An improved glyoxal retrieval from OMI satellite data

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1. Introduction

- Glyoxal (CHOCHO) is the smallest of the alpha-dicarbonyls and the most abundant in the atmosphere.
- CHOCHO is an intermediate product in the oxidation of most VOCs and an indicator of secondary aerosol formation in the atmosphere .
- The primary sources of CHOCHO are emission by plants, vegetation fires, and biofuel combustion.
- The major sinks of CHOCHO are photolysis, reaction with OH, and dry and wet deposition.
- CHOCHO columns can be determined by remote sensing using the Differential Optical Absorption Spectroscopy (DOAS) method.
- CHOCHO has been retrieval from SCIAMACHY and GOME-2 data at IUP-Bremen and from OMI spectra at SAO.

This study is focused on a new CHOCHO product from the OMI satellite instrument including preliminary testing of spectral interference with liquid water over ocean regions and comparison with CHOCHO retrievals using GOME-2 measurements over continental regions.

2. Glyoxal retrieval

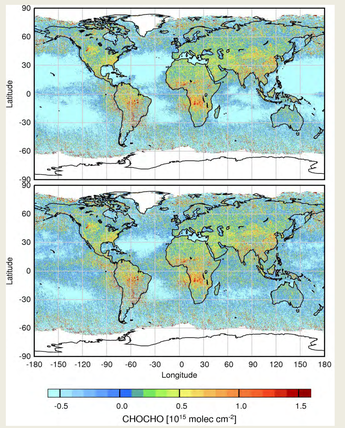
- The DOAS method allows for the determination of atmospheric trace gases with narrow absorption bands in the ultraviolet (UV) and visible.
- The retrieval is performed in two steps. First, the liquid water slant column (SC) is determined using a wider fitting window (410-495 nm) as negative values obtained in the standard glyoxal retrieval are correlated with the ocean regions with strong liquid water absorption. The second step consists of retrieval of CHOCHO in the window of 433-457.5 nm with a polynomial of order 4 and using the liquid water SC from the first fit over ocean regions.
- A normalisation over the Pacific is applited as in Vrekoussis et al., 2009.

Reference cross-sections	
Species	***Reference***
CHOCHO, NO_2 at 220 K and 298 K, O_4, H_2O vapor, Ring, H_2O liquid.	Volkamer et al. (2005), Vandaele et al. (1998) and Bogumil et al. (1999), Hermans et al. (unpublished data), HITRAN database,Vountas et al. (1998), Pope and Fry (1997)

3. Liquid water correction

The figure shows a comparison of monthly global maps of CHOCHO SCs during August 2007. At the top, it shows CHOCHO SC values obtained using the standard CHOCHO retrieval. At the bottom, it shows CHOCHO SCs using the two steps fit.

Clearly the CHOCHO results using the correction are improved over the oceans, because the negative values obtained over these regions are less pronounced. Nevertheless, the interference with liquid water is still present to a lesser degree, judging from the fact that negative CHOCHO SC values still remain.



4. Effect of high temperature NO_2 cross-section

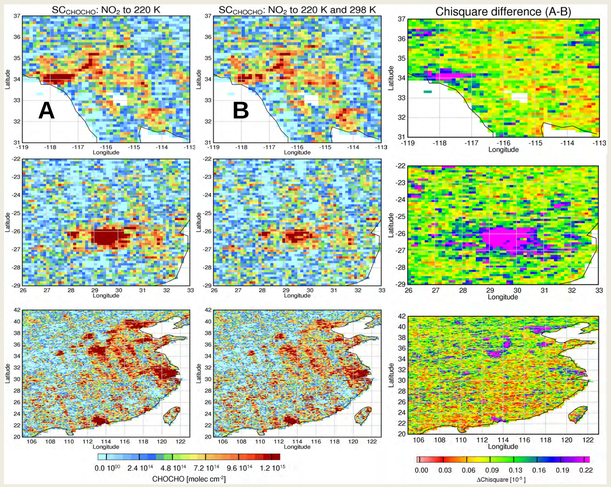
Some anthropogenic regions show unexpected high levels of glyoxal.

