

CAT Resource Center Post-Event Report

HONG KONG RAINSTORM

Report Date: September 14, 2023

Hong Kong Rainstorm Headlines

Information as of September 14, 2023



Extreme conditions
05:30 to 24:00 September 8
Black rainstorm warning
23:05 September 7 to 15:40 September 8



Hong Kong Observatory
Max 1-hour Precipitation: 158.1 mm
Max 24-hour Precipitation: >600 mm



Flood reports: 60
Landslide reports: 75



Fatalities: 2
Injured: 144

- Maximum 1-hour rainfall of 158.1 mm reached the highest record since 1884.
- Black rainstorm warning was in force for 16.5 hours, the longest since its establishment in 1992.
- Widespread flooding occurred across Hong Kong, as shopping malls and car parks filled with rainwater.
- Cities in the Greater Bay Area also experienced heavy rainstorms of over 250 mm in 24 hours.

Hong Kong Flood post-event report comprises the following sections:

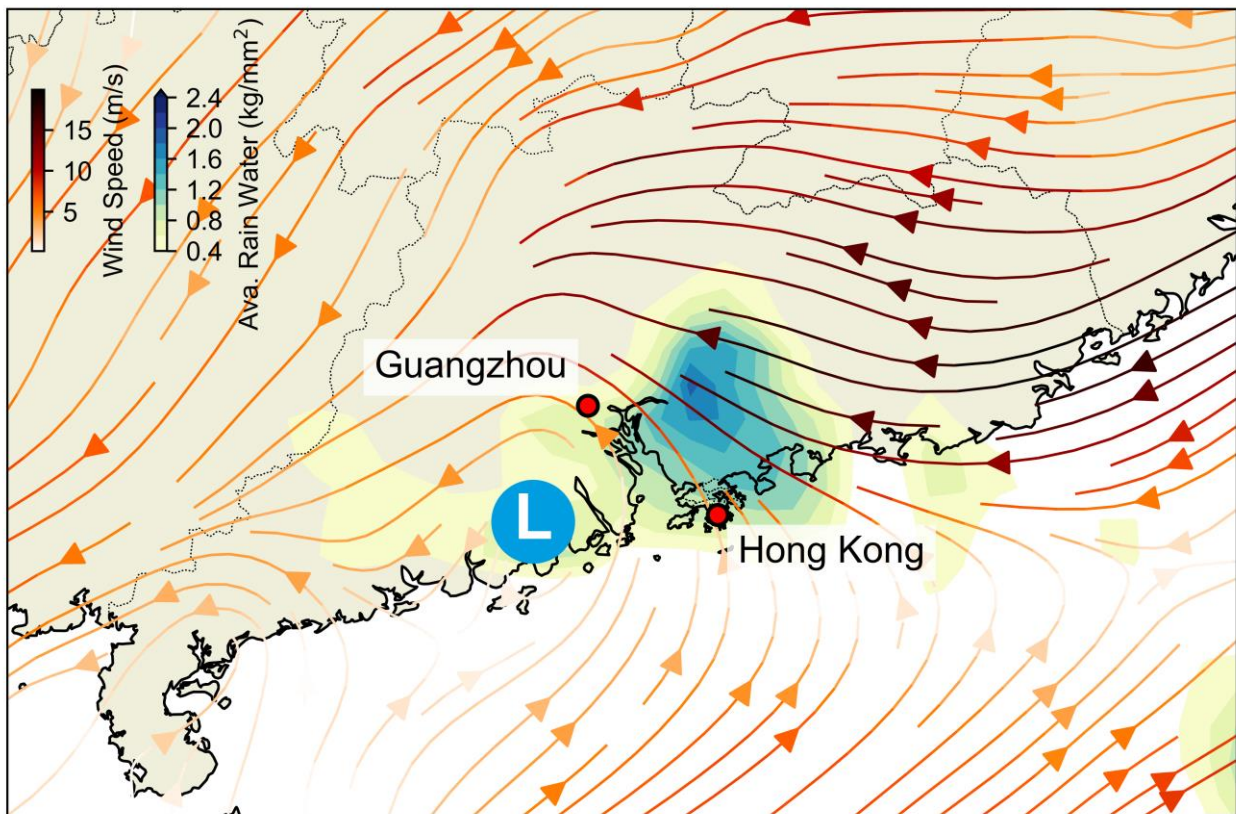
- Meteorological Background
 - Damage Impacts
 - Historical Rainstorm Event
 - Hong Kong's Flood Defense
 - Large Industry Insured Losses
-

Meteorological Background

The western North Pacific typhoon season was very active in late August 2023, with 4 tropical cyclone formations in a week. On August 28, a tropical low northwest of Guam was upgraded to tropical storm and named Haikui. The storm moved mostly westward and gradually intensified over the open Pacific. Haikui struck Taiwan's southeast coast on September 3, with a maximum wind speed estimated to be 155 kph, according to Taiwan's Central Weather Bureau. It crossed the island of Taiwan and exited on its southwest side. Haikui continued tracking westward and made landfall around the border of Fujian and Guangdong as a tropical storm on September 5.

