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*Supplement of*

## **The CU 2-dimensional MAX-DOAS instrument – Part 1: Retrieval of NO<sub>2</sub> in 3 dimensions and azimuth dependent OVOC ratios**

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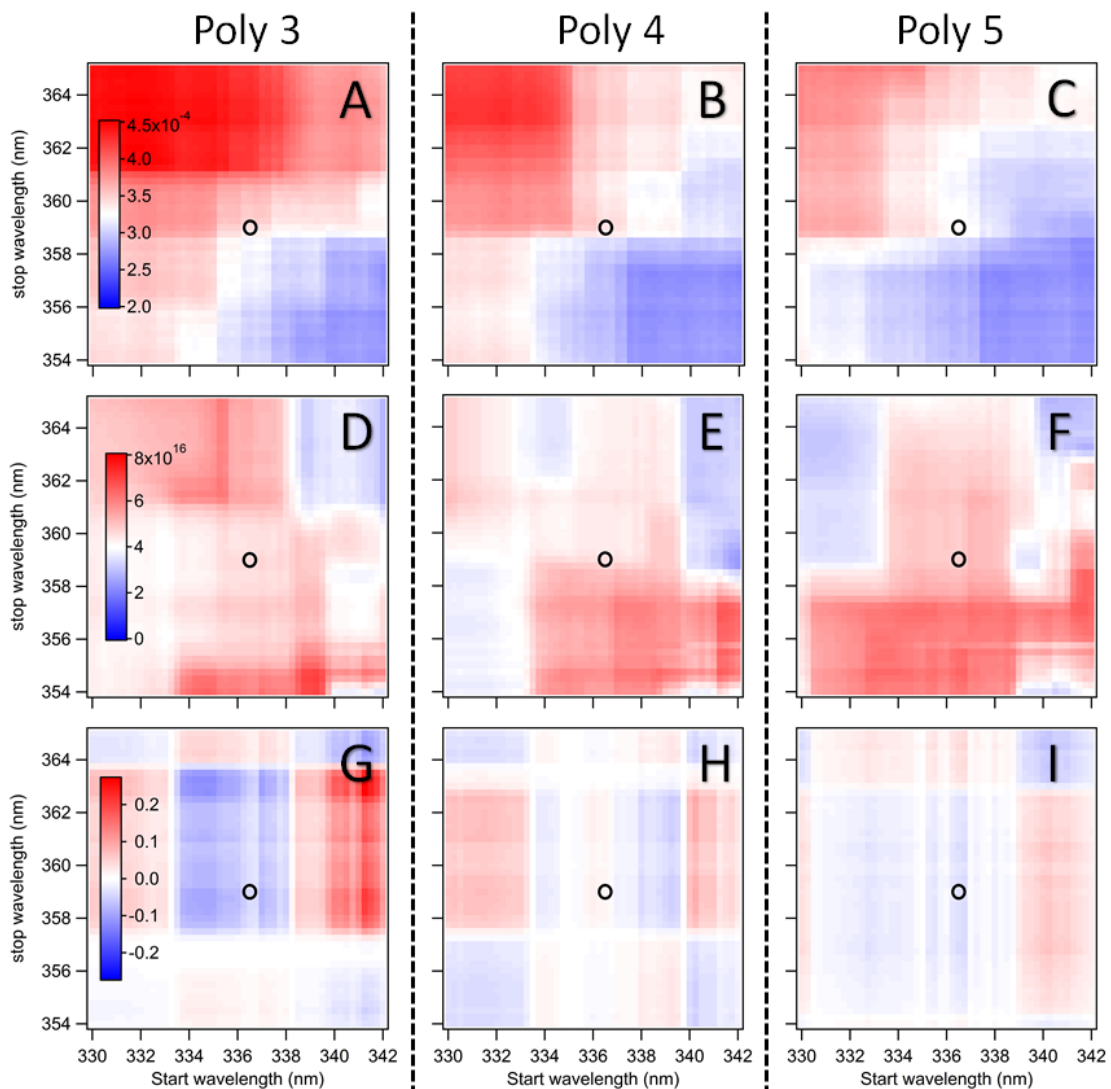


Figure S1. Sensitivity studies of the spectral window for the fit of HCHO (see figure 3 and tables 3 and 4). The top row (A-C) shows the RMS achieved using different polynomial degree (columns). Middle row shows the HCHO dSCD (D-F), and bottom row shows the degree of correlation between HCHO and BrO (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).

