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Ozone profile retrieval optimally for the trend analysis: on development of specialized retrieval algorithms

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Atmospheric ozone measurements are performed for solving two main groups of problems. The former includes analysis of the local atmospheric processes, such as radiative and photochemical simulation, and also local validation of other measurements. The latter includes statistical analysis of long-term observational series with the main goal to reveal the ozone trends and long-term variability. Available algorithms for processing of remote observations are intended for solving the problems of the former group and, therefore, are optimized just for analyzing the local processes. It is proposed a new kind of algorithms for ozone retrieval from remote sensing data - algorithms Specialized for Trend Analysis (STA). New STA retrieval algorithms could increase the current accuracy of trend estimation, because ozone data retrieved by a STA algorithm are intended for use only for the trend analysis. But if used for analysis of the local atmospheric processes the data could give worse results.

In simplified terms, the difference between STA algorithm and ordinary algorithm can be illustrated as follows. The current retrieval algorithm for analysis of the local atmospheric processes provide for a search of the optimum ratio between regular and random retrieval errors. A minimum of the sum of these errors is achieved. Regular errors can be described, for example, by bias or averaging kernel. A statistical analysis of observational series does not change the regular error and decreases the dispersion of random errors, since the latter obey the law of large numbers. Therefore, a statistical analysis destroys the optimum balance between regular and random errors, which is included in the current retrieval algorithms. Taking into account a decrease in the random error in the process of statistical analysis, a preventive decrease in the systematic error of ozone retrieval with the STA algorithm is necessary. However, this will result in some increase in the random error, but the total error could decrease if the data used

for trend analysis. The detailed theoretical consideration of the problem gave the value of the acceptable increase in the random error, which leads to maximum decrease in the total error.

It may be expected that the highest accuracy of estimation of the temporal variability will be achieved when the STA algorithms are applied to processing of data obtained with ozonometers characterized by averaging kernels differing significantly from the unit operator. For example, measurements can be performed with the SBUV and TOMS ozonometers or instruments based on the Umkehr method.