After landing in mainland China, Haikui further weakened, and its remnant transitioned into a low-pressure trough. On September 7, the system moved to the area of the Pearl River Delta. The trough drew in tropical moisture from the southwest, meeting with the easterly monsoon. The convergence of these 2 airstreams triggered widespread heavy rainfall in the region (Figure 1).

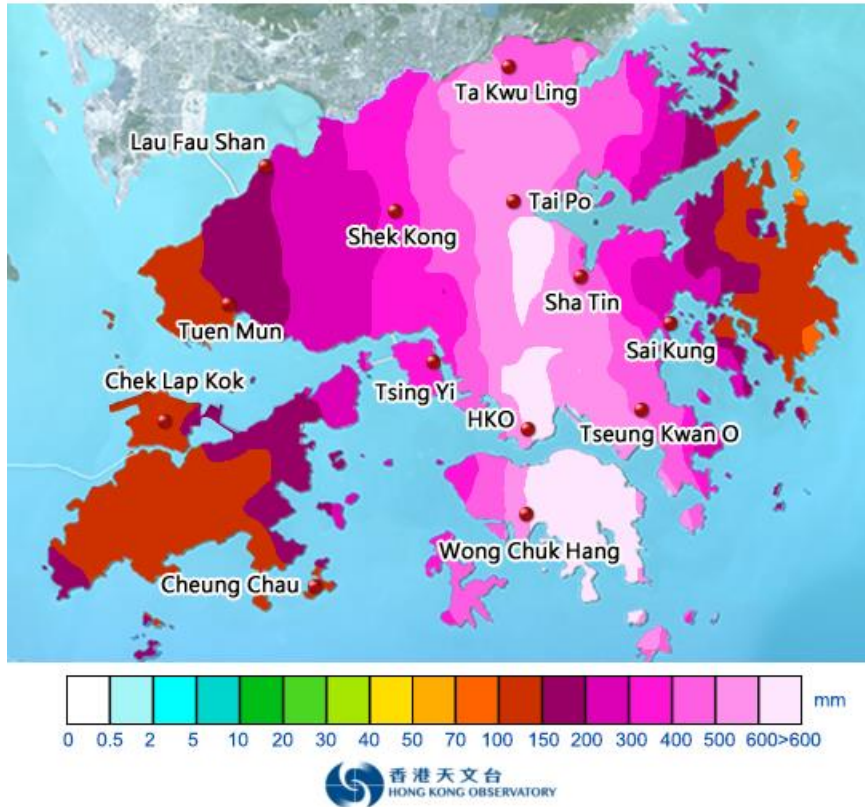
Figure 1: Near surface winds (arrows) and perceptible water (shading) at 20:00 HKT, September 7, 2023. "L" indicates the location of Haikui's remnant.



Source: ECMWF Reanalysis 5 Graphic: Guy Carpenter

The Hong Kong Observatory weather station observed a 1-hour rainfall of 158.1 mm at 00:00 HKT on September 8, the heaviest hour since recording began in 1884. Most of the territories had received more than 600 mm rainfall in 24 hours by 10:00, with part of Hong Kong Island exceeding 800 mm (Figure 2). The unprecedented amount of rain triggered significant flooding across the city.

