Integrated Land Ecosystem - Atmosphere Processes Study

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Newsletter

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Editor's Note

Since its inception in 2004, the Integrated Land Ecosystem-Atmosphere Processes Study (iLEAPS) has become a beacon of interdisciplinary research, illuminating the intricate nexus between terrestrial ecosystems and the atmosphere. This global network has not only deepened our understanding of these complex interactions but also positioned itself at the forefront of promoting global sustainability.

In this editorial, we explore into the latest strides made by iLEAPS researchers, showcasing the vibrant activities and ground breaking events that have shaped this dynamic community. At the heart of iLEAPS' mission lies the exploration of land-atmosphere interactions—a field that encompasses the fascinating exchanges of carbon and water, energy fluxes, and the profound effects of land use and cover changes. By integrating observational data, conducting innovative field experiments, and enhancing predictive models, iLEAPS is paving the way for more accurate forecasts of climate patterns, weather phenomena, and ecosystem dynamics.

A critical component of iLEAPS' work involves assessing the environmental impacts of human activities. Whether it's examining the consequences of deforestation, urban expansion, or other anthropogenic influences, iLEAPS aims to provide comprehensive assessments that inform policy decisions for sustainable land management. This endeavor is increasingly vital as we face the realities of climate change and its far-reaching impacts on ecosystems and public health.

This edition of the iLEAPS Newsletter spotlights recent advancements in our understanding of how surface conditions respond to climate change. Among the featured articles, Dr. Meng's review emphasizes the importance of collaboration in studying land-atmosphere interactions and how it affects weather and climate substantially, based on observations, satellite data and modelling, particularly over the arid and semi-arid regions, including the high-altitude and cold Tibetan Plateau. Professor Jan Cermak, President IFDA offers an insightful glimpse into the captivating world of fog and dew, highlighting the latest research in this niche yet significant field. As he introduces the International Fog and Dew Association, we are reminded of the delicate nexus between the atmosphere and the Earth's surface that these phenomena represent. A dedicated, global network of scientists is at the forefront of exploring the meteorological intricacies, distribution patterns, and trends of fog and dew. Their work not only advances our understanding of these atmospheric wonders but also sheds light on their broader implications for ecosystems and human society.

As we immerse ourselves in these scientific revelations, the importance of interdisciplinary collaboration and pioneering research becomes ever clearer. The iLEAPS community remains steadfast in its commitment to advancing knowledge, fostering global partnerships, and nurturing the next generation of scientists who will lead the charge towards a more sustainable world. Stay engaged with us as we continue to unveil new insights, forge new collaborations, and drive the global sustainability agenda forward.

Acknowledgement

We would like to extend our heartfelt appreciation to Bhagyashri Katre, IITM, Pune, India for her exceptional dedication, expertise, and commitment in crafting this comprehensive Newsletter.

Additionally, we would like to express our gratitude to all those who have provided guidance, feedback, and assistance throughout the development of this report. Your collective efforts have been invaluable in shaping the outcome. We are also truly thankful for the contributions from all authors.

Sincerely,

The iLEAPS IPO

Dr. Meng is a scientist in Northwest Institute of Eco-Environment and Resources, Chinese Academy of Science. She is interested in how land surface conditions respond to climate change, and affect weather and climate substantially, based on observations, satellite data and modelling, particularly over the arid and semi-arid regions, including the high-altitude and cold Tibetan Plateau regions. Now she leads a field observational station called "Zoige Plateau Wetlands Ecosystem Research Station" in Northeast Tibetan Plateau in China. In iLEAPS, Dr Meng will try to bring more collaboration on land-atmosphere interactions and sustainable development in cold Tibetan Plateau region and arid regions between China and other regions globally.

Strong soil moisture-atmosphere interactions on the Tibetan Plateau and its behind energy mechanism

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The Tibetan Plateau (TP) is Asian water tower and ecological barrier for China. The convective activity on the TP is frequent, with a much higher ratio of convective precipitation compared to other regions in Asia. Convective activity affects the water cycle, ecological environment, weather and climate of the TP and surrounding areas. Interactions between land and atmosphere (L-A) play an important role in weather and climate systems. As a sensitive area to climate change and an active area of convective activity, the water vapor local recycling rate and L-A interactions are stronger on the TP.

Soil moisture (SM) is well recognized to govern surface energy and water exchanges at the L-A interface, which in turn affects the development of the atmospheric boundary layer (ABL); thus it leading to significant feedback for regional climate. Soil moisture memory also impacts the precipitation regime (Orth et al., 2012). SM can affect the triggering and development of local afternoon convection by altering surface energy balance and water vapor. The convective boundary layer height on the TP is higher than that of the same latitude plain areas (Chen et al., 2016). A deeper ABL of the TP is relevant to surface heat fluxes, low air density, and atmospheric stratification. The CTP-HIlow framework provides the characteristics of daily-scale soil moisture-atmosphere coupling, its spatial differences, and the coupling strength of the L-A interactions in different weather backgrounds. Further, the ABL energy research reveals soil moisture-atmosphere interactions on the TP and its behind energy mechanism.

Strong soil moisture-atmosphere interactions on the TP

CTP - HI_{low} framework predicts whe-

-ether land surface conditions influence the occurrence of convection.

$$CTP = \int_{P_{surf}-100}^{P_{surf}-300} g\left(\frac{Tv\_env - Tv\_obs}{Tv\_obs}\right)dz \quad , \qquad (1)$$

$$HI_{low} = \overline{(T\text{-}T_d)} * 2 \quad , \qquad (2)$$

where P_{surf} is surface pressure, $Tv_{\_env}$ is a moist adiabatic originating at the P_{surf}-100 hPa, and $Tv_{\_obs}$ is the observed temperature from sounding observations. The CTP is integrated from 100 to 300 hPa above the surface. Positive CTP values indicate instability between 100 and 300 hPa above the surface. T is temperature, and T_d is dew point temperature. Because the surface pressure of the observed stations in the TP is near 600 hPa, the HI_{low} used in this study is double the mean value of the dew point depressions between 50 and 100hPa above the ground surface.

The slab model used by Findell and Eltahir (2003a) (hereafter, FE2003a) was forced by morning sounding observations of 0000 Coordinated Universal Time (UTC) (08:00 Beijing Time [BJT]) from the TP. Hourly precipitation, surface pressure, surface air temperatures observed by 16 national basic meteorological observation stations, and sounding in the TP (shown in Figure 1, black dots) were utilized to force the 1-d model. The Third Tibetan Plateau Atmospheric Science Experiment (TIPEX-III) carried out intensive routine sounding observations four times a day (02:00, 08:00, 14:00, and 20:00 BJT) at the Shiquanhe (SQH, 32.4°N, 80.1°E; 4,280 m), Gerze (GZ, 32.3°N, 84.1°E; 4,416 m), and Jiulong (JL, 29.0°N, 101.5°E; 2,925m) stations (Figure 1, red stars) from July to August 2014.