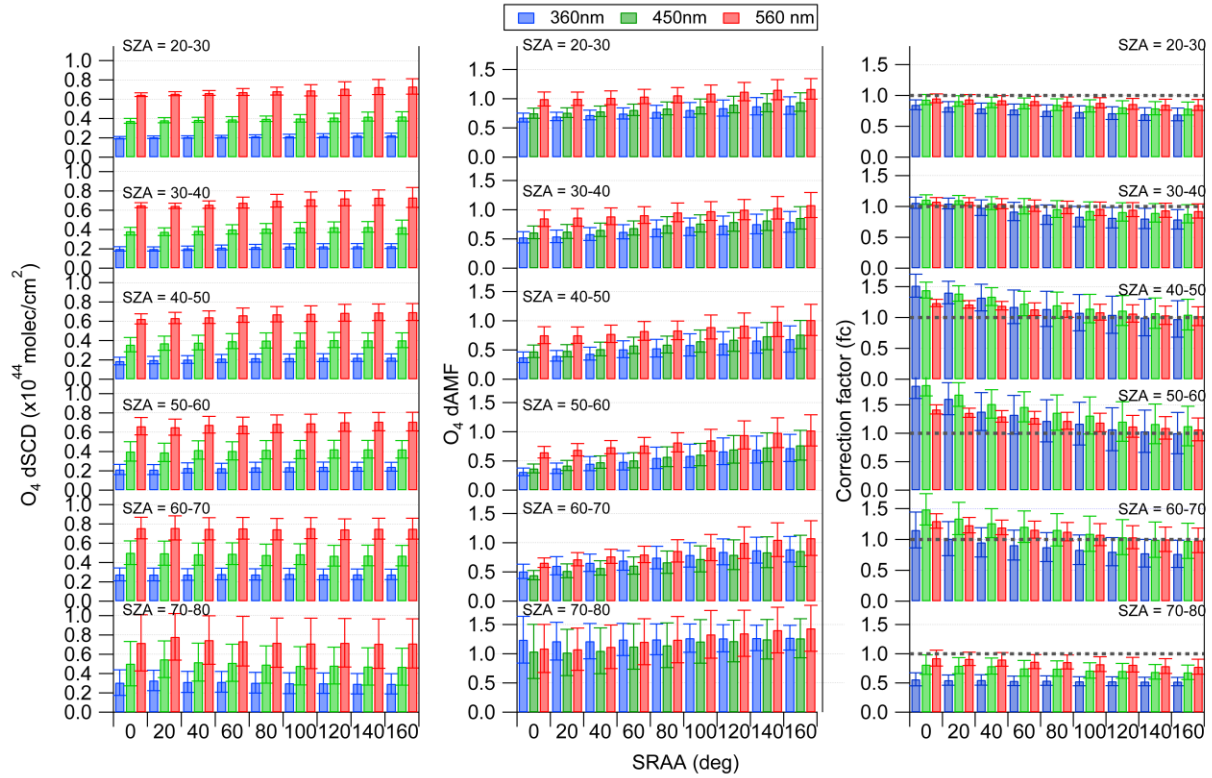


Fig S2.  $O_4$  input parameters to equations 5 and 6; and  $fc$  as a function of SRAA and SZA. The error bars in  $O_4$  dSCD reflect the variability of the measurements, and the error bars in  $O_4$  dAMF and  $fc$  reflect sensitivity studies from Table 5.

