# 7.3 How is the Climate Change in Hong Kong?

Hong Kong is not exempt from the impacts of climate change. In line with the global trends, Hong Kong has recorded more hot weather, more extreme rainfall and a continuing rise in sea level. With Hong Kong gradually developing into a densely populated city, urban development has also played a role in affecting the climate of Hong Kong.

1 Climate change in Hong Kong

2 How does urban development affect the climate of Hong Kong?

3 Microclimate

# 1 Climate change in Hong Kong

The Hong Kong Observatory (HKO) has been conducting meteorological observations since 1884 except during the Second World War (1940–1946). The HKO possesses more than a hundred years of meteorological observation records which are important references for climate change research in Hong Kong.

More Information

Latest temperature trend

## 1.1 Temperature rise

Fig. 1 shows a long-term ascending trend of the annual average temperature in Hong Kong. The annual average temperature increased at a rate of about 0.14° C per decade between 1885 and 2024. The increase has become more significant since the latter half of the 20th century.

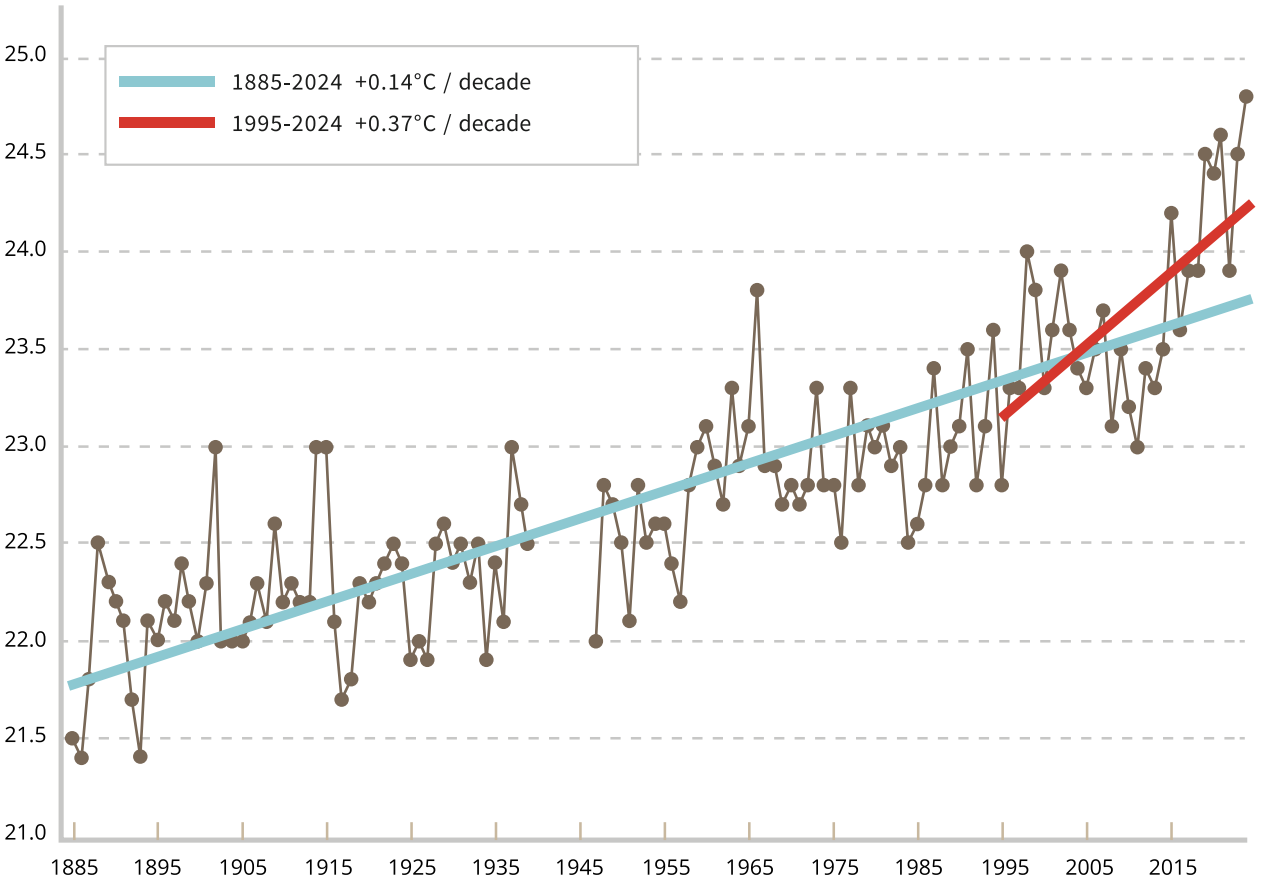



**Fig 1** Annual average temperature recorded at the HKO Headquarters (1885–2024)
Source: HKO

## 1.2 More very hot days and fewer cold days

The numbers of hot nights (with a daily minimum temperature of 28° C or above) and very hot days (with a daily maximum temperature of 33 ° C or above) have increased by a factor of 48 and 10 respectively between 1884 and 2024. (Fig. 2a) In contrast, the number of cold days (with a daily minimum temperature of 12° C or below) shows a decreasing trend. (Fig. 2b)

