

## Accelerating Climate Action: Strengthening TMD's Urban Climate Services and Expertise

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To effectively integrate climate change considerations and climate action—both mitigation and adaptation—into national and sub-national planning processes, reliable climate data and information, including historical records and future projections, are essential. These data serve as a foundation for understanding climate trends, their underlying causes, and potential impacts. Climate services, therefore, play a critical role in providing the necessary data and information to support informed decision-making at various levels.

However, given the complex interactions between climate change impacts and urban environments, a comprehensive range of data is required. This includes climate, environmental, socio-economic, demographic, and human activity-related information, all of which are essential for assessing the situation and addressing climate challenges effectively.

On 4-5 February 2025, the Urban-Act project organised a workshop on Integrated Urban Hydrometeorological, Climate, and Environmental Services (IUS) in collaboration with representatives from the World Meteorological Organization (WMO) and international experts. The workshop aimed to enhance the capacity of staff at the Thai Meteorological Department (TMD)'s Climate Center. Additionally, the workshop facilitated discussions on strategic collaboration within the project to enhance climate monitoring, prediction, and modeling. It also focused on improving the development of tailored climate services and products for the urban sector.

In the session, *Dr Sara Basart, Scientist Officer from Science and Innovation Department, WMO*, provided a brief key concept of the IUS. Development of climate services always start from application perspective with a question of “What is the service that needs to be provided and to which sector? Then input data shall be identified according to the specific indicators for each priority hazard in those sectors. Therefore, Climatologists or meteorologists need to work closely with sectoral stakeholders in defining a clear definition of hazards, identifying impacts, as well as determining hazard indicators and threshold value for early warning.

Dr Sara also emphasised an importance of good quality observation data (or historical weather data) which is the foundation for forecasting (from hours to days), prediction (from weeks to decades), and project (from decades to centuries). In particular at the urban or city scale, high-accuracy and good-quality of input data is required for developing hazard maps and early warning at the city-scale.

Additionally, in order to translate hazard into risk, not only climatological data required but also sectoral specific socio-economic data collected by different agencies also needed to define exposure and vulnerability of system. Therefore, the partnership between meteorological agencies and sectoral stakeholders needs to be established to strengthen this collaboration. Several case studies of partnership for developing climate services are also explained in the session.

## Hong Kong – An experience from a high-density city

Hong Kong is recognised as a city with high-rise building density (60-meter average building height), and high population density (approximately 6,000 people per square kilometer). Hong Kong has also experienced many climate-related disasters, like typhoon, heavy rainfall, and landslide. To cope with this disaster, *Dr Chao Ren, Associate Professor from School of Architecture, the Chinese University of Hong Kong*, explains how the IUS works through Hong Kong case study.

The Hong Kong Observatory (HKO), the meteorological authority in Hong Kong, provides wide range of climate information and products including weather and air quality forecast, warning and advisories for high impact weather, as well as climate prediction and projection through different platforms such as HKO's website, the "MyObservatory" mobile application, TV, radio, newspaper, and social media. The weather and climate services in Hong Kong focus on five priority areas, including energy, public health, water, urban and building environment, and agricultural activities. Some examples of urban-focused weather and climate services are also highlighted.

### **Energy:**

The "9-day Energy Forecast", an online service, developed by HKO and CLP Power Hong Kong Limited, a local power company, to estimate the future energy consumption using the 9-day weather forecast. This information could lead to timely energy saving measures.

### **Infrastructure design and disaster risk reduction:**

Special climate services are also developed closely with different engineering departments to support the design standard and codes of practices to withstand natural disasters, such as code of practice on wind effect, design of drainage system considering climate information, resilient port work design coping with sea level rise and storm surge, and coastal facilities to protect the city from sea flooding.

### **Urban and building environment:**

Climate data and information, in particular urban climate information, provided by HKO are integrated into different urban planning and design, such as the New Town Planning in Hong Kong which considers air ventilation in the city, and a territorial spatial development strategy called Hong Kong 2030+ highlighting climate implementations in the urban development.

### **Public health:**

To enhance elderly caring service, HKO collaborates with the Senior Citizen Home Safety Association (SCHSA) in utilising weather and climate information to understand weather situations affected the caring service. This collaboration is well-recognised as one of WHO-WMO's case studies of climate services for health.

