

## **ACTIVITIES REPORT: JANUARY 1 – DECEMBER 31, 2017**

### **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 and the National Oceanic and Atmospheric Administration 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 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	Department of Mathematical Sciences, University of Wisconsin – Milwaukee Retired

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

Ocean Wave Modeling and Prediction Systems

## **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 – started employment 2/16/17

Dr. Rochelle C. Graham, Meteorologist II

Ms. Barbara Hansen, Administrative Associate

Dr. Theresa Modrick Hansen, Hydrologic Engineer II

Dr. Eylon Shamir, Hydrologic Engineer III

Mr. Cristopher Spencer, Computer Programmer/Analyst II

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

Dr. Nicholas E. Graham, Visiting Scientist

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

## **HRC Office Space**

On November 1, 2016, HRC moved its offices from 12555 High Bluff Drive to 11440 West Bernardo Court, Suite 375, San Diego, CA. The move was to take advantage of lower rent, private offices for staff and one for guests, a larger conference room for training, and a reception/library area.

## **Projects Funded or Ongoing**

ACP, Autoridad del Canal de Panama: *Regular Maintenance 2016.*

ACP, Autoridad del Canal de Panama: *Regular Maintenance 2017.*

California Department of Water Resources (DWR): *Implementation of Stand-Alone INFORM System for DWR, 1/1/16 – 6/29/18 (with Georgia Tech as a subcontractor).*

Goal Honduras: *Operationalizing a Neighborhood Approach to Reduce Urban Disaster Risk in Three High Risk Neighborhoods in Tegucigalpa, 4/18/17 – 3/15/18.*

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, 5/1/15 – 4/30/19.*

Sultanate of Oman: *Implementation of a Flash Flood Guidance System for the Sultanate of Oman, 5/19/15 – 5/31/17.*

UCAR: *Advancing Impact-based Forecasting and Warning Services in El Salvador and Costa Rica, 4/1/17 – 12/31/18.*

UCAR: *Advancing Impact-based Forecasting and Warning Services in the Republic of South Africa, 3/9/17 – 12/31/18.*

UCAR: *Enhanced Flash Flood Guidance System Capability to Ingest and Display Multiple Mesoscale Model Precipitation Forecasts, Black Sea Middle East Flash Flood Guidance System, 11/12/15 – 3/31/17.*

UCAR: *Impact-based Forecasting and Warning Services: Barbados, 2/2/17 – 12/31/18.*

UCAR: *Landslide Hazard Forecast Upgrade for Flash Flood Guidance Systems, Central America Flash Flood Guidance System, 3/26/15 – 3/31/17.*

UCAR: *Advancing Impact-based Forecasting and Warning Services in Guatemala, 12/4/17 – 12/4/19.*

UCAR: *Support for the Burma Department of Meteorology and Hydrology, 2/22/17 – 9/30/18.*

U.S. Bureau of Reclamation, Lower Colorado Region (cooperative agreement) (6/30/15): *A comparison of precipitation downscaling procedures to guide studies of climate change impacts on flooding and water resources, 3/23/16 – 5/31/18.*

Universiteit Gent, Belgian Federal Scientific Policy Office (Belspo): *Patterns and Mechanisms of Climate Extremes in East Africa, 1/10/13 - 12/31/17.*

Vietnam Institute of Meteorology, Hydrology and Climate Change (IMHEN): *Development of Flash Flood Guidance Systems to Support Flash Flood Warning in Vietnam, 10/9/15 – 4/15/16.*

World Bank: *To Perform a Forward-Looking Snowmelt and Flood Hazard Assessment for Tajikistan for the 2017 High Risk Season*, 3/9/17 – 8/30/17.

WMO: *Development and Implementation of a Flash Flood Early Warning System for the State of Chiapas, Mexico*, 10/22/10 – 12/31/16.

