ileaps | Integrated Land Ecosystem - Atmosphere Processes Study

August 2025

# Newsletter

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# Editor's Note

**Dear iLEAPS Community,**

This quarter reflects the strength of our network in delivering high-impact, policy-relevant science. In this edition, you will find detailed coverage of research that addresses critical land–atmosphere challenges and advances our mission of integrating science for sustainability.

We begin with emerging concerns over warming-induced greenhouse gas emissions, where new evidence underscores the need to integrate permafrost thaw, wetland methane, and wildfire feedbacks into climate models and policy frameworks. The Integrated Process Understanding and Mitigation Strategies for Urban Air Pollution in Delhi article presents results from the APHH and PROMOTE programmes—showing how multi-scale modelling, high-resolution emission inventories, and sensitivity analyses can directly inform sector-specific air quality strategies in one of the world's most polluted megacities.

Our recently funded initiatives highlight the role of cross-sectoral collaboration. The TD-MH project will integrate Earth observation, dynamic modelling, and stakeholder engagement to improve mountain water resource prediction in climate-sensitive regions. In parallel, the ESA–Future Earth Delhi NCR project is mapping wastelands, quantifying dust emissions, and assessing the co-benefits of green space conversion for air quality and urban heat mitigation—delivering an integrated decision-support system for planners.

This quarter also showcased iLEAPS' global engagement. At the ACAM Workshop in Bali, our scientists presented advances in methane modelling, black carbon apportionment, and aerosol–climate feedbacks, paving the way for joint thematic sessions and shared data initiatives. The EGU 2025 sessions on fog and dew, co-led by IITM and IFDA, brought together global experts to address forecasting challenges, aerosol–fog interactions, and sustainable water harvesting, setting the stage for the 2026 Fog and Dew Conference in Pune.

We also cover outcomes from sessions at the Sustainability Research and Innovation Congress, including strategies to address global plastic and microplastic pollution and methods for mapping research networks to strengthen knowledge–action systems.

These activities reaffirm the iLEAPS commitment, Advance integrated science across disciplines and scales, Embed co-design with stakeholders to ensure societal relevance, Build global partnerships that link science to actionable solutions.

We invite you to explore the insights, data, and collaborations detailed in these pages, and to consider how your own work can contribute to this shared effort. Together, we can close critical knowledge gaps, inform better decisions, and deliver science that meets the urgency of our planetary challenges.

We thank all contributors, particularly Bhagyashri Katre for the meticulous compilation of this edition, and reaffirm our commitment to the iLEAPS mission: integrating land–atmosphere processes to understand and respond to planetary change.

# Addressing the emergence of warming-induced greenhouse gas emissions in climate research and policy

### Dr. Ben Poulter

**Dr. Poulter** is the Co-chair of iLEAPS & Research Scientist in the Biospheric Sciences Laboratory in the Earth Science Division at the NASA Goddard Space Flight Center in Maryland, USA, and an Adjunct Associate Research Professor in the Department of Geographical Sciences at the University of Maryland. He received his PhD in 2005 from Duke University in North Carolina, USA, studying ecosystem dynamics of wetland systems. As a Marie Curie Fellow, he worked at the Potsdam Institute for Climate Impact Research (PIK, 2006-2009) and the Swiss Federal Research Institute WSL (2009-2011), and then worked as a Post-Doctoral Scientist at Le Laboratoire des sciences du climat et 'environnement (LSCE, 2011-2013). He was a Contributing Author to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, the US Carbon Cycle Science Program 2nd State of the Carbon Cycle Report (SOCCR-2), and to the Global Carbon Project carbon and methane budgets, and currently serves on the Editorial Boards for PLOS ONE and Global Ecology and

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**Dr. Ben Poulter, Spark Climate Solutions, Senior Scientist and iLEAPS Co-chair**

**Host Institutions**

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Increasing greenhouse-gas emission from climate warming feedbacks have long been of concern since the first Earth system models were developed in the 1990s. Three decades on, the recent acceleration in the growth of atmospheric carbon dioxide, methane and nitrous oxide suggests that the warming of permafrost, tropical wetlands and tropical forests is leading to increased natural greenhouse-gas emissions and decreased removals of carbon dioxide.

In May of this year, iLEAPS Co-Chair Ben Poulter, started a position as Senior Scientist at Spark Climate Solutions to help establish a new research and policy program to address warming-induced greenhouse gas emissions (WIE). The WIE program will catalyse science, policy and mitigation activities that are currently a 'blind spot' in cli-

-mate policy. Climate policies have been developed largely in absence of addressing increased emissions of greenhouse gases from natural ecosystems as these systems warm. This 'blind spot' means that the remaining carbon budget to avoid dangerous warming could be much less than currently assumed and that the assumption that the Earth system's climate is stable when net-zero emissions is more uncertain that currently considered.

Spark's new warming-induced emissions program and partnership with other non-governmental organizations and Universities aims to remove this blind spot by catalysing research and policy in this area. To learn more about this program and to participate in the emerging science and policy activities please reach out to Ben Poulter at ben@sparkclimate.org

# Integrated Process Understanding and Mitigation Strategies for Urban Air Pollution in Delhi: Insights from the APHH and PROMOTE Programmes

**Authors**: Sujit Maji, Vikas Singh, Gufran Beig, Ranjeet Sokhi, Jyoti Parikh, Rohit Magotra, Probal Pratap Ghosh

Atmospheric Pollution and Human Health in an Indian Megacity was a four-year research programme (2018-2022) jointly funded by the Ministry of Earth Sciences (MoES) and Department of Biotechnology (DBT) from India and Natural Environment Research Council (NERC), the Medical Research Council (MRC) from UK under the Newton–Bhabha Fund. This programme had been organised into four interrelated themes which are - Emission validation and sources, Processes: physical and chemical, Exposure assessment and validation and health outcomes and Mitigations and interventions, to support research on the sources and emissions of urban air pollution in New Delhi, India.

The overall objectives of the APHH programme were delivered through research partnerships between UK and Indian scientists by implementing chosen FIVE projects. The ultimate goal of the programme was to further improve our understanding of air quality-related aspects, process science and its impact on health

One of the five projects was Process analysis, observations and modelling - Integrated solutions for cleaner air for Delhi (PROMOTE). This project dealt with process science and forecasting model skill development. Significant progress has been made in understanding Delhi's air quality issues and developing effective mitigation strategies. Studies across five Indian megacities, including

Delhi, reveal seasonal and diurnal variability, with a decreasing trend in $PM_{2.5}$ levels observed in Delhi. A traffic emission model was developed to estimate spatiotemporal and speed-dependent emissions, identifying two-wheelers and diesel vehicles as major contributors.

