



Impacts of Climate Change and Extreme Weather Events on Hong Kong

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2018 began with record-low sea ice extents in the Arctic and also globally in January. The global warming trend continued with 2017 set to be in the top three hottest years, i.e. the three hottest years on record, 2015, 2016, and 2017, occurring in a row. The global average temperature for 2013-2017 is likely to be the highest five-year average on record. The atmospheric concentration of carbon dioxide, the single most important greenhouse gas and the main driver of climate change, soared to a record high of 403.3 ppm in 2016.

Accompanying the warming trend are the increases in extreme heat and extreme rainfall events, as well as rising sea level. The observed climate trends in Hong Kong are basically consistent with the trends observed globally. With a shift of the climate normal to the warm side, the chance of heat extremes has increased. A warmer atmosphere with higher moisture-holding capacity fueled by additional evaporation from warmer oceans will enhance the chance of heavy downpours. In the “business-as-usual” scenario where carbon emissions continue unabated, the projected annual maximum daily rainfall and annual maximum 3-day rainfall in Hong Kong could exceed their corresponding climate normals by 20% and 50% respectively. As such, the risk of flooding and landslides is expected to increase correspondingly. Ocean warming and melting land-based ice sheets and glaciers will lead to rising seas. In the same “business-as-usual” scenario, a mean sea level rise of up to about one metre in Hong Kong and adjacent waters is expected by the end of the 21st century. A rising sea level will enhance the chance of coastal flooding and the threat of storm surges brought about by tropical cyclones, as illustrated by the damages in the Pearl River Estuary caused by Super Typhoon Hato in August 2017. The situation could be made even worse in the future with the likelihood of more intense typhoons fueled by warmer oceans.

Facing the hazardous threats posed by climate change, the Hong Kong Observatory looks forward to working closely with government departments, stakeholders and the community to make Hong Kong a weather-ready and climate-smart city through mitigation, adaptation and resilience measures. In this presentation, the latest situation of climate change in the global and local contexts and the impacts of extreme weather events on Hong Kong will be reviewed, including the impacts of Hato and the lessons learnt. We will also look at the future climate in Hong Kong in the context of a warming world and the challenges that lie ahead.



Experience and Wisdoms of Fighting Flooding Challenges from Climate Change and Extreme Weather Events

Prof. Chris ZEVENBERGEN, Water Engineering Department of IHE Delft, the Netherlands

Flooding is one of the most common and destructive natural perils. Many of our most densely populated areas are in coastal zones and in river catchments prone to flooding. Sea-level rise, economic development, and increased frequencies and intensities of storms will require that we continuously invest in adapting our flood risk management (FRM) systems, including flood protection infrastructure such as levees and dams and urban drainage systems.

Adapting to a changing risk of flooding presents a major policy challenge as the upfront costs are high and immediate and the benefits in terms of flood protection are uncertain and possibly far off in the future. Traditional FRM approaches are typically a result of reactive responses to flood disasters and are biased toward quick wins driven by political pressure to “do something.” Moreover, they are often based on static assumptions about long-term probabilities aimed at optimality and economic efficiency with uncertainties implicitly accounted for through safety factors and other allowances. These approaches often encompass large-scale engineering responses. The sustainability of these infrastructure systems is currently under pressure as they are not sufficiently resilient to respond appropriately to slowly changing drivers and shocks (designed for failure). In addition, in the developed world, flood protection infrastructure is aging and reaching its design capacity. Although aging infrastructure poses a risk, it also provides opportunities, such as to correct old mistakes and introduce new technological and management approaches to adapt these systems to changing conditions and enhance their overall resilience. In this presentation, some guiding principles will be presented that could help drive future-proofing FRM approaches, as well as the underlying pressures that create incentives for cost-effectiveness, while maximizing robustness. It is inspired by the recent Dutch history in managing flood risk, as the Dutch are setting the stage for an integrative, adaptive, and synergic approach.



Coastal and Fluvial Defence around Pearl River Estuary: Strategy for Climate Preparedness

Prof. WU Xiaoming, Deputy Chief Engineer, The Pearl River Hydraulic Research Institute

珠江河口經濟總量最大、河口形態最複雜、生物多樣性最高、開發與保護問題最多。近年來，珠江河口各種複雜的水問題，已引起國內外河口學者的關注。隨著粵港澳大灣區城市群協調發展，提升為國家發展戰略，珠江河口將迎來新的發展。

主要介紹珠江河口演變發展、近期熱點問題；珠江河口不同時期防洪重點與規劃思路，近期河口治理實施工程；極端氣候變化環境下，颱風情況及其應對。

珠江河口相關大型工程案例研究分享：港珠澳大橋、廣州南沙港、珠海港等。



The Opportunity of Tackling Climate Change – The Green and Blue Space Conceptual Framework under Hong Kong 2030+

Ms. Phyllis LI, Deputy Director of Planning/Territorial, Planning Department

“Extreme weather events” are listed as the highest environmental risk in the “Global Risks Report 2018” of the World Economic Forum. Hong Kong also experienced the highest recorded temperature in August 2017. The Government is making strenuous efforts to tackle climate change on various fronts including the promotion of climate resilient development through responsive town planning, such as biophilic design and low-impact-development. One of the important roles of town planning is to optimise the symbiotic relationship between different components of the city, taking care of the needs of the people, environment and nature. This is an integral part of Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030 (Hong Kong 2030+). To better prepare for a sustainable future, Hong Kong 2030+ not only provides a spatial framework to guide the future planning, land and infrastructure development and the shaping of the built and natural environment of Hong Kong beyond 2030, but also advocates the proactive enhancement and regeneration of our environmental capacity including the green and blue assets for the benefits of climatic resilience, biodiversity, nature and the community. The Hung Shui Kiu New Development Area and the Yuen Long South Development will be used as examples to illustrate the application of these concepts.



