CARE 2025

CONFERENCE REPORT

International Conference on

Climate Adaptation and Resilience [CARE – 25]

Bridging Science, Innovation, & Communities

March 24-25, 2025

Cochin University of Science and Technology

care2025.in

International Conference on

Climate Adaptation and Resilience [CARE – 25]

Bridging Science, Innovation, & Communities

March 24-25, 2025

Organized by

Department of Atmospheric Sciences (DAS) &
Advanced Centre for Atmospheric Radar Research (ACARR)
Cochin University of Science and Technology (CUSAT)

in collaboration with

Indian Meteorological Society (IMS) Cochin Chapter

CONSOLIDATED REPORT

April 2025

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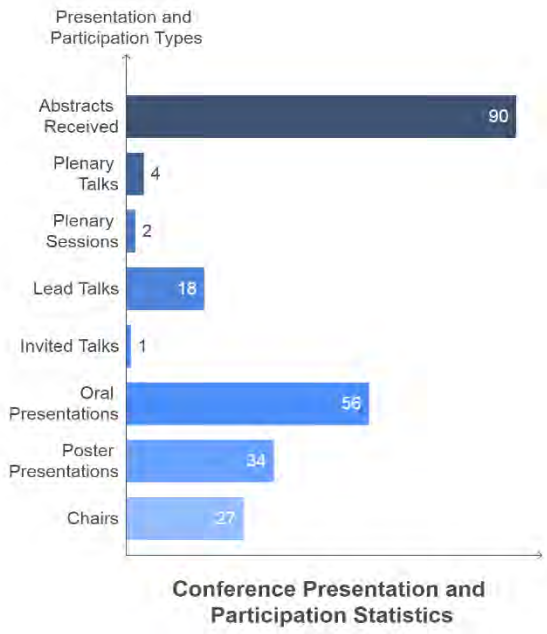
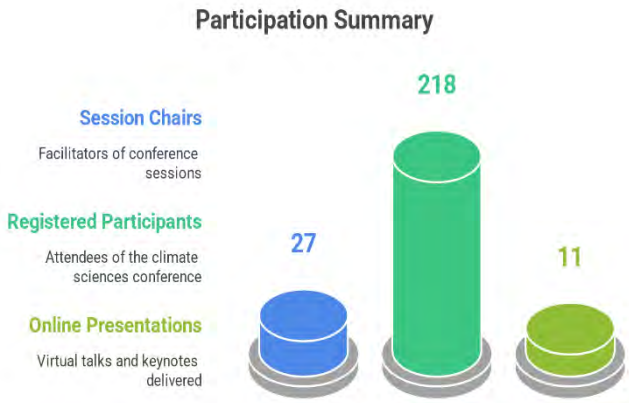
Prologue

The International Conference on Climate Adaptation and Resilience (CARE 2025) was conducted at the Cochin University of Science and Technology (CUSAT), Kerala, India, from 24th to 25th March 2025, in a hybrid mode. The event was organized by the Department of Atmospheric Sciences (DAS) and the Advanced Centre for Atmospheric Radar Research (ACARR) at the Cochin University of Science and Technology (CUSAT), in collaboration with the Indian Meteorological Society (IMS, Cochin Chapter), with participation from national and international delegates. The inaugural ceremony was presided over by eminent scientists and policy leaders, and the sessions were conducted in the Anna Mani Hall and other virtual platforms.

CARE 2025 received **90 abstracts** across a range of climate-focused themes. The conference featured **4 plenary talks** in **2 plenary sessions**, **18 lead talks**, **1 invited talk**, **56 oral presentations**, and **34 poster presentations**, alongside **4 community talks** highlighting the Role of Communities in Disaster Risk Reduction (DRR).





The conference also saw the participation of **27 session chairs** (26 from India and 1 from abroad) and recorded a total of **218 registered participants**. Among these, **11 presentations were made online**, including 6 lead talks, 4 oral presentations, and the KSBB keynote.

The conference was organized under several key themes, with the number of abstracts received under each listed below:

Research Session Counts

Session	Count
Disaster Risk Reduction (DRR)	7
Climate Variability & Extremes (CVE)	17
Climate Adaptation and Resilience (CAR)	4
Tropical Weather and Climate Change (TWC)	4
Marine Biodiversity, Oceans & Climate Change (MBC)	3
Climate Change Impacts and Modeling (CCI)	2
Advancement in Climate Sciences (ACS)	5

The CARE 2025 conference successfully facilitated interdisciplinary collaboration, knowledge sharing, and policy dialogue on climate resilience. It served as a dynamic platform for scientists, community representatives, and policymakers to co-create solutions tailored to regional and global climate challenges.

CARE 2025 Conference Schedule

24 March 2025, 10:00-11:45 IST

Inaugural Session

24 March 2025, 14:00-15:30 IST

KSDMA Joint Session - Disaster Risk Reduction

24 March 2025, 14:00-17:30 IST

KSBB Side Event on Agrobiodiversity

24 March 2025, 16:00-17:30 IST

KSDMA Joint Session - Disaster Risk Reduction

24 March 2025, 14:00-15:30 IST

Climate Variability & Extremes Session

24 March 2025, 16:00-17:30 IST

Climate Variability & Extremes Session (Cont.)

25 March 2025, 11:00-13:00 IST

CMFRI Joint Sessions on Marine Biodiversity

25 March 2025, 09:30-10:30 IST

Plenary Session 2

25 March 2025, 14:00-15:30 IST

Weather Prediction, Climate Monitoring Session

25 March 2025, 16:00-17:30 IST

Valedictory Function of CARE 2025

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33. Dr. Semeena V. Shamsudheen, CEH, UK
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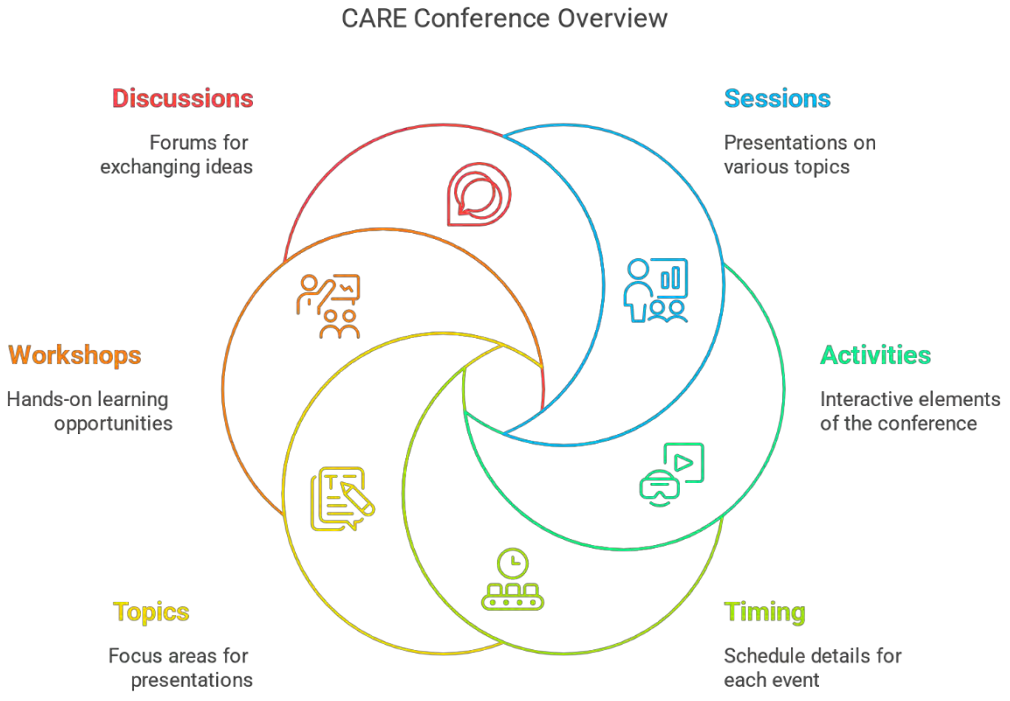
1. Introduction

The Department of Atmospheric Sciences (DAS) and the Advanced Centre for Atmospheric Radar Research (ACARR) at the Cochin University of Science and Technology (CUSAT), in collaboration with the Indian Meteorological Society (IMS, Cochin Chapter), successfully organized the CARE 2025 Conference—Climate Adaptation and Resilience: Bridging Science, Innovation, and Communities—on 24–25 March, 2025, at the Seminar Complex, CUSAT.

The conference brought together a diverse group of scientists, technologists, policymakers, innovators, and community leaders to collectively address the pressing challenges of climate change. CARE 2025 served as a timely platform for interdisciplinary exchange, highlighting the need for transformative strategies that integrate scientific insights, technological innovation, and community-level action.

As climate risks continue to intensify—with increasingly frequent extreme weather events, ecological disruptions, and socio-economic vulnerabilities—the conference emphasized the importance of bridging research with real-world solutions. Through keynote talks, panel discussions, and interactive sessions, participants explored holistic approaches to climate adaptation and resilience, aimed at empowering local communities and strengthening systemic responses to environmental challenges.

CARE 2025 marked a significant step forward in fostering collaboration, sharing best practices, and co-developing actionable strategies for a resilient and sustainable future.



2. Objectives

The CARE 2025 Conference was guided by four key objectives that reflect the core strategies needed to tackle the growing challenges of climate change:

a) **Interdisciplinary Dialogue:** The conference emphasized the importance of fostering collaboration across diverse scientific, technological, and social disciplines. By encouraging open dialogue, CARE 2025 sought to break down traditional silos and promote integrated approaches to climate resilience.

b) **Innovative Technologies:** A central focus of the event was on showcasing cutting-edge technologies that enhance climate resilience. From early warning systems to sustainable infrastructure, participants explored how innovation can provide practical, scalable solutions to complex environmental challenges.

c) **Community Initiatives:** Recognizing the vital role of local stakeholders, the conference aimed to empower communities to take the lead in implementing climate strategies. CARE 2025 highlighted the value of grassroots action and localized responses in building adaptive capacity and fostering long-term resilience.

d) **Research-Policy Alignment:** The conference served as a platform for aligning evidence-based research with effective policy design and implementation, ensuring that climate strategies are both informed and actionable.

2.1. Conference Themes & Relevance

i. **Climate Variability and Extreme Weather Events:** India faces increasing frequency and intensity of climate-related disasters, such as floods, droughts, and cyclones. Understanding these patterns is crucial for developing effective mitigation and adaptation strategies.

ii. **Climate Modeling and Forecasting:** Accurate climate models are essential for predicting future scenarios and informing policymakers. This helps in strategizing resource allocation and disaster preparedness, which are vital for a nation with diverse geographic and climatic conditions.

iii. **Sustainable Infrastructure and Urban Resilience:** Rapid urbanization in India necessitates the development of resilient infrastructure. Sustainable practices can minimize the ecological footprint while ensuring that urban areas can withstand climate impacts.

iv. **Advancement in Observational Technologies:** Innovative technologies for climate observation can enhance data collection and analysis, providing real-time information that is critical for disaster management and response.

v. **Community-Led Adaptation Strategies:** Engaging local communities in adaptation efforts ensures that strategies are culturally relevant and effectively address local vulnerabilities. This is particularly important in a diverse country like India.

vi. **Disaster Risk Reduction and Early Warning Systems:** Strengthening early warning systems is vital for reducing disaster risks, saving lives, and protecting livelihoods. This is integral to India's commitment to improving disaster resilience.

vii. **Policy Frameworks for Climate Adaptation:** Comprehensive policy frameworks are necessary to guide national efforts in climate adaptation, aligning with global commitments and addressing local challenges.

viii. **AI-ML Technologies for Climate Adaptation:** Leveraging artificial intelligence and machine learning can enhance predictive capabilities and optimize resource management, making adaptation strategies more effective and efficient.

2.2. Conference Brochure & Posters

Logo of Conference:

Brochure:

Poster:

Hall Naming and Descriptions

As part of the International Conference on Climate Adaptation and Resilience (CARE 25), we have designated specific halls to honor influential figures in the field of climate science and innovation. Each hall is named after a distinguished individual, reflecting their contributions to climate adaptation and resilience.

Main Hall: Anna Mani Hall: Named after Anna Mani, a pioneering Indian meteorologist and physicist, this hall serves as the central venue for the conference. Mani's groundbreaking work in meteorology and her advocacy for renewable energy exemplify the spirit of innovation that the conference aims to promote.

Mini Hall 1: Pisharoty Hall: This hall is named in honor of Pisharoty, a notable figure in agricultural science. His contributions to the understanding of climate impacts on agriculture make this hall an ideal space for discussions on sustainable farming practices and climate resilience strategies.

Executive Hall: Sikka Hall: Sikka Hall is named after a respected leader in environmental policy. This hall is designated for executive meetings and high-level discussions, emphasizing the importance of policy-making in addressing climate challenges and fostering community resilience.

Mini Hall 2: Ananthakrishnan Hall: Honoring Ananthakrishnan, a prominent researcher in climate science, this hall is dedicated to sessions focused on scientific research and innovations in climate adaptation. His work has significantly advanced our understanding of climate systems.

These halls not only serve as venues for scholarly exchange but also as a tribute to the legacies of these remarkable individuals who have shaped our understanding of climate science and adaptation.

3. Day – 1 (Monday: 24/03/2025)

3.1. Inaugural Session (10:00 – 11:30 IST)

The inaugural session of the CARE 25 International Conference was held on 24 March 2025 at the main hall (**Anna Mani Hall**) of the Seminar Complex, marking the commencement of a prestigious gathering of academicians, researchers, policymakers, and industry experts from across the globe. The theme of the conference, "Climate Adaptation and Resilience," underscored the importance of addressing climate change and its adaptations for the socio-economic well-being of the country.

The session commenced with a warm welcome by **Dr. S. Abhilash, Head of the Department of Atmospheric Science and Director of Advanced Centre for Atmospheric Radar Research (ACARR), CUSAT**, who extended greetings to the distinguished guests, keynote speakers, and participants. He emphasized the significance of the conference in fostering collaboration and advancing knowledge in the field of climate science. Highlighting the importance of accessible early warning systems, he stressed the need for proactive measures to mitigate climate-related risks.

In his presidential address, the **Hon. Vice Chancellor, Prof. (Dr.) M. Junaid Bushiri**, acknowledged the esteemed role of ACARR in leading radar meteorology research in India. He emphasized the urgent need for climate action and the collective responsibility of the scientific community in addressing climate change challenges. The official inauguration of CARE 25 was symbolized by the dignitaries watering a jackfruit plant on the dais, signifying a commitment to sustainability and environmental consciousness.

Figure 3.1 Official inauguration of CARE 25 by the dignitaries watering a jackfruit plant on the dais

The Inaugural address was delivered by **Dr. Grinson George, Director of ICAR-Central Marine Fisheries Research Institute (CMFRI)**, who provided deep insights into ocean life and climate change. He highlighted Kerala's vulnerability to climate change, particularly its impact on the livelihoods of fishermen and the increasing prevalence of water-associated diseases, especially in Kochi. He further elaborated on the rising temperatures affecting fisheries' wealth and emphasized the necessity for widespread awareness and action. Dr. Grinson called for climate change solutions to be integrated at every level of society and stressed the importance of adaptation and resilience strategies in Kerala. The session also saw the release of the conference's abstract volume.

Padma Shri Cheruvayal K. Raman, the Guest of Honor, shared valuable insights on the role of health in personal and societal progress. He emphasized the significance of learning from life experiences over conventional education and posed critical questions about climate change, including the increasing frequency of extreme precipitation events and cyclones in Kerala, shifting weather patterns, and the disappearance of certain fish species. He addressed the role of human activities, such as deforestation, in exacerbating climate change and called for urgent introspection and corrective action.

The **Chief Guest, Shri Madhu S. Nair, Chairman of Cochin Shipyard**, spoke on the importance of sustainability and the integration of technology with nature and climate considerations. He elaborated on urban resilience and the National Hydrogen Mission, while also highlighting Cochin Shipyard's commitment to sustainable growth and its Green Vessel Program, which aligns with global efforts toward environmental conservation.

As part of the event, esteemed teachers and staff members were honoured for their contributions. The felicitation address was delivered by **Dr. Arun A. U., Registrar of CUSAT**, who underscored the importance of such an event in the current scenario. He expressed unwavering support from the university and extended his best wishes for the success of the conference. Following this, **Dr. M. G. Manoj, Scientist D, ACARR, CUSAT** provided a summary of the thought-provoking speech by Cheruvayal K. Raman, reinforcing the key takeaways on climate change and environmental responsibility.

The session concluded with a vote of thanks delivered by **Prof. K. Satheesan, Director School of Marine Sciences & Professor, Department of Atmospheric Science, CUSAT**. He expressed gratitude to the Chief Guest, dignitaries, keynote speakers, sponsors, organizing committee, and participants for their invaluable contributions and support in making the event a success.

The inaugural session set a constructive tone for the rest of the conference, laying a strong foundation for knowledge sharing, networking, and collaborative research. The enthusiasm and engagement exhibited by the attendees reflected the significance of the conference in addressing contemporary global challenges and advancing scholarly discourse in climate adaptation and resilience.

Figure 3.2 Inauguration Ceremony Glimpses

3.2. Plenary Session 1 (11:30 – 13:00 IST)

The inaugural session of CARE-25 was followed by Plenary Session 1 (11:30 -13:00 IST), held in Hall 1 (**Anna Mani Hall**). The session was anchored by Ms. Devika MV, Senior Research Fellow at ACARR, who introduced the **session Chairs, Prof. H. S. Ram Mohan** and **Dr. K. Rajendran**, providing a brief overview of their contributions. **Prof. H. S. Ram Mohan, Emeritus Professor, Department of Atmospheric Sciences, CUSAT**, is a distinguished meteorologist, who has been a key figure in atmospheric sciences, dedicating over four decades to research and education. Prof. Ram Mohan was the founding Head of the Department of Atmospheric Sciences at CUSAT and has held pivotal roles, including Dean of Marine Sciences and Director of the School of Marine Sciences. Even after retirement, he continues to shape academic discourse as an independent writer and editor. The second chair of the session, **Dr. K. Rajendran, is the Director of the Institute for Climate Change Studies (ICCS)** under the Kerala State Council for Science, Technology and Environment (KSCSTE). He holds a Ph.D. from IISc Bangalore and has conducted postdoctoral research at Florida State University and the Japan Meteorological Agency. With over two decades of expertise in climate modeling, climate variability, and climate change projections, his leadership at ICCS focuses on advancing climate research and policy for sustainable development.

Figure 3.3 Chairs for the Plenary Session Anna Mani Hall

The Chairs invited **Prof. Raghu Murthugudde** to deliver the first plenary talk. Ms Devika provided a brief introduction to Prof. Murthugudde before he commenced his talk on **"Climate Change Adaptation and Resilience – Challenges and Solutions"** Prof. Raghu Murthugudde is an esteemed Earth System Scientist and Emeritus Professor at the University of Maryland. He has been the Executive Director of the Chesapeake Bay Forecast System since 2007, leading the

development of the first functional Regional Earth System Prediction framework. Prof. Murthugudde holds a B.Tech. in Aeronautical Engineering from IIT Bombay, an MS in Aerospace Engineering from the University of Texas, and a Ph.D. in Mechanical Engineering from Columbia University. He worked at NASA-GSFC and was a faculty at the Univ of Maryland. He returned to India in 2018 and is now at IITB as a faculty in Climate Studies. In the plenary talk Prof. Murthugudde highlighted the necessity of hyper-local information to effectively simulate large-scale climate variations and discussed the integration of Artificial Intelligence (AI) in weather forecasting, making predictions more precise and efficient. He emphasized the importance of incorporating social sciences into climate models, predictions, and projections to enhance their applicability and effectiveness. He also discussed strategies for reducing climate hazards, including ecosystem-based measures and the construction of water reservoirs to buffer regions facing water scarcity. Prof. Murthugudde concluded by emphasizing that mitigation is a global goal, while adaptation remains a localized effort, requiring tailored solutions for different regions.