WMO: *Development and Implementation of International Regional Flash Flood Guidance and Early Warning Systems*, Phase II, HRC Work Plans I – VII, 7/24/12 – 9/30/18.

## **Publications**

### *Contributions to Books and Special Issues*

Jubach, R., and A.S. Tokar, 2017: “International Severe Weather and Flash Flood Hazard Early Warning Systems—Leveraging Coordination, Cooperation, and Partnerships through a Hydrometeorological Project in Southern Africa,” Water Governance, Stakeholder Engagement, and Sustainable Water Resources Management, Megdal, S.B., Eden, S. and E. Shamir (Eds.) ISBN 978-3-03842-447-5 (PDF) ISBN 978-3-03842-446-8 (Pbk) 2017 CC BY-NC-ND.

### *Research Papers in Journals*

Cheng, Z., and G. Constantinescu, 2017: “Stratification Effects on Flow Hydrodynamics and Mixing at a Confluence with a Highly Discordant Bed and Relatively Low Velocity Ratio,” *Water Resources Research*, 46pp. (Under review)

Cheng, Z., Koken, M. and G. Constantinescu, 2017: “Approximate methodology to account for effects of coherent structures on sediment entrainment in RANS simulations with a movable bed and applications to pier scour,” *Advances in Water Resources*, DOI:10.1016/j.advwatres.2017.05.019.

Georgakakos, K.P., 2018: “The status and outlook for the Global Flash Flood Guidance System with regional application,” *WMO Bulletin – Special Edition on Water* (invited paper, accepted for publication).

Megdal, S.B., Eden, S., and E. Shamir, 2017: “Water Governance, Stakeholder engagement, and sustainable water resources management, (Editorial),” *Water*, 9(3), 190; DOI:10.3390/w9030190.

Posner, A.J., and K.P. Georgakakos, 2016: “An early warning system for landslide danger,” *EOS*, 97, DOI:10.1029/2016EO062323.

Posner, A.J., and K.P. Georgakakos, 2017: “Quantifying the impact of community-scale flood mitigation,” *International Journal of Disaster Risk Reduction*, 24, 189-208.

Shamir, E., 2017: “The value and skill of seasonal forecasts for water resources management in the Upper Santa Cruz River basin, southern Arizona,” *Journal of Arid Environments*, 137: 35-45.

Sukhodolov, A.N., Krick, J., Sukhodolova, T.A., Cheng, Z., Rhoads, B.L., and G.S. Constantinescu, 2017: "Turbulent flow structure at a discordant river confluence: Asymmetric jet dynamics with implications for channel morphology," *J. of Geophysical Research: Earth Surface*, 122, DOI:10.1002/2016JF004126.

### *Articles in Popular Science Journals*

HRC work on landslide assessment was referenced in a *Scientific American* article under Advances/Earth Sciences by Lucas Larsen, with the title: Soil in the Forecast, New landslide-prediction models could enable lifesaving and trustworthy alerts, page 18, May 2017.

### **Other Presentations**

Georgakakos, K.P., 2017: "The Challenge of Flash Flood Warning with Global Coverage," Iowa Informatics Initiative Symposium, University of Iowa, Iowa City, IA, 2/17/17.

Georgakakos, K.P., 2017: "2017 Runoff in Tajikistan," World Bank, Dushanbe, Tajikistan, 11 April 17. (Translated into Russian as well.)

Georgakakos, K.P., 2017: "Global Flash Flood Guidance Systems, Status and Outlook." Initial Planning Meeting on the WMO Global Hydrological Status and Outlook System (HydroSOS), Entebbe, Uganda, 9/26-28/17.

Georgakakos, K.P., 2017: "Global Flash Flood Guidance System and Applications." Intergovernmental Meeting, Colombo, Sri Lanka, 17 October 2017.

Georgakakos, K.P., 2017: "Landslide Assessment with FFGS." Presentation at the National Building Research Organization, Ministry of Disaster Management, Colombo, Sri Lanka, 20 October 2017.

