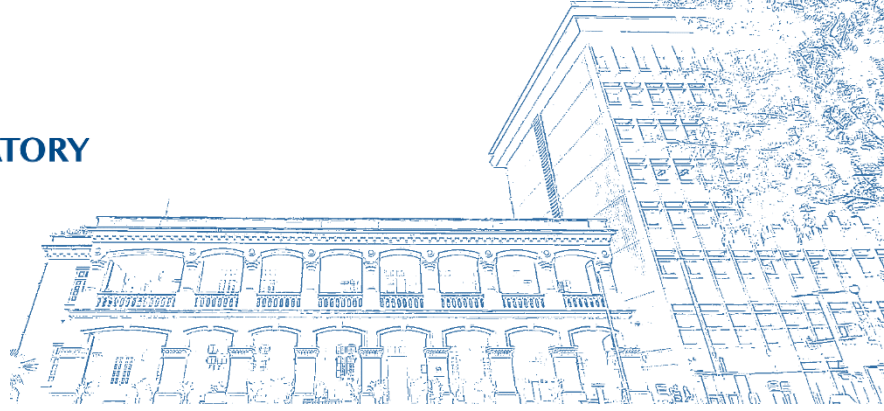


2023



## INTRODUCTION

The three main objectives of the Hong Kong Observatory (the Observatory) are:

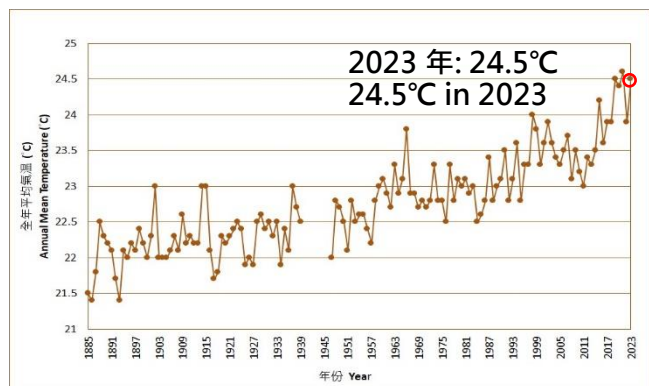
- (1) to provide weather forecasts and warnings to meet the public's demand for weather services, and to provide weather services for aviation and shipping in accordance with international standards;
- (2) to monitor local environmental radiation levels and impacts, and to advise the Government on counter-measures that may be necessary during nuclear emergencies; and
- (3) to maintain the Hong Kong time standard and to provide geophysical, oceanographic, astronomical and climatological information and consultative services to the public and business sectors.

During the financial year 2023-24, the department's total expenditure was \$444.8 million and the total revenue was \$153.4 million. As at 31 March 2024, the department had an establishment of 372 posts.

## The Year's Weather 2023



The year 2023 was one of the second warmest years on record in Hong Kong with the annual mean temperature reaching 24.5 degrees, 1.0 degree above the 1991-2020 normal. In particular, the mean temperature for summer (June to August) reached 29.7 degrees, the highest on record. There were 54 Very Hot Days, 56 Hot Nights in Hong Kong in 2023, respectively ranking one of the highest, and the second highest on record.



Long-term time series of annual mean temperature in Hong Kong (1885-2023)

Five tropical cyclones affected Hong Kong in 2023. The Hurricane Signal No. 10 was issued during the passage of Saola on 1 September. The Increasing Gale or Storm Signal No. 9 and Gale or Storm Signal No. 8 were issued during the passage of Koinu in October and Talim in July respectively.

In terms of extreme weather, September 2023 was an eventful month in Hong Kong with the strike by Super Typhoon Saola on 1 – 2 September and the phenomenal rainstorm on 7 – 8 September. Mainly attributing to the heavy rain associated with Saola and troughs of low pressure in the first half of the month, the Observatory recorded an all-time high September rainfall of 1,067.1 millimetres, more than three times of the September normal. The annual total rainfall was 2,774.5 millimetres, about 14 percent above the 1991-2020 normal.

