
Activities Report: 1 July 2002 - 30 June 2003

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

Ms. Theresa Carpenter, Hydrologic Engineer

Mr. Jason A. Sperflage, Programmer/Analyst

Mr. Steven Taylor, PhD Candidate and Hydrologic Scientist

Ms. Corinne Rice, Administrative Associate

Mr. Jason Portugal, Undergraduate Intern

Ms. Debra Champagne, HRC Senior Accountant Consultant

Projects Funded

ACP, Autoridad del Canal de Panama: *Maintenance and Development Services for Operational Hydrometeorological Forecast System.*

ACP, Autoridad del Canal de Panama: *Advanced Statistical Analysis Using the NWS Models in the Panama Canal Watershed, Short Course.*

California Energy Commission (w/GWRI): *Integrated Forecast and Reservoir Management Demonstration for Northern California Water Resources.*

CALFED (w/GWRI): *Integrated Forecast and Reservoir Management Demonstration for Northern California Water Resources.*

Georgia Institute of Technology (GIT): *Climate and Hydrologic Forecasts for Operational Water Resources Management: A Demonstration Project, subcontract to a NOAA Grant.*

NOAA, Office of Global Programs: *Understanding and Predicting Decadal Variations in ENSO Impacts.*

NOAA, Office of Global Programs: *Ensemble Simulations of Observed Climatic Variability: Verification Methods and Forecast Applications.*

NOAA, National Weather Service: *Assessing the Effects of Scale in Operational Hydrologic Modeling*.

NSF: *Cold Microphysical Effects on Surface Rainfall Variability in the Tropics*.

UCSD – NOAA/OGP: *California Applications Project, Distributed Rainfall Prediction for Northern California*.

NOAA, Office of Global Programs: INFORM: Integrated Forecast and Reservoir Management Demonstration for Northern California Water Resources.

NOAA/NWS-USAID: Central America Mitigation Initiative (CAMI).

NOAA, Office of Global Programs: Seasonal Climate Prediction and Management of the Panama Canal: Estimating the Benefits of Using Climate Forecast Information.

University of Arizona: Natural Spatiotemporal Variability of Climate over the Western United States in the Late Holocene.

Dept of Army, COE: *Assessment of Inflow Forecast Uncertainties, American River and Folsom Dam, California*.

Publications and Presentations

Contributions to Books and Special Issues

Tachikawa, Y., Vieux, B.E., Georgakakos, K.P., and E. Nakakita, (eds.), “Weather Radar Information and Distributed Hydrological Modeling.” IAHS Publication No. 282, International Association of the Hydrologic Sciences (IAHS) Press, Wallingford, GB, 323pp., 2003.

Georgakakos, K.P., “Hydrometeorological Models for Real Time Rainfall and Flow Forecasting,” in Mathematical Models of Small Watershed Hydrology and Applications, V.P. Singh and D.K. Frevert, eds., Water Resources Publications, LLC, Highlands Ranch, Colorado, 593-655, 2002.

Georgakakos, K.P., and A.A. Tsonis, “Observing Extreme Variability in Nonlinear Systems,” in Emergent Nature – Patterns, Growth and Scaling of the Sciences, M.M. Novak, ed., World Scientific Publishing Co.,

London, United Kingdom, 209-221, 2002.

Research Papers in Journals

Andrieu, H., French, M., Krajewski, W.F., and K.P. Georgakakos, "Stochastic-Dynamical Rainfall Simulation Based on Weather Radar Volume Scan Data," Advances in Water Resources, Vol. 26, 581-593, 2003.

Gaffen, D. J., B. D. Santer, J. S. Boyle, J. R. Christy, N. E. Graham, and R. J. Ross, "Multi-Decadal Changes in the Vertical Temperature Structure of the Tropical Troposphere," Science, 287, 1242-1245, 2003.

Georgakakos, K.P., "Probabilistic Climate-Model Diagnostics for Hydrologic and Water Resources Impact Studies," Journal of Hydrometeorology, Vol.4, 92-105, February 2003.

Mason, S. J. and N. E. Graham, "Areas Beneath the Relative Operating Characteristics (ROC) and Levels (ROL) Curves: Statistical Significance and Interpretation," Quarterly Journal Royal Meteorological Society, 128, 2145-2166, 2002.