Shamir E., 2017: "Impact assessment of projected future climate on Alamo Lake and Bill Williams River Watershed," Boulder Canyon Operations Office, Bureau of Reclamation, Boulder City, NV, 10/19/17. Presentation was co-authored with E. Halper, BOR, Phoenix Office Area.

Shamir E., 2017: "Impact Assessment of projected climatic change on water resources in arid environment," Water Resources Planning and Operations Support Group, Bureau of Reclamation, Denver, CO, 10/20/17. Presentation was co-authored with E. Halper, BOR, Phoenix Office Area.

Shamir E., 2017: "The applications of radars in regional flash flood guidance systems," International Workshop on Weather Forecast and Hydrological Application organized by Han River Flood Control Office and Korea Meteorological Administration in Yeosu, Korea, 11/8-10/17.

Shamir E., 2017: “Response of Tree Rings Growth to Various Climatological Indices in the Sierra Nevada Mountains,” American Geophysical Association (AGU) conference, New Orleans, LA, 12/14/17.

## **HRC Technical Reports**

### *Limited Distribution Reports*

Spencer, C.R., Sperflage, J.A., and K.P. Georgakakos, sponsored by the NOAA/NWS Office of International Affairs through a subaward with UCAR, 2017: “Central America Flash Flood Guidance System (CAFFG) User’s Guide,” *HRC Limited Distribution Report No. 45*, Hydrologic Research Center, San Diego, CA, 152pp.

### *Technical Notes*

Shamir, E., Modrick, T.M., and K.P. Georgakakos, 2017: “Development of Hydrologic Modeling Framework for the Bill Williams River Watershed and Alamo Lake,” *HRC Technical Note No. 97*, Hydrologic Research Center, San Diego, CA, 52pp.

Georgakakos, K.P., Modrick, T.M., Shamir, E., Banks, R., Spencer, C.R. and J.A. Sperflage, 2017: “Completion Report: Tajikistan Snowmelt Runoff and Potential Flood Occurrence throughout the 2017 High Risk Period,” *HRC Technical Note No. 95*, Hydrologic Research Center, San Diego, CA, 28pp.

Shamir, Eylon, 2017: “Modifications and Calibration of the Rainfall Weather Generator for the Upper Santa-Cruz River Basin, Arizona”, *HRC Technical Note No. 94*, Hydrologic Research Center, San Diego, CA, 28pp.

Cheng, Z. and K.P. Georgakakos, 2017: “Trip Report for HRC Travel to Tegucigalpa with a List of Pending Date (3-7 July 2017),” *HRC Technical Note No. 93*, Hydrologic Research Center, San Diego, CA, 33pp.

Cheng, Z. and K.P. Georgakakos, 2017: “Trip Report for HRC Travel to Tegucigalpa with a List of Pending Date (23-26 May 2017),” *HRC Technical Note No. 92A*, Hydrologic Research Center, San Diego, CA, 55pp.

Georgakakos, K.P., Modrick, T.M., Shamir, E., Banks, R. and C.R. Spencer, 2017: “Fourth Assessment of Tajikistan Snowmelt Runoff and Potential Flood Occurrence throughout the 2017 High Risk Period,” *HRC Technical Note No. 92*, Hydrologic Research Center, San Diego, CA, 16pp.

Georgakakos, K.P., Modrick, T.M., Shamir, E., Banks, R. and C.R. Spencer, 2017: “Third Assessment of Tajikistan Snowmelt Runoff and Potential Flood Occurrence throughout the 2017 High Risk Period,” *HRC Technical Note No. 91*, Hydrologic Research Center, San Diego, CA, 18pp.

Georgakakos, K.P., Modrick, T.M., Shamir, E., Banks, R. and J.A. Sperflage, 2017: “Second Assessment of Tajikistan Snowmelt Runoff and Potential Flood Occurrence throughout the 2017

High Risk Period,” *HRC Technical Note No. 90*, Hydrologic Research Center, San Diego, CA, 24pp.