## WEATHER SERVICES

### WEATHER SERVICES, MESSAGE DELIVERY AND SOCIAL MEDIA



**Local Weather Reports Disseminated Within the First 10 minutes of Each Hour**

**100 %**



**Total No. of Page Views of the Observatory Websites and the Mobile App MyObservatory**

**163 Billion**



**No. of Followers of the Observatory's Facebook Page**

**~ 330,000**



**No. of Followers of the Observatory's Instagram Account**

**~ 80,000**



**Forecast Accuracy as Verified by Objective Means**

**91 %**



**Calls Handled by the Dial-a-Weather Service**

**4.1 Million**



**Total Accumulated Views of the Observatory's YouTube Channel**

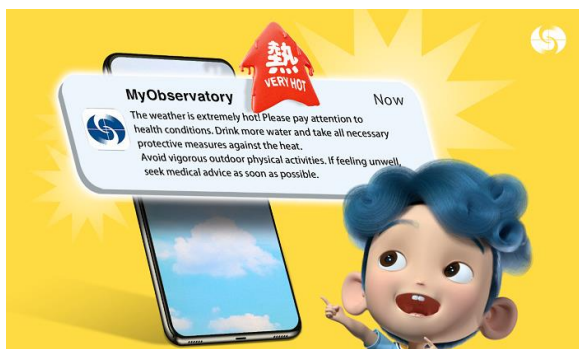
**~9.21 Million**

The Observatory provides weather forecasts and warnings to the public, special users, the shipping and aviation communities to reduce loss of life and damage to property, and to minimise disruption to economic and social activities during hazardous weather.

In 2023, the Observatory fulfilled its performance pledge of issuing at least one weather bulletin every hour of the day, disseminating 100% of the bulletins within 10 minutes after each hour, and attained a forecast accuracy (as verified by objective means) of 91%.

Weather information was enhanced in 2023-24 to meet the needs of the public through:

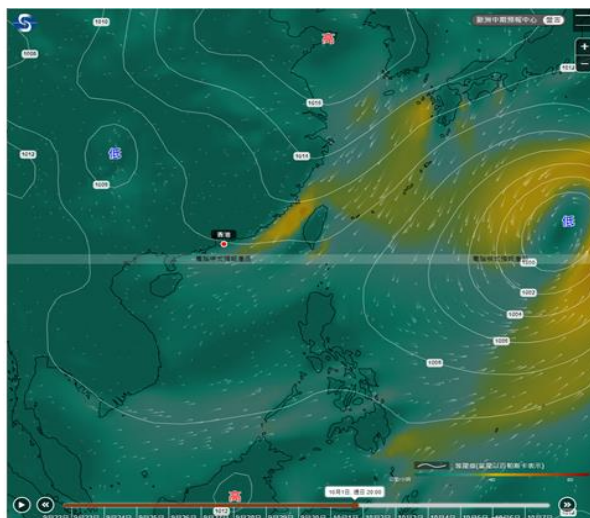
- Enhancing the Very Hot Weather Warning service with a revised set of precautionary actions and a new Special Weather Tips message to alert the general public of extremely hot weather through various channels;



“Extremely Hot Weather” Special Weather Tips during a Very Hot Weather Warning

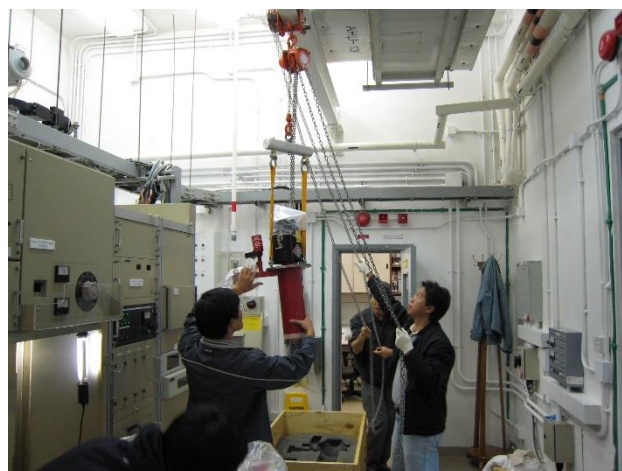
- Enriching the “MyObservatory” with forecast traffic conditions of strategic/major roads in Hong Kong;
- Enriching the “Earth Weather” on HKO website and “MyObservatory” by adding weather forecast products based on artificial intelligence-based prediction models and sea

current forecasts, as well as extending forecast range up to 15 days;



