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Application of an improved artificial bee colony algorithm to inverse problem of aerosol optical constants from spectral measurement data

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Abstract:

An improved Artificial Bee Colony (IABC) algorithm is introduced to obtain the optical constants of aerosols from the spectral measurement data of the aerosol dispersion medium. The direct problem solved using the Finite Volume Method (FVM) combined with Mie scattering theory is used to study the radiative transfer process in the aerosol dispersion medium. Compared with standard Artificial Bee Colony (ABC) algorithm, the IABC can avoid local optima and improve convergence accuracy. Based on the IABC, the optical constants of aerosols over Harbin, China are retrieved under different random measurement errors. Results indicate that there is acceptable retrieval accuracy without errors, and the retrieval accuracy reduces if errors increase. To improve retrieval accuracy, two improved inverse models, namely as double-concentration and double-layer inverse models, are proposed. The investigation reveals that the improved inverse models, especially double-concentration inverse model, can give more accurate predictions even with errors. Finally, the optical constants of aerosols over Beijing available on the website of AERONET are also reconstructed by IABC satisfactorily. All the results show that the

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