Georgakakos, K.P., Modrick, T.M., Shamir, E., Banks, R. and J.A. Sperflage, 2017: “Initial Assessment of Tajikistan Snowmelt Runoff and Potential Flood Occurrence throughout the 2017 High Risk Period,” *HRC Technical Note No. 89*, Hydrologic Research Center, San Diego, CA, 23pp.

### *Technical Communications*

Georgakakos, K.P. and T.M. Modrick, 2017: “Sample Results of a Stand-alone Version of Flow Routing for a Tributary of Panj River in southern Tajikistan,” *HRC Technical Communication 20170712*, Hydrologic Research Center, San Diego, CA, 6pp.

### *HRC Summary Report*

Georgakakos, K.P., 2017: “Visit to Sri Lanka in conjunction with the implementation of the SAsiaFFG system,” *HRC Summary Report 17-20 October 2017*, Hydrologic Research Center, San Diego, CA, 6pp. and 1 Appendix.

## **Educational, Science Cooperation, and Technology Transfer Activities**

### January

- R. Graham traveled to Pretoria, South Africa for the SEFDP/SARFFG workshop and meetings, 1/13-23/17.
- R. Graham conducted tree ring analysis in lab at the University of Arizona at Tucson, 1/29 - 2/3/17.

### February

- D. Beardsley visited HRC for planning of South Africa, Barbados, and Central America IDSS programs, 2/14-15/17.
- K. Georgakakos was recognized as an AAAS Fellow for “*seminal contributions to the development of hydrometeorological models and flood forecasting systems and their application for the benefit of society*” during the American Association for the Advancement of Science (AAAS) Annual Meeting in Boston, MA, 2-18-2017.
- R. Graham attended the kick-off meeting of the Barbados Weather Ready Nations Project, Bridgetown, Barbados, 2/20-25/17.

### March

- R. Graham attended preliminary meetings for future El Salvador IDSS project, 3/27-31/17.

### April

- Six forecasters and hydrologist from Haiti and the Dominican Republic came to HRC for advanced operations training on the Haiti Dominican Republic (HDRFFG) system, 4/3-28/17.



- E. Shamir represented HRC in the Flash Flood Guidance Training for the Jordan Meteorological Department and Second Steering Committee Meeting of the Black Sea and Middle East Flash Flood Guidance (BSMEFFG) System in Amman, Jordan, 4/11-13/17.
- R. Graham gave a Weather Ready Nations Workshop in Cape Town, South Africa, 4/30 - 5/13/17.

#### May

- K. Georgakakos attended meetings with WMO and CAFFG countries in San Jose, Costa Rica, 5/2-6/17.
- N. Graham traveled to Zaragoza, Spain regarding the Universiteit Gent project, 5/4-24/17.
- R. Graham gave a Weather Ready Nations Workshop in Barbados, 5/15-19/17.
- R. Graham and J. Sperflage traveled to Oman for installation and final training on the FFG system, 5/16-25/17.
- Z. Cheng and K. Georgakakos traveled to Tegucigalpa, Honduras for a project meeting and site visit, 5/23-27/17.

#### June

- R. Graham gave a Weather Ready Nations Workshop in El Salvador and Belize, 6/10-16/17.
- E. Shamir attended a meeting with NSF collaborators from the Tree Ring Lab at the University of Arizona in Tucson, 6/28-30/17.

#### July

- Z. Cheng attended project meetings in Tegucigalpa, Honduras, 7/3-7/17.
- T. Modrick Hansen traveled to Jakarta, Indonesia for the WMO FFG Phase II.4A SAOFFG steering committee meeting, 7/10-12/17.
- K. Georgakakos and R. Jubach attended the FFGS Programme Management Meeting in Geneva, Switzerland, 7/17-20/17.

