High Temporal Resolution Aerosol Property Retrieval from EUMETSAT MSG/SEVIRI data

Yong Xue¹, Lu She²

¹ Faculty of Life Sciences and Computing, London Metropolitan University, 166-220 Holloway Road, London N7 8DB, UK
² Key Laboratory of Digital Earth Science, Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences, Beijing 100094, China

Abstract:

Aerosol products from polar-orbiting satellite sensors represent a significant improvement over those from other satellite imagers. However, polar-orbiting satellites are restricted to overpasses at a fixed local time, and thus cannot resolve the diurnal cycle and temporal evolution of aerosols. The geostationary satellites with high temporal resolution are capable of capturing the aerosol diurnal variation. This capability can be used to for air quality and dust transport studies and to further reduce the uncertainties in the current aerosol forcing estimations caused by high temporal variations of aerosol properties, thereby playing a role complementary to global aerosol optical depth (AOD) retrievals from polar orbiting satellites.

ESA is developing five new missions called Sentinels specifically for the operational needs of the GMES programme. Sentinel-4 is a payload that will be embarked upon a Meteosat Third Generation-Sounder (MTG-S) satellite in geostationary orbit scheduled to be launched in 2019. Sentinel-4 is dedicated to atmospheric monitoring.

In this article, we present a new algorithm named Land Aerosol property and Bidirectional reflectance Inversion by Time Series technique and apply it on MSG/SEVIRI data. Aerosol type, surface reflectance and AOD can be determined simultaneously. A detailed analysis of the retrieval results shows that it is suitable for AOD retrieval over land from SEVIRI data. Six AÉrosol RObotic NETwork (AERONET) sites with different surface types are used for detailed analysis and 42 other AERONET sites are used for validation. From 445 collocations representing stable and homogeneous aerosol type, we find that > 75% of the MSG-retrieved AOD at 0.6 and 0.8µm values compare favourably with AERONET observed AOD values, within an error envelope of ± 0.05 ± 0.15τ and a high correlation coefficient (R > 0.86). The AOD datasets derived using the TS method with SEVIRI data is also compared with collocated AOD products derived from NASA TERRA and AQUA MODIS (The Moderate-resolution Imaging Spectroradiometer) data using the Dark Dense Vegetation (DDV) method and the Deep Blue algorithms. Using the TS method, the AOD could be retrieved for more pixels than with the NASA Deep Blue algorithm. This method is potentially useful for air pollution and dust storm monitoring using SEVIRI observations.