

ACTIVITIES REPORT: JANUARY 1 – DECEMBER 31, 2020

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. 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, the National Oceanic and Atmospheric Administration, and the Department of the Interior have served as HRC's Oversight Agencies.

HRC utilized the following methods of performing its mission:

- Publishing research and development results in technical reports, refereed journal papers, monographs, books, and written accounts of technical national and international meetings, and through the internet.
- Developing and participating in demonstration projects concerning science-based prototype observation and prediction systems in collaboration with universities, government agencies, and private industry.
- Organizing short courses and workshops on hydrologic and meteorological topics for government agencies, graduate and undergraduate university students and teachers of science.
- Providing research training for graduate and undergraduate students of collaborating universities.
- Offering post-doctoral research positions for advanced training of new Ph.D.s.
- Accepting visiting scholars from U.S. institutions and other countries, and establishing collaborative research and exchange programs with research institutions in the U.S. and abroad.

HRC's Board of Directors:

Dr. Konstantine P. Georgakakos	HRC and Adjunct Professor Scripps Institution of Oceanography, University of California, San Diego
Mr. Ray Ban	Managing Director Ban and Associates, LLC
Mr. Robert Hartman	Robert K. Hartman Consulting Services
Mr. Richard Kennedy	College of Professional Studies Northeastern University
Professor Anastasios A. Tsonis	UWM Emeritus Distinguished Professor Department of Mathematical Sciences, University of Wisconsin – Milwaukee

HRC's Officers of the Board:

Mr. Jason Sperflage, Treasurer
Mr. Robert Jubach, Secretary
Dr. Konstantine P. Georgakakos, President

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

Disaster Management Protocols

Personnel

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

Mr. Robert Jubach, General Manager

Mr. Randall Banks, Computer Programmer/Analyst I

Dr. Zhengyang Cheng, Postdoctoral Associate

Dr. Rochelle Campbell, Meteorologist III

Ms. Barbara Hansen, Administrative Associate

Dr. Theresa Modrick Hansen, Hydrologic Engineer II

Mr. Robert Hetrick, Scientist/Engineer I

Dr. Eylon Shamir, Hydrologic Engineer III

Mr. Cristopher Spencer, Computer Programmer/Analyst II

Mr. Jason A. Sperflage, Computer Programmer/Analyst II

Ms. Sheila Ragan, Ocean Point Financial Systems, HRC Senior Accountant (contractor) beginning 10/3/06.

Projects Funded or Ongoing 2020

ACP, Autoridad del Canal de Panama: *Regular Maintenance 2018-2021*.

City of Nogales, AZ: *Hosting and maintenance of the Santa Cruz Active Management Area (SCAMA), Water Resources and Climate Assessment Tool (WARCAT)*, 8/1/2019 – 7/31/2020.

Department of Infrastructure, Ports and Energy, Government of St, Lucia: *St. Lucia Flash Flood Guidance System*, 10/24/2019 – 12/10/2021.

NSF, Hydrologic Sciences, in collaboration with the Laboratory of Tree Ring Research, University of Arizona: *Tree ring signal for interannual and seasonal variability of snow pack in the Sierra Nevada*, 5/1/2015 – 4/30/2020.

U.S. Bureau of Reclamation: *Technical Consulting Services for Weather Generator for the Lower Santa Cruz River Basin Study*, 10/1/2018 – 9/30/2021.

U.S. Bureau of Reclamation, Upper Colorado Regional Office: *Software Tool Development to Generate Stochastic Hydraulic Simulations using HEC-RAS*, 8/14/2019 – 12/30/2021.

UCAR: *Advancing Impact-based Forecasting and Warning Services in El Salvador and Costa Rica*, 4/1/2017 – 7/31/2021.

UCAR: *Advancing Impact-based Forecasting and Warning Services in Guatemala*, 12/4/2017 – 7/31/2021.

UCAR: *Advancing Impact-based Forecasting and Warning Services in South Africa*, 3/9/2017 – 12/31/2019.

UCAR: *Global Flash Flood Guidance Implementation Tasks*, 3/1/2018 – 8/31/2021.

UCAR: *Global Flash Flood Guidance Program Support Tasks*, 3/1/2018 – 8/31/2021.

UCAR: *Impact-based Forecasting and Warning Services: Bahamas*, 8/5/2020 - 8/31/2021.

UCAR: *Impact-based Forecasting and Warning Services: Fiji*, 8/3/2020 – 8/31/2021.

UCAR: *Impact-based Forecasting and Warning Services: Indonesia*, 1/19/2018 – 7/31/2021.

UCAR: *Impact-based Forecasting and Warning Services: Sri Lanka*, 1/6/2020 - 8/31/2021.