More Information

Extreme weather events

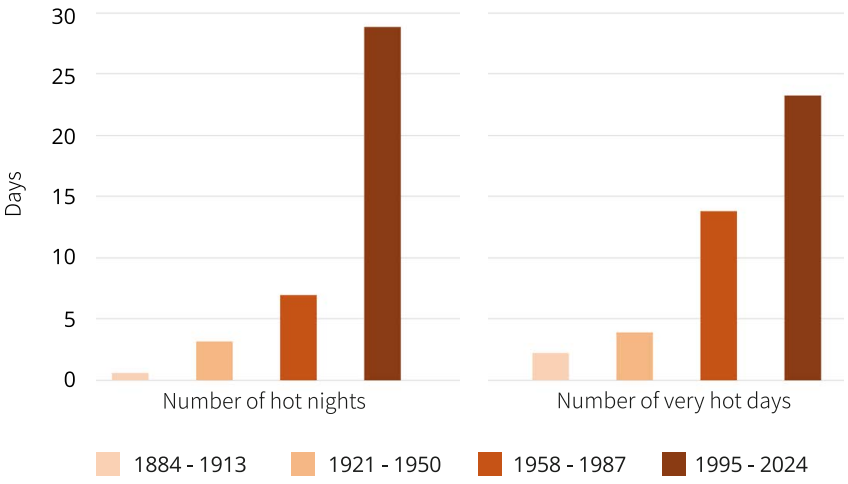



**Fig 2a** Change in the annual number of hot nights and very hot days in Hong Kong (1884–2024)
Source: HKO

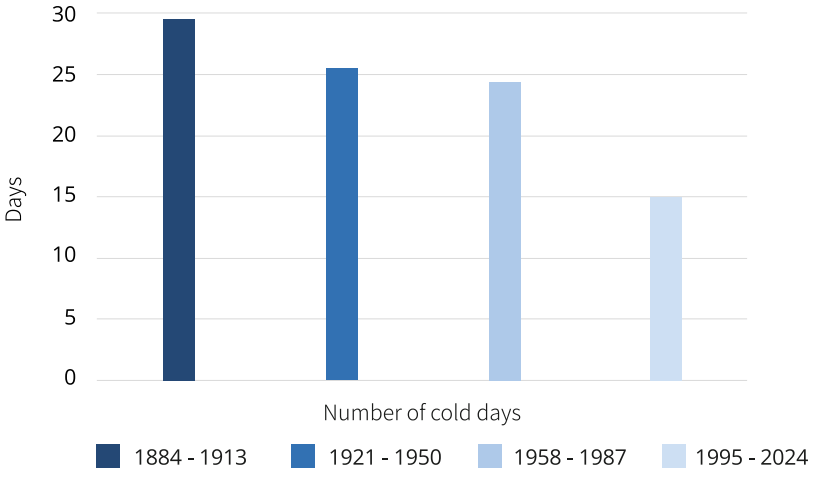



**Fig 2b** Change in the annual number of cold days in Hong Kong (1884–2024)
Source: HKO

## 1.3 More frequent and intense extreme rainfall

Recent studies show that extreme rainfall events have become more frequent and intense over the past century. In the past, the highest hourly rainfall record at the Hong Kong Observatory Headquarters used to be broken once every few decades. However, the record has been broken several times in recent decades. As of July 2025, the highest hourly rainfall recorded at the HKO Headquarters was 158.1mm, set in 2023. (Fig. 3)

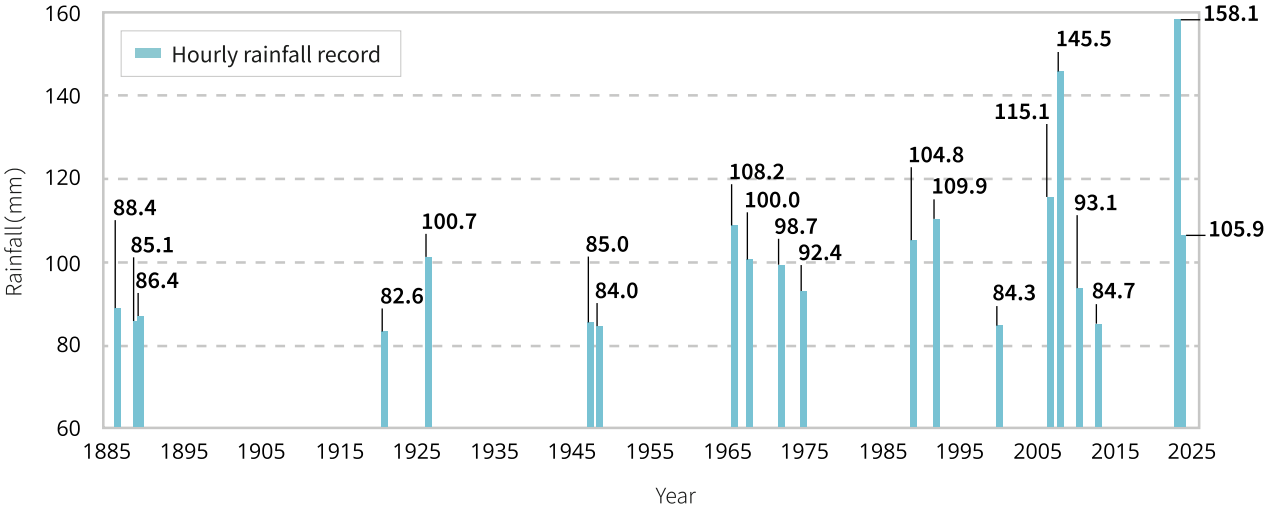



**Fig 3** Top 20 hourly rainfall records at the HKO headquarters (1884–2024)
Source: HKO

More Information

Ranking of highest hourly rainfall

## 1.4 Sea level rise

Tide gauge records in Victoria Harbour have indicated an obvious rise in mean sea level since 1954. On average, the mean sea level at Victoria Harbour rose at a rate of about 32 mm per decade between 1954 and 2024. (Fig. 4)

