
Activities Report: 1 July 1996 - 30 June 1997

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. Its 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 is HRC's Cognizant Agency

HRC realizes its purposes:

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 (formerly with the Iowa Institute of Hydraulic Research, The University of Iowa).

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 Geosciences, 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 Impacts of Global Climate Change

Personnel

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

Mr. David Jackson, Manager, Finance & Administration

Ms. Corinne Rice, Administrative Associate

Dr. Guleid A. Artan, Postdoctoral Research Associate

Dr. Dimitris Tsintikidis, Postdoctoral Research Associate

Mr. Jason A. Sperflage, Programmer/Analyst II

Projects Funded

Food and Agriculture Organization (FAO) of the United Nations, Rome: *Monitoring, Forecasting and Simulation of the River Nile in Egypt.*

NOAA, National Weather Service, Office of Hydrology: *Hydrologic Modeling.*

Food and Agriculture Organization (FOA): *Feasibility Study on the Estimation of Mean Areal Rainfall Over the Blue Nile Region using Meteosat Data.*

National Science Foundation: *IAI Workshop: Inter-American Institute for Global Change Start-Up Grants, Phase I.*

COPEL: *A Decision Support System for the Iguacu River.*

NOAA, National Weather Service, Office of Hydrology: *Sacramento Calibration Technology Transfer.*

NASA, National Aeronautics and Space Administration: *Stochastic-Dynamical Modeling of Space-Time Rainfall.*

NOAA, National Weather Service, Office of Hydrology: *IHFS Implementation and Testing for a Watershed in Panama.*

Bureau of Reclamation, through a Utah State University subcontract: *Hydrologic Forecasts and uncertainty of Folsom Lake Inflows.*

NOAA, National Weather Service, Office of Hydrology: *Mexico Water Resources.*

NOAA, Office of Global Programs: *Improvements to Water Resources Management due to Climate Forecasts.*

Publications and Presentations

Copies of the publications listed may be obtained by writing to: Director, Hydrologic Research Center, 12780 High Bluff Drive, Suite 250, San Diego, CA 92130.

Research Papers in Journals

- Andrieu, H., M. French, K.P. Georgakakos, and W. Krajewski, "A Stochastic Model for Rainfall Simulation Based on a Simplified Dynamical Approach," Water Resources Research, 1996 (in review).
- Apostolopoulos, T.K., and K.P. Georgakakos, "Parallel Computation for Streamflow Prediction with Distributed Hydrologic Models," J. of Hydrology, 197, 1-24, 1997.
- Artan, G.A., C.M.U. Neale, and D.G. Tarboton, "A Distributed Two-Layer Heat and Moisture Flux Model 1. Model Development and Sensitivity Analysis," Water Resources Research, 1997 (in review).
- Artan, G.A., C.M.U. Neale, D.G. Tarboton, and C.L. Hanson, "A Distributed Two-Layer Heat and Moisture Flux Model 2. Model Evaluation and Fluxes Spatial Distribution," Water Resources Research, 1997 (in review).
- Bae, D.-H., Georgakakos, K.P., and R. Rajagopal, 1996, "Rainfall Estimation for Hydrologic Applications. Korean Journal of Hydrosciences, 7, 125-137 (Refereed publication).
- Georgakakos, A.P., Yao, H., Mullusky, M.G., and K.P. Georgakakos, "Impacts of Climate Variability," Water Resources Research, 1996 (accepted)
- Georgakakos, K.P., and W.F. Krajewski, "Statistical-Microphysical Causes of Rainfall Variability in the Tropics," J. Geophysical Research - Atmospheres, 101(D21), 26,165-26,180, 1996.
- Georgakakos, K.P., and O.W. Baumer, "Measurement and Analysis of On-site Soil Moisture Data," J. of Hydrology, 184, 131-152, 1996.
- Guetter, A.K., and K.P. Georgakakos, and A.A. Tsonis, "Hydrologic Applications of Satellite Data: Part 2. Flow simulation and Soil Water Estimates", J. of Geophysical Research-Atmospheres, 101(D21), 26,527-26,538, 1996.
- Haferman, J.L., E. Anagnostou, D. Tsintikidis, W.F. Krajewski, and T.F. Smith, "Physically Based Satellite Retrieval of Precipitation using a 3D Passive Microwave Radiative Transfer Algorithm", J. of Atmospheric and Oceanic Technology, 13, 832-850, 1996.

Tsintikidis, D., and K.P. Georgakakos, "Microphysical and Large-Scale Dependencies of Temporal Rainfall Variability over a Tropical Ocean," Journal of Atmospheric Sciences, 1997 (in review).

