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Supplement of

Intercomparison of commercial analyzers for atmospheric ethane and methane observations

Róisín Commane et al.

Correspondence to: Róisín Commane (r.commane@columbia.edu)

Supplementary Figures for:
Commane et al., Atmospheric Measurement Techniques, Intercomparison of commercial analyzers for atmospheric ethane and methane observations

Figure S1: (a) Raw methane mixing ratios from Aeris MIRA sampling a compressed air cylinder over multiple days of humidity tests in February 2022.

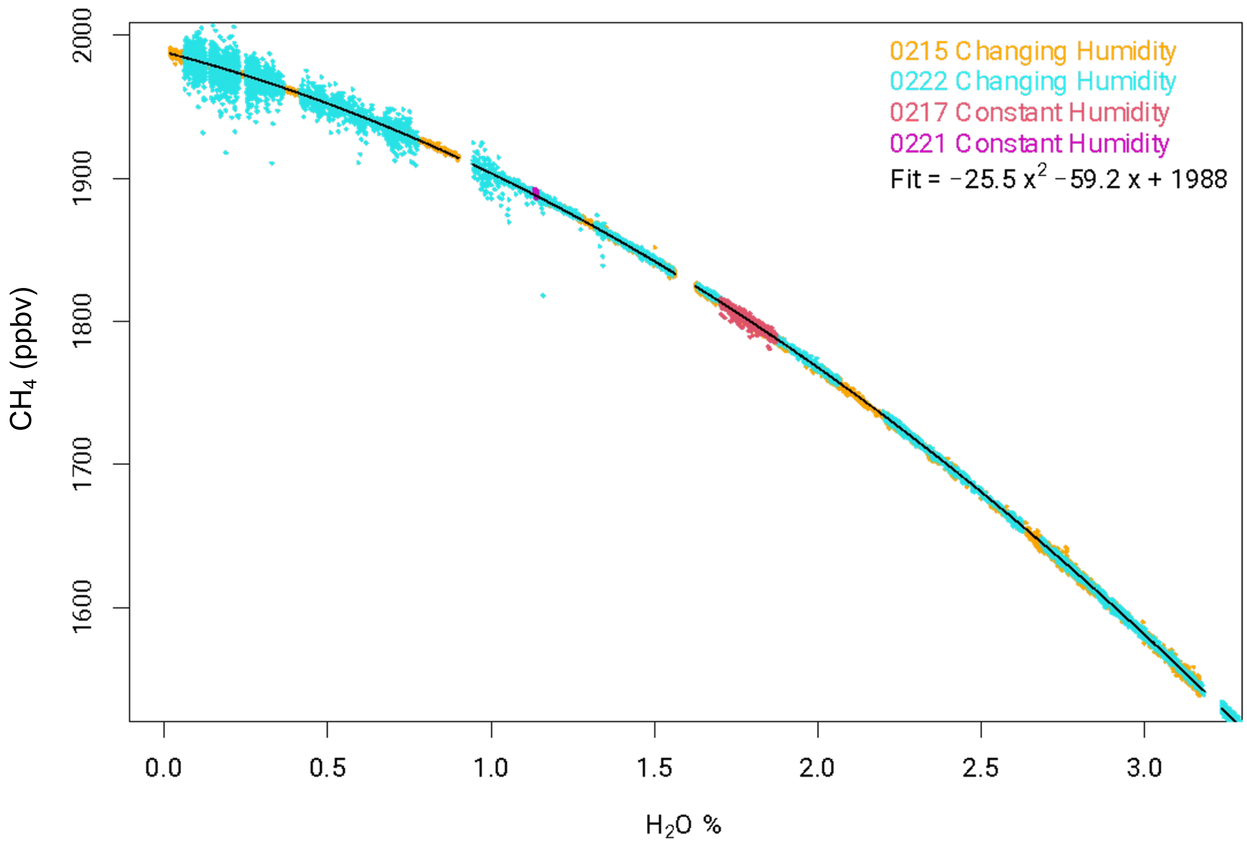

Figure S2. Picarro G2210-i ethane mole fraction for two NOAA calibrated standards. The raw reported mole fractions are shown as small grey points. After correction for water vapor sensitivity (Table 1) and linear calibration (Table 2), the high (4.21 ppbv) and low (0.97 ppbv) span mole fractions are accurate but with a 1sigma standard deviation of 1.34 ppbv and 1.41 ppbv respectively.

