

Activities Report: 1 July 2004 - 30 June 2005

General Description of HRC

The Hydrologic Research Center (HRC) is a publicly-supported non-profit research corporation. It has been more than 12 years since 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 realizes its purposes:

By performing basic and applied research in areas of hydrology, water resources, hydrometeorology and hydroclimatology.

By designing and implementing prototype hydrologic projects for technology transfer and science cooperation.

By publishing research and development results in technical reports, refereed journal papers, monographs, books, and written accounts of technical national and international meetings.

By organizing short courses, workshops, and summer schools on hydrologic topics for Government Agencies, graduate and undergraduate University students, and teachers of Science.

By providing summer research training for graduate and undergraduate students of collaborating Universities.

By offering post-doctoral research positions for advanced training of new Ph.D.'s.

By accepting visiting scholars, and establishing collaborative research and exchange programs with hydrologic research organizations in the U.S. and abroad.

HRC's Board of Directors consists of:

Dr. Konstantine P. Georgakakos

HRC and Scripps Institution of
Oceanography University of California, San
Diego

Professor Witold F. Krajewski

Department of Civil and Environmental
Engineering and Iowa Institute of Hydraulic
Research, The University of Iowa.

Professor Anastasios A. Tsonis

Department of Mathematical Sciences,
University of Wisconsin - Milwaukee

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

Personnel

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

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

Dr. Eylon Shamir, Postdoctoral Associate, Hydrologic Modeling and Prediction

Dr. Jianzhong Wang, Postdoctoral Associate, Hydrometeorology

Ms. Theresa Carpenter, PhD Candidate and Hydrologic Engineer

Mr. Jason A. Sperflage, Programmer/Analyst

Mr. Steven Taylor, PhD Candidate and Hydrologic Scientist

Ms. Corinne Rice, Administrative Associate

Ms. Debra Champagne, HRC Senior Accountant (contractor)

Projects Funded

ACP, Autoridad del Canal de Panama: *PANMAP Upgrade to LINUX Operating System*, 05/01/05 – 09/03/05.

ACP, Autoridad del Canal de Panama: *Continued Consultation Support for PANMAP Operations*, 12/01/04 – 09/01/05.

ACP, Autoridad del Canal de Panama: *Continued Maintenance and Development Services for Operational Hydrometeorological Forecast System*, 11/19/03 – 11/19/04.

Arizona Department of Water Resources (ADWR): *Generation of Likely Scenarios of Future Streamflow for Santa Cruz Active Management Area*, 02/01/05 – 08/01/05.

Baron Advanced Meteorological Systems, LLC (BAMS) / Lockheed Martin: *Destructive Waters (DESWAT) – Romania Flash Flood Guidance System*, 05/01/05 – 03/31/07.

Baron Advanced Meteorological Systems, LLC (BAMS) / Lockheed Martin: *Destructive Waters (DESWAT) – Hydrological Model Calibration and Validation for Romania*, 05/01/05 – 03/31/07.

California Energy Commission (w/GWRI): *Integrated Forecast and Reservoir Management Demonstration for Northern California Water Resources*, 11/1/02 – 6/30/06.

CALFED (w/GWRI): *Integrated Forecast and Reservoir Management Demonstration for Northern California Water Resources*, 6/1/03 – 5/31/06.

NASA: *Seasonal Climate Predictions and Water Resources Management Theoretical and Numerical Research*, 4/15/04 – 04/14/07.

NOAA, Office of Global Programs: *Understanding and Predicting Decadal Variations in ENSO Impacts*, 03/1/01 - 08/31/04.

NOAA, Office of Global Programs: *Ensemble Simulations of Observed Climatic Variability: Verification Methods and Forecast Applications*, 03/1/01 - 08/31/04.

NOAA, National Weather Service: *Uncertainty in Distributed Model Simulations and Potential Benefits of Agricultural Use*: 08/01/03 - 07/31/04.

