Supplement of Geosci. Model Dev., 9, 875–898, 2016
http://www.geosci-model-dev.net/9/875/2016/
doi:10.5194/gmd-9-875-2016-supplement

Geoscientific Model Development
Open Access
EGU

Supplement of

Representativeness errors in comparing chemistry transport and chemistry climate models with satellite UV–Vis tropospheric column retrievals

K. F. Boersma et al.

Correspondence to: K. F. Boersma (boersma@knmi.nl)

Horizontal representativeness errors for monthly mean comparisons

Table S1 shows the statistics of a comparison between monthly mean observed and simulated columns over the greater eastern United States in July 2006, for different degrees of fractional coverage required. Although the optimal agreement (best spatial correlation, smallest differences) is achieved by requiring a per-grid cell total fractional coverage of 0.4-0.7, the agreement does not worsen much for more relaxed coverage constraints, because the looser requirements are offset by the increased number of days available for calculating a monthly average (with up to 25 days available in case of minimum fractional coverage of 0.1), curbing potentially large representativeness errors.

Table S1. Comparison between monthly mean tropospheric NO_2 columns over the eastern United States (30°-44° N, 90°-72° W, 42 grid cells) observed by OMI and simulated by TM5 at a 3° × 2° resolution for July 2006.

Fractional coverage	Mean bias (OMI–TM5)	RMS error	R^2	days	Ratio OMI/TM5
0.05	$+0.67\ 10^{15}$	$0.43\ 10^{15}$	0.757	25.8	1.484
0.10	$+0.67\ 10^{15}$	$0.42\ 10^{15}$	0.764	24.3	1.482
0.20	$+0.64\ 10^{15}$	$0.41\ 10^{15}$	0.779	21.6	1.465
0.30	$+0.62\ 10^{15}$	$0.40\ 10^{15}$	0.784	19.5	1.454
0.40	$+0.62\ 10^{15}$	$0.39\ 10^{15}$	0.800	17.4	1.450
0.50	$+0.62\ 10^{15}$	$0.39\ 10^{15}$	0.798	15.7	1.451
0.60	$+0.60\ 10^{15}$	$0.39\ 10^{15}$	0.807	14.1	1.441
0.70	$+0.57\ 10^{15}$	$0.39\ 10^{15}$	0.804	12.2	1.415
0.80	$+0.56\ 10^{15}$	$0.41\ 10^{15}$	0.780	10.6	1.414
0.90	$+0.51\ 10^{15}$	$0.41\ 10^{15}$	0.785	9.1	1.376

Examples of application of the averaging kernel

Figure S1 shows monthly averaged averaging kernels along with the NO_2 profiles from GEOS-Chem with and without the kernels applied for a grid cell in the North Sea in February 2006 and for a grid cell over Siberia in August 2006. Over the North Sea, GEOS-Chem and TM4 feature comparable NO_2 columns, but in contrast to the examples shown in the main text, the GEOS-Chem profile shape is now more peaked towards the surface than the TM4 profile, in contrast to the NO_x source regions, where GEOS-Chem profiles are more vertically mixed than those from TM4. With the reduced sensitivity in the boundary layer (kernel values < 1), the GEOS-Chem column is reduced (by 14%) and in closer agreement with the average OMI NO_2 column (2.1×10^{15} molec. cm^{-2}) after application of the kernel relative to the column without the kernel applied. Over Siberia, GEOS-Chem simulates substantially enhanced NO_2 columns, probably from biomass burning. The TM4 a priori does not show any sizeable biomass burning enhancements, and the GEOS-Chem column is halved after application of the kernel, reflecting the reduced sensitivity below 600 hPa. Again, the column agrees better with the average OMI column (0.3×10^{15} molec. cm^{-2}) if the kernel is applied.

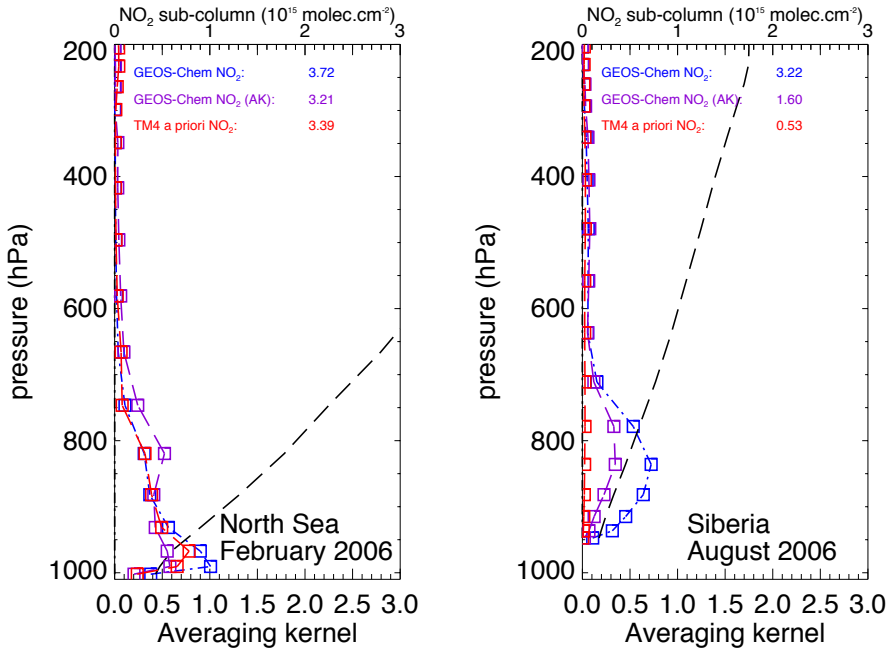

Figure S1. Vertical averaging kernel (black dashed line) and NO_2 profiles simulated by GEOS-Chem (blue), TM4 (red), and GEOS-Chem convolved with the averaging kernel (purple) following Eq. (5). Left panel: monthly average for February 2006 over North Sea grid cell (centered on 54°N, 1.25°E). Right panel: monthly average for August 2006 over Siberia grid cell (centered on 58°N, 108.75°E).