Tsintikidis, D., J.L. Haferman, E. Anagnostou, W.F. Krajewski, and T.F. Smith, "A Neural Network Approach to Estimating Rainfall from Spaceborne Microwave Data", IEEE Transactions on Geoscience and Remote Sensing, 35(5), 1079-1093, 1997.

Tsonis, A.A., Triantafyllou, G.N., and K.P. Georgakakos, "Hydrological Applications of Satellite Data, 1, Rainfall Estimation," J. Geophysical Research - Atmospheres, 101(D21), 26,517-26,525, 1996.

Abstracts

Artan, G.A., C.M.U. Neale, and D.G. Tarboton, "Effects of Data Aggregation on a Distributed Energy Balance Model," 1997 AGU Spring Meeting, Baltimore, May 27-30, 1997, EOS Supplement, pp. S157, 1997.

Bae, K.-H., and K.P. Georgakakos, 1997, "Temporal Analyses of Regional-Scale Hydroclimatology in Monsoon Watersheds. Abstract for Third International Study Conference on GEWEX in Asia and GAME, Cheju Island, Korea, Spring 1997.

Guetter, A.K., and K. P. Georgakakos, "ENSO-Driven Streamflow Forecasts for the Midwestern U.S." Western Pacific Geophysics Meeting, AGU, July 23-27, 1996, Brisbane, Australia, 1996.

Georgakakos, A.P., K.P. Georgakakos, H. Yao, A.K. Guetter, A.M. Grimm, and L. Munhoz da Cunha, "Integrated Forecast-Control Schemes for Operational Reservoir Management with Application in Southern Brazil", 13th Conference on Hydrology, 77th AMS Annual Meeting, Long Beach, California, 2-7 February 1997.

Georgakakos, A.P., H. Yao, A.M. Grimm, A. Guetter, L. Munhoz da Cunha, and K.P. Georgakakos, "Long-Range Hydropower System Operation Planning Using Enso Information," 13th Conference on Hydrology, 77th AMS Annual Meeting, Long Beach, California, 2-7 February 1997.

Georgakakos, K.P., A.K. Guetter, and A.P. Georgakakos, "Issues with Ensemble Flow Forecasting on Seasonal Scales," 21st Annual Climate Diagnostics and Prediction Workshop, Huntsville, Alabama, October 28 - November 1, 1996.

Georgakakos, K.P., et. al, "Modeling and Prediction of Water Resources in California and the Western U.S.", 1996 Fall AGU Meeting, 1996.

Guetter, A.K., and D. Cayan, "Association of the Nile River Streamflow Anomalies with Low Frequency Climatic Indices," 13th Conference on Hydrology, 77th AMS Annual Meeting, Long Beach, California, 2-7 February 1997.

Guetter, A.K., D. Cayan, and K.P. Georgakakos, "Low Frequency Hydrologic Variability of the Continental United States," 13th Conference on Hydrology, 77th AMS Annual Meeting, Long Beach, California, 2-7 February 1997.

Preprints and Conference Proceedings

Bae, D.-H., J.-H. Oh, and K.P. Georgakakos, "Temporal Analyses of Regional-Scale Hydrolclimatology in Monsoon Watersheds," Proceedings International Study Conference on GEWEX in Asia and GAME, March 26-28, 1997, Cheju, Korea.

Georgakakos, A.P., Georgakakos, K.P., Yao, H., and M. Mullusky, "Integrated Forecast-Control System for Reservoir Management," Proceedings International Conference on Water Resources & Environmental Research: Towards the 21st Century, October 29-31, 1996, Kyoto, Japan, 531-538, 1996.

Georgakakos, K.P., Sperflage, J.A., and A.K. Guetter, "Operational GIS-Based Models for NEXRAD Radar Data in the U.S.," Proceedings International Conference on Water Resources & Environmental Research: Towards the 21st Century, October 29-31, 1996, Kyoto, Japan, 603-609, 1996.

Georgakakos, A.P., and K.P. Georgakakos, "Impacts of Climate Variability on the Management of Midwestern Water Resources Systems," Second International Scientific Conference on the Global Energy and Water Cycle, 17-21 June 1996, Washington, D.C., 1996 (poster).

Georgakakos, A.P., Georgakakos, K.P., Yao, H., and M.G. Mullusky, "Forecast Control Schemes for Reservoir Management," Proceedings of the Fifth Water Resources Operations Management Workshop, 4-6 March 1996, Arlington, Virginia, 185-195, 1996.

