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NEWSLETTER

SPECIAL REPORT: SEPRESS Advances in Cross-domain Subseasonal Prediction

From Arctic Sea Ice Prediction to Agricultural Forecasting: Advancing Climate Services Through AI-Hybirds Models

The current climate models remain limited in subseasonal prediction capabilities, yet extended-range forecasts are crucial for strategic decision-making across weather-sensitive sectors. As part of **UNESCO**'s International Decade of Sciences for Sustainable Development (**IDSSD, 2024-2033**) action plan, the **SEPRESS** program research team, jointly led by **CCRS** and **WSDI**, continues to advance relevant scientific research and has recently made significant progress in navigation and agricultural domains.


Prof. LU Mengqian, SEPRESS Chair


Prof. YANG Jing, SEPRESS Co-Chair


Dr. LIU Anling


Dr. ZHU Tao

Assimilating Summer Sea Ice Thickness Enhances Arctic Maritime Navigation and Weather Predictions within Two Months

The Arctic is a hotspot of climate sensitivity, where sea ice changes impact not only local ecosystems and navigation but also mid- and high-latitude extreme weather. However, the subseasonal prediction skill of current climate models remains limited due to the complex coupled feedbacks among sea ice, ocean, and atmosphere, as well as uncertainties in initial and boundary conditions. SEPRESS research team developed an ensemble-based sea ice assimilation system to improve real-time Arctic climate predictions. By assimilating both sea ice thickness and concentration, the system significantly enhances the prediction skill of Arctic sea ice and near-surface air temperature up to two months ahead. This study is the first to quantitatively demonstrate the benefits of summer sea ice assimilation for subseasonal prediction and highlights the critical role of sea ice as both an initial condition and a lower boundary in improving dynamical predictions.

Link of the article: https://doi.org/10.1038/s41612-025-01050-8

Subseasonal Prediction for Agricultural Services: A Hybrid AI+Climate Model for Crop Growth Forecasting

Accurate one-month-ahead crop forecasts are critical for food security and agricultural planning, yet traditional methods struggle with limited data and nonlinear dynamics. SEPRESS research team focuses on developing a machine learning–climate dynamical hybrid model to predict NDVI, a key indicator of crop growth. The model integrates ResNet, U-Net, and the FGOALS-f2 climate system, delivering significantly improved prediction skill over conventional dynamical or statistical approaches, while maintaining a low computational cost. Their work sets a benchmark for real-time subseasonal agricultural services.

Link of the article: https://doi.org/10.1016/j.agrformet.2025.110582

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Mr. QIAN Zhimin and Delegation Visit HKUST

On July 10, 2025, a delegation from the International Forum on Clean Energy (IFCE), led by **Mr. QIAN Zhimin**, visited HKUST. Both parties engaged in in-depth discussions on industry-academia-research cooperation, blue technology, marine economy, and sustainable development frontier research, exploring ways to promote technological innovation and industrial integration to support national carbon peaking and carbon neutrality goals and global green development.

Group photo taken during the IFCE delegation's visit to HKUST.

Prof. LU Mengqian presented the latest progress in meteorological prediction projects during the meeting.

During the meeting, **Prof. LU Mengqian, Director of CCRS at HKUST**, presented the latest progress in meteorological prediction projects, emphasizing how high-precision meteorological models can enhance climate change response capabilities.

Mr. QIAN Zhimin highly commended HKUST's research capabilities in sustainable development and marine technology, stating that IFCE is committed to promoting integrated innovation across industry, academia, and research. He suggested strengthening collaboration to explore cooperation opportunities in marine renewable energy, smart ocean monitoring, and green financial technology, contributing to national carbon peaking and carbon neutrality goals and marine economic development.

meteoNEX Advances to HICOOL Semifinals and Engages in Technical Exchange with Xunlei Limited

The project meteoNEX—Seamless Weather-to-Climate Prediction Service advanced to the semifinal round of the HICOOL Global Entrepreneur Summit and Entrepreneurship Competition on July 27, 2025, which is an international platform aimed at connecting high-potential startups with global opportunities and support in Beijing. Representing the project at the competition was **Mr. LIAO Xuexian**, a member responsible for technology transfer in the research team led by **Prof. LU Mengqian**, Director of CCRS.

