

Opportunities in land surface modeling for Hong Kong and Southeast Asia regions

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Hong Kong University of Science and Technology



- 5 schools,
- ~800 faculty members,
- ~20,000 students from 80 countries



- Coastal
- Sub-tropical forests
- Building

Hong Kong

Land area: 1,104 km²; Population: 7.2 million; Pop density: 6,500/km²



(Video) HK hit with record-breaking rainfall in 139 years, traffic halts as roads turn into rivers

Local | 8 Sep 2023 1:28 am



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Hong Kong society

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Hong Kong / Society

Hong Kong government's response to 16-hour black rainstorm deemed 'too little, too late' as critics urge full review of emergency system

- Public and lawmakers attack government handling of crisis caused by 'once-in-500-years' rainstorm that paralysed parts of city
- Lawmakers and analysts say review of emergency capability needed and that administration would have no excuses for being caught off guard again

Listen to this article



Natalie Wong + FOLLOW

Published: 9:00am, 9 Sep 2023

Climate Change and Extreme Weather Events are Causing Substantial Harm and Suffering

48 dead after highway road collapses in south China's Guangdong, rescue operations on

Beijing • Edited By: Apoorva Sharma • Updated: May 02, 2024, 03:03 PM IST



Published: 13:14, April 29, 2024 | Updated: 20:56, April 29, 2024

Heat wave in Southeast Asia closes schools, triggers health alerts

By Reuters

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148 wildfires extinguished in Alberta in 2024 so far, 50 still burning

A man cools-off along a street to relieve from hot temperatures in Manila, Philip,
(PHOTO / AP)

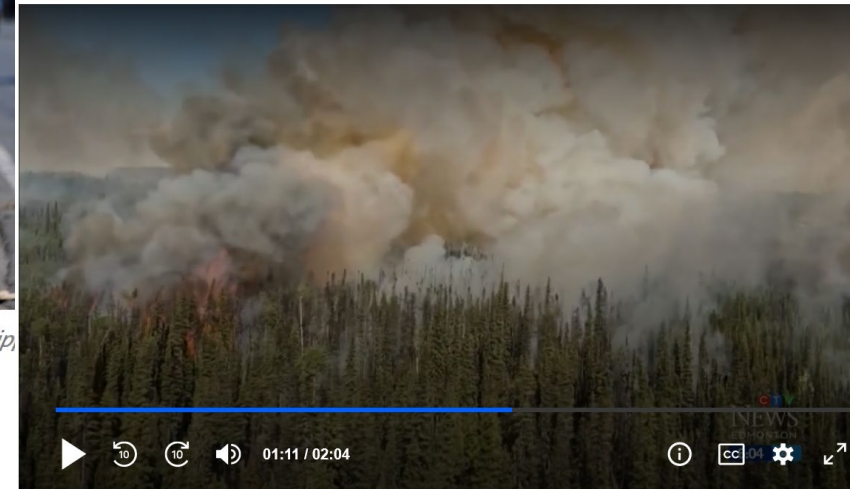


Rescuers work at a collapsed section of the Meizhou-Dabu Expressway in China's Guangdong province
Photograph:(Others)

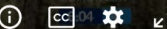
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The United Arab Emirates experienced its heaviest downpour since records began in 1949, Dubai's media office said in a statement. Christopher Pike / Bloomberg via Getty Images

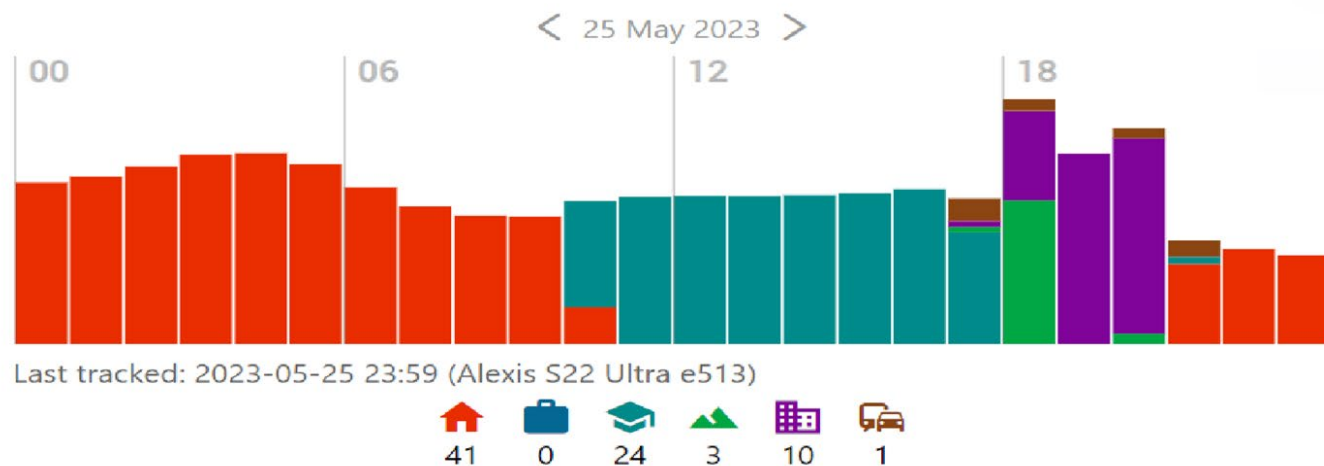


01:11 / 02:04



HKUST long-standing Air quality, Climate, and Sustainability R&D

- Air Quality & Health (25 years of research experience)
- Personalized Real-time Air-quality Information System for Exposure for Hong Kong (PRAISE-HK)



3km x 3km city block

First mobile app providing users with their personalized air exposure budget throughout their day, to alert them of upcoming pollution episodes, to advise what they can do to reduce exposure health risks.

