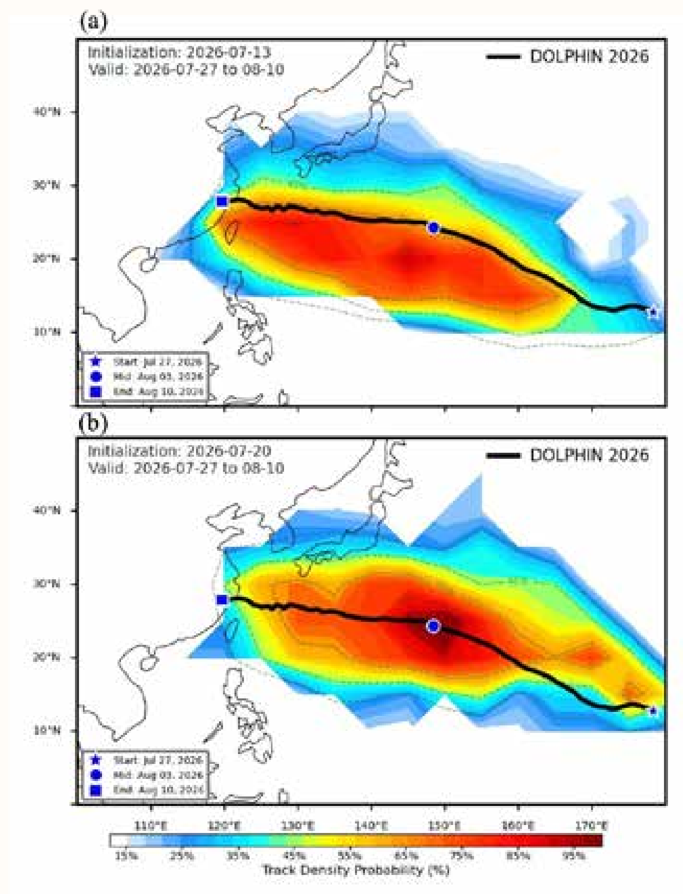
NEWSLETTER

SEPRESS ADVANCE: The Month-Long Warning: HKUST-V1 Detected Typhoon Dolphin 14 Days Before Formation and Locked Its Full Track and Landfall Region 27 Days in Advance

Recently, the SEPRESS/HKUST-V1 sub-seasonal prediction model developed by the Hong Kong University of Science and Technology successfully detected the formation signal of Typhoon Dolphin 14 days before its genesis and locked its full track and landfall region 27 days in advance, once again demonstrating its remarkable long-lead forecasting capability.



Comparison of tropical cyclone track probabilities between the HKUST V1 model (shaded contours) and IBTrACS observational data (black line) for forecasts initialized on (a) 13 July 2026 and (b) 20 July 2026. Markers along the tracks indicate the cyclone's position. The shading represents the probability density of the predicted track from the HKUST V1 ensemble system.

Typhoon Dolphin formed on 27 July 2026 over the western North Pacific and moved northwestward toward eastern coastal China, ultimately making landfall over the coastal area between Zhejiang Province and Fujian Province on 9 August 2026.

With a 13 July initialization, the model stably predicted the high-probability region of typhoon genesis 14 days before formation and successfully forecast the trajectory advancing from the western North Pacific toward East China, delivering a total forecast lead time of approximately 27 days from pre-formation to landfall. The forecast track from this early initialization showed strong agreement with the observed track, with only a slightly southward bias. When the initialization was updated to 20 July, the high-probability region predicted by the model accurately matched the observation — the observed Dolphin track was centered precisely on the high-probability region shown by HKUST-V1, further demonstrating the model's enhanced predictive accuracy.

It is worth noting that a 27-day forecast lead time far exceeds the conventional limits of current operational forecasting. Over such an extended forecast window, traditional forecasting methods struggle to provide effective guidance on track and landfall region. In contrast, the SEPRESS/HKUST-V1 model is able to offer disaster preparedness authorities and shipping enterprises an extremely valuable decision-making window. Accordingly, coastal cities can deploy typhoon preparedness measures well in advance, and shipping companies can adjust routes ahead of time to avoid hazardous sea areas, effectively safeguarding lives and property.