Figure 3.4 Plenary Talk by Prof. Raghu Muthugudde

Following this, the Chairs invited **Prof. K. Mohankumar, Founder Director of ACARR, CUSAT**, to deliver the second plenary talk. Ms Devika provided a brief introduction to Prof. Mohankumar before he commenced his talk on **"Celebrating fifty years of Meteorology at CUSAT: A comprehensive overview"**. With over 42 years of research and 31 years of postgraduate teaching experience, **Prof. Mohankumar** has made remarkable contributions to Atmospheric Sciences, particularly in Middle Atmosphere dynamics, Stratosphere-Troposphere coupling, Monsoon dynamics, and Climate Change. As a Visiting Scientist at Freie Universität Berlin, he collaborated on global atmospheric studies. He has authored over 115 peer-reviewed research articles and led the development of the world's first 205 MHz Stratosphere-Troposphere wind

profiler radar. His leadership at ACARR has positioned India at the forefront of atmospheric radar research, strengthening the nation's climate monitoring and forecasting capabilities. Prof. Mohankumar talked about the history and evolution of the Department of Atmospheric Sciences and ACARR at CUSAT. He highlighted the pioneering role of Prof. R. Ananthakrishnan, who established the meteorology course at CUSAT. He provided a detailed overview of the major milestones achieved by the Department of Atmospheric Sciences, elaborating on the struggles and success stories that shaped the department over the years. He also mentioned the outstanding contributions of various scientists who have played a significant role in advancing research and education in atmospheric sciences. The session provided a valuable platform for discussing both contemporary challenges and the historical foundations of climate science, making it an enriching experience for all Aattendees.

Figure 3.5 Plenary Talk by Prof. K. Mohankumar

3.3. Technical Sessions Day - 1

The Technical Sessions at the International Conference on Climate Adaptation and Resilience (CARE-25) served as the intellectual core of the event, offering a dynamic platform for the presentation and discussion of cutting-edge research, innovative solutions, and policy-oriented insights. Held over two days (March 24–25, 2025) at the Seminar Complex, Cochin University of Science and Technology (CUSAT), these sessions featured oral and poster presentations across diverse themes aligned with the conference's objectives.

The technical sessions started in the four halls in Seminar Complex, CUSAT parallelly in the afternoon of 24 March 2025 at 14:00 IST.

These sessions fostered interdisciplinary dialogue, encouraging collaborative thinking among atmospheric scientists, policymakers, technology developers, and community leaders.

The presentations were followed by interactive Q&A segments, offering rich academic exchange and real-time feedback. Posters displayed alongside the main sessions provided visual summaries of innovative projects and novel research approaches.

The Technical Sessions not only highlighted the vibrancy of current research but also identified actionable pathways toward resilience-building and sustainable climate adaptation. They reflected the core spirit of CARE-25: bridging science, innovation, and community for a climate-secure future.

3.3.1. TS-H1A: Kerala State Disaster Management Authority (KSDMA) Joint Session - Disaster Risk Reduction (DRR)

TS-H1A: KSDMA Joint Session - Disaster Risk Reduction (DRR) 24 March 2025, Time: 14:00-15:30 Venue: Hall 1 (Anna Mani Hall) Chairs: Dr. Sekhar Kuriakose, KSDMA & Dr. Max Martin, Christ Uinversity				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. Sekhar Kuriakose,	Member Secretary, KSDMA & Chief Resilience Officer, KSCCAM	Early warning dissemination systems and expectations from Academicia
2		Smt. Neetha Gopal	Scientist F & Head, IMD Trivandrum	Early Warning Systems of IMD
3	Panel Discussions on **"Role of Communities in DRR"**		**Panelists** 1. Eby Emmanuel, MRRM & Bhoomika, Poonjar 2. S. P. Ravi, President, Kerala Nadeesamrakshana Samithi 3. Vishnu Das, Director, Hume Center, Wayanad 4. Rev. Fr. Francis Kambolathuparambil, VSSS, Munnar	

The **Kerala State Disaster Management Authority (KSDMA) Joint Session on Disaster Risk Reduction (DRR)** was anchored by Ms. Navya, who invited the chairs, panelists, and participants before handing over the session to the chairs. **Dr Sekhar Kuriakose, Member Secretary, KSDMA & Chief Resilience Officer, Kerala State Climate Change Adaptation Mission (KCCAM), and Dr Max**

Martin, Professor, Christ University, Bangalore, chaired the session. Ms. Navya introduced both chairs by briefing their contribution to the scientific community.

Lead Talk 1

Dr. Sekhar Kuriakose was invited to give a lead talk on **"Early Warning Dissemination Systems and expectations from Academia". Dr. Sekhar Kuriakose** is a **specialist in climate change adaptation, disaster management, and geospatial science**, currently heading the **Climate Change Adaptation Mission for the Government of Kerala** and previously leading the Kerala State Disaster Management Authority. He holds a PhD in Geo-Information Science and Earth Observation from Utrecht University and has served as Visiting Scientist at the University of Twente. His work includes research on disaster resilience, the development of management plans for bird sanctuaries in a major marine biosphere reserve, and consultancy on GIS-based ecotourism planning. He also played a key role in promoting TNTMips software across South India and Sri Lanka.

Dr. Sekhar Kuriakose discussed various aspects of disaster management, particularly focusing on the **tsunami early warning system** and its components. He highlighted the role of multiple national and state-level agencies such as **IMD, DDMA, NDMA, and SDMA**, which provide warnings during disasters. In Kerala, specific rules and regulations guide disaster management action plans, including the **Lightning Action Plan and Heat Action Plan**. The Kerala Warning, Crisis, and Hazard Management System plays a crucial role in disseminating warnings at different levels, from the **14 districts to taluk levels**. The importance of risk awareness and vulnerability assessment was emphasized, along with the need for effective monitoring systems. Key monitoring systems include those for water resources, weather conditions, and seismic activities, with institutions like the **National Seismic Centre** providing forecasts for hazards such as lightning and

coastal threats. Daily alerts, including UV network warnings and river water trends, are also crucial components of the system.

To ensure efficient dissemination of warnings, various communication tools such as sirens and strobe lights are used, with details on the number of such systems in each district. The role of communication in disaster management was underscored, emphasizing the need for local language customization and inclusive communication methods tailored for differently-abled individuals using sign language and audio-based alerts.

Figure 3.6 Lead Talk by Dr. Sekhar Kuriakose

Response capability was another key focus, highlighting the importance of volunteer engagement in disaster management. Special shelters play a critical role in disaster response, with 17 specialized shelters across Kerala, including 6 in Idukki district. The session also introduced new initiatives, including the installation of an **X-band radar at Panamaram, Wayanad**, a **joint initiative involving IMD, KSDMA**, and Pushpa Raja College. Additionally, advancements in landslide forecasting systems, developed in collaboration with Amrita University, KU, and IIT Roorkee, were discussed.

Lead Talk 2

Later on in this session, **Smt. Neetha Gopal, Scientist F & Head, IMD Trivandrum**, delivered a lead talk on **"Early Warning Systems of IMD"**, emphasizing its crucial role in disaster risk reduction and climate resilience. **Smt. Neetha K. Gopal**, with over 25 years of experience in meteorology, has become the first woman director of the India Meteorological Department's Kerala region. Specializing in marine and aviation weather forecasting, she has significantly contributed to public weather services. Smt. Gopal holds a postgraduate degree in Meteorology from Cochin University of Science and Technology. She has previously led the Cochin Aviation Meteorological Office and the Doppler Radar Station in Kochi. She highlighted how climate change disproportionately impacts vulnerable populations and stressed the need for both adaptation and mitigation strategies. She outlined IMD's seamless weather forecasting strategy, covering different timescales, from nowcasting (3 hours) to seasonal forecasts (one season ahead). The department provides real-time alerts for extreme weather events, including cyclones, floods, heatwaves, thunderstorms, and droughts, in coordination with national agencies and disaster management authorities.

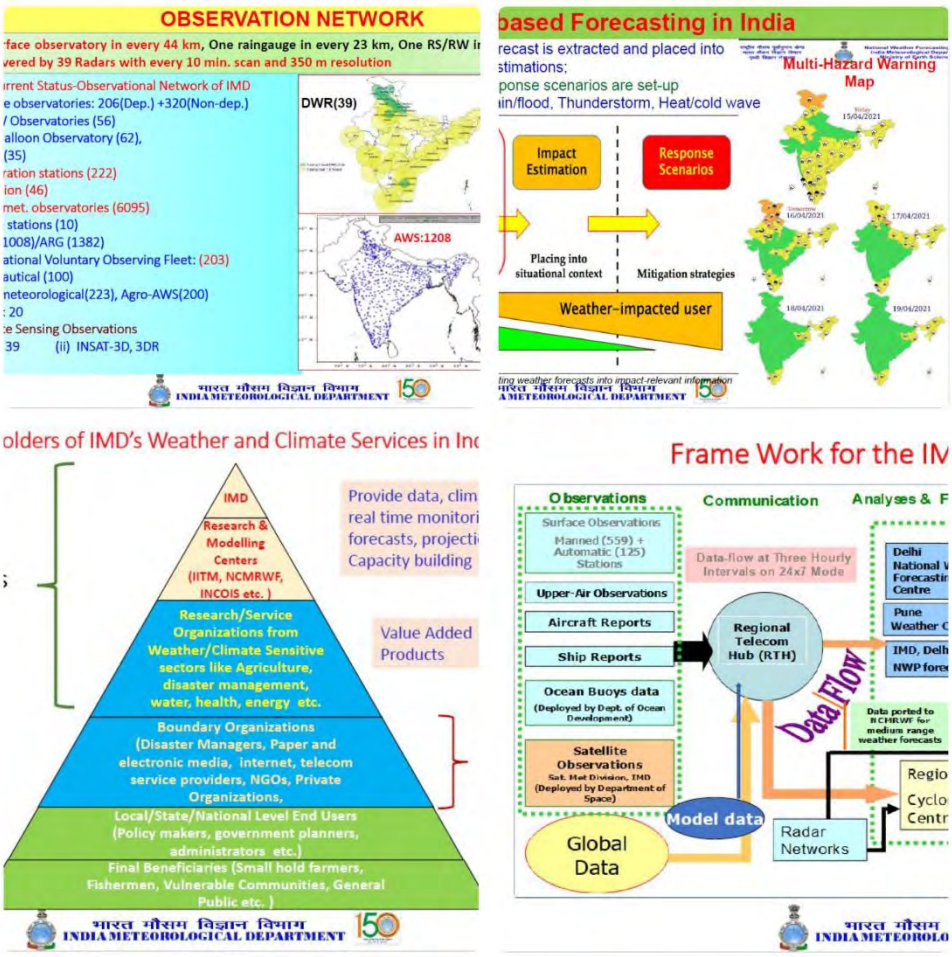


Figure 3.7 Lead Talk 2 glimpses

A significant shift towards **Impact-Based Forecasting (IBF)** was discussed, focusing on assessing risks rather than just predicting weather conditions. Advanced technologies, including Artificial Intelligence (AI) and **Multi-Model Ensemble (MME) techniques**, are being leveraged to enhance forecast accuracy, particularly for cyclone track and intensity predictions. **IMD's observation network**, incorporating surface, satellite, radar, and marine observations, ensures accurate data collection. Warning dissemination is carried out through multiple channels, including mass media, mobile apps, SMS alerts, and CAP (Common Alerting Protocol) alerts, ensuring effective communication to all stakeholders. She also highlighted IMD's sector-specific services for agriculture, aviation, maritime, and urban meteorology, along with future initiatives like crowd-sourcing weather observations, AI-driven forecasting, and expanding last-mile connectivity.

KSDMA Panel Discussion

After the lead talks, the session continued with a panel discussion on **"Role of Communities in Disaster Risk Reduction (DRR)".** The chair invited panelists **Eby Emmanuel (MRRM and Bhoomika, Poonjar), S. P. Ravi, President, Kerala Nadeesamrakshana Samithi, Vishnu Das, Director, Hume Center, Wayanad, and Rev. Fr. Francis Kambolathuparambil, VSSS, Munnar** to share their insights.

Mr. Eby Emmanuel Poondikulam is a committed social entrepreneur working at the grassroots level to empower farming communities in Kerala. He serves as director of both Neeloor Producer Company Limited and Rising Poonjar Farmer's Producer Company Limited, focusing on improving agricultural practices, enhancing market access, and promoting sustainable livelihoods. Based in Kottayam, he blends community engagement with innovative agricultural solutions, supporting farmer-led initiatives and capacity building. His work stands as a strong example of how local leadership can drive rural development and resilience. Mr. Eby Emmanuel spoke about the floods and landslides that have occurred since 2018 and the volunteer systems established in response. He

highlighted various WhatsApp groups that coordinate emergency volunteering and disaster mitigation efforts. The **Meenachil Rain-River Monitoring (MRRM)** system is a trusted and responsible community-led initiative supported by different agencies and educational institutions. A dedicated mobile application is currently under development to monitor river activities. Additionally, KSDMA is funding a weather monitoring kit for MRRM, and the data collected by the system is being used for landslide warnings, surpassing existing state-of-the-art alert systems. However, MRRM still requires more meteorological instruments, such as rain gauges, for improved weather monitoring.

During the discussion, the chair acknowledged the significant contributions of MRRM but emphasized that while community-led data collection and analysis are valuable, forecasting and emergency response actions must also involve scientific and official government agencies to ensure accuracy and efficiency.

Mr. S. P. Ravi is a leading environmental activist in Kerala and currently serves as the President of Kerala Nadee Samrakshana Samithi. He is well known for his long-standing efforts to protect rivers, especially through his work with the Chalakudy River Protection Forum. A key voice behind the "Ozhukanam Puzhakal" campaign, he advocates for the free and natural flow of rivers as essential to Kerala's water security. Ravi combines grassroots activism with policy advocacy, and also serves on the State Advisory Committee of the Kerala State Electricity Regulatory Commission. Mr. S.P. Ravi highlighted the critical role of **community-driven Disaster Risk Reduction (DRR) efforts in the Chalakudypuzha Basin**. He reflected on the lessons learned from the 2018 floods, which caused severe devastation despite early warnings, primarily due to inadequate preemptive actions. Since 2018, the People's Flood Monitoring System has significantly improved preparedness, helping manage subsequent floods in 2019 and 2024. However, major challenges remain, including insufficient weather monitoring infrastructure, lack of real-time reservoir data, and interstate regulatory constraints. To enhance flood and drought mitigation efforts, he called for weather-based protocols, participatory flood modelling, dynamic reservoir rule curves, and integrated management plans. He stressed the importance of community involvement in disaster preparedness and concluded with a powerful message: "Let the rivers flow."

Mr. C.K. Vishnudas is a noted ornithologist and conservation ecologist with more than 20 years of experience studying birdlife in the Western and Eastern Ghats. He is the **Director of the Hume Centre for Ecology and Wildlife Biology in Kalpetta, Kerala**, where he leads biodiversity conservation and research initiatives. Vishnudas also serves as a visiting researcher at IISER Tirupati, focusing on ornithology, biogeography, and conservation biology. His extensive fieldwork and publications have contributed significantly to our understanding of India's avian diversity and ecological landscapes. Mr. C.K. Vishnudas provided

insights into community-led weather monitoring efforts in Wayanad. He emphasized the importance of localized climate action and disaster preparedness, given Wayanad's unique geography, with elevations ranging from 700 to 2,300 meters, making the region highly vulnerable to extreme rainfall, landslides, and climate change impacts. The district, a key agricultural hub, has witnessed increasing rainfall variability and severe weather events, including the 2018 and 2019 landslides and the 2024 floods.

To **enhance early warning systems and preparedness, the Hume Centre has established rain gauges, thermometers, and a community-driven weather monitoring system**. A WhatsApp group, **"Wayanad Weather Forecast",** disseminates real-time weather updates to farmers, disaster management authorities, and the general public. Collaboration with CUSAT's Advanced Centre for Atmospheric Radar Research has enabled the capture of hyper-local weather data, contributing to grid-based rainfall analysis, landslide susceptibility mapping, and early cyclone warnings. A notable achievement of this initiative was a 10-day warning issued in 2023, which allowed farmers to adjust their rice harvesting schedule, preventing significant crop losses. However, several challenges persist, including limited access to real-time government data, low radar coverage, and increasingly erratic weather patterns. Mr. Vishnu Das stressed the need for localized climate data, improved radar networks, and better integration of community-based weather monitoring into disaster management systems. He concluded by emphasizing the importance of prioritizing preparedness and early warnings over post-disaster response.

Rev. Fr. Francis Kambolathuparambil, associated with the **Vijayapuram Social Service Society (VSSS)**, serves as the Parish Priest at St. Peter's Church, Kumarakom and Director of the Cherupushpa Mission League (CML). In his roles, he has been actively involved in community development and disaster risk reduction initiatives. VSSS has implemented programs focusing on building community resilience, integrating risk reduction strategies into sectors like livelihood, health, and sanitation, and collaborating with district disaster management authorities. Fr. Francis's leadership has been instrumental in mobilizing local resources and fostering partnerships to enhance disaster preparedness and response in vulnerable communities. Rev. Fr. Francis Kambolathuparambil emphasized the importance of grassroots resilience. He highlighted how local knowledge, early warning systems, and decentralized relief networks empower vulnerable communities to become first responders. Drawing from his experience in Munnar, he stressed the role of faith-based organizations and participatory disaster management, where communities actively engage in preparedness and recovery rather than being passive recipients of aid. His insights underscored that effective DRR relies on local engagement, social cohesion, and sustained capacity-building.

The session concluded with a call for stronger community participation, enhanced scientific collaboration, and improved forecasting systems to build more resilient disaster preparedness strategies.

TS-H1B: KSDMA Joint Session - Disaster Risk Reduction (DRR) 24 March 2025, Time: 16:00-17:30 Venue: Hall 1 (Anna Mani Hall) Chairs: Prof. K. Mohankumar, CUSAT & Dr. Amal Dev, CUSAT				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. P. S. Sunil	Professor, CUSAT	Subduction Zone Geohazards and its imprints in the Lithosphere-Atmosphere-Ionosphere coupled system
2	CARE-0067	Dr. ARAVINDH PANIKKAVEETTIL	ASSESSING VULNERABILITY AND RISK TO EXTREME WEATHER EVENTS ON THE KERALA COAST USING IPCC AR4 AND AR5 FRAMEWORKS	
3	CARE-0025	MELVIN MANOJ ABRAHAM	SOCIO-ECONOMIC VULNERABILITY AND DISASTER RESILIENCE: ASSESSING COASTAL HOUSEHOLDS IN VELIYANCODE PANCHAYAT, KERALA	
4	CARE-0032	GAYATHRI R	COASTAL DISASTER RISK REDUCTION AND COMMUNITY RESILIENCE: A CASE STUDY FROM THALIKKULAM PANCHAYAT	
5	CARE-0026	MIKHA KHOSH T L	ASSESSING COASTAL VULNERABILITY AND ENHANCING DISASTER RESILIENCE: A SOCIOECONOMIC STUDY IN ERIYAD GRAMA PANCHAYAT, KERALA	
6	CARE-0020	ANJITHA A C	FIGHTING CLIMATE UNCERTAINTY: VULNERABILITY AND RESILIENCE IN KERALA'S COFFEE FARMING	
7	CARE-0035	HEMAVARSHINI B R	AGRICULTURAL DROUGHT VULNERABILITY ASSESSMENT FOR ODDANCHATRAM TALUK, TAMIL NADU FOR THE YEARS 2000, 2008, 2016 AND 2022 USING GEOSPATIAL TECHNIQUES	

Ms. Stefy Thomas initiated the session with a warm welcome to the chairs, lead speaker, and all participants. **Prof. K. Mohankumar and Dr. Amal Dev** together chaired the session. Prof. K. Mohankumar was the founder director of ACARR, CUSAT, CUSAT. With over four decades of research and pioneering contributions to atmospheric sciences, his expertise in middle atmosphere dynamics, monsoon variability, and climate change has been instrumental in advancing India's radar meteorology. **Dr. Amal Dev, Assistant Professor at the Department of Marine Geology and Geophysics, CUSAT**. His research spans metamorphic petrology, geochemistry, and regional tectonics. With extensive international exposure in the USA, Japan, and France, his work continues to shape our understanding of Earth's geological processes.

Prof. K. Mohankumar invited **Dr. P. S. Sunil** for the lead talk on **"Subduction Zone Geohazards and their Imprints in the Lithosphere-Atmosphere-Ionosphere Coupled System"**. Prof. (Dr.) P. S. Sunil is the Head of the Department of Marine Geology & Geophysics at CUSAT. Dr. Sunil's extensive work in tectonic geodesy, marine geophysics, and polar expeditions has made

significant contributions to disaster risk assessment. He has been part of the Indian Antarctic Expedition twice and the Arctic Expedition four times. Dr. Sunil discussed how plate tectonics drives seismic activity, leading to earthquakes, tsunamis, and atmospheric disturbances. Using GPS and InSAR data, he demonstrated how seismic events generate atmospheric waves, impacting weather patterns and radio wave propagation. Case studies included the 2015 Nepal earthquake, the 2004 Sumatra megathrust tsunami, and the 2022 Tonga volcanic eruption, highlighting ionospheric disturbances before and after major geohazards. He emphasized the need for real-time monitoring systems to improve early warning mechanisms for seismic and climatic hazards. After the lead talk, there was a very interactive Q&A discussion and the session continued with oral presentations of six participants.

