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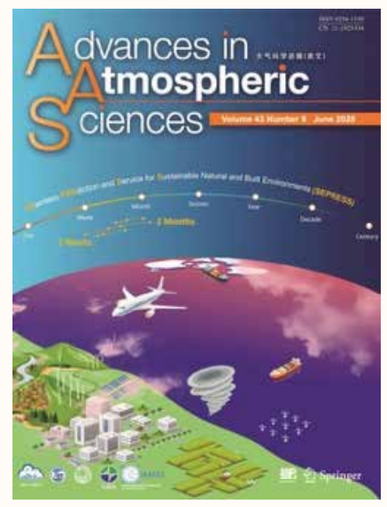
HKUST | CCRS WSDI DMS

NEWSLETTER

SEPRESS Advance: The "Last-mile Efforts" of Subseasonal Prediction and Services for Climate Resilience and Sustainability: Review and Outlook

Subseasonal prediction has emerged as a critical frontier in climate science, bridging the gap between short-term weather forecasts and long-term climate outlooks. Despite current limitations, advances at this timescale are proving essential for disaster risk reduction, resource management, and sustainable development. As part of global efforts, **the SEPRESS program research team** has synthesized recent advances in both scientific understanding and practical applications into a transferable framework, highlighting how forecasts weeks in advance can be translated into actionable strategies across weather-sensitive sectors.

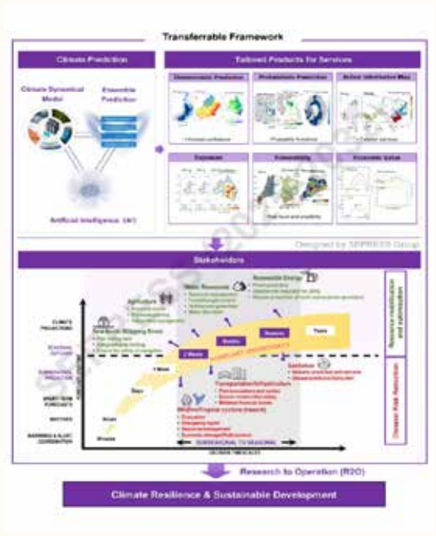


"Last-mile Efforts" in Advances in Atmospheric Sciences cover.

Disaster Risk Reduction: Predictions Driving Early Warnings

The first part focused on Disaster Risk Reduction (DRR), using examples such as wildfires, extreme rainfalls and tropical cyclones to demonstrate how subseasonal predictions could be translated into actionable insights for early warning systems and DRR decision-making. It highlighted the use of action maps to minimize impacts on ecosystems, infrastructure, human health, and economic losses.

Subseasonal prediction skill varies widely across hazard types and regions, requiring these differences to be carefully considered when developing effective "hazard-specific extremes with confidence levels" forecast frameworks to meet the needs of end-users for different disaster types. Tools such as action maps and tailored prediction products enable decision-makers to quickly identify high-risk areas and allocate resources effectively. For instance, Fire Danger Indices (FDI) and flood risk maps help users take preventive measures, while population exposure forecasts for extreme rainfall provide valuable guidance for disaster preparedness.



A user's guide framework for sub-seasonal climate prediction services.

Resource Allocation and Optimization: Supporting Sustainable Development

The second part of our review turns from disaster risk reduction to resource allocation and optimization, demonstrating how subseasonal prediction can directly support sustainable growth. At this critical time scale, forecasts provide actionable insights across renewable energy, water resources, shipping, and agriculture, enabling more efficient resource use and strengthening economic resilience.

They highlight how different sectors are already benefiting: renewable energy operators use forecasts to stabilize wind and solar output; water managers rely on them for reservoir operations, irrigation planning, and flood control; the shipping industry gains safer and more efficient routes; and farmers use predictions of temperature and rainfall extremes to safeguard yields.

This section underscores a key message: when scientific forecasts are translated into tailored decision tools, subseasonal prediction becomes not just a climate service but a driver of optimization, efficiency, and sustainability.