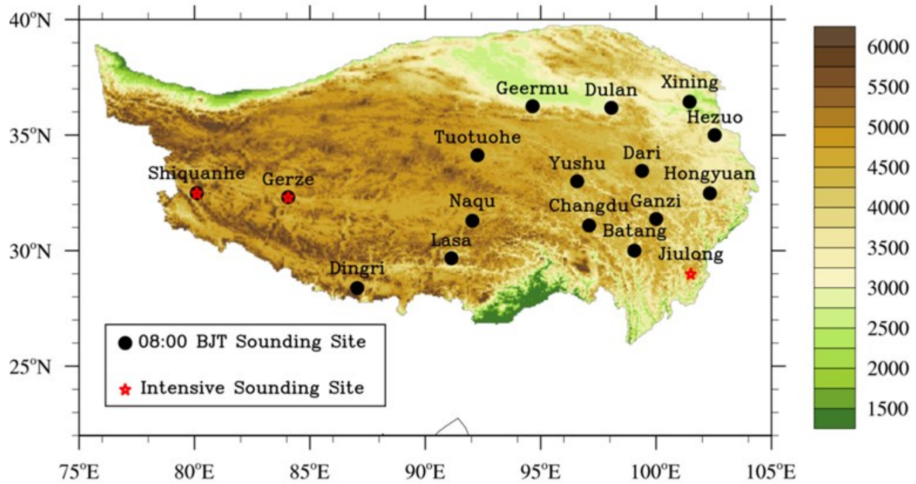

Figure 1 Locations of the 17 Tibetan Plateau stations and the surrounding terrain (unit: m), with the names of the stations marked in the figure.

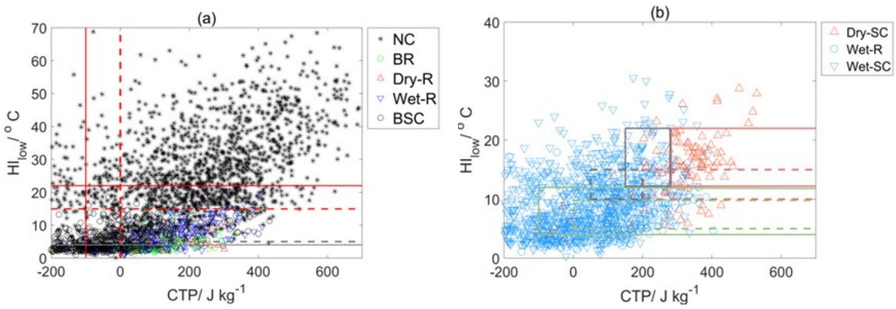

Figure 2 The outcomes of the same results (a) and different results with wet and dry soil (b). (a) includes both no-convection (star), both rain (green circle), dry soil for rain but wet soil for shallow cumulus (SC, red triangle), wet soil for rain but dry soil for SC (blue down triangle), and both SC (black circle).

Atmospheric control accounted for the largest proportion, and the dry-advantage was relatively small (Figure 2). The threshold of CTP for dry advantage cases is approximately 300 J kg^{-1}, which is larger than that of the United States (200 J kg^{-1}) and India (200 J kg^{-1}). It should be noted that SC can be triggered when the CTP is lower than -100 J kg^{-1} .

The convection triggering are mainly atmospherically controlled. The synoptic background strongly influences the triggering of convection over the TP (Figure 3). The proportions of atmospheric control decrease from the north to the south of the TP, i.e., SM impacts increased from the north to the south of the TP. The percentages of convection affected by soil moisture ranged from 9.55% to 50.34% over the TP.

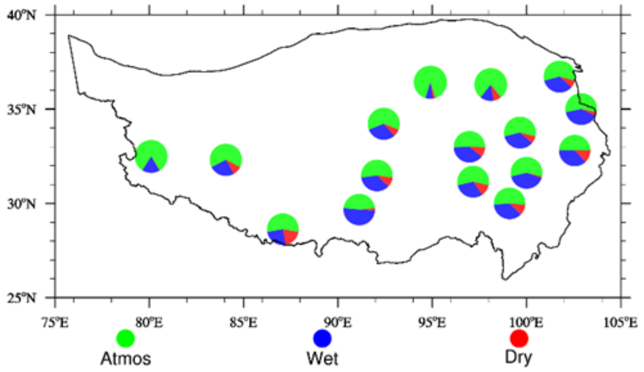

Figure 3 Spatial distribution of outcomes for atmospherically control, wet-advantage, and dry advantage over 16 stations on the Tibetan Plateau.

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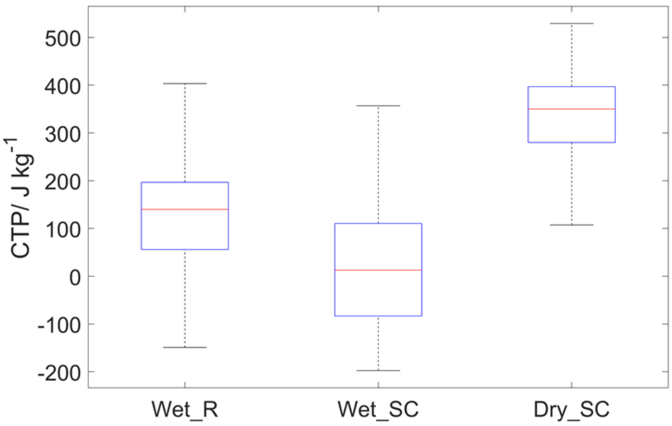

Figure 4 Box-and-whisker plots showing the 5th, 25th, 50th, 75th, and 95th percentile values of CTP shown in Figure 2b.

The convection affected by soil conditions was significantly larger than that in the US (30%) and India (25%). Non-atmospherically controlled cases close to 50%, are mainly located in the broadly central TP. The outcomes affected by surface conditions showed a significant difference in different region of the TP. Over the north of the TP, wet-advantage are relatively small. Dry advantage cases are relatively few over the TP, it takes maximum proportion at the south of the TP.

Why it is strong coupling?

A negative CTP value indicates that the atmosphere is stable, and a larger negative value indicates stronger stability. Convection occurred when the CTP was between -150 and 0 J kg-1. Even though the atmosphere is slightly stable, the convection can still be triggered. Owing to the relatively low air density, the atmosphere's heating efficiency is higher under the same heat fluxes.

Compared to the continental United States (Findell and Eltahir, 2003b; Ferguson & Wood, 2011) and the India (Tuinenburg et al.,

2011), lower air density over the TP leads to a larger buoyancy flux under similar sensible heat flux; thus the ABL grows higher. At the same time, a lower temperature over the TP leads to lower lifting condensation level. A lower lifting condensation level and higher ABL height can trigger convection more easily. With wet soil, water vapor of the land surface is sufficient, even the atmosphere is relatively stable (with negative CTP), a larger buoyancy flux induced by lower density can overcome the stable layer.

