to: (1) determine the weir configuration that would limit the peak 100-year flood stage to 32.3 ft NAVD88 (the basis for real estate acquisition) during construction; (2) determine the hydraulic effectiveness of a bypass canal during construction; (3) provide model outputs for stage and velocity to perform geotechnical and structural analysis; and (4) develop stage-discharge rating curves as part of technical specification for construction. The modeling study included simulations for 5-year, 100-year, and Standard Project Flood (SPF) flows for both during construction and fully conditions. In this paper, the modeling results for 100-year flows for the fully restored condition are presented.

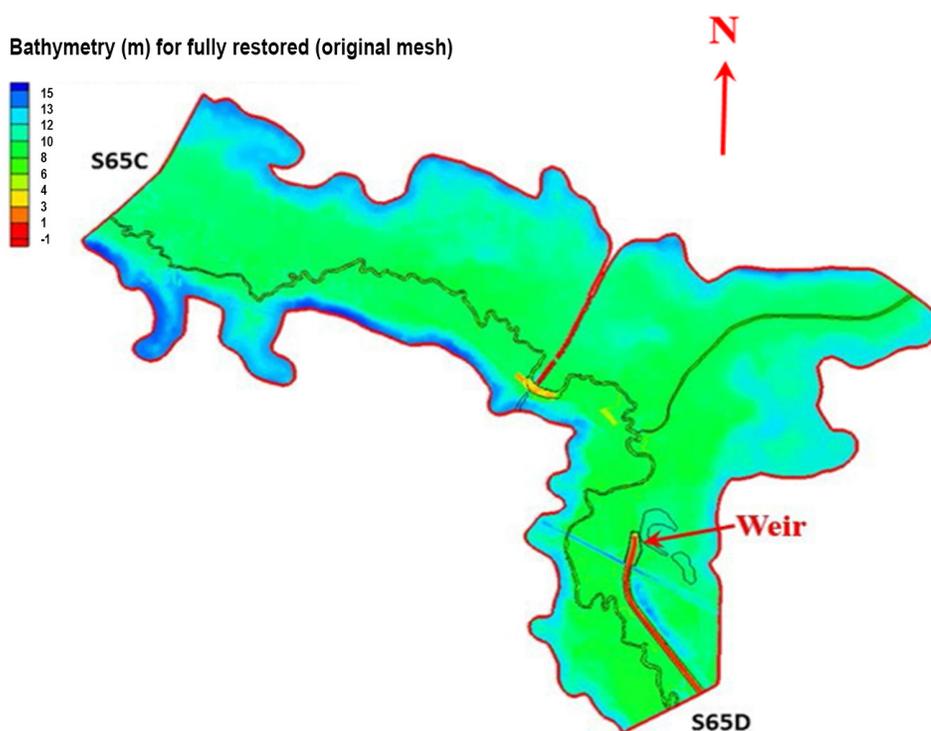
Method

AdH Model Development

USACE, Jacksonville District modified a two-dimensional hydrodynamic AdH flow model originally developed by the USACE Engineer Research and Development Center (Scott, 2010) to simulate the existing, during construction, and full

(continued on page 9)

Figure 1 – Bathymetry and location of the U-shaped weir for the fully restored condition.



floodplain, this channelization of the river had disastrous impacts on the floodplain ecosystem, with a loss of over 19,500 acres of wetlands (SFWMD, 2006). Drastic impacts to native flora and fauna within the floodplain soon followed. By 1971, the year that construction of the project was complete, grassroots environmental groups had formed and were already calling for restoration efforts to start reversing the damaging ecological and biological ef-

programs were implemented (SFWMD, 2014). Scientists, engineers, and stakeholders were enthusiastic to implement the hydrologic restoration project, premised on the understanding that restoring the floodplain would spawn biological and ecological restoration of the affected ecosystem.

In 1999, the hydrologic restoration of the Kissimmee River floodplain began with

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restoration project conditions within the Kissimmee River floodplain upstream and downstream of the proposed site of the U-shaped weir. The AdH flow model is a USACE-certified software package developed by the USACE Engineer Research and Development Center (2015) that includes solutions for two-dimensional shallow water problems using adaptive finite element method (Benner et al., 1987). The hydrodynamic modeling for this project was performed to simulate the effects of the U-shaped weir on the ambient surface water system during the fully restored and construction conditions. The model domain including the location of the weir and the bathymetry for the fully restored condition is shown in Figure 1.

