

Iodide-CIMS and m/z 62: The detection of HNO_3 as NO_3^- in the presence of PAN, peracetic acid and O_3

Raphael Dörich,¹ Philipp Eger,¹ Jos Lelieveld¹ and John N. Crowley.¹

¹Atmospheric Chemistry Department, Max Planck Institute for Chemistry, 55128, Mainz, Germany

Correspondence to: John N. Crowley (john.crowley@mpic.de)

Supplementary Information

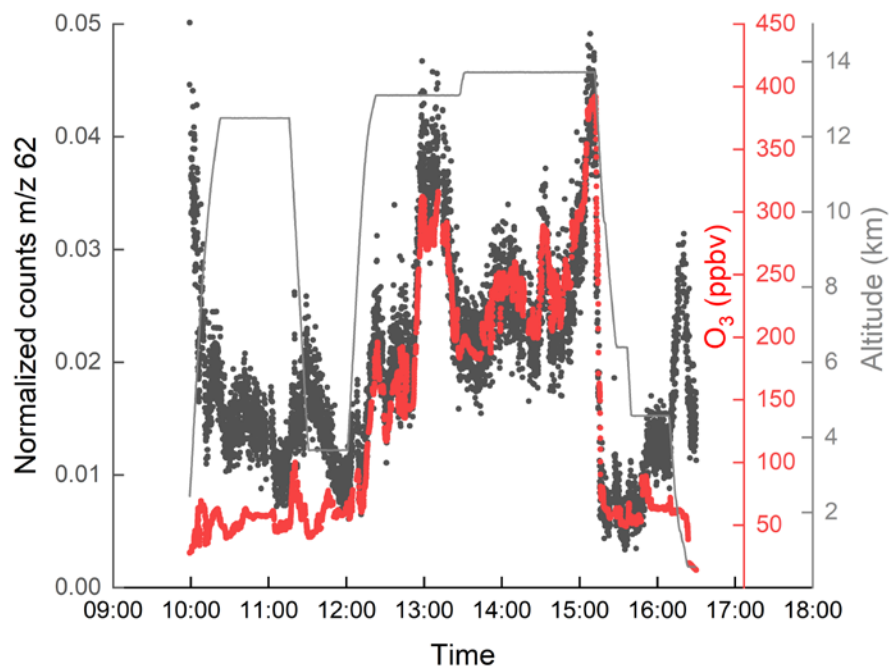


Figure S1. Signal at m/z 62 and O₃ mixing ratios during airborne operation of the I-CIMS during the HALO campaign “CAFE-Africa”.

