# Singapore Cloudburst Flood Model

The Cloudburst model for Singapore is the latest addition to Guy Carpenter's robust suite of flood monitoring tools. Our models and advisory help clients throughout Asia better understand and manage the flood risks they face.

## What are the benefits of using Guy Carpenter's Singapore Cloudburst flood model?

### STATE-OF-THE-ART MODELLING

Integrates most up-to-date underlying scientific and engineering data.

Enhanced methodology to support robust modelling complexity for Singapore.

Incorporates the details of urban data and drainage system on flood defences and mitigations.

- Local Conditions
- Very High Resolution
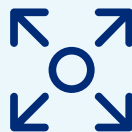
### BROAD RANGE OF APPLICATIONS

Can be used for underwriting, risk management and regulatory requirements.

Accumulation, probable maximum losses (PMLs) and scenario modelling to support management decisions, including climate change assessment.

- Risk Management
- Climate Change

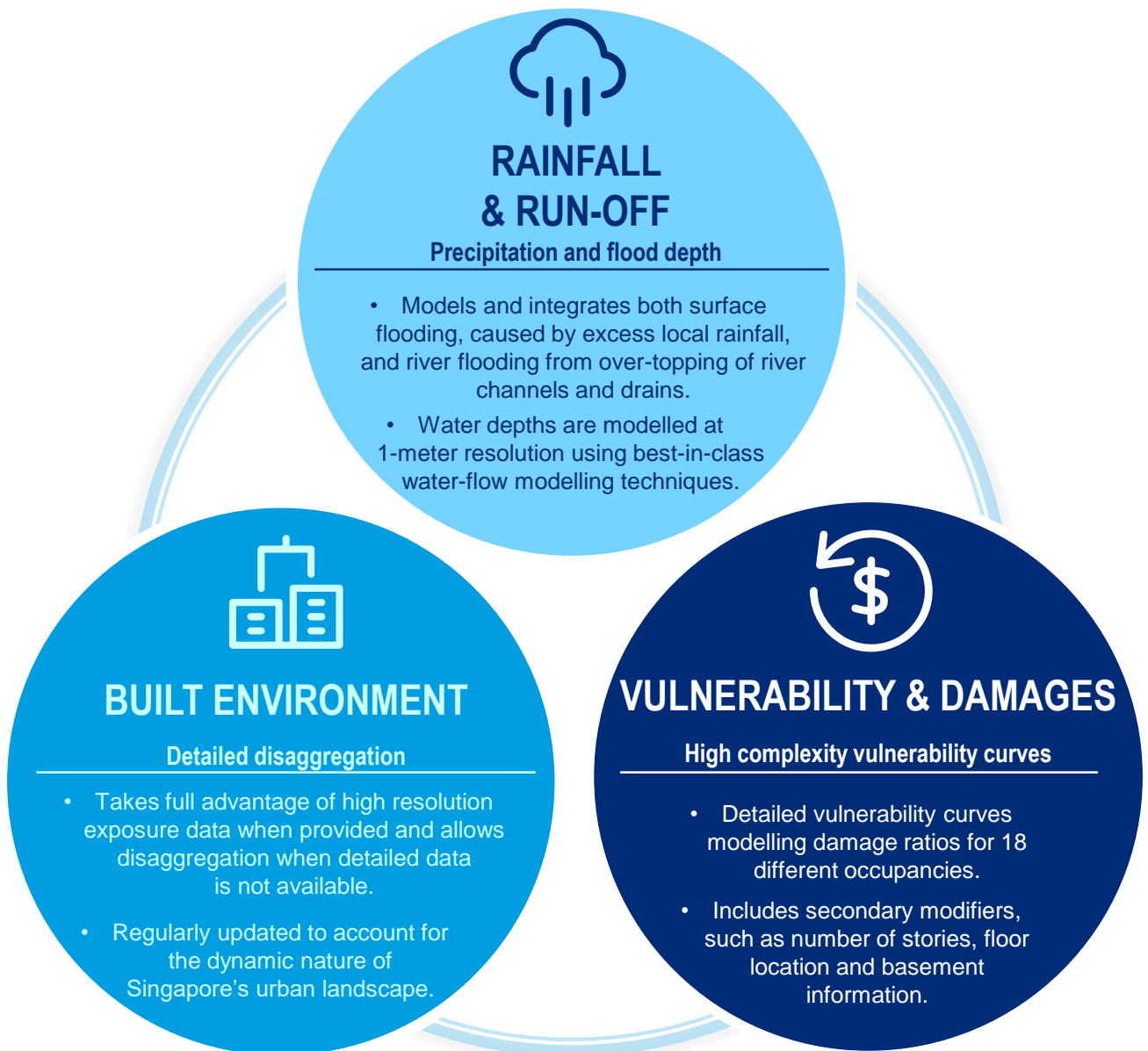### INTEGRATES WITH GC SUITE OF FLOOD MODELS

