Atmospheric
Measurement
Techniques

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Supplement of

The CU 2-D-MAX-DOAS instrument – Part 1: Retrieval of 3-D distributions of NO_2 and azimuth-dependent OVOC ratios

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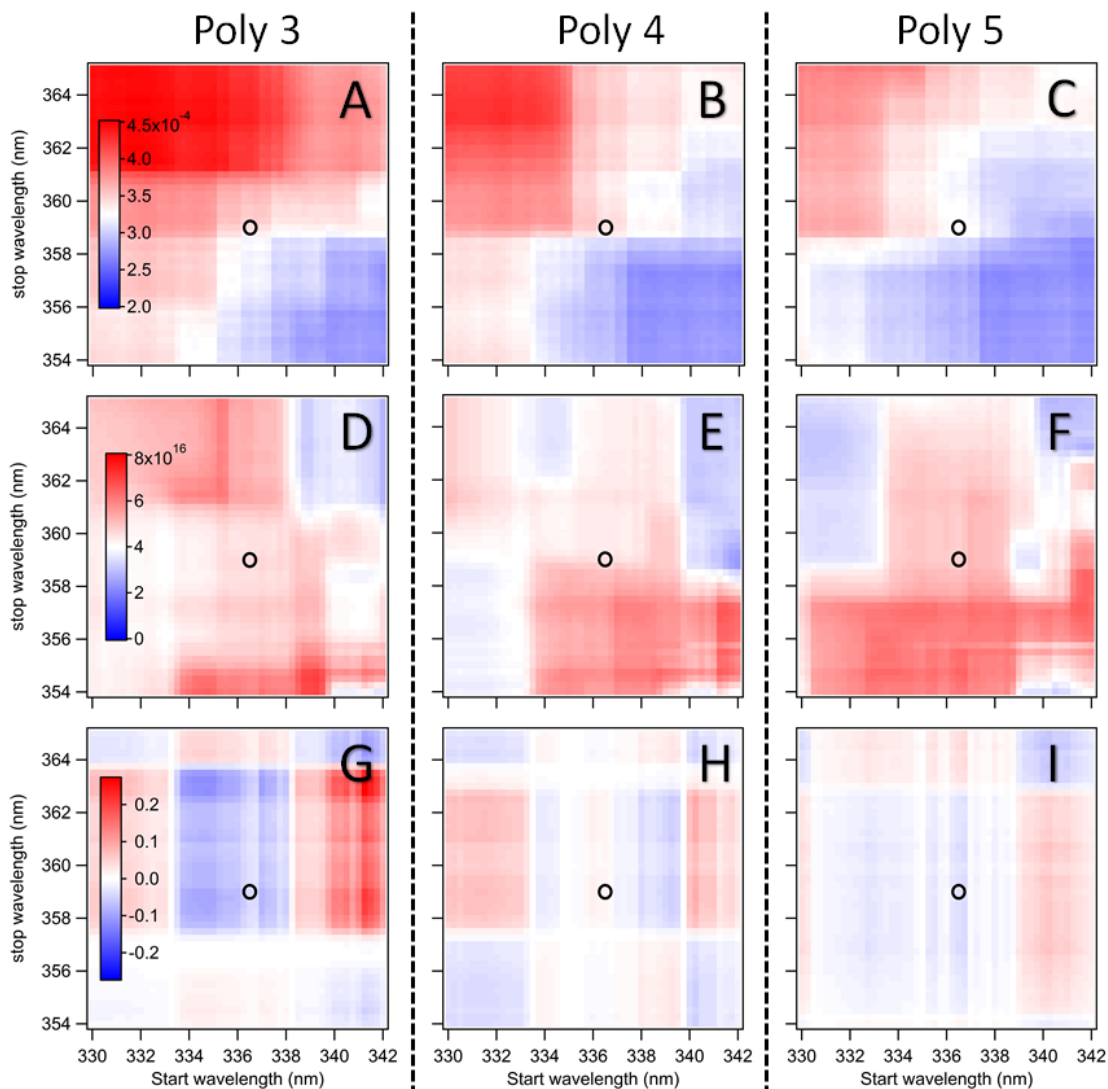
Figure S1. Sensitivity studies of the spectral window for the fit of HCHO (see figure 3 and tables 3 and 4). The top row (A-C) shows the RMS achieved using different polynomial degree (columns). Middle row shows the HCHO dSCD (D-F), and bottom row shows the degree of correlation between HCHO and BrO (G-H) - positive values correspond to some correlation and negative values anti-correlation. As can be seen the retrieval of HCHO is stable under different conditions and the retrieval window applied in this work (black open circle) with a polynomial degree of 3 shows less correlation with BrO with minimum RMS in agreement with Pinardi et al. (2013).
