Introduction

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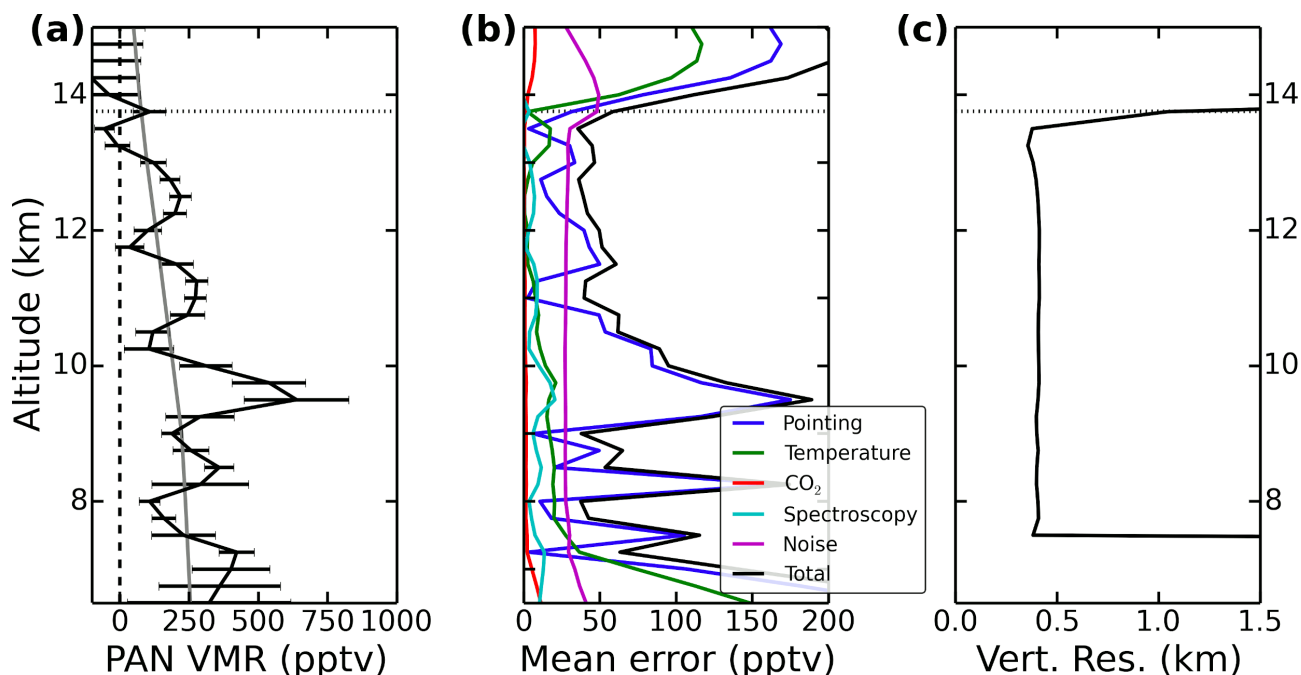

Figure S1: Illustration of the error budget of the PAN retrieval of SouthTRAC flight on 8 September 2019 for a selected profile at 09:38:22 UTC. **(a)** retrieved vertical profile of PAN with total estimated error (black) and initial-guess profile (gray). The retrieved profile has 18.2 degrees of freedom. **(b)** Total error contributions and estimated total error. The following error contributions are considered: Pointing error (0.03° offset to the elevation angle), temperature error (1.5 K temperature offset compared to pre-retrieved temperatures), CO_2 error (5% error assumed in CO_2 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.