Link of the article: http://www.iapjournals.ac.cn/aas/article/doi/10.1007/s00376-025-5256-1

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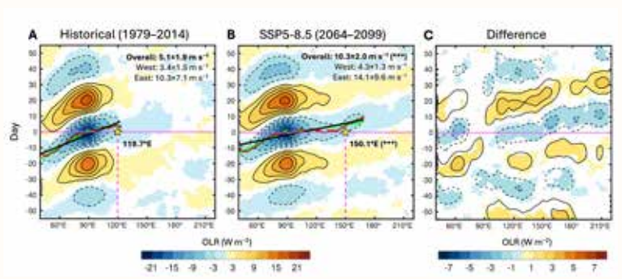
Climate Change Set to Double the Speed of Rain-Bearing Summertime Waves, Intensifying Precipitation Whiplash Globally

Latest research, with **CCRS member Dr. CHENG Tat-Fan** as first author, led by an international team of researchers and meteorologists from the Hong Kong University of Science and Technology (HKUST), University of Hawai'i at Mānoa, and other institutions unravels a key summertime atmospheric pattern that is undergoing dramatic changes due to climate change, promising to accelerate subseasonal precipitation extremes and shorten the window for disaster preparedness across the world.



Projected doubling in the phase speed and expansion of the eastward mode of the Boreal Summer Intraseasonal Oscillation (BSISO) in the high-CO_2 scenario.

Prof. LU Mengqian (left) and Dr. CHENG Tat-Fan (right).

The findings have just been published in a prestigious journal, Science Advances, entitled "Increased Global Subseasonal Whiplash by Future BSISO Behavior."

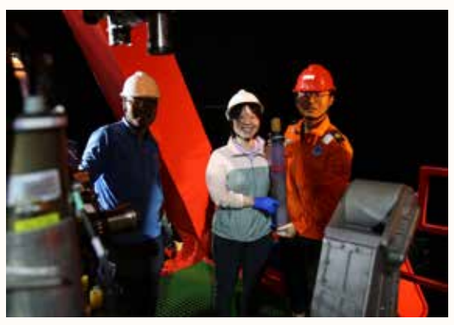
The real-world consequences of these changes were profound, primarily through the intensification of "subseasonal precipitation whiplash"—the abrupt alternation between extreme downpours and droughts within a matter of weeks.

"There is an urgent need to invest in and improve subseasonal-to-seasonal (S2S) forecasting models to keep pace with these changes." **Prof. LU Mengqian**, **a co-author of the study and Director of CCRS**, explained. "For governments, businesses, and communities, adapting to climate change now requires accounting for a new era of subseasonal whiplash, where the speed of change is as challenging as the extremes themselves. There is compelling evidence of the upward trend in subseasonal whiplash events in recent decades. Preparing for high hydroclimate volatility is no longer hypothetical—it is essential for building climate resilience and sustainability in a warming world."

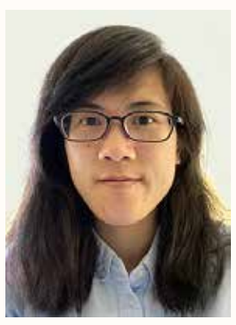
The study contributed to the **"Seamless Prediction and Services for Sustainable Natural and Built Environments" (SEPRESS) program**, which is an HKUST-led, global transdisciplinary "research-to-operation" (R2O) initiative recently endorsed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as part of its International Decade of Sciences for Sustainable Development.

Link to the research article: https://www.science.org/doi/10.1126/sciadv.adv6355

HKUST Researchers Reveal Methane Seeps as Powerful Nutrient Recyclers of the Ocean



Prof. QIAN Pei-Yuan



Prof. LI Jiying

Members of Prof. LI Jiying's group retrieved sediments from the Haima cold seep.

Methane-rich cold seeps are oases of life in the deep sea, where methane release supports unique organisms and has potential impacts on ocean ecosystem health and global climate. Research led by **CCRS members Prof. QIAN Pei-Yuan** and **Prof. LI Jiying**, investigated the Haima cold seeps (1,300–1,500 m depth) in the South China Sea using the Remotely Operated Vehicle equipped with in-situ methane sensors and sediment corer. Through isotopic approaches and geochemical analysis, this work reveals that deep-sea methane seeps function as powerful, previously overlooked engines for recycling essential nutrients such as iron and phosphorus, which are often scarce in oceans. Sediments with high methane activity release iron and phosphorus at rates 10 to 100 times higher than those in surrounding seabed areas, because cold seep microbes could oxidize methane using iron oxides and sulfate, triggering a chain of reactions that enhance the release of iron and phosphate into the water column. Given the widespread distribution of deep-sea cold seeps worldwide, these findings offer valuable insights for larger-scale projections and contribute to assessing their regional and global impacts. The relevant research output was published in Global Biogeochemical Cycles (Lin at al. 2025, doi: 10.1029/2025GB008735).