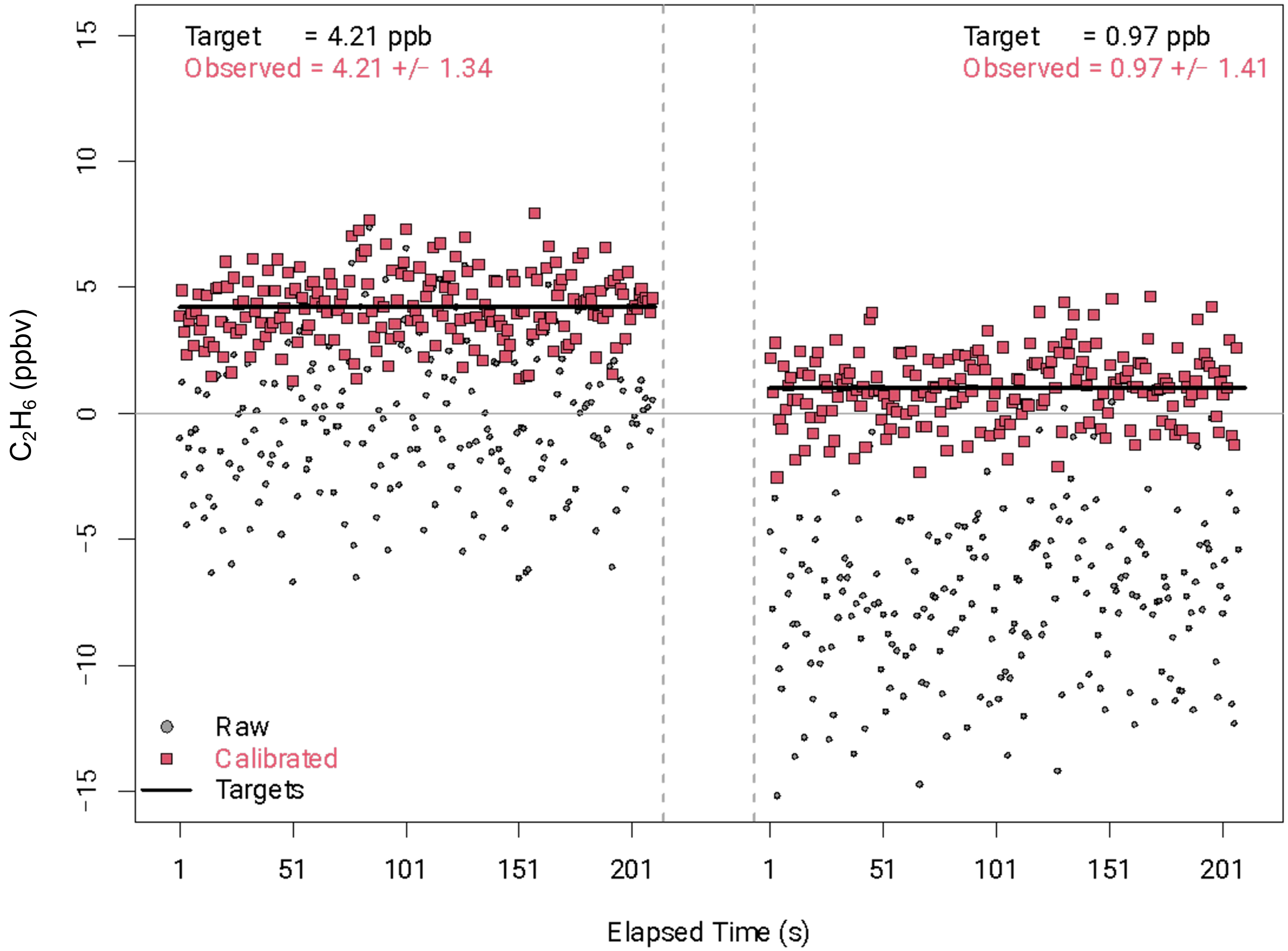

Figure S3: Linearity of (a) methane (1s data) and (b) ethane (10s aggregated data) for two days in February 20-21, 2022. The 1:1 line is shown in black. The slope and intercept calculated from an ordinary least squares with 95% confidence intervals are shown in the top left. The calculated slope and intercept are shown as a red dashed line.

