
Activities Report: 1 July 2003 - 30 June 2004

General Description of HRC

The Hydrologic Research Center (HRC) is a publicly-supported non-profit research corporation. It has been 10 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 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 both in the U.S. and abroad.

HRC's Board of Directors consists of:

Dr. Konstantine P. Georgakakos
Scripps Institution of Oceanography, University of California, San Diego

Professor Witold F. Krajewski
Department of Civil and Environmental Engineering, 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. Jianzhong Wang, Postdoctoral Associate, Hydrometeorology

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

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: *Maintenance and Development Services for Operational Hydrometeorological Forecast System*, 06/01/02 – 08/31/03.

ACP, Autoridad del Canal de Panama: *Advanced Statistical Analysis Using the NWS Models in the Panama Canal Watershed*, Short Course, 08/01/03 – 09/31/03.

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

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.

CONAM, Peru: *SENAMHI PROCLIM Project*, 1/12/04 – 6/30/04.

Dept of Army, COE: *Models for Uncertainty of Operational Folsom Lake Inflow Forecasts – Phase II*, 2/1/04 – 5/31/04.

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*, 8/1/03 - 7/31/04.

NOAA, Office of Global Programs: INFORM: Integrated Forecast and Reservoir Management Demonstration for Northern California Water Resources, 9/1/02 – 8/31/04.

NOAA/NWS-USAID: Central America Mitigation Initiative (CAMI), 9/30/02 – 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, CAFFG, Online Operations Training, dates TBD.

NSF: *Cold Microphysical Effects on Surface Rainfall Variability in the Tropics*, 5/1/02 – 10/31/04

UCSD – NOAA/JIMO, California Applications Project (CAP): *Northern California Regional Water Resource Prediction Management*, 6/1/03 – 6/30/06.

University of Arizona: Natural Spatiotemporal Variability of Climate over the Western United States in the Late Holocene, 8/1/02 – 7/31/05.

Publications and Presentations

Contributions to Books and Special Issues

Georgakakos, K.P., and J.A. Sperflage, “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, 2004 (*in press*).

Research Papers in Journals

Bae, D.-H., K.P. Georgakakos, and S. Kim, "Screening the Utility of Climate Information for Water Resources Applications in Korea, 1, Hydroclimatology," Journal of Hydrology, 2004 (*submitted*).

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

Caires, S., and A. Sterl, J.-R. Bidlot, N. Graham, and V. Swail, "Intercomparison of Different Wind Wave Reanalyses," Journal of Climate, **17**(10), 1893-1913, 2004.

Carpenter, T.M., and K.P. Georgakakos, "Continuous Streamflow Simulation with the HRCDHM Distributed Hydrologic Model," Journal of Hydrology, 298, 61-79, 2004.

Carpenter, T.M., and K.P. Georgakakos, "Impacts of Parametric and Radar Rainfall Uncertainty on the Ensemble Streamflow Simulations of a Distributed Hydrologic Model," Journal of Hydrology, 298, 202-221, 2004.

Georgakakos, K.P., "Analytical Results for Operational Flash Flood Guidance," Journal of Hydrology, 2004 (*submitted*).

Georgakakos, K.P., D.-H. Bae, and C.-S. Jeong, "Utility of Ten-Day Climate Model Ensemble Simulations for Water Resources Planning and Management of Korean Watersheds," Water Resources Management, 2004 (*submitted*).

Georgakakos, K.P., D.-J. Seo, H. Gupta, J. Schaake, and M. Butts, "Towards the Characterization of Streamflow Simulation Uncertainty in DMIP through Multimodel Ensembles," Journal of Hydrology, 298, 222-241, 2004.

Graham, N. E. and S. J. Mason, "A Method of Ensemble Expansion and Improved Forecast Distribution Definition From Climate Simulations," Quart. J. Royal Met. Soc., 2004 (*in press*).

Graham, N. E., 2003: "Late Holocene teleconnections between tropical Pacific climate variability and precipitation in the Western US: Evidence from the proxy record," The Holocene, 14(3), 436-447, 2004.

Jeong, C.S., J.-H. Heo, D.-H. Bae, and K.P. Georgakakos, "Utility of High-Resolution Climate Model Simulations for Water Resources Management over the Korean Peninsula: A Sensitivity Study," Hydrological Sciences Journal, 2004 (*submitted*).

