Supplement of

Tropospheric ozone variability during the East Asian summer monsoon as observed by satellite (IASI), aircraft (MOZAIC) and ground stations

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Fig S1. Change (in tons specie) between 2010 and 2008 of NOx (upper panel) and NMVOCs (lower panel) emissions as derived from EDGAR-HTAP.

Table S1. Indian ground stations specific location and type

<table>
<thead>
<tr>
<th>Station name</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyderabad</td>
<td>78.48</td>
<td>17.37</td>
<td>Urban</td>
</tr>
<tr>
<td>Udaipur</td>
<td>73.68</td>
<td>24.58</td>
<td>Urban</td>
</tr>
<tr>
<td>Jabalpur</td>
<td>79.93</td>
<td>23.17</td>
<td>Urban</td>
</tr>
</tbody>
</table>

Table S2. Chinese ground stations specific location and type in the North China Plain (N1 to N7) and Pearl River Delta (P1 to P13). The station label is used in Figs. S1 and S2.
The NCP surface ozone was measured with a Model 49i or 49c ozone analyzer from Thermo Environmental Instruments (TEI) Inc. with a precision of 1 ppbv. Multipoint calibrations of the O$_3$ analyzer were conducted using a zero air supplier (Model 111) and a calibrator (TE 49c PS).

The O$_3$ at the PRD stations have been measured using an EC9810B ozone analyzer (Ecotech Co., Australia) based on the UV-absorption method and the Lambert–Beer law.

The O$_3$ at the Indian stations was measured using Model EC-9810 ozone analyzer (Ecotech, Australia) (Surendran et al., 2015)

<table>
<thead>
<tr>
<th>Station label</th>
<th>Station name</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>BD</td>
<td>115.52</td>
<td>38.87</td>
<td>Urban</td>
</tr>
<tr>
<td>N2</td>
<td>CZ</td>
<td>116.81</td>
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</tr>
<tr>
<td>N3</td>
<td>TS</td>
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</tr>
<tr>
<td>N4</td>
<td>SJZ</td>
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<td>38.03</td>
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</tr>
<tr>
<td>N5</td>
<td>BJ</td>
<td>116.37</td>
<td>39.97</td>
<td>Urban</td>
</tr>
<tr>
<td>N6</td>
<td>LF</td>
<td>116.75</td>
<td>39.6</td>
<td>Suburban</td>
</tr>
<tr>
<td>N7</td>
<td>XL</td>
<td>117.48</td>
<td>40.4</td>
<td>Rural</td>
</tr>
<tr>
<td>P1</td>
<td>Chengzhong</td>
<td>112.47</td>
<td>23.05</td>
<td>Urban</td>
</tr>
<tr>
<td>P2</td>
<td>Jinjuzui</td>
<td>113.26</td>
<td>22.82</td>
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</tr>
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<td>P3</td>
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<tr>
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<td>Nanshawanqingsha</td>
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<td>Tianhu</td>
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<td>23.65</td>
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</tr>
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</table>
Figure S2. Hourly observations of surface O$_3$ at the North China Plain stations during the EASM of 2011.

Figure 2 has suggested that the NCP region is not affected by the EASM as the rest of China, and we had a general persistence of high tropospheric O$_3$ column values. Figure S1 shows that the urban/suburban NCP stations (N1 to N6) have high diurnal variations with recurrent near-zero O$_3$ values suggesting high O$_3$ losses. This is due to the depletion of O$_3$ through titration by the freshly emitted NO which is common in the shallow nocturnal boundary layer in polluted regions (Duncan et al., 2008; Sillman et al., 1990). These stations show a small decrease from June to July due to the weak effect of the EASM on surface O$_3$ over this region.
Fig S3. Hourly observations of surface O$_3$ at Pearl River Delta during the EASM of 2011.

The ground observations of the PRD stations (P1 to P12) in Fig. S2 show frequent O$_3$ peaks and what is noted is that the decrease detected during the EASM is starting June whereas it was couple of weeks later in the NCP region. In fact, the EASM is latitude dependent and this region is lower in latitude and thus affected by the EASM earlier than the NCP region, a result also detected for the O$_3$ column in Fig. 2. The O$_3$ VMR increase afterwards in July and August and are comparable to the May values due to the decrease in monsoon strength over this region (also seen in Figure 2).

References


Air Pollution version-2 (HTAP-v2) emission inventory and Model for Ozone and Related chemical Tracers (MOZART-4), in press for Atmospheric Environment, 2015.