

STUDY OF SEASONAL VARIABILITY IN THE MODIS AOD VALIDATION WITH GROUND TRUTH DATA OVER AHMEDABAD

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Satellite remote sensing has evolved as an efficient means of aerosol monitoring over an extended spatial scale on a routine basis. The measurement of aerosol properties from previous sensors was confined to remote sensing over oceans taking advantage of the dark background provided by the ocean surface. Aerosol remote sensing over land is more challenging and difficult on account of the surface reflectance related uncertainties. The Moderate Resolution Imaging Spectroradiometer (MODIS), launched aboard the NASA satellites Terra and Aqua in 1999 and 2002 respectively, has proved efficiency in space based monitoring of aerosols over land. It has large spectral coverage of 36 wavelengths providing valuable aid in cloud and snow detection, aerosol size monitoring, surface reflectance parameterization and several other applications. Its large swath of 2330 km provides global coverage every 1-2 days. The highlight of MODIS is aerosol remote sensing over land where it makes use of empirical relations regarding the surface reflectance parameterization to get around the biggest obstacle hindering the aerosol remote sensing over land. In spite of all the advantages, satellite remote sensing depends on ground based observations for details about aerosol models. Besides, ground based observations provide the benchmark to assess the validity and efficacy of retrieval algorithms. This also provides insight into cases where the retrieval algorithm works satisfactorily and cases where further improvement is required. The present work relates to the validation of MODIS derived aerosol optical depth over the urban site, Ahmedabad (72.53°E, 23.03°N), located in a semi arid region in the western Indian state of Gujarat. Based on the meteorological parameters, four seasons are considered for the validation viz, Dry (December to March), Pre-Monsoon (April and May), Monsoon (June to September) and Post-Monsoon (October and November). The MODIS derived aerosol optical depth is averaged over a $0.5^{\circ} \times 0.5^{\circ}$ region centered at Ahmedabad and compared with the Microtops sunphotometer observation taken within half an hour of the MODIS overpass time. Four years of MODIS aerosol optical depth data from 2002 to 2005 from both version 4 and updated version 5 are used for the validation study. Validation of AOD at 0.47 μm and 0.66 μm are treated separately. The comparison of version 4 data shows large scatter and slopes differing from unity for all seasons. The MODIS aerosol retrieval algorithm has recently been updated (version 5) to take into account the role of polarization, angular and seasonal dependence of surface reflectance ratios between visible and mid-IR wavelengths and include the latest aerosol models based on the worldwide AERONET sunphotometer network observations. The updated product shows improved correlation with the ground based observations [Figure 1]. The correlation is studied separately for different years and different seasons. Among years, 2005 has the best correlation possibly related to the higher amount of rainfall received during this year. Among seasons, Pre-Monsoon showed the best correlation whereas Dry season showed largest differences. Overall, the results indicate a better account of surface reflectance in the updated product. But the uncertainties related to the aerosol model are still present as the slopes of correlation are different from unity. The

underestimation is more at 0.47 μm during Dry and Post-Monsoon seasons, which are dominated by fine particles, whereas, for 0.66 μm it is more during Pre-Monsoon and Monsoon seasons, which are dominated by coarse particles.

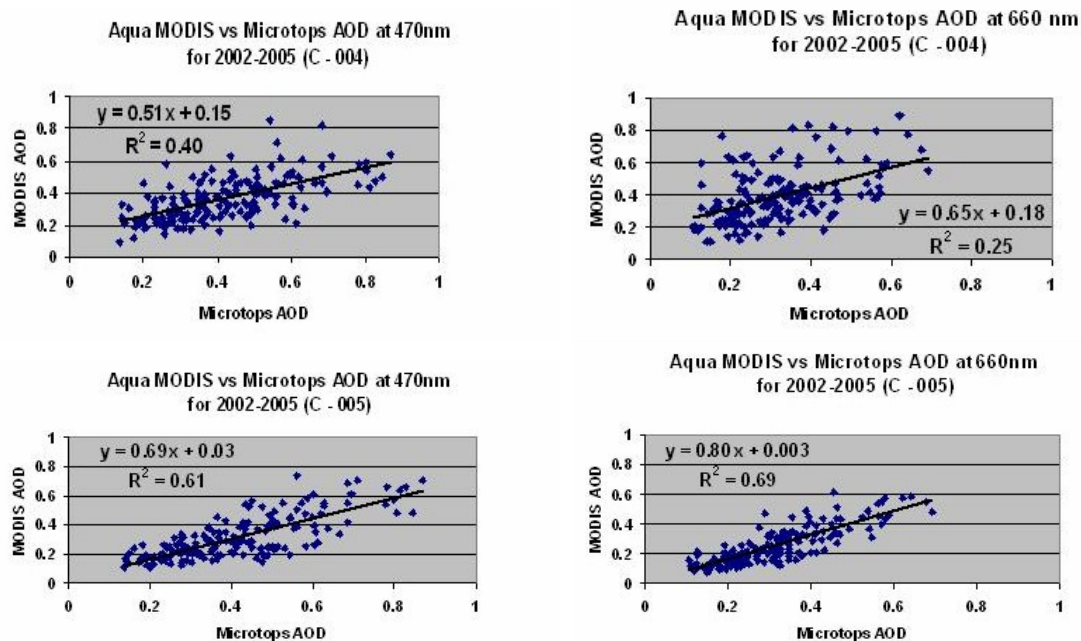


Figure 1. Comparison of MODIS derived AOD (versions C-004 and C-005) for 470 and 660 nm with ground- based sunphotometer data over Ahmedabad for the period 2002-2005

References

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