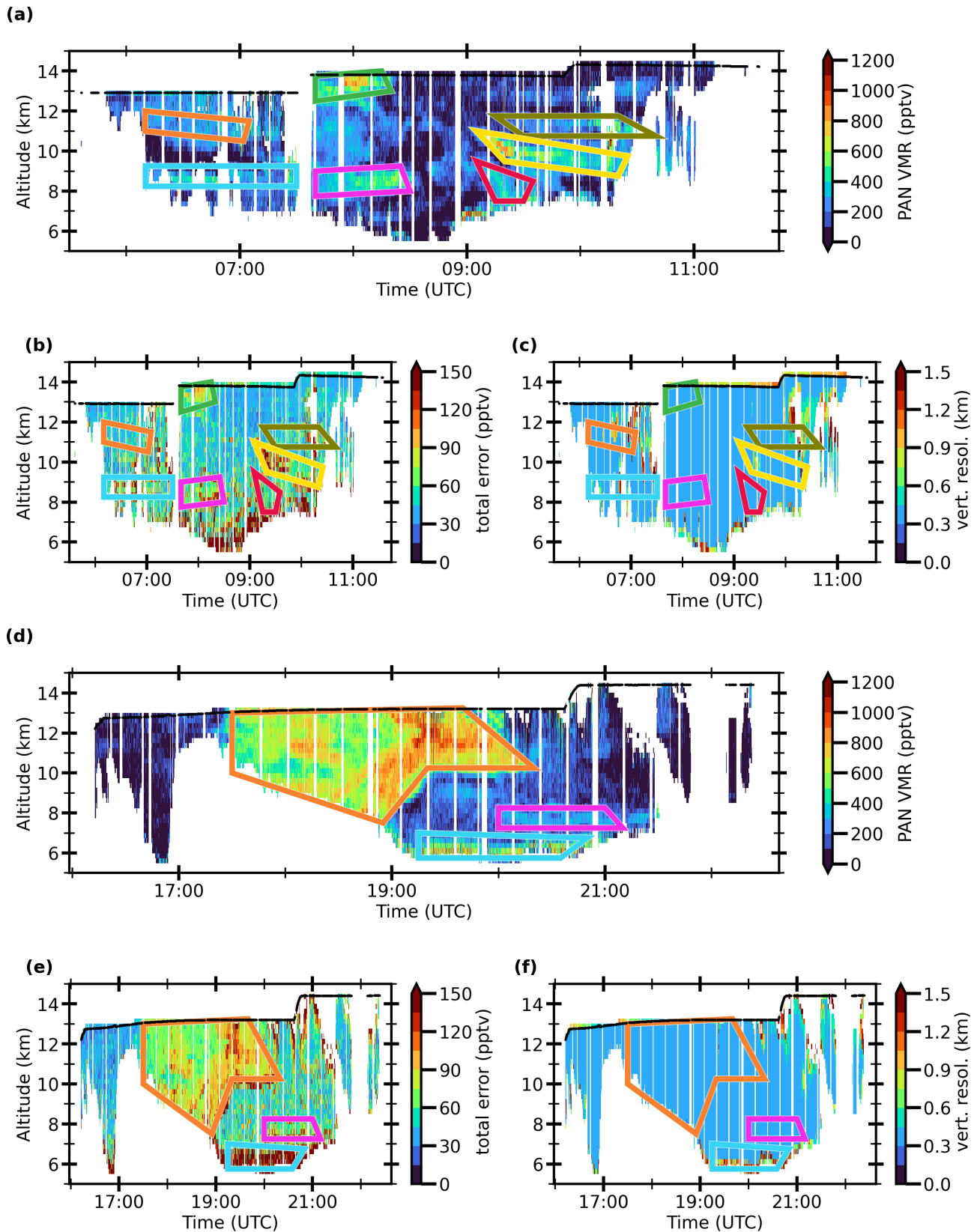
Figure S2: PAN from SouthTRAC flights on **(a-c)** 8 September 2019, and **(d-f)** 7 October 2019: Cross section of **(a,d)** retrieved PAN volume mixing ratio, **(b,e)** total estimated error, and **(c,f)** vertical resolution.