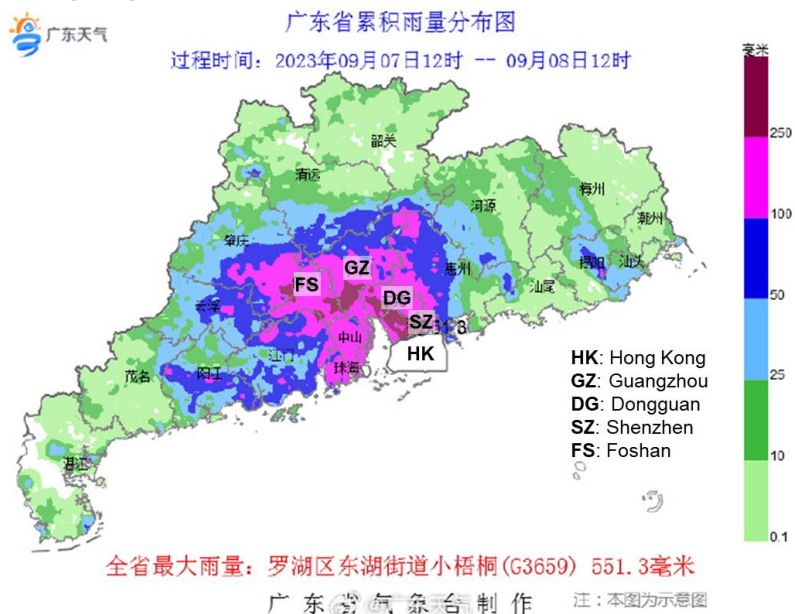
Figure 2: Hong Kong 24-hour rainfall received at 10:00 HKT, September 8, 2023.



Source: Hong Kong Observatory

Most of the Greater Bay Area cities also experienced heavy rainfall on the same night (Figure 3). Stations in Foshan, Guangzhou, and Dongguan observed 24-hour rainfall near or above 400 mm. In Shenzhen, Hong Kong's neighboring city, over 500 mm of rainwater had fallen. It was the heaviest rainstorm to occur since 1952, with widespread flooding reported.

Figure 3: Guangdong 24-hour rainfall received at 12:00 HKT, September 8, 2023.



Source: Guangdong Meteorological Service

Damage Impacts

Hong Kong

Hong Kong Observatory first issued an Amber Rainstorm Warning Signal at 21:25 HKT on September 7, and raised the warning to the highest level (black) at 23:05. A Special Announcement on Flooding in the northern New Territories and a Landslip Warning were issued later at 19:50 and 23:45, respectively. Because of severe flooding, the Hong Kong government declared an "extreme condition" at 05:30 on September 8, which lasted until midnight.

The heavy rainstorm caused city-wide flash floods and landslides. The government received 60 flooding and 75 landslide reports by September 10. About 80 roads across the city were damaged or blocked.

Some notable local impacts are listed below, and Figure 4 shows the affected districts:

Property

- Rainwater half-filled a car park and a shopping center at Wan Tsui Estate in Chai Wan.
- A shopping center in Quarry Bay was flooded.
- Landslides in Tai Tam endangered 3 luxury houses.
- Landslides occurred at Yiu Tung Estate in Shau Kei Wan.
- Landslides near Cha Kwa Ling village in Lam Tin caused 200 residents to evacuate.
- The basement of Temple Mall North, a shopping center in Wong Tai Sin, was flooded with rainwater.

Transportation

- The Wong Tai Sin MTR Station was closed because of flooding.
- Sections of the Kwun Tong Line were suspended because of flooding and power disruption.
- More than 20 buses were stuck on roads because of heavy rain, and bus services were suspended the morning of September 8.
- Landslides damaged the only access route to the rural village of Shek O; 120 residents were evacuated.

Agriculture

- More than 1,000 pigs drowned at a pig farm in Ta Kwu Ling, with an estimated loss exceeding HKD 3 million.

Shenzhen

- Widespread flooding was reported; 6 subway lines were suspended.

Figure 4: Districts with notable damages.



Source: News releases; Graphics: Guy Carpenter

Historical Rainstorm Events

Heavy rainstorms are not rare occurrences in Hong Kong. As a result of substantial flood-prevention investments, the number of casualties has declined greatly over the years (Table 1). Hong Kong Federation of Insurers (HKFI) reported that the rainstorm in 2008 incurred claims of HKD 237 million.

Table 1: List of significant rainstorms occurring in Hong Kong.

Date	Casualties	Significance
September 7 – 8, 2023	2	1-hour rainfall of 158.1 mm (highest since 1884). 24-hour rainfall greater than 600 m (second highest).
June 7, 2008	2	1-hour rainfall of 145.5 mm (highest level recorded prior to the most recent event). 1,000 floods and more than 2,760 landslides reported.
May 8, 1992	4 & 1 missing	1-hour rainfall of 109.9 mm. 350 landslides reported; rainstorm warning system was set up afterward.
June 16-18, 1972	164	Buildings collapsed from landslides in Hong Kong Island and Kowloon.
June 11-13, 1966	64	More than 500 landslides reported; severe flooding in North Point.
July 19, 1926	At least 13	Highest 24-hour rainfall: 534.1 mm.
May 28-30, 1889	At least 23	Highest 24-hour rainfall to date: 697.1 mm.

