This past summer, floodwaters flowed through Iowa City for 32 days. This meant that the Iowa River was still running strong on June 29 and 30, when National Science Foundation (NSF) Director Arden Bement Jr. made an unusual visit to the University of Iowa (UI). Responding to an invitation from CGRER members Larry Weber and Witold Krajewski, Bement toured flooded areas in Cedar Rapids, Iowa City, and the UI, and attended a half-day flood meeting where he listened to presentations from UI faculty and administration, including many CGRER members: half of those present at this invited symposium were thus classified.

At this meeting, Bement suggested that researchers apply for grants within NSF’s SGER (“Small Grants for Exploratory Research”) program, which funds small-scale, exploratory, high-risk research, such as the rapid collection of ephemeral data associated with catastrophic events. Thus, just two weeks after peak flood flows ran through the UI campus, researchers were addressing the flood’s destruction in the manner that they knew best: by planning research studies to learn more about such events, in hopes of better understanding and reshaping future similarities. Within a month, over a dozen research proposals had been submitted to the SGER program. By late summer, eight SGER proposals had been awarded to CGRER members (see page 5). The projects ranged from studies of flood flows, their sediments, and their nutrient contaminants, to examinations of flood impact on the education of young children.

The SGER grants were not the only expression of this flood focus. Even before Bement’s

(continued next page)
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Bill Eichinger, and colleagues are currently completing a NASA grant to validate remotely-sensed observations of soil moisture. (Floods depend, in part, on the land's ability to absorb precipitation, which in turn relates to soil moisture). Rhawn Dennison and his students are looking south and using stalagmites to investigate Holocene variability of the Australian monsoon, discerning trends that are tied to flooding and water resources on that continent. And Jeff Dorale, using stalagmites to trace flood events of past millennia with high resolution, has constructed a continuous 8000-year record of Midwestern Holocene flooding. In California, Konstantine Georgakakos has been developing and deploying flash flood forecasting systems in many parts of the world. Greg Carmichael, through the UNEP project Atmospheric Brown Clouds, is studying the impact of black carbon and other aerosols on the Asian climate, including the timing and intensity of the monsoons and the rates of glacial melting and their implications for flooding. Other flood-related research has been described in earlier CGRER newsletters.

CGRER researchers have thus been moving toward a more sophisticated understanding and measurement of water's flow (and flood flows) over and through the earth's surface. But is it enough simply to understand these processes? History begs a negative answer: In 1993, extensive floods along the Iowa River brought a harsh warning of nature's destructive power to all who witnessed them. Yet a mere 15 years later, the 2008 floods appeared with greater strength, bowed unmoderated over larger areas, and found more, not fewer, floodplain structures to destroy. With today's magnification of nature's expression, one might question the benefits of science. What is the use of greater knowledge about extreme weather events if researchers, the public, and policy makers do not work together to feed information about environmental issues into policy and land-use decisions?

To encourage that end, CGRER members are moving forward on their second area of expertise: propelling scientific knowledge forward into educational offerings. This summer's floods are feeding into several UI courses. Paul Greenough has organized a new disaster-response course in which students will review how disaster-affected communities and their governments have responded to a variety of past environmental catastrophes. Craig Just is incorporating content into existing coursework on how floods in developing countries create suffering and death, and is requiring students to serve local flood-impacted areas as a service-learning course requirement. Keri Hornbuckle is incorporating a number of flood-related lectures into the
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UI’s Civil and Environmental Engineering professor George Malanson and Larry Weber will both be presenting guest lectures in Jim Throgmorton’s new UI course, Learning from the Flood.

During reaching university walls, Gene Takle has been presenting multiple talks on extreme weather events, including extreme rainfall, and their relationship to climate change.

Bill Gutowski, participating in an Ames-based “Science Café” on this summer’s floods, an open discussion sponsored by Sigma XI that focused on communicating science to the public, where he spoke on “Future Extreme Rainfall in Iowa.”

Peter Thorne, taking part in “Future Extreme Rainfall in Iowa.” And Peter Thorne, with his expertise in respiratory hazards, plunged into flood outreach and education, speaking with the media about mold hazards, monitoring, and mitigation, and personal protection in flooded buildings, and filming a video on these subjects that has been aired on public television.

Jerry Schnoor, participating in “Climate Change and Extreme Weather: The Iowa Example.” He spoke with the media about flood outreach and education, and flood resistance resulting from the changes in Iowa’s land use, the Coralville Reservoir, and climate change; to the floods’ multiple effects on people, farmlands, and nature; to an exploration of potential responses to these extreme weather events. The intent is to publish the book rapidly enough to educate the lay public, even as it helps to shape policy and responses to the flooding. The book is being co-sponsored by CGRER and IU’s Civil and Environmental Engineering, edited by Connie Mutel, and published in 2009 by the University of Iowa Press.

All of these research and educational efforts are moving forward in good form. But still one wonders where they are taking us. What more must we – and all those who understand Earth’s ongoing changes – do to address accelerating extreme weather degradation? A recent major report concluded that one of the clearest trends in recent US climate is the 50% increase in rainfall events exceeding four inches in the upper Midwest, with most coming in the winter season. Thus this summer’s floods not only prove that our perception of “the impossible” can happen. These floods could be demonstrating an even harsher future: more floods, perhaps stronger than this year’s, will come. Accelerating rates of change may drive us into an era of flood with severe intensifications – even as the funding necessary for research and healing our planet is increasingly allocated to clean-up efforts.