#### August

- R. Graham traveled to Costa Rica, El Salvador, and Guatemala to give IDSS Central America workshops, 8/7-12/17.
- C. Spencer and J. Sperflage attended a DWR INFORM Demonstration Workshop and Coordination Meeting with the Weather Service in Sacramento, CA, 8/25/17.

#### September

- J. Sperflage traveled to Sacramento to attend a DWR INFORM coordination meeting, 9/25/17.

#### October

- Four engineers from the Municipality of the Central District of Honduras visited HRC to participate in hands-on training for flood prevention, 10/8-22/17.
- R. Graham and R. Jubach attended an Implementers and Advisory Board Meeting regarding the UCAR Central America IDSS project in Washington, D.C., 10/16-20/17.
- E. Shamir attended the Operational Workshop of the Central Asia Region Flash Flood Guidance (CARFFG) System (Step 4 Training) in Astana, Kazakhstan, 10/31 - 11/2/17.

- K. Georgakakos visited Sri Lanka upon the invitation of the US Agency for International Development, Office of Foreign Disaster Assistance, and participated in meetings with the Ministry of Disaster Management Organizational Units (including the Department of Meteorology, Disaster Management Centre, National Building Research Organization, and National Disaster Relief Services). The focus was the South Asia Flash Flood Guidance system implementation and enhancements to include landslide prediction. The report is available from HRC.

#### November

- Ten people from Cambodia, Laos PDR, Thailand, and Vietnam came to HRC for flash flood training on the MRCFFG system, 11/5 - 12/2/17.
- T. Modrick Hansen traveled to San Salvador, El Salvador to attend a WMO FFG CAFFG Workshop and meeting, 11/14-16/17.
- R. Graham and R. Jubach attended the MRC FFG SCM2/SEAFFG Planning Meeting in Hanoi, Vietnam, 11/19-24/17.
- R. Graham traveled to Costa Rica to attend UCAR Central America IDSS project meetings, 11/28 - 12/5/17.

#### December

- R. Graham attended UCAR Central America IDSS project meetings in El Salvador, 12/6-9/17.
- R. Graham attended UCAR Central America IDSS project meetings in Guatemala, 12/10-14/17.

## **Community Outreach Activity**

#### January

- R. Graham attended a meeting for interns at California State University, San Marcos, 1/27/17.

#### March

- R. Graham and E. Shamir mentored three student interns through NSF REU funded tree-ring project. Farah Beattie, Alyssa Martinez, and Nicholas Cypher were from California State University, San Marcos. They worked to develop and test a new methodology for measuring climatic variable using infrared spectrometry.

#### May

- E. Shamir attended a Workshop here in San Diego called Workshop on Improving Long-Range Weather Forecasts and Sub-Seasonal to Seasonal Precipitation Forecasting. The workshop was organized by the Western States Water Council and California Department of Water Resources, 5/17-19/17.

#### June

- R. Graham and E. Shamir mentored student intern Rebecca Kaliff from U.C. Berkeley. She worked on the hydrological development of snow variables and their relationship with tree-ring variables.

- E. Shamir attended a meeting of the San Diego Integrated Regional Water Management at the San Diego County Water Authority, 6/7/17.

#### July

- R. Graham provided technical assistance to the San Diego River Conservancy through evaluation of proposals (e.g. site visits and review of scientific justification for restoration and conservation of the San Diego River).
- E. Shamir served as an Associate Editor for the Journal of Hydrology.
- K.P. Georgakakos served as the Chief Editor for the Journal of Hydrology (Technical area: Surface Hydrology and Hydrometeorology; Impact factor 2015 – 3.04)

#### August

- Two presentations were given related to HRC's NSF tree-ring project. The first presentation was by Farrah Beattie an undergraduate student from California State University, San Marcos. Farrah presented research she led with Nick Cypher and Alyssa Martinez at Dr. Gerardo Dominguez's lab on exploring infrared signal in tree rings early and late wood. The second presentation was by our summer intern Rebecca Kaliff from UC Berkeley. She presented her research on the response of tree rings in the Sierra Nevada to various climatological indices, 8/2/17.
- R. Graham, T. Modrick Hansen, and R. Jubach mentored intern Sean Watson. The focus of his internship was to identify information needed to aid hydro-meteorological forecasters and disaster managers in making decisions regarding warning and response to natural/meteorological hazards.