Op-Ed: Reimagining Megacity Governance in an Era of Amplified Extreme Weather

By Prof. LU Mengqian
Chair of UNESCO SEPRESS Decadal Science Programme

The ongoing strong El Niño event has reset global climate risk benchmarks, unleashing a barrage of unprecedented extreme weather across densely populated Asian megacities. Record heat domes, abrupt torrential downpours, and intensified coastal storm systems have struck urban centres in successive waves. While modern metropolitan management systems have long proven effective in handling conventional climate risks and safeguarding urban operational stability, the rapidly evolving climate reality exposes key limitations in existing city planning and governance frameworks. These established frameworks, tailored for historical climatic conditions, are increasingly misaligned with the accelerating volatility of today's climate system. Hazards once classified as "exceptional extreme weather" have become recurrent seasonal threats, making adaptive governance upgrading and optimisation an urgent, non-negotiable priority for major cities to build greater resilience.

For decades, urban infrastructure design, disaster response protocols, and municipal risk planning have relied on historical meteorological datasets and stationary climate assumptions. This traditional model has served cities well over decades, underpinning stable urban risk prevention and disaster mitigation amid relatively predictable climatic conditions. However, it faces growing limitations under the combined pressure of long-term global warming and amplified El Niño variability. Recent extraordinary tropical activity clearly illustrates the shifting climate regime: Typhoon Atsani, the 21st typhoon of the year, formed on August 24th. Notably, four typhoons developed successively within just six days — on August 19th, 21st, 22nd, and 24th — marking the first occurrence of "four typhoons coexisting" over the South China Sea and the Northwest Pacific this year. Such clustered, high-intensity typhoon activity represents an atypical and aggressive extreme weather pattern rarely observed in historical records. Contemporary climate hazards are no longer isolated, single-dimensional disasters; they evolve into cascading compound risks: extreme heat triggers systemic power grid overloads, short-duration intense rainfall overwhelms ageing urban drainage networks, and tropical cyclones compound wind damage, storm surge and inland flooding in coastal megaregions. These concentrated, concurrent extreme events far outpace the conventional risk parameters that current urban systems are calibrated for. In this context, traditional post-disaster rescue and emergency management mechanisms, though mature and functional for routine crises, require systematic enhancement to address these interconnected, fast-escalating modern urban climate challenges.

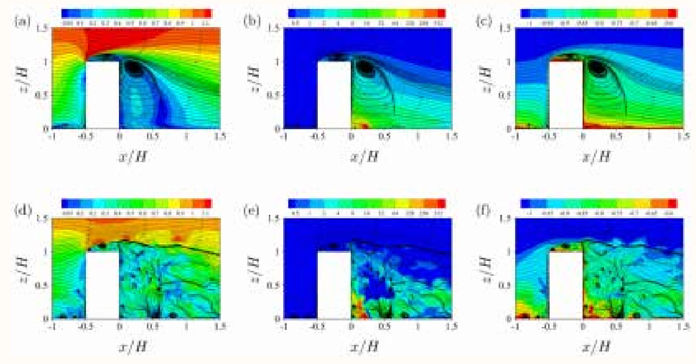
Bridging the widening gap between climate prediction and urban governance practice has therefore become central to further upgrading urban resilience. Advanced climate observation and forecasting systems, as advanced by the SEPRESS decadal initiative, deliver high-precision, real-time hazard monitoring and predictive insights into El Niño-driven climate anomalies, providing powerful scientific support for urban risk management. Notably, existing urban governance institutions have laid a solid foundation for climate risk response through years of accumulated experience and perfected operational mechanisms. The core task ahead lies in targeted institutional optimisation — refining urban zoning, infrastructure investment standards, and cross-administrative coordination mechanisms to fully incorporate dynamic climate variability, so as to match scientific forecasting capabilities with on-the-ground governance execution.

A forward-looking paradigm upgrade is imperative for the continuous improvement of megacity governance. Building on the solid foundation of existing risk management systems, urban climate governance needs to further shift from a dominant reliance on reactive disaster recovery to a balanced model integrating proactive prediction, early prevention and scientific response. Regional climate patterns modulated by El Niño, including multi-year precipitation anomalies and periodic heatwave amplification, should be fully embedded into statutory urban planning standards, complementing the existing risk prevention system to address emerging climate features. For interconnected metropolitan clusters, the mature regional governance cooperation mechanism can be further optimised: as extreme weather systems traverse administrative boundaries freely, unified cross-jurisdictional planning, coordinated early warning deployment, and integrated emergency resource allocation will effectively strengthen the overall synergy of the current urban resilience system.

Equally vital is cross-sector synergy between climate science, urban engineering, and sustainable urban financing. Resilient city development requires more than upgraded physical infrastructure; it demands systematic institutional reform and targeted long-term investment. Translating climate predictive data into actionable municipal policies, and establishing stable financial mechanisms for pre-emptive climate adaptation, will define the resilience of tomorrow's megacities.