Knowles, N., and K.P. Georgakakos, "A Describing Function Approach to Aggregating High-Resolution Land-Surface Data for Macroscale Hydrologic Modeling," Water Resources Research, 2004 (*in revision*).

Shamir, E., B. Imam, E. Morin, H.V Gupta, and S. Sorooshian, "Incorporating Non-parametric description of the hydrograph shape into Parameter Estimation of Hydrological Models," Hydrological Processes, 2004 (*in press*).

Shamir, E., B. Imam, H.V Gupta and S. Sorooshian., "Temporal streamflow descriptors in downward parameter estimation application," Water Resources Research, 2004 (submitted).

Smith, M.B., Georgakakos, K.P., and X. Liang, "The distributed model intercomparison project (DMIP), Editorial," Journal of Hydrology, 298, 1-3.

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, 2004 (*in press*).

Abstracts and Presentations

Georgakakos, K.P., "Satellite and GIS Flash Flood Guidance Project," invited presentation at the NWS International Meeting on NWSRFS, 22-23 October 2003, Kansas City, MO.

Georgakakos, K.P., "Integrated Forecast and Reservoir Management," Keynote Lecture at The International Conference on High-Impact Weather and Climate: Understanding, Prediction and Socio-Economic Consequences (ICHWC2004), Seoul, Korea, 22-24 March 2004.

Georgakakos, K.P., "Flash Flood Forecasting," invited presentation to the NAS Committee to Assess NEXRAD Flash Flood Forecasting Capabilities, 14 May 2004, Boulder, Co.

Georgakakos, K.P., A.A. Ntelekos, and W.F. Krajewski, "Uncertainty Analysis of Flash Flood Guidance: Topographic Data and Model Parametric Errors," presented at the AGU Joint Assembly Meeting, May 2004.

Georgakakos, K.P., "Using Modern Forecasting Tools for the Management of Reservoirs in California: An Adaptation Strategy," invited presentation at the First

Conference on Climate Change and Water Resources: From Climate to Economics: Anticipating Impacts of Climate Change in California, California Energy Commission, 9-10 June 2004.

Graham, N.E., Hughes, M., and K. Cobb, "Coherent Signals in Northern Hemisphere Proxy Records Over the Past Two Millennia: Shared Variability and Support for a Warm Tropical Pacific During the Little Ice Age," presented at the 2003 AGU Fall Meeting - Dec. 8-12 2003.

Graham, N., Hughes, M., Cobb, K., Graumlich, L., Kennett, D., Kennett, J., and L. Stott, "Increasing Tropical Pacific SSTs at the Transition into the Little Ice Age," presented at the Tucson Meeting on Tree-Rings and Climate, April 6-9, 2004.

Graham, N., Cobb, K., Hughes, M., Kennett, D., and J. Kennett, "Evidence for a warming tropical Pacific during the Little Ice Age," presented at the 2004 European Geophysical Society Meeting, Apr. 25-30 2004.

Graham, N., and S. Mason, "Ensemble Expansion for Seasonal Climate Prediction Using Recombination," presented at the 9th International Meeting on Statistical Climatology - May 24-28, 2004.

Graham, N.E., and S.V. Taylor, "Regional Wave Modeling in the Southern California Bight," presented at the AMS 5th Conference on Coastal Atmospheric and Oceanic Prediction and Processes, Seattle, Washington, August 6-8, 2003.

Taylor, S.V., Graham, N.E., Cayan, D.R., and K.P. Georgakakos, "Northwesterly Wind Events Along the California Coast," presented at the 21st Annual Pacific Climate Workshop, Asilomar, California, March 28-31, 2004.

Taylor, S.V., and N.E. Graham, "Evaluation of High Resolution Model Surface Winds and their Effect on Wave Model Performance over the Southern California Bight," presented at the AMS 5th Conference on Coastal Atmospheric and Oceanic Prediction and Processes, Seattle, Washington, August 6-8, 2003.

Preprints and Conference Proceedings

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, Brisbane, Australia, 23-30, 5-9 July, 2004.