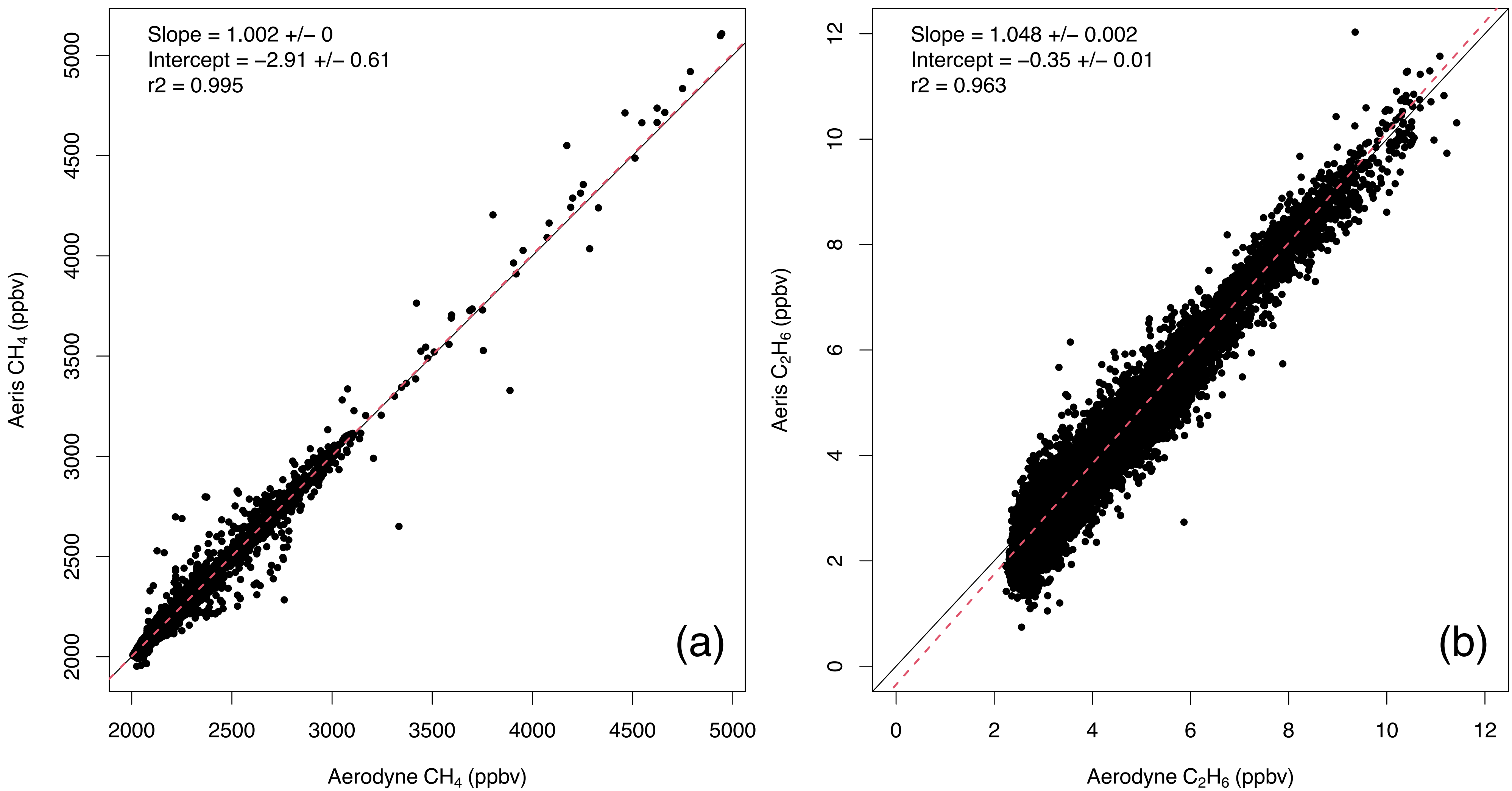

Figure S4: Time series and Allan Variance for (a) methane and (b) ethane for the Aerodyne SuperDUAL. For 100s averaging, we observed a < 0.05 ppbv CH_4 and < 5 pptv C_2H_6 precision.

