# Retrieval of hygroscopic growth factor of uniformly mixed aerosol particles based on immune evolution algorithm

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Based on decomposition of atmospheric extinction coefficient and Mie scattering theory, the objective function, which has the sole variable of the hygroscopic growth factor of uniformly mixed aerosol particles, was established. Furthermore, immune evolution algorithm was further used to optimize the objective function, and a feasible method was proposed to retrieve hygroscopic growth factor of uniformly mixed aerosol particles. The performance of the method was evaluated by utilizing the hourly ground observation data from nephelometer, aethalometer and GRIMM180 environment particle monitor in Chengdu from October 2017 to December 2017, as well as the coincidental environmental and meteorological data, which includes atmospheric visibility, relative humidity (RH) and $NO_2$ mass concentration. The results suggest that the retrieval algorithm is characterized by fast convergence, robustness and precision for all tested samples. hygroscopic growth model of uniformly mixed aerosol particles was established during autumn and winter in Chengdu. Note that this model could significantly improve the simulation accuracy of aerosol scattering coefficient in ambient conditions. The advantage of this model is that the average relative error between the simulated and the measured is only 12.7%. The universal algorithm is beneficial for subsequent study on the aerosol hygroscopic properties and its radiative forcing impacts.

Keywords: aerosol, Mie scattering theory, hygroscopic growth factor, retrieval, immune evolution algorithm

 