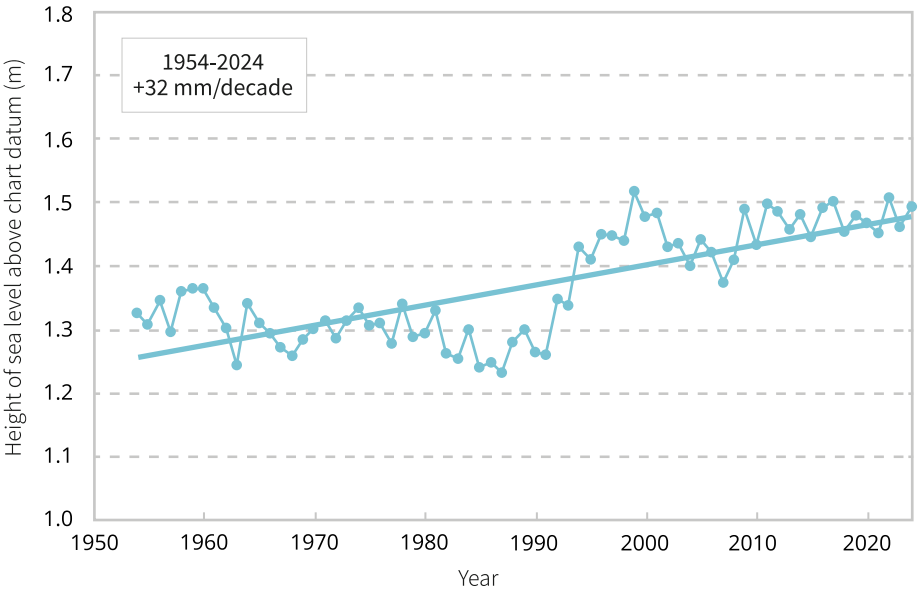



**Fig 4** Annual mean sea level at Victoria Harbour (1954–2024)
Source: HKO

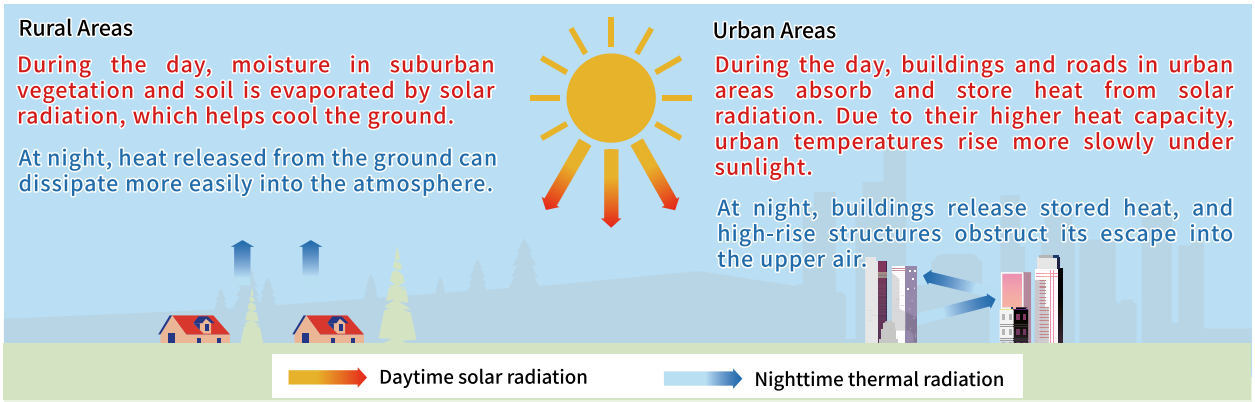
Latest seal level trend

# 2 How does urban development affect the climate of Hong Kong?

Both global warming and local urban development affect the climate of Hong Kong. According to research from the HKO, urban development is one of the factors causing Hong Kong's warming and its contribution could be up to 50%.

## 2.1 Urban heat island effect

Urbanization leads to changes in land use, intensive building development, increased heat emissions, and a high concentration of human activities, which significantly impact the climate in urban areas. Due to the higher heat capacity of urban buildings and reduced vegetation, the heat balance in cities is affected (Fig. 5). The rate of heat dissipation in urban areas gradually becomes slower than in suburban areas, resulting in the urban heat island effect.