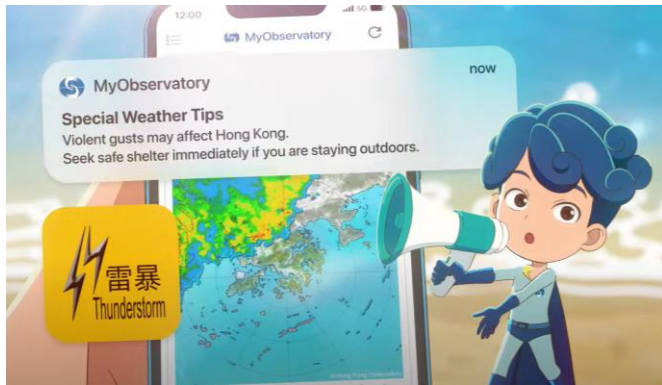
“Pangu” artificial intelligence-based prediction model

- Further enhancing the “Automatic Regional Weather Forecast in Hong Kong & Pearl River Delta Region” service with observations and automatic weather forecasts at newly added urban-scale meteorological monitoring stations;
- Installing and commissioning a replacement storm-detecting weather radar at Tai Mo Shan in support of the Observatory’s weather forecast and warning operations;



The Observatory colleagues are installing new radar components for Tai Mo Shan weather radar

- Providing assistance and technology supports to Labour Department in issuing the Heat Stress at Work Warning;
- Launching a new set of TV and radio Announcements in the Public Interest (API) on threats posed by thunderstorms; and



The Observatory launched a new TV API on thunderstorms-related hazards

- Upgrading the Observatory’s existing meteorological satellite reception systems to enable reception of the new Chinese Fengyun-4B satellite data for enhancing weather monitoring.

The Observatory makes use of the Phased Array Doppler Weather Radar to detect fast-changing high impact weather systems such as hail and waterspout, and enhance HKO’s work in monitoring and predicting high impact weather. Besides, the Observatory continuously supports other weather services as a Regional Specialized Meteorological Centre (RSMC) for Nowcasting of the World Meteorological Organization in the provision of severe weather nowcasting products, sharing of nowcast software or technique development, and capacity building activities.

During the year, the Observatory has achieved the International Organization for Standardization (ISO) 9001 certification for the provision of radar imagery services generated by the Tate’s Cairn Weather Radar System. The Observatory is also

developing a cloud-based platform to manage and process high-volume meteorological data in-situ, and to generate and disseminate forecast products in a more timely manner to support forecast operations.

In 2023, the total number of page views of the Observatory website and mobile weather application “MyObservatory” reached about 163 billion. Users can receive weather warnings and news through the Observatory’s Facebook, Instagram, X, Weibo and WeChat. The Observatory’s YouTube channel accumulated a yearly total of around 9.21 million views. PC users can install the “Weather Wizard” desktop application to obtain the latest weather information. A personalised website that allows users to customise the information they receive is also available. The Dial-a-Weather service (187 8200) handled a total of around 4.1 million calls during the year. The Observatory’s internet time service received about 100 billion visits in 2023.

Professional meteorologists of the Observatory produce and host television weather programmes which are broadcasted through major television channels in the morning and evening. Weather programme and educational feature “Cool Met Stuff” are broadcasted on television, YouTube, Facebook and the “MyObservatory” mobile application.

During the year, the Observatory continued to enhance communication and engagement with the public through social media. The Observatory’s Facebook page and Instagram account attracted around 330,000 and 80,000 followers respectively by the end of 2023.

In 2023, a total of 64 government bureaux, departments and related organisations subscribed to the services of the Observatory through the Government Weather Information Server (GOWISE). Specialised weather services were also



## Local, Regional and International Collaborations

The Observatory established the following local, regional and international collaborations in 2023-24:

### Local Collaborations



The Observatory and the Senior Citizen Home Safety Association (SCHSA) held a joint press conference in December 2023 to remind the public to prepare for changes in weather and to take care of the elderly.



The Observatory collaborated with Ho Koon Nature Education cum Astronomical Centre to organise a competition on the theme of Hong Kong's "Spring, Summer, Autumn, and Winter". The competition was held in July 2023 with participation of 200 students from 50 secondary schools.



Colleague from the Observatory attended the post-screening talks of the movie "Waterworld", co-organised by the Film Programmes Office, the Hong Kong Science Museum and the Hong Kong Space Museum. During the talk, HKO colleague presented the latest situation of climate change and future projection, as well as examining the disparity between the depiction in the movie and reality.