The first oral presentation was given by **Mr. Melvin Manoj Abraham, College of Climate Change and Environmental Science, Kerala Agricultural University** on "Socioeconomic vulnerability and disaster resilience: assessing coastal households in Veliyancode Panchayat, Kerala". The study assessed disaster resilience in Veliyancode Panchayat, highlighting low awareness, climate vulnerability, and ineffective measures, recommending community preparedness, improved coastal management, and targeted adaptation strategies.

The Second Oral presenter **Ms. Gayathri R, College of Climate Change and Environmental Science, KAU** talked on the topic "Coastal disaster Risk reduction and community resilience: A case study from Thalikulam Panchayath". The study assessed coastal disaster risks in Thalikkulam Panchayat, highlighting community preparedness gaps, water quality concerns, and mitigation strategies. Key recommendations included scientific coastal protection, enhanced early warning systems, community training, and improved water infrastructure. Strengthening public awareness and policy implementation is essential for disaster resilience.

The study by **Ms. Aswathy K. Vijayan, Kerala Forest Research Institute** Peechi on "Assessing Forest Fire Dynamics in Attappady, Kerala: Innovations in Disaster Risk Reduction and Ecological Resilience" analyzed forest fire dynamics in Attappady, Kerala, using remote sensing and GIS to assess burn severity, fire-prone zones, and ecological resilience. Findings revealed climate change, human activities, and invasive species as key contributors. Recommendations included community participation, improved fire detection, and sustainable forest management to mitigate future risks.

Mikha Khosh T. L., College of Climate Change and Environmental Science, KAU presented "Assessing Coastal Vulnerability and Enhancing Disaster Resilience: A Socioeconomic Study in Eriyad Grama Panchayat, Kerala". The study analyzed coastal vulnerability in Eriyad Panchayat, highlighting erosion, evacuation challenges, and climate change impacts. Recommendations

included awareness programs, evacuation planning, disaster response training, and sustainable coastal management to enhance resilience.

The presentation by **Ms. Anjitha A. C**. on the title "Fighting climate uncertainty: vulnerability and resilience in Kerala's coffee farming" assessed climate vulnerability in Wayanad's coffee farming, identifying low literacy, lack of subsidies, and poor irrigation as key challenges. Recommendations include micro-irrigation schemes, weather-based insurance, and soil test-based fertilizer applications to enhance resilience.

Ms. B.R. Hemavarshini, Bharathidasan University talked on the topic "Assessment of Agricultural Drought Vulnerability Using Geospatial Techniques in Oddanchatram Taluk, Dindigul District." The study analyzed agricultural drought trends (2000-2022) using geospatial techniques. Findings revealed increasing drought frequency, soil moisture depletion, and rising land surface temperature. Recommendations include drought monitoring systems and sustainable water management for mitigation.

The final oral presentation was by **Mr. Aravindh Panikkaveettil, Christ University, Bangalore** on "Assessing Vulnerability and Risk to Extreme Weather Events on the Kerala Coast Using IPCC AR4 and AR5 Frameworks". The study analyzed climate vulnerability on the Kerala coast, focusing on livelihood risks, policy impacts, and coastal management. Findings revealed a higher vulnerability in southern districts due to ineffective welfare schemes, while northern districts benefit from alternative livelihoods and fewer hazards. Policy shifts towards localized, softer solutions are recommended.

The session concluded by giving mementoes to the chairs and leads.

3.3.2. TS-H2A: KSBB Joint Session

TS-H2A: KSBB Side Event Consultation On Agrobiodiversity In A Changing Climate Guarding Custodian Farmlands for Climate Adaptation and Resilience **24 March 2025, Time: 14:00-17:30** **Venue: Hall 2 (Pisharoty Hall)** Chair: Dr. R.V. Varma, Former Chairman, KSBB			
1	**KSBB Side Event**	**PANEL DISCUSSION** Topic: Climate Adaptation and Resilience of Food and Agricultural Production Landscapes of Kerala	Keynote speaker:Dr. Regine Andersen Research Director, Biodiversity and Natural Resources, Research Professor (Dr. Polit), Fridtjof Nansen Institute, Norway

In **Pisharoty Hall**, the technical session was conducted by **Kerala State Biodiversity Board (KSBB)** in collaboration with **MS Swaminathan Research Foundation, Wayanad**, in the afternoon (14:00-17:30 IST) on 24th March 2025, based on the theme Consultation on Agrobiodiversity in a Changing Climate: **"Guarding Custodian Farmlands for Climate Adaptation and Resilience"**. The objective of this discussion was to identify strategies and methods to empower the

Custodian Farmers of Kerala and accelerate their climate-smart farming efforts and enhance their farmland productivity and resilience. The Kerala State Biodiversity Board has identified over 800 farmers in the state from 8 districts who are passionately conserving a diverse array of plant and animal genetic resources on their farms, ensuring their availability for future adaptation needs. The consultation brought together 30 dedicated custodian farmers from Ernakulam and Alappuzha districts to discuss critical topics including the on-farm conservation of genetic diversity, strategies for maintaining landscape heterogeneity, and enhancing farmers' rights to support climate-smart agriculture.

Rapporteur for the session, Ms. Sreeshma K, started the session by briefly

Figure 3.8 KSBB Sponsored Session

introducing the KSBB side event. Subsequently, the rapporteur handed over the session to the KSBB, and they took over. Before starting the programme, a documentation of KSBB projects and the collection of seeds, crops, and tree conservation were presented to the audience. Ms. Nikitha compered the session, and **Dr. Akhila S Nair** member of KSBB did the welcome address. **Dr. Anil Kumar, KSBB Chairman** highlighted climate adaptation and resilience in his presidential address. He identified Kerala as a climate hotspot due to the Western

Ghats and Arabian Sea. He emphasized farmers' role in biodiversity conservation, defining custodian farmers as cultivators, conservers, and breeders. He mentioned the importance of initiatives like KERA – a World bank supported project which aims to improve the climate resilience of crops in the context of climate change. Dr. Anil concluded his words by talking about the vital role played by international conferences like CARE-25 in connecting people around the globe. **Dr. R. V. Varma, former Chairman, KSBB**, in his inaugural address, emphasized the ecological vulnerability of the Western Ghats due to poor land policies. He stressed preserving Kerala's ecological hotspots and advocated for a system to share knowledge among custodian farmers. He concluded that farmers' rights acts should benefit them, urging their participation in policy making.

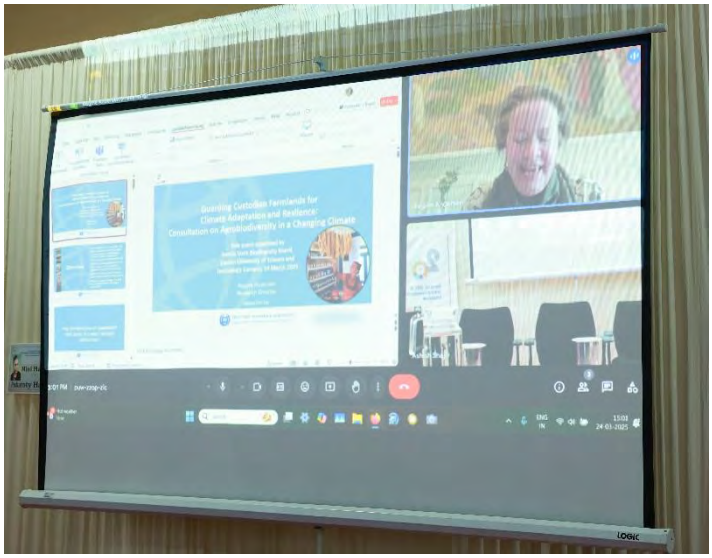


Figure 3.9 Keynote Speech by Dr. Regine Andersen

As per the schedule, the plenary session of the KSBB side event commenced at 14:30 IST with a welcome address by Dr. Anil Kumar, Chairman, KSBB. The session was chaired by Dr. R. V. Varma, former Chairman, KSBB. The topic of the session was **"Climate Adaptation and Resilience of Food and Agricultural Production Landscapes of Kerala"**. The **keynote speaker was Dr. Regine Andersen, Research Director, Biodiversity and Natural Resources, Research Professor (Dr. Polit) Fridtjof Nansen Institute, Norway**. Dr. Regine Andersen delivered the keynote speech, emphasizing the need for establishing Community Seed Banks in India. She discussed balancing Formal Seed Systems (FSS) and Farmer-Made Seed Systems (FMSS) and explained India's role in this context. Drawing from her experience in countries like Ethiopia, she outlined six key factors to consider when setting up a community seed bank: Legislation, Policies, Action, Capacity, Arenas, Guidance.

Dr. Shakeela V., Director, M S Swaminathan Research Foundation, Community Agrobiodiversity Centre, Wayanad delivered the felicitation address, summarizing the activities of the M.S. Swaminathan Research Center. **Dr. Abhilash S.**, Director, Advanced Centre for Atmospheric Radar Research (ACARR), CUSAT, and **Dr. C.K. Peethambaran**, Director of Research (Retd.), Kerala Agricultural University (KAU), Vellanikkara were present on the dais. The Principal Agricultural Officer of Ernakulam also gave a felicitation speech, emphasizing the need to preserve the purity of indigenous crop varieties. She discussed various initiatives being tested in different panchayats and expressed hope that many would become successful models. In his response speech, Dr. C.K. Peethambaran effectively summarized and translated Dr. Regine Andersen's words for farmers and local communities. He also spoke about agrobiodiversity in the context of climate adaptation. Later, **Dr. K. Joseph John, Principal Scientist (Retd.), ICAR-National Bureau of Plant Genetic Resources (ICAR-NBPGR), New Delhi** addressed the changing public perspective following the 2018 floods, highlighting advancements in early warning systems and prediction capabilities. The session also underscored the importance of conserving traditional crop varieties.

Figure 3.10 KSBB Session glimpses

The session was dispersed for a tea break at 04:30 pm. After the tea break of 10 minutes, the dignitaries divided into three separate panels, each focusing on different topics with distinct groups of farmers. The rapporteur for the session was Mr. Arjun.

Panel Discussion 1

Topic: On-farm Conservation of Genetic Diversity in a Changing Climate: Challenges and opportunities for both producers and consumers (Experiences of Custodian farmers)

Panel discussion 1 was chaired by **Dr. C.K. Peethambaran, former Director of Research, KAU**, with **Dr. C.K. Shaju, former Deputy Director of Animal Husbandry**, serving as the Co-chair. The program primarily highlighted the importance of preserving traditional seed varieties. Older seeds are believed to be more resistant to pests and require less nitrogen fixation. Farmers from Alappuzha and Ernakulam participated in the program. Among them, Mr. Anil Kumar shared his experience of planting 2,000 traditional seeds at home to preserve them for future use. Currently, around 750 hectares of land are cultivated with Pokkali rice, a crop that has been gradually declining over the years. Farmers expressed concerns about the dwindling practice of preserving and distributing traditional seeds. They also emphasized that older seed varieties have higher nutritional value compared to modern hybrid seeds. However, most people now rely on market-bought seeds, which lack genetic diversity. Several farmers in the program stated that they still have an abundance of local seed varieties and practice similar cultivation methods. In conclusion, the chair emphasized the need for urgent action to preserve traditional seeds and recommended the following measures:

i. Preservation of land masses
ii. Dynamic conservation
iii. Involvement of communities
iv. The preservation should be done by the farmers i.e. they should plant seeds in different places.
v. Ex situ conservation
vi. In situ conservation
vii. The institutional framework should be established; the government should back up the farmers.
viii. Farmers should be made aware of their opportunities.
ix. The participation should be divided into 4 categories. They are
   - Contractual
   - Collaborative
   - Collegial
   - Consultative

Panel Discussion 2

Topic: Maintaining Landscape Heterogeneity and Landrace diversity; Strategies for climate adaptation and resilience-building (Experiences of custodian farmers)

Panel discussion 2 was moderated by **Dr. Shakeela V**. with **Dr. Deepa, Assistant professor, Rice Research Station, Vyttila, Ernakulam**, as the co-

Figure 3.11 Panel Discussion 2

moderator and **Dr. R. V. Varma** leading the session. They engaged in an insightful exchange with custodian farmers who have been passionately preserving traditional agricultural practices, including both breeders and conservers. After brief introductions from five farmers, the panel delved into the various techniques these farmers implement in their fields. A key point emphasized by the farmers was the importance of parents encouraging their children to develop a deeper connection with the earth and nature. The panel arrived at several important conclusions, including:

- The importance of implementing policies that enhance the economic viability of the agricultural sector for farmers.
- The need to establish improved marketing opportunities for farmers' produce.
- The significance of creating platforms where custodian farmers can share their expertise and contribute to shaping policies aimed at preserving biodiversity. The session concluded with a heartfelt appreciation for the indispensable role that farmers play in safeguarding biodiversity.

Panel Discussion 3

Topic: Evoking Farmers' Rights: Maximizing climate-smart and socio-economic outcomes in seed production and management (Experiences of Custodian farmers)

Panel discussion 3 was chaired by **Dr. C. George Thomas, Former Chairman, KSBB** and **Co-Chaired by Dr. Jiji Joseph, Professor & Head, Department of Plant Breeding and Genetics, College of Agriculture, KAU**, with the lead discussant being Dr. Raji Namboodiri, Assistant Professor & Head in charge, Center for IPR, KAU. The session started with the chair explaining the importance of identifying crops with special properties to the 8 farmers present in the panel. The importance of registering special varieties that would give the farmers plant breeder rights was discussed. The farmers raised their concerns regarding the topic of seed production and management. The problem of indigenous varieties losing their purity when they were grown together (knowingly or unknowingly) with hybrid varieties was discussed, and preventive measures were evaluated. The importance of traditional methods of seed storage and management was evaluated and found to be often more effective than modern methods.

The need for celebrating indigenous seed varieties was discussed and new ideas were brainstormed. The farmers raised their fears regarding the latest trend of the newer generation's growing neglect of the agricultural sector. The problem of the loss of Pokkali cultivation fields to Prone cultivation was raised by farmers. The loss of traditional knowledge was found to be a very real issue and the need for preserving and sharing this wealth of knowledge was discussed. Methods of preservation of endangered seed varieties and the need for developing climate change resilient crops were discussed.

Figure 3.12 KSBB Panel discussions

Summarizing the Panel Discussions

The group reconvened after the panel discussions, and the respective chairs of each panel presented a brief summary of their discussions with the farmers. The insights shared by the farmers were recognized as valuable contributions toward the development of more effective agricultural policies. Dr. R. V. Varma provided an overview of the key points from all three panel discussions and presented them to the audience. Following the concluding remarks by Dr. N. Anil Kumar, Dr. Sreedharan K., Research Officer of KSBB, delivered the vote of thanks. With this, the KSBB side event at Pisharoty Hall concluded around 6 pm.

Figure 3.13 KSBB Session Group Photo

3.3.3. TS-H3A: Climate Variability & Extremes

TS-H3A: Climate Variability & Extremes (CVE) 24 March 2025, Time: 14:00-15:30 Venue: Hall 3 (Ananthakrishnan Hall) Chairs: Prof. C. A. Babu, CUSAT & Dr. Govindankutty, IIST				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. M. R. Ramesh Kumar	Rtd Scientist, NIO Goa	Vagaries in Monsoon: Role of Oceans
2	CARE-0049	Dr. KARTHEEK MAMIDI	DISPERSION CHARACTERSTICS OF ANISOTROPICALLY SCALED MOIST EQUATORIAL WAVES	
3	CARE-0076	DHANYA JOSEPH	RISING SST AND SEA LEVEL VARIABILITY: A GROWING RISK FOR INDIA'S WEST COAST	
4	CARE-0019	ASHISH SHAJI	CONVECTIVE CHAOS: HOW CLIMATE CHANGE ELECTRIFIES INDIAN WEST COAST?	
5	CARE-0054	PRAJWAL K	WIND-PRECIPITATION REGIMES AND MONSOON INTRASEASONAL VARIABILITY: NEW INSIGHTS FROM THE SOUTHWEST COAST OF INDIA	
6	CARE-0029	SRIPATHI GOLLAPALLI	VARIABILITY OF THE SOUTH ASIAN HIGH AND ITS IMPACT ON INDIAN SUMMER MONSOON RAINFALL: A MULTI-SCALE ANALYSIS	

In **Ananthakrishnan Hall (Hall 3)**, the Technical Session TS-H3A took place in the afternoon (14:00–15:30 IST) on March 24, 2025, focusing on the theme **"Climate Variability & Extremes (CVE)."** The rapporteur for the day, Ms. Jisha K. Vishal, opened the session by introducing the chairs and providing a brief description of their backgrounds. **Prof. C. A. Babu and Dr. Govindan Kutty chaired the opening session** of CARE 2025 in Hall 3. Prof. C. A. Babu, an adjunct professor in Atmospheric Sciences at CUSAT, specializes in green technology and brings extensive research and teaching experience. Dr. Govindan Kutty, a professor at the Indian Institute of Space Science and Technology, has significant expertise in atmospheric modeling, data assimilation, and extreme weather predictability. The rapporteur then handed the session over to the chairs, who proceeded to lead the proceedings.

The technical session featured **one lead talk and four oral presentations**. The **lead talk was delivered by Dr. M. R. Ramesh Kumar**, a retired scientist from the National Institute of Oceanography (NIO), Goa, who specializes in air-sea interactions, monsoons, and climate change. His presentation, titled **"Vagaries in Monsoon"** addressed the complex variability of the Indian Summer Monsoon (ISM). Drawing on his extensive expertise in air-sea interactions, he explored the inter-annual variability of the ISM, focusing on its onset date, total rainfall quantum, and intra-seasonal activity. Emphasizing dry spell detection, he referenced his work (Ramesh Kumar and Uma, 2004), which proposed a simple metric: three or more consecutive days of low All India Rainfall (<9 mm/day) in

July or August often correlate with deficient monsoon years. A comparative analysis of the monsoon years 1987 (deficient) and 1988 (excess) revealed that evaporation over the southern Indian Ocean, along with cross-equatorial moisture transport, plays a more critical role in modulating monsoon intensity than evaporation over the Arabian Sea. Dr. Ramesh illustrated how low-level wind flow particularly from the Equatorial Indian Ocean (EIO) region was notably stronger during active or excess monsoon phases compared to weak or break periods. This observation was supported by an analysis of surface pressure, surface winds, 850 mb wind fields, and integrated columnar precipitable water, as detailed in the study by Swapna and Ramesh Kumar (2002). These parameters clearly highlighted the influence of low-level flow dynamics on moisture transport and monsoon activity.

Furthermore, Dr. Ramesh discussed the influence of ocean-atmosphere coupled phenomena, such as the Indian Ocean Dipole (IOD) and El Niño-Southern Oscillation (ENSO), on Indian monsoon behavior. Citing Y. Du (2013), he elaborated on the impact of different IOD phases on the ISM. Early IOD events (EIODs) that peak during July-August were shown to significantly enhance ISM rainfall despite their moderate intensity, owing to increased Arabian Sea evaporation, stronger cross-equatorial winds, and reduced break spells. Finally, he presented findings on the association between convective systems over the northwest Pacific (NWP) and the Indian monsoon, based on observations from 1951 to 2003. It was noted that during the five pentads preceding and following the monsoon onset over Kerala (MOK), convective systems were largely absent in the NWP region, suggesting a possible teleconnection between suppressed Pacific convection and the onset and progress of the ISM. Dr. Ramesh's talk provided a comprehensive synthesis of dynamic ocean-atmosphere interactions influencing monsoon variability and underscored the importance of understanding these linkages for improved seasonal prediction and climate adaptation strategies.

The oral presentations in the session were delivered by Kartheek Mamidi from the University of Calicut, Dr. Dhanya Joseph, Ashish Shaji, and Prajwal K. from ACARR, CUSAT. One participant, G. Sripathi, was unable to present due to unforeseen circumstances.