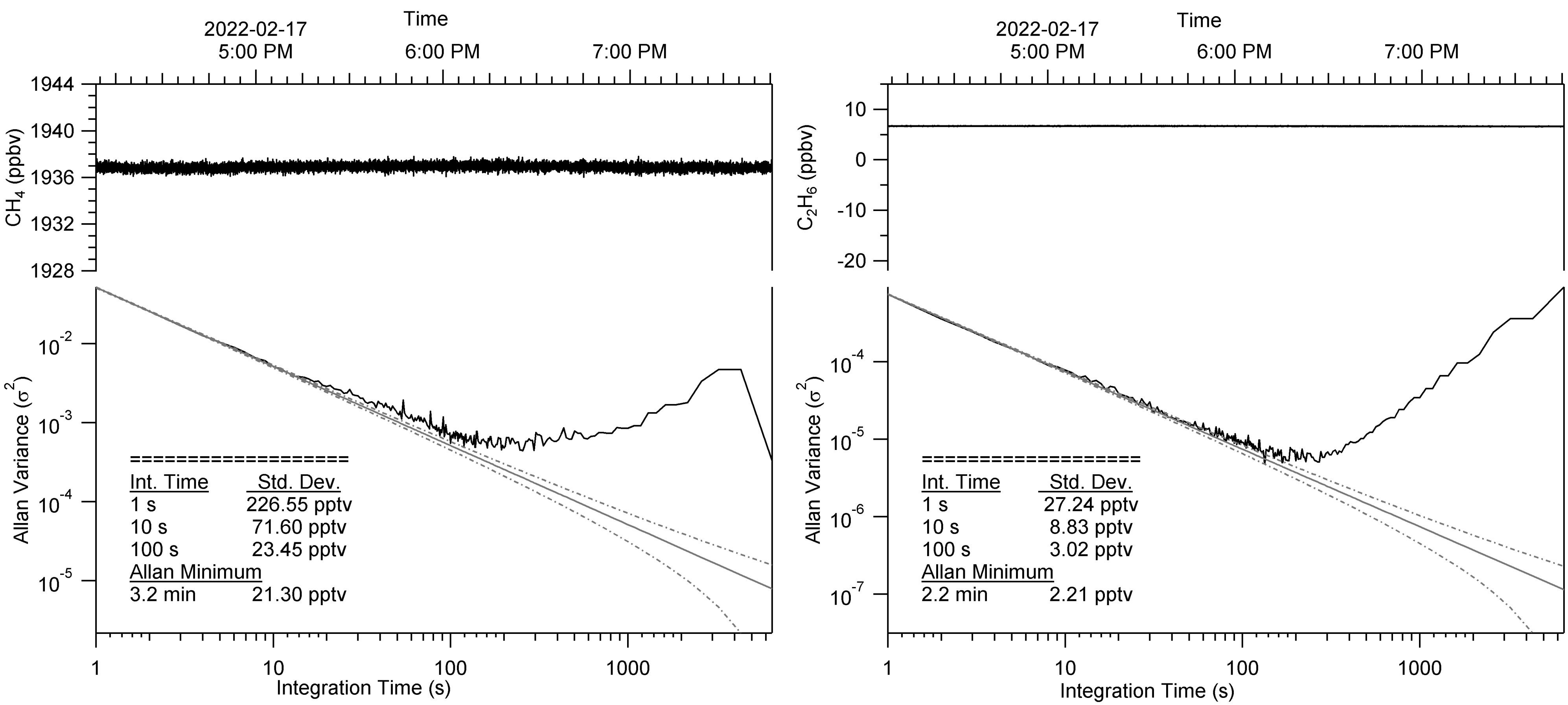

Figure S5. Time series and Allan Variance for (a) methane and (b) ethane for the Aeris Mira LDS. For 100s averaging, we observed a < 0.2 ppbv CH_4 and < 50 pptv C_2H_6 precision.