Representation of the U-shaped Weir in the AdH Model

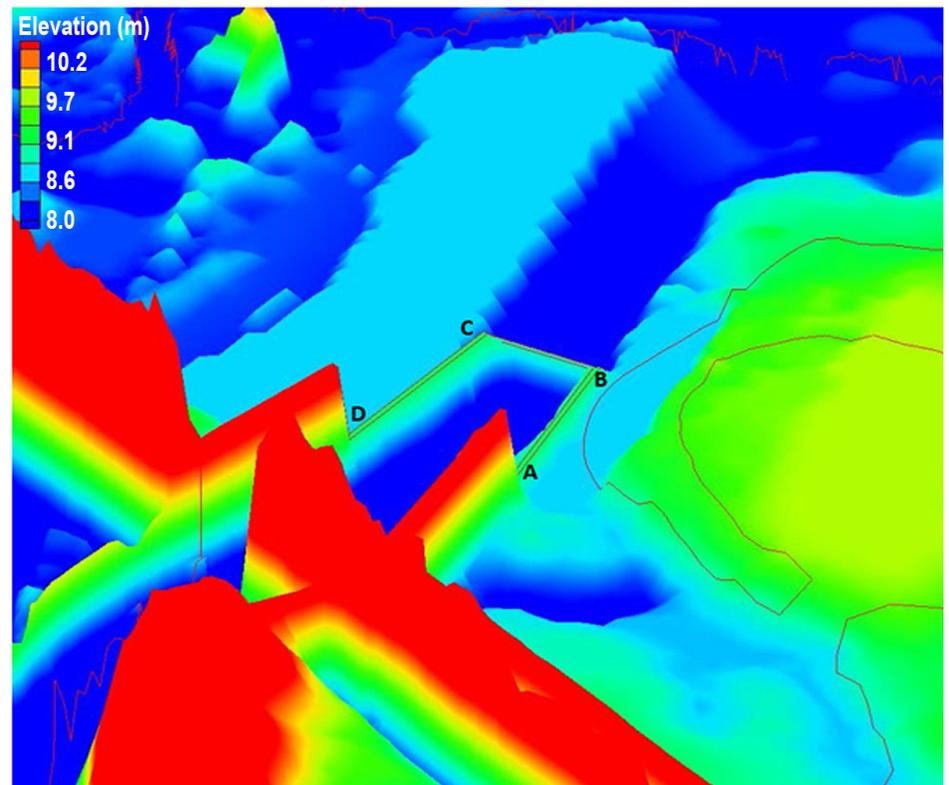
The AdH model requires triangulation of the model domain into a numerical mesh for solving the governing equations based on the adaptive finite element method. Even though the adaptive finite element method allows automatic refinement of the mesh, it is critical to use small triangles to represent the detailed features of a weir. A perspective view of the U-shaped weir represented in the AdH graphical user interface is shown in Figure 2 and the KRR AdH model mesh in the U-shaped weir area is shown in Figure 3.

Results

Simulation of Fully Restored Condition

The KRR AdH model with a refined mesh was applied to simulate the fully restored condition for different storm events. For these conditions, the water levels and flows converging through the weir were simulated. The simulated water levels for 100-year storm event are shown in Figure 4. The weir level was established at 8.78 m (28.8 ft) NAVD88 along the transverse portion and at 9.0 m (29.53 ft) NAVD88 along the longitudinal legs

Figure 2 – A perspective view of the KRR Project U-shaped weir.



after a number of trial runs. The color fill and line contours show the mounding of water upstream of the U-shaped weir. The spatial distribution of water occurs on the watershed due to the absence of the channelized flows in the areas north of the weir.

The velocities in area downstream of the U-shaped weir were also simulated by the model. Flows were computed through the three segments of the weir (see Figure 2) and are presented in Table 1. The velocities and flows were used for the geotechnical analysis associated with the erosion protection (i.e., riprap design) of the channel bank slopes downstream of the weir.

Sensitivity and Uncertainty

Several modeling runs were performed to assess the sensitivity of the peak stages at the U-Shaped weir to increases in flow

and to an increase in the downstream boundary stage at S-65D (Figure 1). The flows based on 5-year (usual flood) storm, 100-year storm (unusual flood), and SPF (extreme flood) conditions were assigned at the boundary to simulate the performance of the U-shaped weir. The sensitivities were assessed for the SPF condition since the tieback levees associated with the U-shaped weir were designed such that the levees are not overtopped by an SPF event.