Dr. Kartheek Mamidi, University of Calicut, presented **"Dispersion Characteristics of Anisotropically Scaled Moist Equatorial Waves".** This paper developed a theoretical model to study how moist equatorial waves disperse under anisotropic space-time scaling. It integrated a shallow water model with moisture as a prognostic variable and highlighted the role of nonlinear advection and adiabatic processes. The analysis revealed that anisotropy leads to dispersion curve intersections and energy localization at planetary-scale wavenumbers. These resonant interactions significantly alter equatorial wave behavior, particularly for Kelvin and Rossby wave modes.

Next, **Dr. Dhanya Joseph**, ACARR, CUSAT presented **"Rising SST and Sea Level Variability: A Growing Risk for India's West Coast".** This research examined the correlation between sea surface temperature (SST) and sea surface height (SSH) along India's west coast using CMIP6 projections. It demonstrated that SST variations strongly influence SSH changes, especially during the monsoon season, with the highest correlation observed between June and September. Projections indicated a sea level rise of 4-5 cm/°C increase in SST, highlighting significant risks for the region. Understanding these relationships is crucial for developing adaptive strategies to mitigate the impact of rising sea levels on coastal communities.

Mr. Ashish Shaji ACARR, CUSAT presented **"Convective Chaos: How Climate Change Electrifies India's West Coast".** This study explored the increasing lightning activity along India's west coast, particularly during the monsoon, due to climate change-induced shifts in atmospheric dynamics. The research identified a trend of rising lightning flash counts in the southern part of the region, driven by deeper convection and enhanced moist static energy. Analysis of a 26-year dataset (1998-2023) from TRMM sensors showed that rising atmospheric instability correlates with more frequent lightning strikes. These findings underscored the urgency of developing disaster management strategies to mitigate the risks of lightning-related hazards in the region.

Lastly, **Mr. Prajwal K.**, ACARR, CUSAT presented **"Wind-Precipitation Regimes and Monsoon Intraseasonal Variability: New Insights from the Southwest Coast of India".** This study investigated the relationship between wind and precipitation during the Indian summer monsoon using K-means clustering of 205 MHz wind profiler radar and rainfall data. It identified five distinct wind-precipitation regimes, with low-wind regimes linked to monsoon breaks and high-wind regimes corresponding to active monsoon conditions. The study also highlighted the role of dry air intrusion at higher altitudes in suppressing rainfall, while increased boundary layer convergence enhanced precipitation. These findings offered new insights into the complex interactions between wind and precipitation variability along the southwest coast of India.

The first-day technical session in Hall 3 was successfully completed. While closing the session, Ms. Jisha K. Vishal thanked the chairs, speakers, and audience for making it a great success.

The second session of CARE 2025 in Ananthakrishnan Hall (Hall 3) began at 16:00 IST, continuing the theme "**Climate Variability & Extremes (CVE).**" The rapporteur for this session, Ms. Ancy P., opened the session by introducing the chairs and providing a brief description of their backgrounds. The session was chaired by **Prof. K. Satheesan** and **Shri Baby Chakrapani**. Prof. K. Satheesan is a professo**r in the Department of Atmospheric Sciences, CUSAT** and the **Director of the School of Marine Sciences**. **Shri Baby Chakrapani**, a **retired associate**

professor from the Department of Atmospheric Sciences, CUSAT, has made significant contributions to research and education in atmospheric sciences. An expert in ocean-atmosphere interactions and climate studies, his work has advanced the understanding of coastal meteorology and air-sea interactions.

TS-H3B: Climate Variability & Extremes (CVE) (Cont.) 24 March 2025, Time: 16:00-17:30 Venue: Hall 3 (Ananthakrishnan Hall) Chairs: Prof. K. Satheeshan, CUSAT & Shri. Baby Chakrapani, CUSAT				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. Govindan Kutty, IIST, TVM	Professor, IIST	From Dynamics to Predictability: Leveraging Ensembles for Improved Weather Forecasts
2	CARE-0036	AMITA PRABHU	INFLUENCE OF SOUTHERN ANNULAR MODE EXTREMES ON SUMMER MONSOON RAINFALL IN INDIA AND WEST AFRICA	
3	CARE-0042	TESNA MARIA	MOISTURE TRANSPORT AND ITS LINK WITH EXTREME MONSOON RAINFALL OVER THE WEST COAST OF INDIA	
4	CARE-0045	ANCY P	DIURNAL AND SPATIAL VARIABILITY OF MONSOON RAINFALL OVER THE WEST COAST OF INDIA: INFLUENCE OF ATMOSPHERIC DYNAMICS AND MOISTURE TRANSPORT	
5	CARE-0132	ARUN V	FEATURES OF RAINFALL DISTRIBUTION DURING TRANSITION FROM SOUTH WEST MONSOON TO POST MONSOON	
6	CARE-0107	BICHU B	INCREASING INTENSITY OF POTENTIAL MESO TO SYNOPTIC SCALE LOW PRESSURE SYSTEMS IN THE NORTH INDIAN OCEAN: NEED OF AN EFFECTIVE EARLY WARNING SYSTEM FOR SOUTH-WEST COAST OF INDIA.	
7	CARE-0083	ADARSH T	CLIMATE VARIABILITY AND ITS IMPACT ON PUBLIC HEALTH: A BIBLIOMETRIC STUDY	
8	CARE-0031	LAKSHMAN KESIREDDY	HIGH-RESOLUTION ANALYSIS OF SEVERE HEAT WAVE DYNAMICS AND THERMAL DISCOMFORT ACROSS INDIA	
9	CARE-0116	ATHIRA SALEEVAN	IMPACT OF FOREST FIRE ON SOIL SYSTEMS IN SOUTHERN WESTERN GHATS, KERALA	

The technical session included a lead talk and several contributory presentations. The lead talk was delivered by **Prof. Govindan Kutty** from the **Indian Institute of Space Science and Technology, Trivandrum**, on the topic "**From Dynamics to Predictability: Leveraging Ensembles for Improved Weather Forecasts.**" The talk focused on the role of numerical weather prediction in forecasting atmospheric changes by solving governing dynamical equations. Prof. Kutty highlighted the inherent unpredictability of weather due to uncertainties in initial conditions, model errors, and external influences. He discussed ensemble forecasting as a critical method to improve predictability by running multiple simulations with slight variations to account for uncertainty. The Uttarakhand heavy rainfall event of June 2013 was analyzed using the Ensemble Sensitivity Analysis (ESA) approach, revealing how geopotential height anomalies influenced precipitation patterns. The study emphasized the importance of data assimilation from satellite observations and targeted observation networks to enhance forecast accuracy. The talk concluded by stressing that ensemble-based approaches could

provide quantitative insights into extreme weather events, aiding in better disaster preparedness and mitigation strategies.

Following the lead talk, the session featured several contributory presentations. **Ms. Amita Prabhu,** Indian Institute of Tropical Meteorology, presented a study titled "**Influence of Southern Annular Mode Extremes on Summer Monsoon Rainfall in India and West Africa.**" Using historical mean sea level pressure (MSLP) data (1949-2013), the study found that extreme negative Southern Annular Mode (SAM) phases contribute to weaker monsoon rainfall through atmospheric circulation changes linked to the Pacific Ocean. The research highlighted the role of sea surface temperature (SST) variations and Rossby wave propagation in modulating monsoon patterns. These findings could improve long-term monsoon forecasting and suggest that incorporating SAM variability into climate models may enhance seasonal monsoon predictions.

Ms. P. Ancy, Department of Atmospheric Sciences, CUSAT presented research on "Diurnal and Spatial Variability of Monsoon Rainfall over the West Coast of India: Influence of Atmospheric Dynamics and Moisture Transport," using TRMM and ERA5 data from 1998-2019. The study identified three rainfall patterns offshore, onshore, and uniform. Offshore rainfall peaked in the morning due to convergence, while onshore rainfall intensified in the afternoon and evening. The results indicated that wind strength and moisture transport significantly influence rainfall distribution. These findings emphasize the need to incorporate diurnal rainfall variations into weather models for better forecasting accuracy, particularly in coastal regions heavily dependent on monsoonal rains.

Then, **Mr. Arun V.** Sree Krishna College Guruvayur, presented results on "**Features of Rainfall Distribution During the Transition from Southwest Monsoon to Post-Monsoon.**" The study examined the transition period from the southwest monsoon to the northeast monsoon, highlighting changes in rainfall and wind patterns. Using CRUTS, ERA5, and NOAA SST data, the research revealed that monsoon withdrawal follows a systematic pattern over 3-4 weeks. The El Niño-Southern Oscillation (ENSO) influences rainfall during this period, with anticyclonic flows reinforcing post-monsoon rainfall. The findings suggest a reversal in the ENSO-rainfall relationship, improving seasonal forecast strategies. Understanding these transitional dynamics is crucial for sectors like agriculture and water resource management, where monsoonal shifts significantly impact planning and preparedness.

Mr. Bichu B. Department of Environmental Sciences, University of Kerala presented a study titled "Increasing Intensity of Potential Meso- to Synoptic-Scale Low-Pressure Systems in the North Indian Ocean: Need for an Effective Early Warning System for the Southwest Coast of India." This study assessed trends in cyclonic disturbances using RSMC records (1982–2022) and the T-number weighted active cyclone hour (TWACH) metric. The analysis indicated a gradual

increase in cyclone intensity, particularly in the Bay of Bengal. Factors such as rising sea surface temperatures and atmospheric instability were linked to these trends, emphasizing the need for improved early warning systems for India's southwest coast. The findings highlight the urgency of strengthening disaster response mechanisms and enhancing coastal infrastructure resilience to mitigate the impact of increasing cyclone activity.

Adarsh T. Sree Sankaracharya University of Sanskrit, conducted a bibliometric analysis on the topic "**Climate Variability and Public Health: A Bibliometric Study**," using Web of Science and PubMed data from 2000-2024. The results showed a sharp increase in publications post-2010, with leading contributions from the USA, China, and the UK. Research themes evolved from pollution-centered studies to broader investigations of climate change and urban health. The findings underscore growing academic and policy interest in climate-related health impacts. This expanding body of research highlights the need for interdisciplinary collaborations and policy interventions to address public health risks posed by climate variability.

Lastly, **Athira Saleevan,** Kerala Forest Research Institute, Peechi presented research on the **"Impact of Forest Fires on Soil Systems in the Southern Western Ghats, Kerala."** The results indicated that fire-affected soils exhibited increased bulk density, reduced porosity, and altered organic carbon content. These changes contribute to higher erosion risks and potential landslides. The study emphasized the need for further research into fire regimes and their implications for ecosystem resilience. The findings call for improved fire management strategies and conservation policies to safeguard soil health and prevent long-term ecological damage in fire-prone regions.

The session concluded with the rapporteur, Ms. Ancy P., expressing heartfelt gratitude to the speakers and chairs for their insightful contributions, leaving the audience with a sense of fulfillment and appreciation for the enriching discussions.

3.3.4. TS-H4A: Kerala State Climate Change Adaptation Mission (KSCCAM) Joint Session-Climate Adaptation and Resilience (CAR)

The **Kerala State Climate Change Adaptation Mission (KCCAM)** is the state Government's initiative to help Kerala become more resilient to climate change. The KCCAM is part of the state government's plan to achieve carbon neutrality. The Mission aims at reducing the overall carbon footprint of the State and also avail the opportunities that carbon economy offers for the overall development of the State. The mission looks at streamlining and administering climate change adaptation and mitigation activities for improved climate governance in the State.

In **Sikka hall**, there were two technical sessions in the afternoon of 24th March 2025. The first technical session (TS-H4A) held during 14:00-16:00 IST was based on the theme **"KSCCAM joint session- Climate Adaptation and Resilience (CAR)"**.

TS-H4A: KSCCAM Joint Session-Climate Adaptation and Resilience (CAR) 24 March 2025, Time: 14:00-15:30 Venue: Hall 4 (Sikka Hall) Chairs: Dr. Krishnamohan, CUSAT & Shri. Siji. M. Thankachan, KSCCAM				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. Deepak Gopalakrishnan (Online)	Department of Meteorology, University of reading, Reading, UK	Subtropical Jet Dynamics And Arabian Rainfall: A New Perspective
2		Dr. Vinoj V (Online)	IIT Bhubaneswar	Climate Change and the warming of the Indian Cities: Implications for Extreme Heat
2	CARE-0052	STEFY THOMAS	SOCIO-ECONOMIC VULNERABILITY AND CLIMATE RESILIENCE IN COASTAL KERALA: A MULTI-CRITERIA ASSESSMENT	
3	CARE-0095	KARTHIK	INCLUSION OF BIOETHICS IN GENERAL EDUCATION FOR CLIMATE CHANGE	
4	CARE-0103	RIYA K R	ANALYSING CLIMATE CHANGE VULNERABILITY AND ADAPTATION STRATEGIES IN KERALA	
5	CARE-0135 (ONLINE)	GOPIKRISHNAN G S	AEROSOL INHIBITION ON PHOTOCHEMICAL SURFACE OZONE FORMATION UNDER FUTURE CLIMATE AND AIR QUALITY SCENARIOS	
6	CARE-0090	LINCY DAVIS	VERIFICATION OF MEDIUM RANGE WEATHER FORECAST AND ITS ROLE IN AGROMET ADVISORY SERVICES	
7	CARE-0145 (ONLINE)	APARNNA RAVI	EXTREME EVENTS – ELUCIDATING THE DYNAMICS OF INDIAN TERRESTRIAL CARBON UPTAKE CAPACITY	

Figure 3.14 Glimpses of KSCCAM Session

Rapporteur for the session, Ms. Silpamol D S initiated the session by introducing the Chairs and gave a brief description about them. The 1st technical session was chaired by Dr. Krishna Mohan and Shri. Siji M Thankachan. Dr. Krishna Mohan K. S. is an Assistant Professor at the School of Environmental Studies, CUSAT. He has contributed significantly to understanding atmospheric phenomena such as tropical cyclones and the Indian monsoon, with a strong focus on climate modeling and geoengineering. Shri Siji M. Thankachan is the Administrative Manager in the Kerala State Climate Change Adaptation Mission (KSCCAM). He plays a vital role in disaster preparedness, response, and mitigation efforts in Kerala. His expertise was crucial during the 2018 Kerala floods, where he played a key role in providing essential updates and overseeing response efforts. Later, the rapporteur handed over the session to the chairs.

The technical session **included two lead talks, and four contributory presentations.** Both the lead talks were online. The session opened with a lead talk by **Dr. Deepak Gopalakrishnan, postdoctoral research scientist in the Department of Meteorology at the University of Reading, UK**. Dr. Deepak's presentation titled "Subtropical jet dynamics and Arabian rain: a new perspective" was based on his collaborative work on wintertime rainfall events in the Arabian region. They studied the mechanism of rainfall events in the winter season, and particularly how subtropical jet modulates the rainfall events. The study was performed using 17-year regional climate simulation using the Weather Research and Forecasting (WRF) model. They proposed a mechanism explaining the sequence of events leading to convection initiation and rainfall of the Arabian region. They also demonstrated the validity of their hypothesis using the WRF model by modifying upper-level jet pattern.

Figure 3.15 Lead Talk by Dr. V. Vinoj

The second lead talk was given by **Dr. Vinoj V, Associate Professor in the School of Earth, Ocean and Climate Sciences, IIT Bhubaneswar**, on **"Climate Change and the warming of the Indian Cities: Implications for Extreme Heat"**. Dr. Vinoj explained the inter-relationship between climate change and urbanization and how the urbanized warming of Indian cities affect the climate change. The analysis of urbanization signatures over Bhubaneswar and Cuttack showed that consistent warming occurred in all the seasons. He observed a 60% additional warming due to urbanization over Indian cities with eastern and central Indian cities at the forefront. It points out to the necessity to follow a differential approach to urban heat management based on the dominant contributor to combat urban warming effectively.

The contributory presentations in this session were delivered by **Ms. Stefy Thomas**, Department of Atmospheric Sciences, CUSAT; **Shri. Gopikrishnan G S, CORAL,** Indian Institute of Technology Kharagpur (online)**; Dr. P Lincy Davis,** Assistant Professor, Department of Agricultural meteorology, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur**;** and **Dr. Aparna Ravi.** Indian Institute of Science Education and Research Bhopal (IISERB), Bhopal (online).

The contributory talks in the session started with **Ms. Stefy Thomas on "Socio-Economic Vulnerability and Climate Resilience in Coastal Kerala: A Multi-Criteria Assessment"**. Coastal Kerala faces complex environmental and socio-economic challenges, including floods, erosion, and livelihood instability. Ms. Stefy developed a Socio-Economic Vulnerability Index (SEVI) that provides a comprehensive framework to assess vulnerability and support targeted adaptation and resilience efforts. The study employed the Analytic Hierarchy Process (AHP) to assess vulnerability across economic, social, and infrastructure categories. Data from 290 household surveys in nine coastal communities were validated through field checks and analyzed using bootstrapping for statistical robustness. The SEVI framework is adaptable for assessing socio-economic vulnerability in coastal regions beyond Kerala, enabling policymakers to track trends and prioritize interventions. Future research aims to enhance predictive accuracy through real-time data, machine learning, remote sensing, and participatory approaches for more effective, community-driven adaptation strategies.

Shri. G S Gopikrishnan presented the paper titled **"Aerosol inhibition on photochemical surface ozone formation under future climate and air quality scenarios"**. He talked about how aerosols modulate tropospheric oxidation by absorbing and scattering solar radiation, altering photochemical reactions, and providing surfaces for heterogeneous chemistry. The uptake of radicals such as HO_2 by aerosols reduces the availability of these species, shifting the balance of ozone formation. The study focused on NOx-limited regions like India and East Asia. The GEOS-Chem chemical transport model was used for the study and the period is the near-present period and future projections for 2046 and 2096 under

different SSP scenarios. Higher aerosol uptake leads to increased radical removal, causing a 40–50% rise in ozone in NOx-limited regions. By 2046, reductions in aerosol-inhibited regimes (AIR) are projected due to emission controls, shrinking further by 2096. However, high aerosol regions will still see a 10–15% ozone increase. He recommends that 80–90% of the increase in surface ozone due to reduced aerosols can be mitigated by an additional 25–50% reduction in anthropogenic NOx emissions in the current scenario. Future policies must integrate aerosol-ozone interactions to manage pollution effectively.

Dr P. Lincy Davis presented the paper **"Verification of Medium-Range Weather Forecast and Its Role in Agromet Advisory Services",** highlighting the importance of MRWF in agriculture for land preparation, sowing, and plant protection. Agromet Advisory Services (AAS) in Kerala, based on MRWF issued by IMD, have helped farmers reduce losses, improve yields, and adopt climate-smart practices. This case study demonstrated how AAS supported dairy farmers in Palakkad in managing heat stress, improving milk yield, and reducing disease risks. Expanding AAS to more livestock farmers can enhance sustainable dairy farming and strengthen climate resilience. By combining weather forecasting, agricultural expertise, and digital technology, AAS is transforming Indian agriculture towards a more climate-resilient and productive system.

In the last presentation of the session, **Dr. Aparna Ravi** discussed about **"Extreme events - Elucidating the dynamics of Indian terrestrial carbon uptake capacity"**. The terrestrial biosphere is the largest but most uncertain carbon sink, requiring improved regional-scale understanding, high-resolution models, and better observations to support India's climate policies and SDGs 13 and 15. The balance between Gross Primary Productivity and Ecosystem Respiration determines whether an ecosystem acts as a CO_2 sink or source, influencing global carbon dynamics. Dr. Aparna developed a high-resolution flux map for India using Vegetation Photosynthesis and Respiration Model (VPRM) especially useful for regions with limited carbon flux observation networks. Model parameterization was carried out using satellite-derived proxies for vegetation physiology and hydro-meteorological parameters. It was observed that India acts as a net carbon sink and evergreen forests demonstrated the highest carbon fixation efficiency, accounting for 63% of the total land carbon. VPRM can be used as a tool to analyse variations in vegetation carbon processes during extreme weather conditions like droughts. These findings can aid in regional carbon budgeting, support policymakers in achieving carbon reduction targets, and improve agricultural practices.

With the above 2 lead talks and 4 contributory talks, the first technical session of the Sikka Hall (Hall 4) concluded at 15:30 IST. **Dr. Ruchith R D, Scientist-C, NIO Goa**, thanked and presented mementoes to the chairs of the

session as a token of appreciation. The hall committee thanked the chairs, speakers and audience for making it a great success.