Influences of meteorological elements

The precipitable water vapor (PWV) of different categories Figure 5 (a) illustrates that convection triggering is relevant to the PWV value. The wet soil advantage has the largest PWV. Relative humidity Figure 5 (b) showed convection triggered under wet or dry soil conditions when RH is larger than 60%. Wind speed (Figure 5c) showed that, except for the atmospheric stability and humidity, the WS over the TP was another factor affecting the convection development. A smaller WS is favorable for the convection. Similar to HI_{low}, the dew temperature depression shown in Figure 5d indicates that no-convention will likely occur under wet and dry soil conditions if the dew temperature depression is more than 10 □. The mean dew temperature depression is lowest in both convection and then wet-advantage. Therefore, it seems likely that when it is humidity enough (e.g., RH>60%), the atmosphere or soil moisture condition could trigger convection more easily.

Energy mechanism of Atmospheric Boundary Layer (ABL) development

The energy for ABL growth (E_all) had a significant positive correlation with accumulated sensible heat flux (EHs) at the three statiothe proportion of different energies at the three sites (Table 1). The accumulated surface sensible heat flux accounted for the most significant proportion, which was consistent with the conclusion that surface sensible heat is the primary energy leading to the ABL growth. The accumulated surface sensible heat flux accounted for 73% at the JL station, which was the closest to the total energy required for the ABL growth. At the SQH Station, the RL also plays the most significant influence (9.7%), except for the accumulated surface sensible heat flux (63%).

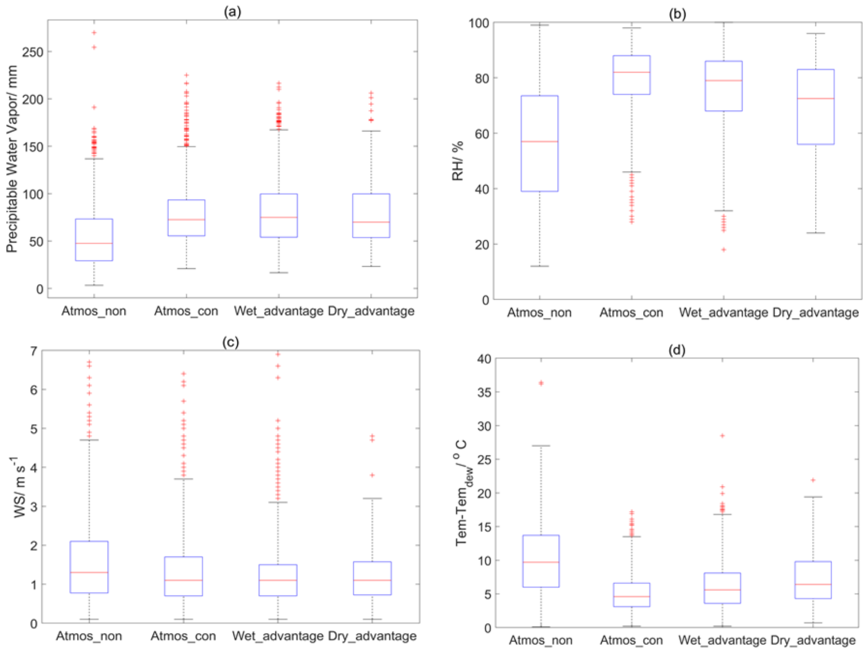

Figure 5 Box-and-whisker plots of precipitable water vapor (a, unit: mm), relative humidity (RH, b, unit: %), wind speed (WS, c, unit: m s-1), dew temperature depression (d, unit: °C) of four categories including no-convection in atmospheric control (Atmos-non), convection in atmospheric control (Atmos-con), Wet-advantage and Dry-advantage.

-ns, which was consistent with the previous results. With comparable accumulated sensible heat fluxes in the observation period, ABL depths show significant differences between days. The contribution of the RL energy (ERL) to the ABL growth was further considered based on the accumulated sensible heat flux. The correlation between the sum of these two parts and the energy required to develop the ABL increased. The surface heat flux was the primary factor influencing boundary layer development. In addition to the surface sensible heat flux, the RL energy, sensible heat (EHs_top) , and latent heat (ELH_top) at the top of the boundary layer also affected the boundary layer development.

There were apparent differences in

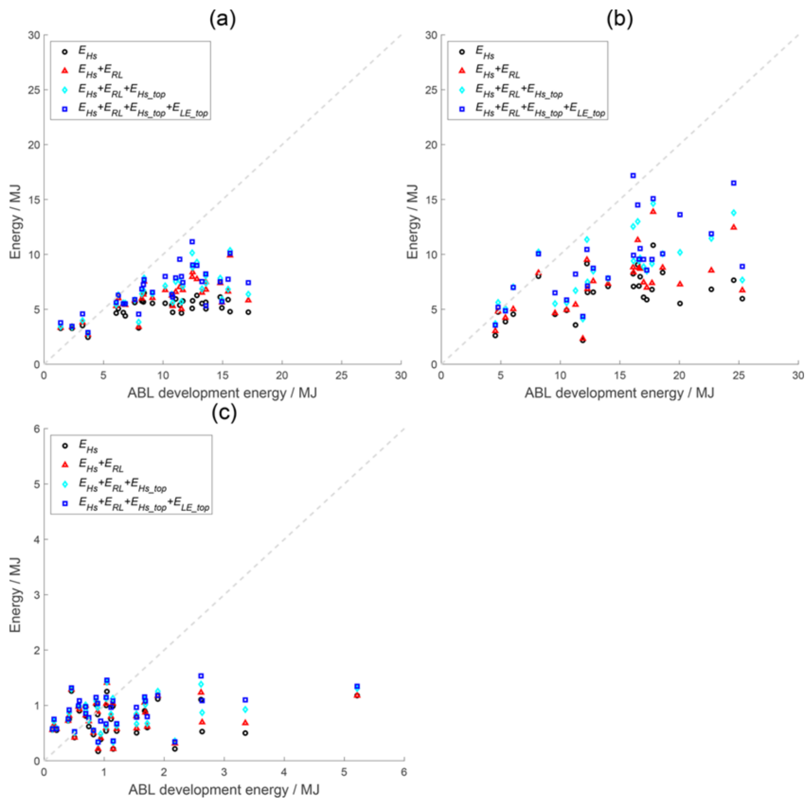

Figure 6 Comparison between the energy absorbed by the development of the atmospheric boundary layer (ABL) and the sum of the components, including accumulated surface sensible heat flux, the energy of residual layer (RL), the energy of sensible heat flux, and latent heat flux of the entrainment layer (EHs, EHs + ERL, EHs + ERL + EHs_top, EHs + ERL + EHs_top + ELH_top) at (a) Shiquanhe (SQH), (b) Gerze (GZ), and (c) Jiulong (JL) stations.

