

ACTIVITIES REPORT: JANUARY 1 – DECEMBER 31, 2012

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:

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Mr. Jason Sperflage, Treasurer

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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) Integrated Water Resources Assessment
- (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 (Carpenter), Hydrologic Engineer II

Mr. Michael Murphy, Jr., Atmospheric Scientist I (resigned 2/15/12)

Dr. Eylon Shamir, Hydrologic Engineer III

Mr. Cristopher Spencer, Computer Programmer/Analyst I

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

Ms. Sheila Ragan, Ocean Point Financial Systems, HRC Senior Accountant (contractor) beginning 10/3/06.

Projects Funded or Ongoing 2012

ACP, Autoridad del Canal de Panama, *Panama Maintenance 2012*

ACP, Autoridad del Canal de Panama, *Panama Maintenance 2013*

ACP, Autoridad del Canal de Panama, *WRF – Historical Reliability 2013*, 2/27/12 - 9/30/13

ACP, Autoridad del Canal de Panama, *Rule Curves for Gatun Dam 2012*, 4/25/12 – 9/15/12

California Energy Commission, *INFORM II*, 5/25/09 – 2/28/13

California Institute for Energy and Environment (CIEE), *Climate Change and California Coastal Sea Level Rise: Vulnerability and Adaptation Study for California*, 6/15/10 – 1/31/12

LEN Technologies, *International Flood Forecasting: Activities in Zambezi River Basin*, Subcontract Agreement: 2010-04, 4/27/11 – 10/31/12

U.S. Israel Bi-national Science Foundation, *Predicting Flash Floods and their Risk in a Dry Climate*, with Hebrew University, Jerusalem, 10/1/09 – 9/30/12

U.S. National Aeronautics and Space Administration (NASA), 11-DISASTER11-0029, *Investigating the Use of NASA Products to Improve the Performance of Regional Operational Flash Flood Guidance Systems Worldwide*, 8/27/12 – 8/26/13

U.S. National Oceanic and Atmospheric Administration (NOAA), *Incorporating Climate Information and Stakeholder Engagement in Groundwater Resources Planning and Management*, 8/1/2012 to 7/31/13

U.S. National Oceanic and Atmospheric Administration (NOAA), *The Paleoclimate Reconstruction (PR) Challenge: A community program to benchmark methods used to reconstruct the last 1-2000 years*, 7/1/08 – 3/31/12

U.S. National Weather Service (NWS), *Implementation of the Hydrologic Research Center River Regulation Scheme into NWS Operations*, 9/16/11 - 9/16/12

University Corporation for Atmospheric Research (UCAR), *Seasonal Snow Melt and Flood Emergency Assessment, 2012*. Southeast Europe: Croatia, Montenegro, Romania, Moldova, Bosnia – Herzegovina, Albania, Republic of Macedonia, Slovenia, Serbia and Greece. Central Asia region: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan. 3/5/12 - 6/30/12

University Corporation for Atmospheric Research (UCAR), Cooperative Agreement with NOAA, *SE Asia Upgrade*, 7/10/12 - 7/1/13

University Joseph Fourier, Grenoble, France, *Global Wave Modeling for Simulating Microseism Generation by Wave-Wave Interaction*, 5/3/10 – 2/15/12

University of Arizona, NSF, *Late Holocene Hydroclimate Variability*, Grant, 8/1/10 – 7/31/13

University of Arizona, *Arizona Tree Ring*, 12/19/11 – 6/30/12

World Meteorological Organization, *El Salvador Flooding and Flash Flooding Disaster Prevention, El Salvador, during the period 5/5/11 – 4/31/12*

World Meteorological Organization, *Development and Implementation of International Regional Flash Flood Guidance and Early Warning Systems (GFFG)*

World Meteorological Organization, *Development and Implementation of International Regional Flash Flood Guidance and Early Warning Systems (GFFG) – Phase II, (5 years)*

Publications

Research Papers in Journals

Ahmed, M., R.C. Graham, N. Graham, et al, 2012: “Continental-scale temperature variability over the Common Era” submitted to *Nature Geoscience*, in review.