The impact of crop residue burning has been analyzed using emissions inventories and modeling, showing contributions to Delhi's $PM_{2.5}$ can

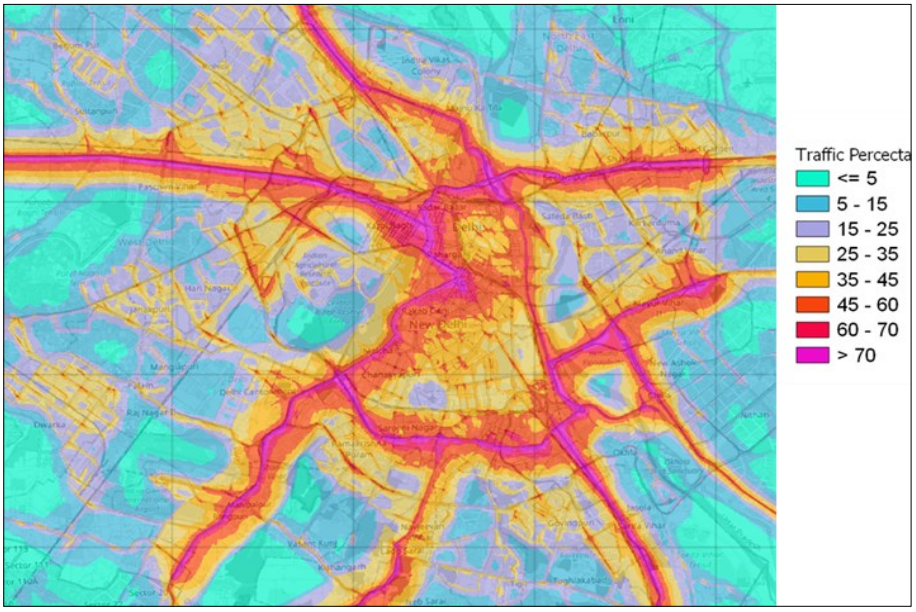


***Figure 1: regional (WRF-Chem/CMAQ) and local street-scale (OSCAR) models capturing PM□.□ spatial heterogeneity.***

peak up to 58% (Beig et al., 2020; Singh et al., 2020). However, it is highly dependent on the transportation pathway of air mass, controlled by meteorological parameters and chemistry involving secondary particle formation from the source to the target region. A multi-scale modelling system has been developed for high-resolution air quality prediction over an urban area. This model combines regional (WRF-Chem/CMAQ) and local street-scale (OSCAR) models, capturing spatial heterogeneity, with $PM_{2.5}$ levels rising from the outskirts to the city center and near roads (primarily due to the transport sector) as shown in figure 1.

Population exposure assessments show that all residents are exposed to $PM_{2.5}$ above NAAQS, with the highest exposure nearroads. 25% of people in Delhi are exposed to a concentration between 60-80 µg/m3, 27% people between 80-90 µg/m3, 36% people between 90-100 µg/m3 and 12% people over 100 µg/m3. 100% population was exposed to $PM_{2.5}$ levels above ~60 µg/m3 and 75% of the total population was exposed to levels above 80 µg/m3. Delhi's population is exposed to annual mean $PM_{2.5}$ concentrations above the NAAQS of 40 µg/m3 and much above the WHO air quality guideline of 5 µg/m3 (figure 2). Regional modeling confirms the need for coordinated emission control strategies, as evidenced by improvements during the COVID-19 lockdown. Ozone and $PM_{2.5}$ sensitivity studies underscore the importance of jointly controlling VOC and $PM_{2.5}$ emissions (Chen et al., 2020).

The WRF-CMAQ system at the University of Hertfordshire has been used to analyze multiple air pollutants across India, with a focus on Delhi and its surroundings. Model simulations at 45 km, 15 km, and 5 km resolutions—evaluated against SAFAR and CPCB observations—capture daily and monthly spatial-temporal variations over Greater Delhi. These simulations support regional inputs for the street-scale OSCAR model, in collaboration with NARL. Two scenarios assessed the role of road transport emissions in Delhi's air quality. Findings indicate that road transport contributes significantly (30–40%) to $NO_2$ and $NO_x$ levels, but its contribution to $PM_{2.5}$ is relatively minor due to substantial inputs from surrounding regions and long-range transport.

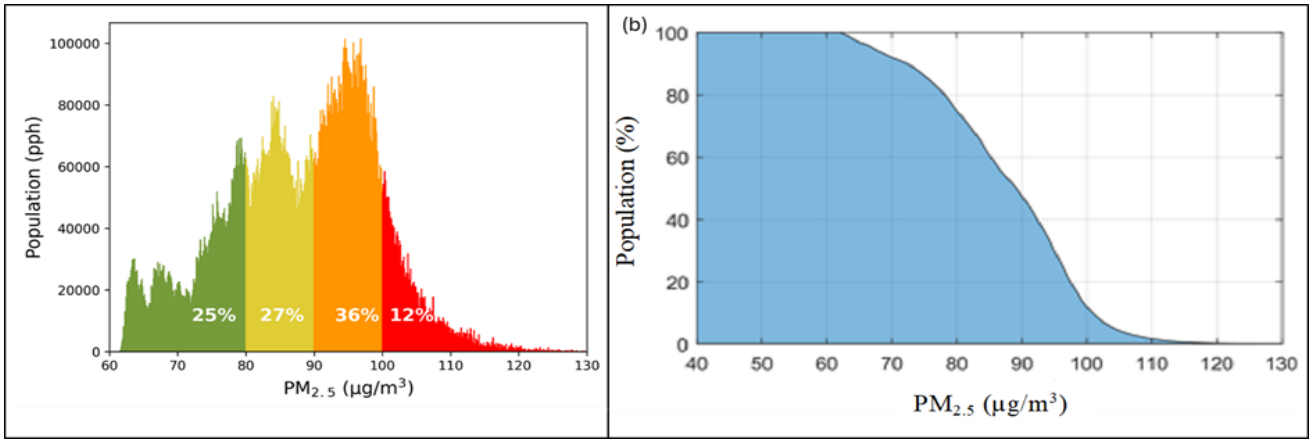


***Figure 2: Population exposure to PM□.□ in Delhi***

Contributions to ozone levels from road transport also vary seasonally and show complex behaviour. Particulate matter analysis highlights the importance of speciated components, as CMAQ simulations show strong seasonal variability. However, the absence of detailed speciated observational data for Delhi limits precise sectoral source attribution, underscoring the need for further research into emission profiles and their seasonal sensitivities.