In addition, the sensible and latent heat flux at the top of the boundary layer account for the same proportion (4%) at this site, and all components accounted for 80.7%.

$$prop = (E_{Hs} + E_{RL} + E_{Hs\_top} + E_{LH\_top}) / E\_all \quad (3)$$

Table 1 Summed surface sensible heat flux, residual layer energy, sensible heat, and latent heat flux of entrainment layer accounted for the proportion of boundary layer development energy (%)

Station	E_{Hs}/E_all	E_{RL}/ E_all	E_{Hs_top}/ E_all	E_{LH_top}/ E_all	**prop**
Shiquanhe (SQH)	62.5	9.7	4.2	4.2	80.7
Gerze (GZ)	45.6	6.6	11.1	3.4	63.3
Jiulong (JL)	73.0	5.4	6.5	5.2	89.6

Effects of wind shear

In addition to these factors, wind shear can affect the ABL development. Increased wind shear is associated with enhanced vertical momentum transport. The CBL depth development of the TP is driven mainly by thermal turbulence, and the kinetic turbulence effect is relatively small (Wang et al., 2015). The descriptions of wind shear were calculated through each observed soundings (Figure 7). Comparisons of the wind shear at different groups of the three stations showed similar characteristics. For *prop* ≥ 60% cases, the wind shear was mainly smaller than the mean value. In contrast, the wind shear is larger than the mean value in prop < 60%, especially at noon (14:00 BJT). The accumulated surface sensible heat flux at the JL Station can explain the total energy required to develop the boundary layer, which may be related to the small wind shear.

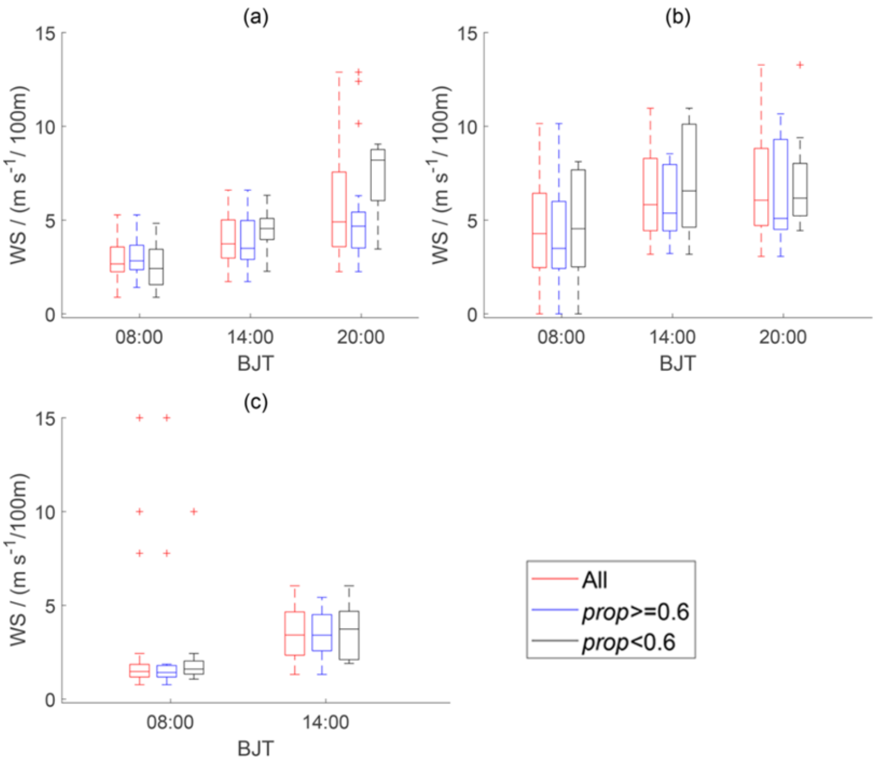

Figure 7 Wind shear (WS) of the boundary layer measured at (a) Shiquanhe (SQH), (b) Gerze (GZ), and (c) Jiulong (JL) Stations.

Research Implications

Soil moisture plays an important role in afternoon precipitation triggering on the TP. Afternoon convection triggering on the TP is mainly affected by atmospheric background, and soil moisture triggering afternoon convection also accounts for a significant proportion. The degree to which soil moisture affects afternoon convection triggering is close to 50% of the sites in the central TP. The positive and negative feedback areas of soil moisture and atmospheric convection are mainly located in the central region of the TP and the southwest region, respectively. Wind speed also has certain influences on the convection triggering. As the TP has a high elevation, low air density, and stronger thermal turbulence, convection can still be triggered under weak atmospheric stability conditions. Soil moisture can affect the devel-

-opment of ABL by altering surface energy balance and water vapor. A lower air density over the TP leads to stronger thermal turbulence, increasing the convective boundary layer height and favoring convection triggering. The surface sensible heat flux, boundary layer entrainment energy, and heat flux at the top of the ABL affected ABL growth. Daily accumulated ground sensible heat flux and residual layer energy play a critical role in the development of the boundary layer on the TP, and the effects of wind shear on ABL growth cannot be ignored. The strong coupling strength was caused by low air density and the sensible heating.

Acknowledgment

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Jan Cermak is a professor of geophysical remote sensing at Karlsruhe Institute of Technology (KIT), Germany. His research focuses on remote sensing of the climate system, with a particular focus on clouds and aerosols. Fog research has been of particular interest to him since 2003. He has developed techniques to characterise fog from the satellite perspective and conducted in-situ and ground-based research on fog processes with partners in various countries. Since 2023 he has been president of the International Fog and Dew Association (IFDA).

Connecting fog and dew research across the world: The International Fog and Dew Association

Fog and dew are fascinating phenomena at the interface between the atmosphere and the Earth surface. A small but well-connected global community is dedicated to improving our understanding of the meteorological processes involved, the spatial and temporal patterns, trends, as well as impacts on ecosystems and society. This contribution presents a concise overview of current research topics, and introduces the International Fog and Dew Association.

Non-rainfall water input

Fog and dew are of immediate importance to human life and to ecosystems as non-rainfall sources of water, and in the case of fog also as a modifier of radiation, a transport agent of pollutants, and an obstacle to traffic (figure 1). Water input is of particular importance in water-limited environments, such as the Atacama and Namib deserts, but also in cloud forests around the world. It is still not entirely understood how the drivers of occurrence and magnitude of non-rainfall water inputs in these regions interact, and what future changes are to be expected in a changing climate, also with respect to spatial patterns. This is true of fog, dew, and also direct adsorption of water vapor at dry surfaces. Material science research meanwhile focuses on identifying the most efficient materials to collect fog water from the air, to make atmospheric water available to local communities.

