Temporal evolution of the boundary layer height using dual-pol C band Radar observations in the Core Monsoon Zone

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Information about the depth and evolution of the planetary boundary layer (PBL) is crucial, considering their influence on the turbulent exchange of heat, momentum and moisture between the surface and the free troposphere. It also influences the extent of vertical mixing, dispersion of pollutants, initiation and development of cloud formations due to the dominance of convective processes during daytime. The underlying surface and the environment have a critical role to play in the growth of the planetary boundary layer, thus demanding a good and systematically consistent observational network to comprehend its complexity. However, the direct observations of the boundary layer height and its evolution at fine spatiotemporal resolution are limited. The conventional estimation by radiosonde is limited by temporal resolution, while the observations by the profiling instruments (wind profiler radars, lidars, sodars) are scantily distributed over the globe.

Traditionally, Doppler weather radars are used to observe rainfall; however, polarimetric signatures of Bragg scatter from these radars can also be utilized to estimate the boundary layer height. In this context, we have utilized the routine observation from dual-pol C-band radar operational at Atmospheric Research Testbed facility in Silkheda, at the station at Core monsoon Zone. A combination of differential reflectivity (ZDR) and co-polar correlation coefficient (RhoHV) signatures are utilized to identify the PBL height. A quasi-vertical profile of ZDR and RHoHV was created by azimuthal averaging the data at high elevation angles, and the range was converted into height. Furthermore, the boundary layer height estimated from the radar has been compared with the one obtained from the collocated radiosonde estimated by utilizing the sharp gradient in the vertical profile of (virtual) potential temperature and water vapor mixing ratio.

The methodology and results will be presented at the upcoming conference, paving the way for utilizing the existing nationwide network of the Doppler weather radars to monitor the boundary layer height at good spatiotemporal resolution.