

Seasonal Aerosol Optical Depth (AOD) variability using satellite data and its comparison over Saudi Arabia for the period 2002–2013

ABSTRACT

This study analyzes the spatiotemporal variations of seasonal Moderate Resolution Imaging Spectroradiometer (MODIS) Deep Blue (DB) AOD at 550 nm from the Aqua satellite over Saudi Arabia for the period 2002–2013. Satellite retrieved AOD is also compared with AERONET AOD over the Solar Village and KAUST station. The result of the seasonal AOD spatial distribution shows that the peak AOD value of 0.6 is observed over Hafr Al Batin, Riyadh, and the Rub Al Khali desert during spring, whereas the Gizan area shows the peak AOD during summer. In contrast, the autumn shows the peak AOD value of 0.5 over Dhahran and in the proximity of Jeddah, whereas Hafr Al Batin, Al Khafji, Al Jubail, and the Rub Al Khali desert show the peak AOD value of 0.4 in winter. Regression analysis shows the AOD increasing trends during spring, summer, and autumn (except for winter) over the entire Saudi Arabia. Over the Solar Village, the AOD increasing trends are also noted during spring and summer, whereas autumn and winter display the AOD decreasing trends. The AOD increasing trends are displayed in all seasons over KAUST. Hence, the AOD increasing/decreasing trends indicate that the number of dust storms either increases or decreases over these regions. Over the Solar Village, the correlation values for MODIS DB AOD versus AERONET AOD are 0.77 (spring), 0.62 (summer), 0.65 (autumn), and 0.75 (winter). Likewise, over KAUST, the correlation values for the same pairing are 0.85 (spring), 0.71 (summer), 0.81 (autumn), and 0.89 (winter). The incorrect aerosol model selection and imperfect surface reflectance calculation are responsible for reducing the correlation. Therefore, this study recommends that the DB algorithm can be used effectively to detect AOD over Saudi Arabia, which will further help to improve the MODIS DB AOD product utilizing the next version of the algorithm.