**Reasons for the temperature differences between urban and suburban areas include:**

- Urban buildings and roads have higher heat capacity, absorbing and storing more solar radiation
- Dense and towering structures obstruct the sky view, hindering the release of thermal radiation at night
- Buildings, air conditioning systems, vehicles, and industrial activities in urban areas emit substantial anthropogenic heat, contributing to urban warming
- High-density development reduces wind speed, impedes moisture evaporation, and suppresses convective heat dissipation

**Fig 5** Impacts of urban development on the heat balance in urban areas

In Hong Kong, the urban heat island effect is primarily a nighttime phenomenon and is more significant in winter, especially under stable atmospheric conditions, light winds and clear sky. Fig 6 shows an example from 2021. Under the influence of a continental airstream over southern China, the weather in Hong Kong was fine and dry on 12 and 13 January, 2021. At the night of 12 January and the early morning on 13 January, light winds and clear sky enhanced the radiation cooling, bringing the temperature at Ta Kwu Ling down to a minimum of –0.9° C in the early morning of 13 January. Due to urban development, the cooling in urban areas was much slower than that in rural areas and the minimum temperature recorded at the HKO Headquarters in Tsim Sha Tsui was 10.4° C, more than 11° C higher than that at Ta Kwu Ling.

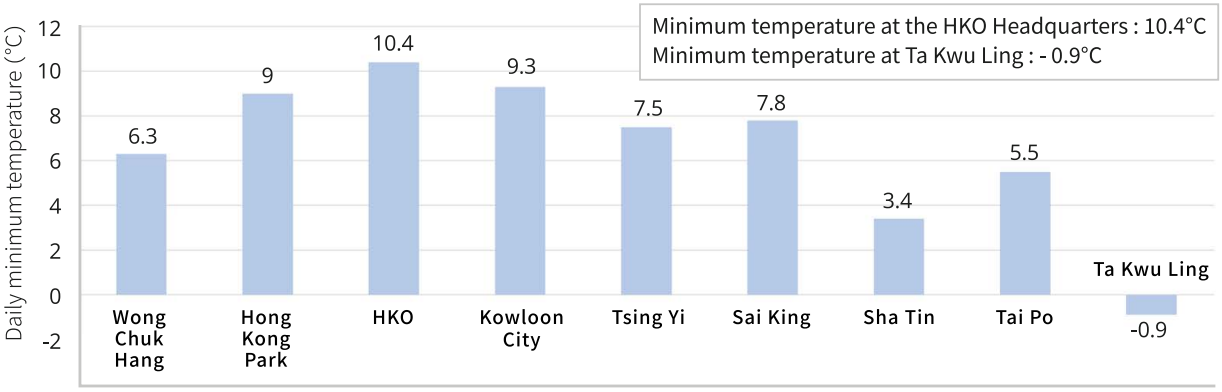



**Fig 6** Minimum temperatures in urban and rural areas of Hong Kong on 13 January 2021
Source: HKO

## 2.2 Impact of urban development on surface winds

The high–rise buildings and dense urban development in Hong Kong have increased land surface friction, obstructing airflow and reducing wind speed in urban areas. Fig. 7 shows that there was no obvious trend in the annual average wind speed at Waglan Island between 1968 and 2024, while the wind speed at King's Park in urban area exhibited a significant downward trend between 1968 and 1990s, but has remained relatively stable since 2000.

More Information

Buildings with wall effect

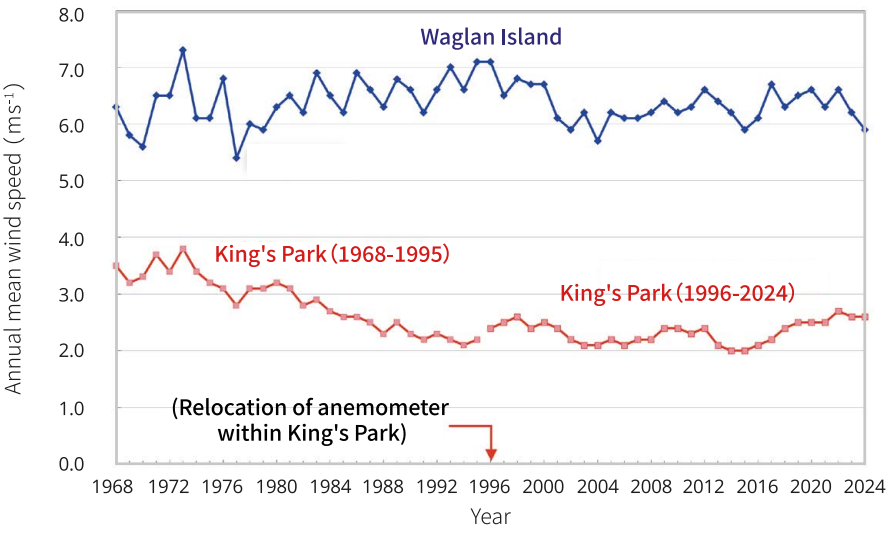



**Fig 7** Annual mean wind speeds at King's Park and Waglan Island (1968–2024)
Source: HKO

## 2.3 Other impacts of urban development

Between 1961 and 2024, the annual mean cloud amount in Hong Kong increased at a rate of 1.0% per decade, with the most significant increase occurring from the 1960s to the mid–1980s. (Fig.8) One possible reason for the increase in cloud cover is that human activities release suspended particulates into the atmosphere, increasing the concentration of condensation nuclei and favouring cloud formation. In addition to the increased condensation nuclei in the atmosphere, the urban heat may enhance convection. Both factors favour precipitation. Research from the HKO indicates that the increasing trend in rainfall in urban areas was higher than that in the New Territories and offshore areas between 1956 and 2005.