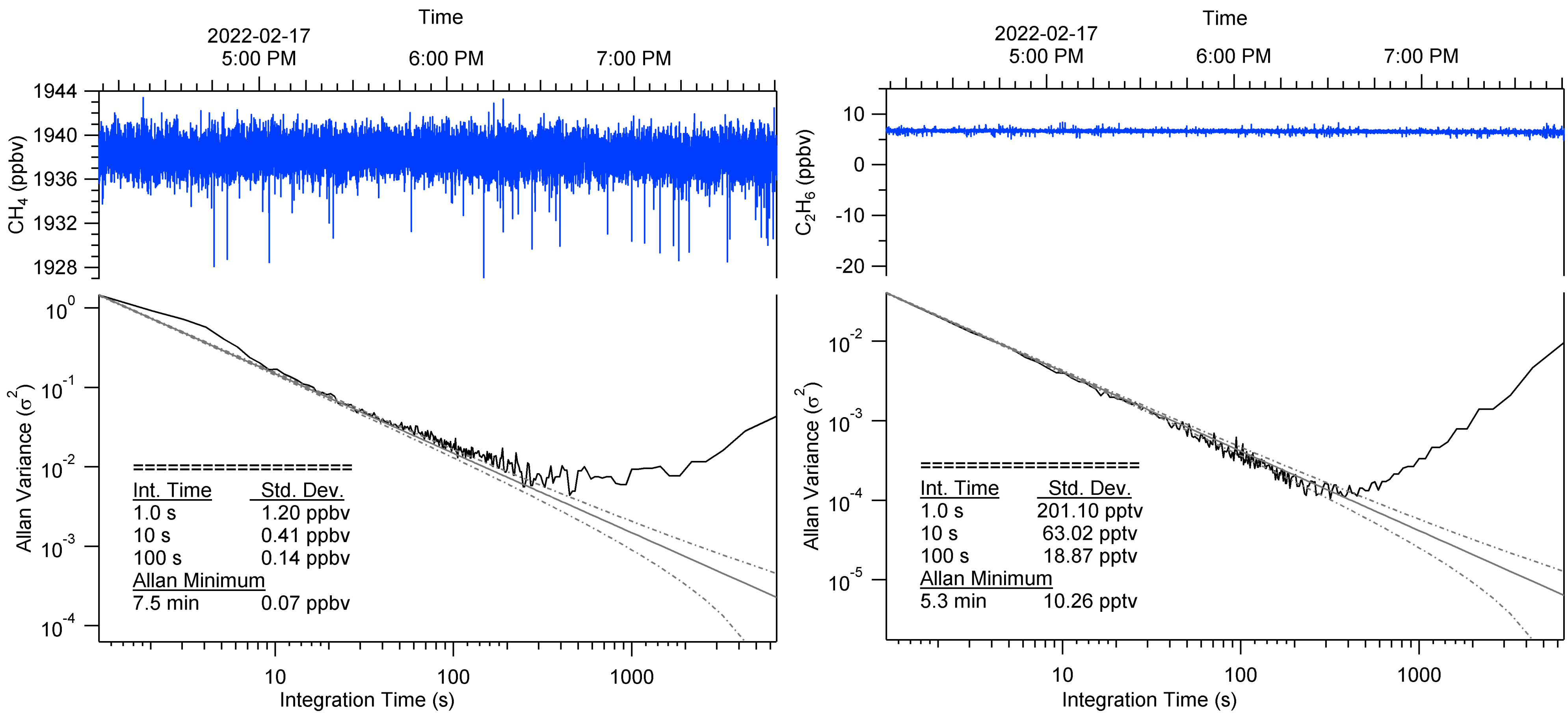

Figure S6: Time series and Allan Variance for (a) methane and (b) ethane for the Picarro G2210-i. For 100s averaging, we observed a < 0.1 ppbv CH_4 and ~ 500 pptv C_2H_6 precision.

