

The Iowa Flood Center

Six Month Progress Report

January 1, 2010

The Iowa Flood Center (IFC) was established and funded by the State of Iowa in spring 2009 and commenced July 1, 2009. *The IFC's overarching objective is to vastly improve flood monitoring and prediction capabilities in Iowa.* This will be accomplished through a variety of activities with the common goal of improving the transfer of the latest research, information, and technologies into the hands of the appropriate agencies, policy makers, citizens, and other stakeholders.

Highlights of Current IFC Activities

Improved Flood Monitoring

1. Every Community Knows its Drainage Basins:

An important lesson learned after the 2008 floods is that the precipitation causing flooding in a community does not always occur locally. Runoff from heavy precipitation in the remote reaches of a basin may cause flooding in communities well downstream from the rain event. In some cases, these flood events, or the magnitude of these events, are unanticipated by the communities, due to lack of knowledge about the extent of region that directly affect them (their upstream neighborhood). With this in mind, the IFC is advancing a project to map the upstream basin(s) of Iowa communities vulnerable to flooding.

IFC Initiative: The IFC developed tools for delineating river basin boundaries and the corresponding river network for Iowa communities. This will help community leaders and citizens identify and monitor the upstream regions that are drained by the streams or rivers that run through their community. This knowledge will also provide better information to design guidelines for watershed management to improve water quality and to target storm runoff control projects. The next step of this project will be to overlay precipitation information (e.g. NEXRAD radar data), stream stage sensor information, and surface runoff travel time through the basin on the basin boundary maps.

Status and Vision: The IFC is currently calculating basin boundaries for rivers passing through communities with more than 1,000 inhabitants (approx. 200 thus far). The rivers and streams are selected based on their potential for flooding. Basin boundaries are calculated using recently updated digital elevations models of the state. These maps are posted in the IFC website using a user-friendly web interface. The IFC will complete this part of the project within the next two months.

Overlaying NEXRAD-derived rainfall, stream gauge information, and estimated flood travel times to these maps will be an ongoing project over the next 6-12 months.

2. Every Bridge Serves as Stream Gauge

The 2008 floods demonstrated that current gauging stations do not provide sufficient data for real-time flood forecasting. Due to the expenses associated with current river gauges (costly infrastructure, equipment, and maintenance), it is not feasible to deploy hundreds of them across the state.

IFC Initiative: The IFC is developing an affordable stream stage monitoring system to install in many locations across the state to supplement data from other sources and to obtain up-to-the-minute data on Iowa's many streams. Inexpensive sensors are mounted on the underside of bridges and use a sonar signal to continuously monitor stream stage/level. This information is transmitted via cell phone network to a central database. Data from hundreds of these sensors will supplement current US Geologic Survey (USGS) gauges to develop a state-wide network of Iowa's rivers and streams.

Status and Vision: A prototype sensor was developed and deployed in Fall 2009. In December 2009, IFC shared this technology with the IDOT and DNR. Both agencies agreed to help develop pilot projects with the sensors. A preliminary network may be operational within 6 to 12 months; a state-wide system of several hundred sensors could be in place in 1-2 years. When complete, this network will vastly improve our ability to monitor stream stages across the state in support of flood prediction and water quality monitoring.

Improved Flood Prediction

3. Understanding Flood Risk

The monitoring projects above will help Iowans anticipate an imminent flood. But detailed maps demonstrating the extent of *any* potential flood in a community do not exist. Most communities may have only a few flood maps (e.g. the 100-year and 500-year maps) and little data to demonstrate the full range of potential flood scenarios.

IFC Initiative: The IFC is developing high-resolution web-based flood inundation map libraries to aid in disaster preparedness and to better communicate flood information to the public. The maps are created using computer models to predict how water travels through the river corridor under various flood conditions. Flood inundation maps will correspond with reported or predicted river stages at USGS stream gauging sites.

Status and Vision: The IFC is currently developing flood inundation models at six locations:

1. Iowa River in Iowa City: The first set of maps for a seven-mile stretch of river is complete and posted on the IFC web site. We have an arrangement in place with the National Weather Service (NWS) to have these maps

placed on the NWS Advanced Hydrologic Prediction Service website for public use in early 2010.

2. Iowa River in Rural Johnson County: The IFC conducted an Iowa River survey from Coralville Dam south to its confluence with the Mississippi River and is currently using these data to create flood inundation maps, servicing small communities and rural areas in southern Johnson County.
3. Cedar River in Cedar Falls and Waterloo: IFC conducted a river survey along the entire study reach and integrated these data with LiDAR and other data sources to develop a numerical model. Preliminary simulations have been performed and are being refined with more detailed structural data.
4. Cedar River in Charles City: IFC is finalizing a river survey along the study reach while also creating preliminary models using LiDAR and other data sources.
5. Des Moines River in Des Moines: IFC obtained computer models developed for a 2005 US Army Corps of Engineers Rock Island District feasibility study and is in the process of updating and modifying them for use in creating a flood inundation map library.
6. Turkey River in Elkader: IFC is preparing a basin-scale hydrologic model to predict Turkey River flows in Elkader and a local river model to generate corresponding flood inundation maps.