Chemical and physical properties

Continual measurements of fog water properties have been performed in various locations, and led to insights into trends in the chemical composition of particles transported. These are on the one hand indicators of ecological processes and anthropogenic pollution as sources of the substances detected. On the other hand nutrients reach ecosystems by this process, and long-term monitoring will reveal changes in environmental conditions. At the same time, the particles at the center of fog droplets fundamentally determine the physical properties of the fog. By acting as cloud condensation nuclei, aerosols of varying provenance and properties influence the size and concentration of the droplets, and thereby the reflectivity of the fog cloud, and indirectly its temporal persistence. More and smaller droplets, as effected by greater concentration of atmospheric aerosols, make the fog brighter, and longer lasting. The magnitude and precise nature of aerosol-cloud interactions remain among the greatest uncertainties in our present-day understanding of the climate system. As a cloud directly at the Earth surface, fog provides a unique opportunity to study the processes and effects in great detail. This is made use of in ground-based campaigns, modeling studies, and analyses using satellite-collected data.

Advances in techniques

Recent years and decades have seen great improvements in the techniques used to analyze fog and dew. New methods and instruments have been developed to precisely quantify dew input and water vapor adsorption at the surface, to collect fog water from the air, to analyse its chemical composition, and the physical make-up including droplet size and concentration. Many collaborative international campaigns have utilized these advancements. At the same time satellite-based remote sensing has greatly improved in spatial detail in temporal resolution, and in information content (i.e., number and position of channels).

Trends and land-atmosphere interactions

All of these advancements are being exploited in efforts to obtain a more complete system understanding, and to quantify systematic changes in the occurrence frequency and properties of fog over time. Improving numerical weather models on the basis of these new insights is an ongoing challenge. Great advances have recently been made using machine-learning techniques, and the potential for the coming years appears great.

The fog and dew research community is well positioned to provide answers to pressing research questions at the interface of climate change and land-surface change, the two the great challenges to human livelihoods. Effects of land cover on atmospheric water are clearly visible (figure 2). Their quantification at the global scale will be one of the challenges for future research.

Figure 1: Fog providing water to the Namib desert environment, while also impairing vehicle traffic. Photo taken near Henties Bay, Namibia, in May 2024 by Deepanshu Malik.

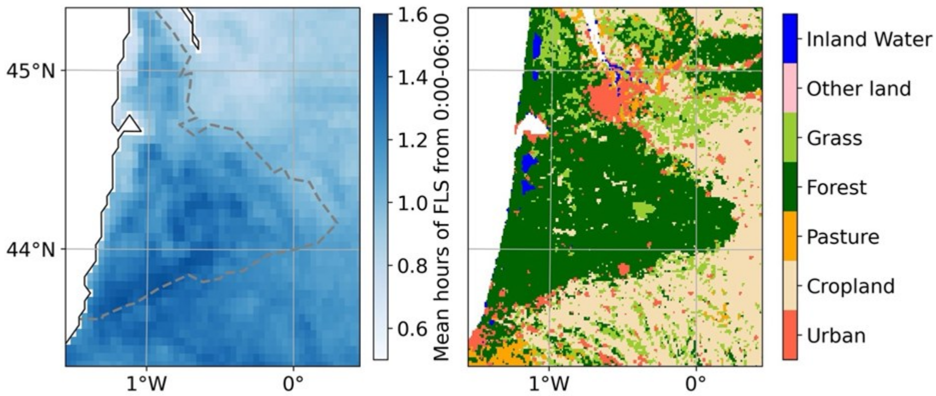


Figure 2: Enhanced fog and low stratus (FLS) occurrence detected in night-time satellite data in and around a large forested area in South-Western France. Figure by Eva Pauli, based on and modified after https://doi.org/10.1029/2021GL097058.

IFDA and conference series

Progress on these and may other related topics has been shared in the nine conferences on "Fog, Fog Collection and Dew" that have been taking place in intervals of three to four years since 1998.

Since then, the conference has travelled to five continents, and brought together a diverse and expanding community of researchers from around the world. The 9th conference, held in 2023 in Fort Collins, Colorado, USA, was attended by 134 participants from 27 countries, including more than 40 students.

To foster exchange within this community, and to oversee the continuation of the conference series, the International Fog and Dew Association (IFDA) was founded at the 2016 conference in Wroclaw, Poland. IFDA is a non-profit organization, and open to participation, primarily via conference contributions. The 10th conference will be held in Pune, India, 21-25 September 2026. Further information on this, as well as the activities of IFDA, can be found at :

https://www.fogdew.org

where you can also subscribe to the community newsletter.

National Training Workshop On: Climate impacts of carbonaceous Aerosols and Measurements (NT-CCAM - 1)

National Training Workshop On: Climate impacts of carbonaceous Aerosols and Measurements (NT-CCAM) was organised at Indian Institute of Tropical Meteorology (IITM), Pune, India from 4 to 7 Dec 2023. The main themes of the workshop included key and emerging topics regarding physical, chemical and radiative impacts of carbonaceous aerosols.

The carbonaceous aerosols influence the climate by altering the earth's radiation budget. The major carbonaceous aerosols include Elemental carbon (EC), Black carbon (BC), Brown carbon (Brc) and organic carbon (OC). While the former three aerosols are majorly absorbing in nature, the latter one has both scattering and absorbingcharacter. Out of these BC is considered as the second most global warming agent after CO_2 .

However, the present-day awareness about these aerosols is limited.

Hence this 4-day workshop was organised for early carrier research fellows/Master students. A total of 60 participants attended this workshop. The climate impact of carbonaceous aerosols mainly focusing on its measurement techniques, was a major theme for this workshop. The workshop covered the measurement aspects of carbonaceous aerosols. It included lectures, field visit, training and hands on training to radiative transfer modules. The workshop addressed the different measurement techniques of carbonaceous aerosols (In ground, balloon and aircraft platforms), their concentration in different regions, their compositions and their climate impacts in terms of radiative forcing. Along with lectures, hands on training on different equipment's and one-dimensional radiative transfer modules were also given. Hands on training on the Optical Properties of Aerosols and Clouds: The Software Package (OPAC) to obtain the optical properties like Aerosol Optical Depth, Single Scattering Albedo, Asymmetry Parameter was given. Along with this hands-on training on the radiative transfer model Santa Barbara DISORT Atmospheric Radiative Transfer (SBDART) was also given. The workshop also included a one-day visit to the High-Altitude Cloud Physics Laboratory (HACPL) in Mahabaleshwar where the participants were introduced to the various measurement techniques present at the facility. The participants were introduced to the OC-EC analyser, the low volume and high volume particulate samplers, Ion Chromatograph, Atomic Absorption Spectrometer and so on. The workshop concluded with a valedictory function.

iLEAPS Flagged PICO Session on "Urban Ecosystem Dynamics: Challenges and Advances"

iLEAPS Flagged PICO Session on "Urban Ecosystem Dynamics: Challenges and Advances" Conducted on 19th April at European Geophysical Union (EGU) Assembly 2024 at Vienna, Austria. This session was lead by Dr. Pallavi Saxena, SSC Member iLEAPS, Dr. Saurabh Sonwani, iLEAPS Early Career Chair of South Asia and Middle East Region, Dr. Semeena V. Shamsudheen, iLEAPS IPO and other members of Sheffield University UK. It has two sub-sessions, Morning Session: Air Quality and Climate Change Mitigation conducted by iLEAPS Team and evening session: Urban Ecosystems: Structure and Functioning conducted by Sheffield University members team. In each sub-session about 14 both onsite and online PICO presentations were held from different parts of countries. Our opening speaker of this session was Dr. Erika von Schneidemesser, Project Leader · Institute for Advanced Sustainability Studies (IASS), Potsdam.