NOAA, Office of Global Programs: *INFORM: Integrated Forecast and Reservoir Management Demonstration for Northern California Water Resources*, 09/01/02 – 08/31/04.

NOAA/NWS-USAID: *Central America Mitigation Initiative (CAMI)*, 09/30/02 – 06/30/04.

NOAA, Office of Global Programs: *Seasonal Climate Prediction and Management of the Panama Canal: Estimating the Benefits of Using Climate Forecast Information*, 06/01/04 – 08/31/05.

NSF: *Cold Microphysical Effects on Surface Rainfall Variability in the Tropics*, 05/01/02 – 10/31/04

NSF: *SGER: Surveying the Southern California Flash Floods of January 2005*, 04/15/05 – 03/31/06.

UCSD – NOAA/JIMO, California Applications Project (CAP): *Northern California Regional Water Resource Prediction Management*, 06/01/03 – 06/30/06.

University of Arizona: *Natural Spatiotemporal Variability of Climate over the Western United States in the Late Holocene*, 08/01/02 – 07/31/05.

Publications and Presentations

Contributions to Books and Special Issues

Georgakakos, K.P., and J.A. Sperfslage, “Operational Rainfall and Flow Forecasting for the Panama Canal Watershed,” in The Rio Chagres: A Multidisciplinary Profile of a Tropical Watershed, R.S. Harmon, ed., Kluwer Academic Publishers, The Netherlands, Chapter 16, 323-334, 2005.

Jeong, Chang Sam, J.H. Heo, D.H. Bae, and K.P. Georgakakos, “Analysis of ECMWF Simulation Information for Korean Water Resources Management,” 6th International Conference on Hydroinformatics, Liong, Phoon & Babovic (eds), 2004 World Scientific Publishing Company, ISBN 981-238-787-0.

Research Papers in Journals

Bae, D.-H., K.P. Georgakakos, and S. Kim, 2004: “Screening the Utility of Climate Information for Water Resources Applications in Korea. 1. Hydroclimatology,” *Journal of Hydrology*, *in revision*.

Bae, D.-H., K.P. Georgakakos, and W.-T. Kwon, 2004: “Screening the Utility of Climate Information for Water Resources Applications in Korea. 2. Discrimination of Extremes,” *Journal of Hydrology*, *in revision*.

Carpenter, T.M., and K.P. Georgakakos, 2004: “Discretization Scale Dependencies of the Ensemble Flow Range versus Catchment Area Relationship in Distributed Hydrologic Modeling,” *Journal of Hydrology*, *in revision*.

Carpenter, T.M., and K.P. Georgakakos, 2004: “Intercomparison of Lumped versus Distributed Hydrologic Model Ensemble Simulations on Operational Forecast Scales,” *Journal of Hydrology*, *submitted*.

Georgakakos, K.P., Graham, N.E., Carpenter, T.M., Georgakakos, A.P., and H. Yao, “Integrating Climate-Hydrology Forecasts and Multi-Objective Reservoir Management for Northern California,” *EOS*, 86(12), 122-127, 2005.

Georgakakos, K.P., D.-J. Seo, H. Gupta, J. Schaake, and M.B. Butts, “Towards the Characterization of Streamflow Simulation Uncertainty Through Multimodel Ensembles,” *Journal of Hydrology*, 298, 222-241, 2004.