UCAR: *Impact-based Forecasting and Warning Services: Support in the development of online courses*, 5/22/2020 – 3/31/2021.

UCAR: *WRN Program Support Tasks*, 9/16/2018 – 8/31/2021.

WMO: *Development and Implementation of International Regional Flash Flood Guidance and Early Warning Systems* (Phase II), Work Plans 8 and 9, Fiji and Southeast Asia, 04/01/2018 – 12/31/2021.

WMO: *Flash Flood Guidance System with Global Coverage*, (Phase III), HRC Work Plan 1, 7/8/2019 - 12/31/2021.

WMO: *Flash Flood Guidance System with Global Coverage* (Phase III), HRC Work Plan 2, 7/1/2020 – 09/30/2022.

Publications

Contributions to Books and Special Issues

Tsonis, A.A., and C. Zerefos, 2020: *Aristotle’s Μετεωρολογικά Meteorology then and now*, 130pp.

Research Papers in Journals

Ben Yona, M., Rimmer, A., Shamir, E., and I. Litaor, 2020: “Hydrologic response in the karstic and basaltic hydro-geological units of Lake Kinneret Watershed,” *Journal of Hydrology*, 583,2020,124572, ISSN 0022-1694, <https://doi.org/10.1016/j.jhydrol.2020.124572>

Cheng, Z., and G. Constantinescu, 2020: “Near and Far Field Structure of Shallow Mixing Layers between Parallel Streams,” *Journal of Fluid Mechanics*, 904, A21, doi:10.1017/jfm.2020.638.

Cheng, Z., and G. Constantinescu, 2020: “Shallow mixing layers between non-parallel streams,” *Journal of Fluid Mechanics* (in review).

Ghimire, G.R., Jadidoleslam, N., Krajewski, W.F., and A.A. Tsonis, 2020: “Insights on Streamflow Predictability across Scales Using Horizontal Visibility Graph Based Networks,” *Frontiers in Water*, doi:10.3389/frwa.2020.00017.

Lepley, K., Touchan, R., Meko, D., Shamir, E., Campbell, R., and D. Falk. 2020: “A multi-century Sierra Nevada snowpack reconstruction modeled using upper-elevation coniferous tree rings (California, USA),” *The Holocene*, 30 (9) <https://doi.org/10.1177/0959683620919972>

Muste, M., Lee, K., Kim, D., Bacotiu, C., Oliveros, M.R., Cheng Z., and F. Quintero, 2020: “Revisiting Hysteresis of Flow Variables in Monitoring Unsteady Streamflows,” *Journal of Hydraulic Research*, 58:6, 867-887, doi:[10.1080/00221686.2020.1786742](https://doi.org/10.1080/00221686.2020.1786742).

Pan, X., Wang, G., Yang, P., Wang, J., and A.A. Tsonis, 2020: “On the interconnections among major climate modes and their common driving factors,” *Earth System Dynamics*, doi.org/10.5194/esd-11-525-2020.

Touchan, R., Black, B., Shamir, E., Hughes, M.K., and D.M. Meko, 2020: “A multimillennial snow water equivalent reconstruction from giant sequoia tree rings,” *Climate Dynamics*, doi.org/10.1007/s00382-020-05548-0.

Tapia-Villaseñor, M.E., Shamir, E., Megdal, S.B., and J.D. Petersen-Perlman, 2020: “Impacts of Variable Climate and Effluent Flows on the Transboundary Santa Cruz Aquifer,” *Journal of American Water Resources Association*, <https://doi.org/10.1111/1752-1688.12853>

Other Presentations

Cheng Z., and K.P. Georgakakos, 2019: “Urban Flash Flood Warning System (UFFWS),” Global FFGS System Workshop, Antalya, Turkey, 4-8 November 2019 (Invited Poster presentation).

Georgakakos, K.P., 2019: “Predicting Flash Floods,” National Technical University of Athens, Athens, Greece, 31 October 2019 (Invited Oral presentation).

Georgakakos, K.P., 2019: “Flash Flood Guidance System On-going Enhancements,” Global FFGS System Workshop, Antalya, Turkey, 4-8 November 2019 (Invited Oral presentation).

Georgakakos, K.P., and E. Shamir, 2020: “Urban Flash Flood Early Warning System,” San Diego County Flood Control District Advisory Commission, On-Line Meeting, 4 June 2020 (Invited Oral presentation).

Georgakakos, K.P., and C.R. Spencer, 2019: “Microwave-Adjusted Global Hydroestimator Precipitation Estimates,” Global FFGS System Workshop, Antalya, Turkey, 4-8 November 2019 (Invited Poster presentation).