HRC Technical Reports

- Georgakakos, K.P., E. Shamir, S.V. Taylor, T.M. Carpenter, and N.E. Graham, in collaboration with A.P. Georgakakos and H. Yao, "Integrated Forecast and Reservoir Management INFORM – A Demonstration for Northern California Phase 1 Progress Report," HRC Limited Distribution Report No.17, Hydrologic Research Center, San Diego, California, 105pp. + 10 Appendices, 21 May 2004.
- Georgakakos, K.P., "Analytical Results on the Operating Policy of a Reservoir to Meet a Volume Target with Uncertain Input Forecasts," HRC Technical Note No. 22, Hydrologic Research Center, San Diego, California, 19 pp., July 2003.
- Wang, J., and K.P. Georgakakos, "Estimation of Potential Evapotranspiration in the Mountainous Panama Canal Watershed, HRC Limited Distribution Report No.18, Hydrologic Research Center, San Diego, California, 56pp., 25 May 2004.
- Georgakakos, K.P., and E. Shamir, "Generate Synthetic 6-hr Flow Estimates for the Folsom Lake Drainage, CA," HRC Technical Communication FOLSOM-2004-01, Hydrologic Research Center, San Diego, California, 3 pp., 21 April 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.

Educational, Science Cooperation and Technology

Transfer Activities

- HRC, established in 1993, celebrated its 10th year anniversary as a prototype nonprofit research, technology transfer and training corporation. The celebration was held in the evening of the 6th of September 2004. Present were the members of the Board of Directors, current as well as past employees, collaborators from various centers, as well as other friends and guests. Dr. Georgakakos spoke on the history of HRC establishment and Dr. Dan Cayan, Director of the Climate Division of the Scripps Institution of Oceanography at UCSD, was the guest speaker on the topic of "Changes in Snowmelt Runoff over the Western United States." Professor Soroosh Sorooshian offered supportive comments on HRC's creation and mission.
- During the spring quarter, Dr. Georgakakos taught the graduate course *SIO-218: Land Surface Hydrology*, at the Scripps Institution of Oceanography, UCSD. This course is now part of the regular SIO/UCSD curriculum.
- Dr. Georgakakos served as a member of the National Research Council Committee on Assessment of Water Resources Research for the Nation. The Committee finished its

deliberations this year and produced the volume entitled *Confronting the Nation's Water Problems: The Role of Research*, which is in press by the National Academy Press as a National Research Council report.

- Ms. Theresa Carpenter represented Dr. Georgakakos at the annual meeting of the Science & Technology Program Steering Team of the U.S. Bureau of Reclamation on matters of research direction and emphasis for the Bureau.
- 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 first year of course work successfully. Mr. Taylor continues his PhD Thesis research on wind wave interactions in the California Bight.
- HRC Staff provided an overview of the Project INFORM (Integrated Forecast and Reservoir Management) to Environmental Modeling Center Representatives of NOAA in December 2003. Collaboration between EMC and HRC targets the development of climate ensemble hindcasts for use by the downscaling and hydrologic forecasting components of the project.
- With assistance from NOAA National Weather Service International Activities Office, HRC Staff facilitated and presented in El Salvador an international workshop on the Central America Flash Flood Guidance (CAFFG) system. The focus of the workshop was to provide training on the overall system, the rainfall data processing component, the soil moisture analysis component, the Flash Flood Guidance component, Flash Flood Guidance products, system and product use, and system implementation and installation procedures. The workshop was held in San Salvador 3-4 June 2004, and included participants from various agencies of the seven Central American countries.
- 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.
- As part of continuing collaboration of HRC staff with SENAMHI (the National Meteorological and Hydrological Service of Peru), Dr. Nick Graham of HRC collaborated with SENAMHI staff in Lima, Peru on the development and interpretation of regionalized global climate change model simulations.
- Mr. Steve Taylor of HRC served as the supervisor for a UCSD undergraduate student's Senior Project in the Earth Systems Program for the 2003-2004 academic year. Dr. K.P. Georgakakos served as the faculty mentor.
- 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 *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

Dr. Caspar Ammann, NCAR, Colorado

Professor Deg Hyo Bae, Sejong University, Korea

Professor David Bowles, Utah State University, Utah

Dr. Henry Diaz, NOAA, CDC, Colorado

Professor Malcolm Hughes, University of Arizona, Arizona

Mr. Robert Jubach, U.S. National Weather Service, Maryland

Mr. Jinhoon Kim, Sejong University, Korea

Professor Witold Krajewski, The University of Iowa, Iowa

Mr. Alexandros Ntelekos, The University of Iowa, Iowa

Professor Carlos Puente, UC Davis, Davis, California

Dr. Marty Ralph, NOAA OAR/ETL, Colorado

Mr. Aaron Volkening, University of Wisconsin, Milwaukee

Dr. Greg Wilson, Baron Advanced Meteorological Systems, North Carolina

Several UCSD faculty and students