- Georgakakos, K.P., 2004: "Analytical Results for Operational Flash Flood Guidance," *Journal of Hydrology*, *in press*.
- Georgakakos, K.P., and T.M. Carpenter, 2004: "Potential Value of Operationally Available and Spatially Distributed Ensemble Soil Water Estimates for Agriculture," *Journal of Hydrology*, *in revision*.
- Georgakakos, K.P., D.-H. Bae, and C.-S. Jeong, 2004: "Utility of Ten-Day Climate Model Ensemble Simulations for Water Resources Planning and Management of Korean Watersheds," *Water Resource Management*, *in press*.
- Graham, N.E., and S.J. Mason, "A Method of Ensemble Expansion and Improved Definition of Forecast Distributions from Climate Simulations," *Quart. J. Royal Met. Soc.*, 607, 939-963, 2005.
- Graham, Nicholas E., and K.P. Georgakakos, 2004: "Simulating the Value of El Nino Forecasts for the Panama Canal," *Advances in Water Resources*, *submitted*.
- Jeong, C.S., J.-H. Heo, D.-H. Bae, and K.P. Georgakakos, 2004: "Utility of High-Resolution Climate Model Simulations for Water Resources Management over the Korean Peninsula: A Sensitivity Study," *Hydrological Sciences Journal*, 50(1), 139-154.
- Ntelekos, Alexandros A., and Krajewski, Witold F., and K.P. Georgakakos, 2004: "On the Uncertainties of Flash Flood Guidance: Towards Probabilistic Forecasting of Flash Floods," *J. of Hydrometeorology*, *submitted*.
- Shamir, E., B. Imam, E. Morin, H.V. Gupta, and S. Sorooshian, "The Role of Hydrograph Indices in Parameter Estimation of Rainfall-Runoff Models," *Hydrological Processes*, 19(11), 2187-2202, 2005.
- Shamir, E., B. Imam, H.V. Gupta, and S. Sorooshian, "Temporal Streamflow Descriptors in Downward Parameter Estimation Application," *Water Resources Research*, 41(6) doi 1029/2004WR003409, 2005.
- Shamir, E., T.M. Carpenter, P. Fickenscher, and K.P. Georgakakos, 2005: "Evaluation of the NWS Operational Hydrologic Model for the American River Basin," *ASCE Journal of Hydrologic Engineering*, *accepted*.
- Shamir, E., and K.P. Georgakakos, 2005: "Distributed snow accumulation and ablation modeling in the American River Basin," *Advances in Water Resources*, *in press*.
- Shamir, E., and K.P. Georgakakos, 2005: "Derivation of Snow Depletion Curve from Distributed Snow Model in the American River Basin," *Journal of Hydrology*, *in review*.
- Knowles, N., and K.P. Georgakakos, 2004: "A Describing Function Approach to Aggregating High-Resolution Land-Surface Data for Macroscale Hydrology Modeling," *Water Resources Research*, *in revision*.
- Tsonis, A.A., and K.P. Georgakakos, "Observing Extreme Events in Incomplete State Spaces with Application to Rainfall Estimation from Satellite Images," *Journal of Nonlinear Processes in Geophysics of the European Geophysical Union*, Vol.12, 195-200, 2005.

Wang, J., and K.P. Georgakakos, "Validation and Sensitivities of Dynamic Precipitation Simulation of Winter Events over the Folsom Lake Watershed: 1964-1999," *Monthly Weather Review*, Vol. 133, 3-19, 2005.

Abstracts, Presentations and Conference Proceedings

Carpenter, T.M., and K.P. Georgakakos, "Spatial Scaling of Distributed Hydrologic Model Uncertainty of Simulated Streamflows," Submitted Abstract – 85th AMS Annual Meeting, 19th Conference on Hydrology, 9-13 January, 2005, San Diego, California.

Georgakakos, K.P., "Global/Regional Short-term Hydrological Forecasting System" Lecture, WMO Twelfth Session of the Commission for Hydrology (CHy), 20-29 October, 2004, Geneva, Switzerland.

Georgakakos, K.P., "Mitigating Adverse Hydrological Impacts of storms on a Global Scale with High resolution, Global Flash Flood Guidance," Invited Paper – Abstracts Volume of International Conference on Storms/AMOS-MSNZ National Conference, Australian Meteorological Society, 5-9 July, 2004, Brisbane, Australia.

Georgakakos, K.P., "Overview of Current Flash-Flood Warning Technology," Presented at the Workshop on Flash-Flood Warnings for the Mekong River Basin, 30-31 May 2005, Bangkok, Thailand.

