
Activities Report: 1 July 2001 - 30 June 2002

General Description of HRC

The Hydrologic Research Center (HRC) is a publicly-supported non-profit research and technology-cooperation 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 development work, 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 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 Hyd. 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, Senior Research Scientist and Manager, Climate Applications

Ms. Debra Champagne, HRC Senior Accountant Consultant

Ms. Corinne Rice, Administrative Associate

Ms. Theresa Carpenter, Hydrologic Engineer

Mr. Jason A. Sperflage, Programmer/Analyst

Mr. Steven Taylor, PhD Candidate and Hydrologic Scientist

Projects Funded

ACP, Autoridad del Canal de Panama: *Maintenance and Support Services for PANMAP Software.*

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

Georgia Institute of Technology (GIT): *Climate and Hydrologic Forecasts for Operational Water Resources Management:*

A Demonstration Project.

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, Office of Global Programs: *Central America Flash Flood Guidance Initial Design Meetings in US.*

NOAA, Office of Global Programs: *Central America Flash Flood Guidance Spatial Data Analysis.*

NOAA, Office of Global Programs: *Central America Regional Soil Moisture Analysis.*

NOAA, Office of Global Programs: *Interagency Meeting for Integrated Forecast and Management (INFORM) in Northern California.*

NOAA, National Weather Service: *Central America Flash Flood Guidance Design – CAMI A.*

NOAA, National Weather Service: *Central America Flash Flood Guidance Data Gathering – CAMI B.*

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

NOAA, Office of Global Programs, with GIT and SIO/UCSD: *Improvements to Water Resources Management due to Climate Forecasts.*

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

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

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

US/Israel Bi-national Science Foundation, w/Hebrew University: *Aggregation of Meteorological Radar Data: A New Approach in Basin Hydrology.*

Publications and Presentations

Contributions in Books and Special Issues

Carpenter, T.M., and K.P. Georgakakos, “Distributed Hydrological Modeling Using Radar Precipitation.” In Remote Sensing and Hydrology 2000, M. Owe, K. Brubaker, J. Richtie and A. Rango, eds., IAHS Publ. No. 267, Wallingford, United Kingdom, 558-562, 2001.

Georgakakos, K.P., D. Tsintikidis, B. Attia and J. Roskar, “Estimation of Pixel-Scale Daily Rainfall over the Nile River Catchment Using Multi-Spectral METEOSAT

- Data.” In Remote Sensing and Hydrology 2000, M. Owe, K. Brubaker, J. Richtie and A. Rango, eds., IAHS Publ. No. 267, Wallingford, United Kingdom, 11-15, 2001.
- 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***
- Carpenter, T.M., and K.P. Georgakakos, “Assessment of Folsom Lake Response to Historical and Potential Future Climate Scenarios, 1. Forecasting,” Journal of Hydrology, 249, 148-175, 2001.
- Carpenter, T.M., K.P. Georgakakos, and J.A. Sperflage, “On the Parametric and Nexrad-Radar Sensitivities of a Distributed Hydrologic Model Suitable for Operational Use,” Journal of Hydrology, 253, 169-193, 2001.
- Georgakakos, K.P., and D.E. Smith, "Soil Moisture Tendencies into the Next Century for the Conterminous United States," Journal of Geophysical Research - Atmospheres, 106(D21), 27,367-27,382, 2001.
- Georgakakos, K.P., “US Corporate Technology Transfer in Hydrometeorology,” Journal of Hydroinformatics, 4(1), 3-13, 2002.
- Graham, N. E. and H. F. Diaz, “Evidence for Intensification of North Pacific Winter Cyclones Since 1948,” Bulletin American Meteorological Society, 82, 1869-1893, 2001.
- Tsintikidis, D., Georgakakos, K.P., Sperflage, J.A., Smith, D.E., and T.M. Carpenter, "Precipitation Uncertainty and Raingauge Network Design within the Folsom Lake Watershed," ASCE Journal of Hydrologic Engineering, 7(2), 175-184, 2002.
- 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, 2002 (*in press*).

