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Computer model forecast flooding in Calgary 10 days before deluge

By Matt McClure, Calgary Herald, February 10, 2014
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Ten days before Calgary was inundated last summer, supercomputers half a world away were spitting out predictions that showed the city would soon be flooded.

Using state-of-the-art weather forecasts that can see rain coming weeks before clouds appear on the horizon and a mathematical model that calculates how precipitation runs off anywhere in the world, Lorenzo Alfieri and his team of researchers in Reading, England, could see that the Bow River was almost certain to surge in late June to levels higher than those seen during the disastrous 2005 floods.

"The signal for a potentially extreme event was clearly shown," Alfieri said in an email interview. "(The system showed) a probability larger than 90 per cent to exceed the 20-year return event."

Alfieri said authorities in Alberta were not alerted to the dire prediction at the time.

"The system is still in a development phase, so there is no official network of partners to send flood alerts," he said.

While the predictions for Calgary generated in the pilot project by the European Centre for Medium-Range Weather Forecasts would prove to be conservative and four days late in predicting when peak flows would hit, the Italian hydrologist said authorities in Canada could fine-tune the system to produce more accurate warnings.

"Local conditions are likely not to be perfectly captured in a global system," Alfieri said. "Results could definitely improve if a similar model was set up on a limited area."

The centre has been providing warning of floods across Europe since 2010. In the three years the global test project has been running, the team has accurately forecast other major floods around the world well in advance of their arrival.

For example, when monsoon rains began to fall in Pakistan in the summer of 2010, they were able to predict the surge that would peak nearly three weeks later, inundating a fifth of the country and killing 2,000 people.

The next year, the team saw that rivers in Thailand and Cambodia would flood two weeks before they crested and caused major damage.

"The usefulness lies in the early warning," Alfieri said. "The strength of the idea is to be able to spot upcoming extreme events everywhere in the world, especially in developing countries which have no other system in place."

John Pomeroy, a hydrologist at the University of Saskatchewan, has compared Alberta's advance notice and preparations before last June's flood to those one would expect to see in a Third World country.

In the case of High River and Canmore, the river forecast centre run by Alberta Environment and Sustainable Resource Development didn't issue flood warnings until after the rivers running through the towns were already overflowing their banks.

Heavy rains had begun to hit the eastern slopes upstream of Calgary and peak flows were less than 24 hours away before city officials began to mobilize crews to construct berms and install sandbags.

"Municipal engineers need flood forecasts that include risk, actionable intelligence delivered soon enough so they can do something to protect vulnerable communities," Pomeroy said. "We may have to spend millions more on forecasting, but it could save billions and spare lives when a flood happens."

Alfieri said the key to the forecast centre's ability to see floods coming long before they happen is the certainty of its long-range weather forecasts.

While river forecasters in Alberta use one-off rainfall predictions generated about two days before a storm hits to model a potential flood, the Europeans are running a complex system based on dozens of precipitation predictions created a week or months before an event.

Generated by one of the world's most powerful computers, these ensemble forecasts are averaged out to calculate the probability of an event that often turns out to be accurate.

In the fall of 2012, for example, the centre predicted Hurricane Sandy's exact landfall three days before forecasters in the United States saw that the massive storm would even hit the eastern seaboard. In the aftermath of that disaster, the U.S. has spent $25 million on two new supercomputers to improve its long-range forecasts.

Rob Hartman, acting director of the office of hydrologic development with the National Weather Service, said the American agency is also investing in a flood prediction system that will use that weather data to give local authorities earlier and better warnings.

"Being able to accurately describe the probability of floods in the short term is a real high value enterprise," Hartman said. "Traditionally, forecasters just put out a single trace and no one knows until after whether it's too high or too low."

Pomeroy said researchers at Environment Canada have also developed an ensemble weather prediction system at their Montreal research facility that could aid flood forecasting, but lack of funding has meant the capability has never been rolled out.

"The federal government is paying out big for disaster assistance, but they haven't invested enough in a tool that could limit the damages," he said. "Last summer's floods in Alberta ought to be a wake-up call." Environment Canada did not respond to Herald questions about their ensemble weather prediction system or research the agency has conducted to use those forecasts to provide flood warnings.

Officials with Alberta's river forecast centre were not available to comment for this story, but Environment and Sustainable Resource Development issued a prepared statement indicating the department is talking to other jurisdictions to learn how it might improve on its performance during last summer's floods.

"We agree that the use of meteorological ensemble model forecast results is a tool that would provide a lead time risk for occurrence of an event," the statement said. "The topic of the (European centre's) forecasts may be discussed during these interviews, but we have not contacted them directly at this point."

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