Georgakakos, K.P., N.E. Graham, A.P. Georgakakos, H. Yao, E. Shamir, S. Taylor, and T.M. Carpenter, "Progress in Operational Integrated Forecast and Management of Northern California Water Resources: Hourly to Seasonal Time Scales," Submitted Abstract – 85th AMS Annual Meeting, Symposium on Living with a Limited Water Supply, 9-13 January, 2005, San Diego, California.

Georgakakos, K.P., and T.M. Carpenter, "Simulated Streamflow Sensitivity Due to Input and Parametric Uncertainty: Spatial Scaling," Submitted Abstract, AGU Fall Meeting, 13-17 December, 2004, San Francisco, California.

Shamir, E., J. Wang, S. V. Taylor, and K.P. Georgakakos, "Analysis of Spatially Distributed Snow Accumulation and Ablation on the American River Basin with Forcing from Dynamic Downscaling Procedures," Submitted Abstract – GEWEX 5th International Scientific Conference on the Global Energy and Water Cycle, June 20-24, 2005, Orange County, California.

Shamir, E., "Evaluate the Snow Depletion Curve Theory in the American River Basin with Distributed Snow Model," Submitted Abstract – 85th AMS Annual Meeting, 19th Conference on Hydrology, 9-13 January, 2005, San Diego, California.

Shamir, E., and K.P. Georgakakos, "Evaluation of the Depletion Theory in the American River Basin with Distributed Snow Model," California Extreme Precipitation Symposium, American River Watershed Conference, California State University, 22 April 2005, Sacramento, California.

- Shamir, E., and K.P. Georgakakos, "Distributed Snow Modeling Suitable for use with Operational Data for the American River Watershed. Presented in Implications of Hydrologic Variability for Prediction in Ungauged Basins, American Geophysical Union, 13-17 December, 2004, San Francisco, California.
- Shamir, E., B. Imam, and S. Sorooshian, "Application of Hydrograph-derived Streamflow Indices in Hydrologic Studies, 2004 Integrated Water Resources Management, American Institute of Hydrology Annual Conference, 17-21 October, 2004, Las Vegas, Nevada.
- Sperfslage, J., K.P. Georgakakos, T.M Carpenter, E. Shamir, and N. Graham, "Design and Implementation of a Real-Time Regional Flash Flood Guidance System for Central America Driven by Adjusted GOES Satellite Rainfall," Submitted Abstract – 21st International AMS Conference on Interactive Information Processing System (IIPS) for Meteorology, Oceanography, and Hydrology, 9-13 January, 2005, San Diego, California.
- Taylor, S., N.E. Graham, D.R. Cayan, and K.P. Georgakakos, "A 20+ Year Climatology of Northwesterly Surface Wind along the California Coast," Submitted Abstract, 85th AMS Annual Meeting, 6th Conference on Coastal Atmospheric and Oceanic Prediction and Processes, 9-13 January, 2005, San Diego, California.
- Taylor, S., N.E. Graham, D.R. Cayan, and K.P. Georgakakos, "Large-scale Atmospheric Circulation ," Submitted Abstract, 85th AMS Annual Meeting, 6th Conference on Coastal Atmospheric and Oceanic Prediction and Processes, 9-13 January, 2005, San Diego, California.
- Taylor, S.V., Graham, N.E., Cayan, D.R., and K.P. Georgakakos, "Northwesterly wind events along the Central and Southern California coasts. Presented at the 13th Conference on Interactions of the Sea and Atmosphere, 9-13 August, 2004, Portland, Maine.
- Wang, J., and K.P. Georgakakos, "The Effects of Cold Microphysical Processes on Surface Precipitation Variability. Part I: Mid-latitude Precipitation," Submitted Abstract – 85th AMS Annual Meeting, 19th Conference on Hydrology, 9-13 January, 2005, San Diego, California.
- Wang, J., and K.P. Georgakakos, "The Effects of Cold Microphysical Processes on Surface Precipitation Variability. Part II: Tropical Precipitation," Submitted Abstract – 85th AMS Annual Meeting, 19th Conference on Hydrology, 9-13 January, 2005, San Diego, California.
- Wang, J., and K.P. Georgakakos, "Effects of Cold Microphysical Processes on the Surface Precipitation Variability of Non-Squall Tropical Ocean Convection," Submitted Abstract – GEWEX 5th International Scientific Conference on the Global Energy and Water Cycle, June 20-24, 2005, Orange County, California.