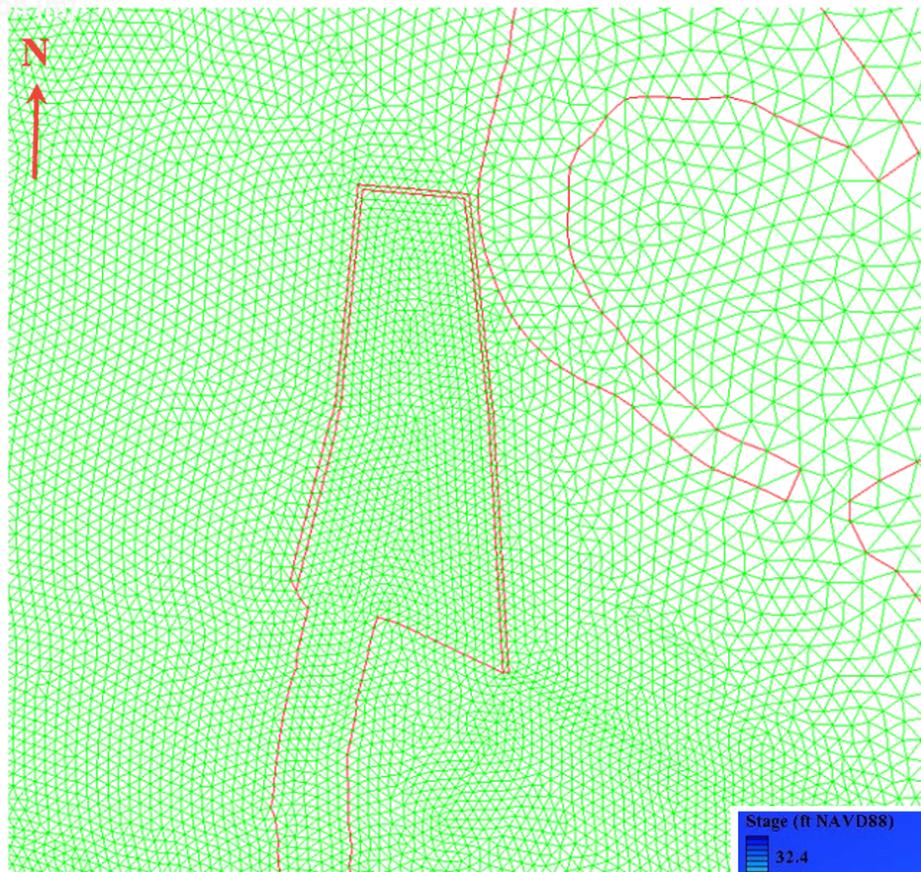
The weir system was further analyzed by simulating the anticipated flows during construction and sizing a bypass channel that would divert flows around the construction site and minimize downtime (i.e., disruption during construction at the site) due to flooding. The construction condition included degraded areas, with and without bypass flow channel, and a series of anticipated flow values through

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Figure 3 – KRR AdH model mesh in the U-shaped weir area.



the main channel. In addition, stage-discharge rating curves were developed by running the model for different upstream boundary flows. The rating curves would provide the construction contractor an indication of the water stage expected at the site under varying flow conditions. All these simulations were performed to quantify the flood stage condition by taking into account the uncertainties involved with seasonal variation of flows during construction.

Summary

The KRR AdH model successfully represented the U-shaped weir under a variety of project feature conditions, flow magnitudes, and downstream stage boundary conditions. The model with a refined mesh was run for different storm events (i.e., 5-year, 100-year, and SPF) for the fully restored condition. To investigate the