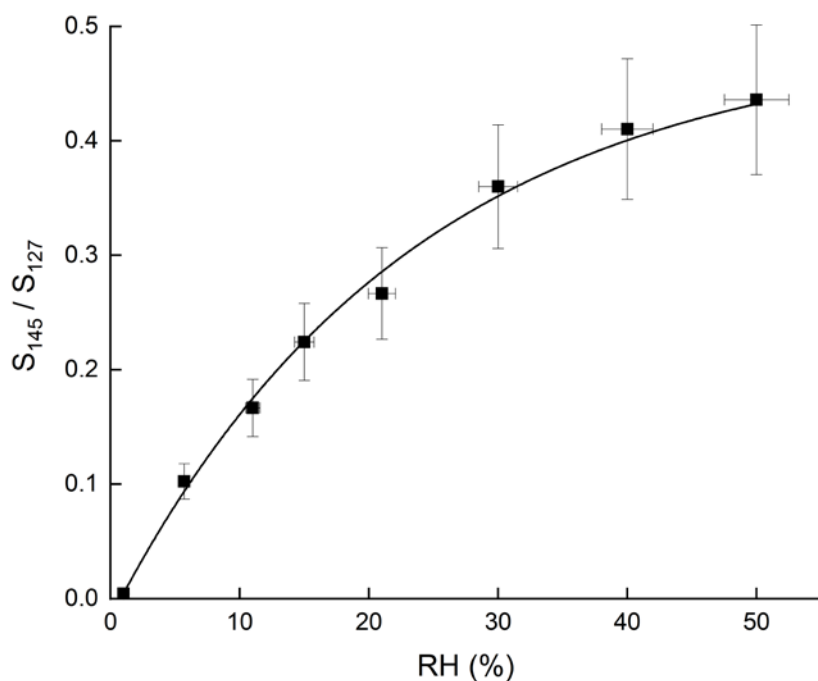


Figure S2. Dependence of the ion-signal ratio m/z 145 / m/z 127 (corresponding to $I(\text{H}_2\text{O})$ and I^- , respectively) on the degree of humidification of zero-air entering the inlet. The relative humidity (RH) was monitored with a hygrometer (Testo 625) at a pressure of 1 bar and a temperature of 298 K. The regression line is: $\text{RH} = -24.616 \ln\{0.969 - (1.923 \times S_{145} / S_{127})\}$.

Using the expression above RH can be converted to a mixing ratio (MR), pressure (P, in mbar) or concentration (C, in molecule cm^{-3}) of H_2O in the IMR via:

$$\text{MR} = \frac{\left(\frac{\text{RH}}{100} \times 31.7\right)}{1000} \times \frac{1200}{2000}$$

where 31.7 is saturation vapour pressure (mbar) of H_2O at 298 K, 1000 is ambient pressure (mbar), 1200 and 2000 are the humidified and total flows (in sccm), respectively into the IMR.

$$P(\text{H}_2\text{O}) = \text{MR} \times 24$$

Where 24 is the pressure (in mbar) in the IMR

$$C(\text{H}_2\text{O}) = P(\text{H}_2\text{O}) \times 2.43 \times 10^{16}$$

Where 2.43×10^{16} is a conversion factor for mbar into molecule cm^{-3} at 298 K

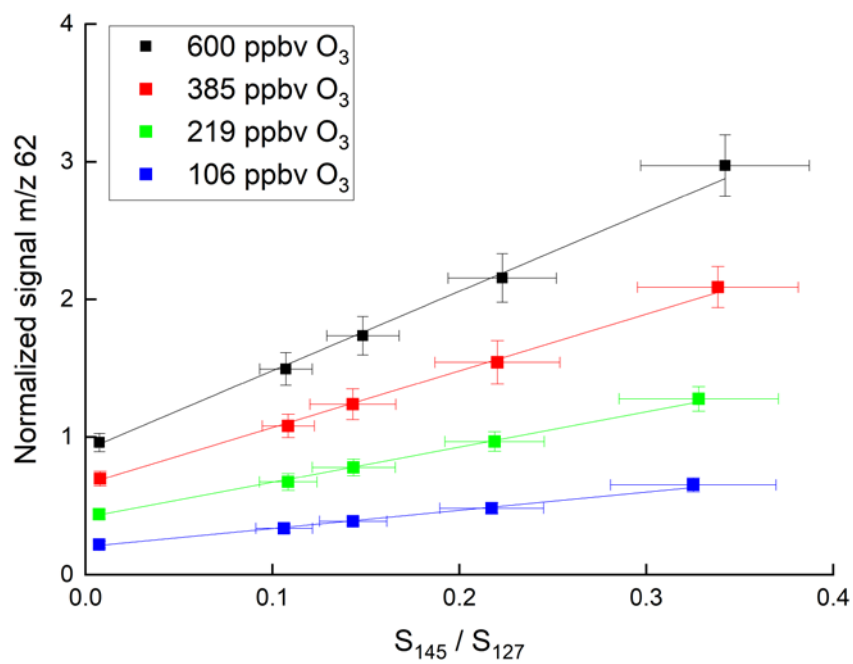


Figure S3. Dependence of the signal at m/z 62 from 38.5 ppb of HNO_3 on the amount of H_2O in the IMR (as indicated by the ratio of signals of I^- (m/z 127) and its water cluster (m/z 145)). The error bars are 1σ statistical uncertainty in the signal at m/z 62, m/z 127 and m/z 145