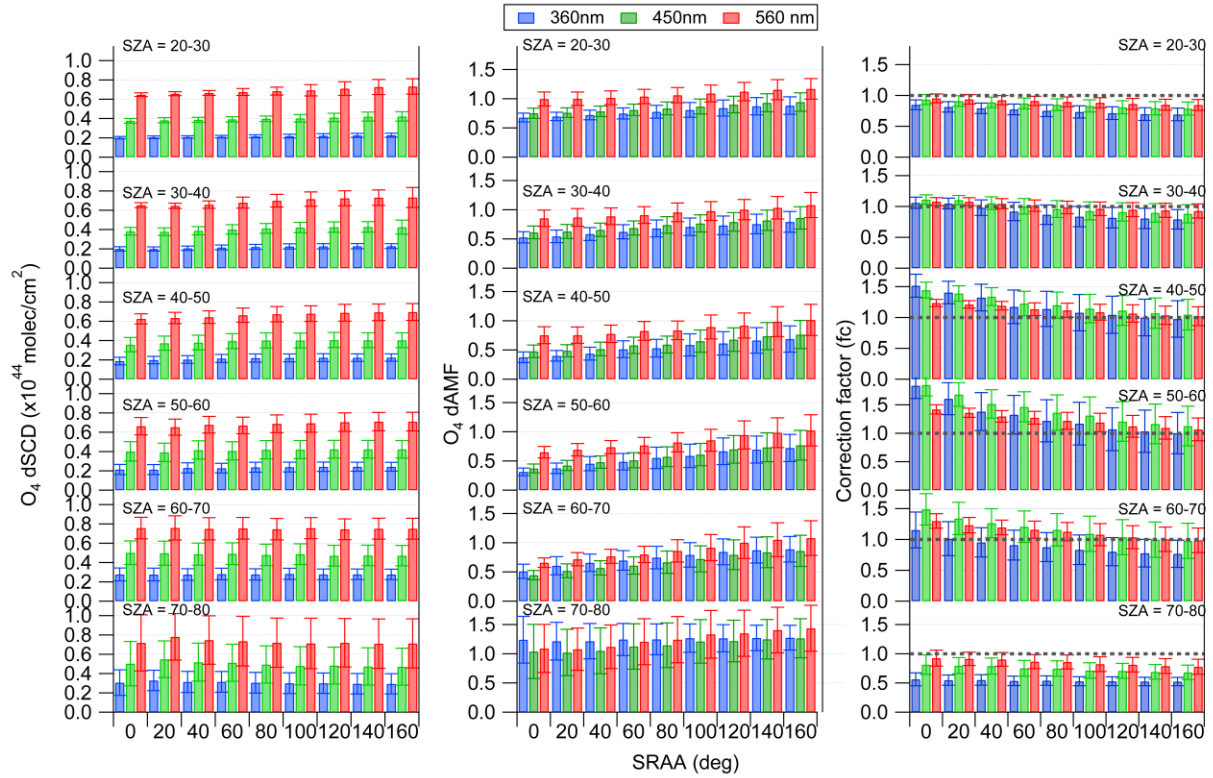
Fig S2. O_4 input parameters to equations 5 and 6; and fc as a function of SRAA and SZA. The error bars in O_4 dSCD reflect the variability of the measurements, and the error bars in O_4 dAMF and fc reflect sensitivity studies from Table 5.