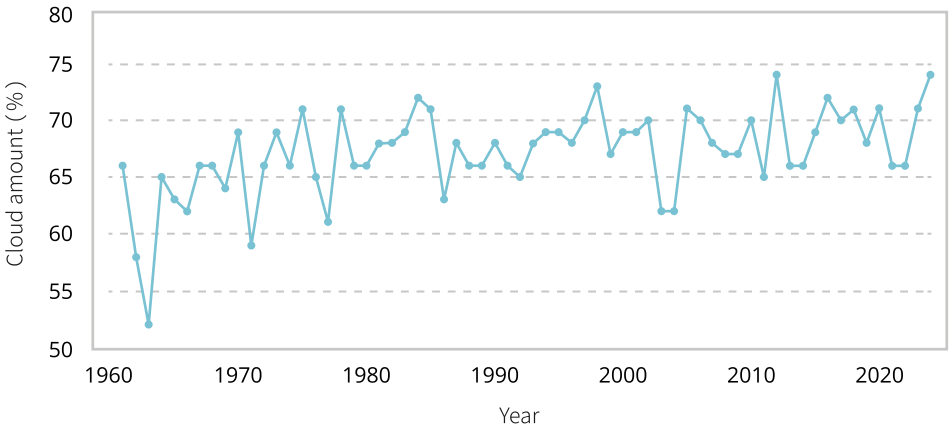



**Fig 8** Annual mean cloud amount recorded at the HKO Headquarters (1961–2024)
Source: HKO

Increases in cloud amount and suspended particulates reduce the amount of solar radiation reaching the Earth's surface. The amount of solar radiation observed in Hong Kong showed a significant decreasing trend from 1968 to the early 1980s. From the 1980s to the 1990s, the solar radiation levels remained relatively stable, while an increasing trend has been observed since 2000. (Fig. 9)

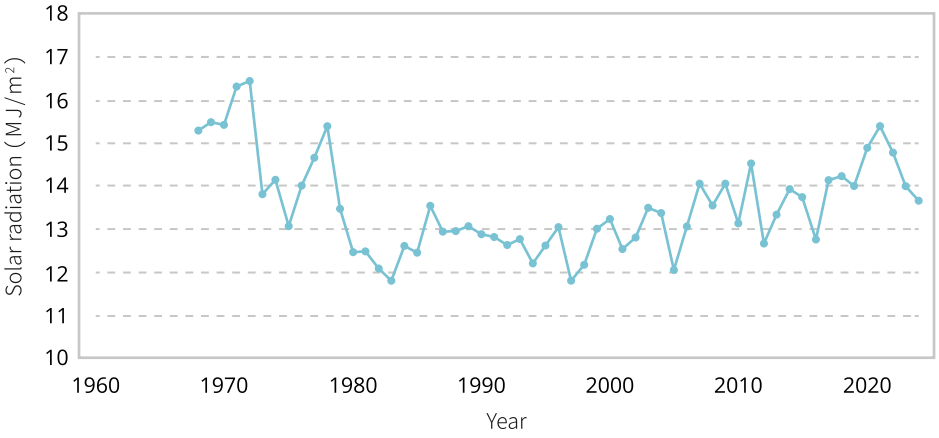



**Fig 9** Annual mean daily total global solar radiation recorded at King's Park (1968–2024)
Source: HKO

More Information

Climate change in Hong Kong — cloud amount, solar radiation and evaporation

Relative humidity is affected by air temperature and the amount of water vapour in the air. With the same amount of water vapour in the atmosphere, relative humidity decreases with increasing temperature. During the day, the temperature rise in the rural areas is significantly higher than that in urban areas, resulting in lower relative humidity in rural areas. In the evening, the rural areas cool faster than urban areas, leading to higher relative humidity in rural areas. (Fig. 10)

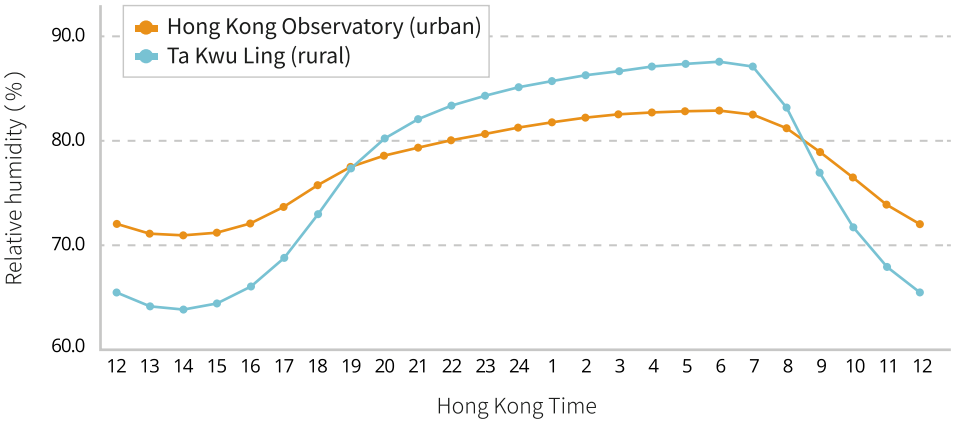



**Fig 10** The average diurnal variation of relative humidity at the HKO and Ta Kwu Ling (1989–2024)
Source: HKO

## Urban heat island effect and global warming

Urban development causes the urban heat island effect, which makes cities warmer. However, the impact of the urban heat island effect is confined to cities and has limited contribution to global warming. The Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) points out that the urban heat island effect has raised global land surface air temperature trends by no more than 10% over the past hundred years.