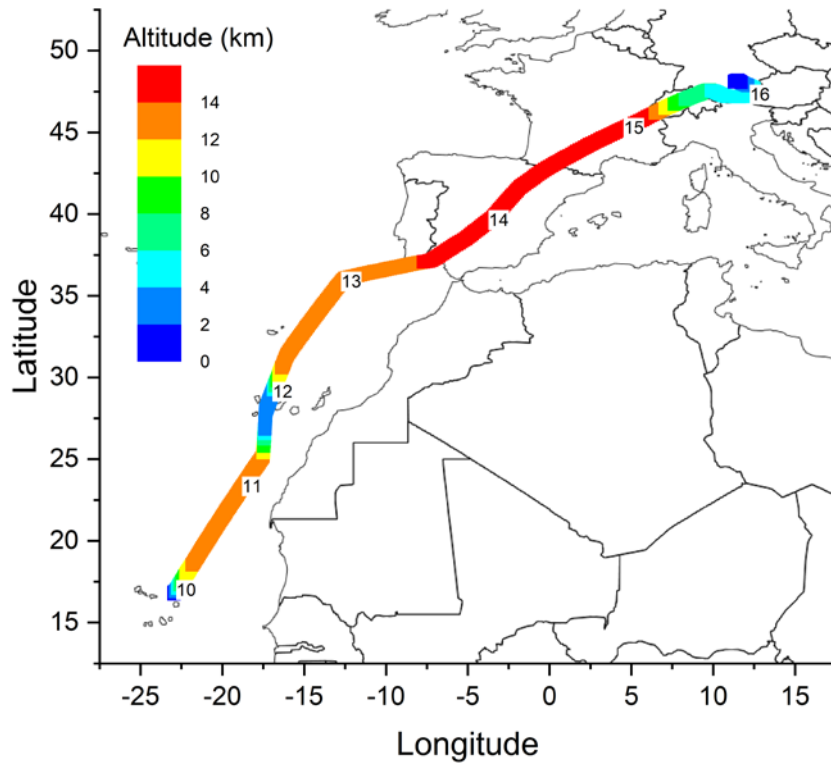


Figure S4. Flight track (colour coded with altitude) during the return leg (Cap Verde Islands to Oberpfaffenhofen) of the HALO-campaign “CAFE-Africa”. The numbers on the track indicate the time (UTC).

