

## **ACTIVITIES REPORT: JANUARY 1 – DECEMBER 31, 2014**

### **General Description of HRC**

The Hydrologic Research Center (HRC) is a publicly-supported non-profit research corporation. HRC was established in July of 1993 in San Diego, California. In October 1998, the Internal Revenue Service affirmed the non-profit status of HRC beyond the advanced ruling period of 5 years. HRC's purpose is to advance the science and engineering of hydrology through research and science cooperation, and to provide technology transfer and hydrologic training services. The National Science Foundation and the National Oceanic and Atmospheric Administration have served as HRC's Oversight Agencies.

HRC utilized the following methods of performing its mission:

- Publishing research and development results in technical reports, refereed journal papers, monographs, books, and written accounts of technical national and international meetings, and through the internet.
- Developing and participating in demonstration projects concerning science-based prototype observation and prediction systems in collaboration with universities, government agencies, and private industry.
- Organizing short courses and workshops on hydrologic and meteorological topics for government agencies, graduate and undergraduate university students and teachers of science.
- Providing research training for graduate and undergraduate students of collaborating universities.
- Offering post-doctoral research positions for advanced training of new Ph.D.s.
- Accepting visiting scholars from U.S. institutions and other countries, and establishing collaborative research and exchange programs with research institutions in the U.S. and abroad.

HRC's Board of Directors:

Dr. Konstantine P. Georgakakos

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Areas of research, development, and technology transfer include:

Hydrologic Science and Engineering

- (a) Floods, Flood Warning and Flood Control
- (b) Droughts
- (c) Processes of the Global Hydrologic Cycle
- (d) Remote Sensing of Hydrologic State Variables and Fluxes
- (e) Hydrology of Environmental Pollution and Restoration
- (f) Energy Production by Hydrologic Systems
- (g) Hydrologic Applications of Artificial Intelligence

Hydrometeorology

- (h) Precipitation and Surface-Runoff Processes

Hydroclimatology

- (i) Land-Surface/Atmospheric Interactions
- (j) Hydrology of the Interaction of Land and Ocean
- (k) Hydrologic and Water Resources Impacts of Climate Variability and Change

Disaster Management Protocols

Ocean Wave Modeling and Prediction Systems

## **Personnel**

Dr. Konstantine P. Georgakakos, Director and Senior Research Scientist

Mr. Robert Jubach, General Manager

Dr. Nicholas E. Graham, Climate Applications Manager, and Senior Research Scientist

Dr. Rochelle C. Graham, Meteorologist II

Ms. Barbara Hansen, Administrative Associate

Dr. Theresa Modrick, Hydrologic Engineer II

Dr. Ari Posner, Postdoctoral Associate

Dr. Eylon Shamir, Hydrologic Engineer III

Mr. Cristopher Spencer, Computer Programmer/Analyst II

Mr. Jason A. Sperflage, Computer Programmer/Analyst II

Ms. Sheila Ragan, Ocean Point Financial Systems, HRC Senior Accountant (contractor) beginning 10/3/2006.

## Projects

Autoridad del Canal de Panama (ACP): *Draft Restriction Reliability*, 7/31/14 – 8/31/14.

Autoridad del Canal de Panama (ACP): *Panama Maintenance 2014*, 10/1/13 – 9/30/14.

Autoridad del Canal de Panama (ACP): *Panama Maintenance 2015 and Chagres Distributed Ensemble Forecasting*, 10/1/14 – 10/1/15.

NOAA: *Incorporating Climate Information and Stakeholder Engagement in Groundwater Resources Planning and Management*, 8/1/12 - 7/31/15.

NWS/Office of Hydrologic Development, Indefinite Delivery/Indefinite Quantity solicitation, teamed with Lynker Technologies, Deltares, LEN Technologies, Ace Info, and AMEC: *Hydrologic/Hydrometeorologic Modeling*, (full project dates 9/26/13 – 9/25/18), 9/26/13 – 2/26/15 (Tasks 1-4).