## 2.4 Measures to mitigate the urban heat island effect

### 2.4.1 Enhance urban greening

Trees help with cooling. The temperatures under tree shade are much lower than those on concrete or asphalt surfaces exposed to sunlight. The yellow and orange areas in the thermal image in Fig.11a show that road surfaces and buildings exposed to direct sunlight (as shown in the photo in Fig.11b) have relatively higher temperatures. The blue and dark blue areas show that the temperatures are relatively lower in areas under tree shade. The temperature difference can be 10° C or more. Therefore, increasing the urban greening ratio can offer more tree shades and create a cooler environment for pedestrians.

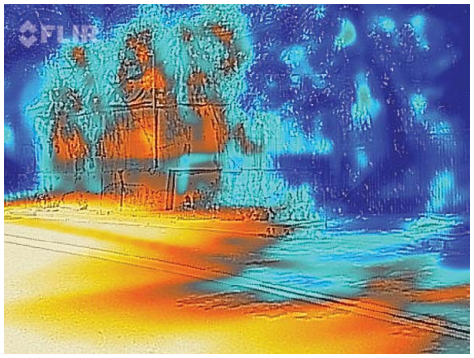



Fig 11a Thermal image

Fig 11b Photo

In addition, increasing urban vegetation coverage, such as through green roofs and vertical greening on building exteriors, can provide shade, reduce surface temperatures, and contribute to cooling through plant transpiration.

### 2.4.2 Improve building materials

The use of green building materials with high reflectivity and thermal emissivity (such as applying white or reflective coatings on roofs and walls, or paving surfaces with highly permeable materials) can significantly reflect solar radiation, enhance ground moisture evaporation, and reduce surface heat absorption, thereby effectively lowering urban temperatures.

### 2.4.3 Improve urban planning

Urban planning and design play a crucial role. Building volume, building height, city ventilation and green coverage should all be considered in the planning stage. For example, increasing the distance between buildings can reduce the “wall effect”, enhance natural ventilation and mitigate the urban heat island effect.

# 3 Microclimate

Although Hong Kong is a small place, the climatic characteristics at a certain location may be different from those prevailing in the surrounding large area. This is due to variations in geographical locations, site environment and weather conditions at a certain time. Even in the same district, the temperature and humidity at different locations can be different. We call this phenomenon "microclimate".

Microclimate is a specific climatic condition within a small area, mainly affected by factors such as topography, wind direction, building orientation and density, etc.

Take a more prominent example, winds over roads at the city centre or the leeward side of high-rise buildings are generally weaker. Together with other factors such as traffic and heat from buildings, the aforesaid regions become stuffy and heat accumulates, leading to higher temperatures. On the other hand, temperatures over coastal or windward areas are usually relatively lower (Fig. 12). Besides, the construction materials and building density in the urban area also affect the diurnal variations of air temperatures (Fig. 13).

More Information

Smart weather: microclimate

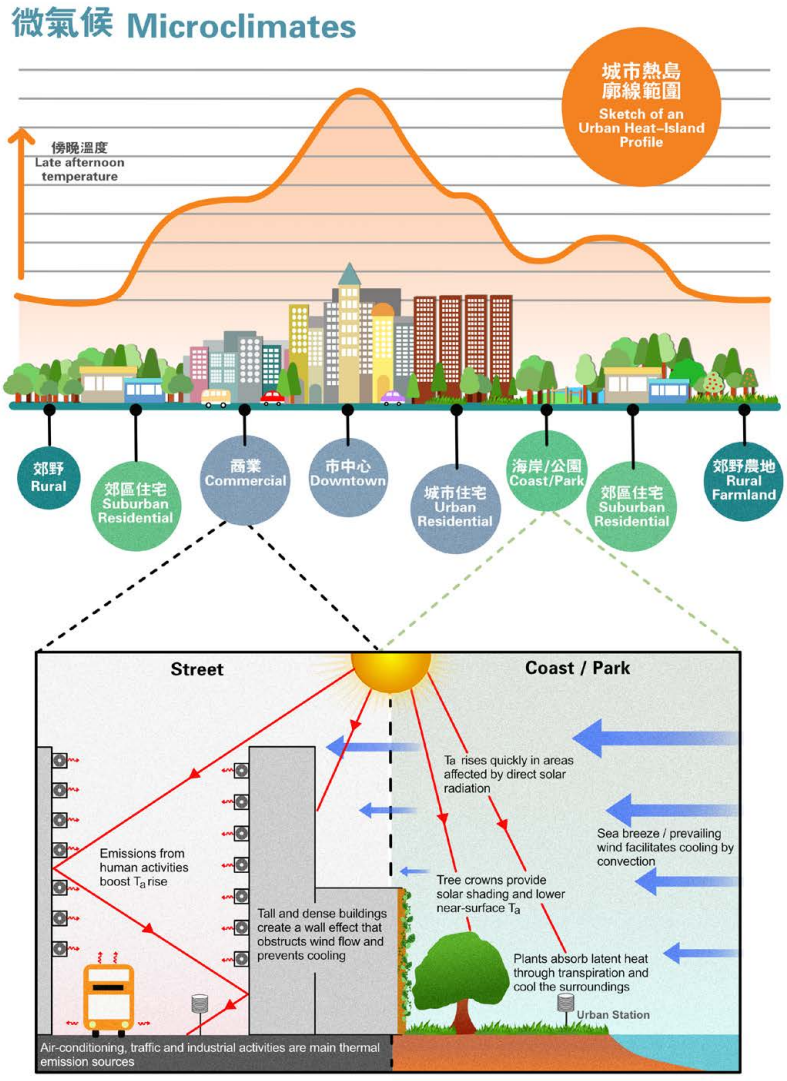



**Fig 12** Sketch of an urban heat island profile (top) ; impact of environmental factors and human activities on microclimate (bottom)
Source: HKO