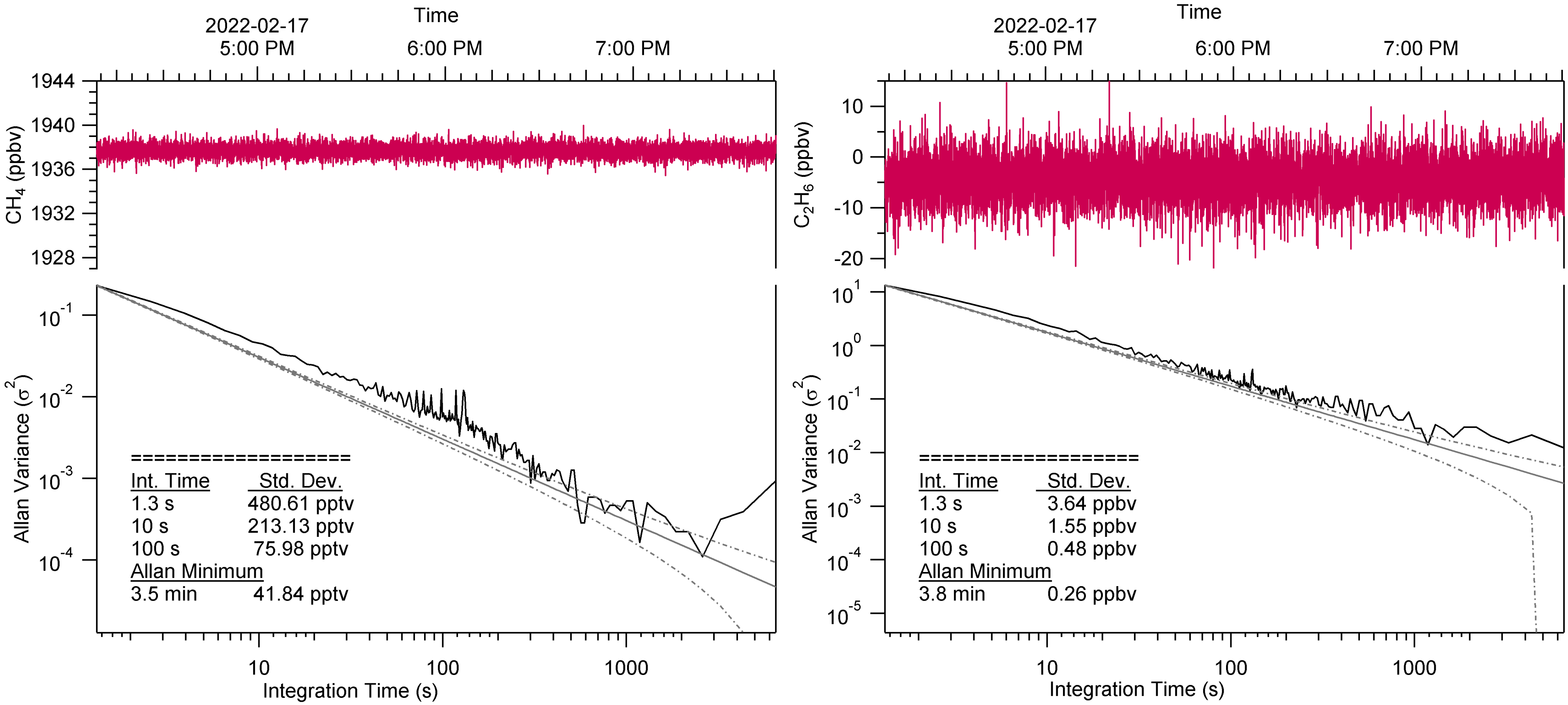

Figure S7. Time series and Allan Variance for (a) methane isotopes and (b) ethane for the Picarro G2210-i when running in isotopic measurement mode. The ethane data has about 1.5 times lower precision in this mode than when set to measure ethane while the methane precision is unchanged. For 100s averaging, we observed a < 1 ppbv C_2H_6 and < 1 ‰ dCH_4 precision.

