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Aerosol retrieval from GF-5B DPC multi-angle data over Jing-jin-ji Region

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The Directional Polarimetric Camera (DPC) aboard the Chinese GF-5B satellite is designed to monitor aerosols and particulate matter (PM). In this paper, the aerosol content over the Jing-jin-ji (JJJ) Region was retrieved from the DPC's multi-angle signals using a combination of dark dense vegetation (DDV) and multi-angle methods [1, 2]. The retrieval process is outlined as follows: 1) Utilizing DPC data acquired at the nadir angle, the aerosol optical depth (AOD) for the default aerosol model was derived by applying linear parameters of land surface reflectance between the blue and red bands from the MOD09 surface product. 2) After atmospheric correction using the retrieved AOD, the surface reflectance at other angles was calculated. 3) The reflectance values in four bands were normalized, and the variance of the normalized reflectance at all angles was computed. 4) If the variance was found to be below a specified threshold, the output corresponded to the default aerosol model. If the variance exceeded the threshold, the AOD value associated with the minimum variance of other aerosol model was considered as the output.

Using the described method, AOD images were successfully retrieved over the JJJ region from DPC data between January and June 2022. Notably, on February 10, May 2, and June 20, the AOD images derived from DPC effectively depicted the distribution of aerosols across the JJJ region. To validate our method, aerosol products obtained from the AERONET Beijing-RADI site were utilized. Additionally, aerosol products from MODIS and GRASP [3] were collected over the Beijing-RADI site for the purpose of comparison. The MODIS AOD data included DDV and deep blue (DB) methods. The validation process for our method closely resembled that of GRASP. However, the validation outcomes for the MODIS DDV and DB methods were not as satisfactory as those of GRASP. The reduced number of validated cases for MODIS (DDV) can be attributed to sparse vegetation during the fall and winter seasons. In terms of evaluation metrics, the correlation coefficient (R^2) and root mean square error (RMSE) of GRASP were the most favorable among the four methods. Our method achieved an R^2 value greater than 0.9 and an RMSE lower than 0.1. Conversely, the results obtained from MODIS were notably higher than those from AERONET.

Keywords: DPC, aerosol, multi-angle, JJJ region

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