Correlation across the regions in Asia-Pacific with Guy Carpenter's suite of flood models. Allows loss modelling for events that hit multiple countries.

Comprehensive coverage of all countries in Asia with the best of regional and local data support.

- Complete Coverage of Asia
- Local Knowledge and Data

# Best-in-Class Components

The Guy Carpenter Cloudburst Flood model for Singapore estimates losses caused by urban floods due to heavy precipitation. It combines a stochastic event set with a detailed built environment and proprietary vulnerability functions to model the losses in the highest possible detail. The model includes climate change impact assessment to help you future-proof your organization.

## RAINFALL & RUN-OFF

**Precipitation and flood depth**

- Models and integrates both surface flooding, caused by excess local rainfall, and river flooding from over-topping of river channels and drains.

- Water depths are modelled at 1-meter resolution using best-in-class water-flow modelling techniques.

## BUILT ENVIRONMENT

**Detailed disaggregation**

- Takes full advantage of high resolution exposure data when provided and allows disaggregation when detailed data is not available.

- Regularly updated to account for the dynamic nature of Singapore's urban landscape.

## VULNERABILITY & DAMAGES

**High complexity vulnerability curves**

- Detailed vulnerability curves modelling damage ratios for 18 different occupancies.

- Includes secondary modifiers, such as number of stories, floor location and basement information.

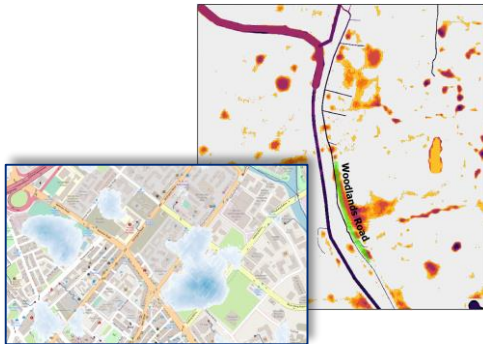# Singapore Cloudburst Model Highlights

## Precipitation

Precipitation events are developed using local rain station observations from Singapore. 26 local observation stations with daily data from 1981-2021 have been used to build historically realistic stochastic precipitation events.
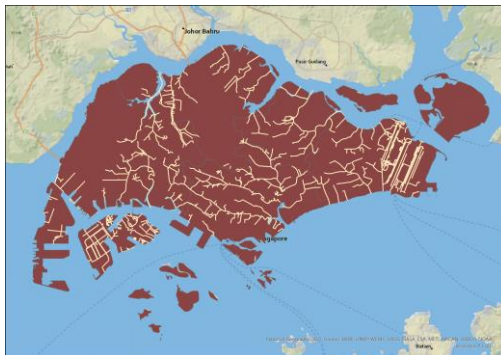
## Water Flow Modelling

By combining stochastic precipitation, DTM and 2 different hydraulic modelling techniques, water depths following cloudburst are modelled.
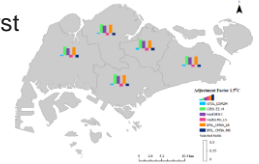


## Flood Mitigation

Incorporates drainage system, flood defenses, and comprehensive land-use and land-cover conditions in the modelling to account for surface flow impacts.



## Climate Change Adjustment Factors

Singapore Cloudburst model can provide views of climate change impacts on portfolio losses.