Georgakakos, A.P., Yao, H., Grimm, A.M., Guetter, A.K., Munhoz da Cunha, L., and K.P. Georgakakos, "Long-range Hydropower System Operation Planning Using ENSO Information," Preprints 13th Conference on Hydrology, February 2-7, 1997, Long Beach, American Meteorological Society, Boston, MA, J34-J35, 1997.

- Georgakakos, A.P., Georgakakos, K.P., Yao, H., Guetter, A.K., Grimm, A.M., and L. Munhoz da Cunha, "Integrated Forecast-Control Schemes for Operational Reservoir Management with Application in Southern Brazil," Preprints 13th Conference on Hydrology, February 2-7, 1997, Long Beach, American Meteorological Society, Boston, MA, J63-J65, 1997.
- Guetter, A.K., and K.P. Georgakakos, "Uncertainty in the Prediction of Streamflow by Real-Time Prediction Models Using Satellite Rainfall Estimates", Preprints 13th Conference on Hydrology, February 2-7, 1997, Long Beach, American Meteorological Society, Boston, MA, J109-J112, 1997.
- Guetter, A.K., Cayan, D.R., and K.P. Georgakakos, "Low Frequency Hydrologic Variability of the Continental United States," Preprints 13th Conference on Hydrology, February 2-7, 1997, Long Beach, American Meteorological Society, Boston, MA, 1-4, 1997.
- Guetter, A.K., Cayan, D.R., and N.L. Dias, "Hydroclimatological Patterns of Streamflow and Soil Water Variability in Southern Brazil," Preprints 13th Conference on Hydrology, February 2-7, 1997, Long Beach, American Meteorological Society, Boston, MA, 244, 1997.
- Guetter, A.K., and Cayan, D.R., "Association of the Nile River Streamflow Anomalies with Low Frequency Climatic Indices," Preprints 13th Conference on Hydrology, February 2-7, 1997, Long Beach, American Meteorological Society, Boston, MA, J57-J60, 1997.
- Tsintikidis, D., and K.P. Georgakakos, "Spatiotemporal Variability in Tropical Rainfields," International Conference on Water Resources & Environmental Research: Towards the 21st Century, October 29-31, 1996, Kyoto, Japan, 277-284, 1996.
- Tsintikidis, D., and K.P. Georgakakos, "Application of a Stochastic/Dynamical Model in the Study of Oceanic, Tropical Rainfall and Runoff, Preprints 13th Conference on Hydrology, February 2-7, 1997, American Meteorological Society, Boston, MA, J31-J33, 1997.
- Tsintikidis, D., and G. J. Zhang, "Numerical Simulations of the Coupling between Sea Surface Temperature, Large-Scale Circulation & Surface Evaporation, Preprints Climate Variations, February 2-7, 1997, Long Beach, American Meteorological Society, Boston, MA, 41-44, 1997.

HRC Technical Reports

Georgakakos, K.P., "Hydrologic Modeling," *Final Report*, Hydrologic Research Center, San Diego, California, 25 pp, April 1997.

Georgakakos, K.P., "Evaluation of the Uncertainty in Nile Forecast System Predictions," *HRC Limited Distribution Report No. 3*, Hydrologic Research Center, San Diego, California, 19 pp., September 1996.

Georgakakos, K.P., and G.A. Artan, "Hydrologic Modeling and Forecasting for the Upper Iguazu River Catchment," *HRC Limited Distribution Report No. 5*, Hydrologic Research Center, San Diego, California, 65 pp., February 1997.

Georgakakos, K.P., and A.K. Guetter, "Sensitivity Studies of NFS ESP Forecasts with Respect to Parametric Uncertainty and ENSO Influences," *Progress Report*, Hydrologic Research Center, San Diego, California, 27 pp, July 1996.

Georgakakos, K.P., D. Tsintikidis, and G. Artan, "Feasibility Study on the Estimation of Mean Areal Rainfall over the Blue Nile Region using METEOSAT Data," *HRC Limited Distribution Report No. 4*, Hydrologic Research Center, San Diego, California, 53 pp., February 1997.

Sperflage, J.A., and K.P. Georgakakos, "OH/WMO Calibration Training Video," *Progress Report OH-97.1*, Hydrologic Research Center, San Diego, California, 10 pp., February 1997.

Sperflage, J.A., "HRC Distributed Hydrologic Model," *User's Outline*, Hydrologic Research Center, San Diego, California, 6 pp., October 1996.

Books and Special Issues

Georgakakos, K.P., ed., Special Issue on Soil Moisture in Journal of Hydrology, October 1996.

Georgakakos, K.P., "Coupled Rainfall-Flow Forecasting Models," Hydrological Applications of Weather Radars, B. Braga, (ed.), 1997 (in press). (Refereed publication.)