International Workshop on Stratosphere-Troposphere Interactions and Prediction of Monsoon weather Extremes (STIPMEX)

International Workshop on Stratosphere-Troposphere Interactions and Prediction of Monsoon weather EXtremes (STIPMEX) was held at Indian Institute of Tropical Meteorology, Pune, India. during 02-07 June 2024. Several experts from around the world deliberated on these and related topics which led to an exchange of knowledge across different institutions globally. Around 220 participants from India and 30 different countries of Asian, European, American, and African continents attended the International workshop. The workshop and its themes (1) Stratosphere-Troposphere Interactions and (2) Prediction of Monsoon weather Extremes have a global importance and hence it was supported by the Ministry of Earth Sciences, Govt. of India, WMO, WWRP, WCRP, APARC, and Forschungszentrum Jülich, Germany. The papers presented in the STIPMEX will be published in a special issue of 'Atmospheric Chemistry and Physics' after peer review. There was an overwhelming response by national and international scientists and students.

FE General Assembly 2024 Helsinki, Finland

Photo credits : Jere J. Aalto.

The third General Assembly of Future Earth was held in Helsinki on 12-13 June 2024.

Representatives from the Global Research Networks (GRNs) of Future Earth gathered on site and online for an inspiring and impactful meeting.

Keynotes were delivered by Prof. Joyeeta Gupta, co-chair of Earth Commission on what is needed to get to safe and just space for a resilient planet and well-being for all and Sirkku Juhola from the Future Earth Governing council about the role of society in extreme events. Panel discussion addressing joint planetary crisis was followed with Linwood Pendleton (Executive director of Ocean Knowledge Action Network),

Norichika Kanie (Professor at Keio University, Japan), Henrik Larsen (European Environment Agency) and Joyeeta Gupta and Antony Capon (Monash University) moderated by Sophie Hebden from the European Space Agency.

Thematic breakout discussions with a view to identifying integrated gaps in our understanding were led by Anik Bhaduri from Water Resources and Semeena Shamsudheen from iLEAPS (Extreme events and societal impacts), Cornelia Krug (Bending the curve on biodiversity loss, where Pallavi Saxena was invited to deliver a talk), Kristie Ebi (Health risks of disruptions to Earth's physical systems), and Herbert Mba Aki, Ph.D. (Advancing Sustainable Development Beyond the SDGs). Semeena also lead the breakout on second day of the assembly on the topic "Science Direction" for Future Earth. She was also part of the organising committee of the General Assembly together with Co-chairs Cornelia Krug & Kristie Ebi, Anik Bhaduri, Stephane Blanc, Semeena Valiyaveetil Shamsudheen, Hannah Liddy, Ariane de Bremond, Xiaoyu Fang, Herbert Mba Aki, Ph.D., Ria Lambino, Fumiko Kasuga, Jakob Lundberg, Wendy Broadgate.

National Training Workshop On: Climate impacts of carbonaceous Aerosols and Measurements (NT-CCAM – 2)

National Training Workshop On: Climate impacts of carbonaceous Aerosols and Modelling (NT-CCAM 2) was organised by Indian Institute of Tropical Meteorology (IITM), Integrated Land Ecosystem Atmosphere Processes Study (iLEAPS), World Meteorological Organization (WMO) at Indian Institute of Tropical Meteorology (IITM), Pune, from 25 to 27 June 2024. The main theme of the workshop was to provide basic training on the modelling of carbonaceous aerosols with WRF-Chem model to early career researchers from various institutes across India. The carbonaceous aerosols influence the climate by altering the earth's radiation budget. The major carbonaceous aerosols include Elemental carbon (EC), Black carbon (BC), Brown carbon (Brc) and organic carbon (OC). While the former three aerosols are majorly absorbing in nature, the latter one has both scattering and absorbing character. Out of these BC is considered as the second most global warming agent after CO_2. However, the present-day awareness about these aerosols is limited due to inadequate observations across the globe. Hence it is necessary to use atmospheric models to characterise and study the effects of carbonaceous aerosols.

In this scenario, this 3-day workshop was organised for early carrier scientists/research fellows/Master students. A total of 55 participants (from more than 10 national laboratories and more than 5 academic institutes) attended this workshop. The workshop included lectures on WRF-Chem model and extensive hands-on training wr.to carbonaceous aerosols. The resource persons explained each module of WRF-chem model and provided extensive hands-on training to participants. Further, the participants were gathered into groups and were given assignments to workout themselves. Finally, each group of participants were asked to present their results. The workshop concluded with a valedictory function and distribution of certificates to participants with the benedictions of guests from ILEAPS, WMO, IMD and CAQM.

Feedback - NT-CCAM – 2 Workshop

Dr. Asfa Siddiqui

The course provided a comprehensive understanding to the beginners towards the usage of WRF-Chem. Thank you. It was much needed training and hands on.

Mr. Harshal Liladhar Patil

This workshop opening the doors for early career researcher who wanted to work related to Air Pollution ,Atmospheric Chemistry and WRF- WRF Chem Modelling. I would like to thank you IITM, Pune who gave us opportunities to learn and give the hands on training workshop.

Ms. Sneha Sunil

Currently, I am working on the aerosol-cloud intercations over the Indian region. As part of my research objective I will be working on unique case studies to understand the representation of aerosol-cloud interaction process in the WRF-Chem.
As an early career researcher, my area of research intrest is belongs to WRF Chem modelling and I trying to this learning methodology in my Polar Research work.