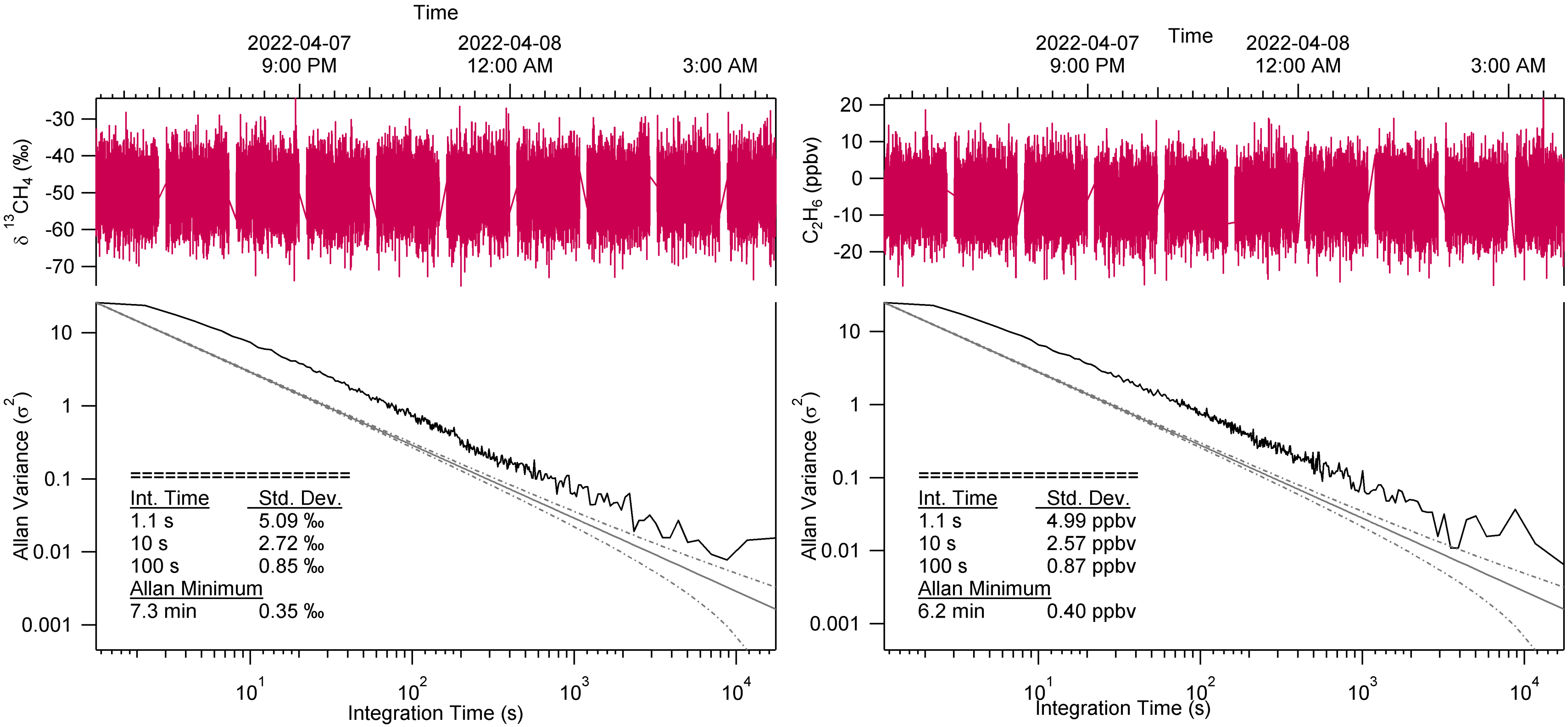

Figure S8: Time series of ambient sampling of all three instruments for Feb 17 – 21, 2022 (Time in UTC). (a) Methane (CH_4, ppbv), (b) ethane (C_2H_6, ppbv) and (c) ethane/methane ratio (C_2H_6/CH_4, %). Compressed air tanks were sampled on Thursday and Monday. The Aerodyne SuperDUAL data (black line) is shown at 1s, the Aeris MIRA (blue circle) is a 10s average and the Picarro G2210-i is 1s for (a) CH_4 and (b) 5 minute average for C_2H_6. All three analyzers observed plumes of methane on Friday night (Feb 18th) into Saturday morning (Feb 19th). While the Aerodyne SuperDUAL and Aeris MIRA also saw increases in ethane that identified these plumes as natural gas, the Picarro G2210-I did not. The Picarro G2210-i also reported a decrease in ethane when sampling a compressed air cylinder, contrary to the increase reported by the Aerodyne SuperDUAL and Aeris MIRA.