Based on the monitoring of local climate situation in Hong Kong, the number of very hot days (maximum temperature  $\geq 33^{\circ}\text{C}$ ) and hot nights (minimum temperature  $\geq 28^{\circ}\text{C}$ ) increased. Additionally, the annual temperature is expected to rise about 1.5 to 3.5 $^{\circ}\text{C}$  by the 21<sup>st</sup> century. Therefore, HKO has been collaborating with partners on heat health study, as

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well as providing heat related advisory, alerts, and warning to the public. The Very Hot Weather Warning system has been recently updated to have 3 (three) alert levels, which include “very hot ( $\geq 33^{\circ}\text{C}$ )”, “prolonged heat (a few days of very hot day or hot night)”, and “extremely hot ( $\geq 35^{\circ}\text{C}$ )”. Then the Hong Kong Red Cross will take further action.

Additionally, Dr Chao also shared some future plans to improve the weather and climate services in Hong Kong such as increasing urban weather and environmental monitoring network for high density city, developing impact-based and risk-based weather services collaborating with sensitive stakeholders, and embracing social media, big data, and innovative technologies.

At the end of presentation, Dr. Chao highlighted importance of the development of climate-partnership in order to use as collaboration platform for developing, improving, and disseminating climate services and products.

### **Public-Private Engagement in climate service development in China**

Dr Chao shared a good case study of the Public-Private Engagement for Smart Meteorological Services in Mega-Cities (PPE-SMSC) project developed by China Meteorological Administration (CMA), Hong Kong Observatory (HKO), and Macao Meteorological and Geophysical Bureau (SMG). This pilot project launched in 2021 to explore the PPE model in developing integrated urban meteorological services in WMO Regional Association (WMO RA) II. For the collaboration, over 35 key stakeholders from diverse sectors, such as government departments, enterprises, academic institutes, and individuals have been involved in this project.

The key objectives are to share gridded meteorological data through PPE mechanism, and to collaboratively develop disaster risk early warning systems, urban climate impact assessment, and risk-based forecasting systems, which also contribute to the Early Warnings for All (EW4All), WMO’s initiative.

After 4 (four) years of implementation, many urban climate services, including its applications, have been developed through collaboration between meteorological offices and various stakeholders, such as:

- **“High-density and high-frequency gridded meteorological dataset”**, obtained through a dense local observation network, has been shared to different governments, enterprises, research institutions.
- Shenzhen meteorological office worked closely with disaster prevention department to build an effective **“People-centered Multi-Hazard Early Warning System (MHEWS)”**, starting from collecting risk data to create critical threshold index, until establishing progressive forecast and early warning service strategy.
- **“Warning bell”**, a tailored early warning information dissemination service made for students and their parents on the WeChat platform, has been jointly developed with software company and education authorities.
- **“Metro Precision Meteorological Service Platform”**, a service providing real-time weather information, issuing current disaster risk assessment, as well as emergency response instruction

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- Shenzhen meteorological office worked with planning department to develop "**Shenzhen's ventilation corridors**", as well as applying at a city scale to solve urban heat island issue.
- "**Risk-based Storm Surge Forecast services**" has been developed by HKO using Numerical Weather Prediction (NWP) ensembles to create risk matrix, as well as formulating action plan for different risk level.
- SMG developed "**Flood Alert Service**" using 2 (two) machine learning (ML) models, as well as promoting understanding of publics on different flood severity stickers.

Lastly, enabling policies to attract and support multi-stakeholder participation in developing the IUS are highlighted. Dr Chao provided examples of enabler, including "**Shenzhen Meteorological Service Regulations**" outlining rights, obligations, and responsibilities for parties, "**information sharing platform**" enabling information flow among stakeholders, "**industry-university-research cooperation**" establishing technology innovation labs, and "**public feedback system**" getting opinions and suggestions to improve the services.

After the two-day workshop, representatives from the WMO took the opportunity to engage with other Urban-Act project partners, including the Economic and Social Commission for Asia and the Pacific (ESCAP) and the Asian Disaster Preparedness Center (ADPC) from the Urban Resilience Building and Nature (URBAN) project under the IKI. These discussions aimed to enhance alignment of activities and foster stronger collaboration to better support the Thai Meteorological Department (TMD) in the future.