

# **Dust Storm over Delhi-NCR: Implications on Atmospheric Boundary Layer Height**

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## **Abstract**

We have investigated the implications of dust storms on the atmospheric boundary layer (ABL) over IIT Delhi's remote atmospheric observatory (28.95°N, 77.10°E), an upwind rural site of Delhi, located in the Sonapat, Haryana. We have utilised ABL height retrieved from Ceilometer CL61, particulate matter (PM) concentrations from TSI-made DustTrak Pro, and the met data from weather station for this study. The storm occurred on 16<sup>th</sup> May at 03:00 AM local time, showing 38% and 160% increase in PM<sub>2.5</sub> and PM<sub>10</sub> concentrations, respectively, compared to the previous day. MODIS-Terra satellite imagery corroborates the influx of dust particles with backward trajectory analysis showing Thar desert and middle eastern countries as origin. During the event, the stable nocturnal boundary layer suddenly becomes unstable with the influx of the dust particles. The observed turbulence further aided the vertical mixing followed by creation of a residual layer, inhibiting further entrainment. In the morning, dust particles get mixed in the convective boundary layer but in afternoon, the ABL suddenly collapses and remains the same until the rain with high winds washes out the dust particles. The next day, PM concentrations again rise with no clear ABL top and washes out with another rain in the morning of 18<sup>th</sup> May. These collapses in ABL top might not be a mere coincidence with the dust storms but it could be directly associated with the changes in the local radiative forcing as the dust is cooling in nature which reduces the surface temperature. These sub-grid scale fluctuations in the ABL height are not captured in the ERA-5 reanalysis data. Further, the association between local radiation budget during the dust storms and ABL height will be added to this study. These findings are crucial to improve local climate models by providing feedback mechanism associated with dust storm meteorology.

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YES, I am an early career scientist.

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