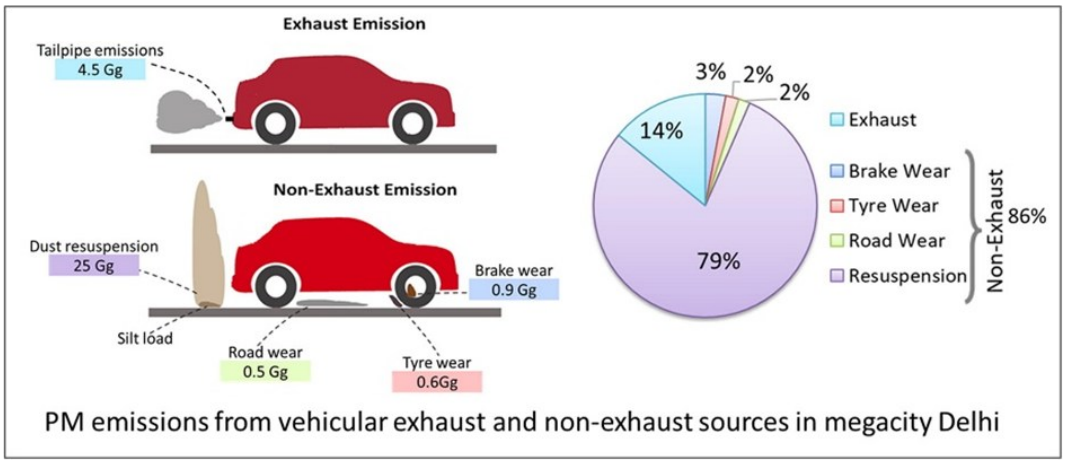


***Figure 3: Exhaust and Non-Exhaust Emission Sources in Delhi***

Non-exhaust sources, such as the resuspension of local and transported dust, significantly contribute to particulate matter (PM) levels in Delhi, underscoring the need for a comprehensive mitigation approach (figure 3)(Singh et al., 2020). Delhi continues to rank among the most polluted cities globally, with $PM_{2.5}$ and $PM_{10}$ posing serious health risks. Key pollution sources include vehicular emissions, industrial activities, construction dust, and crop residue burning. Factors such as inadequate enforcement, low public awareness, and unfavourable geography further exacerbate the problem. To address this, a range of strategies is needed—promoting electric vehicles, expanding and modernizing public transport, enforcing emission norms, eco-friendly technologies, improved fuel standards and increasing public awareness about pollution's health impacts. While the transport sector is often prioritized in mitigation efforts, other sectors—industry, construction, residential combustion, waste burning, and agriculture—also make substantial contributions to air pollution. Comprehensive, cross-sectoral policies are thus essential for effective air quality management. Survey findings and economic analyses show that by 2030, an integrated policy combining these measures results in the lowest overall cost for the transport sector, primarily due to early adoption of efficient technologies and scrappage of older vehicles (figure 4). The government has initiated policies promoting sustainable transport, including non-motorized mobility and cleaner fuels. However, challenges remain in infrastructure development, behavioural change, and policy enforcement. Regional contributors such as stubble burning in neighbouring states, urban sprawl into NCR, degradation of the Aravalli range, and seasonal meteorological influences also worsen Delhi's air quality. Tackling these requires coordinated regional planning, stricter environmental regulations, and conservation efforts. Ultimately, multi-stakeholder involvement—government bodies, regulatory agencies, and civil society—is

crucial for achieving sustained improvements in Delhi's air quality.

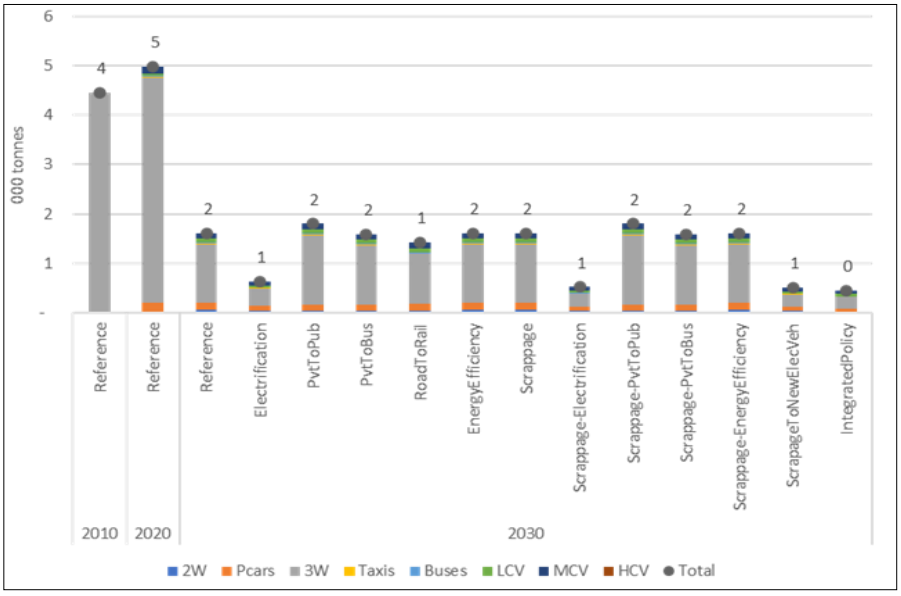


***Figure 4: Integrated policy measures will lead to reduction of PM emissions***

Secondary aerosol (SA) formation plays a crucial role in Delhi's air quality, but existing parameterization schemes are often inadequate, having been developed for different environmental conditions. Both inorganic and organic SA formation is highly sensitive to meteorological and thermodynamic factors, as well as the emissions of natural and anthropogenic precursors. Hydrochloric acid (HCl) from waste, trash, biomass burning, and other combustion sources has been identified as a major contributor to secondary inorganic aerosols (Zhang et al., 2022; Angelucci et al., 2021; Fan et al., 2021; Sharma et al., 2019; Li et al., 2012), particularly in Delhi (Acharja et al., 2022; Chen et al., 2022; Gunthe et al., 2021; Pawar et al., 2023; Faxon et al., 2013). Local emissions from traffic, industry, and residential combustion, along with meteorological conditions—such as high temperatures and humidity in summer or low ventilation and high moisture in winter—facilitate heterogeneous and aqueous-phase reactions, enhancing secondary aerosol production (Chate et al., 2014; Reyes-Villegas et al., 2023). Under these conditions, the condensational sink created by high background aerosol concentrations can be offset, enabling aerosol nucleation events and further aerosol growth, especially during winter stagnation episodes (Qiao et al., 2021; Mönkkönen et al., 2005). These processes substantially elevate $PM_{2.5}$ levels. In addition to traditional secondary inorganic components (nitrate, sulfate, ammonium), chloride and oxygenated organic aerosols significantly increase aerosol hygroscopicity, aerosol liquid water content (ALWC), and water uptake. This enhances aerosol scattering efficiency, reduces visibility, and influences radiative properties in urban air (Liu et al., 2022; Acharja et al., 2021; Gunthe et al., 2021; Psichoudaki et al., 2012). Given the seasonally variable and complex nature of SA formation and nucleation, incorporating these processes into future modeling and policy efforts is essential for accurate air quality forecasting and the development of effective mitigation strategies in Delhi.