Sponge City Development and Progresses in Mainland China

Prof. CHE Wu, Beijing University Of Civil Engineering And Architecture

報告基於大陸海綿城市建設的背景，簡要介紹海綿城市試點建設推進的總體情況；闡述海綿城市的系統構成和幾大主要目標；強調海綿城市的核心主要由四大子系統構成，同時也指出海綿城市各子系統及主要相關專業之間合理銜接的重要性；梳理海綿城市建設實踐中的主要工程體系，並結合某試點城市的具體案例，強化分析上述內容。



Urban Surface Water Management - International Experience and Best Practice

Ir. Dr. David GALLACHER, Executive Director, Environment Hong Kong, AECOM

For much of the history of cities, urban surface water management has been strictly utilitarian. Drainage systems have been design to convey rainfall quickly and directly to receiving waterbodies, increasing pollution loading and causing flood management issues downstream. Rivers and streams have been used for wastewater disposal; and straightened, deepened and lined with concrete to aid navigation and reduce flood risks. Furthermore, water has been abstracted from lakes and rivers to meet potable/non-potable demand, impacting biodiversity resources and hydrological functioning. Little consideration has been given to the aesthetic, ecological or social aspects of urban surface waters.

This trend has been reversed in many cities over the last few decades, with river and lake restoration projects improving surface water quality, increasing biodiversity, and revitalizing waterfronts through the creation of parks, public spaces and other developments. Furthermore, drainage and flood management are being considered as part of a more holistic planning framework, with low impact development and sponge city concepts incorporated into urban and landscape design.

In this presentation, we will review changing attitudes and approaches urban surface water management, illustrated with case studies. This review will be followed by an analysis of current conditions in Hong Kong, and how best practices can be applied in a local context.



Sponge City Rollout and Deployment in Southern China

Mr. ZHU Jialin, 廣東華禹生態智慧城市水資源研究院院長、華南海綿城市與水生態產業創新聯盟理事長

珠三角城市群是中國經濟發展強大引擎，但是作為河網地區及臨海城市所面臨的一個重要問題是常有的颱風等帶來的強降雨，尤其是與颱風同時出現的高潮位所引起的洪澇、反灌等水患災害，對百姓的生命財產帶來巨大的威脅。

針對臨海城市及三角洲雨季常有的強降雨所引起的洪澇等災害以及周圍河道狹窄，水位變幅過大，難以建設高標準的實體堤岸的問題。作為這一類問題的解決手法，首先是如何採用一種新型子堤與實體堤防有效結合來建設高規格的防洪設施，然後是如何建設簡易可靠的排澇及蓄洪系統。



Building Flood Resilience for Adaptation to Climate Change and an Application Trial in Hong Kong

Ir. LAU S. C., Edwin, Chief Engineer/Land Drainage, Drainage Services Department

Climate change has brought more extreme weather conditions to Hong Kong and its impact to our drainage system could be substantial. Building flood resilience in the drainage infrastructure becomes more important in this ever changing world. To improve the city's flood resilience, the Drainage Services Department is actively promoting the "Blue-green Infrastructure" concept, which aims to simulate the natural water cycle through infiltration, evaporation and transpiration to capture rain, control flood at source and reuse stormwater collected.

In various new development areas, the Drainage Services Department is actively collaborating with other government departments to plan and design a wide variety of blue-green infrastructures in the early stage. Using the project "Development of Anderson Road Quarry Site" as an example, the blue-green infrastructure includes the co-use of flood attenuation lake and public open space, re-use of rainwater, wider application of sustainable drainage components of porous pavement and bioswale, and the pilot use of grey water treatment system in district scale with a view to promoting water friendliness and aligning with the latest design intent of Anderson Road Quarry as a smart, sustainable and low carbon new developed areas.



Climate Change - Water Resilience Development of Hong Kong

Mr. CHUNG Siu Wing, Joseph, Chief Engineer / Development (2), Water Supplies Department

Water rationing is not uncommon in the old days of Hong Kong. The Water Supplies Department has succeeded in developing a three-pronged water supply system, comprising local yield, imported Dongjiang water from Guangdong Province and seawater for toilet flushing, which supported our thriving economic development in the past decades. In the face of climate change and increasing yet competing demand for water resources in the Pearl River Delta region due to continued population and economic growth, we have embarked on the Total Water Management (TWM) Strategy in 2008, emphasising on containing the growth of water demand by conservation and developing new water resources to strengthen our water resilience and preparedness of the challenges ahead. The presentation will cover the ongoing efforts of the Water Supplies Department in these aspects.