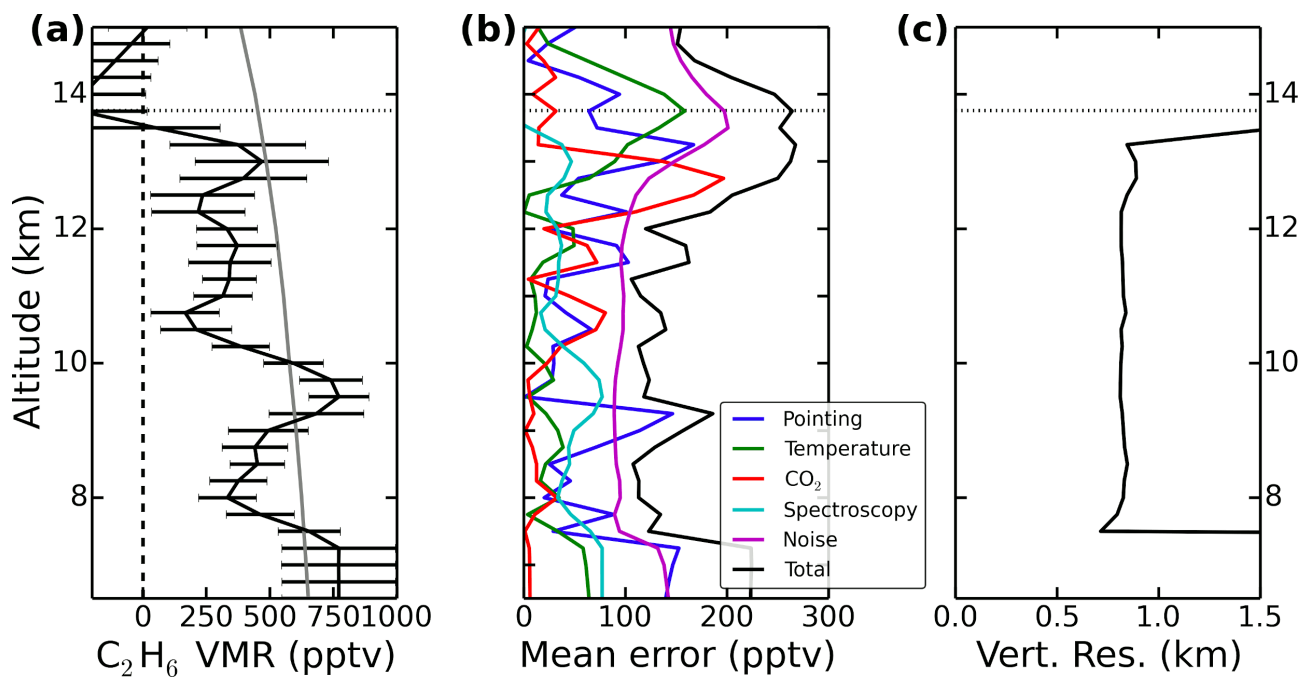
Figure S3: Same as Fig. S1, but for C_2H_6. The retrieved profile has 9.5 degrees of freedom. The spectroscopic error for C_2H_6 