A simplified aerosol retrieval algorithm based on Landsat-8 and Sentinel-2 over urban area

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Observation of aerosols is critical due to aerosols radiative effects on radiation balance and adverse impacts on public health. Aerosol optical depth (AOD) which is the measure of aerosols distributed within a column of air from surface to the top of atmosphere is now a common index for investigating aerosols loading over the world. However, high spatial resolution AOD observations which is important for improving air pollution model especially in urban areas are still limited. In this study, a simplified aerosol retrieval algorithm based on the Landsat-8 and Sentinel-2 measurements is developed to retrieve high resolution AOD over urban areas. With the high resolution radiation measurements from the Landsat-8 and Sentinel-2 satellites, the spatial resolution of the retrieved AOD could be as high as 30 m. The retrieval algorithm is evaluated based on 5 year data from Landsat-8, 2 year data from Sentinel-2 and 5 year AERONET AOD data at 5 sites in Beijing. Overall, the correlation coefficient between the satellite-based AOD and AERONET provided AOD is better than 0.95. About 85.8% retrieved AOD based on the Landsat-8 measurements fall within the expected error(EE) with a root-mean-square error(RMSE) of 0.106 while 78.6% retrieved AOD based on the Sentinel-2 fall within the EE with the RMSE of 0.126. The results show that the new algorithm performs well in AOD retrieval over the complex urban area. The algorithm may provide a way to monitor high resolution air pollution in urban area and has potential to help improving current air pollution model.

Keywords: aerosol optical depth, high resolution aerosol retrieval, satellite, Landsat-8, Sentinel-2