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Study of the aerosol influence on errors in retrieving the CO_2 total column amount

Yu.M. Timofeyev, Ya.A. Virolainen, A.V. Vasilyev, A.V. Polyakov

Research Institute of Physics, St. Petersburg State University, 198504 St. Petersburg, Russia (Yu.M.Tim@JT14934.spb.edu/Phone:+7-812-4284486)

Measurements of outgoing reflected and scattered solar radiation in near-IR spectral range (1.61 and 2.06 μm CO_2 bands and O_2 band at 0.76μm) will be used in the Orbital Carbon Observatory (OCO) Project for retrieving the total CO_2. Having in mind high requirements to the accuracy of measuring the CO_2 total column amount (0.1-0.5%), it is essential to considerate accurately all possible sources causing retrieval errors and ways for eliminating those. In the paper, the influence of different types of aerosol on outgoing near-IR radiation and methods for accounting this influence in the CO_2 retrieval have been studied.

The study is based on constructing the statistical models of tropospheric aerosols of different types. Spectral correlations between different aerosol optical characteristics, errors of an approximation and an extrapolation of their spectral dependences were analyzed by calculating the spectral covariance matrices of optical aerosol characteristics (extinction and scattering coefficients, scattering phase functions) and their eigenfunctions.

It have been shown that the accuracy of the optimal parameterization of spectral dependence of aerosol optical characteristics (based on an expansion in terms of the orthogonal basis) is higher (by an order of magnitude and more) than the frequently used approximation based on Angstrom formula. Aerosol extinction coefficients in different spectral ranges are characterized by intense correlations, but spectral correlations between extinction coefficients and phase function parameters (the mean scattering cosines) are small. Statistical characteristics of the "effective measurement noise" caused by variations of microphysical and optical aerosol parameters are calculated. Different approaches to the minimization of aerosol influence based on invoking the

additional information (climatology and numerically modeled data, measurements by other satellite devices) are proposed and discussed.