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Comparison of Contrast Reduction based MODIS AOT estimates with AERONET measurements

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Satellite remote sensing of aerosols offers global and seasonal coverage of aerosol distribution patterns resolving the spatial and temporal heterogeneities introduced by the existence of different sources and thus providing a more accurate and continuous quantification and characterization of the presence of aerosols in the atmosphere. Several retrieval methods have been implemented for various satellite sensors on an operational basis, providing global standard aerosol products such as Aerosol Optical Depth (AOD) and particle size related parameters. Current techniques such as dark pixel reflectance (MODIS, MERIS), multi-angle reflectance analysis (MISR, AATSR) or quantification of light polarisation by aerosols (POLDER) rely on known surface reflectance behaviours (e.g., low surface reflective bands or low sensitivity to polarised light) to separate the surface from the atmospheric signal by first modelling surface contribution. Their accuracy and has a limited application for highly reflective or heterogeneous surfaces such as urban, desert or snow covered areas. Another set of algorithms, the so-called Contrast Reduction based algorithms, might complement information given since their principle is based on the existence of a time invariant heterogeneous surface that allows AOT retrieval by measuring the contrast differences between a pair of images with similar viewing geometry. This paper presents the results of applying a contrast reduction based algorithm to a one year dateaset of MODIS images and comparing it to the AOT measurements of five European urban influenced AERONET stations (Barcelona, Cabo da Roca, Lille, Modena, Paris). Results demonstrate a high correlation (r=0.8, =0.05 and rmse=0.08) between the MODIS contrast reduction derived AOT results and the AERONET measurements, although a systematic overestimation is observed. The error analysis further shows sensitivity to observation geometry, time-lag between reference and polluted images, seasonality and the type of land cover surrounding a site. Future work will extend the validation of this technique to other AERONET stations to comprise a wider range of land cover conditions and therefore determine the limitations of the application of this algorithm to a larger scale product.