Georgakakos, K.P., Banks, R., and J.A. Sperflage, 2020: “Flash Flood Guidance and Common Alerting Protocol (CAP),” 2020 CAP Implementation Workshop, Geneva, Switzerland (On Line Meeting), 29-30 September 2020 (Invited Oral presentation).

Georgakakos, K.P., Modrick Hansen, T.M., Shamir, E., Cheng, Z., Sperflage, J., Spencer, C., and R. Banks, 2020: “Data needs and realizable exchange strategies on global scales for high resolution operational land-surface forecasts,” WMO Data Conference (On Line Meeting), 18 November 2020, (Poster Presentation).

Shamir, E., 2020: “A Comparison of precipitation downscaling procedures to guide studies of climate change impacts on flooding and water resources,” Bureau of Reclamation’s Boulder Canyon Operations Office, Boulder City, Nevada, 23 June 2020.

Shamir, E., Modrick-Hansen, T.M., Cheng, Z., and K.P. Georgakakos, 2019: “Verification Guidelines for the Flash Flood Guidance System Products and Derivative Warnings,” Global FFGS System Workshop, Antalya, Turkey, 4-8 November 2019 (Invited Poster presentation).

HRC Technical Reports

Limited Distribution Reports

Spencer, C.R., Sperflage, J.A., Banks, R., and K.P. Georgakakos, 2020: South Asia Flash Flood Guidance (SAsiaFFG) System User's Guide. *HRC Limited Distribution Report No. 60*, Hydrologic Research Center, San Diego, CA, 122pp.

Banks, R., Sperflage, J.A., Spencer, C.R., and K.P. Georgakakos, 2020: Mapserver Supplement to FFGS User's Guide SAsiaFFGS. *HRC Limited Distribution Report No. 60S*, Hydrologic Research Center, San Diego, CA, 19pp.

Technical Report Series

Georgakakos, K.P., and R. Banks, 2020: "Geometry Analysis of Radar Volume-Scan Elements for CAPPI Precipitation Estimation and Implementation of Training Code," *HRC Technical Report Series No. 103*, Hydrologic Research Center, San Diego, CA, 30pp.

Technical Communications

Campbell, R., and C. Kattan, 2020: "Hydrometeorological Early Warning Systems in El Salvador, Case Study of Tropical Storms Amanda and Cristobal," *HRC Technical Communication WRN02_TC20200902*, Hydrologic Research Center, San Diego, CA, 21pp.

Cheng, Z., and K.P. Georgakakos, 2020: "Development of Probabilistic Simulations in HEC-RAS Flow and Sediment Transport – Progress Report," *HRC Technical Communication 20201020HECRAS*, Hydrologic Research Center, San Diego, CA, 43pp.

Cheng, Z., and K.P. Georgakakos, 2020: "Development Plan for the Monte-Carlo Simulation and Analysis (MCSA) Tool to Support the Development of Probabilistic Simulations in HEC-RAS Flow and Sediment Transport," *HRC Technical Communication MCSA20200115*, Hydrologic Research Center, San Diego, CA, 8pp.

Georgakakos, K.P., 2020: "Guidelines for the Exchange of Radar Data for Effective Ingest and Quality Control within the Operational FFGS," *HRC Technical Communication CA-20200402*, Hydrologic Research Center, San Diego, CA, 4pp.

Georgakakos, K.P., 2020: "Plan for Remotely Executed IT Training on System Administration for the Flash Flood Guidance System (FFGS)," *HRC Technical Communication HRC-20200422*, Hydrologic Research Center, San Diego, CA, 4pp.

Georgakakos, K.P., 2020: "Plan for Remotely-Executed Training on Radar Precipitation for the Flash Flood Guidance System (FFGS)," *HRC Technical Communication HRC-20200407*, Hydrologic Research Center, San Diego, CA, 4pp.

Georgakakos, K.P., 2020: "Sensitivity Analysis of Gridded Radar CAPPI Precipitation," *HRC Technical Communication 20200318*, Hydrologic Research Center, San Diego, CA, 6pp.

Georgakakos, K.P., 2020: “Summary of Proceedings of WAFFGS On-Line Meeting on Data Exchange,” *HRC Technical Communication 20200723*, Hydrologic Research Center, San Diego, CA, 6pp.

Georgakakos, K.P., Spencer, C., and R. Banks, 2020: “An Introduction to the La Plata Data Analysis and Quality Control System (DAQCS),” *HRC Technical Communication 20200908*, Hydrologic Research Center, San Diego, CA, 5pp.

Other Communications

Jubach, R, Pilon, P. and C. Barrett, 2020: “Sustainability Strategy for the Global Flash Flood Guidance System, Version 1.0,” prepared for the MoU Partners (WMO, USAID/BHA, NOAA/NWS and HRC) and for adoption by the WMO Congress, 89pp.

