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Comparison of CALIOP Level 2, Version 3 Backscatter and Extinction products with MPLNET data at Kanpur, India

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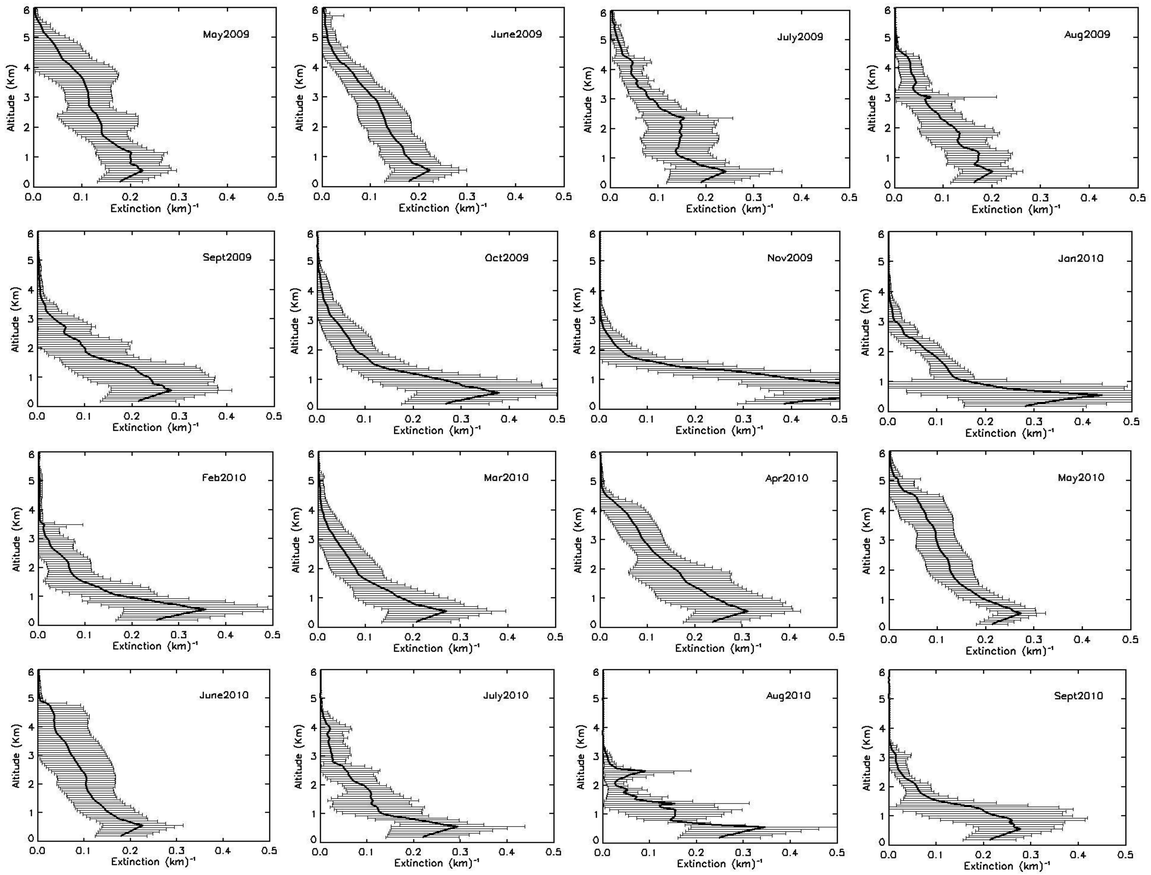
Background

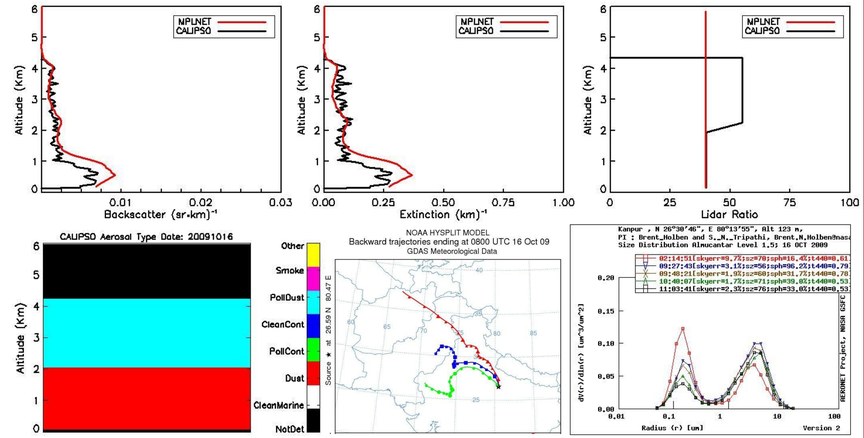
- *Cloud-Aerosol LIDAR with Orthogonal Polarization* (CALIOP), launched aboard the *Cloud-Aerosol LIDAR and Infrared Pathfinder Satellite Observation* (CALIPSO) in April 2006, provides vertical profiles of backscatter, extinction, optical depth, layer height and thickness.
- The Micro Pulse Lidar Network (MPLNET) is a worldwide network of Lidars co-located with Aerosol Robotic Network (AERONET) sun/sky photometers. Regular observations from IIT Kanpur site available since May 2009.