This year's severe El Niño, characterised by unprecedented clustered typhoon activity and the rare "four-typhoon coexistence" phenomenon over offshore waters, serves as a definitive wake-up call and a valuable comprehensive test for urban climate governance. Rather than negating past governance achievements, it fully reveals the necessity of iterating and upgrading urban governance systems to adapt to rapidly shifting climate conditions. The growing clustering and intensity of extreme weather events — from persistent extreme heat waves to concentrated back-to-back typhoon formation — indicate that we can no longer solely rely on climate experience and governance frameworks of the past. As extreme weather becomes the new normal, science-informed, forward-looking governance optimisation — built upon the solid strengths of current management systems — is not merely a critical climate agenda. It is the core guarantee for consolidating urban public safety, maintaining economic stability, and supporting long-term sustainable development for billions of urban dwellers in high-risk megacity regions.

HKUST Researchers Break the "Mapping Bottleneck" in Inflow Turbulence Generation for Atmospheric Boundary Layer Simulations with Adaptive Energy-Preserving Mapping Strategy



Time-averaged (a–c) and instantaneous (d–f) values of the AEPM-generated numerical results for velocity (a, d), pollutant concentration (b, e), and temperature (c, f) around a building.

This work focuses on developing a reliable inflow turbulence generation method for the numerical simulations of atmospheric boundary layers (ABLs), which is crucial for predicting extreme weather disasters, heat-island effect, and pollutant dispersion in the urban areas. Existing inflow turbulence generation methods suffer from unrealistic vertical spatial correlation properties when mapping homogeneous turbulence fields onto realistic ABLs. To address this, an adaptive energy-preserving mapping (AEPM) algorithm for synthesizing inflow turbulence in large-eddy simulations (LESs) is proposed. The AEPM maps the RFG-generated inflow turbulence with the spatial weighting functions described by the Gaussian functions. Adaptive shape- and scale-correcting algorithms are proposed to match the target turbulent kinetic energy, spatial correlation, and flow continuity of the ABLs. The AEPM is comprehensively validated through three sets of LESs, including the ABLs around a rectangular building under neutral and unstable thermal stratifications and that over flat terrain. The simulation results match well with the wind-tunnel experimental results in the time-averaged distributions of streamwise velocity, pollutant distribution, and temperature in all the tested cases. The wall-modeled LES (WMLES) exhibits comparable accuracy to the wall-resolved LES (WRLES), but with much reduced computational costs. The AEPM shows great potential in supporting accurate predictions of airflow, pollutant dispersion, and heat transfer in urban environments.

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CUAESS Holds 2nd Young Scholars Forum and Council Meeting at Tsinghua University

From left to right: Prof. LU Mengqian, Prof. LI Siliang, Prof. LUO Yong, Prof. LIU Congqiang, Academician CHEN Deliang, Prof. DING Aijun, Prof. GUO Weidong, and Prof. ZHU Jialei.

The Chinese University Alliance of Earth System Science (CUAESS) held its 2nd Young Scholars Forum on 16 August 2026 at Tsinghua University in Beijing. Experts and young researchers from member institutions and universities both in China and abroad gathered to present and exchange ideas on frontier topics in Earth system science.

Thirteen young scholars delivered academic presentations covering a wide range of disciplines including atmosphere, ocean, hydrology, ecology, climate change, urban environment, energy, and artificial intelligence. Topics ranged from tropical forest drought recovery and atmospheric rivers coupled with marine heatwaves to urban heat exposure and photovoltaic energy balance. The panel of judges provided in-depth commentary on scientific rigor, methodological innovation, and interdisciplinary application value.

Following expert evaluation, the "Outstanding Presentation Award" was given to Dr. GOU Ruijian from Laoshan Laboratory, the "Scientific Interdisciplinary Innovation Award" to Dr. YANG Xiaoye from the University of Gothenburg, and the "Resilience Research Award" to GUO Wei from Tianjin University.

CUAESS convened its 2nd Council Meeting at the Mong Man Wai Building, Tsinghua University.

After the forum, CUAESS convened its 2nd Council Meeting, where members discussed the Alliance's logo design, member management regulations, talent cultivation, and the integration of AI with Earth system science. The Council also explored mechanisms for joint internships, course sharing, and credit recognition among member institutions.

CUAESS, co-founded by Tsinghua University, Nanjing University, Tianjin University, and HKUST, is committed to advancing cross-institutional collaboration in Earth system science and nurturing the next generation of researchers to address global environmental and climate challenges.