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A flash flood in Boon Lay Way on April 17, when a deluge set a new record for highest daily rainfall for the month since 1980. The flash floods that day overwhelmed drainage systems, flooding pavements and causing high water levels in drains and canals. LIANHE ZAOBAO FILE PHOTO

NUS researcher develops model to project flooding

Tool, along with underground storage of rainwater, could mitigate floods here, he says

Shabana Begum

As the world prepares to deal with shifting weather patterns due to climate change, finding ways to harness rainwater to prevent floods and meet needs during dry periods becomes all the more important.

One option may lie underground. Parched aquifers – or bodies of rock beneath the surface that hold water – can be replenished when flood waters flow through pipes or canals and are stored there.

Using drought- and flood-prone California as a case study, a researcher from the National University of Singapore (NUS) has developed a computer model that can project the volume and location of floods under a changing climate until the year 2100.

The model also recommends investments in groundwater infrastructure for various parts of the US state so that flood waters can be optimally stowed underground.

California's volatile climate, which switches between periods of drought and deluge, is likely to become more severe and erratic as the planet warms.

Heavier torrents and earlier snowmelt due to rising temperatures will drive up flood volumes, said Assistant Professor He Xiaogang from the civil and environmental engineering department at NUS, who led the study. He had pursued the project as a postdoctoral fellow at Stanford University.

"The tool can be customised and applied to regional and global scales to map the flood water recharge potential of those areas," added Prof He.

During droughts, up to 60 per cent of California's water comes from groundwater.

Singapore does not depend on groundwater to meet its needs but, instead, relies on water from Malaysia, rainfall collected in its reservoirs, desalination and treatment of used water.

But Prof He said the tool and groundwater recharge could be a possible way for Singapore to mitigate floods.

A deluge on April 17 – which set a new record for highest daily rainfall for that month since 1980 – caused flash floods that overwhelmed drainage systems, flooding pavements and causing high water levels in drains and canals.

The Centre for Climate Research Singapore has projected that with rising global temperatures, the nation could see more intense and frequent heavy rainfall events.

But is channelling flood waters underground a possible solution for Singapore?

Experts said more studies are needed in order to understand the groundwater systems here, starting with groundwater models.

Noting that Singapore has a complex geology, Dr Pang Chee Meng, chief engineering and technology officer at national water agency PUB, said it is data-intensive to build a reliable groundwater model.

He added that the country's geology consists of top weathered soil and solid rock beneath, and the range and variation of soil and rocks in different areas are significant.

A small amount of rain seeps through the top weathered soil as groundwater, and flows towards the nearest drains and into reservoirs.

In 2016, PUB said it is furthering its groundwater monitoring.

Dr Pang said: "We have installed monitoring wells and sensors to provide a better understanding of the presence of groundwater in Singapore... We will continue to build on the data collected."

Prof He's study was published in the journal Science Advances last month, and a policy brief was prepared by Stanford University this month.

Commenting on the study, Dr Cecilia Tortajada, an adjunct senior research fellow at the Lee Kuan Yew School of Public Policy's Institute of Water Policy, said: "The study in California, although very promising, would not be applicable for Singapore. Geological formations in Singapore are not favourable for groundwater occurrence."

She added: "It would first be necessary to have a whole series of modelling studies."

nshab@sph.com.sg