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New fast method to compute$k$-distribution parameters for any spectral channel of optical instruments

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As known, the radiative transfer with multiple scattering within a spectral range of gas absorption is a sophisticated problem and a straightforward approach (line-by-line calculations) is extremely time-consuming even with the most powerful computers.

The exponential sum fitting and k-distribution methods are the main methods of choice to solve this problem. Within these methods the mean radiance can be computed as a weighted average of some pseudo-monochromatic radiances. The k-distribution method seems to be more preferable.

A lot of satellite optical instruments with very different spectral channels are deployed currently and the conventional computation k-distribution parameters for each of them is a very time-consuming procedure, requiring the processing of huge detailed information about spectral gas absorption with regard to temperature and pressure.

A new method of computation of the k-distribution parameters for any satellite optical instruments characterized by own spectral channels using the preliminary developed mainframe data base of the k-distribution parameters for a very high spectral resolution is proposed and verified. The data base of the k-distribution parameters developed in the Institute of Environmental Physics (Bremen, Germany) for processing the SCIAMACHY data and available in Internet can serve as this mainframe base. The computation of the k-distribution parameters for any spectral channel with developed procedure takes a fraction of second on PC. The accuracy of this simple approach is demonstrated for the oxygen band 760 nm.

This newly developed approach seems to be very expedient for many problems solution, particularly in satellite remote sensing.