Mr. Vaibhav Bangar, Ph.D Student

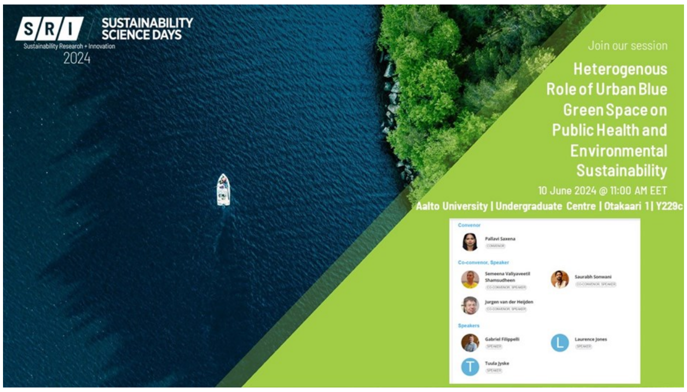
It has opened a plethora of new concepts for me. I have gained tremendously from this workshop. The application of the theoretical concepts learned over time into WRF-Chem has polished my concepts and has inspired me for further research.As an early career researcher, my area of research intrest is belongs to WRF Chem modelling and I trying to this learning methodology in my Polar Research work.

Ms. Nidhi Sanjay Patil

The workshop's focus on high-resolution modeling techniques allows for more accurate representation of urban environments, aiding in the identification of pollution hotspots and the development of targeted interventions. This knowledge directly contributes to my goal of improving urban air quality and public health outcomes.

iLEAPS Flagged Interactive Round Table Session on "Heterogenous Role of Urban Blue Green Space on Public Health and Environmental Sustainability" in SRI Congress 2024

iLEAPS Flagged Interactive Round Table Session on "Heterogenous Role of Urban Blue Green Space on Public Health and Environmental Sustainability" conducted on 10th June at Sustainability Research Innovation (SRI) Congress 2024 at Aalto University, Espoo, Finland. This session was lead by Dr. Pallavi Saxena, SSC Member iLEAPS, Dr. Saurabh Sonwani, iLEAPS Early Career Chair of South Asia and Middle East Region, Dr. Semeena V. Shamsudheen, iLEAPS IPO and Dr. Jurgen van der Heijden SSC member, Future Earth Finance & Economics KAN. This session had 5 invited speakers as Dr. Gabriel Filippelli, Chancellor's Professor, Director of the Center for Urban Health, Executive Director, Environmental Resilience Institute, Indiana University -Purdue University, US (onsite speaker), Dr. Jurgen van der Heijden, Senior consultant, TNO, the Dutch Organization for Applied Scientific Research, Netherlands (online speaker), Prof. Laurence Jones, Group Leader: Wetlands Grasslands and Croplands, UK Centre for Ecology and Hydrology (online speaker), Dr. Saurabh Sonwani, Assistant Professor, Department of Environmental Studies, Zakir Husain Delhi College, University of Delhi, Delhi, India (onsite speaker) and Prof. Tula Jyske, Associate Professor, University of Helsinki, Finland (onsite speaker). Prof. Gabriel Filippelli was our Opening Speaker of this session.



Early Warning and Decision Support System for Air Quality Management in Jaipur inaugurated

Jaipur, the capital city of Rajasthan, India, grapples with substantial air pollution challenges attributed to rapid urbanization, industrialization, and increased vehicular traffic. Major pollutants, including particulate matter (PM10 and PM2.5), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and ozone (O_3), consistently surpass national air quality standards. The city's geographical location, surrounded by arid and semi-arid regions, amplifies pollutant dispersion, resulting in poor air quality. Seasonal variations, particularly dust storms in pre-monsoon months, further contribute to deteriorating air conditions. The Respirable Particulate Matter (RSPM) in the city of Jaipur, exhibits a persistent upward trend over the last decade, particularly during the summer and winter seasons, and this elevated particulate pollution poses a substantial risk to public irreversible damage, with gaseous pollution considered a lesser threat in the region. The imperative need for early warning systems in Jaipur arises to predict upcoming air pollution episodes, allowing policy-makers to pro-actively inform the public and provide guidance, while also necessitating specific information on local emission sources for effective pollution abatement strategies.

Building upon the success of the initial Air Quality Early Warning System implemented in Delhi, IITM has expanded its forecasting capabilities to include Jaipur and developed a state-of-the-art air quality early warning forecasting system for Jaipur and its surrounding areas. The comprehensive modeling framework utilizes the Weather Research and Forecasting model coupled with Chemistry (WRF-Chem), seamlessly integrating the three-dimensional variational (3DVAR) framework from the community Grid point Statistical Interpolation (GSI) system. The system operates through two domain runs, with the outer domain covering the entire Indian subcontinent at a horizontal grid spacing of 10 kms. The resulting output is then subjected to dynamical downscaling, refining the resolution for Jaipur and its vicinity to a horizontal grid spacing of 2 kms. This forecasting configuration integrates a data assimilation facility adept at incorporating satellite data for Aerosol Optical Depth (AOD) retrievals, along with surface observational data related to particulate matter. Furthermore, the authorities need detailed information on emission sources causing upcoming air pollution events and seek solutions to mitigate the impact of forecasted events. In line with these needs, a Decision Support System (DSS) is integrated into the system. The DSS provides insights into the source apportionment of particulate pollution in the city.

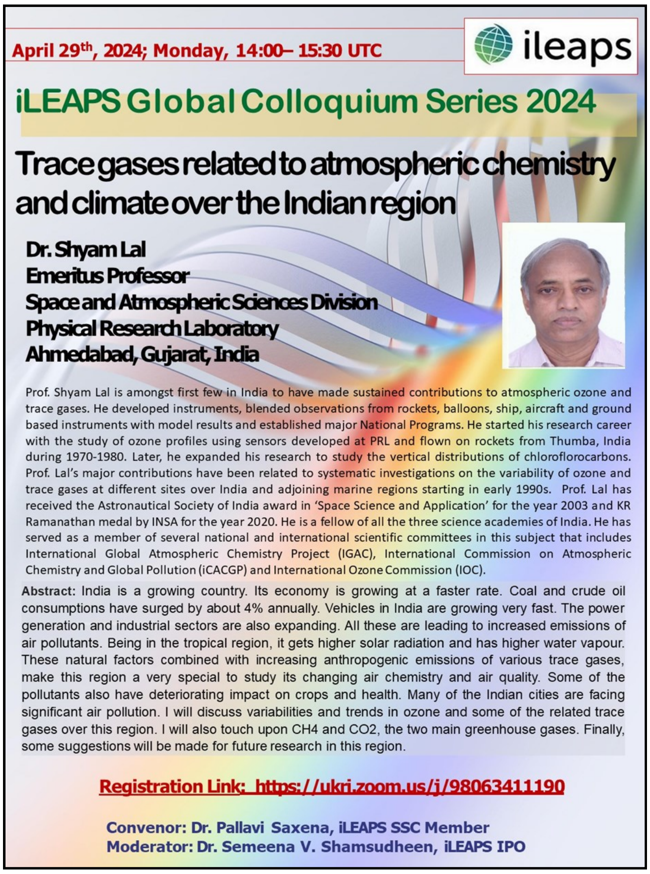
It recognizes and measures the contributions made by different regions and sectors to the total pollution burden. Moreover, the DSS aids in making decisions about air quality management by evaluating how specific interventions at the source level could affect predicted air pollution events. Effective management of air quality, facilitated by the DSS, is critical for Jaipur, especially considering its status as a favoured tourist destination.