Accurate prediction and forecasting of air quality in Delhi necessitate improved parameterizations tailored to local conditions, particularly for deposi- aerosol processes. Existing dry deposition

-tion schemes, such as M3Dry and STAGE, which are implemented in the PROMOTE framework, remain largely unvalidated for Delhi due to the lack of flux measurement data. This gap in validation limits the confidence in model predictions. Moreover, the influence of these parameterizations on both gaseous and particulate species is highly sensitive to meteorological conditions—such as temperature, humidity, and wind patterns—as well as seasonal dynamics, land cover types, and chemical species involved. These interdependencies introduce variability in model outputs and are a key source of bias when compared with observations. As such, addressing these deficiencies through targeted observational campaigns and localized scheme development is essential to enhance model reliability and inform air quality management strategies for Delhi.

Although developing detailed source-specific contributions to daily air quality—such as those integrated into Decision Support Systems—was not within the original project objectives, such analyses are essential for a clearer understanding of emission source impacts. A recently developed high-resolution (1 km × 1 km) emission inventory by the NPL group, covering pollutants such as CO, $CO_2$, VOCs, PM, and NOx, holds significant potential for incorporation into future Decision Support Systems to enhance their resolution and relevance. In the absence of direct measurements of dust fluxes in Indian urban environments, dust emissions have been estimated using the AP-42 methodology. However, some of the assumptions underlying this approach may not be fully applicable to Delhi's unique conditions, introducing uncertainties in dust emission estimates. Since dust is a major contributor to particulate matter, particularly during the dry months, we propose dedicated boundary layer flux measurements of dust in future projects to reduce these uncertainties and improve model accuracy.

In conclusion, the APHH programme and the PROMOTE project have significantly advanced the scientific understanding of air pollution processes in Delhi, highlighting the multifaceted and regionally interconnected nature of the problem. Key advancements include high-resolution emissions modeling, coupled WRF-Chem-OSCAR simulations, and integrated observational analyses which together provide insights into the complex dynamics of $PM_{2.5}$ and ozone pollution. Critical findings on the role of HCl emissions in winter visibility loss and the timing of agricultural residue burning offer actionable strategies. The project's multi-pronged mitigation approach—spanning transport, industrial emissions, and land protection—presents practical pathways for improving air quality. The research also stresses the need for multi-sectoral mitigation strategies, regionally coordinated planning, and robust policy interventions. Continued collaboration between scientists, policymakers, and civil society will be essential to translate this science into effective, equitable, and sustainable air quality improvements for Delhi and other Indian megacities.

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# iLEAPS at the ACAM Workshop – Showcasing Research and Building Partnerships 11-13 June, 2025 Bali, Indonesia

The iLEAPS Scientific Steering Committee (SSC) meeting in Bali, Indonesia (9–10 June 2025) was held alongside the Atmospheric Chemistry and Asian Monsoon (ACAM) Workshop, providing a unique opportunity for iLEAPS scientists to engage directly with a broad international community of atmospheric researchers. Our participation highlighted the strength of iLEAPS' science and its relevance to regional and global challenges.

**iLEAPS Contributions Across ACAM Sessions**

In one of the plenary sessions, Garry Hayman, Science Officer of iLEAPS International Project Office, presented an engaging overview of iLEAPS' mission and activities, emphasizing our focus on land–atmosphere interactions and their role in Earth system processes. He outlined the network's global reach, its support for early-career scientists, and its role in fostering interdisciplinary collaborations. His talk introduced ACAM participants to iLEAPS' priorities—greenhouse gas budgets, aerosol–land feedbacks, and integrated observation-modelling approaches—sparking interest in joint initiatives.

**Science Sessions**

iLEAPS scientists contributed cutting-edge research:

- Garry Hayman presented: *"Investigating Global Methane Pledge Scenarios Using the UK Earth System Model."* He discussed model□based explorations of methane mitigation strategies, their projected impacts on climate, and the implications for achieving global methane reduction pledges. This work underscored iLEAPS' contribution to science –policy dialogues on greenhouse gas management.

- Eliani Ezani delivered a well-received presentation titled: *"Atmospheric Black Carbon in Klang Valley, Malaysia: Temporal Variations and Source Apportionment Using Online AE33 Measurements."* She showcased detailed field measurements revealing diurnal and seasonal patterns of black carbon, linked to both local and regional sources. Her results highlighted the significant role of traffic emissions and biomass burning, offering valuable insights for regional air quality policies.

**Poster Presentation by iLEAPS ECR**

Complementing the oral presentations, iLEAPS Early Career Representative from South Asia and Middle East Region, Saurabh Sonwani shared a poster on: *"Carbonaceous Aerosol Characterization and Their Association with Meteorological Parameters during Summer Monsoon and Winter Monsoon in a Tropical Megacity."*

The poster detailed aerosol composition measurements and their correlations with monsoonal meteorology, illustrating how shifts in climate patterns influence air quality dynamics in densely populated urban reg

**Strengthening Collaboration with ACAM**

Through these contributions, iLEAPS demonstrated the depth and breadth of its scientific expertise—spanning methane modelling, black carbon source apportionment, and aerosol–climate interactions.

The workshop provided fertile ground for discussions on:

• Coordinated observation and modelling activities to understand feedbacks between land, atmosphere, and human activities.

• Opportunities for early-career engagement and capacity building through cross□network collaborations.

**Looking Forward**

• Building on this engagement, iLEAPS and ACAM are exploring the possibility of:

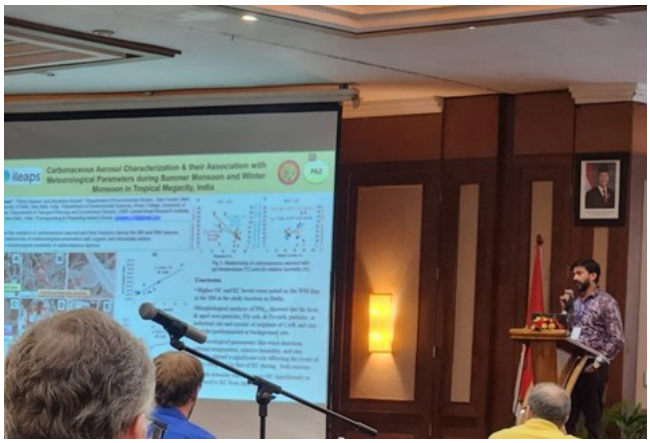
• Co-organizing thematic sessions at upcoming international conferences,