Morin, E., Georgakakos, K.P., Shamir, U., Garti, R., and Y. Enzel, "Objective, Observations-based, Automatic Estimation of the Catchment Response Time Scale," Water Resources Research, Vol. 38(10), pg 30, 1-16, 2002.

Wang, J., M.R. Hjelmfelt, W.J. Capehart, R.D. Farley, "Coupled Model Simulation of Snowfall Events over the Black Hills," Journal of Applied Meteorology, 42(6), 775-796, 2003.

Carins S., A. Sterl, J.-R. Bidlot, N. E. Graham, and V. Swail, "Climatological Assessment of Reanalysis Ocean Data," Journal of Climate, 2003, (*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, Holocene, 2003, (*accepted*).

Carpenter, T.M., and K.P. Georgakakos, "Continuous Streamflow Simulation with the HRCDHM Distributed Hydrologic Model," Journal of Hydrology, (*submitted*).

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, (*submitted*).

Georgakakos, K.P., Seo, D.-J., Gupta, H., Schaake, J., and M.B. Butts,
“Characterizing Streamflow Simulations uncertainty in DMIP Through
Multimodel Ensembles,” Journal of Hydrology, (*submitted*).

Graham, N. E. and S. J. Mason, “A Method of Ensemble Expansion and Improve
Forecast Distribution Definition From Climate Simulations, Quart. J.
Royal Met. Soc., 2003, (*submitted*).

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, 2003, (*submitted*).

Abstracts and Presentations

Georgakakos, K.P., Carpenter, T.M., Graham, N.E., Georgakakos, A.P., and H.
Yao, 2003: Assessment of Potential Climate Forecast Benefits for Water
Resources Management. Invited poster and presentation at the 10th
Annual U.S. - Japan Meeting, 15-17 January 2003, Irvine,
California. Graham, N. E., “Decadal variability over the North Pacific in
the NCAR CSM,” Western Pacific Geophysics Meeting, Wellington, NZ,
July 2002.

Georgakakos, A.P., and K.P. Georgakakos, “The Value of Climate and
Hydrologic Forecasting for Reservoir Management,” presented at the
GEWEX – IAHS Workshop, 22-25 July 2002, Dresden.

Georgakakos, K.P., “A Describing Function Approach to Aggregating High-
Resolution Land-Surface Data for Macroscale Hydrologic Modeling,”
abstract, AGU Fall 2002 Meeting, Dec. 6-10, 2002.

Georgakakos, K.P., Graham, N.E., and A.P. Georgakakos, “Use of Climate
Information in Water Resources Management: Path from Research to
Operations,” abstract, Climate Prediction Assessments Workshop,
Research and Applications on Use and Impacts, October 28-30, 2002,
Alexandria, VA.

Georgakakos, K.P., and A.P. Georgakakos, “INFORM: Integrated Forecast and
Reservoir Management – A Demonstration Project for Northern California
Reservoirs,” poster presented at the 10th U.S.-Japan Workshop on Global
Climate Change, January 15-17, 2003, Irvine, CA.

Georgakakos, K.P., “Probabilistic Climate Model Diagnostics for Hydrologic and
Water Resources Impacts Studies,” seminar at UC Berkeley, 7 February
2003, Berkeley, CA.

- Georgakakos, K.P., "A Look To The Future of Water, Weather and Climate Services in Relation to the NWS," presentation given at the Western Region Field Managers Workshop, 5-7 June, 2003, Salt Lake City, UT.
- Graham, N. E., "Decadal variability over the North Pacific in the NCAR CSM," Western Pacific Geophysics Meeting, Wellington, NZ, July 2002.
- Graham, N. E., R. R. Strange, and H. F. Diaz, "Intensification of North Pacific Winter Cyclones, 1948-98: Impacts on the California Wave Climate," 7th WAVES Workshop, Banff, Canada, October, 2002.
- Graham, N.E., and K.P. Georgakakos, "Improving Panama Canal Hydro-Management using Coupled Model Forecasts, Presentation in NOAA Meeting on Climate Services," Alexandria, VA, October, 2002.
- Graham, N. E., "Tropical modulation of western US precipitation during the past 1000 years: Inferences from proxy data," Hadley Circulation: Past, Present and Future, Honolulu, November, 2002.
- Graham, N. E., M. Hughes, D. Meko, D. Rodbell and L. Thompson, "Tropical modulation of low frequency precipitation variability in the western US during the past 1000 years," American Geophysical Society Winter Meeting, San Francisco, December, 2002.

