Winter Fog Experiment (WiFEX): 10 Years of Unraveling India's Winter Fog

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The Winter Fog Experiment (WiFEX), launched in the winter of 2015 at Indira Gandhi International Airport (IGIA), New Delhi, has completed a remarkable milestone — ten successful years of dedicated research into North India's dense winter fog and its impact on daily life and aviation safety.

Led by the Indian Institute of Tropical Meteorology (IITM) under the Ministry of Earth Sciences (MoES), with support from the India Meteorological Department (IMD) and the National Centre for Medium Range Weather Forecasting (NCMRWF), WiFEX is one of the world's few long-term open-field experiments focused solely on fog — an elusive winter hazard that regularly disrupts air, rail, and road transport across the Indo-Gangetic Plain.

What began at IGIA — India's busiest and most fog-affected airport — has grown into a robust observational network now reaching Jewar Airport, Noida, and Hisar, Haryana, covering key aviation corridors across North India. Over the past decade, WiFEX scientists have deployed advanced instruments, micrometeorology towers, ceilometers, and high-frequency sensors to collect detailed data on temperature layers, humidity, wind, turbulence, soil heat, and aerosols — building an unmatched dataset that reveals how dense fog forms and disperses.

These insights have powered the development of a high-resolution (3 km) probabilistic fog prediction model, which now stands among the region's most advanced tools for operational forecasting. This model can reliably predict when fog will begin, how dense it will be, how long it will last, and when it will clear — achieving more than 85% accuracy for very dense fog (visibility below 200 meters). For airlines, pilots, air traffic controllers, and passengers, this means fewer costly diversions, fewer delays, safer runways, and more informed travel during the challenging winter fog season.

WiFEX's contribution goes far beyond forecasts. This pioneering effort has pushed the frontiers of fog science, revealing how air pollution, urban heat islands, land-use changes, and tiny airborne particles influence fog thickness and duration. These findings are now improving early warning systems and helping policymakers design better urban and air quality management plans.

With this strong foundation, WiFEX is stepping into its next phase — **WiFEX-II**— which will extend localized, runway-specific fog predictions to more airports in North India. By installing dedicated sensors at additional sites, airport operators will gain real-time data to help them activate response plans and ensure operations remain safe and efficient — even in the thickest fog.

After ten winters and countless hours of fieldwork, WiFEX stands as a shining example of what sustained, focused research and collaboration can achieve. By connecting observations to models and models to real-world decisions, WiFEX proves that science can clear the path forward.

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