



Atmospheric Research Testbeds: Role of Radar Remote Sensing

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Indian summer monsoon, which is a part of the Asian monsoon system, is a prominent tropical circulation system in the general circulation of the atmosphere. India receives more than 80% of the annual rainfall during a short span of four months (June to September) of the southwest monsoon season. The variability in the onset, withdrawal and quantum of rainfall during the monsoon season has profound impacts on water resources, power generation, agriculture, economics and ecosystems in the country. Numerical models play a vital role in monsoon prediction. But all weather and climate models have some systematic biases due to inadequate representation of tropical clouds by parameterization schemes. Long-term observations of clouds including its microphysical properties and convection and precipitation are critical for understanding the root causes of model errors and/or biases.

Atmospheric Research Testbed is a highly focused observational and analytical research effort and it will provide resources for validating cloud resolving models and conventional global climate models using both statistical and process-oriented approaches. These efforts are vital in the interest of accelerating improvements in both observational methodology and monsoon prediction models in India. IITM is developing an Atmospheric Research Testbed in Central India (ART-CI) in Silkheda, Sehore District. In ART-CI, Dual Polarimetric Doppler Weather Radars (DWR) and millimeter wavelength cloud radars will play a major role in observing 3-dimensional structure of clouds and precipitation over core monsoon zone. Dual-pol C-band DWR was commissioned in June 2021 and observations were collected for last 2 monsoon seasons. It is proposed to augment a Radar wind profiler to observe wind profiles up to 10 km and Ka-band cloud radar for cloud vertical structure.

An orographic research testbed was already established at Mahabaleshwar (Satara District, Maharashtra) in the Western Ghats to better understand aerosol-cloud-precipitation interactions and orographic clouds and precipitation processes. Observations of X-band and Ka-band radar were collected to study the spatio-temporal distribution of cloud vertical structure and precipitation processes under the influence of orography.

Presently, an Urban Radar Network Testbed is being developed over Mumbai Metropolitan Region for high spatio-temporal resolution of precipitation. In this network, 4 short-range X-band radars will be commissioned and the network will enable to do better nowcasting and flood warning systems. Details of these atmospheric research testbeds will be presented.