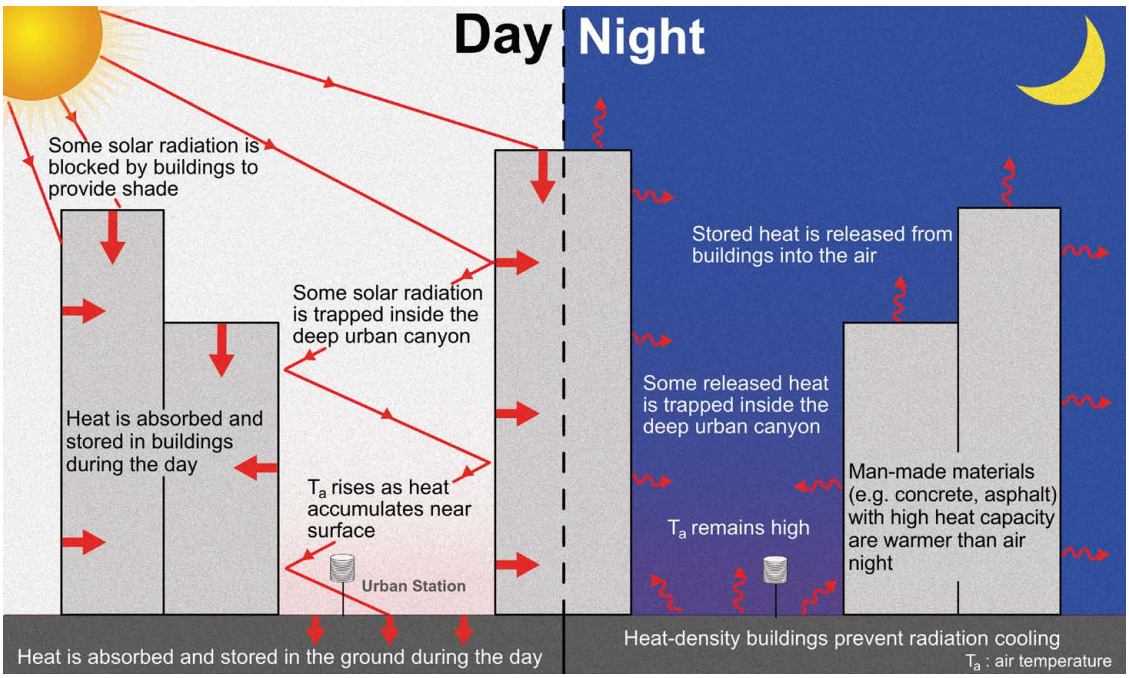



**Fig 13** The effects of construction materials and building density on diurnal variations of air temperatures.
Source: HKO

To have a better understanding of the city's microclimate for improving weather information services, Hong Kong Observatory (HKO) has set up a number of urban meteorological monitoring stations ("urban stations" in short) in various districts. While traditional weather stations (e.g. the Meteorological Garden at the HKO Headquarters) are typically set up on lawns, the urban stations are located very close to urban infrastructure and activities (Fig.14 (right)).

**More Information**

Automatic Regional Weather Forecast in Hong Kong & Pearl River Delta Region

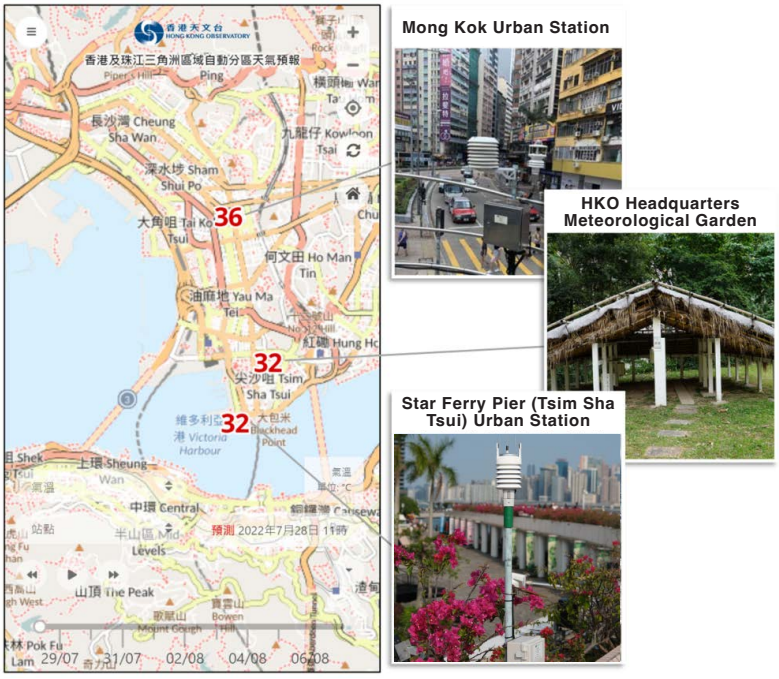



**Fig 14** Screenshot of Observatory's "Automatic Regional Weather Forecast in Hong Kong & Pearl River Delta Region" webpage at 11 a.m. on 28 July 2022 (left), showing temperatures recorded at Meteorological Garden at the Hong Kong Observatory Headquarters, the urban stations at Mong Kok and Star Ferry Pier (Tsim Sha Tsui) (right).
Source: HKO