A reason for these high levels is possible interferences with NO_2 absorption.

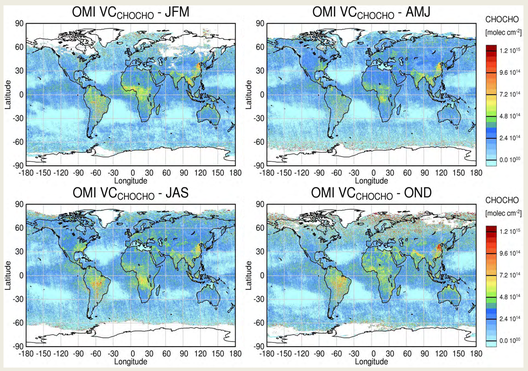
An additional NO_2 cross-section at high temperature is included in the glyoxal retrieval.

Monthly maps of glyoxal SC for September 2007 are shown in the figure.

The glyoxal values decreased over these regions and the chisquare improved. However, the high glyoxal values still remain over China, and on a smaller scale over Los Angeles and South Africa.

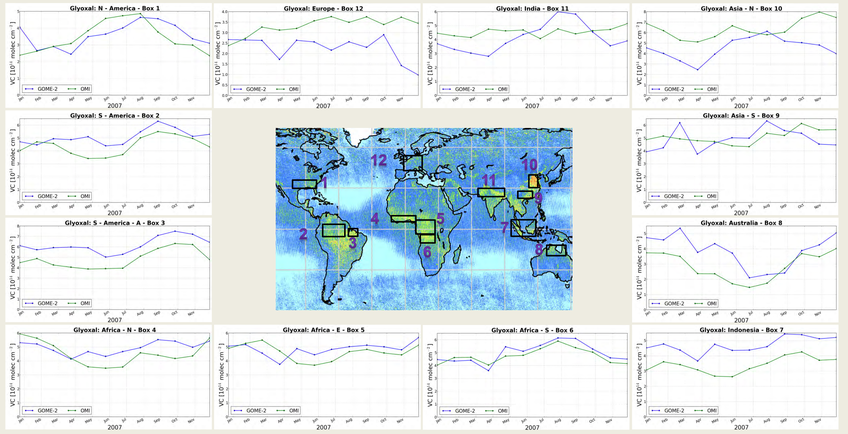


5. Glyoxal seasonal variaton and comparasion with the GOME-2 product



Monthly means of OMI CHOCHO vertical columns (VCs) for January, February, and March (JFM), April, May, and June (AMJ), July, August, and September (JAS) and October, November, and December (OND) in 2007.

High values are found over areas with large biogenic backgrounds such as South America and Africa but also over China.



The comparison of the seasonal variation of CHOCHO VCs from OMI and GOME-2 over some regions with biogenic and anthropogenic backgrounds shows a similar behavior and good agreement between both results. However, the GOME-2 values are slightly higher than OMI values for some regions with large biogenic background.

Regions with large anthropogenic NO_2 backgrounds (Asia N, Asia S, India, and Europe, North America) show high OMI CHOCHO values.

6. Summary and Outlook

- An improved glyoxal product has been retrieved from OMI data.
- Reduction in the negative values over ocean regions is obtained using the two steps retrieval proposed by Lerot et al.
- Using an additional high temperature NO_2 cross section reduces the high glyoxal values over regions with large anthropogenic NO_x emisions.
- The preliminary comparison of OMI glyoxal with GOME-2 results shows good agreement.
- The OMI values are systematically lower than GOME-2 glyoxal values for regions with biogenic background but higher over China.
- Further work will be performed in order to get a better correction of cloud and aerosol effects, in particular in the case of biomass burning when atmospheric aerosol levels are high.

Acknoledgements

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- **GOME-2** lv1 data have been provided by EUMETSAT.
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