This list will continue to grow (The IFC is in conversation with the US Army Corps of Engineers to obtain their data for the Cedar River in Cedar Rapids in Spring 2010.) In the next 2-5 years, flood inundation maps could be completed for all Iowa communities at risk of severe riverine flooding. These maps go beyond FEMA requirements and greatly improve Iowa's ability to make informed emergency management decisions, saving property and lives.

Other IFC Accomplishments / Highlights

4. The IFC supports and represents the collective work of 14 faculty and technical staff members and 20 graduate and undergraduate students from the University of Iowa and Iowa State University. These students, representing our future workforce in flood monitoring and prediction, are engaged in all IFC activities – from river surveys, to map development, to design and testing of rainfall, soil moisture, and river stage sensors.
5. The IFC has close working relationships with the Iowa Department of Natural Resources (DNR), The National Weather Service (NWS), the US Army Corps of Engineers, Iowa Department of Agriculture and Land Stewardship (IDALS) and the Iowa Department of Transportation (IDOT) to enhance their service to Iowa. For example, the IFC is conducting a pilot study for the DNR to develop methods and tools for applying the new statewide LiDAR data in creation of approximate-method flood inundation maps for Poweshiek County. This project will provide guidance necessary for the DNR to conduct similar analyses throughout Iowa.

6. The IFC is developing radar-rainfall maps for Iowa. The maps are currently based on the Davenport and Des Moines weather radars operated by the NWS, but they will soon be expanded to cover the entire state (seven NEXRAD radars). The rainfall maps are displayed in near real time on the background of Google maps and thus have zooming capabilities.
7. The IFC is developing a basin-scale hydrologic model for the Iowa-Cedar River basin for real-time flood forecasting. A smaller scale prototype (for Clear Creek watershed near Iowa City) is being tested. The system uses real-time NEXRAD radar rainfall data.
8. The IFC is testing a prototype small radar network (acquired with a federal grant) that might become the backbone of the future operational weather forecasting complementing systems such as NEXRAD.
9. To date, several Iowa communities, including Palo, Charles City, Iowa City, Coralville, Waterloo, Cedar Falls, and Elkader, have sought and received IFC assistance. The IFC is working with Palo, for example, to better understand their local concerns and to provide technical advice. The IFC installed a real-time rain gauge station in Atkins and in Palo.
10. Larry Weber, Director of IIHR-Hydroscience & Engineering and an expert in river hydraulics, serves on Iowa's Water Resources Coordinating Council (WRCC), helping the Council better appreciate Iowa's primary flooding issues. IFC Director Witold Krajewski and Research Engineer Nate Young also serve on the Floodplain Working Group of the Iowa WRCC. Weber and Young also participated in the DNR Floodplain Mapping Program Planning Event (May 2009) and Young participated in the DNR/WRCC Floodplain Mapping Event in October 2009. In this way, the IFC is helping to guide the technical elements of the Iowa DNR's Floodplain Mapping Program.
11. The IFC continues to inform Iowans about the Center and about Iowa's most pressing flood-related issues through programs across the state – from Rotary Club presentations to programs in local cafés.

Vision for the Future

As the Iowa Flood Center moves forward on current projects, plans are also being formulated for future projects to benefit Iowans. Next year the IFC will begin using its modeling capabilities to evaluate different flood mitigation strategies on an “even playing field.” For example, the IFC may develop a model to test a distributed water storage concept proposed by one local group. Such a concept would allow controlled release of flood waters from the different tributaries in a basin to stagger their discharge into larger rivers. A model of this concept will need to explore the physical elements of building and remotely controlling dozens of storage structures, cost, maintenance, and legal concerns.

Future IFC activities may also incorporate other aspects of flooding, including health issues, policy and politics, economics, education, and social implications. For example, in 2008 University of Iowa faculty in the Department of Sociology worked with the Cedar Rapids School District to study the impact of the flood on school children living in the impacted areas.

Additional Information

The IFC is unique in this nation as the first center of its kind devoted to floods. For the first time, a preeminent university program in hydrometeorology and hydraulics is working closely with local agencies, communities, and decision-makers to better understand their concerns and to put the latest technology to work for them.

The Iowa Flood Center currently operates on a one-year state appropriation of \$1.3M for FY 2010. The Center’s future depends on continued state funding.

Follow IFC progress on its recently launched website: <http://www.iowafloodcenter.org>. The site provides up-to-date status on several projects, with updates and new initiatives coming on line regularly.

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