Figures and tables

Table 1 Annual CO emissions: *a priori* and *a posteriori* estimates for selected regions, Tg a⁻¹.

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Figure 3 Seasonal variation of CO concentrations at remote surface sites. Climatological observations from NOAA/GMD (1988-2001) [Novelli et al. 2003] are shown in black, 2004-2005 observations are in blue. Vertical lines show interannual variability of monthly mean concentrations. GEOS-Chem model values are shown in red (*a priori* sources) and in green (*a posteriori* sources). Note the differences in scale between panels.

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Figure 6 Scatterplots of CO observational datasets vs. the GEOS-Chem model. Points represent daily observations averaged over the 2° x 2.5° grid of the model for the period May 2004 – April 2005, with the exception of TES (July 2005 – April 2006) and the GMD/MOZAIC data (monthly climatological averages as described in Figures 3 and 4). The green dashed line is the 1:1 relationship. The red solid line is a reduced-major-axis (RMA) fit. Correlation coefficients and slopes are given inset. Symbols on the top three panels are colored by their degrees of freedom (DOF) for signal. Units are 10¹⁸ molecules cm⁻² for the satellite panels and 10² ppb for the GMD/MOZAIC panel.

Figure 7 Annual mean correction factors to the *a priori* combustion sources of CO from Figure 1 as derived from the adjoint inversion of MOPITT, AIRS, and SCIAMACHY CO columns for May 2004 - April 2005.

Figure 8. Ratio of *a posteriori* to *a priori* CO emission estimates for different seasons in (a) North America (b) Europe and Middle East, (c) Asia, (d) Africa and S. America.

Figure 9. Fractional *a priori* and *a posteriori* model bias against MOPITT, AIRS and SCIAMACHY during September, October and November of 2004 from the three dataset inversion (top and middle rows); *a posteriori* model bias against MOPITT, AIRS and SCIAMACHY CO during the same months from individual dataset inversions (bottom row).
Table 1 Annual CO emissions: *a priori* and *a posteriori* estimates for selected regions, Tg a⁻¹

<table>
<thead>
<tr>
<th>Region</th>
<th>Fossil fuel</th>
<th>Biofuel</th>
<th>Biomass burning</th>
<th>Total</th>
<th>Total</th>
<th>Best prior estimates²</th>
<th>Inverse model results³</th>
</tr>
</thead>
<tbody>
<tr>
<td>US⁴</td>
<td>35.2</td>
<td>2.5</td>
<td>2.6</td>
<td>40.2</td>
<td>49.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alaska and Canada⁵</td>
<td>1.4</td>
<td>0.4</td>
<td>15.4</td>
<td>17.2</td>
<td>21.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe⁶</td>
<td>60.4</td>
<td>15.2</td>
<td>2.5</td>
<td>78.1</td>
<td>94.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E Asia⁷</td>
<td>136</td>
<td>67.1</td>
<td>12.8</td>
<td>216</td>
<td>354</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE Asia⁸</td>
<td>43.6</td>
<td>45.7</td>
<td>83.4</td>
<td>173</td>
<td>306</td>
<td></td>
<td></td>
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<tr>
<td>S. America</td>
<td>15.8</td>
<td>16.6</td>
<td>86.6</td>
<td>119</td>
<td>183</td>
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<td></td>
</tr>
<tr>
<td>Africa⁹ (NH)</td>
<td>27.4</td>
<td>21.4</td>
<td>74.9</td>
<td>124</td>
<td>175</td>
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<tr>
<td>Africa⁹ (SH)</td>
<td>6.48</td>
<td>10.1</td>
<td>74.0</td>
<td>90.3</td>
<td>168</td>
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</tr>
<tr>
<td>Australia</td>
<td>4.1</td>
<td>1.3</td>
<td>17.2</td>
<td>22.6</td>
<td>40.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global</td>
<td>319</td>
<td>160</td>
<td>379</td>
<td>858</td>
<td>1350</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Values for May 2004 – April 2005. Oxidation of co-emitted NMVOCs from combustion contributes an additional 140 Tg a⁻¹ (*a priori*) and 217 Tg a⁻¹ (*a posteriori*). Oxidation of methane and biogenic NMVOCs contributes an additional 853 Tg a⁻¹ and 426 Tg a⁻¹ (*a priori*) and total of 1290 Tg a⁻¹ (*a posteriori*).  
² From the bottom-up emission inventories described in Section 3 and used as *a priori* for the inversion.  
³ Inversion using MOPITT, AIRS, and SCIAMACHY (Bremen) data for May 2004-April 2005.  
⁴ Contiguous 48 states. The fossil fuel source is from the EPA NEI 99 inventory, reduced by 60% on the basis of constraints from ICARTT aircraft observations in summer 2004 [Hudman et al., 2008].  
⁵ The summer of 2004 saw unusually large boreal forest fire activity in Alaska and Canada [Pfister et al., 2005; Turquety et al., 2007]  
⁶ European region (including European Russia) as defined by the EMEP emission inventory.  
⁷ Includes China, Korea and Japan, same as in Figure 2.  
⁸ Includes SE Asian regions described in Heald et al. [2004] and Kopacz et al. [2009]: India, SE Asia, Philippines and Indonesia  
⁹ Africa region as defined by Chevallier et al. [2009] and includes the Arabian peninsula
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Figure 8a. Ratio of \textit{a posteriori} to \textit{a priori} CO emission estimates in North America for different seasons.
Figure 8b Same as Figure 8a but for Europe
Figure 8c Same as Figure 8a but for Asia
Figure 8d Same as Figure 8a but for Africa and S. America
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