Educational, Science Cooperation, and Technology Transfer Activities

January

- R. Campbell traveled to Barbados for a workshop, January 18-25, 2020.
- K. Georgakakos traveled to Pretoria, South Africa for the Initial Radar Planning Meeting, January 19-25, 2020.

February

- E. Shamir traveled to Tucson, AZ to attend a NSF project meeting, February 5-7, 2020.
- Z. Cheng traveled to Jakarta, Indonesia for the Jakarta UFFWS Training Workshop, February 21-29, 2020.

March

- E. Shamir gave an on-line Weather Ready Nations Workshop (WRN) in Guatemala on March 3-5, 2020.
- R. Campbell traveled to Miami, FL and Washington, D.C. for SCM on March 2-6, 2020.

April

- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in El Salvador on April 17 and 22, 2020.
- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Guatemala on April 21, 2020
- R. Campbell was an invited speaker at the CREWS Caribbean global and regional meeting on April 23, 2020.
- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Indonesia on April 30, 2020.

May

- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in Indonesia on May 18 and 28, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in Guatemala on May 11, 13, and 28, 2020.

- R. Campbell was an invited speaker at the CREWS Caribbean Global and Regional Meeting on May 29, 2020.

June

- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Indonesia on June 15, 2020.
- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Fiji on June 24, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in El Salvador, Guatemala, and Costa Rica on June 26, 2020.

July

- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in Bahamas on July, 7, 9, and 15, 2020.
- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Guatemala on July 21, 2020.
- SAsiaFFGS Remotely-Executed IT Administration Training (On-Line), 8 July – 7 August, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in El Salvador on July 23 and 28, 2020.

August

- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Fiji on August 10, 2020.
- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Bahamas on August 18, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in El Salvador, Guatemala, and Costa Rica on August 27, 2020.

September

- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Guatemala on September 2, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in El Salvador and Indonesia on September 16, 2020.
- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Costa Rica on September 17, 2020.

October

- K. Georgakakos gave an invited speech at the on-line Inauguration of the South Asia Flash Flood Guidance System (SAsiaFFGS) organized by the Ministry of Earth Sciences of India, the Natural Disaster Management Agency of India, and the Central Water Commission of India, 22 October 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in Costa Rica on October 8, 12, 19, 22, and 27, 2020.
- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in El Salvador on October 26, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in Guatemala on October 2, 6, 9, 13, 21, 26, and 29, 2020.

November

- R. Campbell gave an on-line Weather Ready Nations Workshop (WRN) in Indonesia on November 2, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in Guatemala on November 3, 4, 6, 10, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in El Salvador on November 3 and 13, 2020.
- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in Costa Rica on November 6 and 13, 2020.

December

- R. Campbell gave on-line Weather Ready Nations Workshops (WRN) in Costa Rica, El Salvador, and Guatemala on December 18, 2020.

Community Outreach Activity

- R. Campbell mentored Jaqueline Rivera in El Salvador. The focus of the internship was to identify information needed to aid hydrometeorological forecasters and disaster managers in making decisions regarding warning and response to natural/meteorological hazards. The goal was to identify specific information (or parameters) and a framework for evaluating such information which is comprehensive yet flexible and scalable such that this could be adapted to different regions with varying but data-sparse environments. A key part of this evaluation was the incorporation of social and economic dimensions into the hazard risk assessment.
- R. Campbell worked remotely assisting in training communities in emergency response activities around Covid-19.
- Z. Cheng served as reviewer of *Journal of Hydrology*, *Journal of Hydraulic Research*, *Water Resources Research*, and *Journal of Hydraulic Engineering*.
- E. Shamir attended the City of San Diego TAC Meeting on 1/27/2020.
- E. Shamir served as an Associate Editor for the *Journal of Hydrology*, Elsevier.
- E. Shamir reviewed manuscripts for the following peer reviewed journals: *Science*, *BAMS*, *Environmental Research Letters*, *Journal of Hydrometeorology*, *Journal of Applied Meteorology and Climatology*, *Journal of Hydrology*, and *Water*.
- E. Shamir was a member of the County of San Diego Technical Peer Review Panel for the Updated Hydrology and Water Quality Guidelines.
- HRC's AGUTV Video shoot on October 29, 2020. HRC was selected by AGU to highlight the research-to-operational applications process the Center has been following for more than two decades. The video was produced and may be accessed through: <https://www.youtube.com/watch?v=x7prQnRFXCY>
- K. Georgakakos continue serving as the PhD thesis advisor for Ms. Erica De Biasio, a PhD candidate at Scripps Institution of Oceanography, UCSD. She and K. Georgakakos had regular weekly meetings. Ms. De Biasio studies are supported by HRC.

Visitors

There were no visitors due to the COVID-19 pandemic.