3.3.5. TS-H4B: Tropical Weather and Climate

In **Sikka hall**, the second technical session (TS-H4B) on the theme **"Tropical weather and Climate Change (TWC)"** began in the afternoon at 16:30 IST on 24th March, 2025. This session included two lead talks (of 20 minutes duration) and four oral (10 minutes duration) presentations. Rapporteur for the session was Ms. Agna S S.

TS-H4B: Tropical Weather and Climate (TWC) 24 March 2025, Time: 16:00-17:30 Venue: Hall 4 (Sikka Hall) Chairs: Dr. Manoj M G., CUSAT & Dr. Abish B., KUFOS				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. Jayasankar C. B. (Online)	Florida Sate University, USA	Diurnal Temperature Range Projections for India: A regional climate modeling approach
2		Dr. Baiju Dayanandan (Online)	University of Nizwa, Oman	Decadal Temperature Changes in Oman (1981–2020): A Spatiotemporal Assessment
2	CARE-0014 (Online)	SEETHA CJ	EXCHANGE BETWEEN ATMOSPHERIC BOUNDARY LAYER AND FREE TROPOSPHERE OVER THE INDIAN MONSOON REGION	
3	CARE-0108	ARDRA T S	EXPOSURE TO SURFACE OZONE AND ITS ASSOCIATED HEALTH EFFECTS IN INDIA FOR THE YEAR 2022	
4	CARE-0027	AJITH P P	PRE-MONSOON RAINFALL VARIABILITY OVER INDIA IN ASSOCIATION WITH MJO AND ENSO	
5	CARE-0129	KRISHNA KUMAR E.K	CONTRASTING REGIONAL RESPONSES OF INDIAN SUMMER MONSOON RAINFALL TO EXHAUSTED SPRING AND CONCURRENTLY EMERGING SUMMER EL NIÑO EVENTS	

The **hall manager, Dr. Smitha A**, initiated the session by introducing the Chairs and gave a brief description about them. **Dr. Manoj M G and Dr. Abish B chaired this session** of CARE'25. Dr. Manoj M G is the Scientist-D & Academic Coordinator of Advanced Center for Atmospheric Radar Research (ACARR), CUSAT. He is an expert in tropical atmospheric processes, aerosols, and monsoon dynamics. He leads the Atmospheric Processes Studies group at ACARR, focusing on tropical atmospheric processes to enhance weather and climate understanding. Dr. Abish B is the Assistant Professor in Climate Science at the Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies (KUFOS). His research focuses on aerosol-cloud interactions, Indian summer monsoon, and Indian Ocean warming.

The session begins with a lead talk by **Dr. Jayasankar C B** in **online mode**. He is a Postdoctoral Research Associate in COAPS, Florida State University (USA), specialist in high-resolution climate modeling, Indian Summer Monsoon and Extreme weather analysis. His topic of presentation was "Diurnal Temperature

Range Projections for India: A regional Climate Modeling approach". The study presents an analysis of diurnal temperature range (DTR) trends over India using high-resolution regional models. It highlighted the spatial heterogeneity in DTR trends, with many regions experiencing a decline across all four seasons due to radiative flux changes and enthalpy flux influences. Present day simulations of RSM-ROMS were able to effectively capture the daily maximum and minimum temperatures over India, validating observational data. Under the RCP 8.5 emission scenario, significant DTR reductions are projected over the Gangetic Plains and over southeastern India in Mid-21st century. Significant future DTR reductions were also observed over Bihar and eastern Uttar Pradesh, and the rain shadow areas of peninsular India.

The **second lead talk** also in online mode, was delivered by **Dr. Baiju Dayanandan, Associate Professor at the Natural Science and Medical Science Research Centers, University of Nizwa**. Oman. His research interests include Astrophysics, Gravitation, Cosmology, Atmospheric Science, Space Science, Air Quality, and Climate Change. He collaborates with NASA (AERONET) and NCAR focusing on air quality and climate change research. Dr. Baiju's presentation on "Decadal Temperature Changes in Oman (1981-2020): A Spatiotemporal Assessment" analyzed decadal temperature changes in Oman from 1981 to 2020 using ERA5 reanalysis data. The study revealed significant and uneven warming trends across the country, with northern and central regions experiencing the most pronounced increases in average (Tavg), maximum (Tmax), and minimum (Tmin) temperatures. Urban areas like Muscat and Sohar have seen accelerated warming, while interior desert regions face more extreme heat. Seasonal analysis highlighted more severe warming in spring and summer, especially over high-altitude and inland areas, with localized cooling in coastal Dhofar. The study emphasizes the urgent need for adaptive strategies to address the growing threats of heat stress, water security, agriculture, and public health in Oman.

The **contributory talks** were delivered by **Ms. Seetha C J,** SRM Institute of Science and Technology, Chennai, India (online); **Ms. Aswani S**, College of Agriculture, Kerala Agricultural University; **Mr. Ajith P P**, Department of Atmospheric Science, CUSAT; and **Mr. Krishna Kumar E K**, Senior Research fellow, ACARR, CUSAT.

The contributory talk in the session started with **Ms. Seetha C. J.,** who presented a paper on **"Exchange Between Atmospheric Boundary Layer and free Troposphere over the Indian Monsoon Region"** in online mode. This study analyzed atmospheric boundary layer (ABL) and Free Troposphere (FT) exchange fluxes over India, focusing on diurnal and seasonal variations. She observed that maximum entrainment (FT to ABL) occurs at midday, while detrainment (ABL-to-FT exchange) peaks in the evening, with seasonal shifts. Local flux dominates diurnally, while horizontal advection and convection prevail seasonally. Winter

shows subsidence-driven entrainment over Delhi and Mumbai, with detrainment due to subsidence and horizontal advection over Chennai. During the summer monsoon, detrainment is mainly driven by horizontal advection and convection in SW monsoon stations, while horizontal advection dominates in NE monsoon stations. It was observed that the subsidence over Indo-Gangetic Plain during the winter season leads to an increase in ozone transport causing the increased pollution level.

The presentation by **Ms. Aswani S.** was on **"Drought management in rice using foliar applicants"** in which the impact of drought mitigation by foliar application on morphological and biochemical profile and the productivity of rice were assessed. The study evaluates the effect of foliar applicants on plant growth, yield, and biochemical parameters under moisture stress. Salicylic acid (200 ppm) showed the best results in improving plant height, fresh shoot weight, root characteristics, and grain yield. KCl application enhanced proline content, while Kaolin increased chlorophyll and membrane stability. Economic analysis suggested that salicylic acid provided the highest benefit-cost ratio. NBT staining revealed differential stress responses among treatments. The findings suggest that salicylic acid is the most effective foliar applicant, offering both agronomic benefits and economic returns under varying moisture conditions.

The third presentation was by **Shri. Ajith P P** on **"Pre-Monsoon Rainfall variability over India in association with MJO and ENSO"**. The study examined the impact of ENSO and MJO phases on India's rainfall patterns in the early (1981-2000) and recent (2001-2020) epochs, revealing that northeastern (NE) India experiences enhanced (reduced) rainfall during El Niño (La Niña) years in the recent epoch. During MJO Phase 2 in the early epoch, positive rainfall anomalies were widespread along the eastern coast, while in the recent epoch, it confined to southern Tamil Nadu and Odisha. In Phase 3, positive rainfall anomalies along coastal Andhra Pradesh and Odisha in the early epoch have diminished recently, while increasing over the southern peninsula. Ajith showed that the changes in rainfall is related to the changes in SST, large scale circulation and moisture transport. Decreased (increased) rainfall along India's eastern coast (southern tip of India) in MJO Phases 2 and 3 was linked to stronger equatorial westerlies and cyclonic circulation over the southern tip in the recent years. Phase 4 saw increased rainfall in NE India due to an SST gradient enhancing moisture advection, while shifts in wind circulation over the northern BoB was the reason for reduced rainfall during phase 6.

The **last talk** of the session was by **Shri. Krishna Kumar E. K.,** who presented a paper on **"Contrasting Regional Responses of Indian Summer Monsoon Rainfall to exhausted spring and concurrently emerging Summer EL NINO Events"**. This study investigates the distinct influences of an exhausted spring El Niño (springtime) and emerging summer El Niño (summertime) on the

regional variability of ISMR. The two ENSO categories were formulated based on the time of occurrence of positive SST anomalies over the Niño-3.4 region in the Pacific. The monsoon circulation features were remarkably different in response to the exhausted spring El Niño and emerging summer El Niño phases, which distinctly dictate regional rainfall variability. The dynamic and thermodynamic responses reveal that exhausted spring El Niño events favor excess monsoon rainfall over eastern peninsular India and deficit rainfall over the core monsoon regions of central India. In contrast, emerging summer El Niño events negatively impact the seasonal rainfall over the country, except for a few regions along the west coast and northeast India.

The second technical session of the first day in the Sikka Hall (Hall 4) was **successfully completed at 18:00 IST**. While closing the session, **Mr. Ruchith R D, Scientist-C, NIO Goa, and Dr. Sreelaka P P, Assistant Professor, CUSAT thanked and presented mementoes to the chairs Dr. Manoj M G, and Dr. Abish** respectively. The hall committee thanked the chairs, speakers and audience for making the session successful.

4. Day – 2 (Tuesday: 25/03/2025)

4.1. Plenary Session 2 (09:30 – 10:30 IST)

In **Anna Mani Hall**, there was one plenary session and two Technical Sessions

25 March 2025, Time: 09.30-10.30 Hrs Venue: Hall 1 (Anna Mani Hall) Chairs: Prof. Mohammad Hatha, CUSAT & Prof. P. Mohanan, CUSAT			
SN	**Presenting Author**	**Institute/Affiliation**	**Title**
1	**Prof. Raghu Murtugudde**	**Emeritus Professor UMD, USA & Retired Professor, IITB**	Ocean Ecosystems - Silent Sufferers or Active Amplifiers?
2	**Dr. Swapna Panickal**	**Scientist F, Dy.Director, CCCR, IITM, Pune**	Coupled Modeling System for Assessing Regional Climate Response to Global Climate Change

The session began with an introduction by the hall manager Dr. Kavya Johny, ACARR, who anchored the session and introduced the Chairs, providing a brief overview of their backgrounds. **Prof. Mohammad Hatha, and Prof. P. Mohanan** chaired Plenary Session 2 of CARE-25, held in Hall 1. Dr. Mohamed Hatha is a Professor in the Department of Marine Biology, Microbiology and Biochemistry, CUSAT. He started his career in Industry as Head of Quality Assurance Division of a leading seafood processor and exporter where he developed HACCP based production in the seafood industry for the first time in India. He was instrumental in getting the coveted USFDA A listing for the company. In 1996 Dr. Hatha shifted to teaching and research and has taught in various universities in India and abroad since then. Being a passionate academic, he was awarded with Fulbright Scholarship in 2012 and spent a short stint as Fulbright Visiting Scholar at Michigan State university. His research interest

include Microbial diversity, Antimicrobial resistance, Food borne pathogens, Cold active enzymes, Marine biogeochemicals. Dr. P. Mohanan is a retired Professor from Department of Electronics, CUSAT and is currently working as Coordinator, ACARR. He worked as an Engineer with the Antenna Research and Development Laboratory, Bharat Electronics, Ghaziabad, India. Dr. Mohanan was the recipient of Dr. S. Vasudev Award 2011 from Kerala State Council for Science, Technology and Environment Government of Kerala, in 2012, Career Award from the University Grants Commission in Engineering and Technology, Government of India, in 1994 and UGC BSR award 2016. He was selected as IEEE distinguished speaker for region 10.

4.1.1. Plenary Talk 1

As the session commenced, Prof. Mohammad Hatha, the first Chair, discussed the far-reaching implications of global warming, particularly concerning its effects on oceans and air-sea interactions. He emphasized that reversing these impacts would require considerable time and that the devastating effects of climate change are likely to persist for an extended period. Following this, Prof. Hatha briefly introduced the key speakers and their topics, before inviting the **first lead speaker, Prof. Raghu Murthugudde**, to deliver the plenary talk. Dr. Kavya Johny provided a brief introduction to Prof. Murthugudde before the talk. Prof. Raghu Murtugudde is an Earth System Scientist. Currently he is an Emeritus Professor at the University of Maryland's Department of Atmospheric and Oceanic Science and the Earth System Science Interdisciplinary Center. He has been the Executive director of the Chesapeake Bay Forecast System since 2007 leading the development of the first functional Regional Earth System Prediction framework.

Prof. Raghu Murthugudde delivered an insightful talk on the topic, **"Ocean Ecosystems: Salient Sufferers or Active Amplifiers?"** He began by describing the ocean as the "battery storage and the memory of the Earth system," underscoring the critical role it plays in regulating global energy. He noted that

the oceans absorb more than 90% of the additional energy trapped by climate change. Prof. Murthugudde delved into the concept of bio-climate feedback, questioning whether these processes lead to net damping or amplification of climate change effects. He explored the resilience, diversity, and productivity of marine ecosystems, outlining the organizing principles of these ecosystems. He poignantly stated, "Nature makes the rules, biology finds the loopholes," highlighting the adaptability of marine life. He further discussed the global mitigation potential provided by various ocean-based climate actions, emphasizing the crucial role of marine ecosystems in global efforts to address climate change.

In conclusion, Prof. Murthugudde highlighted innovative solutions to climate change, including the potential of super-enzymes that break down plastics in the ocean, offering promising pathways for mitigating some of the environmental impacts.

4.1.2. Plenary Talk 2

Following this, the **Chair invited Dr. Swapna Panickal, Scientist F at IITM, Pune**, to present the second plenary talk. Dr. Kavya Johny briefly introduced Dr. Panickal before she took the stage. Dr. Swapna Panickal is a distinguished climate scientist currently serving as Scientist F and **Director at the Centre for Climate Change Research (CCCR)** within the Indian Institute of Tropical Meteorology (IITM), Pune. She earned her M.Sc. in Oceanography and M.Tech. in Atmospheric Sciences from Cochin University of Science and Technology, followed by a Ph.D. in Marine Sciences from Goa University in 2006. Dr. Panickal played a pivotal role in developing India's first Earth System Model (IITM-ESM), which participated in the Coupled Model Intercomparison Project Phase-6 (CMIP6) experiments. Dr. Panickal's talk was titled "Coupled Modelling System for Assessing Regional Climate Response to Global Climate Change." In her presentation, Dr. Panickal

discussed the associated risks of increased surface temperatures in the context of the Sustainable Development Goals (SDGs). She emphasized that the ocean, as the largest absorber of heat, plays a critical role in climate regulation. Through long-term global mean temperature data, she illustrated how Earth's system is increasingly out of balance, with global mean sea levels continuing to rise. She also addressed concerns related to glacier mass balance, a key indicator of climate change.

Dr. Panickal then provided an in-depth analysis of the regional-scale implications of ocean warming, particularly focusing on the variability of El Niño and La Niña events in the current climate scenario. She highlighted long-term trends in Indian monsoon rainfall, noting the impacts of Indian Ocean warming, including the weakening of the monsoon and the increasing frequency of extreme weather events, such as the Kerala floods and landslides, and the extreme precipitation observed in Mumbai during monsoons.

Moving on to mitigation and adaptation strategies, Dr. Panickal emphasized the importance of advanced climate models in accurately predicting future climate scenarios. She discussed how models like the Pratyush supercomputer, along with machine learning techniques, are being used to enhance prediction accuracy. Furthermore, she highlighted the IITM-ESM (Earth System Model) and its applications for various climate-related studies and policy formulation.

The talk was followed by an engaging Q&A session, where attendees had the opportunity to ask questions and discuss key aspects of presentations by both the lead speakers. **Prof. Mohammad Hatha presented a memento to Dr. Swapna Panickal, while Prof. P. Mohanan presented a memento to Prof. Raghu Murthugudde** as a token of appreciation. **Dr. K. Vasudevan** presented mementoes to the chairs.

4.2. Technical Session Day - 2

4.2.1. TS-H1C: Central Marine Fisheries Research Institute (CMFRI) Joint Sessions on Marine Biodiversity, Oceans & Climate Change (MBC)

Ms. Stefy Thomas welcomed the attendees to the first technical session of Day 2, held in Hall 1. This session was a **joint presentation by CMFRI on Marine Biodiversity, Oceans, and Climate Change**. Ms. Stefy introduced the chairs of the session, **Dr. Saji P. K. and Dr. Imelda Joseph**, before handing over the proceedings to them. **Dr. Saji P. K. is an Assistant Professor, Department of Physical Oceanography, CUSAT**. With over two decades of expertise in coastal ocean modeling, air-sea interaction, and ocean instrumentation, Dr. Saji has made significant contributions to understanding circulation patterns in the Bay of Bengal and the Indian Ocean. **Dr. Imelda Joseph, Principal Scientist at CMFRI** is a pioneering researcher in mariculture and aquaculture nutrition. Dr. Joseph's work

has advanced solid-state fermentation technology for aquafeed and popularized cage culture techniques in India. Dr. Imelda Joseph provided an introduction to the session and warmly welcomed Dr. Ratheesh Kuamr to deliver the first lead talk of the session.

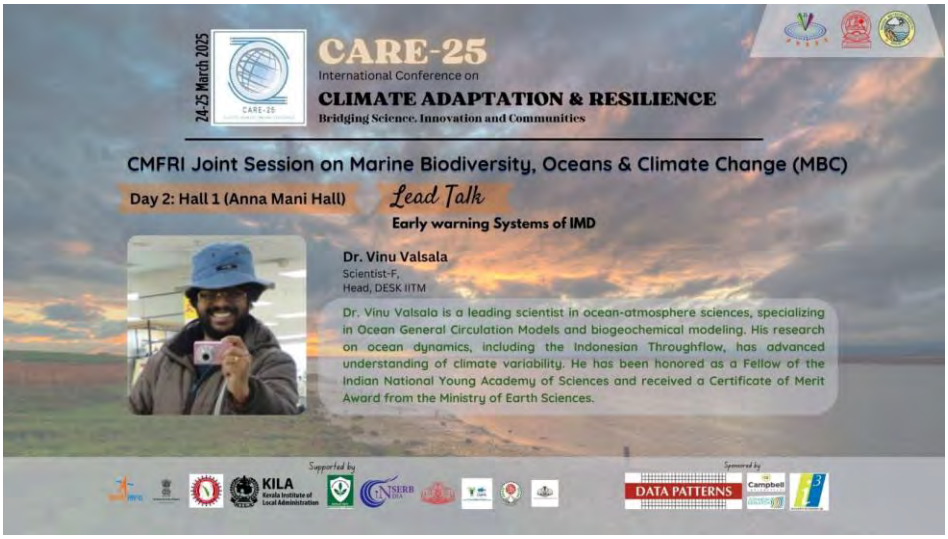
TS-H1C: CMFRI Joint Sessions on Marine Biodiversity, Oceans & Climate Change (MBC) 25 March 2025, Time: 11:00-13:00 Venue: Hall 1 (Anna Mani Hall) Chairs: Dr. Saji P. K., CUSAT & Dr. Imelda Joseph, Principal Scientist, CMFRI.				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. Ratheesh,	Scientist, CMFRI	Impacts of climate change on marine biodiversity and fisheries.
2		Dr. Vinu Valsala	Scientist F & Head, DESK, IITM	Climate Variability and Predictability of small Pelagic Fishes of Indian Coasts from a dynamic Modeling perspective.
3	CARE-0037	ASWANI S	DROUGHT MANAGEMENT IN RICE USING FOLIAR APPLICANTS	
4	CARE-0089	VENKADESH SAMYKANNU	SPATIO-TEMPORAL ASSESSMENT OF ECOLOGICAL VARIABILITY IN PUNJAB USING REMOTE SENSING ECOLOGICAL INDEX AND PADDY YIELD ANALYSIS	
5	CARE-0030	MALAVIKA A R	COMPARATIVE ANALYSIS AND STATISTICAL EVIDENCE OF DEEP OCEAN WARMING TREND IN THE ARABIAN SEA AND BAY OF BENGAL	
6	CARE-0117	AVINASH PAUL	A CASE STUDY OF THE LONGEST-LASTING MARINE HEATWAVE IN THE SOUTHEAST ARABIAN SEA	
7	CARE-0119	URMILA P	CLIMATE CHANGE AND RISING UNDERWATER NOISE LEVEL IN THE INDIAN OCEAN: IMPLICATIONS ON ACOUSTIC COMMUNICATION AND SENSING	
8	CARE-0121	PEARL JO AN K	CLIMATE VARIATION EFFECTS ON SOUND PROPAGATION LOSS IN SOUTH EASTERN ARABIAN SEA	
9	CARE-0013	HARIKRISHNAN NAMBOOTHIRY N	AN ANALYSIS OF URBAN HEAT ISLAND PHENOMENA IN THE URBAN AGGLOMERATIONS OF ERNAKULAM AND THIRUVANANTHAPURAM DISTRICTS OF KERALA	
10	CARE-0064	MEGHA MARIA LAL	BUILDING CLIMATE RESILIENT CITIES; THE ROLE OF ECO INNOVATION AND SUSTAINABLE INFRASTRUCTURE	

Dr. Ratheesh Kumar R, is **Scientist at CMFRI**, who specializes in marine biodiversity, fisheries management, and biological oceanography. His extensive research on marine ecology, crustacean taxonomy, and marine mammal diversity has enhanced our understanding of India's marine ecosystems. Dr. Ratheesh's talk focused on "Impacts of Climate Change on Marine Biodiversity and Fisheries." He discussed the various threats to marine biodiversity, particularly within the context of fisheries. He highlighted the significant impacts of climate change, such as ocean warming, rising sea levels, and altered storm patterns, which are disrupting marine ecosystems and biodiversity. In addition to climate change, Dr. Ratheesh addressed other environmental threats, including pollution and waste in the oceans, and their detrimental effects on marine life. He emphasized the urgent need for nature-based solutions to promote a sustainable

future for marine ecosystems. He also explored deep-sea fishing opportunities and the potential for agriculture and marine culture as sustainable practices for a green future, contributing to both environmental and economic resilience.