## Regional Collaborations



The Observatory and the China Meteorological Administration signed an updated "Arrangements for Long-term Co-operation in Meteorological Science and Technology" to further expand their scope to cover the Belt and Road initiatives and enhance Guangdong-Hong Kong-Macao Greater Bay Area cooperation.



The Observatory and the Guangdong Earthquake Agency signed a cooperation framework agreement to improve the earthquake monitoring and information services.



The Guangdong-Hong Kong-Macao Greater Bay Area (GBA) Meteorological Monitoring and Warning Center (Hong Kong) officially commenced preparation work in September 2023. This will help foster the high-quality development of meteorological services in the GBA, enhance the disaster prevention and mitigation capability of Hong Kong itself, attract excellent meteorological talents to the GBA and further promote scientific research co-operation, and provide strong weather service assurance to the GBA in creating an international first-class bay area and a world-class city cluster.



Meteorologists from the China Meteorological Administration, United Nations Economic and Social Commission for Asia and the Pacific / World Meteorological Organization Typhoon Committee, Guangdong Meteorological Service, Macao Meteorological and Geophysical Bureau, Guangxi Meteorological Service, Hainan Meteorological Service and HKO attended the 36th Guangdong - Hong Kong - Macao Seminar on Meteorological Science and Technology and the 28th Guangdong - Hong Kong - Macao Meeting on Cooperation in Meteorological Operations in Zhuhai.

A total of 31 technical reports were presented at the seminar, covering topics such as analysis of high-impact weather, forecast and observation techniques, numerical prediction, climate change, urban weather and micro-climate.

## International Collaborations



HKO and the World Meteorological Organization (WMO) updated a Memorandum of Understanding (MOU) to further strengthen meteorological cooperation. HKO will continue to develop and operate two WMO global weather information websites, support the meteorological and hydrological services in the Asian region on nowcasting hazardous weather and capacity development activities, and strongly support the WMO Voluntary Cooperation Programme (VCP) by providing a variety of meteorological training courses to WMO Members.

The Director of HKO and the Secretary-General of the WMO, Professor Celeste Saulo, signed an updated MOU to further strengthen meteorological co-operation.



The workshop was attended by 18 participants from the National Meteorological and Hydrological Services in 18 countries.

HKO organised a workshop on "Recent Advances of Severe Weather Forecast Techniques using Machine Learning (ML)" under the VCP of WMO. Hands-on practical sessions on applying ML techniques in rainfall nowcasting and artificial intelligence weather model for tropical cyclone track prediction were conducted during the workshop. Speakers also shared their experience with the participants.



HKO attended the 19th World Meteorological Congress in Geneva, Switzerland to discuss the direction and the strategy of meteorological work worldwide. During the Congress, HKO renewed the MOU with the Thai Meteorological Department to further strengthen meteorological collaboration.



HKO signed agreements with overseas official meteorological services, including the Agency for Meteorology, Climatology and Geophysics of the Republic of Indonesia and Papua New Guinea National Weather Service to strengthen meteorological cooperation on data exchange, technologies in weather forecasting as well as safety and efficiency of international civil air navigation.



## Public Education

In 2023-24, the Observatory continued to promote awareness of high-impact weather, the impacts of climate change and the Observatory's services through public education. Noteworthy activities include:



The Observatory organised a series of publicity activities in celebration of the 140th anniversary of HKO, including launching a thematic webpage, publishing a book "Stories under passing storms", producing a special series of educational videos and a feature programme "Time Travel Climate Mission" jointly with the Radio Television Hong Kong, to promote HKO's services and to raise public awareness on climate change.



The Observatory organised an online "Tropical Cyclone Name Collection Activity" to identify additional suitable names with Hong Kong characteristics, and raise public awareness and knowledge of hazards caused by tropical cyclones.



The Observatory organised a weather observation public course in October and November. During the course, participants gained a basic understanding of weather observation and its applications. The participants could even have practical experience in taking weather observations and coding weather reports.



The Observatory organised HKO Open Day in March 2024 together with the Online Open Day. The Open Day enhanced public understanding of HKO services and raised public awareness on the risks associated with the extreme weather under climate change.