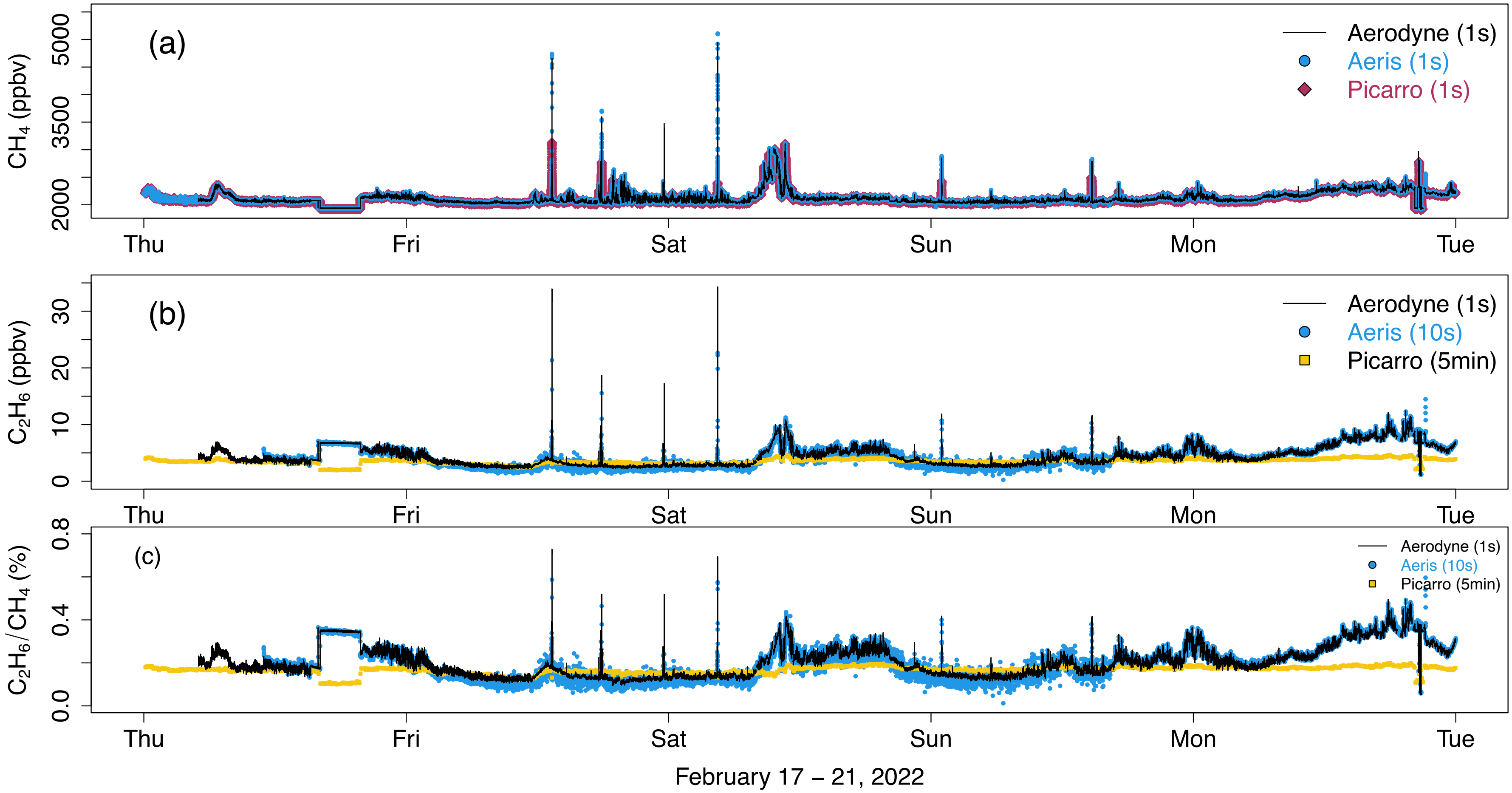

Figure S9: Time series of ambient sampling of all three instruments for 13:10 – 13: 30 UTC Feb 18, 2022. (a) Methane (CH_4, ppbv) and water vapor (cyan, % measured on SuperDUAL, 1Hz), (b) ethane (C_2H_6, ppbv) and carbon monoxide (CO, ppbv, green, measured on SuperDUAL, 1Hz). The Aerodyne SuperDUAL data (black line) is shown at 1s, the Aeris MIRA (blue circle) is 1s average and the Picarro G2210-i is (a) 1s, (b) 10s and 5 minute average. This is a zoomed in version of Figure 4 (a) and (b). The Picarro G2210-i CH_4 is slow to return to background concentrations due to the low flow rate. The C_2H_6 reported by the Picarro G2210-i is reduced during the increase observed by the Aeris MIRA and Aerodyne SuperDUAL instruments plume.