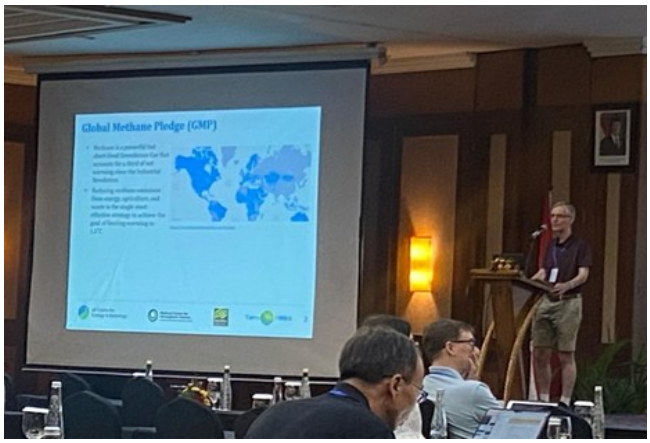
• Jointly developing science–policy briefs on methane and aerosol feedbacks,

• Encouraging shared data initiatives and training workshops that strengthen both networks.

The iLEAPS team extends its appreciation to ACAM organizers and participants for such a productive and inspiring exchange of ideas. The ACAM workshop was a significant step forward in deepening collaboration between communities working on atmospheric chemistry, monsoon dynamics, and land–atmosphere processes.






**Acknowledgement**

iLEAPS is grateful to ACAM organizers and participants for providing this vibrant platform. The exchange of knowledge and ideas in Bali has paved the way for future joint initiatives that bridge atmospheric chemistry, land–atmosphere processes, and sustainability science.

## Sustainability Research and Innovation Congress (SRI2025) Session Note

# Global Plastic Waste and Microplastic Pollution: Addressing Transboundary Challenges

**Speakers:**

**Pui Yi Wong, Independent Researcher, Basel Action Network**

**Sarah Brooks, Professor, Texas A&M University**

**Norfazrin Mohd Hanif, Senior Lecturer, Department of Earth Sciences and Environment, Universiti Kebangsaan Malaysia**

**Sharifah Norkhadijah Bt Syed Ismail, Associate Professor, Department of Environmental and Occupational Health, Faculty of Medicine and Health Science, Universiti Putra Malaysia (UPM) Berilmu.**

**Eliani Ezani,, Senior Lecturer, Department of Environmental and Occupational Health, Faculty of Medicine and Health Science, Universiti Putra Malaysia (UPM)**

**Professor Dr. Ahmad Zaharin Aris, Senior Professor, Department of Environmental Science and Technology, Faculty of Forestry and Environment, Universiti Putra Malaysia, 43400 UPM**

**Convenor: Semeena Valiyaveetil Shamsudheen, iLEAPS IPO, UKCEH, UK**

**Co-Convenor: Eliani Ezani**

**Session Overview**

This session at SRI2025 brought together leading researchers and practitioners to explore the urgent issue of global plastic waste and microplastic pollution, with a focus on transboundary movement of plastics, environmental leakage, and policy responses. The speakers provided multidisciplinary insights—spanning environmental science, public health, waste management, and international regulation—highlighting how plastic waste flows across borders, accumulates in ecosystems, and fragments into microplastics that threaten biodiversity and human well-being.

**Key Points and Themes**

• Global Waste Trade and Leakage: Norfazrin Mohd Hanif and Eliani Ezani detailed shifting global plastic waste flows after policy interventions. Export bans have redirected waste streams to Southeast Asia, often overwhelming local management capacity. This leads to open dumping, informal recycling, and environmental leakage that accelerates microplastic generation.

• Health and Ecosystem Risks: Sharifah Norkhadijah Bt Syed Ismail and Prof. Dr. Ahmad Zaharin Aris emphasized the chemical complexity of plastics and the risks from additives and contaminants. Microplastics are now detected in soils, rivers, marine systems, and food chains, with growing evidence of potential impacts on human health, including respiratory and endocrine effects.

• Regional Perspectives and Policy Gaps: Pui Yi Wong presented regional case studies highlighting the gap between regulatory frameworks (e.g., Basel Convention amendments) and on-ground enforcement. The speakers agreed that inconsistent monitoring and limited capacity in many import-receiving nations allow illegal or poorly tracked shipments to persist.

Innovations and Local Responses: Sarah Brooks showcased emerging solutions, including improved monitoring networks, circular economy initiatives, and safe-by-design plastics that simplify chemical compositions for future recyclability. They also highlighted community-led programs integrating citizen science into microplastic tracking.

**Takeaway Messages**

• A cap on global plastic production and targeted use restrictions remain critical to tackle pollution at source.

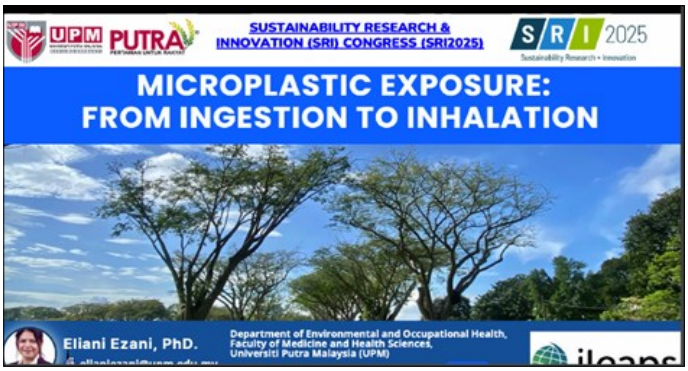
• Strengthening international cooperation and aligning national policies can curb illegal waste trade and support sustainable waste management.

• Monitoring and data sharing—through open databases and standardized protocols—are key to understanding microplastic pathways and shaping evidence-based policy.

Technological and design innovations must go hand in hand with reductions in production to ensure a safe and circular plastics economy.

**Conclusion**

The session underscored that plastic pollution is a transboundary challenge requiring global solutions. Speakers called for collaborative action linking science, policy, and community engagement to build resilient systems for managing plastics and mitigating microplastic impacts—paving the way for a sustainable future.

## Sustainability Research and Innovation Congress (SRI2025) Session Note

# Mapping Global Research Networks to Build Effective Knowledge-Action Systems for Sustainable Futures

**Speakers:**

Ariane de Bremond, Executive Director, Global Land Programme, GLP/University of Maryland, College Park

Semeena Valiyaveetil Shamsudheen, iLEAPS Executive Officer, UK Centre for Ecology and Hydrology.

**Session Overview**

This session explored how **global research networks** can be leveraged to create stronger links between knowledge generation and on-the-ground action for sustainability. The speakers highlighted that solving complex environmental and social challenges requires not only excellent science but also effective systems that connect researchers, policymakers, practitioners, and local communities.