The Observatory organised educational events and outreach activities to engage the public, in particular young people and students, through the ‘Science in Public Service Campaign’, the ‘Public Course on Weather Observation’, the ‘Community Weather Information Network’, and participated in the ‘InnoCarnival 2023’ organised by the Innovation and Technology Commission, which included workshops, scientific talks, practicals, day camp, quiz competition, guided tours to the Observatory’s facilities. HKO also conducted public talks, interviews and training courses as well as producing TV weather programmes and educational materials on hazardous weather phenomena.

## **RADIATION MONITORING AND ASSESSMENT**

The Observatory monitors ambient radiation levels in Hong Kong and conducts radiological measurements on air, soil, water and food samples. In the event of a nuclear emergency, the Observatory will notify and advise government departments on the possible consequences in Hong Kong and recommend protective action. HKO organises training and exercises on radiation monitoring, assessment and protection for other government departments involved in the Hong Kong contingency plan for nuclear emergencies. The work involves:

- Operating a network of radiation monitoring stations, an aerial radiation monitoring system, two radiological survey vehicles, a radiation laboratory and an emergency radiation data management system;
- Keeping abreast of the latest development on the methodology for nuclear accident consequence assessment; and
- Planning and participating in exercises and drills in response to nuclear emergencies.

In 2023–24, all radiation monitoring and assessment work was carried out satisfactorily. All equipment was maintained in a state of readiness. The Observatory Exercises, drills and training on radiation monitoring, assessment and protection were conducted. In response to the discharge of nuclear-contaminated water from Fukushima of Japan, the radiation monitoring of sea water samples in local waters was enhanced and the measurement results were disseminated to the public on a new webpage. Outreach activities such as public and school talks were conducted to enhance public education. The school community ambient radiation measurement programme named “Gamma-Go” continued to promote students’ understanding of radiation through STEM activities.

## **TIME STANDARD, GEOPHYSICAL AND CLIMATE SERVICES**

The Observatory maintains the Hong Kong time standard, provides time signals for the public and contributes to the International Bureau of Weights and Measures for the determination of the universal standard time. It provides geophysical, oceanographic, astronomical and climatological information, climate projection, seasonal and annual forecast to meet the requirements for planning, engineering design and environmental impact assessments. It monitors earthquakes and the sea level and releases related information to the public, including the operation of the tsunami warning system. It also keeps abreast of research and development on international issues such as global climate change and advises the public and government bureaux/departments on the likely implications. The work involves:

- Maintaining a network of caesium beam atomic clocks as the Hong Kong time standard and providing time signals for radio

broadcasts, automatic telephone answering service and synchronisation of clocks via the Internet;

- Operating seismological, tide and sea level monitoring networks and conducting related analyses;
- Carrying out real-time exchange of seismic data with overseas centres and disseminating earthquake information by various means;
- Compiling climatological and other related data;
- Conducting studies on climate change in Hong Kong and promoting public understanding; and
- Providing updates on the effects of El Niño, La Niña and other longer-term atmospheric phenomena on Hong Kong.

Initiatives undertaken in 2023-24 include:

- Providing scientific support to studies by relevant government bureaux/departments on the mitigation, adaptation and resilience-building measures required in combatting climate change and its impacts including extreme weather events;



Guangdong Meteorological Service, Macao Geophysical and Meteorological Bureau and Hong Kong Observatory jointly compiled the “Guangdong-Hong Kong-Macao Greater Bay Area Climate Bulletin 2022” (Chinese version only). The bulletin covers the climate status of the Greater Bay Area in 2022, as well as major weather and climate events.

- Monitoring climate change-related scientific studies, and provided the latest assessment of climate change and its impacts, as well as enhanced and updated climate projections to support policy making and action planning of relevant government bureaux/departments; and
- Promoting public understanding and awareness of climate change and its impacts through conducting school talks, participating in public fora, launching online quiz games, producing educational videos, and publishing articles and latest international research findings on global climate change on the HKO website.

## PUBLIC OPINION SURVEY

In the public opinion survey conducted in 2023, the public considered that on average 78% of the weather forecasts issued by the Observatory were accurate, and gave an average score of 7.6 to its overall service.