Georgakakos, K.P., 2012: “Water supply and demand sensitivities of linear programming solutions to a water allocation problem,” *Applied Mathematics*, 3, 1285-1297.

Georgakakos, K.P., N.E. Graham, F.-Y. Cheng, C. Spencer, E. Shamir, A.P. Georgakakos, H. Yao, and M. Kistenmacher, 2012: “Value of Adaptive Water Resources Management in Northern California under Climatic Variability and Change: Dynamic Hydroclimatology,” *J. of Hydrology*, 412-413, 47-62.

Georgakakos, A.P., H. Yao, M. Kistenmacher, K.P. Georgakakos, N.E. Graham, F.-Y. Cheng, C. Spencer, and E. Shamir, 2012: “Value of Adaptive Water Resources Management in Northern California under Climatic Variability and Change: Reservoir management,” *J. of Hydrology*, 412-413, 34-46.

Graham, N., D. Cayan P. Bromirski, and R. Flick, 2012: “Multi-model projections of 21st century North Pacific winter wave climate under the IPCC A2 scenario,” *Climate Dynamics*, in press, DOI:10.1007/s00382-012-1435-8.

Graham, R.C. 2012: “Improving a tree-ring reconstruction from east-central Scandinavia: 822 years of warm-season temperatures,” submitted to *Holocene*.

Hillers, G., N. Graham, M. Camillo, S. Kedar, M. Landis and N. Shapiro, 2012: “Global oceanic microseism sources as seen by seismic arrays and predicted by wave action models,” *Geochemistry, Geophysics and Geosystems*, 13, DOI:10.1029/2011GC003875.

Meixner T., E. Shamir, and J. Duan, 2012: “Hydrologic connectivity in an arid climate: a case study of the Lower Santa Cruz River, Arizona,” submitted to *Journal of River Research and Applications*, in review.

Murphy, M., K.P. Georgakakos, and E. Shamir, 2012: “Diagnostic analysis of an unprecedented heavy rain event in the Panama Canal Watershed,” submitted to *International Journal of Climatology*, in review.

PAGES 2K Consortium and N. Graham, 2012: “Continental-scale temperature variability over the Common Era,” submitted to *Science*, in review.

Sade, R., A. Rimmer, I. Litaor, E. Shamir, and A. Furman, 2011: “The sensitivity of snow-surface temperature equation to sloped terrain,” *Journal of Hydrology*, 408 (3-4), pg. 308-313.

Shamir E., K.P. Georgakakos, and M. Murphy, 2012: “Frequency Analysis of the 7-8 December 2010 Extreme Precipitation in the Panama Canal Watershed,” *Journal of Hydrology*, DOI:101016/j.jhydrol.2012.12.010, pp. 136-148.

Shamir, E., L. Ben-Moshe, A. Ronen, T. Grodek, Y. Enzel, K.P. Georgakakos, and E. Morin, 2012: “Geomorphology-based index for detecting minimal flood stages in arid alluvial streams,” submitted to *Hydrology and Earth System Sciences*, in review.

Shamir, E., K.P. Georgakakos, C. Spencer, T.M Carpenter, M. Murphy, and R. Jubach, 2012: “Flash Flood Forecast for Haiti during the Passage of Hurricane Tomas, 4 -5 November 2010,” submitted to *Journal of Hydrology*, accepted.

Abstracts, Presentations and Conference Proceedings

Georgakakos, K.P., 2012: “Hydrometeorological Prediction for Real-Time Warning,” invited presentation at the AGU Fall 2012 Meeting (Session H24B).

Graham, R.C. 2012: “Continental-scale temperature variability over the Common Era,” presented at AGU Fall 2012 Meeting, San Francisco, by D. Kaufman.

Graham, R.C. 2012: “Reconstruction of Winter and July Precipitation in the US Southwest using minimum blue intensity measurements from *Pseudotsuga menziesii*,” presented at AGU Fall 2012 Meeting, San Francisco, by D. Griffin.

Modrick, T., 2012: “Simulated Change in Flash Flood Occurrence Frequency under Climatic Change,” AMS Meeting, New Orleans.

Modrick T., 2012: “Regional Bias in Satellite Precipitation,” (Presentation H44E-01), AGU Fall 2012 Meeting, San Francisco.