HRC Technical Reports

- Carpenter, T.M., and K.P. Georgakakos, “Uncertainty in Simulations of Distributed Models and Utility of Ensemble Distributed Soil Moisture Estimates for Large-Scale Agriculture,” HRC Limited Distribution Report No.19, 30 November 2004.
- Georgakakos, K.P., and E. Shamir, “Generate Synthetic 6-hr Flow Estimates for the Folsom Lake Drainage, CA,” HRC Technical Communication FOLSOM-2004-02, Hydrologic Research Center, San Diego, California, 73 pp., 20 July 2004.
- Georgakakos, K.P., T. M. Carpenter, E. Shamir, J. Wang, S.V. Taylor and N. E. Graham, “Integrated Forecast and Reservoir Management INFORM – A Demonstration for Northern California Phase 2 Progress Report,” HRC Limited Distribution Report No. 20, 14 April 2005.
- Graham, N.E., Climate Impacts of North Pacific Winter Wave Variability: The Southern California Bight and the Gulf of the Farallones, PIER Energy-Related Environmental Research, California Energy Commission, CEC-500-2005-018, 2005.
- Graham, N.E., and M.P. Hoerling, “Some Model Results Relating to Late 20th Century Climate Trends,” Final Report to NOAA/CLIVAR/PACS Project, HRC Final Report, 2004.
- Sperflslage, J.A., K.P. Georgakakos, T.M. Carpenter, E. Shamir and N.E. Graham, in collaboration with Rosario Alfaro, Instituto Meteorológico Nacional, San José, Costa Rica, and Lorena Soriano Servicio Nacional de Estudios Territoriales, San Salvador, El Salvador, “Central America Flash Flood Guidance (CAFFG) User’s Guide,” HRC Limited Distribution Report No. 21, 20 December 2004 (English and Spanish versions).

Educational, Science Cooperation and Technology Transfer Activities

- Dr. Georgakakos was appointed to the National Academy of Science/National Research Council Committee on “Integrated Observations for Hydrologic and Related Studies,” and attended the first workshop in Washington, D.C., on February 22, 2005.
- Dr. Georgakakos was appointed to the National Academy of Science/National Research Council Committee on “Estimating and Communicating Uncertainty in Weather and Climate Forecasts,” and attended the first workshop on 27-28 April 2005.”
- Dr. Georgakakos, along with Dr. Graham, gave a presentation to the offices of USAID/ OFDA in Washington titled, “Central America Flash Flood Guidance System – CAFFG,” on December 8, 2004.
- As part of its educational program, HRC continues to support two Ph.D. candidates at UCSD: Ms. Theresa Carpenter and Mr. Stephen Taylor. Ms. Carpenter completed the Climate Sciences Division Departmental exam successfully and is now working on her PhD Thesis research proposal on flash floods. Mr. Taylor continues his PhD Thesis research on wind wave interactions in the California Bight.