South Africa Weather Service (SAWS): *Upgrade and modification of the South Africa Flash Flood Guidance (SAFFG) System*, 1/31/14 - 3/31/15.

UCAR: *BSMEFFG Enhancement for Turkey with Higher Resolution Basins Suitable for use with Radar Data and FFG Training in Santo Domingo*, 8/13 – 10/13.

UCAR: *Development and Presentation of a Short Course on Introduction to Applied Radar Hydrology for Belize*, 2/24/14 - 5/30/14.

UCAR: *Flash Flood Early Warning System Applications, Kankai River Basin, Nepal and Urban Flash Floods*, 9/26/14 – 5/31/15.

UCAR: *Training Support and System Improvement of the Mekong River Commission Flash Flood Guidance System (MRCFFG)*, 7/10/12 – 3/31/14.

UN International Organization for Migration (IOM): *Evaluate the Effectiveness of Check Dams in the Millet and Brise Tout Ravines in Haiti Using Hydrologic/Hydraulic Modeling*, fixed price. Task 1: 1/29/14 – 2/26/14.

UN International Organization for Migration (IOM): *Modelling and Reporting on the Evaluation of the Effectiveness of Check Dams in Ravines Millet & Trouchat in Haiti Using Hydrologic/Hydraulic Modeling*. Task 2: 10/15/14 – 4/15/15.

Universiteit Gent, Belgian Federal Scientific Policy Office (Belspo): *Patterns and Mechanisms of Climate Extremes in East Africa*, 2/13/14 – 12/31/17.

WMO: *Development and Implementation of a Flash Flood Early Warning System for the State of Chiapas, Mexico*, 2010 – 2015.

WMO: *Development and Implementation of International Regional Flash Flood Guidance and Early Warning Systems*, Phase II, HRC Work Plans I – III, 2012 – 2017.

## Publications

### *Research Papers in Journals*

- Georgakakos, K.P., Graham, N.E., Modrick, T.M., Murphy, Jr., M.J., Shamir, E., Spencer, C.R., and J.A. Sperfslage, 2014: "Evaluation of real-time hydrometeorological ensemble prediction on hydrologic scales in Northern California," *Journal of Hydrology*, 519 (2014) 2978-3000.
- Modrick, T.M. and K.P. Georgakakos, 2014: "Changes in precipitation, soil moisture, and flash flood occurrence under projected climatic change in mountainous Southern California," *Journal of Hydrology Regional Studies*, (in review).
- Modrick, T.M., and K.P. Georgakakos, 2014: "Regional bankfull geometry relationships for southern California mountain streams and hydrologic applications," *Geomorphology*, 221, 242-260.
- Osuna-Orozco, R., Georgakakos, K.P. and A. Posner, 2014: "Assimilation of satellite standing water estimates into an operational soil water model: A Kalman Filtering approach," *Journal of Hydrology*, (in review).
- Peleg, N., Shamir, E., Georgakakos, K.P., and E. Morin, 2014: "A framework for assessing hydrological regime sensitivity to climate change in a convective rainfall environment: a case study of two medium-sized eastern Mediterranean catchments, Israel," *Hydrology and Earth System Sciences*, 19,567-581 (DOI: 10.5194/hessd-19-567-2015).
- Posner, A. and K.P. Georgakakos, 2014: "Normalized Landslide Index Method for Susceptibility Map Development in El Salvador," *Natural Hazards*, (in review).
- Posner, A. and K.P. Georgakakos, 2014: "Soil Moisture and Precipitation Thresholds for Real-Time Landslide Prediction in El Salvador," *Landslides*, (in review).
- Posner, A., Georgakakos, K.P., and E. Shamir, 2014: "MODIS Inundation Estimate Assimilation into Soil Moisture Accounting Hydrologic Model: A Case Study in Southeast Asia," *Remote Sensing*, 2014(6): 10835-10859. DOI: 10.3390/rs61110835.
- Sade, R., Rimmer, A., Litaor, M.I., Shamir, E. and A. Furman, 2014: "Snow surface energy and mass balance in a warm temperate climate mountain," *Journal of Hydrology*, 519 (2014) 848-862.
- Shamir, E., and K.P. Georgakakos, 2014: "MODIS land surface temperature as an index of surface air temperature for operational snowpack estimation," *Remote Sensing of the Environment*, 152, 83-98.
- Shamir, E., Megdal, S.B., Carrillo, C, Castro, C.L., Chang, H., Chief, K., Corkhill, F.E., Eden, S., Georgakakos, K.P., Nelson, K.M., and J. Prietto, 2014: "Climate change and water resources management in the Upper Santa Cruz River, Arizona," *Journal of Hydrology*, 521 (2015) 18-33.