HRC Technical Reports

Limited Distribution Reports

Shamir E., T.M. Carpenter, C. Spencer, and K.P Georgakakos, 2012: “Snow Assessments for Southern Europe and the Black Sea and Middle East Region for the Spring of 2012,” *HRC Limited Distribution Report No. 39*, Hydrologic Research Center, San Diego, California.

Georgakakos, K.P., E. Shamir, and T.M. Carpenter, 2012: “*Analysis of Gatun Lake Rule Curves*,” *HRC Limited Distribution Report No. 40*, Hydrologic Research Center, San Diego, California.

Technical Notes

Spencer, C., M. Murphy, J. Sperflage, and K.P. Georgakakos, 2011: “Central American WRF (CAWRF) Model Systems Administration,” *HRC Technical Note No. 44*, Hydrologic Research Center, San Diego, California.

Carpenter, T.M., 2011: “Survey of Real-Time Rain Gauge and Automated Weather Stations for Central America,” *HRC Technical Note No. 46*, Hydrologic Research Center, San Diego, California.

Shamir E., T.M. Carpenter, N. Graham, and K.P Georgakakos, 2012: “Snow assessments for Northeastern Afghanistan for June 2012,” *HRC Technical Note No. 47*, Hydrologic Research Center, San Diego, California.

Spencer, C. and K.P. Georgakakos, 2012: “User’s Guide for CHPS Installation and Configuration of the HRC/GWRI Upstream River Regulation Module,” *HRC Technical Note No. 48*, Hydrologic Research Center, San Diego, California.

Others

Shamir E. and K.P. Georgakakos, 2012: “Assessment of the Frequency of Snow Cover for South-East Europe and Central Asia Regions,” *HRC Technical Communication 20120215*, Hydrologic Research Center, San Diego, California.

Shamir E. and K.P. Georgakakos, 2012: “Assessment of the Frequency of Snow Cover for South-East Europe and Central Asia Regions – 1st Update,” *HRC Technical Communication 20120321*, Hydrologic Research Center, San Diego, California.

Shamir E. and K.P. Georgakakos, 2012: “An Update Assessment of the Frequency of Snow Cover for Central Asia Region,” *HRC Technical Communication 20120409*, Hydrologic Research Center, San Diego, California.

Educational, Science Cooperation, and Technology Transfer Activities

- R. Jubach and K. Georgakakos traveled to Geneva, Switzerland to negotiate the next phase of the Global Flash Flood Guidance program with the WMO and USAID/OFDA.
- HRC staff discussed flash flood guidance with the China Meteorological Administration delegation (20 people).
- K. Georgakakos, R. Jubach, and E. Shamir traveled to Ankara, Turkey for a Regional Workshop on Snow Accumulation and Melt in Southeastern Europe and the Black Sea Middle East.
- R. Jubach traveled to Washington, D.C. for a meeting with NWS and USAID regarding the Zambezi project.
- R. Jubach was a guest speaker at the U.S. – ASEAN Emergency Preparedness Workshop in Bangkok, sponsored by the U.S. Trade and Development Agency.
- T. Modrick attended the annual WRF training at NCAR in Boulder, Colorado.
- E. Shamir attended a coordination meeting in Tucson, Arizona with the project advisory committee for the “Incorporating climate information and stakeholder engagement in groundwater resources planning and management,” project.
- C. Spencer traveled to the California Nevada River Forecasting Center in Sacramento, California to demonstrate the prototype FOREUPREG Module for application within real-time CHPS operations and again in December to participate in the final FOREUPREG Module installation and training workshop for the benefit of the CNRFC staff. (Upstream Regulation Project).
- E. Shamir traveled to Israel for a meeting regarding the “Predicting flash floods and their risks in a dry climate,” project in collaboration with Efrat Morin, Uri Dayan, and Yehuda Enzel at the Hebrew University of Jerusalem.
- K. Georgakakos traveled to Panama City for meetings on future work.
- K. Georgakakos visited the Directorate General of Meteorology and Air Navigation within the Public Authority for Civil Aviation of the Sultanate of Oman to discuss the possible implementation of the flash flood guidance system for the country.
- Graham, N., 2012: Invited Participant in International Continental Drilling Project (ICDP) planning workshop for the “DeepCHALLA” project in Nairobi and Taveta, Kenya.
- E. Shamir participated in a Remote Sensing Workshop in San Diego California. The workshop was sponsored by the Environmental Defense Fund, NASA, the California Water Foundation and the Water Education Foundation.
- System Administration and system operations training on the Mekong River Commission Flash Flood Guidance (MRCFFG) System for representatives of the MRC Regional Flood Management and Mitigation Center and the Vietnam National Centre for Hydro-Meteorological Forecasting was conducted at HRC, October 22 – November 16.
- E. Shamir attended the Kick-Off Workshop with the stakeholders and relevant agencies in Tucson, Arizona for the “Incorporating climate information and stakeholder engagement in groundwater resources planning and management,” project.
- K. Georgakakos and R. Jubach attended the initial planning meeting for the South Asia Flash Flood Guidance System implementation at the office of the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu, Nepal. The meeting was organized jointly by ICIMOD and the World Meteorological Organization.

