Information Content Analysis for multiangle satellite ultraviolet polarimetric measurements

Yanli Qiao[1], Gu Haoran[2,3]

1 Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Heifei 230031, China;
2 Aerospace Information Research Institute, Chinese Academy of Sciences, Beijing 100101, China;
3 University of Chinese Academy of Sciences, Beijing 100049, China

Many previous studies have shown that multiangle, multispectral polarimetric remote sensing can provide valuable information on aerosol microphysical and optical properties, in which the aerosol layer height (ALH) is an important parameter. Based on the optimal estimation (OE) theory and information content analysis method, we use the Unified Linearized Vector Radiative Transfer Model (UNL-VRTM) as the forward model to simulate the Jacobian results corresponding to the intensity and polarization radiance at the top of the atmosphere (TOA) under the variation of different aerosol microphysical parameters. With introducing the degree of freedom for signal (DFS) and a posteriori error to quantity the information content of ALH, we horizontally compare the ability of intensity and polarization measurements to retrieve the aerosol layer height under the multi-angle observation mode of the common satellite ultraviolet channels (such as 365nm and 388nm). The sensitivity study results show that: (1) The extended ultraviolet band is an important information source for passive remote sensing ALH retrieval. The variation of the aerosol model microphysical parameters has an important impact on the Jacobian results of scale height, and the magnitude of the influence is different. Therefore, the right choice of aerosol model types is very important for ALH retrieval. (2) The information content for the ALH retrieval is significantly improved by adding the multi-angle polarimetric measurements, while the polarization observation shows better results and it is less affected by the aerosol model error than the intensity measurements. Especially, it can improve the ALH retrieval under low aerosol optical depth (AOD). Combined with the ALH retrieval capability between different channels, the results of this study can help to develop the next generation spaceborne polarimetric sensors and corresponding ALH retrieval algorithm