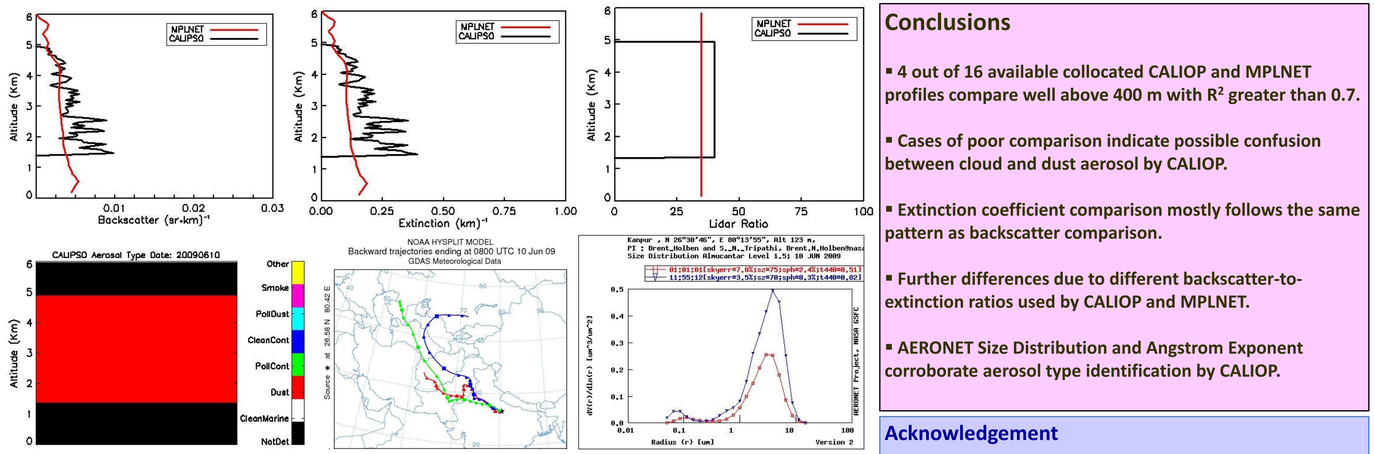
Monthly averaged profiles of MPLNET derived extinction coefficients for May 2009 to September 2010. No Level 2 MPLNET profiles were obtained for December 2009. Higher values of extinction are noticed at 2 to 4 Km during April and May, a period marked by heavy dust episodes. October to March are accompanied by high values of extinction near the surface *(Misra et al, 2012).*

Data Analysis

- Comparison of CALIOP derived backscatter and extinction coefficients made with corresponding quantities from *Micro Pulse LIDAR Network* (MPLNET) over Kanpur, India, for May 2009 to September 2010.
- Constraints: Difference between CALIOP and MPLNET observation time should be less than 3 hours.
- 24-hour HYSPLIT Backtrajectory analysis performed to make sure that both the instruments are measuring the same air parcel.
- The 400 m to 6 Km altitude range is divided into 100 m bins, and mean backscatter in each bin calculated. Linear regression of mean backscatters from the two instruments is performed to calculate R^2 and slope.
- CALIPSO Vertical Feature Mask, Lidar Ratios used by CALIOP and MPLNET for retrieval, and AERONET Size Distribution are used for detailed examination of the comparisons.
- Under the constraints, 16 cases are obtained, with 4 cases having good comparison (R^2> 0.7).



Comparison of CALIOP and MPLNET backscatter and extinction profiles, Lidar Ratio taken by CALIOP algorithm for the retrieval process, aerosol type inferred by CALIOP, 5-day backtrajectory ending at CALIOP overpass location, and AERONET derived aerosol size distribution for 16 October 2009 case. MPLNET observation time is 8.7 hrs. Both the profiles compare well at all heights above 1.5 Km (R^2= 0.85). CALIOP underestimates below 1.5 Km leading to lower value of slope of linear fit (=0.55). October is the burning season when agricultural fields are prepared for the next season. AERONET data shows AOD= 0.58 and α= 1.31 at CALIPSO overpass time which is indicative of fine particles. AERONET derived size distribution shows equally dominant fine and coarse modes. This information is well captured by CALIOP feature mask data that shows Dust below 2 km and Polluted Dust between 2 and 4 km. The 5-day backtrajectories at 1, 2 and 3 Km are seen to come across the dust dominated Western Indian region. MPLNET Lidar Ratio for this case is 39.77 sr. CALIOP Lidar Ratio is 40 sr between altitude 0 to 1.95 Km, and 55 sr between 1.95 to 4.35 Km.



Comparison of CALIOP and MPLNET backscatter and extinction profiles, Lidar Ratio used by CALIOP algorithm for the retrieval process, aerosol type inferred by CALIOP, 5-day backtrajectory ending at CALIOP overpass location, and AERONET derived aerosol size distribution for 10 June 2009 case. MPLNET observation time is 10.6 hrs. The aerosol type inferred by CALIOP is Dust which is reasonable with prevailing climatology during this season. AERONET data shows α = 0.28 and a single coarse mode size distribution which is indicative of dust aerosols. However, there is large gap in AERONET data and blocks in MPLNET data, implying possible cloud presence during the period. MPLNET Lidar Ratio is 34.80 sr, whereas CALIOP Lidar Ratio is 40 sr between 1.35 to 4.95 Km *(Misra et al, 2012)*

Conclusions

- 4 out of 16 available collocated CALIOP and MPLNET profiles compare well above 400 m with R^2 greater than 0.7.
- Cases of poor comparison indicate possible confusion between cloud and dust aerosol by CALIOP.
- Extinction coefficient comparison mostly follows the same pattern as backscatter comparison.
- Further differences due to different backscatter-to-extinction ratios used by CALIOP and MPLNET.
- AERONET Size Distribution and Angstrom Exponent corroborate aerosol type identification by CALIOP.

References

Amit Misra, S. N. Tripathi, D. S. Kaul, and Ellsworth J. Welton, (2012), Study of MPLNET derived aerosol climatology over Kanpur, India, and validation of CALIPSO Level 2 Version 3 Backscatter and Extinction products , *J. Atmos. Oceanic Tech.* (in Press)

Acknowledgement

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