- R. Graham attended USAID TraiNet Training in Washington, D.C. The training allows her to facilitate the visa process for participants in our training programs located in the USA.
- K. Georgakakos and C. Spencer attended the Upstream Regulation Project Workshop at OHD in Silver Spring, Maryland.
- The HRC - FFHT (Flash Flood Hydrometeorologist Training) program is under development. Courses completed – Elements of Hydrology, GIS/QGIS, Flash Flood Guidance Products and Models, Elements of Meteorology, and the CAFFG training course.
- The Flash Flood Forum News online interactive forum is operational. The forum allows learners to post questions and stories of interest.
- Three Flash Flood Guidance Gazettes have been produced and received positive feedback as to their utility. This Newsletter provides forecasters with information on case studies suitable for training, valuable pointers from the field in the use and interpretation of the products, and a forum for the continuing validation of the FFG products and associated warnings.
- R. Graham continued to foster and discuss developments of science curriculum with a variety of foundation and industry partners.
- E. Shamir held a Bi-National Science Foundation (BSF) project coordination meeting at HRC with the project partner (Hebrew University).
- C. Spencer traveled to ABRFC in Tulsa for the Upstream Regulation Project Workshop.

Community Outreach Activity

- The 22nd Annual North American Dendroecological Fieldweek (NADEF) was held at the Valles Caldera National Preserve, Science and Education Center in Jemez Springs, NM. R. Graham was part of a team who led a group of graduate students, professionals and dendrochronologists on the collection, and dendroclimatic analysis of a site near the Valles Caldera National Preserve and examined maximum density measurements using the blue reflectance method.
- R. Graham visited EJE School, El Cajon to discuss the development of an emergency education curriculum related to science technology, engineering, and mathematics (STEM) as an after school program.
- E. Shamir was an active member of the Data Committee of the National Hydrologic Warning Council (NHWC).
- E. Shamir - Peer Review of more than 10 journal manuscripts for the Journal of Hydrology (Elsevier).
- HRC is sponsoring a student at UCSD, Rodrigo Osuna Orozco.
- K. Georgakakos continues his service as Editor-in-Chief of the *Journal of Hydrology*.

Visitors

- Elena Petre
- Jeffrey O'Hara
- Craig Herrera, 10 News
- Sergey Borsch and Yuri Simonov, Russian Hydrometeorological Institute of Moscow
- Stephen Sexauer
- Raymond Ban
- Dr. Chiara Lepore, MIT
- Zachary Plopper, Wild Coast, San Diego
- Dr. Rosario Alfaro, NOAA/NWS, International Activities Office
- Boly Chen of the Regional Flood Management and Mitigation Center (RFMMC), Mekong River Commission, Phnom Penh, Cambodia
- Pichaid Varoonchotikul of the RFMMC, Mekong River Commission, Phnom Penh, Cambodia
- Long Vu Duc of the Vietnam National Centre for Hydro-Meteorological Forecasting, Hanoi, Vietnam
- Hamid Moradkhani, Portland State University
- Professor Efrat Morin, Hebrew University, Israel