## *Conference Proceedings*

Georgakakos, K.P., Graham, N.E., Modrick, T.M., Shamir, E., Sperflage, J., Spencer, C., Georgakakos, A.P., Yao, H., and M. Kistenmacher: “Integrated Forecast and Reservoir Management: The INFORM System,” 10<sup>th</sup> International HEPEX Symposium, College Park, MD, 6/24/14.

Georgakakos K.P., Modrick, T.M., and E. Shamir: “Using weather radar precipitation data worldwide in conjunction with operational flash flood warning systems,” International Symposium on Weather Radar and Hydrology, ASCE Environmental and Water Resources Institute, Washington, D.C, 4/7-10/14.

Modrick, T.M. and K.P. Georgakakos, 2014: “Integrated modelling to assess climate change impacts on small-scale hydrologic response and flash flooding, In: Ames, D.P., Quinn, N.W.T., Rizzoli, A.E. (Eds.),” Proceedings of the 7<sup>th</sup> International Congress on Environmental Modelling and Software (iEMS), San Diego, California, USA, 6/15-19/14, ISBN: 978-88-9035-744-2.

Modrick, T.M., Graham, R., Shamir, E., Jubach, R., Spencer, C., Sperflage, J. and K.P. Georgakakos: “Operational Flash Flood Warning Systems with Global Applicability. In: Ames, D.P., Quinn, N.W.T., Rizzoli, A.E. (Eds.),” Proceedings of the 7<sup>th</sup> International Congress on Environmental Modelling and Software (iEMS), San Diego, CA, 06/15-19/14. ISBN: 978-88-9035-744-2.

Shamir, E., Carrillo, C., Castro, C, Hsin-I, Chang, H-I., Megdal, S., Eden, S. and J. Prietto: “Water resources vulnerability to climate change in the Upper Santa Cruz River Arizona,” Proceedings of the 7<sup>th</sup> International Congress on Environmental Modelling and Software (iEMS), San Diego, CA, 6/15-19/14. ISBN: 978-88-9035-744-2.

## *Other Abstracts*

Georgakakos, K.P.: “Operational Prediction for Flash Flood Warning and Reservoir Management – Utility for Climate Impact Studies,” 2014 APEC Climate Symposium, Nanjing, China.

## *Other Presentations*

Georgakakos, K.P.: “Integrated Forecast and Reservoir Management: the INFORM System,” American Meteorological Society, Atlanta, GA, 2/3-4/14.

Shamir, E.: “Ground water, climate and stakeholder engagement (GACASE) for water resources planning and management,” Salt River Project and ADWR for the Arizona-Mexico Commission, Hermosillo, Mexico, 2/7/14.

Shamir, E.: “The Global Flash Flood Guidance System and Early Warning Program,” Flood Management Association Luncheon, San Diego Chapter, 2/27/14.

Georgakakos, K.P.: “Evaluations of Hydroclimatological Forecasting and Decision Support in an Operational Environment for Northern California,” Atmospheric Sciences Department, University of Arizona, Tucson, AZ, 4/18/14.

Shamir, E.: “Connecting Climate Change and Surface Water Flows to Aquifer Recharge and Groundwater Management,” 14<sup>th</sup> Biennial Symposium on Managed Aquifer Recharge, Anaheim, CA, 7/31/14.

