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Intercomparison of MODIS-Aqua C051 and C006 Level 3 Deep Blue AOD and Ångström exponent retrievals over the Sahara desert and the Arabian Peninsula during the period 2002-2014

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Dust loads emitted from the arid regions of Northern Africa and the Arabian Peninsula account for the major portion of the global dust aerosol burden. Depending on prevailing atmospheric circulation they can be transported far away from their source areas. Considering the key role of dust aerosols to weather and climate a better description of their spatial and temporal variability it is an issue of great importance.
The main target of the present study is to describe aerosols' regime over Northern Africa and Arabian Peninsula using Deep Blue aerosol optical depth (AOD550nm) and Ångström exponent (α412-470nm) measurements. Given the applied changes to the retrieval algorithm, emphasis is also given to the inter-comparison between the data from Collections 051 and 006. The analysis is performed using MODIS-Aqua daily Level 3 data at 1°x1° spatial resolution over the period 2002-2014. The study region extends from 20°W to 60°E and from 0° to 40°N.
The obtained long-term geographical distributions reveal many similarities between C051 and C006 AOD retrievals. They both indicate a zone of high AODs along the parallel of 15°N, extending from the western coasts of Africa to Chad where the maximum values ($\sim$1.3) are recorded. In the Arabian Peninsula, the maximum AODs (up to 0.6) are found in Iraq. On the contrary, more apparent differences between the two collections are found for α412-470nm. It is evident a reduction of C006 retrievals, which is more pronounced across the Sahara desert. In C006, the α412-470nm values over the deserts of Northern Africa and Middle East mostly vary from 0 to 0.6 while higher values (up to 1.5) are observed in sub-sahel regions, west coasts of Saudi Arabia and Iran. During the study period, in both collections, AOD has decreased by up to 93% in N. Africa (northern parts of Algeria) while it has increased by up to 70% in the Middle East (northern parts of Iraq). Reversed tendencies are found for the α412-470nm retrievals.
For the entire region, there is a good agreement between the C051 and C006 AOD retrievals (R=0.917). Nevertheless, the comparison reveals an overestimation/underestimation of C006 with respect to C051 in lower/higher AODs than 0.25. Although the seasonal cycle of AOD does not change from C051 to C006, showing double maxima in boreal spring and summer, positive differences (up to 20%) are found from March to August against negative differences (still up to 20%) in winter and autumn. For α412-470nm, there are negative differences up to 25% throughout the year although both retrievals co-variate in time (R=0.793). The intrannual variation of α412-470nm reveals that the lowest values ($\sim$0.5) are found from March to June while the highest ones (0.75-0.83) are observed in winter. According to our results, the seasonal cycles of AOD and Ångström exponent do not reveal significant year by year variation. The study will be complemented in the future by comparing C051 and C006 AOD and α412-470nm MODIS retrievals against corresponding ground measurements from AERONET stations within the study region.