HKUST long-standing Air quality, Climate, and Sustainability R&D

Climate Adaptation and Resilience (CARE, care.hkust.edu.hk)

engaged top-level decision-making, regulatory, managerial, finance, academic, professional, philanthropic, education, communication, and community leaders

... a groundbreaking initiative to ensure that everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027.



Early Warnings for All



Disaster Risk Reduction



Disaster risk knowledge

Systematically collect data and undertake risk assessments

- Are the hazards and the vulnerabilities well known by the communities?
- What are the patterns and trends in these factors?
- Are risk maps and data widely available?

World Meteorological Organization



Detection, observations, monitoring, analysis and forecasting of hazards

Develop hazard monitoring and early warning services

- Are the right parameters being monitored?
- Is there a sound scientific basis for making forecasts?
- Can accurate and timely warnings be generated?

Preparedness and response capabilities



Build national and community response capabilities

- Are response plans up to date and tested?
- Are local capacities and knowledge made use of?
- Are people prepared and ready to react to warnings?

International Federation of Red Cross

Warning dissemination and communication



Communicate risk information and early warnings

- Do warnings reach all of those at risk?
- Are the risks and warnings understood?
- Is the warning information clear and usable?

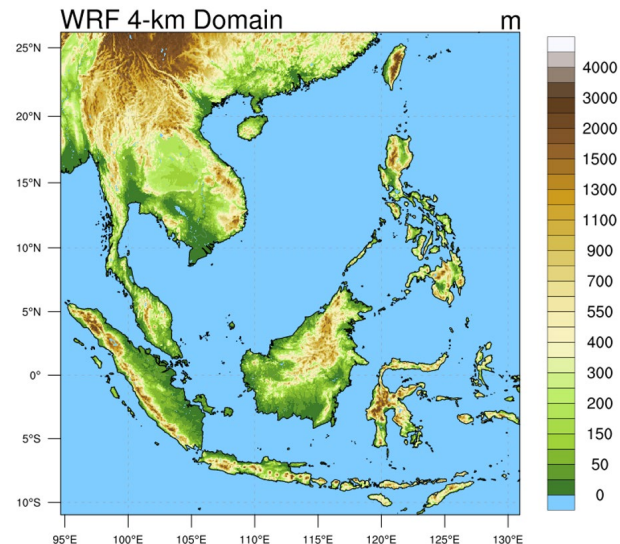
International Telecommunication Union

HKUST cross-scale human-nature integrated modeling framework

MPAS-based multi-hazard warning systems for Hong Kong and Southeast Asian megacities based



Global Scale
100 km
resolution



Continental scales
4-km resolution



City Scales



Farm Scales



Neighborhood and
Building Scales
< 100-meter
resolution

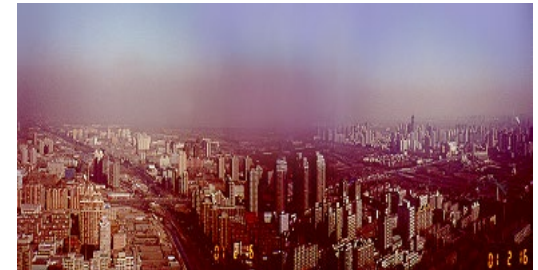


WORLD
METEOROLOGICAL
ORGANIZATION

World Weather Research
Programme Implementation Plan
2024-2027



- Improve urban-scale minute-to-season prediction and warning systems and exposure to weather-related hazards, risks, and threats to create sustainable cities
- Enhance observations in the urban atmospheric boundary layer
- Engage stakeholders, governments, communities to improve city resilience



Challenge in land-surface modeling

- Most models does not perform well in tropical regions
- Effects of Asian megacities on extreme weather
- Complex coastal ecosystem: agriculture, mangrove, wetland, tropical forests



Opportunities in land-surface modeling

- **HKUST launched a new campus in Guangzhou in 2022**
- **Will recruit 500 new faculty members**
- **HKUST-GZ Earth, Ocean and Atmospheric Sciences(EOAS)**



Jinshu Chi
(Assistant Professor)



**Subtropical
broadleaf**



Mangrove



Shenzhen Met Tower (356m)

Existing and new flux tower network in the Hong Kong and Pearl River Delta region

- Modeling cross-scale subtropical and urban land-atmosphere interactions for Hong Kong and Southeast Asia regions are challenging and exciting.
- We'd like to contribute to the community MPAS Noah-MP and urban canopy modeling efforts

