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Four innovations in flood technology the industry must grasp

26-04-2017

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Rising populations and a more volatile climate mean flood risk is a growing problem globally. Paul Drury of Ambiental, a specialist in flood modelling, spoke to Intelligent Insurer about four advances that will help the re/insurance industry improve its response to flood risk.

Monitoring floods from above

As flood waters rise, the industry is utilising the latest technology to pinpoint the affected areas and analyse the impact, says Paul Drury, product manager at Ambiental, a specialist in flood modelling.

“Historically there has been a lack of accurate and timely mapping showing the extent of flooding. This can limit the effectiveness of the response and hinder the speed of recovery after the event,” he explains.

Technologies such as earth observation satellites and unmanned aerial vehicles (UAVs, also known as drones) are beginning to be used to capture data from floods to generate useful digital products for insurers and loss adjusters.

Drury suggests that such products are also important for central commanders in government and emergency response teams so that all responders have reliable information on which to base decisions concerning the evacuation of people, accessibility and assessment of damages.

The earth observation satellites are able to see through clouds and decipher bodies of water from space using synthetic aperture radar (SAR).

By processing the images and manipulating the data in geographic information systems—used for capturing, storing, checking, and displaying data related to positions on Earth's surface—it is then possible to reduce uncertainty and overcome the limitations of SAR flood detection in complex urban environments, says Drury.

"UAVs can get much closer to a flood. They can capture high-detail imagery of floods, are relatively inexpensive, and can perform a systematic survey of a flood-affected town," he says.

"During the winter storms of 2014/5, in collaboration with leading academics, Ambiental surveyed Cockermouth in Cumbria and captured high precision data identifying the flood extent and damages," he adds.

"Satellite and drone-based systems can be used in a complementary way by surveying a wide area as well as obtaining close-up views. This approach enables cross-validation and helps to ensure a dependable flood monitoring solution."

Forecasting floods

Before flood waters rise there can be telltale signs that a flood event is imminent, and having advanced warnings can provide substantial benefits to both the inhabitants of affected areas and those tasked with responding to the event, according to Drury.

For example, long-range forecasting can use ground-based or satellite weather radar to observe clouds and wind directions in order to predict rainfall.

These predictions are then run through a flood forecasting model, making it possible to simulate the consequence of water as it falls within a catchment area which, Drury says, enables an understanding of how the water will move through the catchment and the speed at which it will travel.

"From this it is possible to predict flood conditions and determine where and when flooding will occur, and to what severity," he says.

However, the accuracy of flood forecasting is dependent on the resolution of the model input data, Drury explains.

For example, the Flood Forecasting Centre in the UK is operated through collaboration between the Met Office and the Environment Agency, which makes it possible to 'train' the forecasting system to predict floods with a high degree of accuracy so that warnings can be issued.

Ambiental has also developed a flood forecasting system for the government of Malaysia, which uses techniques such as a water accounting system that makes use of dynamic land use and soil moisture inputs to further improve accuracy and realism.

Predicting the impact of climate change

As a result of greenhouse gas emissions resulting from human activity, temperatures and rainfall are likely to increase in future, according to the UK Climate Projections projects undertaken by the Department for Environment, Food & Rural Affairs, and the Met Office.

“Traditional flood mapping uses past records of rainfall, river flow and floods levels to inform a prediction of what is likely to happen in the future, and good historic data can be used to determine the probability and severity of flooding,” says Drury.

“However, the changing climate is making the use of past data as a guide to the present more challenging.

“This was brought into sharp focus during the Cumbria floods of 2014/5 when the observed rainfall exceeded all previously recorded values in some locations, leading to more flooding than expected,” he says.

“Relatively short historic records cannot always take account of the most extreme weather events and therefore traditional flood maps might be under-predicting the flood hazard.

“This becomes even more important when considering long-term decisions relating to land use, planning and infrastructure. As such, insurers may also want to consider future flood hazards when designing longer term underwriting strategies and appraising potential accumulations of risk.”

Climate scientists have taken a proactive approach to the UK’s future climate with the use of probabilistic modelling for time epochs starting in 2020, 2050 and 2080, according to Drury.

“Data modellers ran several thousand future weather simulations, stochastically generating predictions under low, medium and high emissions scenarios, to give a range of estimates,” he explains.

“Ambiental is now using these simulations to generate improved flood predictions, hazard maps and databases which can be used to better account for extreme flood events, both now and in the future.”

Advanced flood catastrophe models

To accurately price risk relating to flood events and loss modelling it is necessary to consider more than just the hazard of flooding and, rather, consider all the potential financial consequences that could arise, according to Drury.

“Insurers must ensure that they remain solvent in order to sustain their operations through catastrophic flood events,” he says.

Under Solvency II, as part of the compliance process, insurers and reinsurers are under greater pressure to better understand the models they are using, and provide evidence that these models are fit for purpose, depending on the nature and spread of their exposure.

“Catastrophe modellers are using details of their insurance portfolio to evaluate exposure to loss based on the expected vulnerability of assets at varying intensities of flooding,” Drury suggests.

“A clearer picture of loss metrics can be determined by running the data through a catalogue of historic and probabilistically generated flood event scenarios,” he adds.

An example of this can be seen in Ambiental’s Australia FloodCat flood model, which calculates the impact of flooding for individual properties, based on specific build characteristics and flood depth experience through each event in the catalogue.

“In the past flood loss modelling was typically undertaken at postcode or Catastrophe Risk Evaluation and Standardising Target Accumulations (CRESTA) resolution,” says Drury.

“From a technical perspective, more detailed models can provide processing and data storage challenges. However, recent advances in server and supercomputing capabilities have made it feasible to perform large modelling runs using a high number of samples, down to individual property level, which can be run in extraordinarily quick timeframes.”