**Indian Institute of Tropical Meteorology (IITM), Pune**

**PRESS RELEASE (14.9.2024)**

# India's first Urban Radar Network in Mumbai: Enhancing Rainfall Monitoring with City-Wide Coverage

## Key Highlights

- **India's first Urban Radar Network in Mumbai is dedicated to Nation** on 14th September 2024

- Inaugurated by Dr. M. Ravichandran, Secretary MoES during the Stakeholders Workshop on "Severe Weather and Meteorological Services over Maharashtra", Mumbai

- Established by IITM for enhancing rainfall monitoring with city-wide coverage.

- IITM deployed X-band polarimetric radars at closely spaced network at four locations viz., Panvel, Vasai-Virar, Vile Parle, and Kalyan-Dombivli, providing comprehensive coverage of the Mumbai Metropolitan Region.

- Establishment of this state-of-the-art radar network in Mumbai marks a significant leap forward in urban weather observation capabilities, setting a new standard for monitoring and responding to severe weather in Indian cities.

*14.9.2024; Colaba, Mumbai:* Mumbai Weather Radar Network has been inaugurated by the Chief Guest, Dr. M. Ravichandran (Secretary, Ministry of Earth Sciences (MoES)) during the Stakeholders Workshop on "Severe Weather and Meteorological Services over Maharashtra", organized by IMD-Regional Meteorological Centre, Mumbai on 14th September 2024 at the Cariappa Auditorium Sena Cinema, Colaba, Mumbai (Maharashtra) in presence of dignitaries, Guest of Honour, Mr. Bhushan Gagrani (IAS Municipal Commissioner, Mumbai), Guest of Honour, Dr. Ravindra D. Kulkarni (Vice Chancellor, University of Mumbai), Dr. R. Krishnan (Director, IITM), Dr. G. Pandithurai (Project Director, Atmospheric Research TestBed ART-IITM), Dr. Mrutyunjay Mohapatra (Director General of Meteorology, IMD), Mr. S. G. Kamble (Head, Regional Meteorological Centre, Mumbai).





Photographs: Glimpses from stakeholders workshop organised by IMD-RMC-Mumbai

**Brief about the state-of-the-art Mumbai Urban Weather Radar Network (Urban radar testbed):**

Mumbai is susceptible to extreme weather events, especially those linked to heavy rainfall. Traditionally, rainfall intensity and accumulation have been measured using rain gauges, which provide accurate but limited data from specific locations. This method, however, only captures point-based observations and has limitations in providing a complete picture of the rainfall distribution and movement over the entire city.

Weather radar has emerged as an alternative approach that can measure rainfall over vast areas, offering continuous coverage and effectively providing information on rain that will be similar to having thousands of rain gauges spread across the landscape. This broader coverage is crucial for a city like Mumbai, where localized heavy downpours can lead to flash floods and other disruptions, and a more comprehensive real-time observation network is needed to improve nowcasting and early warning systems.

With an aim to enhance the real-time weather observation in Mumbai, the Indian Institute of Tropical Meteorology (IITM) in Pune has established India's first Urban Radar Network in Mumbai by deploying four closely spaced network of X-band polarimetric radars that will improve weather warnings and response times. The newly installed radars, strategically positioned at Panvel, Vasai-Virar, Vile Parle, and Kalyan-Dombivli, providing comprehensive coverage of the Mumbai Metropolitan Region. These radars will ensure that no rainfall events go unnoticed or undetected.

Data from each radar will be integrated into a single MOSAIC, offering real-time tracking of weather systems across the Mumbai. This unified approach will deliver a complete and continuous view of the Mumbai's weather patterns. This network will significantly enhance rainfall monitoring and nowcasting capabilities in the region.

Traditional weather radars typically include S-band radar, having antenna size of about 8 m and C-band radar, having antenna size of 4 m, that are designed to monitor large-scale weather patterns, such as low-pressure areas and cyclones. However, they require substantial infrastructure and have limitation in accurately observing the lower atmosphere due to the Earth's curvature, which limits the radar signal line of sight over larger distances. In a city like Mumbai, tall buildings can also block radar signals, reducing radar effectiveness in detecting near-ground weather events.

