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Workshop on the Fundamentals of Air Quality Modelling and Its Role in Air Quality Management

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Location: Inspire Hall, Le Méridien New Delhi

Concept Note

Economic development in the last century has led to significant environmental damage, and one such cost is increased air pollution. The Western world experienced extremely poor air quality during the early and mid-twentieth century. However, in recent decades, with mitigation efforts, air quality levels have steadily improved. Unfortunately, air pollution is now worsening in the Global South. Poor air quality poses serious risks to public health and economic productivity and can lead to premature mortality. Therefore, air quality management (AQM) is essential for sustainable growth. AQM refers to the strategies, policies, and regulatory frameworks designed to monitor, control, and reduce air pollution.

The history of AQM can be traced back as a response to understand and improve poor air quality over major urban centres in the West during 1960s and 1970s. India established the Central Pollution Control Board (CPCB) in 1974 and added the Air (Prevention and Control of Air Pollution) Act in 1981. Over the years, India has made progress in AQM by developing the National Ambient Air Quality Standards (NAAQS), expanding monitoring through the National Air Quality Monitoring Programme (NAMP) and Continuous Ambient Air Quality Monitoring Stations (CAAQMS), and initiating the National Clean Air Programme (NCAP) in 2019.

The key components of AQM include identification of emission sources, monitoring of air pollution, and use of air quality models. These models are computational tools that simulate the behaviour, transport, and dispersion of air pollutants considering various factors such as emissions from different sources, weather conditions, topography, and atmospheric chemical processes. By predicting how pollutants spread across time and space, air quality models help in assessing the impacts of pollution sources; forecasting air quality; and providing valuable insights for decision-makers, urban planners, and regulatory agencies to formulate and evaluate the effectiveness of mitigation measures. The history of air quality models started with simple box models, which progressed to simple plume dispersion models including plume rise and mixing height computations. These later evolved as photochemical models

that were able to simulate pollutant distribution over gridded regions across the globe. By the 1990s, air quality models became a fundamental part of AQM required by US Clean Air Act, and model derived estimates are also currently used to develop state implementation plans. However, the use of air quality models for AQM and policymaking in India remains limited. Greater adoption of air quality models could help policymakers better understand pollution dynamics and design more effective solutions. Air quality modelling can help Indian states

- quantify the relative contribution of local (state/city) vs transported regional pollution;
- develop scientific, data-driven state action plans; and
- move towards mutually beneficial regional / multi-state AQM frameworks.

Building capacity among government officials and researchers tasked with developing AQM is essential and would help ensure that air quality models are well understood and effectively utilized. Hence, the Center for Study of Science, Technology and Policy (CSTEP) is organising a 2-day regional workshop on '*The Fundamentals of Air Quality Modelling and its role in Air Quality Management*'. The first day will cover lectures on the fundamentals of air quality modelling targeted at early-mid career researchers from Institutes of Repute, think tanks, academic institutions, and pollution control boards. The second day will include two panel discussions and research presentations showcasing the latest advancements in air quality modelling and their role in effective AQM. Participants will gain insights into how air quality models can inform policy decisions, especially in developing countries like India where air pollution is a pressing issue. During the workshop, we will also present results based on the latest reduced complexity modelling tools developed by CSTEP and Indian Institute of Technology Bombay (IIT-B), in collaboration with the University of California, Berkeley; University of Washington; and Carnegie Mellon University for policy use in India.

Organising committee:

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About CSTEP: The Center for Study of Science, Technology and Policy (CSTEP) is one of India's leading think tanks, with a mission to enrich policymaking with innovative approaches using science and technology for a sustainable, secure, and inclusive society. Our current work is anchored in the grand challenges of our time, namely, Clean Energy Transition, Clean Air for All, and Sustainable and Secure Future for all. Our work focuses on ensuring that our ideas are borne out of evidence and implementable at scale.

About Atmospheric Composition Modelling group: The Atmospheric Composition Modelling group at CSTEP focuses on enhancing the current understanding of atmospheric composition and its evolution. We synthesise weather prediction, dispersion, chemistry transport, and reduced complexity models, which can be employed to comprehend the intricate atmospheric processes influencing air quality over a region. The group utilises a variety of ground- and space-based atmospheric measurements to validate model outcomes. By harmonising diverse models and observations, we aim to provide insights for formulating effective air pollution control strategies within a specified geographical area.