CONVOLUTION CALCULATION OF DIFFERENTIAL CROSS SECTIONS OF RING EFFECT

Dong Han[1,2,3], *Liangfu Chen*[1], *Weimin Wu*[3], *Shenshen Li*[1,2], *ChaoYu*[1,2]

1. State Key Laboratory of Remote Sensing Science, Jointly Sponsored by the Institute of Remote Sensing Applications of Chinese Academy of Sciences and Beijing Normal University, Beijing, China
2. Graduate University of Chinese Academy of Sciences, Beijing, China
3. Education Technology Department, Qingdao University, Qingdao, China

Beijing, China

E-mail: handong74@gmail.com

The Ring effect [1] is one significant limitation to the accuracy of the retrieval of trace gas constituents in atmosphere, while using satellite data with Differential Optical Absorption Spectroscopy [2] technique. The Ring effect refers to the filling in of Fraunhofer lines, which is known as solar absorption lines, caused almost entirely by Rotational Raman scattering[3]~[8]. The inelastic component of the molecular scattering results in a net increase of radiance in the line because more radiation is shifted to the wavelength of an absorption line than shifted from this wavelength to other wavelengths. The Rotational Raman scattering by N_2 and O_2 in the atmosphere is the main factor that leads to Ring effect. Basically, the Ring effect is considered as a pseudo-absorption process in retrieval of trace gas constituents in atmosphere [9]. The solar spectrum in Fig. 1 measured by OMI/AURA is convolved with rotational Raman cross sections of N_2 and O_2, divided by the original solar spectrum, with a cubic polynomial subtracted off, to create a differential Ring spectrum. This method has been suggested in order to obtain an effective differential Ring cross-section for the DOAS fitting process. The differential Ring spectrum could be used to improve the accuracy of the retrieval of the trace gases concentration. The results in this paper have been in basic agreement with the corresponding results calculated with radiative transfer model in Fig. 3, and the R^2 statistics are R^2(B)=0.9663,R^2(C)=0.9639,and R^2(D)=0.9624. At last but not the least, the computational complexity calculated at fixed wavelength of 410nm or of 488nm is 0.128% of that calculated with wavelengths from 410nm to 488nm.

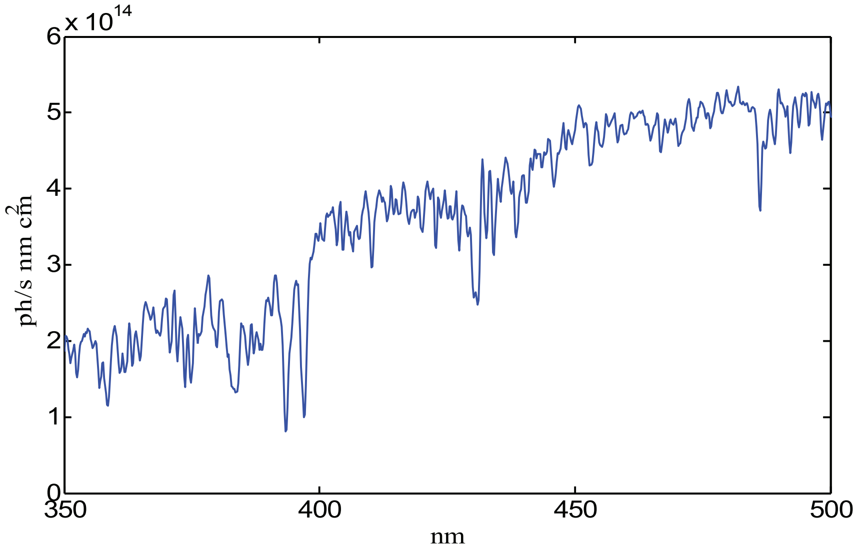

Fig. 1 The solar spectrum measured by OMI/AURA on February 6, 2008

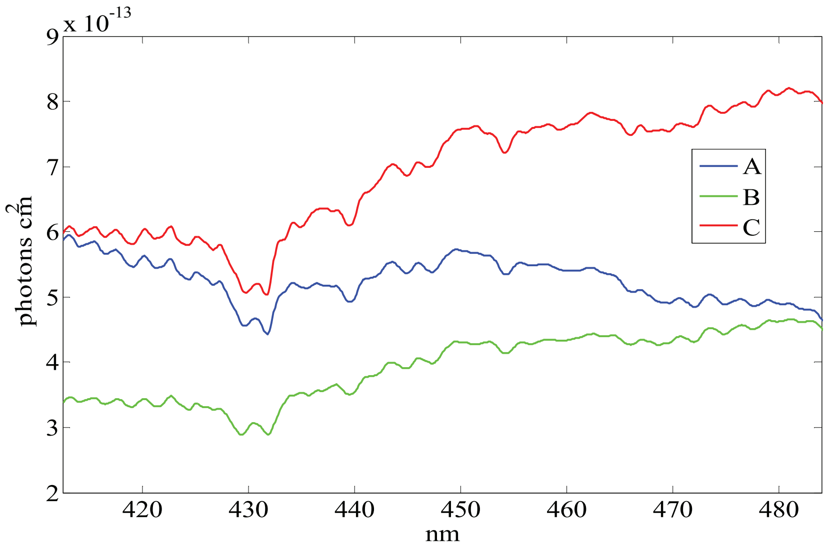

Fig. 2 The solar spectrum convolved with rotational Raman cross sections of N_2 and O_2 to create Ring spectrums

(A) Convolved with rotational Raman cross sections of N_2 and O_2 at wavelengths from 410nm to 488nm.

(B) Convolved with rotational Raman cross sections of N_2 and O_2 at wavelength of 488nm.

(C) Convolved with rotational Raman cross sections of N_2 and O_2 at wavelength of 410nm.

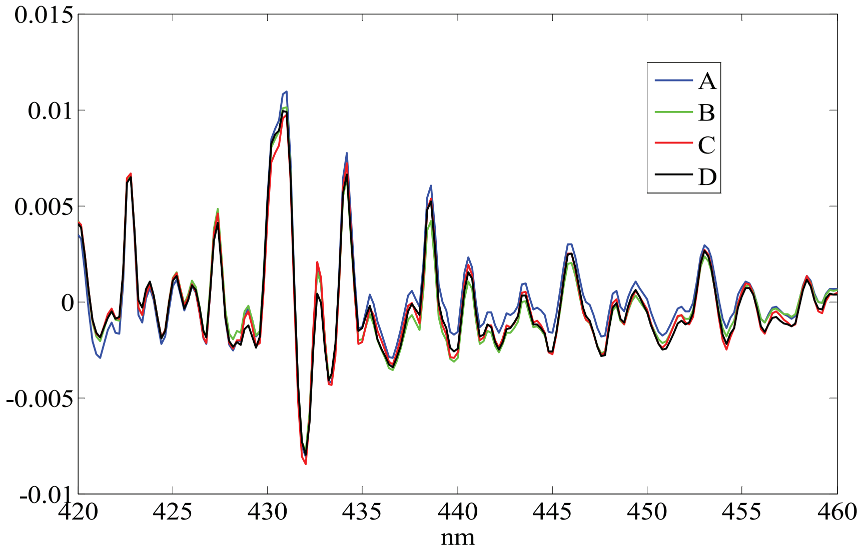

Fig. 3 Comparison of differential Ring spectrum calculated with RTM (A) and derived in this study after normalization at

(B) wavelengths from 410nm to 488nm,

(C) wavelength of 410nm,

(D) wavelength of 488nm.

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