How should academia respond to this challenge? Can we, personally and academically, favor returning to business as usual when the “usual climate” is becoming a moving target? Is it conscionable to redirect our academic activities to research and teaching focused on extraordinary events – even as they increasingly batter our lands and lives? Are the 2008 floods challenging us to reach beyond our academic comfort zone, into using our expertise in ways especially different in form and substance? And if so, what expressions will be most effective? What can we do to move our society toward solid science-based policy and economic solutions to environmental problems, irrespective of their political and economic implications? The floods of 2008 brought scientists and policy-makers closer together, introducing each to the other’s visions. But how will this introduction play out? What will this crisis keep us engaged long enough to push environmental necessarily economic, administrative, and lifestyle shifts into reality?

We have a long ways to go. The resulting frustration was expressed by Jerry Schnoor in an editorial, “Lessons from the flood” that he wrote for the journal Environmental Science & Technology (August 1, 2008, page 5379), which he edited. After discussing our need to eliminate construction on floodplains, understand hydrological fluctuations, proceed beyond our trust in levees, and celebrate the strengths of human community when tackling unexpected floods, he wrote the following about our blindness to the insidious role of climate change in worsening extreme weather events:

“What many Katrina victims will say with certainty that the floods of 2008 were caused by climate change; there have been larger floods in the past, and there will be larger ones in the future. But to ignore the substantial evidence that our massive disruption of global biogeochemical cycles on earth could amplify climatic extremes, and to not at least take action to prevent such an outcome, is reckless and irresponsible. Denial still runs rampant through the U.S., like a flood on the Iowa River.”

Flood photos: Tom Jorgensen and Tim Schoon University Relations.

References


Zeolites are alumino-silicates with very large surface areas, and with pores of molecular dimensions, that are already widely used in catalysis and in water softeners. This research project involves very small zeolites – nanocrystalline zeolites with crystal sizes less than 100 nm in diameter. These tiny particles remain porous, but have larger surface areas and decreased diffusion path lengths relative to microcrystalline zeolites. As such, they can be tailored to environmental applications, such as adsorption of air or water pollutants. The study will use DFT (Density Functional Theory) calculations to model surface properties of functionalized nanocrystalline zeolites, so that their properties can be optimized for these environmental applications.

Climate Change Impacts on Cold Season Hydrologic Processes and Spring Soil Moisture Recharge in the Upper Midwest. PI: Kristie J. Franz (ISU, Geological and Atmospheric Sciences). $27,073.

This grant will initiate studies of past and projected changes in the Midwest’s cold-season climate: its snow cover, snow melt rates, and frozen ground traits. These traits are crucial to understanding spring soil-moisture recharge, spring flooding, and water availability to summer crops; yet Midwestern cold-season climate has not been previously studied in much depth. Weather records for the past 50 years will be used to assess and model historic weather, streamflow, and soil moisture trends for six Minnesota and Iowa watersheds; hydrological models will then be used to estimate expected climate-change-related alterations of 2041-2070 cold-season hydrologic processes. Such numerical models are vital for assessing the impact of a changing climate on the water cycle, thereby producing information that can help guide future land use, agricultural practices, and natural disaster planning.


Characterizing the movement of sediment along river bottoms has always posed a challenge: the movement of these bouncing particles is confounded by both the variability of the bed material itself, and by streamflow’s turbulent nature. This project will develop techniques to use thousands of minute, motion-sensing, radio-tracking techniques (RFIDs, or Radio Frequency Identification systems) to simulate individual sand-sized sediment particles and to study their movement. Their use will enable the researchers to study the displacement, rate of motion, and pathways of individual “sediment” particles, and will feed into predictive models of sediment movement. In future years, this technology could be used for applications-oriented field monitoring of sediments, for example their problematic deposition around hydraulic structures.
The University of Iowa’s Center for Global and Regional Environmental Research (CGRER) promotes interdisciplinary efforts that focus on the multiple aspects of global environmental change, including its regional effects on natural ecosystems, environments, and resources, and on human health, culture, and social systems. Center membership is composed of interested faculty members at any of Iowa’s colleges and universities.

Center goals are promoted by encouraging interdisciplinary research and dialogue among individuals whose disciplines touch upon any of the multifaceted aspects of global change. More specifically, the Center awards seed grants, fosters interdisciplinary courses, provides state-of-the-art research facilities and equipment, and holds seminars and symposia. The Center encourages students to broaden their studies and research through considering the multi-disciplinary aspects of global and regional environmental problems. Through such activities, the Center attempts to assist Iowa’s agencies, industries, and citizens as they prepare for accelerated environmental change that may accompany modern technologies.

Housed in the Iowa Advanced Technology Laboratory at the University of Iowa, the Center was established by the State Board of Regents in 1990 and received funding from a public utility trust fund, as mandated by the State of Iowa’s Energy Efficiency Act.

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