The session concluded with an interactive and elaborate Q&A session, where attendees had the opportunity to ask questions and further discuss the topics presented.

The Chair **Dr. Saji P. K.** invited the next lead speaker, **Dr. Vinu Valsala**, to deliver a talk on **"Climate Variability and Predictability of Small Pelagic Fishes of Indian Coasts from a Dynamic Modeling Perspective"**. Ms. Stefy provided an introduction to Dr. Valsala before the talk commenced. Dr. Vinu Valsala, Scientist F and Head of the DESK division at IITM, is an expert in ocean general circulation models (OGCM), climate variability, and ocean tracer transport models. His research has significantly advanced our understanding of biogeochemical modeling, ocean pCO2 variability, and planetary wave dynamics.



Dr. Valsala began by highlighting that the climate impacts on the landings of small pelagic fishes along the Indian coasts is a well-established area of research, but one that still requires further understanding. He emphasized the strong connection between climate variability and fisheries, noting that while progress has been made, our understanding of these connections remains limited.

He discussed how the relationship between climate and fisheries offers valuable long-term predictability of fishery resources. Dr. Valsala introduced the Indian Ocean-NUMERO Ecosystem Model, a numerical dynamical model focused on oil sardines, exploring the relationship between lower trophic and upper trophic levels. This model, developed based on bio-energy balance, successfully captures the climate variability affecting the total landings of sardines along the Kerala coast. The model has significant applications, particularly in dynamic forecasting of fisheries and in assessing the impacts of climate change on fishery resources.

The talk was followed by a highly interactive discussion with the audience, where participants actively engaged with the speaker on the presented topics.

The **session proceeded with oral presentations**. The first participant, **Ms Malavika A. R., Amrita Vishwa Vidyapeetham** presented her work titled **"Comparative Analysis and Statistical Evidence of Deep Ocean Warming Trends in the Arabian Sea and the Bay of Bengal".** She discussed the seasonal and interannual temperature variability observed in the deeper layers of the ocean. Notably, inter-decadal oscillations were found even at depths of up to 1000 meters. Her temperature data, spanning from 0 to 1000 meters, revealed a steady increase in temperature in both the Arabian Sea and the Bay of Bengal, except at depths of 98 meters and 135 meters.

The second presentation, by **Mr. Avinash Paul**, Department of Atmospheric Sciences, CUSAT focused on **"A Case Study of the Longest-Lasting Marine Heatwave in the Southeast Arabian Sea".** He explained that the growth of the Marine Heatwave (MHW) is primarily driven by atmospheric heat flux. He highlighted studies showing that increasing MHW events in the Southeast Arabian Sea (SEAS) could have significant implications for primary productivity and may also contribute to coral bleaching, particularly along the Lakshadweep coast. Avinash also outlined the key areas for future research in this field.

The third presentation, delivered by **Ms. Megha Maria Lal, IUCIPRS, CUSAT** was titled "Building Climate-Resilient Cities: The Role of Eco-Innovation and Sustainable Infrastructure." She emphasized the need for a comprehensive approach to address climate change challenges and presented key strategies aligned with the Sustainable Development Goals (SDGs) to foster sustainable urban development and resilience.

Following each presentation, a Q&A session allowed the audience to engage with the speakers and further discuss their findings.

At the conclusion of the session, the Chairs presented mementoes to the lead speakers in recognition of their contributions. Additionally, **Prof. K Satheesan presented mementoes** to the Chairs in appreciation of their role in moderating the session.

4.2.2. TS-H2C: Climate Variability and Extremes (CVE Cont.)

Day-2 (25th December 2025) of CARE-25 in the **Pisharoty Hall** started with the Technical Session TS-H2C based on **Climate Variability and Extremes (CVE)** at 11:05 am. The rapporteurs for the session, Ms. Hindhiya Shabu and Ms. Sreeshma K, initiated the session by introducing the Chairs and providing a brief description of their credentials. **Dr. Sabin T.P. and Dr. M.R. Ramesh Kumar chaired the session**. **Dr. Sabin T.P., Scientist E in the Centre for Climate Change Research Division at the Indian Institute of Tropical Meteorology (IITM)**, a research institution under the Ministry of Earth Sciences, Government of India. **Dr. Ramesh Kumar M.R.**, now retired, was a Chief Scientist at CSIR-National Institute of Oceanography (Headquarters, Goa), Department of Physical Oceanography. After the introduction, the rapporteurs handed over the session to the chairs. The technical session featured two lead talks and seven oral presentations. The lead talks were delivered by Dr. Jayanarayanan Kuttippurath, and Dr. Girish Gopinath.

Rapporteur Ms. Sreeshma K introduced Dr. Jayanarayanan Kuttippurath, providing a brief description of his credentials. **Dr. Jayanarayanan Kuttippurath, Associate Professor at the Centre for Ocean, River, Atmosphere and Land Sciences (CORAL), IIT Kharagpur**, delivered a lead talk on **"Air pollution in India in a climate change context: impact of policies and environmental regulations"**. Dr. Kuttippurath began by emphasizing the importance of clean air, highlighting that air is fundamental to all living organisms, and access to clean air should be considered a basic right. He noted that India ranks third in the global air pollution index, with the Indo-Gangetic Plain (IGP) identified as a major hotspot due to high levels of pollutants. Discussing the trends in air pollution, Dr. Kuttippurath presented data from the last two decades, showing a consistent increase in pollutants such as tropospheric ozone and its precursors across India. He attributed these trends to industrial emissions, vehicular pollution, and other anthropogenic activities. To address the challenge of air pollution, he outlined several mitigation strategies, including:

- Reducing emissions at the source through improved industrial processes and fuel efficiency.
- Transitioning to renewable energy sources to minimize reliance on fossil fuels.

- Strengthening environmental laws and their implementation to ensure compliance.
- Developing long-term and sustainable solutions to tackle pollution at a systemic level.

TS-H2C: Climate Variability and Extreme Weather Events (Cont.) 25 March 2025, Time: 11:00-13:00 Venue: Hall 2 (Pisharoty Hall) Chairs: Dr. Sabin. T. P, IITM & Dr. M. R. Ramesh Kumar, NIO, Goa				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Prof. Jayanarayan Kuttipurathu	IIT Kharagpur	Air pollution in India in a climate change context: impact of policies and environmental regulations
2		Prof. Girish Gopinath	KUFOS	Geospatial Technology for Mapping, Monitoring and Modelling of Landslides
3	CARE-0066	NANDHULAL K	INVESTIGATION ON THERMODYNAMIC PARAMETERS ASSOCIATED WITH THUNDERSTORM ACTIVITY IN KERALA, INDIA	
4	CARE-0065	AMINA HANEEF	MINI CLOUDBURST AND KOOTTICKAL LANDSLIDE: A HYDROMETEOROLOGICAL PERSPECTIVE ON EXTREME WEATHER EVENTS	
5	CARE-0120	ANU UNNY	A CRITICAL ANALYSIS OF SELECTED STATE ACTION PLANS ON CLIMATE CHANGE IN INDIA	
6	CARE-0113	JISHA K VISHAL	IMPACT OF VOLCANIC AEROSOLS ON THE INDIAN SUMMER MONSOON: INSIGHTS FROM THE PAST MILLENIUM	
7	CARE-0015	DR. SREEKUMAR HARIDAS	LOOMING DROUGHT ON INDIA'S WEST COAST: INSIGHTS FROM CMIP6 PROJECTIONS	
8	CARE-0085	SALMA JOSE	COMPREHENSIVE MONITORING AND ANALYSIS OF AEROSOL OPTICAL PROPERTIES IN THE CALICUT REGION USING ADVANCED OPTICAL INSTRUMENTS	
9	CARE-0096	BREANILA PAUL A	MARINE HEATWAVES IN THE ARABIAN SEA: EL NIÑO'S INFLUENCE AND MONSOON SEASON DYNAMICS	
10	CARE-0091	SREEVIDYA RAVI	ANALYSIS OF THE EXTREME RAINFALL EVENT OVER KERALA ON OCTOBER 16, 2021, USING NUMERICAL SIMULATION: A CASE STUDY	

Dr. Kuttippurath elaborated on India's legal framework for air quality improvement, citing key legislations such as Article 38(A) and Article 51(A)g of the Indian Constitution, which emphasize environmental protection. He also discussed the National Clean Air Program (NCAP) launched in 2019, which aims to reduce particulate matter (PM) emissions by 20-30% (compared to 2017-18 levels) by 2024-25. His analysis of PM10 measurements across Indian cities revealed significant progress, with 17 out of 28 cities already achieving a 50-60% reduction, resulting in decreased mortality rates associated with air pollution.

Addressing the issue of Sulfur dioxide (SO_2) emissions, Dr. Kuttippurath identified the IGP as a major emission hotspot, primarily due to mining activities and coal-based thermal power plants. He pointed out that 51-56% of SO_2 emissions

originate from the energy sector. However, he noted a declining trend in SO_2 emissions over the past decade, attributing this to:

- The adoption of SO_2 converters in power plants.
- The increased use of renewable energy sources.
- The electrification of railway lines.
- The success of government initiatives like the Ujjwala Yojana, which promotes cleaner cooking fuels.

A notable aspect of the presentation was a study conducted during the COVID-19 lockdown, which demonstrated a significant improvement in air quality. The research indicated enhanced vegetation growth in both croplands and forests, directly correlating with reduced emissions. This finding underscores the link between cleaner air and ecological benefits. Following the presentation, an interactive discussion took place. As a token of appreciation, Dr. Sabin T. P. handed over a memento to Dr. Jayanarayanan Kuttippurath on behalf of CARE-25.

Afterwards, rapporteur Ms. Hindhiya Shabu introduced Dr. Girish Gopinath, providing a brief description of his credentials. **Dr. Girish Gopinath, Professor & Head of the Department of Climate Variability & Aquatic Ecosystem at Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi**, Kerala, delivered a lead talk on **"Geospatial Technology for Mapping, Monitoring, and Modelling of Landslides"**. Dr. Gopinath, an expert in Geology and Geo-informatics, discussed the application of geospatial technology in disaster management, particularly for landslide monitoring and prediction.

Dr. Gopinath began by emphasizing the integration of geospatial technology in daily life, providing examples of GIS applications, GeoAI, and Cartosat satellite data. He elaborated on various remote sensing techniques, highlighting how different methodologies and satellite imagery can be selected based on specific requirements for landslide studies. Focusing on landslides in Kerala, Dr. Gopinath pointed out that while the Malayalam language has only one general term for landslides—"urulpottal", they can actually be classified into multiple types, such as: Rockfall, Rockslide, Debris flow, Mudflow, etc we call Mass wasting. He stated that most landslides in Kerala are debris falls, except for major recent events like the Mundakkai and Chooralmala landslides. He further discussed changes in monsoon patterns, noting that the rainy season has shifted from June-July to August-September, with fewer rainy days but more extreme rainfall events. Dr. Gopinath identified rainfall-triggered landslides as a growing concern in Kerala since 2018, alongside other contributing factors such as: Slope stability, Soil type, Land use patterns, and Vegetation cover. He highlighted that a major cause of landslides in Kerala is the alteration of first-order streams and changes in land use patterns. Discussing the recent Wayanad landslide, he noted that the thickness of overburden exceeded 25 meters, which triggered a disastrous landslide.

Additionally, the rocks in the region are crisscrossed with joints, and the area received 523 mm of rainfall over two days, exacerbating the situation.

After the presentation, discussions revolved around how land use and land cover (LULC) changes affect landslides. A key concern raised was the impact of unscientific rain pits in rubber plantations, which have triggered several landslides in Kerala. While quarries were considered as potential triggers for landslides, Dr. Gopinath emphasized that their overall effect is relatively low compared to other contributing factors. He also detailed the different data and sources from which relevant data can be obtained for effective landslide assessment and prediction. As a token of appreciation, Dr. Ramesh Kumar handed over a memento to Dr. Girish Gopinath on behalf of CARE-25.

The first contributory talk of the session was by **Mr. Nandhulal** from Sree Krishna College, Guruvayur. The title of his talk was **"Investigation on Thermodynamic Parameters Associated with Thunderstorm Activity in Kerala"**. His study analyzes thunderstorm activity in three regions of Kerala during pre-monsoon seasons (2013–2023), revealing peak occurrences in the afternoon and distinct nocturnal variations. ERA5 reanalysis shows CAPE peaks 5–6 hours before storms, with nocturnal events exhibiting prolonged instability. Afternoon thunderstorms are widespread, driven by strong updrafts at 500 hPa, while nocturnal storms are influenced by local conditions. The findings highlight shifts in convective dynamics and the need for continued monitoring of extreme weather events.

The second talk was given by **Ms. Amina Haneef** from Kerala University, and the title of her talk was **"Kootickal Landslide and Mini Cloudburst: Hydrometeorological Perspectives on Extreme Weather Events"**. Her study investigates the hydrometeorological triggers and land-use factors contributing to the Koottickal landslide that happened on October 16, 2021. Analysis using AWS, GPM, and ERA5-Land data highlighted the mini-cloudburst nature of the event, while downscaled LULC assessments revealed a 61% reduction in forest cover over two decades, increasing vulnerability. Land-use changes, including deforestation and agricultural expansion, exacerbated hydrometeorological risks, emphasizing the need for advanced early warning systems and geospatial monitoring. Sustainable land-use planning and community-driven disaster preparedness are crucial to mitigating future landslide risks in Kerala. During the discussion, one of the lead speakers, Prof. Jayanarayan Kuttipurath, posed a question about cloudbursts, asking for clarification on the phenomenon. In response, Ms. Amina explained a cloudburst as an intense, short-duration rainfall event where precipitation exceeds 100 mm per hour over a localized area.

The third talk was by **Ms. Anu Unny** from Kerala University, and the title was **"A Critical Analysis of Selected State Action Plans on Climate Change in India"**. She presented a comparative study on State Action Plans on Climate

Change (SAPCCs) in India, focusing on Kerala, Karnataka, Tamil Nadu, and Rajasthan. She highlighted the challenges in policy formulation, including data inadequacy, insufficient stakeholder participation, and financial constraints, which have hindered effective climate action at the state level. Her analysis emphasized Kerala's relatively better performance and pointed out its limitations in achieving climate resilience. The presentation underscored the need for stronger policies to meet India's emission reduction commitments under the Paris Agreement, sparking an engaging discussion on the future of climate governance.

The next talk was by **Ms. Jisha K Vishal** from CUSAT about **"Impact of Volcanic Aerosols on the Indian Summer Monsoon: Insights from Past Millenuim"**. Her study examines the impact of major volcanic eruptions (850–1849 CE) on the Indian Summer Monsoon (ISM) using the CESM-LME model. Findings show a significant reduction in ISM precipitation during the eruption year, with drought conditions lasting up to two years, exacerbated by increased El Niño events in the following year. The drying effect is driven by enhanced atmospheric stability, weakened monsoon circulation, and volcanic-induced ENSO dynamics, with the strongest response observed for tropical eruptions. These insights highlight the complex interactions between volcanic aerosols, ENSO, and monsoonal variability, informing future climate projections.

The next talk was by **Dr. Sreekumar Haridas** from CUSAT about **"Looming Drought on India's West Coast: Insights From CMIP6 Projections"** which explored CMIP6 projections indicating rising temperatures and increasing extreme weather events on India's west coast, particularly in Kerala. By 2050, temperatures are expected to rise by over 2°C, and Arabian Sea SST by ~1.4°C, leading to shifts in rainfall patterns. While monsoon rainfall may increase in central Kerala under SSP3 -7.0, severe and prolonged droughts, especially in Idukki and Palakkad, are projected under multiple scenarios. These findings highlight the urgent need for comprehensive water management strategies to mitigate future drought impacts. One of the session chairs, Dr. Sabin asked a question about how drought was quantified, to which Sreekumar Haridas responded that it was measured using the self-calibrating Palmer Drought Severity Index (scPDSI).

The next talk was by **Ms. Breania Paul** from Kerala Agricultural University about **"Marine Heatwaves in the Arabian Sea: El Nino's Influence and Monsoon Season Dynamics"**. This study analyzes marine heatwaves (MHWs) in the Arabian Sea from 1982 to 2024, revealing a significant increase in their frequency, particularly in the northern region. El Niño events contribute to intensified MHWs by weakening or delaying the monsoon, leading to drier conditions over central India. Understanding the link between El Niño, marine heatwaves, and monsoon variability is crucial for predicting and mitigating climate change impacts on marine ecosystems and regional economies. One of the session chairs, Ramesh Kumar, asked her to define marine heatwaves, and she provided the answer.

The last talk was by **Ms. Tesna Maria** from ACARR, CUSAT. The title of the talk was **"Moisture Transport and its Link With Extreme Monsoon Rainfall Over the West Coast of India."** This study examines the relationship between moisture transport and extreme monsoon rainfall over India's west coast using observational and reanalysis data from 1990 to 2023. While the dynamic component of moisture transport has remained largely stable, the thermodynamic component has significantly increased in the southwest region. This increase correlates with rising Arabian Sea SSTs, potentially driving the observed trend of extreme rainfall. These findings highlight the role of changing moisture dynamics in monsoon variability under future warming scenarios. One of the session chairs, Dr. Sabin, asked whether there is any trend for dynamics along the southwest coast, to which she responded that they had checked but found no significant trend in the case of extreme rainfall. He also inquired about the impact of mesoscale convective systems (MCS) on extreme events, and she confirmed their influence, stating that they are currently working on it.

As a token of appreciation, the first chair of the session, **Dr. Sabin T.P., was felicitated with a memento by Dr. Manoj M.G., Scientist-D, ACARR, CUSAT. Similarly, the second chair, Dr. Ramesh Kumar M.R., was honoured with a memento by Prof. C.A. Babu, CUSAT, on behalf of CARE-25**. The session concluded at 1:15 PM, with the session rapporteur Ms. Hindhiya, thanking all chairs, lead talkers, and participants.