Educational and Technology Transfer Activities

More than 75 reprints of published and in-press articles were sent out by HRC Staff in response to requests. Mailing of remaining copies of past Activities Reports and Reprints of HRC Staff articles was also completed during this year.

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, and J. of Geophysical Research.

As part of a cooperative agreement with the Office of Hydrology, National Weather Service, HRC is in the process of producing a training video series for the World Meteorological Organization (WMO). The focus of the video series is the Calibration of the Sacramento soil moisture accounting model. Dr. Dan Fread and Dr. Eric Anderson of the Office of Hydrology, NWS, and Dr. Konstantine Georgakakos of HRC are lecturers. Mr. Jason Sperflage of HRC is preparing the graphics for the video. The video will be disseminated world wide.

An invited technology transfer seminar was offered on May 2, 1997, by Dr. Georgakakos in Sacramento to Bureau of Reclamation, NWS, and California State Officials on real time hydrologic prediction under uncertainty.

On May 15, 1997, Dr. Georgakakos gave an invited seminar at the Cincinnati Earth System Science Center on Hydrologic Research Center research activities with emphasis on hydrologic modeling and prediction.

As part of a FAO Agreement HRC implemented a forecast-uncertainty evaluation system at the Nile Forecast Center in Cairo. The system is used by NFC Engineers to generate ensemble flow forecasts for the Blue Nile which account for input and parameter uncertainty.

As part of a technology transfer agreement with COPEL in Southern Brazil and in collaboration with Georgia Tech, HRC implemented an integrated forecast-control system for the upper Rio Iguaçu. This system, which is the result of a feasibility study, is now being evaluated for adoption by COPEL engineers/managers in real time operations.

HRC in collaboration with the Iowa Institute of Hydraulic Research is in the process of organizing the Fourth International Symposium on Hydrologic Applications of Weather Radar. The first announcement was mailed in June 1997. The Meeting will be held in San Diego during the period 4-9 April 1998.

HRC Visitors during the summer of 1997:

Professor Mark French, University of Louisville, Kentucky (Visiting Scholar: 1-31 July 1997)

Professor Deg-Hyo Bae, Changwon National University, Korea (Visitor: 8-16 July 1997)

Ms. Marina Bondar, Graduate Student, University of Louisville, Kentucky (Student Visitor: 1-16 July 1997)

Mr. Jason Madsen, Undergraduate Student, UC Santa Barbara (HRC Internship: 14 July - 14 September 1997)

Visitors

Professor Theodore Apostolopoulos, Athens University of Economics and Business, Athens, Greece

Dr. Walter Bach, U.S. Army Research Office, Research Triangle Park, North Carolina

Dr. Dan Cayan, Scripps Institution of Oceanography, UCSD, California

Dr. Shyh Chen, Scripps Institution of Oceanography, UCSD, California

Mr. James Cramer, The University of Iowa, Iowa

Dr. Nelson Luis Dias, Universidade Federal do Parana, Curitiba, Brazil

Dr. Jinfan Duan, Lawrence Livermore National Laboratory, Livermore, California

Dr. Edwin (Ted) Engman, Goddard Space Center (NASA), Greenbelt, Maryland

Mr. Todd Elvins, San Diego Supercomputing Center, California

Dr. Christopher Field, Carnegie Institution of Washington, Stanford, California

Dr. Mark French, University of Louisville, Louisville, Kentucky

Dr. Aris Georgakakos, Georgia Institute of Technology, Atlanta, Georgia

Dr. Lisa Goddard Scripps Institution of Oceanography, UCSD, California

Dr. Nick Graham, Scripps Institution of Oceanography, UCSD, California

Dr. Alice Grimm, Federal University of Parana, Curitiba, Brazil

Dr. Alexandre Guetter, SIMEPAR, Curitiba, Brazil

Professor James Kahn, University of Tennessee, Knoxville, Tennessee

Dr. Randy Koster, Goddard Space Flight Center, Greenbelt, Maryland

Mr. Noah Knowles, Scripps Institution of Oceanography, UCSD, California

Professor Witold Krajewski, University of Iowa, Iowa

Dr. Laertes Munhoz da Cunha, COPEL, Curitiba, Brazil

Dr. Christa Peters-Lidard, Georgia Institute of Technology, Atlanta, Georgia

Dr. John Roads, Scripps Institution of Oceanography, UCSD, California

Dr. Michael Sale, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Mr. Gilberto Valle-Filho, CEMIG, Belo Horizonte, Brazil

Dr. Guang Zhang, Scripps Institution of Oceanography, UCSD, California