Mitigating the impacts of extreme weather

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Extreme weather events such as heavy rainfall, storms, floods or forest fires can considerably damage roads, railways, communication systems and power lines. Now, researchers within the EU-funded RAIN project—due to be completed by 2017—are planning to analyse associated risks and to assess how climate change may alter the threats posed by extreme weather events. As part of this latter, broader scope, scientists want to improve weather warnings specifically addressed at infrastructure operators. Here, Katrin Nissen, senior scientists at the institute of meteorology of the Free University in Berlin, Germany, talks to RAIN about the challenge to improve weather warnings by learning from past events.

What kind of challenges do you encounter?

Rain data are often available for each day. That is, it includes the total amount of rain fallen over an entire day. But this amount does not always matter. Often, the intensity over a much shorter period, for example 15 minutes, poses problems for certain infrastructures. We have to find methods to still be able to work with these data. There is no perfect solution.

A similar problem occurs when we work with weather forecasts and climate change models. These do not predict the rainfall for a specific location but for a larger area. For example, if the rain was distributed evenly over an entire region, most likely nothing harmful would happen. But if the same amount of rain fell on a single location where an important infrastructure is based, it would certainly matter. The only way

to solve this problem is to work with probabilities. This means that we calculate how probable an extreme rainfall is for a specific location.

What are the limitations of this probability-based approach?

The trouble is that forecasts can never be perfect. We can only make predictions with limited accuracy. This is because we need observation data as input for the weather forecasting models. But we do not have sufficient data. Particularly, we lack data from remote areas such as above the ocean or in the upper layers of the atmosphere. There, we have different approaches to estimate the uncertainties. For example, we can run the forecasting models several times using different, but plausible estimates in locations were no measurements are available, as starting conditions for the forecasting models.

What is the focus of your research?

Our group focuses specifically on heavy rainfall and extreme winds. Other groups work on different extreme weather events or the infrastructure part. We try to find out which kind of extreme weather poses risks for certain infrastructures. What are the thresholds for actual risks? To do so, we talk to representatives of telecommunication companies, road construction and railway companies as well as energy providers. We ask them to identify events that actually caused problem in the past. We use data from official weather records over the past decades to analyse these events and the associated weather forecasts. We want to understand where, how often and to which extent did these events occur? We develop tools to automatically filter data on extreme weather events from the huge amount of historic data sets. We also look at predictions from climate models to estimate how risks may change in the future.

What is the next step?

We try to find out how to minimize the effects of heavy rainfall on various infrastructures. We also want to improve warnings. For example, we ask the operators of infrastructures what kind of warning they received in the past. When did they get the warning? How precise was the warning? We also ask whether they prefer a simple warning or a more detailed analysis of the probability of an event.

More information: rain-project.eu/

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