Urban stations can collect microclimate data over the living environment of the public. For example, at 11 a.m. on 28 July 2022 (Fig. 14 (left)), the difference in temperature recorded at the Meteorological Garden in the HKO Headquarters, compared to that recorded at the urban station at Mong Kok, was as large as 4°C, although both are located in the same Yau Tsim Mong District. In addition, it was continuously sunny and very hot in Hong Kong during mid– to late July 2022. Time series traces of hourly average temperatures recorded at the HKO Headquarters and neighbouring urban stations showed significant differences in diurnal variation patterns (Fig.15). Urban microclimate studies can provide basic urban climate information to help improve town planning.

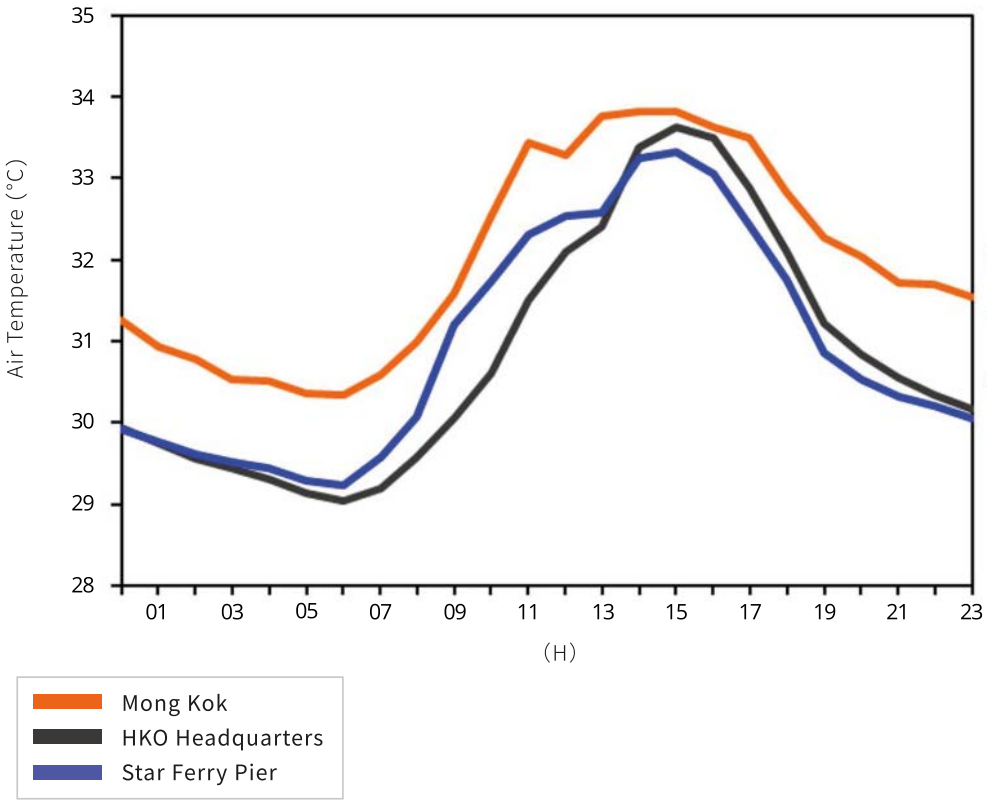



**Fig 15** Time series of the hourly average air temperature from 9 to 31 July 2022 at different weather stations.
Source: HKO

# 7.3 Chapter Summary

## How is the Climate change in Hong Kong?

### 1 Climate change in Hong Kong

The HKO has been conducting meteorological observations since 1884, providing important references for climate change research in Hong Kong.

#### Temperature rise

The annual average temperature increased significantly, at a rate of about 0.14 °C per decade between 1885 and 2024. The increase has become more pronounced in the latter half of the 20th century.

#### Changes in extreme weather

Over the past hundred years, the numbers of very hot days and hot nights have increased significantly, while the number of cold days decreased. Extreme rainfall events have become more frequent and intense. As of July 2025, the highest hourly rainfall recorded at the HKO Headquarters was 158.1mm, set in 2023.

#### Sea level rise

Mean sea level at Victoria Harbour has indicated an obvious rise. On average, the mean sea level rose at a rate of about 32 mm per decade between 1954 and 2024.

### 2 Impacts of urban development

In addition to global warming, urban development also affects the climate of a city. The climate of Hong Kong, including temperature, wind speed, rainfall, and cloud amount, is influenced by both global warming and urbanization.

### 3 Microclimate

Due to differences in geographical location and surrounding environment, distinct differences in microclimates can exist across different areas of Hong Kong. Urban meteorological monitoring stations collect microclimate data, which helps improve urban planning.