**Key Points and Themes**

- **Why Networks Matter:** Semeena Shamsudheem emphasized that global networks enable sharing of data, tools, and experiences across borders. They help build capacity in under-represented regions, foster trust between stakeholders, and accelerate co-creation of solutions that are context-sensitive and scalable.

- **From Knowledge to Action:** Ariane de Bremond focused on the concept of **knowledge-action systems**, where research is deliberately aligned with decision-making needs. She presented examples from Future Earth and the Global Land Programme, showing how integrated networks can translate scientific insights into policy guidance and community initiatives.

- **Mapping and Gaps:** The session introduced methods for **mapping existing networks**, identifying overlaps, gaps, and under-served regions or topics. This mapping allows prioritization of new collaborations and avoids duplication of effort, strengthening global capacity to meet sustainability goals.

**Co-design and Inclusivity:** Both speakers stressed that successful knowledge-action systems require inclusive governance—actively involving early-career researchers, Indigenous communities, and practitioners to ensure relevance and legitimacy of outcomes.

**Takeaway Messages**

- Building effective knowledge-action systems requires moving beyond siloed projects to coordinated, well-mapped networks.
- Networks should prioritize co-production of knowledge, with stakeh-

- -olders engaged from research design through implementation.

- Strengthening global connections accelerates sustainable futures, particularly by filling knowledge gaps and fostering equitable participation.

**Conclusion**

The session highlighted that mapping and nurturing global research networks is not just an academic exercise but a strategic pathway to real-world impact. By connecting science with action through inclusive, well-coordinated systems, we can drive transformative change towards sustainability.

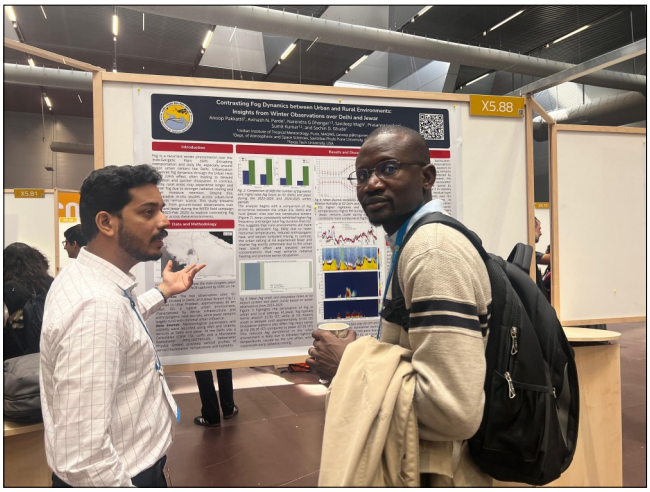
# Joint iLEAPS–IFDA Session and Meeting at EGU 2025: Advancing Global Collaboration on Fog and Dew Research

At the European Geosciences Union (EGU) General Assembly 2025 in Vienna, the Indian Institute of Tropical Meteorology (IITM), Pune, in partnership with the Integrated Land Ecosystem–Atmosphere Processes Study (iLEAPS) and the International Fog and Dew Association (IFDA), led two landmark engagements that placed fog and dew research in the global spotlight. Session AS2.2 – Fog and Dew: Advancing Our Understanding for Better Warning Systems

Convened by Dr. Sandeep Wagh (IITM, India) with co-conveners Dr. Jan Cermak (Karlsruhe Institute of Technology, Germany), Dr. Semeena V. Shamsudheen (IITM, India), Dr. Sachin D. Ghude (IITM, India), and Dr. Almuth Neuberger (Stockholm University, Sweden), this session brought together around 50 participants from multiple disciplines, including atmospheric scientists, policymakers, and aviation meteorology experts.

Over two days (30 April – 1 May 2025), the session featured 32 presentations—10 oral and 22 posters—covering aerosol microphysics, high-resolution fog modelling, dew harvesting innovations, and real-world case studies from airports affected by visibility hazards. Contributions drew on datasets from *WiFEX, FogLife*, and international dew networks, offering a rich evidence base for improving operational forecasting.

Presentations highlighted fog and dew from a public interest perspective, emphasizing that scientific advances must be paired with effective communication and stakeholder engagement to deliver maximum societal benefit—particularly for transportation safety and water scarcity. The session drew approximately 50 participants, including scientists, ear

early-career researchers, policymakers, and aviation meteorology experts. Discussions focused on standardizing visibility parameterizations, integrating radiometric profiles, and examining the influence of urbanization on fog dynamics.

The session concluded with a call for establishing a global research consortium on fog and dew, along with an announcement of the upcoming 2026 Fog and Dew Conference at IITM Pune, underscoring the importance of continued international collaboration.

**Joint iLEAPS–IFDA Workshop (SPM77)**

Held on 2 May 2025, this workshop served as a targeted platform to align iLEAPS' land–atmosphere research with IFDA's expertise in fog and dew science and application. The meeting attracted 30 participants and was explicitly designed to:

1.Foster interdisciplinary dialogue on fog and dew formation processes.

2.Share advances in observation, modelling, and field campaign design.

3.Identify collaborative opportunities in climate science, agriculture, water harvesting, and aviation safety.

4.Shape the agenda for the 2026 IFDA Fog and Dew Conference in Pune.

**Key scientific intersections emerged:**

• *iLEAPS perspective:* Land-surface processes—such as soil moisture, vegetation transpiration, and urban heat island effects—are critical drivers of nocturnal cooling, radiative loss, and fog/dew formation.

• *IFDA perspective:* Microphysical processes, dew harvesting techniques, and operational safety applications require integrated modelling and observational datasets for actionable outcomes.

Discussions also addressed the integration of flux-tower measurements, satellite land-surface temperature data, and advanced aerosol–fog interaction modelling. Joint field campaigns combining iLEAPS' land–atmosphere expertise with IFDA's microphysical and instrumentation capabilities were proposed as a pathway to improved early warning systems.

**Impact and Outlook**

Together, the AS2.2 session and SPM77 workshop demons-

-trated how targeted, cross-disciplinary collaboration can tackle the multifaceted challenges of fog and dew research—from microphysical understanding to operational forecasting and societal applications. By linking land–atmosphere science with real-world needs in aviation safety, water security, and climate resilience, these engagements have laid a strong foundation for global partnerships.

With the 2026 Fog and Dew Conference on the horizon, the collaborations initiated at EGU 2025 are poised to evolve into sustained, actionable research networks—advancing both scientific discovery and public benefit in the years ahead.

# iLEAPS SSC Meeting – Bali, Indonesia (09–10 June 2025)

## Held in conjunction with the ACAM (Atmospheric Chemistry and Asian Monsoon) Workshop: 09-13 June 2025

The iLEAPS Scientific Steering Committee (SSC) met in Bali, Indonesia on 09–10 June 2025, alongside the ACAM Workshop, bringing together SSC members, early-career representatives, and invited partners to discuss ongoing initiatives and future directions for iLEAPS.