Georgakakos, K.P.: “Operational Flash Flood Warning,” World Bank Flood Showcase Meeting, Washington, D.C., 9/22-25/14.

Georgakakos, K.P.: “Operational Prediction for Flash Flood Warning and Reservoir Management – Utility for Climate Impact Studies,” 2014 APEC Climate Symposium, Nanjing, China, 10/27-29/14.

## **HRC Technical Reports**

### *Limited Distribution Reports*

Sperfslage, J., Spencer, C. and K.P. Georgakakos, 2014: “South Africa Flash Flood Guidance System (SAFFG) User’s Guide 2014 Update Edition,” *HRC Limited Distribution Report No. 44*, Hydrologic Research Center, San Diego, CA, 254pp.

### *Technical Notes*

Georgakakos, K.P., Bal, A., and J. Espinosa, 2014: “Mean Daily Gatun Lake Levels with Low Percentiles of Non-EXCEEDANCE for Various Demands and Rule Curves,” *HRC Technical Note No. 74*, Hydrologic Research Center, San Diego, CA, 30pp.

Georgakakos, K.P., 2014: “A Two-State Depth-Integrated Soil Water Model for Water Balance Calculations,” *HRC Technical Note No. 72*, Hydrologic Research Center, San Diego, CA, 25pp.

Shamir, E., 2014: “Modifications and Calibration of the Hydrologic Modeling Framework for the Santa-Cruz River Basin, Arizona,” *HRC Technical Note No. 71*, Hydrologic Research Center, San Diego, CA, 17pp.

Posner, A. and K.P. Georgakakos, 2014: “Soil Moisture and Precipitation Thresholds for Landslide Warning El Salvador,” *HRC Technical Note No. 70*, Hydrologic Research Center, San Diego, CA, 33pp.

Posner, A. and K.P. Georgakakos, 2014: “Combining Objective and Subjective Weighting in Landslide Susceptibility Map Development for El Salvador, C.A.,” *HRC Technical Note No.69*, Hydrologic Research Center, San Diego, CA, 27pp.

Georgakakos, K.P., 2014: "Evaluation of Bias in the Satellite Precipitation Estimates of the South Africa Flash Flood Guidance System (SAFFG)," *HRC Technical Note No. 68*, Hydrologic Research Center, San Diego, CA, 34pp.

Georgakakos, K.P. and A. Posner, 2014: "Summary of Activities for HRC Travel to Haiti (5-9 February 2014)," *HRC Technical Note No. 67*, Hydrologic Research Center, San Diego, CA, 19pp.

Shamir, E., Georgakakos, K.P., Peleg, N. and E. Morin, 2014: "Hydrologic Model Development for the Dalia-Taninim Watersheds in Israel," *HRC Technical Note No. 66*, Hydrologic Research Center, San Diego, CA, 42pp.

Shamir, E., Spencer, C., and K.P. Georgakakos, 2014: "Hydrologic Model Parameters for the High Resolution BSMEFFG Basins in Turkey," *HRC Technical Note No. 65*, Hydrologic Research Center, San Diego, CA, 20pp.

Georgakakos, K.P., 2014: "Inference on the Estimation of Import Volumes to Meet Target Level Reliabilities for Controlled Lakes," *HRC Technical Note No. 64*, Hydrologic Research Center, San Diego, CA, 22pp.

### *Technical Communications/Memorandums*

Georgakakos, K.P., Bal, A., and J. Espinosa, 2014: "Impacts of Water Saving Basins on Panama Canal Reliability against Draft Restrictions," *HRC Technical Communication HRC-PANCANAL-20140606*, Hydrologic Research Center, San Diego, CA, 7pp.

Georgakakos, A.P., Yao, H., Kistenmacher, M., Modrick, T.M., and K.P. Georgakakos, 2014: "2014 Water Resources Assessment for Northern California," *HRC Report to INFORM Agencies*, Hydrologic Research Center, San Diego, CA, 76pp. (Issued: January 2014, February 2014 and March 2014).

