

Development of a Near-Sea- Level Calibration Algorithm for Aerosol Optical Depth Measurement Using a Ground-Based Spectrometer

Abstract

Aerosol optical depth (AOD) is a measurement that represents the total attenuation of solar terrestrial radiation caused by aerosols. Measurement of AOD is often performed using ground-based spectrometers, because this approach has the highest accuracy, as well as high spectral and temporal resolutions. However, frequent calibration of a ground-based spectrometer is often difficult for both absolute laboratories and the conventional Langley method. This is because the former are usually not readily available for most users, whereas the latter is always complicated by possible temporal drifts in the atmosphere. In this paper, a new Langley calibration algorithm was developed to allow frequent calibration, even at near-sea-level sites. The proposed algorithm uses a combination of clear-sky detection, the Perez-Du Mortier (PDM) model and a statistical filter to constrain the extrapolation to get the closest possible extraterrestrial constant over a wide range of the light spectrum. A high degree of linearity was observed between the near-sea-level irradiance predicted by the proposed algorithm and the reference value simulated by the SMARTS model. Overall, the results indicate that Langley calibration at low altitude is feasible provided that strict data screening is imposed. © Taiwan Association for Aerosol Research.