Improved Inversion of Aerosol Components in the Atmospheric Column from Remote Sensing Data

Ying ZHANG, Zhengqiang LI, Yang OU

Aerospace Information Research Institute, Chinese Academy of Sciences, China

This study develops an improved algorithm for retrieving atmospheric columnar aerosol components from optical remote sensing data. This is achieved by using the complex refractive index (CRI) of a multi-component liquid system in the forward model and minimising the differences with observations. The aerosol components in this algorithm comprise five species combining eight sub-components including black carbon, water-soluble and water-insoluble organic matter, inorganic salt (ammonium nitrate, AN), sea salt (sodium chloride, SC), dust-like (DU), and aerosol water content in fine and coarse modes (AWf and AWc). The calculation of the complex refractive index (CRI) in the multi-component liquid system allows the separation of the water soluble components (AN, WSOM and AWf) in the fine mode and the sea salt (SC) and water content (AWc) in the coarse mode. The uncertainty in the retrieval results is analysed based on the simulation of typical models, showing that the complex refractive index (CRI) obtained from instantaneous optical-physical inversion compares well with that obtained from chemical estimation. The algorithm is not only used for ground-based remote sensing, but is also transferred to satellite inversion algorithms to obtain larger area-wide observations. Based on the POLDER observations, the study inverted the spatial distribution of aerosol optical, microphysical and chemical parameters in the North China region and made a preliminary comparison with ground-based observations. The comparison shows that the column mass concentration of aerosol black carbon mass concentration is consistent with that observed on the ground, and the MAE is 0.38. The mass ratios of black carbon, inorganic salt and organic aerosol are in good agreement with the mass ratios of the ground chemical sampling analysis results.