is estimated to be 10% (Wiegele et al., 2012)
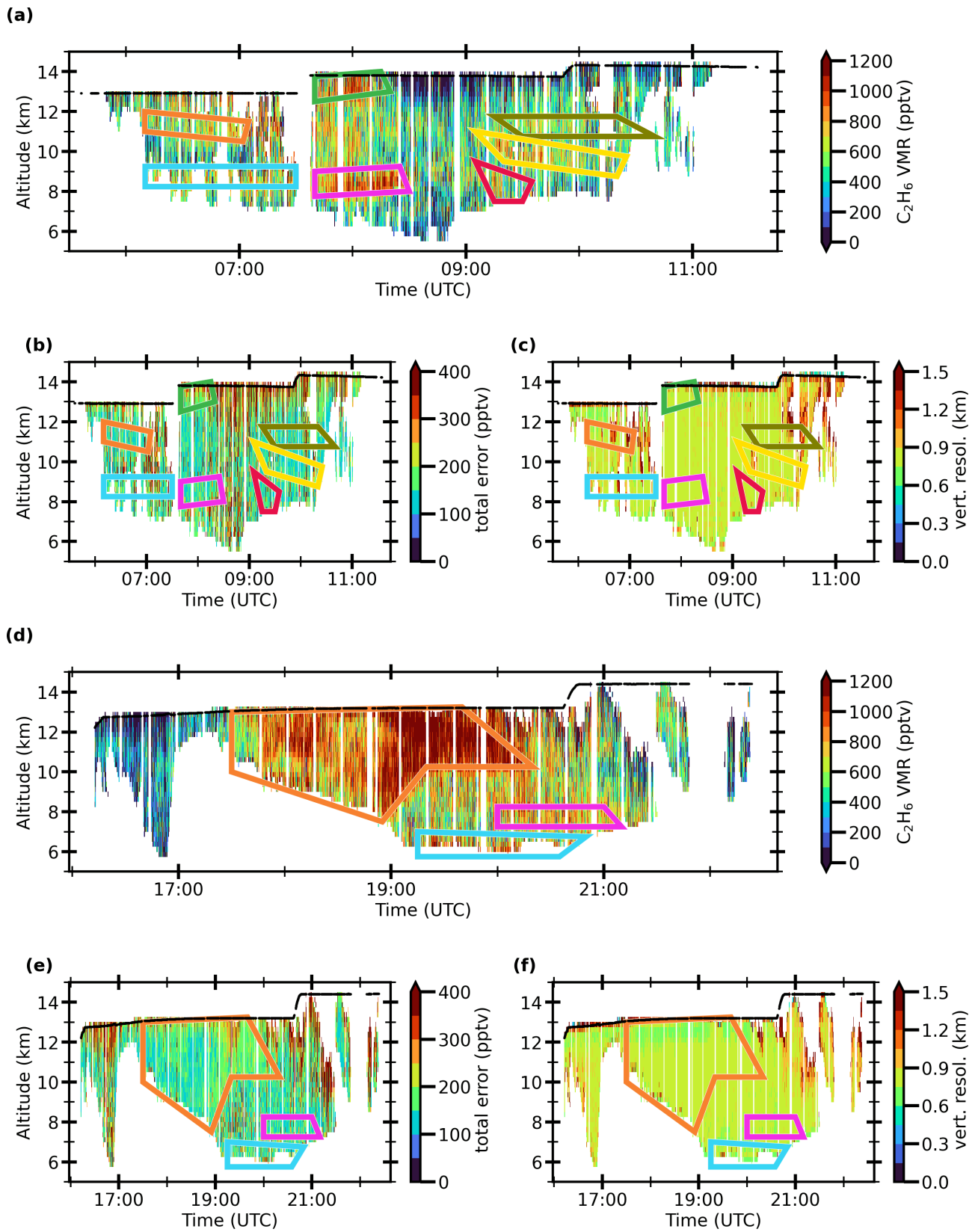
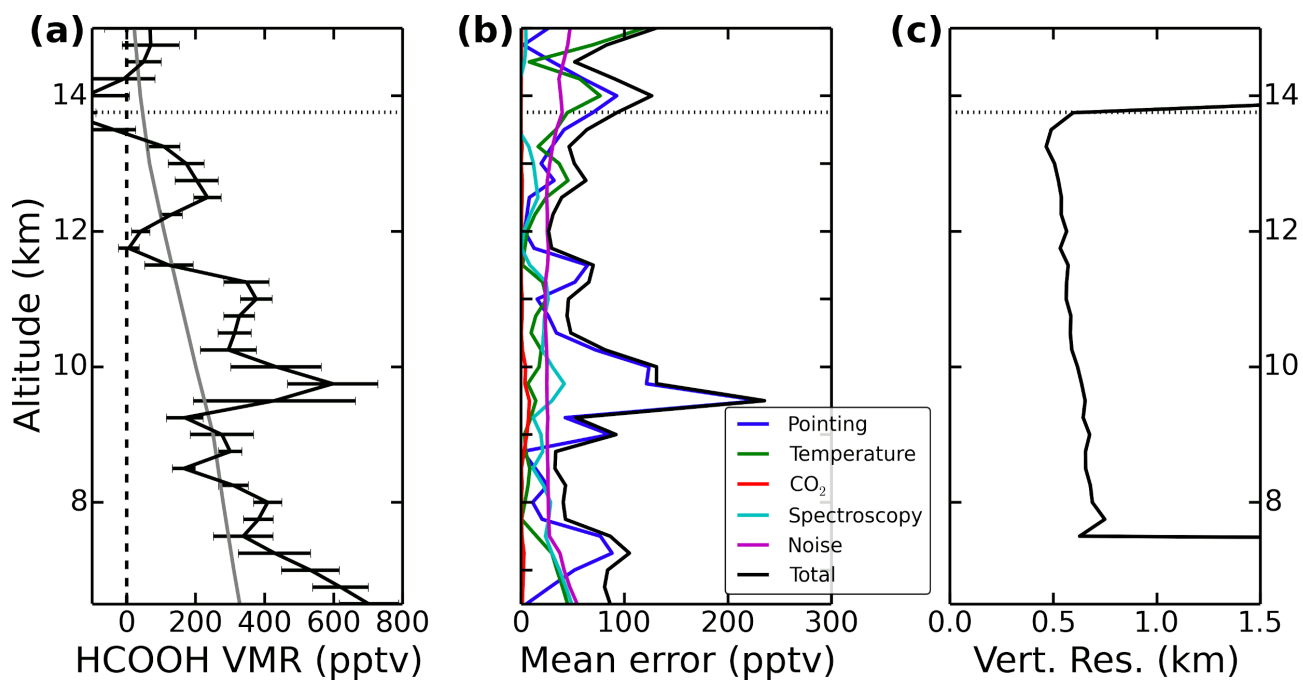Figure S4: Same as Fig. S2, but for C_2H_6.