**Key Highlights**

**Strategic Planning and New Initiatives:**

The SSC reviewed progress against the current iLEAPS Science Plan and began outlining priorities for the next phase (2026–2030). Discussion focused on enhancing our role in linking land–atmosphere research with broader sustainability agendas, including the Sustainable Development Goals, initiating different Working Groups and the emerging Global Plastics Treaty.

**Strengthening Regional Engagement:**

Members shared updates from regional networks, highlighting active collaborations in Asia, Africa, and Latin America. The SSC emphasized the importance of supporting regional workshops and early-career researcher (ECR) activities, particularly through capacity building and joint proposals to funding calls

**Partnership with other Global Research Networks of Future Earth and ACAM:**

Co-location with the ACAM (Atmospheric Chemistry and Asian Monsoon) Workshop provided a unique opportunity to exchange ideas with the atmospheric chemistry and climate communities. Representatives from IGAC (International Global Atmospheric Chemistry), SOLAS (Surface Ocean–Lower Atmosphere Study), Future Earth Taipei, iCACGP (International Commission on Atmospheric Chemistry and Global Pollution), and LAECESS (Latin America Early Career Earth System Scientists Network) joined the meeting online. They shared updates on their ongoing activities and expressed interest in exploring future joint initiatives with iLEAPS. Notably, iLEAPS already maintains strong collaborative relationships with IGAC and SOLAS, providing a solid foundation for further co-working opportunities.

**Early-Career Contributions:** Our ECR representatives shared innovative project updates and proposed new engagement formats, including short policy briefs and community-driven webinars to strengthen the science–policy interface.

**Outcomes and Next Steps**

- Discussions were well received regarding future SSC activities, with clear milestones outlined for collaborative research,

- Joint events, and outreach initiatives.

- Plans were made to enhance visibility through improved communication, including regular newsletters, social media engagement, and contributions to international conferences.

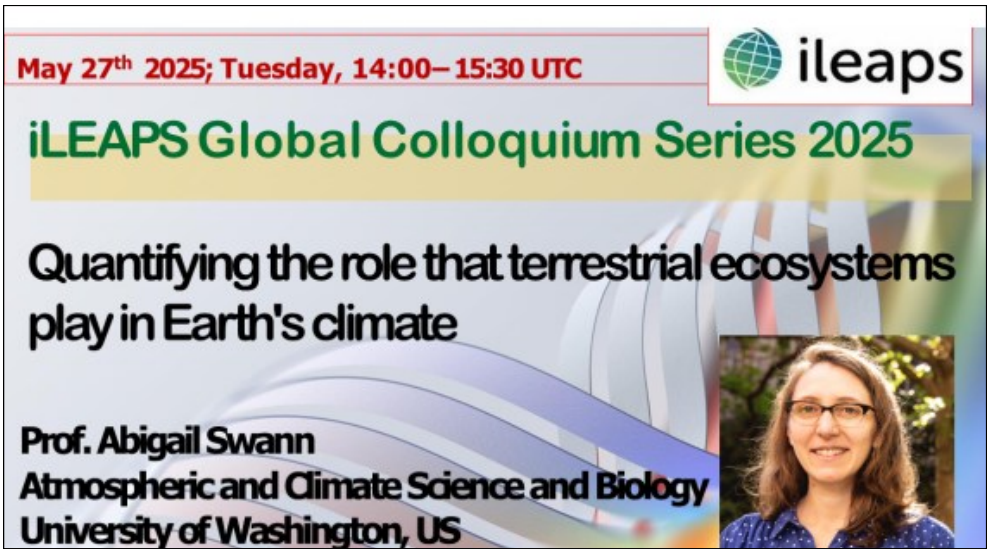
- The SSC expressed gratitude to local organizers and ACAM colleagues for a highly productive and inspiring setting in Bali.

**Looking Ahead:**

The Bali meeting reaffirmed iLEAPS' commitment to advancing integrated land–atmosphere research and fostering strong global networks that bridge science and policy for a sustainable future.

For more details or to get involved in upcoming activities, keep an eye on our next newsletter or visit the iLEAPS website.

## iLEAPS Colloquium Series-2025





## Funding Success: Future Earth Cross-Cutting Initiatives, March 2025

# A Transdisciplinary Approach to Improve Water Resources Prediction in Complex Mountain Regions (TD-MH)

**Jointly led by:** iLEAPS, Mountain Research Initiative (MRI), Sustainable Water Future Programme (Water Future), Future Earth Asia (FEA), and Future Earth China (FEC)

### A Major Step Forward for Mountain Water Security

We are delighted to announce that the proposal "Transdisciplinary Approach to Improve Water Resources Prediction in Complex Mountain Regions (TD-MH)" has been successfully awarded funding through the Future Earth Cross-Cutting Initiatives 2025 call. This achievement highlights the strength of collaboration across multiple Future Earth Global Research Networks and regional hubs, and the growing global recognition of the urgent need for better water resource predictions in mountain regions.

### Why This Project Matters

Climate change is rapidly transforming mountain hydrological systems, with far-reaching consequences for water security. Shrinking snow cover, glacial retreat, and more frequent extreme events—droughts, flash floods—are already impacting billions of people who depend on mountain-sourced water for drinking, agriculture, hydropower, and ecosystem services. Yet, reliable predictions remain elusive due to limited data, complex terrain, and the need to integrate human and natural system dynamics.

Through a truly transdisciplinary and co-designed approach, TD-MH will:

- Integrate advanced land surface models, satellite Earth Observation data, dynamic downscaling, and machine learning techniques to generate high-resolution water availability forecasts.

- Launch with stakeholder workshops in the Tibetan Plateau region to identify key decision-makers' needs, co-develop indicators, and ensure outputs are usable and relevant.

Establish an open data platform and produce guidelines for applying model outputs in planning and policy, supported by international organizations such as WMO TPRCC, GEO, and UNESCO.

### Expected Outcomes

- A white paper on best practices for integrating EO data into hydrological prediction.

- A practitioner's guide to apply TD-MH outputs in real-world water management.

- An open-access data repository to support ongoing decision-making.

- Peer-reviewed publications and groundwork for larger follow-on projects.

By bringing together global ex-

TD-MH will improve predictions of water resources under climate change and strengthen adaptive capacity in some of the world's most sensitive mountain regions.