Source: Climate Challenge, PCMarket Magazine

Hong Kong's Flood Defense

Hong Kong receives an average of 2,400 mm rainfall per year. Heavy rainstorms in a short period can cause flooding across the region, especially in low-lying rural areas, natural flood plains, and older urban areas. The Drainage Services Department was set up in 1989 for flood prevention and sewage management. Several long-term improvement measures have been implemented for flood defense. Current drainage systems are designed for 10- to 50-year rainstorms for rural areas, and 50- to 200-year rainstorms for urban areas.

In rural areas, natural rivers were straightened, widened, deepened, and installed with linings to increase their capacity. For low-lying villages, embankments were built to protect them, and stormwater was pumped to outside drainage channels.

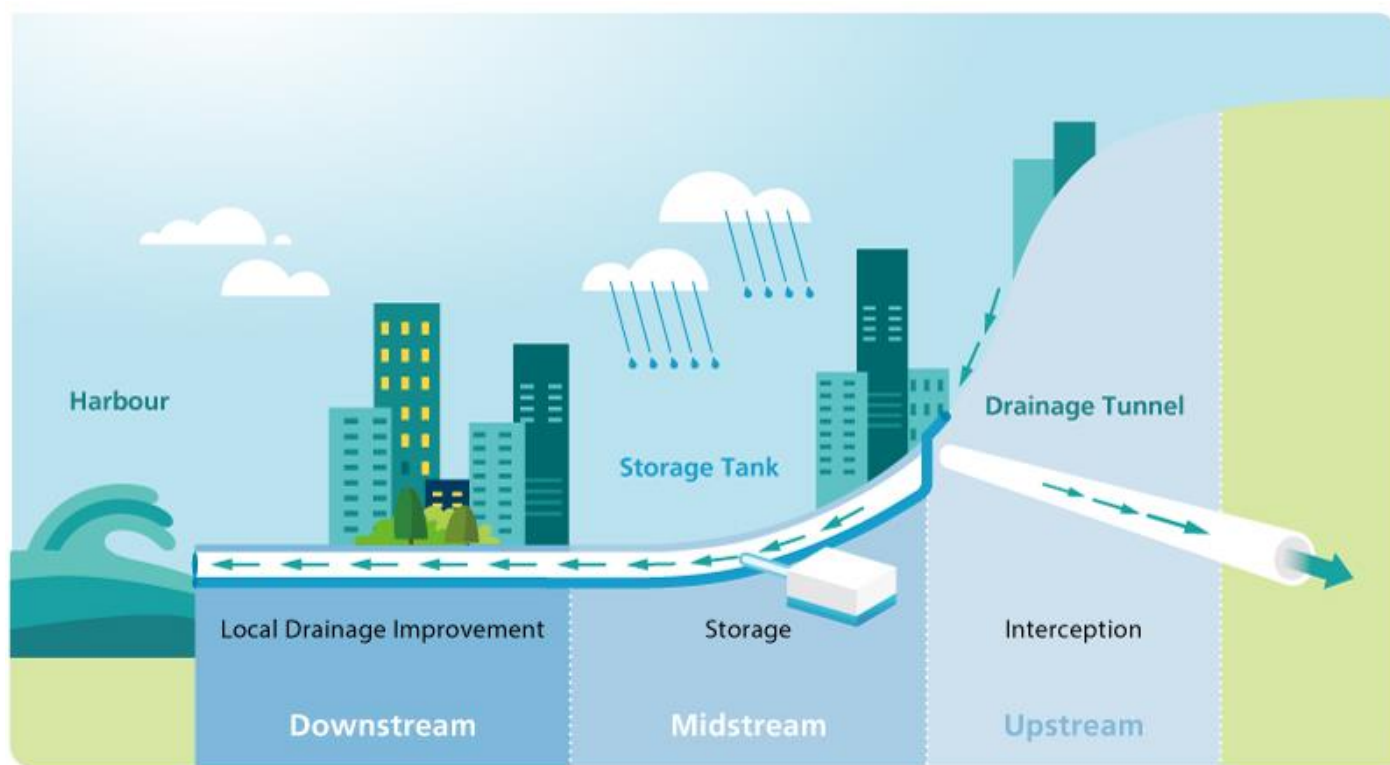
In urban areas, a "three-pronged flood prevention strategy" was implemented: upstream interception, flood storage, and downstream local drainage improvement (Figure 5).

Four drainage tunnels (including the Kai Tak Transfer Scheme and Hong Kong West, Lai Chi Kok, and Tsuen Wan Drainage Tunnels) spanning about 21 km were built to divert stormwater to rivers or the sea.