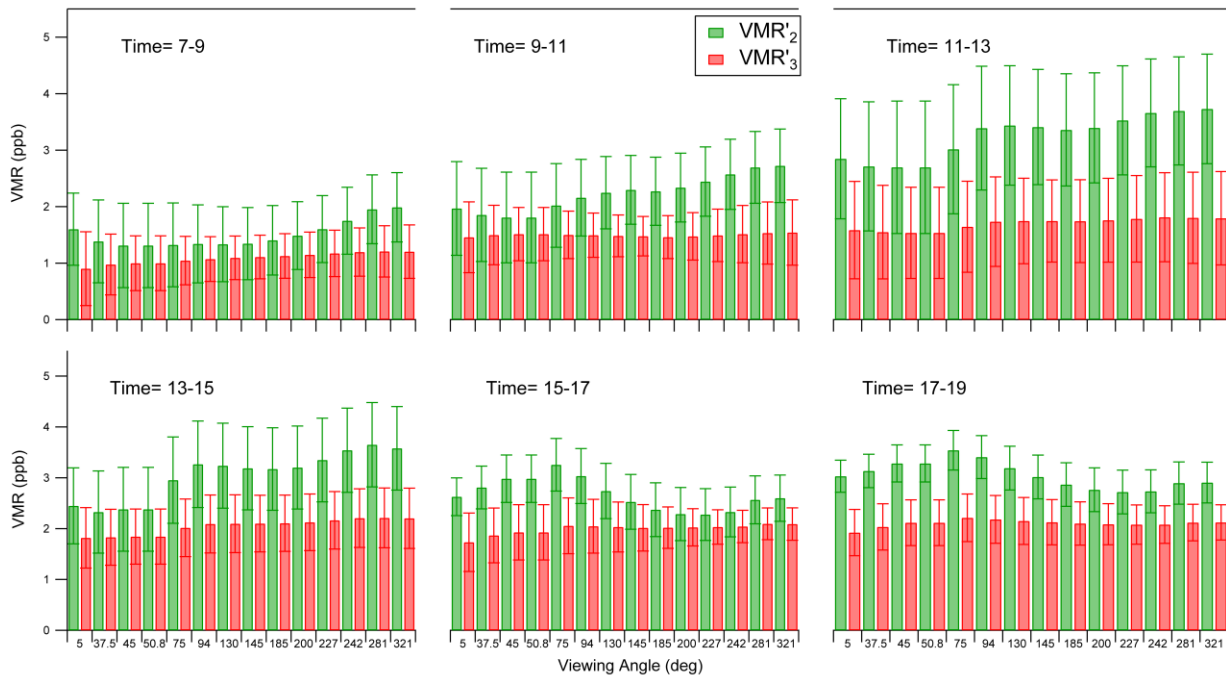
Fig S3. Azimuth and time dependence of NO$_2$ VMR$_2$ and VMR$_3$. The data from Figure 9 is binned using data from 2hr time intervals. The error bars represent the overall uncertainty after error propagation.
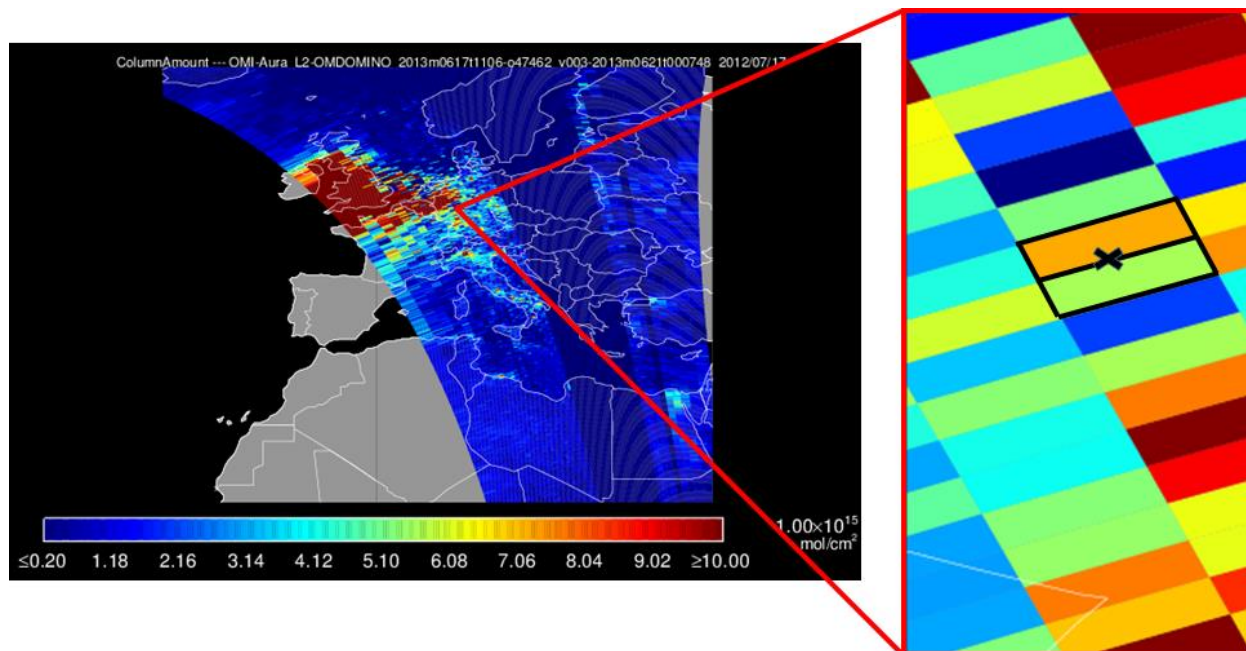

Figure S4. Tropospheric NO$_2$ VCD obtained on June 17 2013 with the OMI instrument (data derived with the DOMINO v2.0). On the right it is shown the NO$_2$ VCD pixel around Mainz (cross). The two pixels representative of the path length probed by the CU 2D-MAX-DOAS are marked. The size of the pixel is ~15x30km.