- In July 2004, Mr. Jason Sperflage traveled to the Instituto Meteorológico Nacional (IMN) in Costa Rica for the on site installation and training of the Central America Flash Flood Guidance (CAFFG) system. The system is now in operation at IMN producing real-time high resolution mean areal precipitation, soil moisture and flash flood guidance estimates for the seven countries of Central America. Public site: <http://www.hrc-lab.org/CAFFG>
- Mr. Jason Sperflage and Dr. Georgakakos traveled to Korea for a series of meetings on the development of a flash flood guidance system for the Han River basin in collaboration with Sejong University. They presented an invited seminar at the Korean Meteorological Agency.
- Dr. Eylon Shamir, Mr. Jason Sperflage and Dr. Georgakakos traveled to Romania to meet with national agencies regarding the development of a flood forecast system for Romania. HRC is collaborating with Lockheed Martin and Baron Advanced Meteorological Systems (BAMS) in this project. HRC will provide technology transfer services in model parameter estimation and in flash flood guidance implementation.
- Dr.'s Eylon Shamir and Georgakakos conducted a field tour of the Santa Cruz River (SCAMA and Mexican Regions), along with ADWR (Arizona Dept of Water Resources) personnel and Mexican officials for the purpose of looking for evidence that might explain the trend of reduction of summer flow peaks at the Buena Vista gauge.
- As part of the *NSF SGER* grant on southern California flash flooding, HRC staff and local college students conducted field surveys throughout southern California in February and March 2005. The objective of the field campaign was to collect field evidence of the hydrologic impact of the significant rainfall that occurred throughout southern California in January 2005. The target impacts were evidence of landslides and stream flooding. The field campaign also entailed limited stream surveys of representative small streams (drainage areas less than ~50 mi²) throughout the region. The stream surveys gathered information on the channel bankfull width and depth, channel slope, high water depth, and flood prone area. Three teams were formed for field surveys conducted between February 11-18, consisting of two members from HRC and two additional student team members. The teams deployed to different regions, covering the San Rafael and Santa Ynez mountains (HRC co-leaders S. Taylor and J. Wang), the San Gabriel and western San Bernardino mountains (T. Carpenter and E. Shamir), and San Diego county and eastern San Bernardino mountains (K. Georgakakos and J. Sperflage). Student team members included: J. Hill, L. Hogarth, B. Munson of USCD, F. Fortunat of Moorpark College, I. Graham of Ventura College, and C. Luttrell of Texas A&M. Additional surveys were conducted by HRC Staff (T. Carpenter, E. Shamir, S. Taylor, J. Wang) on March 2-3, 2005, covering Palomar Mountain in San Diego County, and San Jacinto mountains in Riverside County.
- Theresa Carpenter, Nicholas Graham, Eylon Shamir and Jianzhong Wang were accepted to membership in the San Diego Chapter of Sigma Xi (Scientific Research Society).
- In response to direct requests and as a result of HRC mailing, reprints of current journal articles were disseminated to hundreds of recipients in the US and abroad.
- HRC Staff members served as Reviewers for NASA, NOAA, NSF and DOD proposals, and for research papers submitted to *Advances in Water Resources*, *Water Resources Research*, *J. Applied Meteorology*, *J. Climate*, *J. Hydrology*, *ASCE J. Hydrologic Engineering*, *J. of*

Geophysical Research, J. of Hydrometeorology, Hydrological Processes Journal and Science.

Visitors

Dewey Burchfield, Baron Advanced Meteorological Systems, Raleigh, North Carolina

Tom Burnet, Baron Advanced Meteorological Systems, Raleigh, North Carolina

Janice Davis, Georgia Institute of Technology, Atlanta, Georgia

Robert Jubach, U.S. National Weather Service, Silver Spring, Maryland

Bob Kuligowski, NOAA/NESDIS, Camp Springs, Maryland

John McHenry, Baron Advanced Meteorological Systems, Raleigh, North Carolina

Jeffrey O'Hara, UCSD Graduate Student, San Diego, California

Roderick Scofield, NOAA/NESDIS, Camp Springs, Maryland

Sezin Tokar, USAID, Washington, D.C.

Dimitris Tsintikidis, Dept of the Navy, Space & Naval Warfare Sys Center, San Diego,
California

Jim Verdin, USAID, Washington, D.C.

Jeff Vukovich, Baron Advanced Meteorological Systems, Raleigh, North Carolina

Greg Wilson, Baron Advanced Meteorological Systems, Raleigh, North Carolina