## High Resolution DTM

A 1-meter resolution digital terrain model (DTM) captures detailed local conditions in the Singapore area. The DTM is hydrocorrected and covers Singapore mainland and surrounding islands.

## High Resolution Built Environment

Leveraging building stock data from GEM (Global Earthquake Model), land-use data from the Singapore Master Plan and point resolution for individual buildings to create a detailed built-environment disaggregation engine.
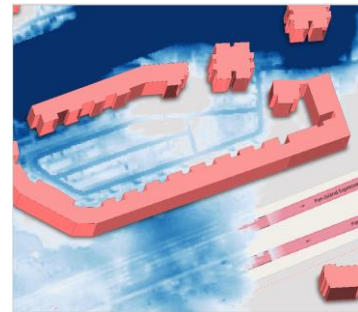


## Vulnerability

Individual vulnerabilities for 18 occupancy types and a large set of secondary modifiers. Allowing for specification about number of stories in the building, floor location and basement existence provides important information for possible location vulnerability.

# Model Usage

Guy Carpenter Singapore Cloudburst Flood model utilizes the industry-owned, open-source OASIS loss modelling platform and provides various level of outputs including average annual losses and event loss tables (AALs and ELT). Model is suitable for underwriting purposes with supported data at high resolution.
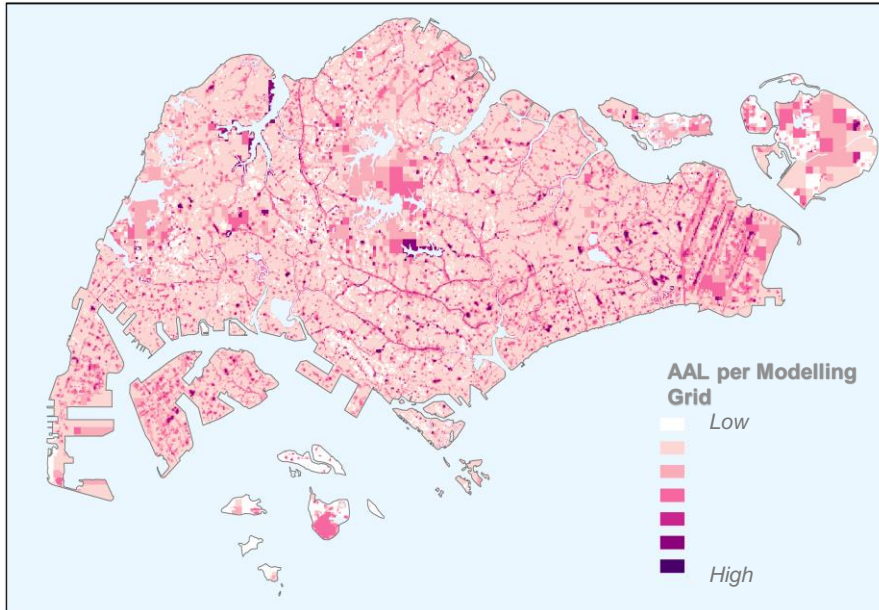


# Contacts

If you are interested in learning more about the Singapore Cloudburst model or would like to organize a technical presentation about the details, please don't hesitate in contacting any of the people below:

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**About Guy Carpenter**

Guy Carpenter & Company, LLC is a leading global risk and reinsurance specialist with 3,400 professionals in over 60 offices around the world. Guy Carpenter delivers a powerful combination of broking expertise, trusted strategic advisory services and industry-leading analytics to help clients adapt to emerging opportunities and achieve profitable growth. Guy Carpenter is a business of Marsh McLennan (NYSE: MMC), the world's leading professional services firm in the areas of risk, strategy and people. The company's 83,000 colleagues advise clients in over 130 countries. With annual revenue of nearly $20 billion, Marsh McLennan helps clients navigate an increasingly dynamic and complex environment through four market-leading businesses including Marsh, Mercer and Oliver Wyman. For more information, visit www.guycarp.com and follow Guy Carpenter on LinkedIn and Twitter @GuyCarpenter.