Stormwater storage tanks at Tai Hang Tung, Sheung Wan, Happy Valley, and On Sau Road collect water temporarily to alleviate the burden of downstream drainage systems. Another 5 extra tanks are being planned.

Local drainage improvements also were carried out to increase river capacity and enlarge or construct new underground drains. Over 100 km river sections and 90 km drains have been upgraded to date.

Figure 5: Conceptual layout of the three-prong flood prevention strategy



Source: Drainage Services Department

These infrastructure investments have mitigated damages from heavy rainfall, allowing Hong Kong to return to normal economic activities shortly after a flooding event. For example, the city’s MTR subway system resumed operation on all lines on September 9.

Large Industry Insured Losses

Tropical cyclones and monsoon troughs are frequent in Hong Kong and can bring heavy precipitation. The rainstorm between September 7 and 8 was equivalent to 1/4 the annual average. Two recent weather events involving large claims were Super Typhoon Mangkhut and Hato. Below are their incurred claim amounts as reported by the Hong Kong Federation of Insurers (HKFI).

Table 2: Incurred claims for Mangkhut and Hato.

Year	Event	Estimated Total Claims Incurred (HKD)
2018	Super Typhoon Mangkhut	3,058 M
2017	Super Typhoon Hato	858 M

These figures represent surveyed losses of members of HKFI from property damage, business interruption, contractor all risks, marine, employee compensation, motor, and travel coverages.

Source: HKFI

Many will remember the huge number of fallen trees in the aftermath of Mangkhut, as well as the broken-glass debris from the Two Harbourfront office tower in Hung Hom, which generated a substantial single-building risk loss. Since that time, insurers have raised policy excess levels. Although the recent rainstorm in Hong Kong did not generate this type of severe wind damage, its significant damages focus attention on several issues of importance. In particular, since rain-driven events can cause large motor losses, it is important to note that, according to the latest statistics from the Hong Kong Insurance Authority, the motor protection gap has widened recently as both the total number of cars increased and the proportion of private cars with comprehensive coverage decreased (from 47% in 2017 to 43% in 2021). Furthermore, many homeowners and small and medium enterprises that currently

do not have property insurance are likely to reassess their purchase decisions. In short, all segments of society can learn from this storm and consider improvements in warning systems, flood defenses, and insurance risk transfer for greater financial resilience.

Sources: Hong Kong Observatory, Guangdong Meteorological Services, Hong Kong SAR Drainage Services Department, Hong Kong Federation of Insurers, Hong Kong Insurance Authority, South China Morning Post, PCMarket Magazine, Radio Television Hong Kong, Xinhua News, Taiwan Central Weather Bureau, Central European Centre for Medium-Range Weather Forecasts (ECMWF)

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 more than 85,000 colleagues advise clients in 130 countries. With annual revenue of over \$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 us on LinkedIn and Twitter

This publication / website / product / service contains information that is copied or extracted from data made available in publications of the Hong Kong Observatory (the "Observatory"). The provision of the information copied or extracted from the Observatory's publications shall not be constituted as any form of co-operation or affiliation by the Observatory with any person in relation to this publication / website / product / service or any contents herein. Nothing in this publication / website / product / service shall give rise to any representation, warranty or implication that the Observatory agrees with, approves of, recommends or endorses this publication / website / product / service. The Observatory does not have any liability, obligation or responsibility whatsoever for any loss, destruction or damages (including without limitation consequential loss, destruction or damages) howsoever arising from or in respect of your use or misuse of or reliance on or inability to use any contents herein.

Guy Carpenter & Company, LLC provides this report for general information only. The information contained herein is based on sources we believe reliable, but we do not guarantee its accuracy, and it should be understood to be general insurance/reinsurance information only. Guy Carpenter & Company, LLC makes no representations or warranties, express or implied. The information is not intended to be taken as advice with respect to any individual situation and cannot be relied upon as such. Statements concerning tax, accounting, legal or regulatory matters should be understood to be general observations based solely on our experience as reinsurance brokers and risk consultants, and may not be relied upon as tax, accounting, legal or regulatory advice, which we are not authorized to provide. All such matters should be reviewed with your own qualified advisors in these areas.

Readers are cautioned not to place undue reliance on any historical, current or forward-looking statements. Guy Carpenter & Company, LLC undertakes no obligation to update or revise publicly any historical, current or forward-looking statements, whether as a result of new information, research, future events or otherwise. The trademarks and service marks contained herein are the property of their respective owners.