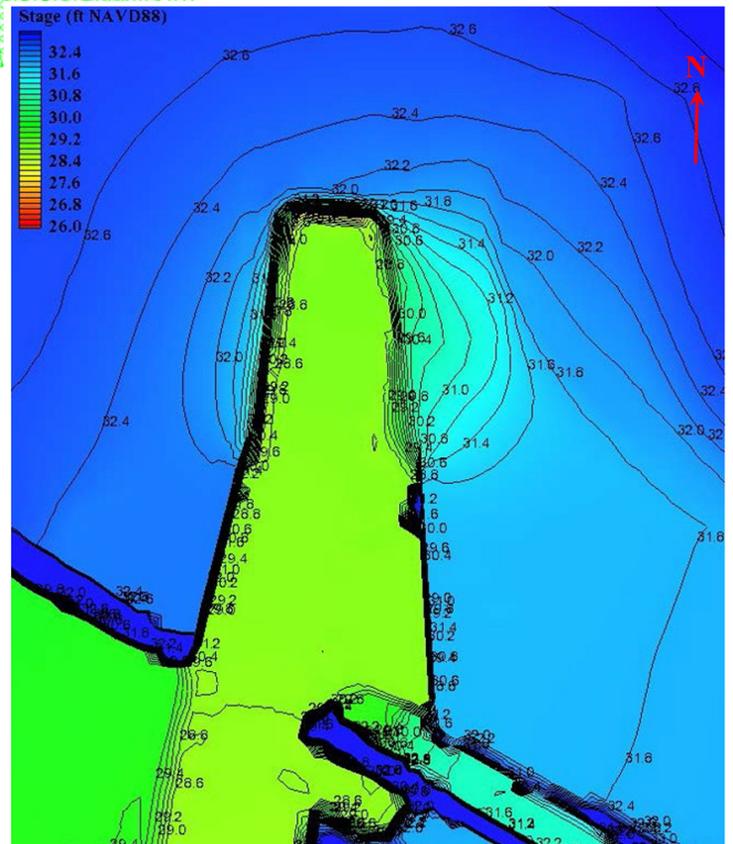
effects of the weir on the water levels and the magnitudes of velocities, the model was run to simulate a number of scenarios with weir crest at different elevations. Through the simulations of different trial scenarios, it was established that the transverse portion of the weir should be set at 28.8 ft NAVD88 and the legs of the weir should be set at 29.55 ft NAVD88.

The variations of

water levels and the magnitudes of velocities at the site were examined for the fully restored condition. The mounding of water occurs upstream of the weir for the 100-year storm event flow condition. The simulation suggests that the retention of water occurs in the floodplain upstream of the weir due to the backfill of the C-38 canal and the resulting absence of upstream channel conveyance. Downstream of the weir, the channelized flow occurs to some extent through the adjacent historic Kissimmee River and to a much larger extent through the massive and hydraulically efficient C-38 canal. The two-dimensional flow AdH model was appropriate to determine the flow distribution through these two alternate water courses. The model simulated flow values as well as spatial variations of velocities that were useful for geotechnical analysis associated with the erosion control and bank protection of the

(continued on page 11)

Figure 4 – Water levels for 100-year storm event.



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Table 1 – 100-Year Flow Across the U-shaped Weir (weir crest elevation at 28.8 ft NAVD88).

Segment	Length (ft)	100-Year Flow (cfs)
AB	1,023	2,602
BC	500	7,719
CD	1037	8,102

channel slopes downstream of the weir.

In short, the model simulations were useful in designing the weir for the hydrologic restoration of the upstream areas, for providing information to support the erosion protection analysis, and for designing a flow bypass channel to divert flow and minimize downtime during the construction of the weir. To account for an event more severe than the 100-yr condition, the extreme flow condition (Standard Project Flood (SPF), 125% of the 100-yr flows) was simulated and the results were analyzed (not mentioned in the paper to maintain brevity) to ensure that the weir was designed to safely accommo-

date this condition.

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The American Institute of Hydrology (AIH) certifies the competence and ethical conduct of professionals in the field of hydrology by conferring the Professional Hydrologist and Hydrologic Technician certification on qualified individuals.

AIH is the only nationwide organization that certifies professionals in this field. If you are currently a practicing professional and interested in becoming certified, apply for AIH membership and certification in one of our three specialty areas:

- Surface Water
- Groundwater
- Water Quality

To become a member or learn more about AIH and the certification process for water resources professionals, please visit our web site or contact us.

News from AIH

Summary of 2018 AIH Member Survey

Earlier this year, AIH invited its members to fill out a survey to understand how the organization may better serve the needs of its membership. The response to the survey was encouraging (126 respondents) and provides good insights into member expectations from AIH. Below are key take-aways from the survey.

Interaction Opportunities

A strong majority of AIH members expressed an interest in interacting with fellow AIH members at a local, regional, or national level. Thus, there is a clear desire among the membership to benefit not just from services directly provided by AIH, but also from the network of AIH peers. Approximately 45% of respondents expressed they would possibly attend a national AIH conference.