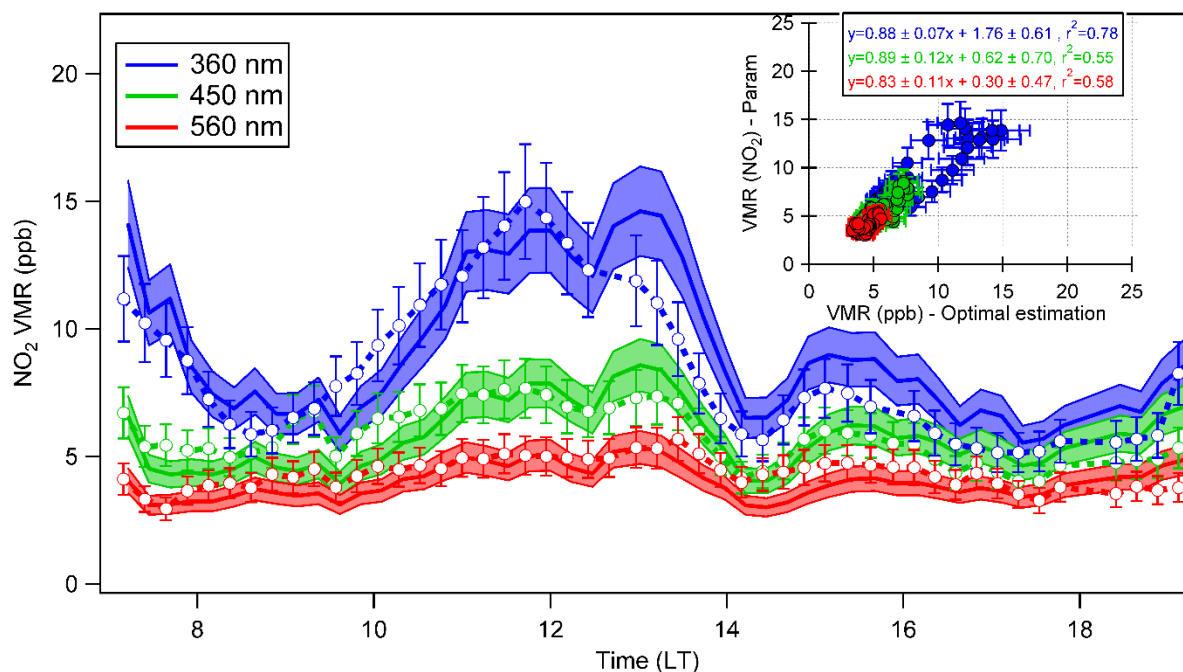
Figure S5. Multi-wavelength comparison of NO_2 time series using the parameterization approach (continuous lines) and optimal estimation (open circles). In order to account for the different range sensitivity we have averaged the NO_2 profiles from figure 6 to a similar representative height of the parameterization approach for each wavelength. In this case we have used a height of 0.2, 0.6, and 1.0 Km for the 360, 450, and 560nm. The insert shows the linear correlation for each wavelength.