4.2.3. TS-H3C: Climate Change Impacts and Modeling (CCI)

The CARE 2025 2nd day session in **Ananthakrishnan Hall (Hall 3)** commenced at 11:00 IST with Technical Session TS-H3C, themed **"Climate Change Impacts and Modeling (CCI)".** The session featured **three lead talks (20 minutes each), one invited talk (30 minutes), and two oral presentations (10 minutes each).**

TS-H3C: Climate Change Impacts and Modeling (CCI) 25 March 2025, Time: 11:00-13:00 Venue: Hall 3 (Ananthakrishnan Hall) Chairs: Dr. Madhu V., CUSAT & Dr. Vinod Shankar, Indian Air force				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. Praveen V. K	Scientist, IITM	Advancing the IITM Earth System Model: Insights in Version 3 Development
3		Dr. Hamza Varikoden	Scientist, IITM	Recent changes in the rainfall pattern over Western Ghats during southwest monsoon period
		Prof. Sandeep, S	IIT, Delhi	Weakening of Indian Summer Monsoon in Response to Polar Sea Ice Melt
4	Invited	Prof. Sanjay Kumar Mehta	SRM	Overview On The Studies Of Atmospheric Boundary Layer Over The Indian Monsoon Region
5	CARE-0023	BALASUNDHAR B V	COMPREHENSIVE EVALUATION OF AEOLUS WIND PRODUCTS AGAINST IN-SITU OBSERVATIONS AND RE-ANALYSIS DATASETS OVER THE INDIAN MONSOON REGION	
6	CARE-0084	VINOD P G	GEO-SPATIAL ANALYSIS OF EROSION AND DEPOSITION TRENDS IN THE CHALIYAR RIVER BASIN, KERALA (2014–2024) USING REMOTE SENSING AND GIS-BASED SPECTRAL INDICES	

Ms. Rona Maria Sunil, the rapporteur, opened the session by introducing the chairs and briefly highlighting their contributions. The session was chaired by two distinguished experts: Dr. V. Madhu, Assistant Professor in the Department of Atmospheric Sciences, CUSAT, who specializes in monsoon meteorology and ozone studies with a focus on the upper troposphere-lower stratosphere, and Group Captain (Dr.) N. Vinod Sankar, a veteran meteorologist with over 34 years of service in the Indian Air Force. Dr. Sankar is an expert in aviation meteorology and advanced modeling, having served in key roles in training, modernization, and the UN peacekeeping mission in the Democratic Republic of Congo, with notable international publications to his credit.

The **first lead talk** was delivered by **Dr. Praveen V. K**., Scientist D at IITM Pune, an expert in Earth System Modeling and climate change impacts. His research focuses on cumulus convection parameterization and the effects of climate change on synoptic-scale systems. He presented **"Advancements in the IITM Earth System Model (IITM-ESM) Version 3"**, highlighting its contributions to CMIP6 and upcoming CMIP7 experiments. The upgraded model shows significant improvements in global precipitation, monsoon intra-seasonal oscillations, synoptic systems (such as low-pressure systems), sea-ice concentration, and oceanic circulation. He also emphasized its role in contributing to the IPCC AR6 and national climate assessments, with enhanced resolution, energy balance, and ocean biogeochemistry components. The projections indicate a more intense but sporadic Indian monsoon, a global temperature rise of up to ~5.7°C, and a sea level rise approaching 1 meter by 2100 under high-emission scenarios.

The **second lead talk** was presented by **Dr. Sandeep, Associate Professor, at IIT Delhi**, whose work explores the dynamics of the Indian summer monsoon under climate change, combining traditional meteorology with AI/ML applications. Dr. Sandeep discussed the **"weakening of the Indian Summer Monsoon (ISM) in response to polar sea ice melt"**, using long-term coupled climate simulations. His findings reveal that Antarctic and combined Arctic-Antarctic sea ice melts significantly weaken monsoon winds and reduce precipitation over India, compared to Arctic melt alone. The study emphasizes that oceanic heat transport and shifts in the Intertropical Convergence Zone (ITCZ) driven by polar changes play a key role in monsoon variability. This research highlights the importance of including polar-tropical interactions in future monsoon projections.

The third lead talk was delivered by **Dr. Hamza Varikoden**, Scientist F at IITM Pune, who specializes in monsoon variability, ENSO-monsoon interactions, and future projections using climate models. A recipient of multiple best paper and poster awards, his research provides deep insights into multi-decadal climate

variability. Dr. Varikoden presented **"Recent changes in the rainfall pattern over the Western Ghats during the southwest monsoon period"**. His study highlighted increasing trends in extreme rainfall events (EREs), regional shifts in seasonal rainfall distribution, and their links to climate change and weakening monsoon systems. Using observational and model data, he also emphasized the devastating impacts of extreme weather events, such as the 2024 Wayanad landslide, and the rising incidence of lightning activity over the region. The presentation called for urgent attention to orographic influences, climate projections, and disaster preparedness across the Western Ghats.

The invited talk was delivered by **Prof. Sanjay Kumar Mehta**, **Professor at SRMIST, Chennai**, who presented cutting-edge insights on tropopause dynamics, aerosol-cloud interactions, and troposphere-stratosphere exchange processes. Titled **"Overview of Studies on the Atmospheric Boundary Layer over the Monsoon Region".** Prof. Mehta's talk emphasized the influence of sea breezes, thermodynamic structure, and cloud interactions. Using tools such as micro-pulse lidar, radiosondes, and AERONET, his studies showcased atmospheric boundary layer (ABL) dynamics during extreme weather events, monsoon phases, and tracer variability. He highlighted the transition between single and double mixed layers, the role of the Thermal Internal Boundary Layer (TIBL), and how fuzzy logic and WRF simulations can capture diurnal ABL evolution. His work bridges observational and modeling approaches to improve understanding of boundary layer processes critical for monsoon weather and climate modeling.

Later, two contributory papers were presented, offering valuable insights into region-specific climate and atmospheric studies. **Mr. Vinod P. G**., from the School of Environmental Studies, CUSAT, presented his work on **"Geo-Spatial Analysis of Erosion and Deposition Trends in the Chaliyar River Basin, Kerala (2014-2024)".** Using Landsat-based remote sensing and key spectral indices such as NDWI, SAVI, and AWEI, the study highlighted a net sediment gain of 13.85 km^2 over the decade. The findings revealed that erosion dominates along riverbanks and high-energy zones, while deposition has led to the formation of sandbars and floodplains, increasing flood risk potential. The presentation emphasized the need for strategic sediment management and showcased the utility of geospatial tools for riverine monitoring.

Mr. Balasundhar B. V., from the Department of Physics and Nanotechnology, SRMIST, delivered a talk on **"Comprehensive Evaluation of Aeolus Wind Products Against In-Situ Observations and Reanalysis Datasets Over the Indian Monsoon Region".** The study validated ESA's Aeolus satellite wind data using radiosonde observations and reanalysis datasets (ERA5 and IMDAA) across different monsoon seasons. The results showed strong correlations (0.72 for Rayleigh-clear and 0.66 for Mie-cloudy retrievals) and highlighted seasonal wind biases, offering potential for direct assimilation into weather models

like WRF. The talk underlined Aeolus's role in enhancing wind data coverage and improving forecast accuracy over the Indian monsoon region.

These thought-provoking talks laid the foundation for a highly engaging technical session that sparked valuable discussions among participants. Each presentation concluded with a lively Q&A session, reflecting the audience's keen interest in climate change and atmospheric modeling.

4.2.4. TS-H4C: Advancement in Climate Sciences (ACS)

Day 2 (25th March 2025) of CARE-25 in **Hall 4 (Sikka Hall)** started with the Technical Session TS-H4C based on the theme **"Advancement in Climate Science (ACS)"** at 11:00 IST. This session included **two lead talks (of 20 minutes duration) and five oral (of 10 minutes duration) presentations**. Rapporteur for the day were Mrs. Sreevidya Ravi and Ms Silpamol D S.

TS-H4C: Advancement in Climate Sciences (ACS) **25 March 2025, Time: 11:00-13:00** **Venue: Hall 4 (Sikka Hall)** Chairs: Dr. Sreekala P P, CUSAT & Dr. Ajil Kottayil, CUSAT				
SN	**Talks**	**Presenting Author**	**Institute**	**Title**
1	Lead	Dr. SHINTO ROOSE (online)	McGill University, CANADA	APPLICATION OF HIGH-RESOLUTION CLIMATE SIMULATIONS TO UNDERSTAND THE IMPACT OF URBAN HEAT MITIGATION STRATEGIES IN MONTREAL
2		Dr. ATHIRA U N (Online)	KAUST	CHARACTERISTICS OF WEATHER EXTREMES OVER ARABIAN PENINSULA
3	CARE-0069	Dr. KAVYA JOHNY	WHEN AI MEETS METEOROLOGY: MODELLING THE 2018 EXTREME KERALA FLOOD	
4	CARE-0041	KRISHNA JAYAMOHAN	DEEP LEARNING-BASED PREDICTION MODEL AND EARLY WARNING FOR RAINFALL-INDUCED LANDSLIDES IN IDUKKI, KERALA	
5	CARE-0040	ELIZABETH SHANI N X	OFFSHORE WINDFARMS AND UNDERWATER NOISE PROLIFERATION	
6	CARE-0168	SARATH KUMAR D	URBAN SPRAWL ASSESSMENT USING AI BASEDML TECHNIQUES - A CASE STUDY ON COIMBATORE CITY, TAMILNADU	
7	CARE-0131 (Online)	MEHZOOZ NIZAR	CLOUDSENSE: A MODEL FOR CLOUD TYPE IDENTIFICATION USING MACHINE LEARNING FROM RADAR DATA	

The hall manager, Dr. Smitha A, initiated the session by introducing the chairs and briefly describing them. **This session was chaired by Dr. Sreekala P P, and Dr. Ajil Kottayil**. Dr. Sreekala P P, is an Assistant Professor in the Department of Atmospheric Sciences, CUSAT. She has extensive experience in weather and climate research, with a strong focus on monsoon variability, climate modeling, and extreme weather prediction. She has contributed significantly to monsoon prediction, agro-meteorology, and climate change impact studies. Dr. Ajil Kottayil is a Scientist-C in ACARR, CUSAT. He has extensive experience in satellite remote

sensing, radiative transfer modeling, and wind profiler data processing and analysis. His research interests include infrared and microwave remote sensing of Earth's atmosphere, radiative transfer modeling and inversion algorithms, the science of extreme events using observations and models, and understanding the convective sources of air in the tropopause region using Lagrangian back-trajectory modeling. The hall manager handed over the session to the chairs and the chairs introduced the lead talks of the session.

The session begins with a **lead talk** by **Dr. Shinto Roose in online mode.** He is a postdoctoral researcher at the **Climate Change and Sustainable Engineering and Design Lab in the Department of Civil Engineering and TISED at McGill University, Canada**. His research focuses on high-resolution climate modeling and analysis tailored to engineering-relevant applications. He is the recipient of the Indian Meteorological Society's Young Scientist Award for the best paper published in meteorology in 2023. The topic of the presentation by Dr. Shinto was **"Application of high-resolution climate simulations to understand the impact of urban heat mitigation strategies in Montreal"**. The talk focused on the application of high-resolution (250 m) regional climate simulations using the Global Environmental Multiscale model, coupled with a single layer urban canopy model, to access the effectiveness of white/cool roofs in mitigating the Urban Heat Island effect over the Island of Montreal, Canada's second-largest urban agglomeration. A key focus was the role of non-synoptic winds, which counteract the expected benefits of white roofs. The presentation demonstrated how the reduction in land-water temperatures and associated weakening of sea breezes alter surface heat fluxes, impacting the overall benefits of this strategy, along with changes in planetary boundary layer height, convective activity, and summer rainfall patterns. The talk highlighted complex land-atmosphere feedback and underscores the importance of integrated modelling approaches to accurately quantify both the benefits and unintended consequences of urban heat mitigation strategies.

Dr. Athira U.N. delivered the **second lead talk** on online mode. Dr. Athira is **a Research Specialist in Urban Lab at KAUST, Saudi Arabia**. She is specialized in extreme weather events, regional climate modeling, and climate dynamics. Her current research focuses on climate extremes and their impact on livability, as well as urban climate modeling to enhance resilience in rapidly developing arid cities. The talk was on **"Characteristics of Weather Extremes over Arabian Peninsula"**, that investigates extreme weather events over Qatar, focusing on two different aspects-temperature extremes and the rainfall extremes. This study analyzed heatwaves from 1994–2023, highlighting the impact of land-atmosphere interactions and large-scale circulation. Significant land surface drying limits evaporative cooling and amplifies surface heating. Upper-level divergence and positive geopotential height anomalies enhance subsidence, suppressing convection and increasing solar radiation. Vertical velocity patterns confirm

widespread descending motion, reinforcing heatwave persistence. The results emphasize the strong coupling between atmospheric circulation and land surface processes in driving extreme heat. The long-term (epochal) variability of extreme rainfall in Qatar was also analysed focusing on 10 mm events from 1950–2024. Findings show an overall increasing rainfall trend, except during the global warming hiatus period, after which the trend resumes. Analysis revealed a recent northward shift in heavy rainfall events driven by large-scale moisture dynamics, highlighting the need for a deeper understanding to improve extreme weather prediction and mitigation in a warming climate.

There were **5 contributory presentations** in this session, delivered by Dr. Kavya Johny, ACARR, CUSAT; Krishna Jayamohan, Amrita School of Physical Sciences, Amrita Vishwa Vidyapeetham, Coimbatore (online); Ms. Elizabeth Shani N X, Naval Physical and Oceanographic Laboratory; Sarath Kumar D, Department of Remote Sensing, Bharathidasan Universtiy; and Mehzooz Nizar, Department of Atmospheric Sciences, CUSAT.

The first contributory talk was by **Dr. Kavya Johny** on the topic **"When AI Meets Meteorology Modeling the 2018 Extreme Kerala Flood".** Evaluating different parameterization schemes in WRF can improve flood event simulations, while data assimilation may further reduce forecast errors. Integrating AI with physical models can enhance real-time forecasting by improving intensity, and spatial, and temporal accuracy. NCEP-FNL, GFS, IMD, and GPM data were used for the analysis, and simulations were conducted for three days using the Grell 3D cumulus scheme and WSM6 microphysics scheme. This study investigates the efficiency of assimilation in WRF, with the outputs fed into a neural network (NN) model to optimize forecast performance regarding spatio-temporal distribution and intensity. The proposed AI model (WRFDA-LSTM) achieves a maximum prediction accuracy with a spatial correlation of 0.66, demonstrating the advantage of integrating AI with physical models to enhance real-time forecasting, with potential applications in early warning and disaster preparedness.

Mr. Krishna Jayamohan presented **"Deep learning-based prediction model and early warning for rainfall-induced landslides in Idukki, Kerala"**. The study aims to develop an LSTM-based deep learning model for rainfall-triggered landslide prediction in Idukki District, integrating rainfall and geospatial data, to enable real-time early warnings. The Long Short-Term Memory (LSTM) model was used for the study. The developed LSTM-based model achieved 97.1% accuracy in predicting rainfall-induced landslides in Idukki, Kerala, effectively identifying critical rainfall thresholds. By capturing temporal and spatial dynamics with meteorological and geospatial data, the model outperforms traditional methods with a low false-negative rate, enhancing disaster prevention. The model provides actionable alerts, improving response time compared to static threshold-based systems.

The third presentation was by **Ms. Elizabeth Shani N** X titled **"Offshore Wind Farms and Underwater Noise Proliferation"**, in which she explained about the impact of offshore wind farms on underwater noise proliferation. Construction phase of wind farms produce most intense noise ~160db. Offshore wind farms generate underwater sound pressure levels exceeding 200 dB re 1 µPa and distrupt communication and Echolocation of marine species. Noise pollution also increase stress level and behavioral changes apart from causing physical injury. The study utilizes an acoustic propagation model with the RAM Parabolic Equation method to assess underwater noise from offshore wind farms, considering sound speed and bathymetry of the stations. The study reveals that noise levels at 30 km remain below 100 dB, with deeper depths (>400 m) experiencing higher noise levels than shallower regions. To mitigate the effects of underwater sound propagation, many methods can be adopted among which, the use of bubble curtains is the most effective noise reduction technique.

Mr. Sarath Kumar D presented a paper **"Urban sprawl assessment using AI-based ML techniques - A case study on Coimbatore city, Tamil Nadu"**. Urban sprawl is the uncontrolled expansion of poorly planned, low-density, auto-dependent development, spreading across vast areas and increasing distances between homes, stores, and workplaces. It leads to high segregation between residential and commercial zones, negatively affecting residents while also disrupting ecosystems and displacing wildlife. To compute urban sprawl and perform spatial prediction modelling, Sarath Kumar used AI-based machine learning techniques and Remote sensing. The study utilized Google Earth Engine, IDRISI Selva Land Change Modeler, and CA-Markov simulation for land use and land cover (LULC) change analysis. Parameters like elevation, slope, roads, and railway tracks contribute to the Multi-Layer Perceptron based transition model, which generates transition potential maps for future LULC predictions. Wasteland and agriculture classes are inferred to be dropping off in the regions of north and west parts of the city (namely Thudiyalur, Sarvanampatti, Sivanandhapuram, and Vadavalli), expressing the probability due to urban expansion. The results of this study will assist policymakers to make policies to control the issues of population expansion and related concerns.

The last talk of the session was by **Mr. Mehzooz Nizar** on **"CloudSense: A model for cloud type identification using machine learning from radar data"**. This study proposed a novel model called CloudSense which used machine learning to identify precipitating cloud in the Western Ghats of India. The radar reflectivity profile data obtained from an X-band radar during July-August 2018 were used in CloudSence to classify clouds into four categories namely stratiform, mixed stratiform-convective, convective and shallow clouds. About 73 % of the precipitating cloud profiles have been correctly identified and classified. Among various ML models evaluated, Light Gradient Boosting Machine (LightGBM) showed the best test results with a Balanced Accuracy (BAC) of 0.79 and F1-Score

of 0.8. CloudSense performed better than the conventional radar algorithm, achieving a BAC of 0.8 and F1-Score of 0.79 while the latter attained a BAC of 0.69 and F1-Score of 0.68. The study shows that ML based approach can provide more accurate cloud detection and classification which would be useful to improve precipitation estimates over the complex terrain of the Western Ghats.

The second day technical session of the team Sikka was successfully completed at 13:00 IST. At the end of the sesson, **Dr. Prasanth A.Pillai, Scientist E, IITM Pune, thanked and presented the chairs** with a memento. Dr Prasanth is expertise in Indian summer monsoon and its interaction with tropical Oceans, Seasonal Prediction of Indian summer monsoon, and prediction of weather and Climate extremes over India. The Hall committee thanked the chairs, speakers, and the audience for making the session a great success.

4.2.5. TS-H1D: Kerala Institute of Local Administration (KILA) Joint Panel Discussion Session on "Weather Prediction, Climate Monitoring and Dissemination"

TS-H1D: KILA Joint Session -Weather Prediction, Climate Monitoring and Dissemination
25 March 20255, Time: 14:00-15:30
Venue: Hall 1 (Anna Mani Hall)
Chairs:
Dr. P. V. Revikumar, Quater Aeronautical Academy & Dr. Monish Jose, KILA

SN	Talks	Presenting Author	Institute	Title
	Panel Discussions on **"Weather Prediction, Climate Monitoring and Dissemination"**		**Panelists** Dr. Max Martin, Christ University : **Forecasting with Fishers: A Community-based Approach to Climate Adaptation.** Dr. Susmitha, IITM : **Extended Range Prediction and Applications.** Dr. Prasanth Pillai, IITM : **Seasonal Prediction of Rainfall and Temperature over Indian region.** Dr. Sabin T P: **The Need for High-Resolution Climate Simulations for Sectoral Applications.** Mr. Jamshad (Suprabhatham Daily, Media): **Role of Media in the dissemination of Weather forecasts.**	

Kerala Institute of Local Administration (KILA) has been engaged in the capacity building activities for local governance in Kerala since its establishment in 1990. The institute is supported by the government of Kerala, as its nodal agency for training, research and consultancy for the local self-government institutions. The institute engages in different capacity building activities of the local bodies, both rural and urban. As a training and research institute, KILA is committed to the following objectives.

- To undertake various training programmes for the elected representatives and officials
- To facilitate and strengthen theprocess of de-centralized planning

- To undertake action-oriented research activities
- To document best practices on local governance for wider dissemination
- To organize seminars, workshops and discussions.

Figure 4.1 Chairs during KILA's Session

The second technical session, themed "Weather Prediction, Climate Monitoring, and Dissemination," was **chaired by Dr. P.V. Revikumar, Quater Aeronautical Academy and Dr. Monish Jose**. Dr. Monish Jose is an Assistant Professor of Public Administration at the Kerala Institute of Local Administration (KILA). Dr. P.V. Revikumar is the Head of Department/Training Manager & Chief Meteorology Instructor, Qatar, imparting Training to WMO Meteorologists, Forecasters and Technicians. He is an experienced forecaster with expertise in aviation, marine, and general weather forecasting, and possess solid understanding of NWP products for aviation. Dr. Monish Jose holds a Ph.D. in

Economics and has a strong background in natural resource management, econometrics, and public policy. At KILA, he leads key projects like One Local Government One Idea (OLOI), Thozhil Sabha, and the Development of Climate Action Tracking Tool (DCAT). His work focuses on local governance, climate action, and sustainable development. Dr. Jose also collaborates with UNEP on disaster risk reduction and actively contributes to capacity-building initiatives for local governments and community development.