Education

An overwhelming number of members (90%) think it is important for AIH to provide opportunities for continuing education, with 80% of members being personally interested in attending AIH-facilitated webinars. This indicates a strong signal from members that AIH should be more involved in providing continuing education opportunities.

Communications

Overall, AIH members are satisfied with the quality and quantity of communications from AIH. However, only a slim majority (54%) of members expressed satisfaction with quality of material in the AIH Bulletin. This signals room for improving the Bulletin. There is also room to expand AIH's social media outreach, with less than 9% members currently following AIH on social media.

Other Professional Organizations

Many AIH members indicated they are members or other professional organizations, such as American Water Resources Association, American Society of Civil Engineers, and National Groundwater Association. This provides AIH with good opportunities for sharing knowledge and

resources with other professional bodies. Several members suggested names of other organizations that AIH can collaborate with to co-host conferences.

In the interest of brevity, the full findings of

the survey cannot be discussed here, but members are encouraged to check out findings posted here: https://aih.memberclicks.net/assets/docs/AIH%20Member%20Survey%20Summary_SE_Compiled_pg1_2.pdf

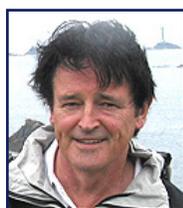
Welcome New Members!

AIH welcomes the following individuals to AIH, admitted under various membership categories between January 1, 2018 and August 31, 2018.

Name	Category	Organization	Location
Alexander Olsen-Mikitowicz	Student	Colorado State University	Fort Collins, CO
Fletcher Douglas Shields	PH	Doug Shields Engineering, LLC	University, MS
Jocelyn Beaudette	HT	Pacific Gas & Electric	Angels Camp, CA
John Miller	HIT	Wood Group	Chantilly, VA
Joseph Daconta	PH	Wood, Patel, & Associates	Phoenix, AZ
Patrick O'Brien	HIT	Leonard Rice Engineers, Inc.	Denver, CO
Ramanitharan Kandiah	PH	Central State University	Wilberforce, OH
Rewati Niraula	HIT	Tarleton State University	Stephenville, TX
Timothy Ingram	PH	EKI Environment & Water	Davis, CA

AIH Awards

AIH Board of Directors selected two outstanding individuals to receive AIH awards in recognizing their contributions to advance hydrology and dedication to professional community in general.



Dr. Thomas Dunne, Professor, Bren School of Environmental Science and Management, and Professor in Earth Science and in Geography, University of California, Santa Barbara, was selected to receive the AIH Ray K. Linsley Award for Surface Water in recognizing his exemplary international leadership as an educator and scientist, and fundamental contributions to the development of hillslope and fluvial process representations in the advancement of hydrological science.



John R. Gray, Scientist Emeritus of the USGS, was selected to receive the AIH Robert G. Wetzel Award for Water Quality in recognizing his outstanding contribution to the extension and deepening of understanding of sedimentology and to advancing technology and approaches for sediment sampling and monitoring. His leadership and passion for sediment science were well recognized by his colleagues and peers within the U.S. Geological Survey and beyond.

New AIH President Elect

In AIH elections held in October 2018, Jamil Ibrahim was elected as President-Elect of the organization for 2019-2020. He will transition to the position of President on January 1, 2021.

Jamil is a Principal Hydrologist with the consulting firm Stantec in Sacramento, California, and has more than 20 years of

experience in ecosystem restoration, flood risk management, water supply reliability, and navigation improvement projects. He received his BS in Environmental Studies from the State University of New York, College of Environmental Science and Forestry, and MS in Hydrologic Sciences from the University of California, Davis. Jamil was certified as a Professional Hydrologist (PH)

in 2006 and has been serving AIH as Vice President for Institute Development since 2016.



AIH Welcomes New Executive Committee Member

In its September meeting, the AIH Executive Committee (EC) voted to appoint Jolyne Lea to the position of Secretary on the EC. Under normal circumstances, EC members are elected by AIH's general membership but this appointment was necessary to fill the position vacated by Marc Horstman, who had to resign because of competing commitments. AIH had sought nominations for appointment to the EC position and Jolyne was one of the nominated candidates.

