Ambiental

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How to count the cost of flooding before it happens

Two canoeists paddle along a flooded residential street in Beverley, Yorkshire. A man wades waist-deep through water in New Orleans. Destitute families huddle under tarpaulins in villages across Burma.

Floods of recent years have brought striking images of ingenuity amid the suffering. But they present complex problems for utility companies, local authorities and insurance companies, which all have to deal, in different ways, with the aftermath of severe flooding.

Pluvial flooding - caused directly by rainwater - can be surprisingly destructive: last year, UK insurers paid out £3bn for the damage caused by the torrential summer rain.

How can organisations respond to the difficulties of predicting when and where floods are going to happen? Historically, they have had to make do with broad-brush data to make rough calculations about the impact of floods.

For instance, Andrew Haggen, network modelling manager at Thames Water, the utility, says that when it uses static data to assess what damage might be caused by a burst water main or a heavy rainfall, the figures cannot show how that changes over time or what would happen if the two events coincide. "Looking at the combined effect of those two problems is a complex problem to try to solve," he says.

"There is particular difficulty associated with modelling floods because they are infrequent," says John Pethica, chief scientist at the National Physical Laboratory, a government organisation that develops and applies accurate measurement standards for use in science and technology.

He explains that simple predictions of the incidence and effects of flooding combine calculations involving geometry, volumes of water and rain, and hydrodynamics to work out how high the water will rise.

But he says: "Unfortunately life is a lot more complicated than that. You have to worry about things like how porous the soil is, what underwater structures there are, how rapidly evaporation occurs and what the vegetation is - a whole series of things."And if there is uncertainty in more than one of the measurements, the combination of the two will affect the accuracy of the forecast.

In the past five years, however, increased computing power and availability of high-quality topographical data have helped climate experts make more accurate forecasts about the effect of flooding on a town, a street or even a building.

Ambiental, a company founded in 1997 by applied mathematician Justin Butler and some Cambridge University colleagues, is applying sophisticated modelling techniques to high-resolution data to help utilities, insurers and public sector bodies plan.

It can tell an insurance company, for example, which buildings would be affected by a certain amount of rainfall, how deep the floodwater would be and how long it would last. Or construction companies and planners can investigate whether a particular development is susceptible to flooding.

The data used by Ambiental to model outcomes come principally from light detection and ranging providers (Lidar). This, Dr Butler explains, is the "optical equivalent of sonar", in which a laser scanner attached to an aircraft sends out a signal: the time from leaving the aircraft to its return is measured, giving accurate information about distance, which is used to build a detailed digital picture of the topography.

Much of this data come from third parties, but Ambiental also charters an aircraft to gather its own data. "If you use coarse or inaccurate topographic maps, the accuracy of the flood prediction - the path, the depth and the extent of the flood model - is going to be compromised," says Dr Butler.

Ambiental's 3-D maps show, by resolving features on the ground to within 1 to 2 metres , how water would flow around buildings in a residential street.

The models can be integrated with Google Earth, commercial geographical information systems or an Excel spreadsheet to obtain a clearer sense of risks and help plan for contingencies.

Thames Water has been using Ambiental models and, says Mr Haggen, it has become much more efficient in its capital investment.

"Although we know we need to invest money in a particular area, we can be much more precise in the size of the solution that needs to be implemented," he says.