## AWARDS WON BY THE OBSERVATORY

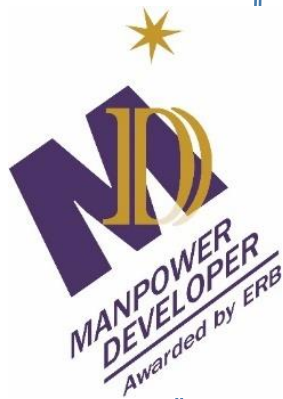
The Observatory won a number of awards in 2023-24:



The Cool Met Stuff episode "Carbon Multiverse" and "Flooding can occur even during Amber rainstorms (Part 1 and 2)" produced by the Observatory won the third prize in the short video category and the professional category of the 2023 China Science Film and Video "Kelei Cup" respectively. The "Kelei Cup" is known as the highest award for science film and video in China. This award recognises the Observatory's efforts in promoting science education.



The Observatory was awarded the Smart Mobility Award (Smart Transport) Bronze Award of the Hong Kong ICT Awards 2023 and the Best IoT Innovation Award in the 13th Guangdong-Hong Kong IoT Competition for its project "Estimation of Standing Water Conditions at Airport Runways".



The Observatory was awarded as a "Manpower Developer" for the eighth year in a row, with validity of two years, to recognise its ongoing efforts and achievements in nurturing and development of talent.



The Observatory has been awarded the Certificate of Merit for the eleventh time in the The Hong Kong Awards for Environmental Excellence under the Public Services Sector, which recognises its contributions to environmental protection.

## OUTLOOK

The Observatory will continue to enhance its services in the following aspects in 2024-25:

### Weather Services

- Continue to provide weather forecasts, regional weather services and extended weather outlook, including multi-hazard and impact-based forecast;
- Continue to develop and enhance nowcasting and forecasting services on high-impact weather for the public and special users;
- Enhance dissemination of weather information to the public by conducting media briefing hourly with a video about the latest weather condition when Black Rainstorm Warning Signal is in force, and issuing “Special Weather Tips” to alert the public if the hourly rainfall is significantly higher than the threshold criteria (70 millimetres per hour) of the Black Rainstorm Warning;
- Explore better utilisation of technologies such as big data and artificial intelligence to further enhance the risk assessment capability of government departments on hazards such as flooding in the event of extreme weather conditions;
- Continue to implement the aviation meteorological facilities in support of the full operation of the Three-Runway System project of the HKIA;
- Procure and install more low-level windshear and turbulence detection equipment at the HKIA to support its future development;
- Continue to enrich the content of the mobile weather application “MyObservatory” and HKO website, and enhance the HKO chatbot

with voice function;

- Continue to enhance marine meteorological observations through the deployment of buoys, both drifting and moored over the South China Sea, and installation of meteorological equipment onboard merchant and fishing vessels;
- Continue to enhance the nowcast products and provide support for other weather services under the RSMC for Nowcasting;
- Continue to enrich the “Earth Weather” webpage on HKO website with more weather forecast products based on prediction models;
- Continue to implement the numerical weather prediction models on the high performance computer system in support of weather forecast operation;
- Continue to develop the cloud-based platform for managing meteorological data and generating products; and
- Establish a virtual training centre to strengthen co-operation on the provision of training for the meteorological personnel of the Belt and Road countries.

### Radiation Monitoring and Assessment

- Implement the agreed arrangements between Hong Kong and Guangdong on radiation monitoring and assessment;
- Conduct drills, exercises and communication tests on emergency response in conjunction with other government departments as well as the relevant Guangdong counterparts;
- Organise training on radiation monitoring and assessment;

- Take forward the enhancement of radiation monitoring and assessment facilities; and
- Further promote outreach activities and the Gamma-Go programme to enhance public education on radiation.

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**Time Standard, Geophysical and Climate Services**

- Undertake and support monitoring and assessment of earthquake, tsunami risk and sea level in the region;
- Enhance its earthquake monitoring and tsunami warning capability;
- Enhance earthquake monitoring and information service by setting up a new network of earthquake intensity meters over the territory;
- Strengthen the tide gauge network to better cope with extreme sea level conditions;
- Monitor and study climate change issues, enhance climate projections, as well as provide relevant government bureaux/departments with latest information and assessment of climate change and its impacts to support their studies;
- Engage various stakeholders to promote the effective use of climate data in support of the emerging needs of different sectors and government bureaux/departments; and
- Conduct outreach activities to promote public understanding of measures required in combatting climate change.