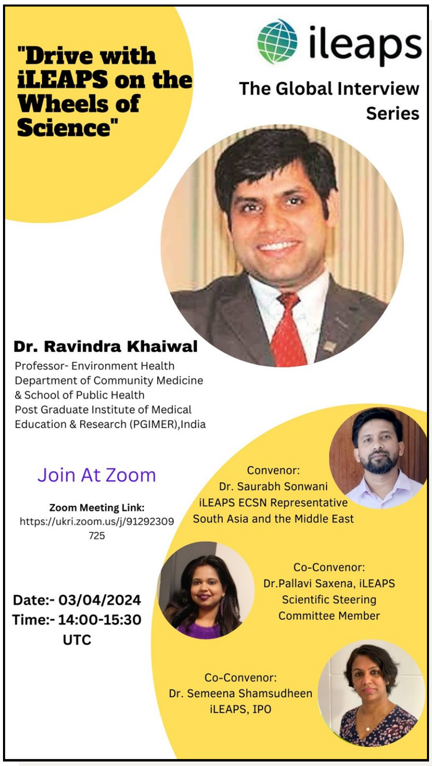
The Decision Support System (DSS) for Air Quality Management in Jaipur district is designed to assist the policy-makers in identifying the source-wise contribution to the fine particulate matter pollution in Jaipur district. The DSS provides contributions of the eight surrounding districts i.e. Dausa, Sawai Madhopur, Tonk, Ajmer, Nagaur, Sikar, Mahendergarh, and Alwar; and the Jaipur district itself to the PM2.5 pollution in Jaipur district. DSS also provides the contribution from stubble burning activities to the PM2.5 load in Jaipur district. For each of the aforementioned districts, the contribution from the individual sectors including transport, industries, energy, and residential is also provided. For the city of Jaipur, the DSS provides contributions of the eight surrounding districts i.e. Dausa, Sawai Madhopur, Tonk, Ajmer, Nagaur, Sikar, Mahendergarh, and Alwar; 12 tehsils within the Jaipur district namely Amber, Bassi, Chomu, Chaksu, Mauzamabad, Phagi, Phulera, Sangner, Jamwa Ramgargh, Viratnagar, Kot Putli, Shapura; part of Jaipur Tehsil which does fall in the city limits; and Jaipur city itself; to the PM2.5 pollution in Jaipur city. DSS also provides the contribution from stubble burning activities to the PM2.5 load in Jaipur city. For each of the aforementioned districts and tehsils, the contribution from the individual sectors including transport, industries, energy, and residential is also provided. For the Jaipur city, the contributions from other sectors including construction and demolition activities, road dust, waste burning, diesel generator sets, and hotels-restaurants can also be viewed. All this information is available everyday for the next four days.

The system is designed to assist the Rajasthan State Pollution Control Board (RSPCB), empowering them to take proactive measures in minimizing exposure to deteriorating air quality conditions. The early warning and decision support systems aim to notify Jaipur about upcoming air pollution episodes and provide a daily breakdown of the main contributors to particulate matter pollution for the next five days. This information is crucial for effective air-quality management in the city. The system also enables policymakers to assess the effectiveness of source-level interventions before implementation, facilitating science-based decisions to manage air quality. Thus, the improved air quality resulting from these measures will reduce the risks of mortality and morbidity associated with acute exposure to air pollution in the region.

The system was recently inaugurated by the Honourable Chief Minister of Rajasthan Shri. Bhajanlalji Sharma on 5th June 2024 at Jaipur, India.

iLEAPS Global Colloquium Series – Episode 3





iLEAPS Global Interview Series: Drive with iLEAPS On Wheels of Science

Honours and Recognitions

Dr. PALLAVI SAXENA

Contributed as one of the Lead Author in Independent Expert Report on "Key Challenges and Research Gaps in Climate Change and Biodiversity" on behalf of Future Earth (as iLEAPS SSC Member) for European Commission

Contributed as one of the Lead Author in Independent Expert Report on "Key Challenges and Research Gaps in Climate Change and Biodiversity" and Invited Author on behalf of Future Earth at the Launch Event of this report in European Union Office, Helsinki, Finland on 11th June, 2024. Its a very significant publication focuses on planetary health, social and economic forum, governance and policy reforms that are need to be address for research in the upcoming field of climate change and biodiversity. You can go through the link to access this publication https://op.europa.eu/.../lang.../format-PDF/source-323921461

Upcoming Events

- **FUNCHEM (Fire Uncertainity in Chemistry, Emissions and Modelling) will be organized as BBURNED**-iLEAPS Joint Workshop from 14th to 15th September, Kuala Lumpur, Malaysia for Early Career Researchers. On behalf of iLEAPS, Dr. Pallavi Saxena SSC Member as Lead Co-Convenor along with Dr. Saurabh Sonwani , Chair of Early Career of South Asia and MiddleEast and Dr. Semeena V. Shamsudheen, iLEAPS IPO. For more details visit the website https://igacproject.org/events/fire-uncertainty-chemistry-emissions-modelling-funchem

- **iLEAPS Discussion Session on "Atmospheric Deposition on Ocean Biogeochemistry"** will be held at SOLAS Conference 2024 at National Institute of Oceanography Goa, India. Convenor: Semeena V. Shamsudheen, iLEAPS IPO and Co-Convenor: Sophie Hebden, Sarah Connors, Pallavi Saxena, Langley Dewit, Saurabh Sonwani, Sachin Ghude, Hannah Liddy, Douglas Hamilton. The date and details of event will soon be released.

- **International Fog and Dew Association (IFDA)** 10th International conference on fog and dew will be held in Pune, India, 21-25 September 2026.

- **Eighth WMO International Workshop on Monsoons (IWM-8)** The International Workshop on Monsoons (IWM) is a major quadrennial symposia/workshops series organized by the World Weather Research Programme (WWRP) of the World Meteorological Organization (WMO). The eighth workshop in this series, the IWM-8, is being organized at Pune, India, jointly by the Indian Institute of Tropical Meteorology (IITM), Pune, Ministry of Earth Sciences (MoES), Government of India and the WWRP's Working Group on Tropical Meteorology Research (WGTMR), in cooperation with the India Meteorological Department, International Monsoons Project Office (IMPO) and CLIVAR/GEWEX Monsoons Panel of the World Climate Research Programme (WCRP). The workshop will be held at IITM Pune during 17-21 March 2025 in Hybrid mode permitting On-site and Virtual participation.

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