Georgakakos, K.P., 2014: "Belize training workshop, Introduction to applied radar hydrology," *HRC Technical Communication No. 20140407*, Hydrologic Research Center, San Diego, CA, 3pp.

Georgakakos, K.P., Graham, N.E., Modrick, T.M., Shamir, E., Spencer, C. and J.A. Sperflage, in collaboration with Georgakakos, A.P., Kistenmacher, M., Yao, H. and D. Kim, 2014: "Integrated Forecast and Reservoir Management (INFORM) Enhancements and Demonstration Results for Northern California (2008-2012)," *California Energy Commission Report No. CEC-500-2014-019*, Hydrologic Research Center, San Diego, CA, 529pp. On line:  
<http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-500-2014-019>

Modrick, T.M., Posner, A., and K.P. Georgakakos, 2014: "Response to TSMS Comments on Turkey High-Resolution Basin Delineation," *HRC Technical Communication 20140109*, Hydrologic Research Center, San Diego, CA, 7pp.



## *Others*

Modrick, T.M. and K.P. Georgakakos, 2014: "INFORM 2014 Forecast Outlook," *HRC Technical Memorandum INFORM-201401*, Hydrologic Research Center, San Diego, CA, 7pp.

## **Educational, Science Cooperation, and Technology Transfer Activities**

- For the past year K.P. Georgakakos has been a member of the Climate Change Technical Advisory Group (CCTAG) of the California Department of Water Resources (DWR) and has contributed to the latest report pertaining to water resources management under climatic change. The CCTAG Members were individually recognized by the DWR in November 2014 for their significant contribution to the mission of the DWR.
- K.P. Georgakakos continues to serve as the Chief Editor for the Journal of Hydrology. (Technical area: Surface Hydrology and Hydrometeorology; Impact factor 2013 – 2.964)
- K.P. Georgakakos continues to advise a UCSD Ph.D. Candidate (Mr. Rodrigo Osuna-Orozco) in the area of landslide diagnosis and prediction.
- N. Graham continues to serve as a member of the NAM-2K working group quantifying the magnitude of hydroclimatic variability over western North America during the past 2000 years.
- R. Graham reviewed manuscripts for the Global and Planetary Change, Tree Ring Research, Trees – Structure and Function, and Plant Ecology.
- T. Modrick reviewed manuscripts for the Journal of Hydrologic Engineering.
- A. Posner reviewed manuscripts for the Journal of Hydrology, Journal Geomorphology, Advances in Water Resources, and Natural Hazards.
- E. Shamir reviewed manuscripts for the Journal of Hydrology, Journal of Hydrologic Engineering, Journal of Hydrometeorology, Remote Sensing of Environment, and Water.

## January

- J. Sperflage gave a presentation to HRC staff, "Norton Security and One Note Introduction," 1/15/14.
- C. Castro, University of Arizona, gave a presentation to HRC staff, "Creating a unified perspective of the North American monsoon: from the paleoclimate record to climate change projections," 1/24/14.
- K.P. Georgakakos gave a presentation to HRC staff, "Initial Results on the Estimation of Import Volumes to Meet Target Reliabilities of Large Reservoirs," 1/31/14.
- T. Modrick served as mentor for Ms. Jaime DiFulvio, a student of the GIS certification program at Mesa College, for the GIS Work Experience course. Jaime's internship focused on (a) GIS-based watershed delineation, (b) incorporation of meteorologic data (station and gridded data) into the GIS and evaluation, and (c) understanding and assessment of flash flood guidance during a particular event from the SARFFG System. January – May 2014.

## February

- K.P. Georgakakos and A. Posner traveled to Haiti to collaborate with the International Organization for Migration (IOM) of the UN on data collection for the Haiti Gabion Project of HRC, 2/6-9/14.

- K.P. Georgakakos met with Elissa Lyn at HRC to discuss issues concerning the Climate Change Program of the California Department of Water Resources, 2/20/14.
- R. Graham and T. Modrick traveled to Pretoria, South Africa for the SARFFG Operational Workshop. 2/24-26/14.