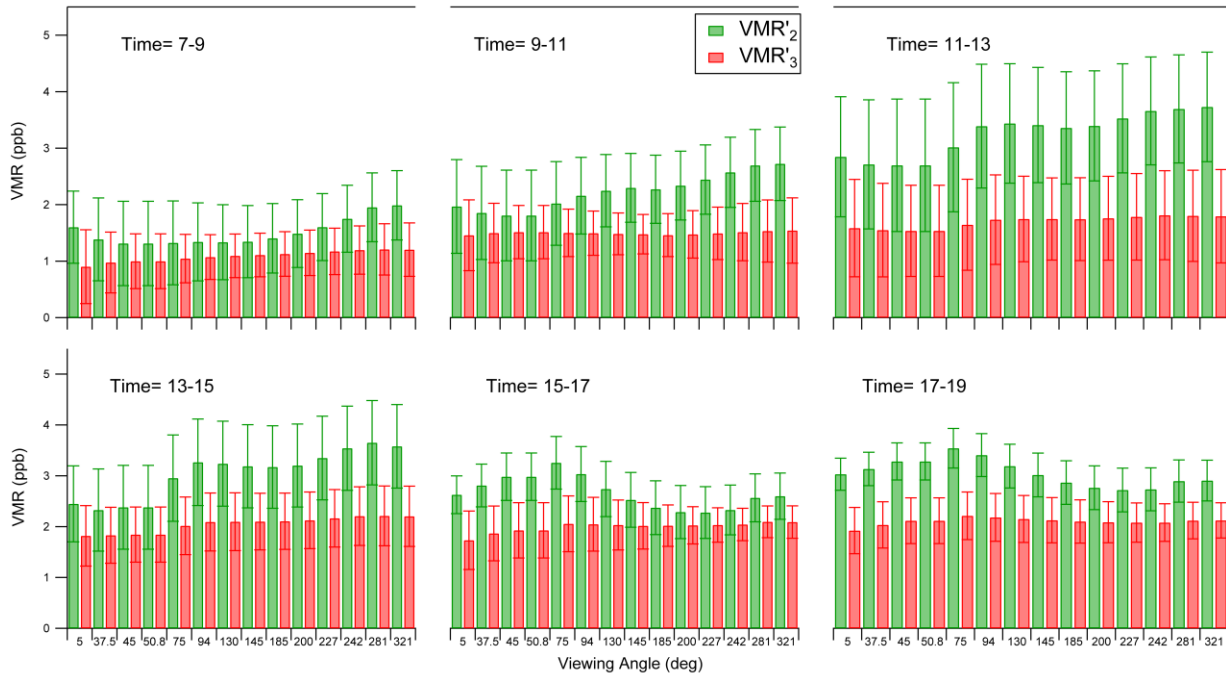


Fig S3. Azimuth and time dependence of  $\text{NO}_2$   $\text{VMR}_2$  and  $\text{VMR}_3$ . The data from Figure 9 is binned using data from 2hr time intervals. The error bars represent the overall uncertainty after error propagation.

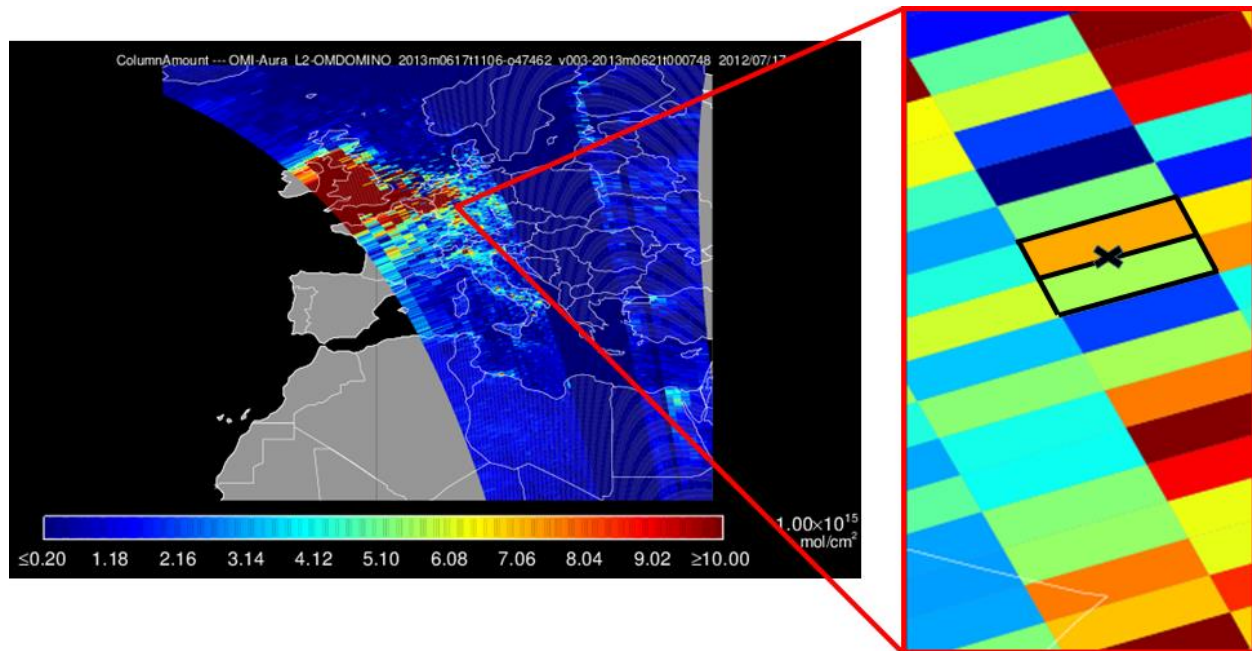


Figure S4. Tropospheric  $\text{NO}_2$  VCD obtained on June 17 2013 with the OMI instrument (data derived with the DOMINO v2.0). On the right it is shown the  $\text{NO}_2$  VCD pixel around Mainz (cross). The two pixels representative of the path length probed by the CU 2D-MAX-DOAS are marked. The size of the pixel is  $\sim 15 \times 30 \text{ km}$ .