#### September

- E. Shamir served on the Advisory Committee of the 2017 American Water Resources association/Tel Aviv University International Conference on Cutting-Edge Solutions to Wicked Water Problems, Tel Aviv, Israel, 9/10-11/17.
- R. Graham traveled to Jakarta, Indonesia to attend WRN Indonesia meetings, 9/15-22/17.
- A. Shamir, a high school intern, gave a talk on the work she completed this past summer. Her work pertained to the study of the water management of the Folsom Lake Reservoir in California under climatic variability and change, 9/21/17.
- E. Shamir reviewed 6 journal manuscripts for Journal of Hydrology, JAWRA, Water, Remote Sensing, and Atmosphere.
- E. Shamir reviewed a proposal for the NSF-Hydrology.

#### October

- K. Georgakakos attended meetings on SASIAFFG and landslides in Colombo, Sri Lanka, 10/14-21/17.

#### November

- HRC hosted a presentation by a local elementary school team that participated in the 2017 First Lego League Tourney on rain water harvesting technology, 11/2/2017.

## Visitors

### January

- Zhengyang Cheng

### February

- Board Members: Raymond Ban, Robert Hartman, Richard Kennedy, Anastasios Tsonis
- Dan Beardsley, National Weather Service
- Farrah Beattie, California State University, San Marcos
- Alyssa Martinez, California State University, San Marcos
- Nicholas Cypher, California State University, San Marcos
- Jim Purpura, Consultant
- Brandt Maxwell, National Weather Service

### March

- Rebecca Kaliff, UC Berkeley

### April

- Israel Acosta, INDRHI, Dominican Republic
- Wagner Lorenzo, ONAMET, Dominican Republic
- Wagenr Rivera, ONAMET, Dominican Republic
- Marie Carmelle Valcourt Chery, Agriculture Ministry/National Water, Haiti
- Nichole Francois, National Meteorological Center, Haiti
- Wilner Polydor, OFNAC, Haiti

### July

- Sean Watson

### September

- Ariella Shamir

### October

- Roberto Elias Granados Chahin, Municipality of the Central District, Honduras
- Carlos Fernando Diaz Flores, Standing Committee on Contingencies, Honduras
- Gustavo Selim Simon Hasbun, Municipality of the Central District, Honduras
- Luis Andres Villafranca, Municipality of the Central District, Honduras
- Eugene Poolman and Elizabeth Webster, South Africa

### November

- First Lego League Tourney Team of Elementary School students
- Akhom Thamalangsy, Department of Meteorology and Hydrology, Lao PDR

- Viphanou Phethany, Department of Meteorology and Hydrology, Lao PDR
- Phongphorn Panatchagorn, Meteorological Dev. Bureau, Hydromet Division, Thailand
- Supapap Patsinghasanee, Department of Water Resources, Thailand
- Anh Quoc Nguyen, Mekong River Commission, Cambodia
- Sothy Hun, Ministry of Water Resources and Meteorology, Cambodia
- Tong Seng, Ministry of Water Resources and Meteorology, Cambodia
- Lim Sopheap, Mekong River Commission, Cambodia
- Manh Linh Nguyen, National Center for Hydro-Meteorological Forecasting, Vietnam
- Mai Tuyet Tran, National Center for Hydro-Meteorological Forecasting, Vietnam

#### December

- 26 people from the China State Flood Control and Drought Relief Headquarters