#### March

- K.P. Georgakakos traveled to Belize to present a radar seminar to the Belize Weather Service. 3/31/14 – 4/4/14.

#### April

- A. Posner gave a lunch time science seminar at California State University San Marcos, “Advances in Remote Sensing with Application to Flood and Landslide Prediction,” 4/17/14.

#### May

- K.P. Georgakakos traveled to Geneva, Switzerland for WMO meetings, 5/17-21/14.
- J. DiFulvio, Mesa College, gave a presentation to HRC staff, “Report on GIS internship activities and results,” 5/23/14.

#### June

- A. Posner served as a mentor to Renan Alves de Oliveira, a visiting student from Brazil. His internship focused on understanding the Infinite Slope Model and testing its behavior using numerical simulations. June – July 2014.
- T. Modrick gave a presentation to HRC staff, “Hydrologic applications of regional bankfull geometry relationships for Southern California,” 6/6/14.
- E. Shamir gave a presentation to HRC staff, “Statistical and dynamical downscaling methods for projected hydrologic impact assessment,” 6/11/14.
- D. Tarboton, Utah State University gave a presentation to HRC staff, “Recent research at Utah State University,” 6/18/14.

#### July

- K.P. Georgakakos attended meetings at Elsevier in Amsterdam, 7/7-8/14.
- R. Osuna-Orozco, Student, gave a presentation to HRC staff, “Soil Moisture Assimilation,” 7/9/14.
- T. Modrick gave a presentation to HRC staff, “Precipitation, soil moisture, and flash flood frequency changes under projected climate change for Southern California,” 7/16/14.
- R. Alves de Oliveira, Student, gave a presentation to HRC Staff, “An intern’s exploration of the Infinite Slope Model,” 7/25/14.
- R. Osuna-Orozco, Student, gave a presentation to HRC staff, “Landslides,” 7/30/14.

#### August

- E. Poolman, South Africa Weather Service, gave a presentation to HRC staff, “Flash Flood Concerns in Southern Africa and a Look at the Severe Weather Forecasting Demonstration Project”, 8/13/14.

## September

- R. Graham gave a presentation to HRC staff, “A hydro-meteorologist’s guide to dendrochronology,” 9/3/14.
- R. Jubach attended the Flash Flood Summit at the National Water Center at the University of Alabama in Tuscaloosa, 9/9-11/14.
- K.P. Georgakakos gave a presentation to HRC staff, “Soil moisture modeling,” 9/17/14.

## October

- R. Jubach traveled to Washington, D.C. for the Initial Program Meeting with USAID, WMO, and NOAA for SWFDP/SARFFG linkages, 10/13-17/14.
- C. Spencer gave a presentation to HRC staff, “Standardization of Global FFG Systems,” 10/22/14.
- R. Graham attended SARFFG Training Workshop in Pretoria, South Africa, 10/26 – 11/2/14. She was responsible for the development of the training protocol and co-lectured with Eugene Poolman for the three day workshop. The annual Severe Weather Forecasting Demonstration Project (SWFDP) training included a Flash Flood Guidance training component. This year was the trial and will be used as a model for future co-training events.

## November

- J. Sperflage gave a presentation to HRC staff, “Watershed delineation post-processing in C,” 11/05/14.
- A. Rimmer, Israel Oceanographic & Limnological Research Ltd., The Kinneret Limnological Laboratory, gave a presentation to HRC staff on the principles of large scale karst hydrological modeling, 11/20/14.
- R. Graham attended Stakeholder Workshops in Zambia and Malawi, 11/30 – 12/14/14. Her role was to provide the technical experience for the FFG systems and increase the understanding of the unique properties of flash floods.

## December

- A. Posner gave a presentation to HRC staff, “Regional Real-time Landslide Hazard Forecast System Development,” 12/11/14.

## **Community Outreach Activity**

- K.P. Georgakakos served on the San Diego Water Policy Implementation Task Force.