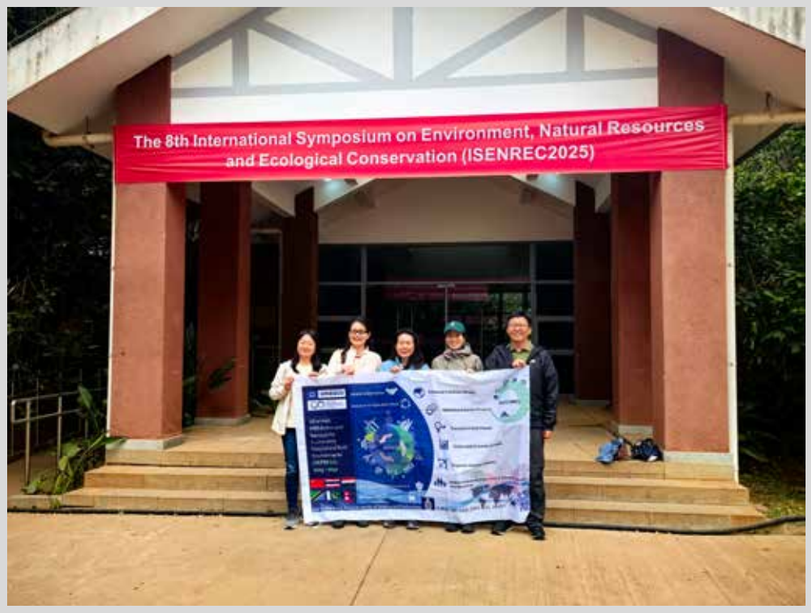
Mr. LIAO Xuexian at HICOOL 2025

Prior to the semifinals, meteoNEX successfully passed the preliminary round held in Hong Kong on June 4.

On July 29, Mr. LIAO also engaged in a technical exchange and discussion with the Xunlei team, further exploring pathways for future development and innovation.

Dr. David LEUNG, Head of Smart System and Project Development, OKT (4th from left); Ms. Risa LUO, Director of Public Relations, Xunlei (4th from right); Mr. David CHOI, Manager (Technology Management), OKT (1st from left); Mr. LIAO Xuexian (2nd from left)

SEPRESS Team Explores Agricultural Climate Services in Kenya



Members of the **SEPRESS program** recently participated in **ISENREC 2025** in Kenya and visited **the Sino-Africa Joint Research Center (SAJOREC)**. The team conducted field investigations at the **Kenya-China Modern Agriculture Demonstration Base**, focusing on East Africa's needs for climate prediction in agriculture. This visit strengthens SEPRESS's commitment to enhancing climate services in resource-limited regions and promotes international collaboration in sustainable development.

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Launch of "Strengthening Hong Kong's Capacity to Achieve Sustainability through Policy Innovation"

The new project, **Strengthening Hong Kong's Capacity to Achieve Sustainability through Policy Innovation**, led by CCRS member **Prof. Alexis LAU** has just commenced. It aims to enhance Hong Kong's capacity for sustainability and climate leadership by proposing a forward-looking climate governance structure built on existing institutions and policies, while addressing current fragmentation and emerging needs for cross-bureaucracy coordination. Taking a "Think & Do" approach, the project explores policy design and implementation within specific industries to inform the evolution of a robust climate governance framework. A rough research outline has been developed, and the next steps include stakeholder outreach and recruiting dedicated researchers. The goal is to deliver proposals by the fourth quarter of 2026 for presentation to the government and the public policy community.


Prof. Alexis LAU, Project Leader


Prof. Christine LOH, Project Partner

HKUST Researchers Advance Insights into Sustainable Synthesis of Urea

Urea ($CO(NH_2)_2$) is a widely used material in chemical industry and agricultural fertilization. However, the current industrial manufacture of urea through Haber-Bosch and Bosch-Meiser processes is energy-intensive and CO2-emissive, consuming more than 2% of the global energy supply and generating more than 1% of the anthropogenic emission of greenhouse gases. This study, led by **Dr. ZHAO Qinglan** from the research group of CCRS member **Prof. SHAO Minhua**, focuses on the electrochemical co-reduction of carbon dioxide and nitrates (CO2NO3RR) for sustainable urea production. Through a combination of experimental methods and theoretical simulations, **Δ**G*HOOCNO–**Δ**G*N–**Δ**G*COOH+**Δ**G*H2O is proposed as a potential descriptor for predicting the efficiency of CO2NO3RR toward urea formation. Their findings provide systematic guidance for future design of high-efficiency catalysts, addressing the global challenge of sustainable nitrogen fixation and contributing to the ambition of carbon neutrality by 2050.


Prof. SHAO Minhua

Dr. ZHAO Qinglan

CCRS Research on Cross-Pacific Atmospheric Rivers Cited by U.S. DOE Climate Report

Cover of the U.S. DOE Climate Report (2025)

Cross-Pacific atmospheric rivers (ARs) are a major driver of extreme and prolonged precipitation on the U.S. West Coast. A recent study led by Prof. LU, Director of CCRS, systematically classifies five distinct cross-Pacific AR pathways using a self-organizing map algorithm, revealing that many ARs originate in East Asia and travel thousands of kilometers across the Pacific before landfalling in North America. These ARs tend to produce longer-lasting precipitation than those forming near the coast, posing higher risks of flooding and landslides. The study also identifies key atmospheric pressure dipole configurations and oceanic climate modes—such as the Eastern Pacific ENSO and Indian Ocean Basin-wide Mode—that influence AR propagation and predictability. These insights improve our understanding of AR-related extreme weather and support better seasonal forecasting and disaster preparedness. **This research was recently cited by the U.S. Department of (DOE) latest report, *"A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate – Chapter 6: Extreme Weather,"* which plays a pivotal role in shaping U.S. climate policy.**