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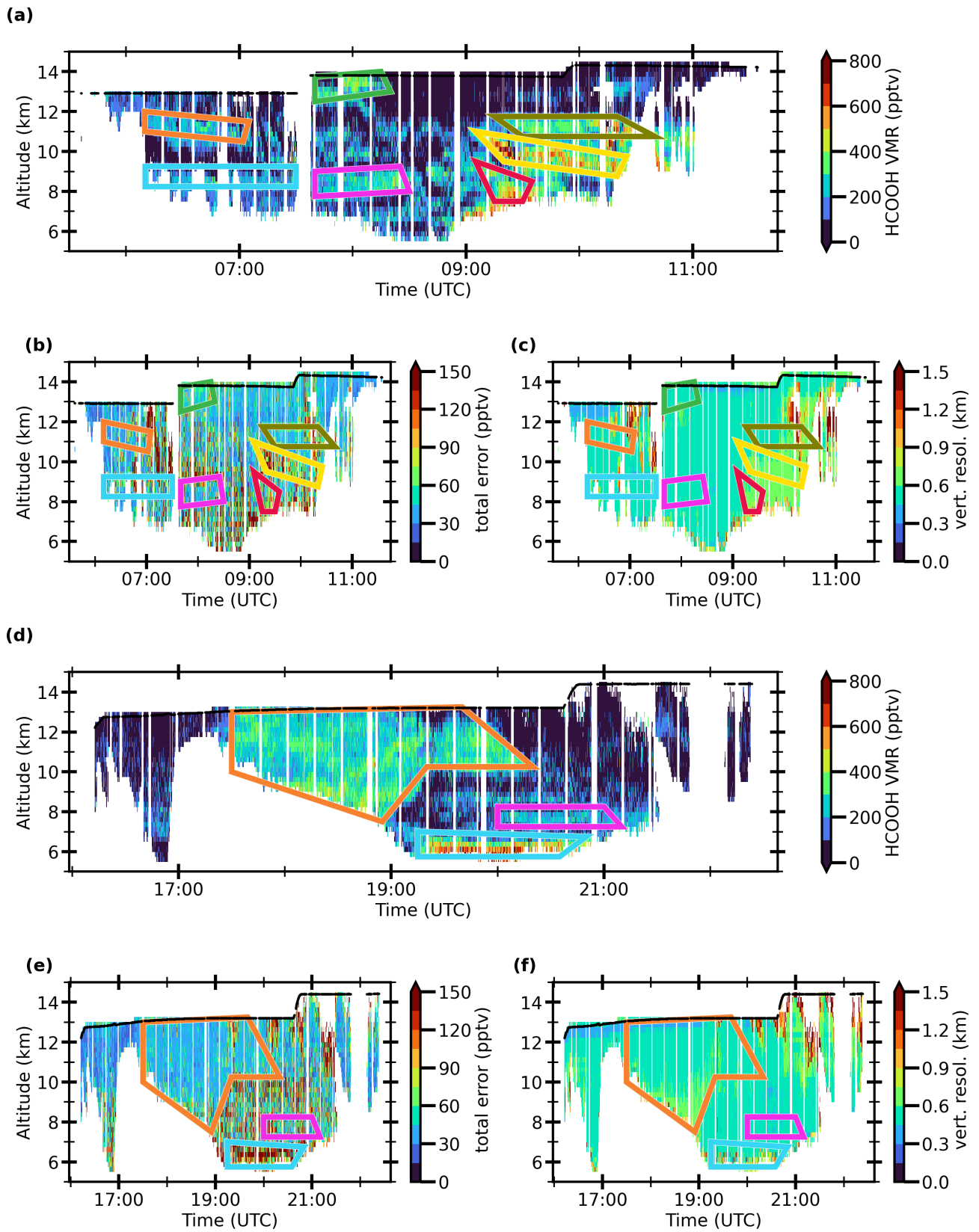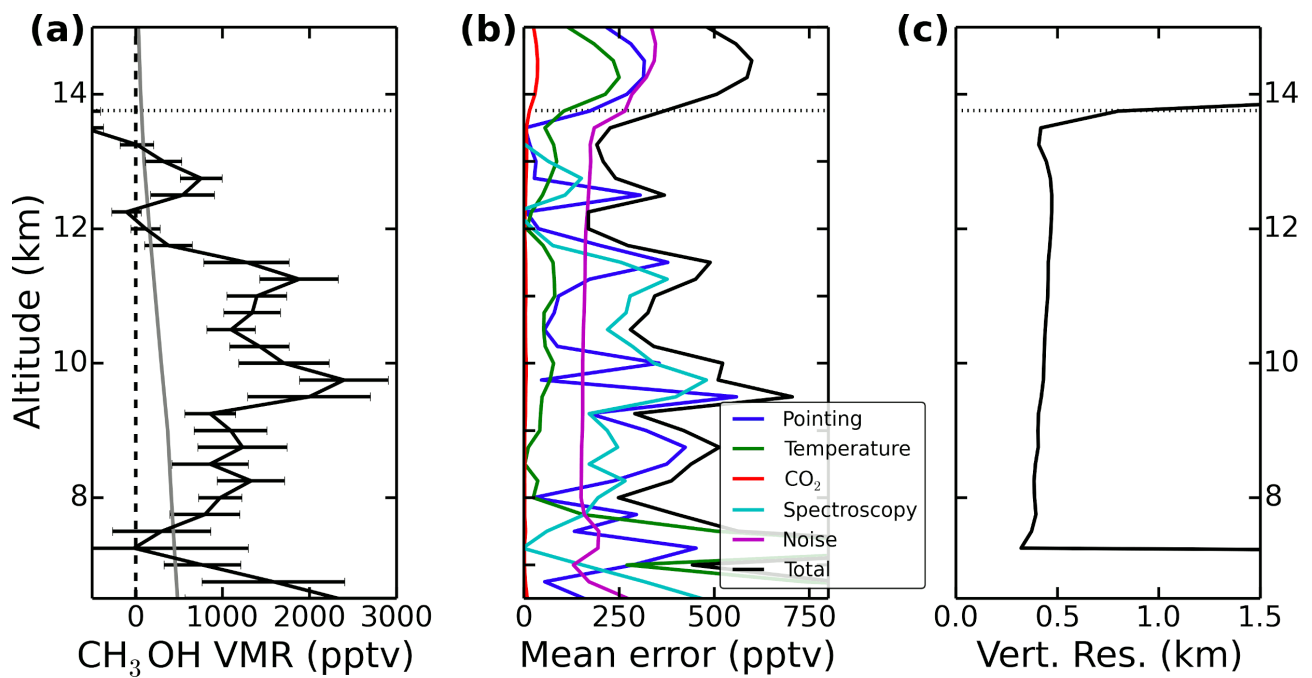
Figure S6: Same as Fig. S2, but for HCOOH.