Andrieu, H., French, M., Krajewski, W.F., and K.P. Georgakakos, "Stochastic-Dynamical Rainfall Simulation Based on Weather Radar Volume Data," Advances in Water Resources, 35 pp., 2002 (*accepted*).

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, 41 pp., 2002 (*accepted*).

Georgakakos, K.P., "Probabilistic Climate Model Diagnostics for Hydrologic and Water Resources Impacts Studies," Journal of Hydrometeorology, 46 pp., 2002 (*accepted*).

Preprints and Conference Proceedings

Georgakakos, K.P., "Technology Cooperation in Water Resources Engineering," in Proceedings of First International Conference of Environmental Recovery of Yugoslavia (ENRY), 27-30 September 2001, Belgrade, Yugoslavia, 1-6, 2002.

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>).

Graham, N.E., "Changes in Mid-latitude Cyclones and Storm Tracks in Reanalysis Results, Historical Analyses and *in-situ* Data," Workshop Report, IPCC Workshop on Changes in Extreme Weather and Climate Events, Beijing, China, 11-13 June 2002, 77-79, 2002.

HRC Technical Reports

Carpenter, T.M., Sperflage, J.A., and K.P. Georgakakos, "Central America Areal Flash Flood Guidance, Analysis of Central America Terrain Elevation, Soils and Land-Cover Data," HRC Technical Communication CAAFFG-2001-02, Hydrologic Research Center, San Diego, California, 21 pp., October 2001.

Georgakakos, K.P., Carpenter, T.M., Graham, N.E., Georgakakos, A.P., and H. Yao, "Integrated Forecasting and Management for Northern California Reservoirs," HRC Technical Communication INFORM-2001-01, Hydrologic Research Center, San Diego, California, 9 pp., December 2002.

Georgakakos, K.P., Graham, N.E., and T.M. Carpenter, "Development of a Flash Flood Forecasting System for Central America," HRC Technical Communication CAAFFG-2002-02, Hydrologic Research Center, San Diego, California, 17 pp., May 2002.

Georgakakos, K.P., J.A. Sperflage, and N.E. Graham, "Central America Flash Flood Guidance, System Design Meetings in Costa Rica," HRC Technical Communication CAAFFG-2002-01, Hydrologic Research Center, San Diego, California, 15 pp., February 2002.

Georgakakos, K.P., "Central America Areal Flash Flood Guidance, July 2001 US Meetings Summary," HRC Technical Communication CAAFFG-2001-01, Hydrologic Research Center, San Diego, California, 8 pp., September 2001.

Georgakakos, K.P., J.A. Sperflage and T.M. Carpenter, "Hydrologic Forecasting Software Enhancement for the NWSRFS in Support of California Central Valley Operations," HRC Limited Distribution Report No. 12, Hydrologic Research Center, San Diego, California, 100 pp., July 2001.

Sperflage, J.A. and K.P. Georgakakos, "Enhancements and Validation of the Operational Rainfall Forecast System for the Panama Canal Watershed," HRC Limited Distribution Report No. 13, Hydrologic Research Center, San Diego, California, 88 pp., February 2002.

Educational, Science Cooperation and Technology Transfer Activities

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*.

As part of the 33rd anniversary of SENAMHI (Servicio Nacional de Meteorología e Hidrología) of Peru, Ms. Theresa Carpenter was one of five invited speakers who participated in a 1-day seminar hosted and organized by SENAMHI entitled "El Niño, Fenómenos Meteorológicos y Climáticos Extremos y La Planificación en la Prevención y

Mitigacion de Desastres Naturales en el Peru" on March 22, 2002 ("El Nino, Meteorologic Phenomena and Climate Extremes, and Plans for Prevention and Mitigation of Natural Disasters in Peru"). Ms. Carpenter discussed the HRC Flash Flood Guidance initiative for Central America. The audience included various representatives from SENAMHI, the Department of Civil Defense, and agricultural community.