The session commenced with Ms. Niveda, the anchor, inviting the chairs to the panel. Dr. P.V. Ravikumar welcomed the five panellists and introduced **Dr. Max Martin**, who led the panel discussion. Before his talk, Ms. Niveda provided a brief overview of Dr. Max Martin's contributions. Dr. Martin is a **Professor at the Life Science Department of Christ University, Bangalore**. Earlier he designed and led the science component of Forecasting with Fishers, a research initiative of Sussex University in close collaboration with the Advanced Centre for Atmospheric Radar Research, CUSAT. This initiative contributed to a detailed understanding of climate hazards faced by traditional fishers of southwestern India, and ways to co-produce and share localised marine forecasts using scientific inputs as well as fishers' traditional and local knowledge.

Dr. Max Martin spoke on "Forecasting with Fishers", emphasizing the significance of the southwest and northeast monsoons and the high risks faced by fishermen due to extreme weather conditions. He highlighted the challenges of inadequate forecasts and false alarms, which impact the fishing community. Additionally, he underscored the importance of the research by Abhiram et al. on cyclogenesis and thermodynamic changes in the ocean. He stressed the need for improved early warning systems and forecasting methods and concluded his talk with a video documentary showcasing the effects of climate change on fishermen's lives.

Dr. Susmitha Joseph, Scientist F from IITM Pune is an expert in the fields of Monsoon Variability and Predictability, Sub-seasonal to Seasonal (S2S) Prediction, and the Prediction of Extreme Weather Events. Her extensive academic background and research contributions have made her a recognized figure in the field of meteorology. Her research areas include exploring the mechanisms behind monsoon breaks and droughts, understanding the role of ENSO (El Niño-Southern Oscillation) in influencing the intraseasonal variability of the monsoon, and investigating the impact of Sea Surface Temperature (SST) biases in modeling the Indian Summer Monsoon. Dr. Susmitha discussed about **"Extended-range prediction and its applications"**, explaining various prediction scales, from short-term weather forecasts to seasonal predictions. She emphasized the importance of subseasonal forecasts and their applications across multiple sectors, including health, energy, urban and rural infrastructure, and agriculture. She introduced the IITM ERPv2 framework and elaborated on its collaborative efforts with NCMRWF and INCOIS. She also highlighted the predictability skills of the ERP ensemble model, which can extend up to three weeks, providing insights into intraseasonal variability, monsoon breaks, and active spells.

Figure 4.2 Panel Discussion Glimpses during KILA's Session

Dr. Prasanth A Pillai, Scientist E, IITM Pune, is an expert in atmospheric sciences with a focus on the Indian summer monsoon, its variability, and its interaction with tropical oceans. Dr. Pillai's research interests primarily lie in understanding the diagnostic and modelling aspects of the Asian monsoon variability, particularly the ENSO-monsoon teleconnection, and the role of oceans in predicting monsoon patterns. He has contributed significantly to the study of the Tropospheric Biennial Oscillation and its influence on the monsoon system. Furthermore, he has investigated large-scale factors that control extreme weather events over India. Dr. Pillai discussed about **"Seasonal prediction of rainfall and temperature over the Indian region".** He explained the challenges of seasonal prediction and the progress made over the years. He compared prediction capabilities before and after the Monsoon Mission, illustrating how IMD's statistical models have evolved, leading to improved predictability.

Dr. Sabin T. P. Scientist E at IITM Pune and leads the high resolution climate modelling group. He has contributed to the IPCC AR6 as a chapter scientist and lead author. He has also represented India at international forums, including the UN COP Climate Summit. He has authored Assessment of Climate Change over Indian region, India's first national climate change report. In his talk he highlighted the "**need for high-resolution climate simulations**" to address sectoral applications. His talk emphasized how advanced simulations contribute to improved forecasting and risk assessment across various industries.

Mr. K. Jamshad is a seasoned journalist serving as the **Senior Sub-Editor at Suprabhatham Daily**, a prominent Malayalam newspaper based in Kerala. With extensive experience in media, he has developed a deep understanding of the challenges involved in disseminating accurate weather forecasts to the public. Mr. K. Jamshad, spoke on the **"role of media in the dissemination of weather forecasts".** He highlighted the challenges of delivering early warnings for extreme weather events, particularly in Kerala. He discussed the role of the media in ensuring accurate communication of weather forecasts to the public and emphasized the responsibility of journalists in preventing misinformation.

Following the presentations, the panel discussion continued with engaging insights from panellists and audience participation. The discussion covered various aspects of weather forecasting, climate monitoring, and dissemination strategies, with a focus on improving forecast accuracy and enhancing public awareness.

Figure 4.3 Presentation Mementoes

4.3. Poster Session

The CARE 2025 Conference hosted a vibrant poster session featuring a diverse range of research themes across climate science, environmental monitoring, and sustainable development. The session showcased 20+ posters under the following thematic areas:

I. **Disaster Risk Reduction and Early Warning Systems**: This category highlighted innovations in landslide susceptibility assessment, rainfall dynamics, and slope stability analysis specific to Kerala, India. Key contributors included Vishnu Subran, Sreelakshmi K S, and Suraj P R.

II. **Sustainable Infrastructure and Urban Resilience:** Posters explored urban heat island effects and their relation to land use changes, climatology, and agriculture. Studies by Sriyansu Nayak, Harinandana M S, and Abhilash U Bagunavar addressed challenges in thermal comfort and environmental impacts.

III. **AI/ML Techniques in Climate Sciences:** Machine learning models were applied to forecast thunderstorms, optimize rainfall prediction, and model sea surface temperatures. Work from Dharmadas Jash, Ajaykumar V C, and Abhijith Prasad M illustrated cutting-edge approaches using deep learning.

IV. **Advancement in Observational Techniques:** Presenters shared innovations in atmospheric profiling, remote sensing, and pollutant measurement. Notable studies included Dr. Aiswarya S's work on aerosol retrieval and Vinod P G's Sentinel-2 based water quality modeling.

V. **Climate Modeling and Forecasting:** Focused on future projections and drought modeling, this section featured research on rice cultivation under climate change, wind energy utilization, and CFSV2 drought predictions. Contributors included Chandana B Jyothi, Praveen S, and Prasanth A. Pillai.

VI. **Climate Extremes and Atmospheric Dynamics:** This section presented an extensive range of topics: heat waves, PM pollution, monsoon dynamics, cyclone intensification, and aerosol impacts. Researchers such as Karthika G, Niranjana Krishna, and Thanaya Pradeep contributed to understanding regional and intra-seasonal climate variability.

The poster session fostered rich scientific exchange and interdisciplinary collaboration, reflecting the growing importance of data-driven approaches and regional insights in tackling climate and environmental challenges.

Figure 4.4 Poster session in Day 2

4.4. Valedictory Function of CARE 2025

The **Valedictory Function of CARE 2025** marked the culmination of two days of insightful discussions, research presentations, and collaborations focused on climate adaptation and resilience. The session reflected on the key takeaways from the conference and reinforced the commitment of researchers, policymakers, and practitioners to advancing climate science and community-based solutions.

Figure 4.5 Valedictory Session

The event commenced with a **Welcome Address by Dr. M.G. Manoj, Scientist D, ACARR, CUSAT**, setting the stage for the evening. This was followed by the **Presidential Address by Prof. K. Satheeshan, Convenor of CARE 2025**, Department of Atmospheric Sciences, CUSAT, who emphasized the importance of bringing together experts from diverse fields to foster interdisciplinary solutions for climate resilience.

The function was honoured by the presence of **Prof. S. Bijoy Nandan, Senior Professor and Dean at the Faculty of Marine Sciences, CUSAT**, who delivered a thought-provoking speech on the role of **marine sciences, biodiversity conservation, and sustainable coastal management in addressing climate change**. His insights highlighted the need for collaborative research and policy integration to protect vulnerable coastal communities.

A key highlight of the session was the **recognition of outstanding research contributions**. The Best Oral Presentation **Awards were announced by Prof. C.A. Babu, Department of Atmospheric Sciences, CUSAT** and the **Award was**

conferred by Prof. S. Bijoy Nandan, Senior Professor and Dean at the Faculty of Marine Sciences.

Figure 4.6 Glimpses of valedictory function

4.4.1. Distinguished Awardees, CARE 2025, March 24-25, 2025, CUSAT

1. **Anjitha A. C., CARE - 0020**
   Fighting Climate Uncertainty: Vulnerability and Resilience in Kerala's Coffee Farming. Anjitha A. C.[1,*], M. Hema[1], A . Prema[1], Denny Franco[1]
   [1]Agricultural Economics, Kerala Agricultural University, Vellanikkara, Thrissur.

2. **Amita Prabhu, CARE - 0036**
   Influence of Southern Annular Mode Extremes on Summer Monsoon Rainfall in India and West Africa Amita Prabhu[1,*] and S. Arya[1, 2]

[1]Radar and Satellite Meteorology Department, Indian Institute of Tropical Meteorology (IITM), Pune, India. [2]Academy of Scientific and Innovative Research (AcSIR), Ministry of Earth Sciences (MoES) - IITM, Pune, India.

3. **Gopikrishnan G. S., CARE - 0135**
   Aerosol Inhibition on Photochemical Surface Ozone Formation Under Future Climate and Air Quality Scenarios

   Gopikrishnan G. S.[1,2,*], D. M. Westervelt[2], J. Kuttippurath[1]

   [1]Lamont Doherty Earth Observatory (LDEO), Columbia University, New York, USA. [2]CORAL, Indian Institute of Technology, Kharagpur.

4. **Krishna Kumar E. K., CARE - 0129**
   Contrasting Regional Responses of Indian Summer Monsoon Rainfall to Exhausted Spring and Concurrently Emerging Summer El Niño Events

   Krishna Kumar E. K.[1,2,*], S. Abhilash[1,2], Syam Sanker[2], P. Vijay Kumar, K. R. Santosh[2], A.V. Sreenath[1]

   [1]Department of Atmospheric Sciences, Cochin University of Science and Technology, Kerala, India. [2]Advanced Centre for Atmospheric Radar Research, Cochin University of Science and Technology, Kerala, India.

5. **Malavika A. R., CARE - 0030**
   Comparative Analysis and Statistical Evidence of Deep Ocean Warming Trend in the Arabian Sea and Bay of Bengal

   Malavika A. R.[1,*], Maya L. Pai[2], Kavya Johny[3]

   [1]Department of Mathematics, Amrita School of Physical Sciences, Amrita Vishwa Vidyapeetham, Kochi Campus, India. [2]Department of Computer Science and IT, School of Computing, Amrita Vishwa Vidyapeetham, Kochi Campus, India. [3]Advanced Centre for Atmospheric Radar Research (ACARR), Cochin University of Science and Technology, Kerala, India.

6. **Prajwal K., CARE - 0054**
   Wind-Precipitation Regimes and Monsoon Intraseasonal Variability: New Insights from the South-West Coast of India

   Prajwal K[1,*], Ajil Kottayil[1], Prince Xavier[2], Bernard Legras[3]

   [1]Advanced Centre for Atmospheric Radar Research, Cochin University of Science and Technology, Kerala, India. [2]Met Office Hadley Centre, Exeter, UK. [3]Laboratoire de Météorologie Dynamique, IPSL, CNRS UMR8539, ENS-PSL/Ecole Polytechnique/Sorbonne Université, Paris, France.

7. **Sarath Kumar D., CARE - 0168**
   Urban Sprawl Assessment Using AI Based ML Techniques - A Case Study on Coimbatore City, Tamilnadu

Sarath kumar D.[1,*] and D. Ramesh[1]
[1]Department of Remote Sensing, Bharathidasan University.

8. **Tesna Maria, CARE - 0042**

Moisture Transport and Its Link with Extreme Monsoon Rainfall Over the West Coast of India

Tesna Maria[1,*], Ajil Kottayil[1], Prince Xavier[2], Viju O. John[3]
[1]Advanced Centre for Atmospheric Radar Research, Cochin University of Science and Technology. [2]Met Office, Exeter, United Kingdom. [3]EUMETSAT, Eumetsat Allee 1, 64295, Darmstadt, Germany.

9. **Vinod P. G., CARE - 0084**

Geo-Spatial Analysis of Erosion and Deposition Trends in the Chaliyar River Basin, Kerala (2014–2024) Using Remote Sensing and GIS-Based Spectral Indices

Vinod P. G.[1,*], Anand M.[2], S. Abhilash[3]

[1,2]School of Environmental Studies, Cochin University of Science and Technology, Kerala, India. [3]Advanced Centre for Atmospheric Radar Research, Cochin University of Science and Technology, Kerala, India.

The **Best Poster Awards** were announced by **Dr. Ajil Kottayil** and **conferred by Prof. S. Bijoy Nandan.**

1. **Chandana B. Jyothi, CARE – 0100**

   Modeling the Future of Rice Cultivation in Central Kerala: Climate Change and Yield Projections

   Chandana B. Jyothi[1,*], P. Lincy Davis[1], B. Ajithkumar[1], Arjun Vysakh[1], K. R. Riya[1\]

   [1]Department of Agricultural Meteorology, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur.

2. **Rona Maria Sunil, CARE - 0078**

   STJ-Modulated TEJ Variability: A New Perspective on Intraseasonal Monsoon Dynamics

   Rona Maria Sunil[1] and M. G. Manoj[1]

   [1]Advanced Centre for Atmospheric Radar Research, Cochin University of Science and Technology, Kerala, India.

3. **Neethu C. S., CARE - 0033**

   Intensification of Heat Waves in India: Synoptic Conditions and Atmospheric Dynamics

   Neethu C. S.[1,*] and B. Abish

   [1]Department of Climate Variability and Aquatic Ecosystems, Faculty of Ocean Science and Technology, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi, India.

4. **Naveen A. Y., CARE - 0099**

   Decoding Landslide Risks: A Unified AHP, GIS, and Rainfall Threshold Approach in Idukki District, Kerala

   Naveen A. Y.[1,*], K. Ajith[2], B. Ajithkumar[1], Arjun Vysakh[1], K. V. Murali[3]

   [1]Department of Agricultural Meteorology, College of Agriculture, Kerala Agricultural University, Vellanikkara, Thrissur.
   [2]Regional Agricultural Research Station, Kumarakom.
   [3]College of Forestry, Kerala Agricultural University, Vellanikkara, Thrissur.

In addition, the **Logo Design Award** was introduced this year to recognize creative representation of CARE 2025's vision. The award is presented to **Arun Kulappuram, Department of Atmospheric Sciences, CUSAT.**

Special memento to Mr. Arun Kullappuram for Logo design

The **Vote of Thanks was delivered by Dr. S. Abhilash, Chairman of CARE 2025**, who expressed gratitude to all contributors, including organizers, technical

teams, session chairs, reviewers, and volunteers, whose efforts ensured the smooth execution of the conference. He acknowledged the invaluable support of research institutions and participants who enriched the discussions with their expertise.

Vote of thanks by Dr. Abhilash S.

As the session drew to a close, attendees stood together for the **National Anthem**, symbolizing a collective commitment to climate resilience. The conference concluded with a call to action, encouraging participants to **carry forward the insights, collaborations, and innovative solutions developed during CARE 2025**. The discussions held over the past two days must now translate into impactful policies, research projects, and community-driven initiatives.

With a strong sense of purpose and renewed determination, the **CARE 2025 conference ended not as a conclusion, but as a beginning**—a step toward fostering long-term partnerships and implementing actionable strategies to address climate challenges. The organizing committee expressed their heartfelt appreciation to all attendees and looked forward to continuing these vital conversations in future forums.

5. CARE 25 in Media

അന്താരാഷ്ട്ര കാലാവസ്ഥാ സമ്മേളനം തുടങ്ങി

കൊച്ചി ▸ കൊച്ചി സർവകലാശാല സെമിനാർ കോംപ്ലക്സിൽ കെയർ 2025 അന്താരാഷ്ട്ര കാലാവസ്ഥാ സമ്മേളനം തുടങ്ങി. സിഎംഎഫ്ആർഐ ഡയറക്ടർ ഡോ. ഗ്രിൻസൺ ജോർജ് ഉദ്ഘാടനം ചെയ്തു.

കൊച്ചി ഷിപ്പ്യാർഡ് ചെയർമാൻ മധു എസ്. നായർ മുഖ്യാതിഥിയായിരുന്നു. കുസാറ്റ് വൈസ് ചാൻസലർ ഡോ. എം. ജുനൈദ് ബുഷിരി അധ്യക്ഷത വഹിച്ചു. നെൽവിത്തുകളുടെ സംരക്ഷകനായ ചെറുവയൽ രാമൻ കൃഷി അനുഭവങ്ങൾ പങ്കുവെച്ചു.

ഇന്ത്യൻ മീറ്റിയറോളജിക്കൽ സൊസൈറ്റിയും സർവകലാശാലയിലെ അറ്റ്മോസ്ഫെറിക് സയൻസ് വകുപ്പും അഡ്വാൻസ്ഡ് സെന്റർ ഫോർ അന്തരീക്ഷ റഡാർ റിസർച്ചും (എസിഎആർആർ) ചേർന്നാണ് സമ്മേളനം സംഘടിപ്പിക്കുന്നത്. രജിസ്ട്രാർ ഡോ. എ.യു. അരുൺ, പ്രോഗ്രാം സംഘാടകരായ ഡോ. അഭിലാഷ് എസ്., ഡോ. കെ. സതീശൻ, ഡോ. മനോജ് എന്നിവർ പ്രസംഗിച്ചു. മുൻ ഫാക്കൽറ്റി അംഗങ്ങളെയും ആദരിച്ചു. സമ്മേളനം ചൊവ്വാഴ്ച സമാപിക്കും.

കൊച്ചി സർവകലാശാലയിലെ അന്താരാഷ്ട്ര കാലാവസ്ഥാ സമ്മേളനത്തിന്റെ ഉദ്ഘാടന വേദിയിൽ സിഎംഎഫ്ആർഐ ഡയറക്ടർ ഡോ. ഗ്രിൻസൺ ജോർജ്,ചെറുവയൽ രാമൻ, കുസാറ്റ് വൈസ് ചാൻസലർ ഡോ. എം. ജുനൈദ് ബുഷിരി എന്നിവർ പ്ലാവിൻ തൈ നനയ്ക്കുന്നു

6. Outcome of the Conference

The CARE 2025 (Climate Adaptation and Resilience) Conference, held at CUSAT, successfully brought together researchers, policymakers, industry experts, and community leaders to deliberate on pressing climate challenges and collaborative solutions. The outcomes of the conference are as follows:

- **Strengthened Interdisciplinary Collaboration:** The event fostered meaningful dialogue among climatologists, engineers, data scientists, and social scientists. Several interdisciplinary research collaborations were initiated, aimed at integrating climate modeling, AI-ML, and sustainable development practices.
- **Policy Recommendations Drafted:** Actionable policy briefs were developed focusing on disaster preparedness, urban climate resilience, and inclusive climate governance. These drafts are expected to be submitted to state and national bodies to inform future climate action plans.
- **Launch of Community-Led Pilot Projects:** As a key outcome, CARE 2025 announced the launch of community-led climate adaptation pilots in vulnerable coastal and tribal regions of Kerala. These initiatives will incorporate local knowledge with scientific strategies.
- **Showcased Innovative Technologies:** The conference showcased cutting-edge observational tools, real-time weather monitoring systems, and AI-

driven climate forecasting models. Demonstrations emphasized how tech-driven solutions can bridge gaps in disaster response and planning.

- **Training and Capacity Building:** Workshops held during the event focused on building skills in climate modeling, risk assessment, and resilience planning. These sessions empowered young researchers and local administrators with practical tools and knowledge.
- **Commitment to Sustainable Urban Planning:** Urban planning experts committed to developing guidelines for climate-resilient infrastructure, especially in flood-prone and heat-vulnerable urban centers.
- **Roadmap for AI-ML Integration in Climate Science:** A roadmap was drafted for integrating AI and ML in climate data analytics, with a focus on improving early warning systems, resource optimization, and predictive modeling for local governments.

7. Event Photographs











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Climate Adaptation and Resilience [CARE – 25]
Bridging Science, Innovation, & Communities

Organized by
Department of Atmospheric Sciences (DAS) &
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Cochin University of Science and Technology (CUSAT)
in collaboration with
Indian Meteorological Society (IMS) Cochin Chapter

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