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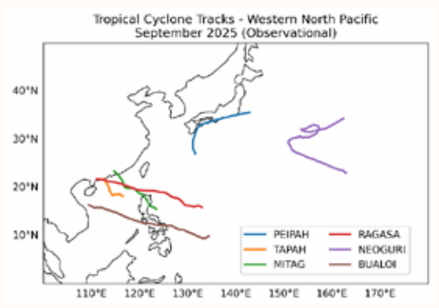
SEPRESS Typhoon Forecasts Show High Accuracy in September 2025



Observed Typhoon Activity Paths in the Northwest Pacific for September 2025.

The SEPRESS team released its very first forecast outlook for tropical cyclone (TC) activity in the Northwest Pacific for September 2025, with an initialization date of August 30th, and demonstrated strong predictive skill. The monthly forecast issued on August 30 predicted 5.45 typhoons with 2.98 landfalls in China. The actual observations recorded 6 typhoons with 3 landfalls (Taba, Mina, and Ragasa), closely matching the prediction. The forecast also accurately captured typhoon-prone areas, particularly around the Greater Bay Area and east of the Philippines.

The team's bi-weekly forecast released on September 11 accurately predicted the formation and movement of typhoons Mina and Ragasa, which developed east of the Philippines and moved through the Bashi Channel into the South China Sea during September 18-24.

Looking ahead, SEPRESS will continue to release monthly forecast outlooks. In October, new prediction products were launched, covering the Northwest Pacific Tropical Cyclone, Surface Air Temperature in China, and Global Sea Surface Temperature. These forecast products serve as technical reference for disaster prevention and mitigation efforts.

SEPRESS Member Attends Belt and Road Summit to Share Progress on Seamless Prediction Applications

The 10th Belt and Road Summit was held at the Hong Kong Convention and Exhibition Centre in Wan Chai from September 10-11, 2025. Under the theme "Collaborate for Change, Shape a Shared Future," the summit served as a crucial international business platform for promoting Belt and Road cooperation.

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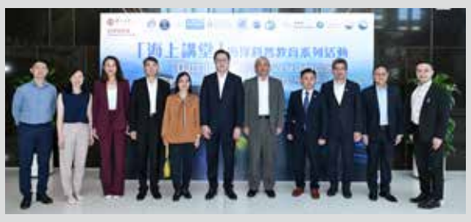
During the two-day forum, SEPRESS team representative, Mr. LIAO Xuexian actively participated in a core agenda item: the Global Project Business Matching Session. During the matching session, he engaged in in-depth discussions with representatives from climate risk assessment, renewable energy, AI sectors, and international non-profit organizations (NPOs). He highlighted the role of seamless meteorological prediction services in climate change investment risk assessment, as well as their applications in providing decision support and resource optimization for key sectors including renewable energy, shipping, and agriculture. He stated that the SEPRESS initiative will continue to advance service development for different regions and industries to better meet diverse needs and help society and industries achieve sustainable development.

CCRS Supports the “Class at Sea” Marine Science Program



Group photo at the “Class at Sea” event. 3rd from left: Prof. LU Mengqian, Director of CCRS; 4th from left: Prof. QIAN Peiyuan, Affiliated member of CCRS.

On September 5, Otto Poon Center for Climate Resilience and Sustainability supported the "Class at Sea: Marine Science for Global Citizens" program. This innovative initiative enabled students to virtually explore deep-sea environments alongside marine scientists through live sharing and interactive demonstrations. Students witnessed mysterious marine organisms and unique deep-sea habitats while learning about marine science. The program enhanced youth's understanding of marine science and inspired their interest in ocean conservation, contributing to Hong Kong's role as an international maritime hub in marine environment protection and sustainable development.

Otto Poon Lecture Series Launches with Green Finance Discussion

Group photo at the inaugural Otto Poon Lecture Series. 5th from left: Dr. John Ure; 5th from right: Prof. LU Mengqian.

The inaugural Otto Poon Lecture Series was successfully held at HKUST's Academic Building on October 3, 2025. British political economist **Dr. John Ure** delivered a lecture titled ***Mind the Gap: Green Finance and Climate Change — Late or Too Late?*** In his presentation, Dr. Ure examined the disparity between available funding and resources needed to achieve the Paris Goals, analyzing both the limitations of current public-private financing models and the challenges of directing capital flow to the Global South. He proposed the establishment of an International Green Bank as a potential solution.