Dr. Georgakakos attended a CALFED Science forum panel in Sacramento on January 8, 2002. He presented materials related to new integrative forecast- management capacity related to climate that could be of interest to CALFED, targeting the improved management of water resources at major reservoir sites in California.

Dr. Georgakakos participated in the USWRP QPF Workshop Organizing Team whose purpose was to produce a Science Plan that outlines a 5-10 year program of research consistent with the quantitative precipitation forecasting goals of the USWRP. He also gave an invited talk for a white paper on QPF and hydrologic modeling at the pertinent meeting, held at NCAR in Boulder, Colorado, 5-7 March 2002.

Dr. Georgakakos served as a member of the National Science Foundation SHE (Seismology-Hydrology-Electric Power) Peer Review Panel, which reviewed Small Business Innovation Research (SBIR) proposals on 23-25 September 2001 in Washington, D.C.

Dr. Georgakakos participated at a workshop organized by WMO in Bogotá, Columbia on 5-6 December 2001 and presented a keynote lecture on the topic of "Regional Operational Flash Flood Prediction."

Dr. Georgakakos and colleagues from Scripps Institution of Oceanography and San Diego Super Computing Center participated in the production of a UCSD TV video segment on the topic "Where Water Comes from and Where it Goes." The video segment of a 15-minute duration was broadcast on several days in November and December 2001.

Dr. Georgakakos and Ms. Carpenter gave a seminar at NWS/Office of Hydrology on April 9, 2002. The seminar entitled "Distributed Hydrologic Modeling for Operational Use: Sensitivity to Parametric and Radar-Rainfall Input Uncertainty" was open to all interested HL employees. The seminar was followed by several smaller group discussions with HL staff collaborating with HRC on distributed modeling research, and with discussion of HRC staff with other HL groups with interests in various HRC research areas. Additionally, staff of the NWS California Nevada River Forecast Center visited HRC in San Diego and received training on state estimators suitable for use with operational databases and hydrologic models.

In line with HRC's two major research and technology transfer initiatives, INFORM and CAAFFG, HRC staff met with several agency representatives in the US and in several Central American countries to discuss HRC's vision for the initiatives and to receive feedback from technical and management staff of the agencies on project goals,

objectives, design, data and technical issues. INFORM stands for Integrated Forecast and Reservoir Management, and it is a joint initiative with the Georgia Water Resources Institute (GWRI) that targets the improved management of the Northern California reservoir system using available climate and hydrologic information within an operational environment. CAAFFG stands for Central America Areal Flash Flood Guidance and targets the deployment of a distributed flash flood prediction system over all seven countries of Central America with a resolution of 100-300 square kilometers. CAAFFG uses satellite rainfall estimates, spatial databases integrated through a Geographic Information System (GIS) and modern hydrologic-hydraulic theory to arrive at estimates of flash flood threat over large areas with high spatial resolution.

Dr. Georgakakos was selected to serve on a new National Research Council Committee on Water Resources Research, with a significant purpose to assess the adequacy of the nation's investment in water resources research.

HRC Staff participated in joint seminars between Scripps Institution of Oceanography and HRC on issues of climate and hydrology.

Visitors

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

Dr. Dan Cayan, Dr. Michael Dettinger, Dr. Noah Knowles and several graduate students of the Scripps Institution of Oceanography, UCSD, La Jolla, California

Mr. Peter Fickenscher, NOAA-NWS, California Nevada River Forecast Center, Sacramento, California

Dr. John Helly, San Diego Super Computer Center, San Diego, California

Mr. Robert Jubach, NOAA National Weather Service, International Activities Office, Silver Spring, Maryland

Dr. Steve Doss-Hammel, Mr. Ted Rogers, Dr. Dimitris Tsintikidis, SPAWAR Systems Center, San Diego, California

Mr. Carlos Vargas, Meteorology and Hydrology Section of the Panama Canal Authority, Panama City, Panama