Jolyne is a Hydrologist with the USDA Natural Resources Conservation Service

at the National Water and Climate Center in Portland Oregon. She received her M.S. (1985) in Watershed Management-Hydrology from the University of Nevada Reno and her B.S. (1981) from the University of Connecticut in Natural Resources Management. In her position at USDA, she runs seasonal water supply forecast models based on the western US mountain snowpack. In addition, she oversees the climate data and products for the NRCS to support conservation activities of the agency. She has been involved with Oregon AIH chapter since the 1990s and is the current President.

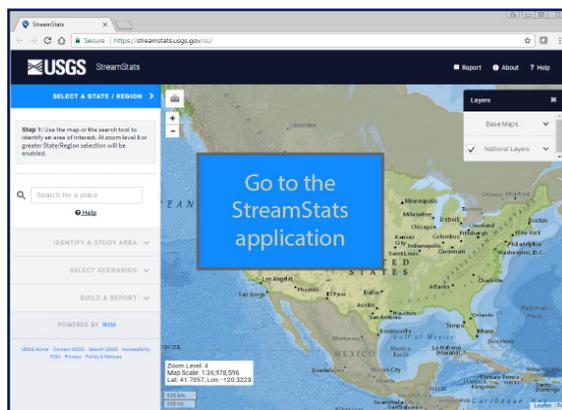
Jolyne spends her free time training her dogs, and traveling with her family.

AIH welcomes Jolyne to the Executive Committee and sincerely thanks Marc Horstman for his service.



Hydrology News - USGS Releases StreamStats 4

Earlier this year, the USGS released StreamStats 4. StreamStats 4 is a significant upgrade to the previous version of StreamStats (v.3). It is a web-based application that uses GIS analytical tools to report stream flow characteristics for water-resource planning, engineering, and design purposes. It provides the user a GIS interface to delineate drainage basins for selected streams, and estimates basin characteristics and flow statistics for many areas (where functionality is available); the availability of flow statistics vary from state to state. For instance, in Illinois and Indiana where a significant amount of recent USGS research has result-



ed in publication of statistical methods to estimate low-flow frequency and harmonic

mean flows for ungaged and unregulated streams, new algorithms are incorporated into StreamStats 4. This allows the user to access StreamStats 4 in a GIS format, find an ungaged stream of interest, and identify estimates of everything from drainage basin area to 7-day, 10-year low flows; to the 500-year peak flood flow. If interested in StreamStats 4 go to <https://water.usgs.gov/osw/streamstats/>

- Contributed by Ron St. John (St. John - Mittelhauser & Associates, Inc., Downers Grove, IL)

In Memoriam

Dr. Joseph Rosenshein (1929 - 2018)

Joseph Rosenstein, AIH President from 1992-1994, passed away on April 21, 2018. Joseph was born in Kimball, West Virginia. After graduating from high school in 1946, he enlisted in the Army and served in occupied Japan. Upon discharge, he earned his B.A. in Geology from the University of Connecticut, M.A. in Geology from Johns Hopkins University, and Ph.D. in Geology from the University of Illinois at Urbana-Champaign.

Joseph worked for more than 41 years for the Water Resources Division of the US Geological Survey (USGS). His USGS work took him to postings in Indiana, Rhode Island, Florida, Kansas, and several other states.



During his career, he authored or co-authored more than 60 publications ranging in scope from local hydrologic problems to broad national or regional groundwater issues. A recurring emphasis in his published work is the protection of aquifers from contamination and exploitation.

Joseph was active in the field of hydrology. He was a founding member of the American Institute of Hydrology and served the organization in several different positions. He also participated actively with the American Geophysical Union, Geological Society of America, International Association of Hydrogeologists, and the National Research Council.

Joseph has received a number of awards including the Burke Maxey Distinguished Service Award (Geological Society of America), Founder's Award (American Institute of Hydrology), and the Meritorious Service Award and Medal (US Geological Survey). ■

Credits: This bulletin was made possible by the following team of member-volunteers and AIH staff:

Editors: **Amy Kaarelela** (Freese and Nichols), **Ed Baquerizo** (Ahtna Environmental), **Nathan Barber** (Tennessee Valley Authority), and **Rahul Ranade** (Northwest Hydraulic Consultants).

Technical reviewer: **Kelley Sterle** (University of Nevada, Reno)

Production: **Nicole Singleton** (AIH), **Stephanie Ehlerding** (AIH)