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Figure S7: Same as Fig. S1, but for CH$_3$OH. The retrieved profile has 18.6 degrees of freedom. The spectroscopic error for CH$_3$OH is estimated to be 20% (Rothman et al., 2004)
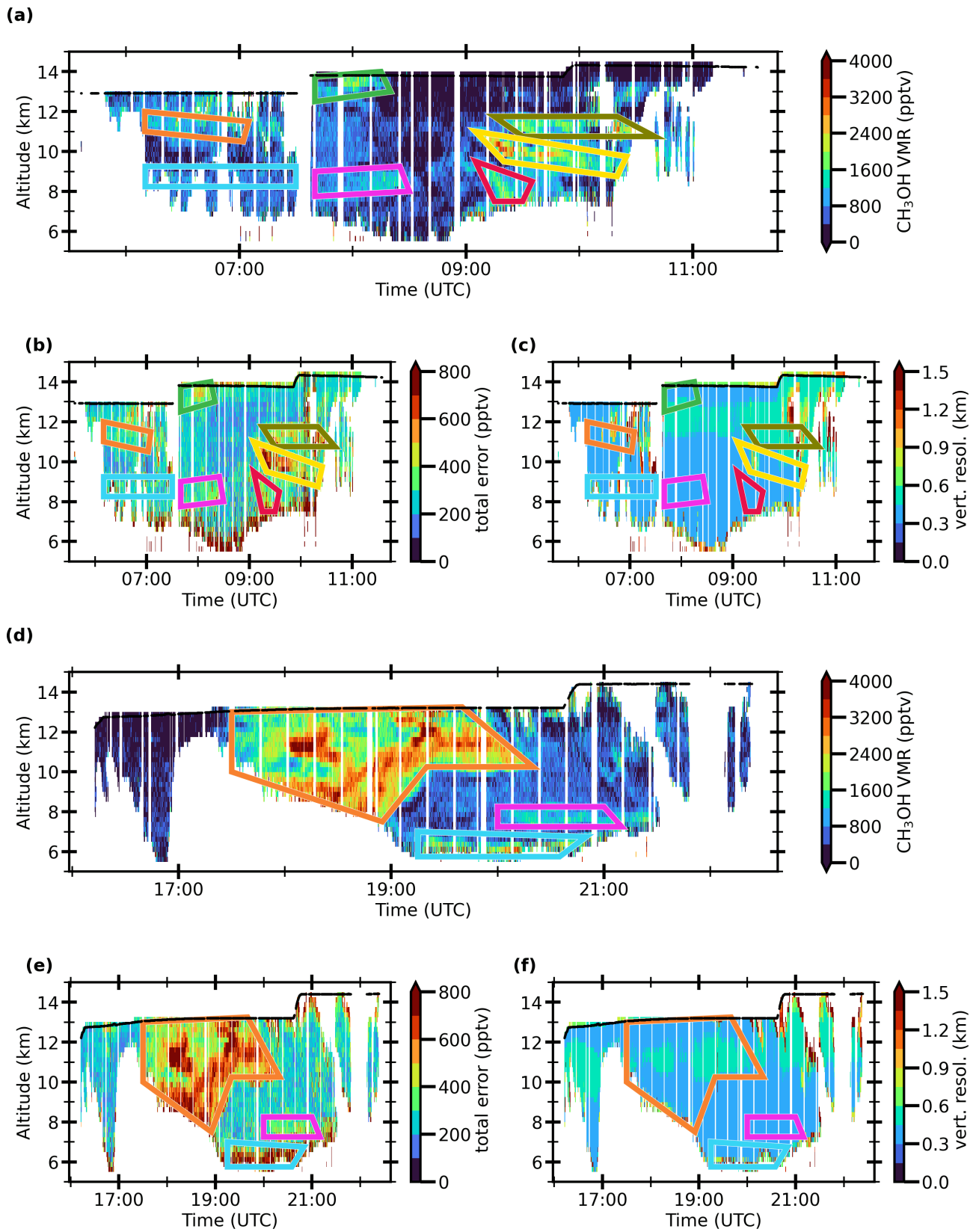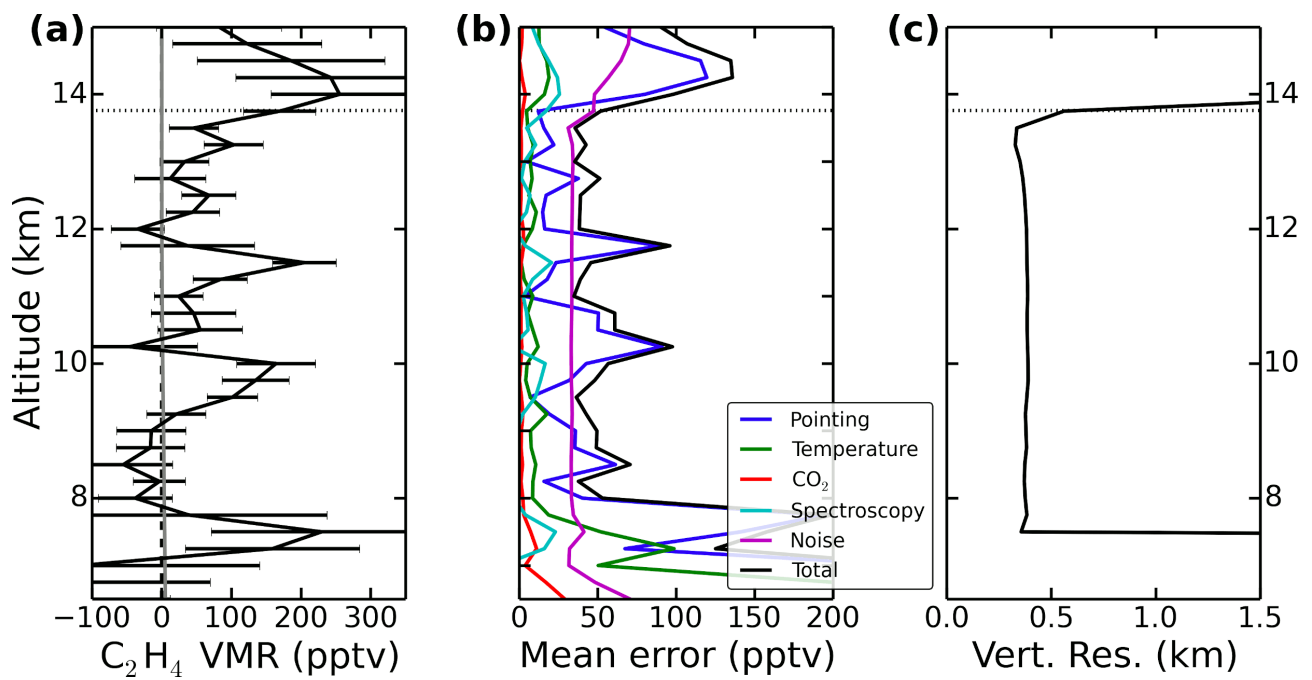
Figure S8: Same as Fig. S2, but for CH$_3$OH.

