Informativeness of satellite measurements of spectral aerosol extinction coefficient with respect to stratospheric aerosol microphysical properties

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Stratospheric aerosol has a great impact on such important processes in the atmosphere as the transfer of solar and thermal radiation, the cloud generation, the ozone photochemistry. To describe quantitatively this impact, it is necessary to determine the aerosol size distribution function (SDF). One of few remote methods for determining the SDF vertical profiles in global scale is based on a solution of the inverse problem on retrieving the SDF from measurements of spectral aerosol extinction coefficients (AEC). The AEC values are derived from sun occultation measurements (e.g. SAGE II, Ozon-Mir, POAM III, SAGE III experiments). In the report, the Shannon information content of AEC measurements with respect to SDF is calculated and analyzed and the impacts of the measurement data and used a priori information to the solution of the inverse problem are estimated. Similar analysis was also performed for the inverse problem on retrieving the SDF integral characteristics (total number density, area surface concentration and volume concentration). The calculations were carried out for different satellite devices (SAGE I, II and III) and different levels of AEC measurement errors. It has been shown that the solution of the inverse problem by statistical regression method is mainly formed by a priori statistical information on SDF (not by the measurement data). With Tikhonov regularization method, inputs of AEC measurement data and a priori information to the solution of the inverse problem are more or less the same.