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Urban floods – a rising problem

Two global phenomena are clearly leaving their mark on the world in the present age; climate change and increasing urbanisation This can be a challenging cocktail that causes major flooding, destruction and, in the worst case, loss of life.

When Texas was hit by Hurricane Harvey in late August, large areas of land were flooded. Persistent downpours over several days had fatal consequences because the terrain is flat and covered with settlements, asphalt and concrete, meaning that the water had nowhere to go.

“Climate change is causing more frequent and more intense extreme events

such as hurricanes, storm surges and downpours. At the same time, increasingly more and larger areas are being urbanised, with large concentrations of population and more advanced infrastructure. All in all, this threatens life and safety and can lead to an increasingly greater economic loss for society," says Carl B. Harbitz, Head of Risk, landslide geotechnics and climate impact at NGI.

Floods can have many causes and can take many shapes. In Norway, we are most accustomed to a flood occurring when rivers change their course or burst their banks. Built-up areas are also flooded as a consequence of major precipitation or storm surges, which are extra high water levels caused by low pressure and tidal waters. The consequences are more serious because of urbanisation and population compaction.

Advanced modelling

When Florida was hit by Hurricane Irma it the beginning of September, huge areas were also flooded. In this instance it was onshore winds and storm surges that carried seawater inland. The last time the city of Tampa was hit by a tropical Hurricane, it had 10,000 inhabitants, while today it has a population of 3 million.

Rescue after hurricane Harvey, Texas 2017

Weather forecasts can tell us that low pressure and storm surges are on the way. The consequences, however, are less easy to predict.

“At NGI we have expertise in storm surge modelling. Thus, we can calculate how the flood from a storm surge develops locally, depending on details in the submarine terrain, as well as how it will be carried inland. Then it is easier to prepare measures and implement them in the correct location,” says Carl B Harbitz.

He emphasises that different weather phenomena often occur simultaneously and affect each other. For example, a storm surge triggered by tidal water can be strengthened by a major water flow along a watercourse. It is therefore particularly important to calculate the possible consequences of extreme weather.

Rescue after typhoon Ondoy Philippines 2009

“Better safe than sorry” is important

All Norwegian municipalities have been ordered to assess how climate change in the coming years will affect the individual municipality and which precautions the municipality has taken. Key to this work are questions such as: How will the municipality be affected by floods, landslides/avalanches, extreme precipitation, storm surges and rising sea levels in the coming years? How can the municipality best protect people, buildings and infrastructure from the consequences of future climate change?

For Larvik and Lardal municipalities in Norway, NGI contributed with these kinds of analyses in its report Adapting to climate change, which forms the basis of the municipalities' overall risk and vulnerability analysis conducted previously this year. The study was the first of its kind and is a pilot project partly financed by the Norwegian Environment Agency.

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SOME FACTS:

- NGI is managing the research project EVOKED, which forms part of The Research Council of Norway's climate initiative and is included in a European collaboration. The aim of the project is to adapt technical data on climatic conditions and offer information in a more accessible format, known as "Climate services". The target groups are public sector employees and others who work with risk analyses and climate change adaptation.
- NGI is a research partner in Klima 2050, a centre for research-based innovation (SFI), which is aiming to reduce risk through climate change adaptation. One of the main topics of the research is: How do you predict and limit soil slides triggered by precipitation?
- Based on the debris slides in Kvam in Gudbrandsdalen in 2011 and 2013, NGI has investigated and assembled the data in a database. The database has been prepared with Sintef and the NVE (Norwegian Water Resources and Energy Directorate) as partners and forms part of the major research project, Klima 2050. The aim is to reduce the risk of future landslides/avalanches.
- In 2016, NGI prepared a report for Larvik and Lardal municipalities in a pilot project. The municipalities used the report as a scientific basis to take into account natural hazards and climate change in the municipalities' overall risk and vulnerability analysis.
- In collaboration with the CICERO think tank, NGI has invited municipalities in Eastern Norway to a workshop on risk and vulnerability analyses. There are plans to hold similar events in other parts of the country.

The Norwegian Geotechnical Institute (NGI) is a leading international centre for research and consulting within the geosciences. NGI develops optimum solutions for society, and offers expertise on the behaviour of soil, rock and snow and their interaction with the natural and built environment.
NGI works within the markets Offshore energy; Building, construction and transportation; Natural hazards, and Environmental Engineering.
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Contacts

Kjell Hauge
Press Contact
Senior Communications Advisor
kjell.hauge@ngi.no
+4793449553