

## **Sabbatical Report**

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**Fall 2007 - Spring 2008**

The following is a report of efforts undertaken during the 2007-2008 academic year. During this time, I spent 4 months at Columbia University's International Research Institute for Climate and Society, and 5 months at the U.S. Army Corps' Hydrologic Engineering Center.

### **International Research Institute (IRI) for Climate and Society, Columbia University, Palisades, NY (August 21 – December 20, 2007)**

At IRI, I collaborated on several projects involving climate variability/change risk assessment and water resources decision support systems, including the following: (1) Hydrologic forecasting for New York City water supply reservoirs in the Upper Delaware River basin; (2) Hydrologic forecasting in the Comoe River Basin in Burkina Faso, West Africa; (3) Water supply forecasting for the City of Manila, Philippines; and (4) Preliminary investigation of hydroclimatic predictability in the Great Lakes Basin. I read numerous papers on seasonal climate forecasting and became familiar with on-line data and software tools available for developing statistical forecast models. I also became familiar with general circulation model (GCM) downscaling methods.

In addition to collaborative research, I helped to develop materials for a training course on climate risk management for the water resources sector, sponsored by the World Bank Institute. Some of these materials will be used in CE5666 Water Resources Planning and Management.

During this time I completed drafts or revisions of the following publications:

- Fry, L., D.W. Watkins, Jr., and J.R. Mihelcic. "Water and Non-Water-Related Challenges of Achieving Global Sanitation Coverage," *Environmental Science and Technology*, 42(12): 4298-4304, 2008.
- Cowden, J.R., D.W. Watkins Jr., J.R. Mihelcic. "Stochastic Rainfall Modeling in West Africa: Parsimonious Approaches for Domestic Rainwater Harvesting Assessment," *Journal of Hydrology*, 361: 78-95, 2008.
- Watkins, D.W. Jr. "Watersheds: Hydrology and Drainage," Chapter 10 in *Field Guide in Environmental Engineering for Development Workers: Water, Sanitation, Indoor Air*, eds. J.R. Mihelcic, E.A. Myre, L.M. Fry, B.D. Barkdoll, American Society of Civil Engineers Press, Reston, VA, in press, 2009.
- Etkin, D., P. Kirshen, D. Watkins, A. Diallo, G. Hoogenboom, M. Roncoli, J. Sanfo, M. Sanon, L. Somé, J. Zoungrana. "Stochastic linear programming for

improved reservoir operations for multiple objectives in Burkina Faso, West Africa.” World Environmental and Water Resources Congress, ASCE, Honolulu, Hawaii, May 12-16, 2008.

- Watkins, D.W., and V.W. Griffis. “Conditioning Ensemble Streamflow Prediction Forecasts Using Climate Signals in the Midwestern U.S.,” World Environmental and Water Resources Congress, ASCE, Honolulu, Hawaii, May 12-16, 2008.
- Watkins, D.W., and W. Wei. “The Value of Seasonal Climate Forecasts and Why Water Managers Don’t Use Them,” World Environmental and Water Resources Congress, ASCE, Honolulu, Hawaii, May 12-16, 2008.

Two proposed activities at IRI did not come to fruition. First, development of a climate prediction database for various regions in the developing world was not feasible in the time available, as seasonal climate forecasting can not be “automated” to the extent I thought possible. Second, a study of rainwater harvesting in the Millennium Villages did not occur because the potential collaborator left Columbia University.

### **Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, CA (January 7 – June 20, 2008)**

My main task at HEC was to review existing Corps software (HEC-FDA) and policies on flood damage assessment, and provide recommendations for the next generation of procedures and software tools. The final product was a 40-page report, presented at an agency-wide meeting in Vicksburg, MS, in June 2008. A draft of the following paper was also completed:

- Pingel, N., and D. Watkins, “Multiple Source Expected Annual Flood Damage Computations,” *J. Water Resources Planning & Mgmt.*, in press, 2009.

This study of flood damage assessment procedures proved more time-consuming than expected, and so other proposed activities were abbreviated. I did review a new version HEC’s Prescriptive Reservoir Model (HEC-PRM), documented bugs and provided advice for further development. Using a similar modeling approach, I began development of a conceptual optimization model as part of the IJC Upper Great Lakes Regulation Study. (Work on the IJC study continues through 2009.) A final proposed activity—developing hydrologic modeling procedures for ungaged basins—was not accomplished. However, a Ph.D. student advisee at Michigan Tech (Lauren Fry) is continuing work on this topic.

During my time at HEC, I also reviewed training course materials and software (in addition to HEC-FDA and HEC-PRM) for possible use in CE3620 Water Resources Engineering; and I compiled journal papers and case studies for development of a new course, CE4640 Stormwater Management and Low Impact Development, first offered in Spring 2009.

## Other Effort

Throughout this period I continued to be involved with research, proposal writing, and student advising at Michigan Tech.

The following research proposals were submitted as PI or co-PI:

- Optimization Models for Shared Vision Planning in the IJC Upper Great Lakes Regulation Study , U.S. Army Corps of Engineers (PI).
- Developing Global Engineers Through Technological Innovation for Public Health Improvements in Tanzania, NSF (co-PI).
- Characterizing Human Health and Ecosystem Impacts of Increasing Sediment and Pollutant Transport in Great Lakes Watersheds Induced by Climate Change, EPA (PI).

The following meetings and conferences were attended:

- ASCE Environmental and Water Resources Institute Council Weekend, Los Angeles, Feb. 22-23, 2008.
- WATERS Network Community Workshop, National Science Foundation, Arlington, VA, March 24-25, 2008.
- Engineers Without Borders-USA International Conference, Seattle, WA, March 28-30, 2008.
- ASCE World Environmental and Water Resources Congress, Honolulu, HI, May 12-16, 2008.
- Traveled to Panama to visit four active Peace Corps volunteers in our Peace Corps Master's International program, April 12-19, 2008.

During this time I continued to serve as graduate advisor or co-advisor for four Ph.D. students and two M.S. students, and I served on three M.S. graduate defense committees.

Finally, I continued the following professional service activities:

- ASCE/EWRI Environmental & Water Resources Systems Committee – Vice Chair; Chair, Systems Education Task Committee to develop case studies in environmental and water resources systems; and Chair, ad hoc committee to establish Quentin Martin Award for best paper in the *J. Water Resour. Plng. & Mgmt.*
- ASCE/EWRI Operations Management Committee – Past Chair; Member of sub-committee to plan the 8<sup>th</sup> Operations Management Workshop (2009/2010)
- Associate Editor, ASCE *Journal of Water Resources Planning and Management*