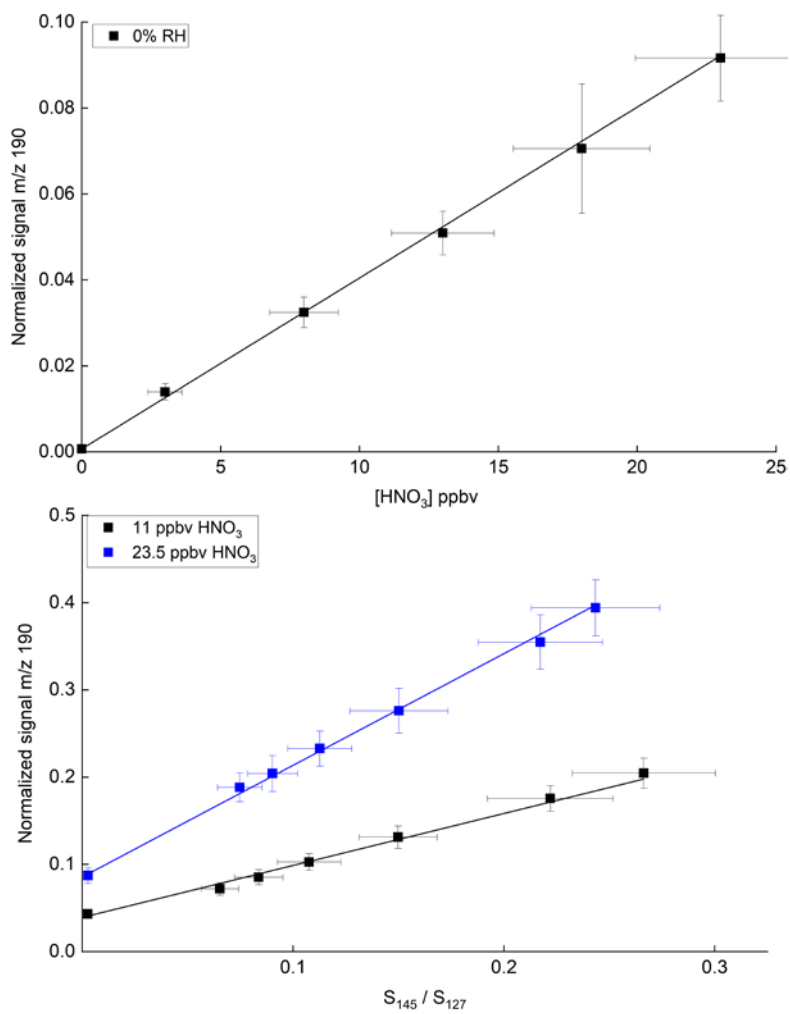


Figure S5. Upper panel: Dependence of the signal at m/z 190 due to the $\text{I}(\text{HNO}_3)$ cluster on the HNO_3 mixing ratio. Lower panel: Dependence of the signal at m/z 190 on the relative humidity (S_{145}/S_{127}).

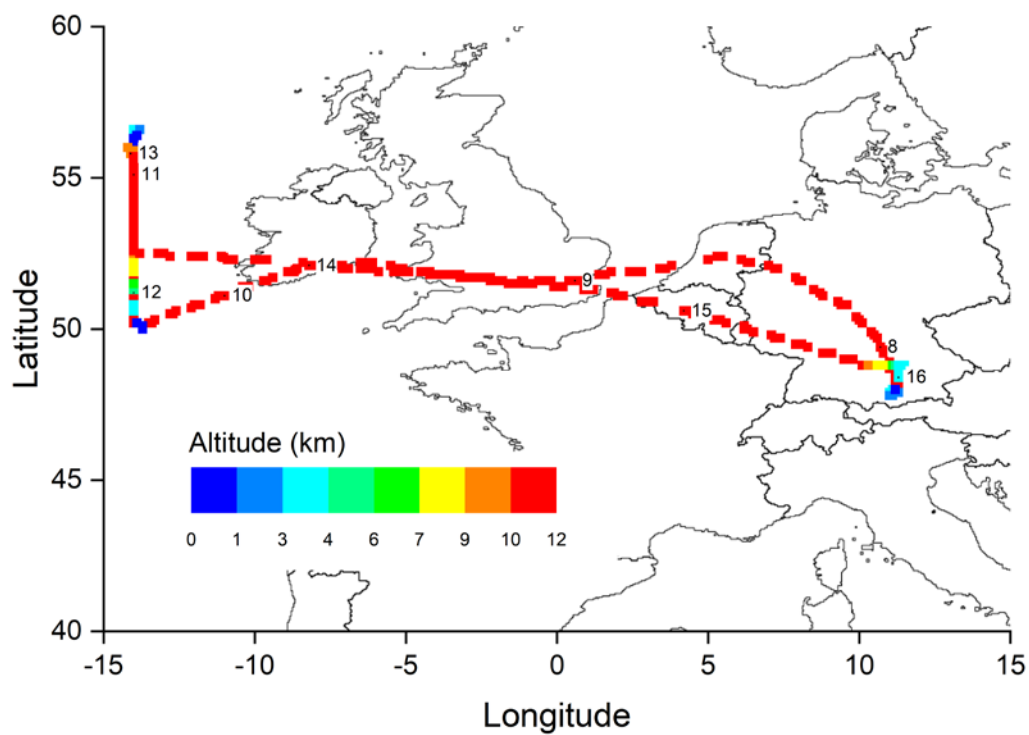


Figure S6. Flight track (colour coded with altitude) during a flight (30.05.2020) over Europe of the HALO-campaign “CAFE-EU”. The numbers on the track indicate the time (UTC).