Preprints and Conference Proceedings

- Carpenter, T.M., Georgakakos, K.P., and J.A. Sperflage, "Distributed Model Flow Sensitivities to Input and Parametric Uncertainty: Case Studies for three Watersheds in the Central U.S., paper #J5.8, AMS 83rd Annual Meeting, 9-13 February 2003, Long Beach, CA.
- Carpenter, T.M., and K.P. Georgakakos, "Distributed Model Flow Sensitivity to Uncertainty in Radar-Rainfall Input." In Weather Radar Information and Distributed Hydrological Modeling, Edited by Y. Tachikawa, B.E. Vieux, K.P. Georgakakos, and E. Nakakita. IAHS Publication No. 282. IAHS Press, Wallingford, UK, 114-120, 2003.
- Carpenter, T.M., "Characterizing Precipitation Forecast Errors for the Folsom Lake Watershed", Proceedings of the 2003 California Weather Symposium: Forecasting Extreme Precipitation in the Sierra Nevada and Implications for the American River Watershed, June 5-6, 2003, Sacramento, CA, pp. 103-117, 2003.
- Carpenter, T.M., and K.P., Georgakakos, "Impacts of Parametric and Radar-Rainfall Uncertainty on Flow Simulations From a Distributed Hydrologic

- Model,” Preprints of the Second Federal Interagency Hydrologic Modeling Conference: Hydrologic Modeling for the 21st Century, July 28 - Aug 1, 2002, Las Vegas, NV.
- Carpenter, T.M., Georgakakos, K.P., Graham, N.E., Georgakakos, A.P., and H. Yao, “Incorporating Hydroclimatic Variability in Reservoir Management at Folsom Lake, California,” paper #7.10, AMS 83rd Annual Meeting, 9-13 February 2003, Long Beach, CA.
- Georgakakos, K.P. and T.M. Carpenter, “A Methodology for Assessing the Utility of Distributed Model Forecast Applications in an Operational Environment.” In Weather Radar Information and Distributed Hydrological Modeling, Edited by Y. Tachikawa, B.E. Vieux, K.P. Georgakakos, and E. Nakakita. IAHS Publication No. 282. IAHS Press, Wallingford, UK, 85-92, 2003.
- Georgakakos, K.P., “Climate Forecasts and Water Resources Management: A Fertile Field for Hydroinformatics,” Keynote in Proceedings of the Fifth International Conference on Hydroinformatics, Volume Two: Software Tools and Management Systems, 1-5 July 2002, Cardiff, United Kingdom, 797-804, 2002.
- Georgakakos, K.P., “Hydrologic Short Term Forecasting with QPF Input,” White Paper in Proceedings of USWRP Warm Season Precipitation Workshop, 5-7 March 2002, National Center for Atmospheric Research, Boulder, Colorado, 5 pp., 2002. (On line at: <http://www.mmm.ucar.edu/uswrp/warmseasonabstracts/georgakakos.htm>).
- Georgakakos, K.P., Graham, N.E., and A.P. Georgakakos, “Integrated Forecast and Reservoir Management – Lessons Learned,” paper #7.9, AMS 83rd Annual Meeting, 9-13 February 2003, Long Beach, CA.
- Georgakakos, K.P., and J.A. Sperflage, “Operational rainfall and flow forecasting for the Panama Canal Watershed,” paper # J4.10, AMS 83rd Annual Meeting, 9-13 February 2003, Long Beach, CA.
- Morin, E., Georgakakos, K.P., Shamir, U., Garti, R., and Y. Enzel, “Investigating the effect of catchment characteristic on the response time scale using distributed model and weather radar information.” In Weather Radar Information and Distributed Hydrological Modeling, Edited by Y. Tachikawa, B.E. Vieux, K.P. Georgakakos, and E. Nakakita. IAHS Publication No. 282. IAHS Press, Wallingford, UK, 177-185, 2003.

HRC Technical Reports

Georgakakos, K.P., “Sensitivity Analysis of Multi-Lead PANMAP Rainfall Forecasts for the Significant Storm Period of December 2000,” HRC Technical Note No. 18, Hydrologic Research Center, San Diego, California, 55 pp., July 2002.

Georgakakos, K.P. and J.A. Sperflage, “Performance Analysis of Operational SS-SAC Forecasts for Headwater Sub-Catchments of the Panama Watershed, 2000-2002, HRC Technical Note No. 21, Hydrologic Research Center, San Diego, California, 37 pp., October 2002.

