Optical parameters of aerosols in sub Himalayan region and their behaviour in projection of short term rain events.

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Starting with a brief description of the Portable Atmospheric Lidar used for measuring aerosol over Guwahati (26^0N and 92^0E), a station situated in a semi urban location in sub Himalayan region, we give our procedures adopted for evaluation of optical properties of aerosols i.e. extinction and back scatter coefficients and profiling, for both dry and wet seasons. The lidar being situated in a semi rural area, methodical screening approaches adopted for selection of echograms free from shoot and fossil burning by- product are described while evaluation of system constant C and lidar ratio S. The ratio so obtained is examined further with the model output based on the Mie –scattering theory (Yabuki et al 2003) and the figure of S=20-30 received by us is near to the model value (in between urban and maritime environment) with refractive index N=1.5 (real part) and imaginary part varying between 0 to .0059, suggesting that in dust free environment, aerosols are weakly absorbing particles, which in a way supports our observation. The aerosol extinction and backscatter profiles are then presented for a year highlighting the seasonal features and associated physical and dynamical aspects. Adopting similar approaches it is found that the lidar ratio in case of dust goes higher than 35 and for cloudy situation, it comes down to 20 though subjected to the type of cloud present. Reliability of these values is then examined with the model output of Yabuki et. al 2003, and model values (urban to maritime) for S>35, correspond to particles with R.I (imaginary part)>0.001, indicating presence of high absorption aerosols and thereby supporting our observation. In case of cloudy atmosphere, S varies with cloud type. The paper explains this by quantifying these parameters specially for low lying rain bearing clouds hovering over this region at heights as low as 250 meters. Supporting data from radiosonde operated by India Meteorological department are also presented in this connection. Satellite aerosol data of sub Himalayan range are also used as additional inputs.

Regarding role of aerosols on cloud, our observation indicates that aerosol counts that go up during the process of formation of rain or rain bearing clouds can be used as short-term rain predictor. We demonstrated such observations by considering low rain rate situations. Well-developed cloud layer may be seen even within 2 minutes of enhancement of aerosol counts by more than 2 folds. We observe that values of σ

(aerosol) also increase from 0.08/km to 0.2 /km (typical figure) at 1 km height (maximum count altitude) prior to the mild and short rain event. However we cannot isolate contribution of water vapour to the total counts and also note that our observations do not indicate role of aerosols directly on rain or cloud formation, but enhancements of counts as well of σ values prior to rains, are indications of possibility of using of such parameters for short-term rain predictions. These are discussed by taking aerosol optical features during dry and wet –monsoon conditions.

Reference:

M. Yubuki, H. Kuze, H. Kinjo and N. Takeuchi “Development of vertical distribution of aerosol parameters using multi wavelength lidar data “ Jpn. Jr. Appl. Phys. Vol.42, pp 486-494, 2003.