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Retrieval of the optical depth and vertical distribution of particulate scatterers in the atmosphere using O_2 A- and B-band SCIAMACHY observations over Kanpur: a case study.

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Owing to the known distribution of O_2 in the atmosphere, the strong O_2 A-band has been frequently used to derive aerosol and cloud properties from space. Using a synthetic study, we show that the combined use of the O_2 A and B-band provides additional information on the vertical distribution of atmospheric scatterers as both bands are very different in terms of their absorption strengths and underlying surface albedos. SCIAMACHY onboard ENVISAT is the first instrument to provide spectral data at moderate resolution ($0.2\,$nm-$1.5\,$nm) in the UV/VIS including both the O_2 A- and B-bands. Using SCIAMACHY specifications, we make combined use of these bands in an optimal estimation algorithm. Using information content analysis and synthetic studies, we show that our algorithm is applicable both over bright and dark surfaces for the retrieval of the parametrized vertical profile of aerosol, in addition to the optical thickness.

Due to computational and instrumental limitations, we restrict application to real data to a case-study over Kanpur through the year 2003. A comparison of the results with coincident AERONET data shows the same seasonal pattern of haziness over Kanpur, which manifests itself in a correlation coefficient of 0.92 for non-monsoon monthly mean AOTs. The retrieved particulate optical thicknesses are found to be anti-correlated with the relative contrast of the apparent lambertian equivalent albedos at $682\,$nm and $755\,$nm by a factor of 0.788, confirming the hypothesis made in *Sanghavi* et al, 2010. Retrospective comparison of retrieved vertical profiles with CALIPSO data shows that the retrieved heights are within in the seasonally expected ranges.