As an alternative, short-range X-band radars, having 1m antenna, are specifically designed to cover smaller areas with high resolution and provide measurements closer to the surface. This makes them far more effective at monitoring localized weather events, such as intense downpours, thunderstorms, and short bursts of extreme rainfall, often leading to urban flooding. Additionally, X-band radars are well-suited for filling observational gaps that traditional radars miss due to obstructions. Their smaller size also means they require much less infrastructure, making them easier to install and deploy in densely populated urban environments.

Each of the four radars in the network has a range of 60 kms, collectively providing coverage across a vast area of about 50,000 km$^2$. The weather data generated by these radars will be updated in intervals of less than five minutes, with a resolution of 50 m. The high-resolution data will enhance nowcasting capabilities, allowing for real-time monitoring and prediction of localized weather events. Providing rapid real-time weather updates over larger domain will allow authorities and stakeholders to respond more effectively to changing weather conditions, minimizing disruptions and maximizing preparedness.

Short-range radar networks, similar to the one being deployed in Mumbai, have already proven successful in countries like USA, South Korea, Japan, and China. These networks have enhanced weather forecasting, particularly in urban areas prone to localized weather events. Now, India is testing this innovative approach in its cities, where urban flooding caused by heavy rainfall has become a frequent and growing concern. This is particularly important in cities like Mumbai, where rapid urbanization worsen the impact of sudden, heavy downpours.

The combined radar observations from IITM and IMD will provide forecasters with real-time, high-resolution rainfall maps, significantly improving rainfall nowcasting. This, in turn, will aid in making more informed decisions to protect the residents of Mumbai.

The establishment of this state-of-the-art radar network in Mumbai marks a significant leap forward in urban weather observation capabilities, setting a new standard for monitoring and responding to severe weather in Indian cities.

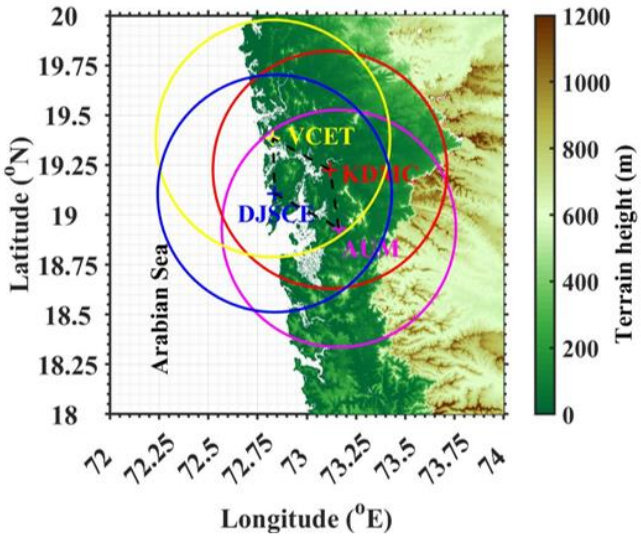


**Fig.**: Urban Radar Network over Mumbai comprising of four X-band polarimetric radars. Each circle indicate 60 km radar coverage. Radars are separated at distance of 30 km.

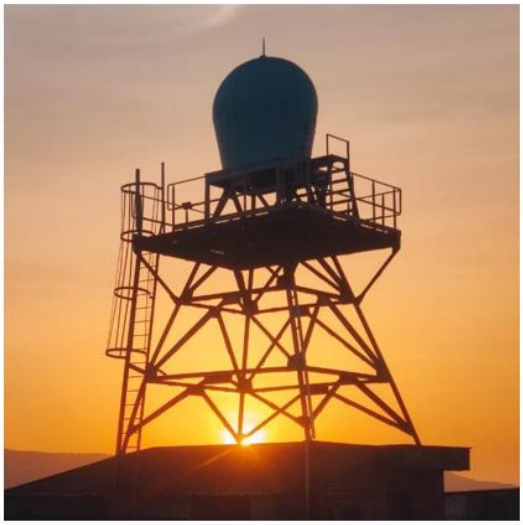

**Fig.**: A tower mounted radar setup at one of the sites of network in Mumbai.

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