



## Supplement of

## **Biomass burning pollution in the South Atlantic upper troposphere: GLORIA trace gas observations and evaluation of the CAMS model**

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## Introduction

In this document, supplementary information for retrieved GLORIA trace gases is shown in the figures below (Figs. S1-S10).



Figure S1: Illustration of the error budget of the PAN retrieval of SouthTRAC flight on 8 September 2019 for a selected profile at 09:38:22 UTC. (a) retrieved vertical profile of PAN with total estimated error (black) and initial-guess profile (gray). The retrieved profile has 18.2 degrees of freedom. (b) Total error contributions and estimated total error. The following error contributions are considered: Pointing error ( $0.03^{\circ}$  offset to the elevation angle), temperature error (1.5 K temperature offset compared to pre-retrieved temperatures), CO<sub>2</sub> error (5% error assumed in CO<sub>2</sub> profiles used in the forward calculation), spectroscopic error (3.2% according to Glatthor et al., 2007), and the retrieval noise. (c) Vertical resolution of this retrieval result. The dotted line represents the flight altitude of the aircraft.



Figure S2: PAN from SouthTRAC flights on (a-c) 8 September 2019, and (d-f) 7 October 2019: Cross section of (a,d) retrieved PAN volume mixing ratio, (b,e) total estimated error, and (c,f) vertical resolution.



Figure S3: Same as Fig. S1, but for  $C_2H_6$ . The retrieved profile has 9.5 degrees of freedom. The spectroscopic error for  $C_2H_6$  is estimated to be 10% (Wiegele et al., 2012)



Figure S4: Same as Fig. S2, but for  $C_2H_6$ .



Figure S5: Same as Fig. S1, but for HCOOH. The retrieved profile has 14.6 degrees of freedom. The spectroscopic error for HCOOH is estimated to be 7% (Grutter et al., 2010)



Figure S6: Same as Fig. S2, but for HCOOH.



Figure S7: Same as Fig. S1, but for  $CH_3OH$ . The retrieved profile has 18.6 degrees of freedom. The spectroscopic error for  $CH_3OH$  is estimated to be 20% (Rothman et al., 2004)



Figure S8: Same as Fig. S2, but for  $CH_3OH$ .



Figure S9: Same as Fig. S1, but for  $C_2H_4$ . The retrieved profile has 20.5 degrees of freedom. The spectroscopic error for  $C_2H_4$  is estimated to be 10% (Gordon et al., 2017)



Figure S10: Same as Fig. S2, but for  $C_2H_4$ .