Evaluation of the effect of strong aerosol loads on satellite retrievals of tropospheric NO$_2$, SO$_2$ and HCHO using MAX-DOAS observations in Wuxi, China

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Extraction of six days with haze pollution and without clouds

<table>
<thead>
<tr>
<th>Day</th>
<th>Scene</th>
<th>Local time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Day1</td>
<td>Jan 26, 2012, 13:30</td>
</tr>
<tr>
<td>2</td>
<td>Day2</td>
<td>Jan 27, 2012, 07:45</td>
</tr>
<tr>
<td>3</td>
<td>Day3</td>
<td>Jan 28, 2012, 14:45</td>
</tr>
<tr>
<td>4</td>
<td>Day4</td>
<td>Jan 29, 2012, 14:45</td>
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<tr>
<td>5</td>
<td>Day5</td>
<td>Jan 30, 2012, 14:45</td>
</tr>
<tr>
<td>6</td>
<td>Day6</td>
<td>Feb 1, 2012, 14:45</td>
</tr>
</tbody>
</table>

Table 1: geometry of cloud fraction, cloud top pressure, cloud optical thickness and AOD from MODIS and OMI UV aerosol index (at about 13:30) as well as the AOD, single scattering albedo and visibility, values from 12:30 to 14:30 on the seven days. The day 7 is specially used for Fig. 4 because of its small CRF.

Comparison of the boxAMFs, AMFs and VCDs from different procedures for OMI pixels

**Aerosol:** including MAX-DOAS aerosol profile. **Cloud and Cloudy:** box-AMF for clear and cloudy part of the OMI pixel (no aerosols). **Total:** box-AMF using independent pixel approximation. STD: box-AMF provided DOMINO and BIRA datasets.

**AMF**

- Aerosol clear and total AMFs are from the corresponding boxAMFs and MAX-DOAS shape factors. Aerosol, clear, total, STD and dataset VCDs are from the corresponding AMFs and satellite SCD. Dataset clear indicate the values from DOMINO and BIRA datasets. MAX-DOAS VCDs are from the MAX-DOAS profiles.

**VCD**

- Cases with haze pollution and without cloud interference.
- Aerosol and trace gas profiles from MAX-DOAS observational data. Study on the effect of aerosol and trace gases vertical distribution on tropospheric boxAMF, AMF and VCD of satellite observation.

**Shape factor effect:** The vertical distributions of SO$_2$ and HCHO from MAXDOAS are closer to the surface than those from the chemistry transport model. AMF including the MAX-DOAS shape factors are in general smaller than from the off-line datasets by 25% for SO$_2$ and 35% for HCHO and by -5% to 25% for NO$_2$.

**Effect on VCD:** Assuming the VCD_aerosol is most correct, the difference between OMI and MAX-DOAS VCD ranges from -40% to 28% for NO$_2$, from -70% to -8% for SO$_2$ and 40% to 200% for HCHO.

**Fig. 1:** MODIS true color images (about 13:30) and the vertical profiles of aerosol and trace gases retrieved by MAX-DOAS. AOD from AERONET (located at -18 km south-west of the site) level 1.0 and 1.5 and from MAX-DOAS.

**Fig. 2:** The boxAMFs from different procedures for one OMI pixel and shape factors of the trace gases and aerosol profiles.

**Fig. 3:** The AMFs and VCDs from different procedures for one OMI pixel.