## January

- R. Graham served as industry water advisor for the Environmental Sustainability Committee of the San Diego Unified School District, October 2013 – June 2014.
- R. Graham served as Advisor to Ralph West and the staff of the College Career and Technology Education for the San Diego Unified School District in the development of project-based learning for grades 7 – 12. October 2013 – June 2014.
- R. Graham acted in an advisory capacity to Swansea University, UK and Auckland University, NZ in relation to development of flash floods (floods) and disaster resilience curriculum for new courses they wish to incorporate into existing and developing Masters Programs.

## March

- K.P. Georgakakos, T. Modrick, A. Posner, and E. Shamir visited Atkins Engineers to discuss a potential collaboration, San Diego, CA, 3/11/14.
- K.P. Georgakakos and E. Shamir visited the Salt River Project (SRP) and Arizona Department of Water Resources in Phoenix, AZ, 3/20/14.

## April

- R. Graham wrote and submitted an article with the description of the Hydrologic Research Center and a second with a description of the Global Flash Flood Program to Wikipedia. Both were accepted.
- E. Shamir participated in two meetings of the Groundwater Users Advisory Council (GUAC) Santa Cruz Active Management Area, Nogales, AZ, 4/21/14 and 9/24/14.
- E. Shamir and WRRC-UA conducted SARP/NOAA transferability workshops introducing climate assessment and water management framework in Prescott (4/22/14), Phoenix (4/23/14), Sierra Vista (4/29/14), and Tucson (4/30/14).

## May

- R. Graham met with the San Diego Foundation and UCSD regarding the development of intern programs, 5/19/14.
- R. Graham met with CSU-SM regarding development of intern programs, 5/21/14.
- E. Shamir visited Eastern Municipal Water District Orange County and Reclamation's Temecula Field Office for discussion and site visit to key locations in the San Jacinto watershed, 5/27/14.

## June

- R. Graham established a structured internship program.
- N. Graham attended PAGES-2K NAM-2K working group meeting in Fort Collins, CO, 6/23-26/14.

## July

- K.P. Georgakakos and R. Graham attended a meeting to coordinate collaborative efforts with HRC to establish an intern program at California State University, San Marcos, 7/14/14.

## August

- R. Graham met with CSU-SM regarding development of intern programs, 8/7/14.
- R. Graham met with the San Diego Foundation and CSU-SM regarding the development of intern programs, 8/13/14.

## September

- R. Graham met with Bridgette Strickland, Program Associate, The San Diego Woman's Foundation about funding internship programs, 9/5/14.

## November

- R. Graham met with Jill Litschewski, Director, Science & Mathematics Programs, California State University, San Marcos to discuss developing a course for their water resources management program, 11/12/14.

- E. Shamir attended a Groundwater, Climate and Stakeholder Engagement (GCASE) Project Workshop: Exploring the Transferability of the GCASE Methodology to locations in Sonora, Mexico, in Rio Rico, AZ, 11/13/14.

## **Visitors**

- Dr. Cristopher Castro, University of Arizona
- Elissa Lynn, California Department of Water Resources
- Dr. John Woodward, Adjunct Faculty, San Diego Mesa College and Cooperative Work Experience Education instructor
- Vesa Korkala, INTEL
- Dr. Harvey Rodda, Hydro-GIS Ltd.
- Brandt Maxwell, U.S. National Weather Service
- Rob Thompson, Australian Government, Bureau of Meteorology
- Hugh Bruist, Australian Government, Bureau of Meteorology
- David Tarboton, Utah State University
- Prof. Efrat Morin, Hebrew University, Israel
- David Bandrowski, Trinity River Restoration Program, Reclamation
- Ibrahim Demir, Assistant Research Engineer, University of Iowa/Iowa Flood Center
- Eugene Poolman, South Africa Weather Service
- Dr. Alon Rimmer, Israel Oceanographic & Limnological Research Ltd., The Kinneret Limnological Laboratory (November 2014 – February 2015)
- Graeme Aggett, Lynker Technologies
- Jilles Jonker, Elsevier