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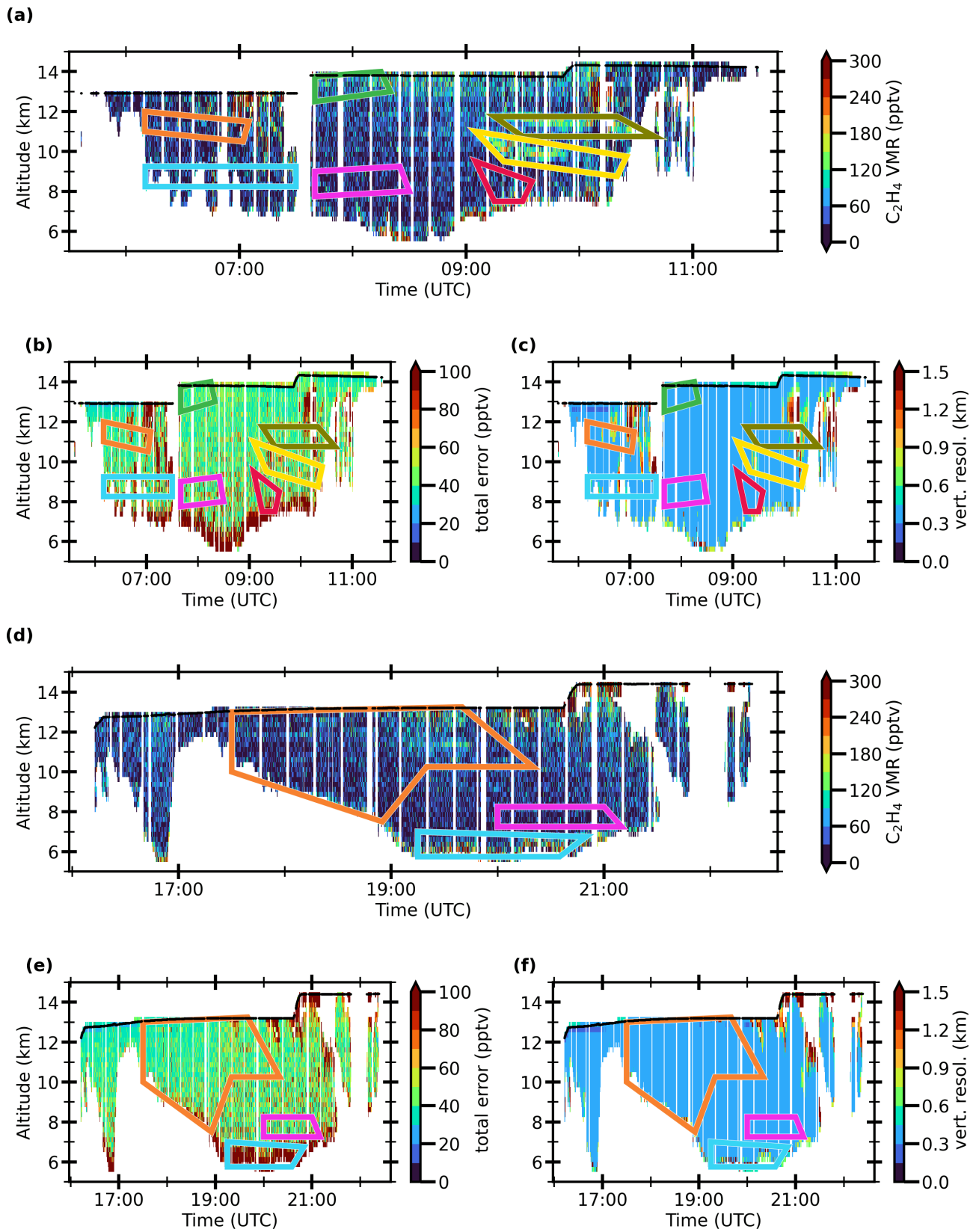
Figure S10: Same as Fig. S2, but for C_2H_4.