***iLEAPS warmly congratulates all partners and looks forward to sharing progress from this exciting new initiative.***

## Funding Success: ESA–Future Earth Joint Programme Supports New iLEAPS-Led Initiative

# Enhancing Urban Resilience and Air Quality Management in Delhi NCR through Integrated Earth Observation and Decision Support Systems

**Funding Source:** Funding for Case Studies Using Earth Observation in LMICs through the ESA–Future Earth Joint Programme

**Led by:** iLEAPS in collaboration with Indian Institute for Tropical Meteorology, Pune, India, NCAR, and The University of Texas at Austin, Austin

iLEAPS is delighted to announce that the project "Enhancing Urban Resilience and Air Quality Management in Delhi NCR through Integrated Earth Observation and Decision Support Systems" has been awarded funding through the ESA–Future Earth Joint Programme for Case Studies in LMICs.

This initiative targets the National Capital Region (NCR) of India, where rapid urbanization has intensified heat stress and particulate pollution. Using high-resolution Sentinel-2, Sentinel-3, and Sentinel-1 Earth Observation data, combined with machine learning and advanced modelling (AIRWISE and NSM_Urban frameworks), the project will:

Map and quantify open wastelands across 19 NCR districts and assess their contribution to dust emissions.

Simulate the benefits of converting wastelands into green spaces, evaluating impacts on air quality, thermal comfort, and urban resilience.

Develop a Decision Support System to guide planners and policymakers with actionable strategies.

**Stakeholder Engagement**

Key agencies—including the Commission for Air Quality Management (CAQM), Delhi Pollution Control Committee (DPCC), and National Disaster Management Authority (NDMA)—will co□design project outputs. Stakeholder workshops at project inception and mid□term will ensure a two-way exchange of knowledge, keeping solutions relevant to regional policy needs.

This project marks a major step forward in integrating Earth Observation with urban planning to tackle climate and air quality challenges in one of the world's fastest-growing megacity regions.

**Expected Outcomes**

High-resolution wasteland maps and quantified dust contributions across NCR

Scenario assessments showing benefits of green space conversions

A Decision Support System empowering planners to reduce heat stress and particulate pollution

iLEAPS is proud to celebrate this success in securing ESA–Future Earth funding. By integrating EO data, machine learning, and stakeholder co-design, this project will deliver actionable insights to enhance urban resilience and air quality in one of the world's most dynamic regions. (For more details, contact the iLEAPS International Project Office.)

## 10th International Conference on Fog, Fog Collection, and Dew

The upcoming 10th International Conference on Fog, Fog Collection, and Dew will take place from the **21st to 25th September 2026 in Pune, India.**

The conference will provides a dynamic forum for the exchange of ideas and the latest research findings from scientists worldwide interested in the life cycle of fog and dew at the interface between surface, vegetation and the atmosphere, and in the collection of fog and dew for freshwater production.

Its interdisciplinary character at the crossroads between fog and dew physics and chemistry and their interactions with and impacts on vegetation, materials, and human activities makes it unique as well as the range of topics and participants.

Both advanced scientific findings and fog collection projects find a broad audience. Participants include repre-sentatives from universities, the private sector, government and international agencies, and educational organiza-tions.

**Dates:** 21–25 September, 2026

**Venue:** IITM, Pune, India

**More details:** https://ews.tropmet.res.in/fogdew26/

## World Meteorological Organization

### 11th WMO Scientific Conference on Weather Modification (Pune, India, 3-7 November 2025)

**The Eleventh WMO Scientific Conference on Weather Modification will be held at IITM Pune, India during 3-7 November 2025.**

**The Conference is being organized in the following main areas:**

a) Weather Modification Research and the study of cloud and precipitation processes

b) Operational weather modification projects, methods, outcome, and their scientific assessments

c) Weather Modification, and the physical and socio-economic environment aspects

**Specific sessions will be conducted for**

* Observational studies
* Field measurements

* Laboratory Studies
* Modelling studies
* Emerging Technologies for weather modification/ weather forecasting
* Decision support systems and nowcasting towards Weather management
* Advanced statistical methods, including data-driven models, AI/ML
* Physical, environmental, and socio-economic aspects, ethical aspects
* Operational cloud seeding
* Climate Intervention Research, Stakeholders /policymakers perception and demands

**Dates:** 3–7 September, 2025

**Venue:** IITM, Pune, India

**More details:** https://wmo-11scwxmod.tropmet.res.in/

## INTROMET-2025: International Symposium on Tropical Meteorology Comes to Pune

The TROPMET/INTROMET conference series, the flagship event of the Indian Meteorological Society (IMS) since 1992, continues to be the largest and longest-running platform for exchanging ideas in meteorology, ocean-ography, climate science, and allied fields. Held annually as TROPMET and every fourth year as the international symposium INTROMET, the event now celebrates its 30th edition — hosted this year by the Indian Institute of Tropical Meteorology (IITM), Pune.

From 18–20 November 2025, INTROMET-2025 will bring together scientists, policymakers, students, and stake-holders from across the globe under the theme:

**“Advances in Tropical Weather, Ocean, and Monsoon Climate Research for a Sustainable Future”**

Spanning 28 sub-themes across earth, atmosphere, ocean, and environmental sciences, the symposium will spotlight the role of cutting-edge research and emerging technologies in improving tropical weather forecasting, understanding monsoon systems, and addressing the challenges of climate change.

In an era where extreme events are becoming more frequent, these advancements are essential for mitigating natural disasters, boosting agricultural productivity, optimizing water resources, and building resilient communi-ties. By integrating innovative techniques with deep scientific insights, INTROMET-2025 aims to translate re-search into actionable solutions for sustainable development and climate resilience.

# Upcoming Events

**Dates:** 18–20 November 2025

**Venue:** IITM, Pune, India

**More details:** https://intromet25.tropmet.res.in/

## 7th iLEAPS Open Science Conference, Hiroshima, Japan


The 7th iLEAPS (Integrated Land Ecosystem-Atmosphere Processes Study) Open Science Conference will be held in Hiroshima, Japan, with the iLEAPS-Japan committee. https://esd.nies.go.jp/ileaps-japan/eng/ https://esd.nies.go.jp/ileaps-japan/ from the National Institute for Environmental Studies https://esd.nies.go.jp/ileaps-japan/ hosting the event at Hiroshima University. The conference is scheduled for **March 1-5, 2027.**

**Location:** Hiroshima University, Hiroshima, Japan.

**Dates:** March 1-5, 2027 (with pre-conference events on February 27-28).

**Sponsor:** iLEAPS (Integrated Land Ecosystem-Atmosphere Processes Study).

**Organized by:** iLEAPS-Japan, with support from the National Institute for Environmental Studies.

**Focus:** Open Science within the context of iLEAPS' research on land-atmosphere interactions.

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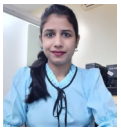

**Newsletter Prepared By Bhagyashri Katre**

**IITM,Pune**