Georgakakos, K.P. and T.M Carpenter, “Probabilistic Analysis of Model Complexity Versus Parametric and Input Uncertainty in Operational Streamflow Forecasting,” HRC Technical Note No. 20, Hydrologic Research Center, San Diego, California, 15 pp., October 2002.

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.

Taylor, S.V., K.P. Georgakakos and N.E. Graham, “Program for the Study of Northwesterly Wind-Wave Events in the Southern California Bight Region,” HRC Limited Distribution Report No. 14, Hydrologic Research Center, San Diego, California, 84 pp., September 2002.

Educational, Science Cooperation and Technology Transfer Activities

“Recent Hydrologic Applications Using Remotely Sensed and Environmental Data and Geographic Information Systems”, UNIDATA Summer Workshop: Expanding Horizons – Using Environmental Data for Education, Research and Decision Making; one hour presentation of HRC’s research activities that involve use of radar, satellite and in situ data along with GIS for hydrologic modeling, given by Ms. Theresa Carpenter, 23-27 June 2003, Boulder, CO.

HRC participated in the NOAA-NWS sponsored Distributed Model Intercomparison Project (DMIP). In addition to submitting simulation results for the 5 study watersheds and 12 locations, Dr. Georgakakos and Ms. Theresa Carpenter participated in the DMIP Phase I workshop, held 8/20-23/2002.

Ms. Theresa Carpenter participated in the NOAA-OGP Human Dimensions of Global Change Principal Investigators Meeting on 23-25 October 2002 at Seabrook Island, South Carolina. Together with Dr. Aris Georgakakos of Georgia Tech, they participated in a

poster session and presented results of the integrated reservoir forecast-management study for Folsom Reservoir.

Dr. Georgakakos and Ms. Carpenter gave a seminar at the Office of Hydrologic Development of NWS on May 1, 2003. The seminar was entitled "Impact of Parametric and Input Uncertainty on Flow Simulations from a Distributed Hydrologic Model". The seminar presented results from the 3-year cooperative research agreement with HRC and OHD. Approximately 20-25 members of NWS Staff attended the seminar.

In June 2003 Ms. Carpenter and Mr. Jason Sperflage of HRC visited Belize, El Salvador, Guatemala, Honduras, and Nicaragua, where they presented seminars and held discussions with the national meteorological and hydrological agencies on advanced regional flash flood warning methods and systems.

Dr. Georgakakos served as a member of the National Research Council Committee on Assessment of Water Resources Research for the Nation.

Dr. Georgakakos was appointed on the Science Steering Team of the U.S. Bureau of Reclamation.

Dr. Georgakakos served as a member of the International Steering Committee of International Conference of GIS and Remote Sensing in Hydrology, Water Resources and Environment, 16-19 September 2003, Three Gorges Dam, China; and as a member of the International advisory Committee of 6th International Conference on Hydroinformatics 2004, 21-24 June 2004, Singapore.

Mr. Stephen Taylor had his second successful PhD Thesis Committee meeting on 3 June 2003 at the Scripps Institution of Oceanography, University of California San Diego (UCSD).

Mr. Taylor attended the 7th International Workshop on Wave Hindcasting and Forecasting, October 21-25, 2002, in Alberta, Canada.

Ms. Carpenter was accepted as a PhD candidate at the Scripps Institution of Oceanography, UCSD, Climate Sciences Curricular Group.

Dr. Georgakakos taught the graduate course SIO-209: Land Surface Hydrology at the Scripps Institution of Oceanography, UCSD, in the Fall of 2002.

In response to direct requests and as a result of HRC mailing, reprints of current journal articles were disseminated to a few hundred 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, and Science.

Visitors

Dr. Phil Arkin, Earth System Science, Interdisciplinary Center, U. of Maryland, College Park, Maryland

Professor Deg Hyo Bae, Dept. of Civil and Environmental Engineering, Sejong University, Seoul, Korea

Professor David Bowles, Utah Water Research Laboratory, Utah State University, Logan, Utah.

Dr. John Helly, San Diego Supercomputing Center, San Diego, California

Dr. Noah Knowles, NRC-USGS, Menlo Park, California.

Dr. Efrat Morin, U. of Arizona, Tucson, Arizona.

Several UCSD faculty and students