

## Supporting Information for *Evaluating vertically resolved Pandora formaldehyde retrievals using airborne and ground-based in situ measurements*

Figure S1 shows the reduction in column and surface uncertainties from extending the fitting window. Data in these plots were first filtered by the fitting residual (root mean square residual  $< 0.0014$ ). Measurements with  $> 100\%$  uncertainty were also removed to avoid cloud-affected outliers.

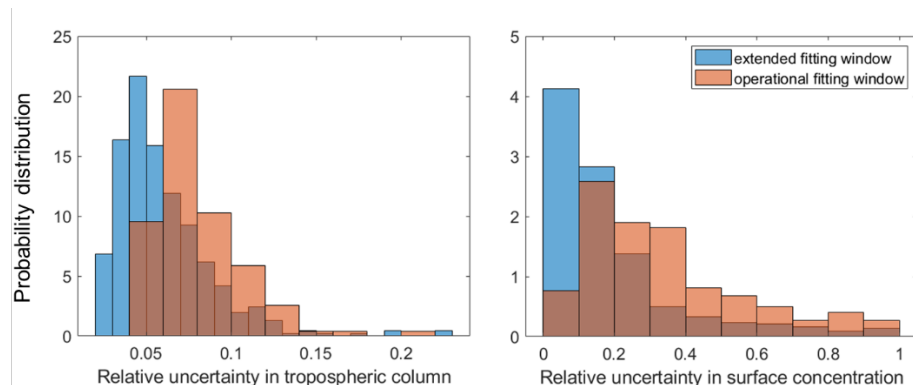


Figure S1. Distributions of the relative uncertainty in tropospheric columns and surface concentrations for operational (328.5-359 nm) and extended (328.5 – 365 nm) fitting windows applied to all Pandora observations used in this comparison.

Figure S2 shows an example of airborne HCHO observations near the Pandora RRC location. Larger HCHO concentrations were observed when the aircraft sampled southwest relative to the Pandora. Although vertical sampling in the southwest direction was limited, the high HCHO layers observed there seem to extend a few 100 meters higher than in the southeast.

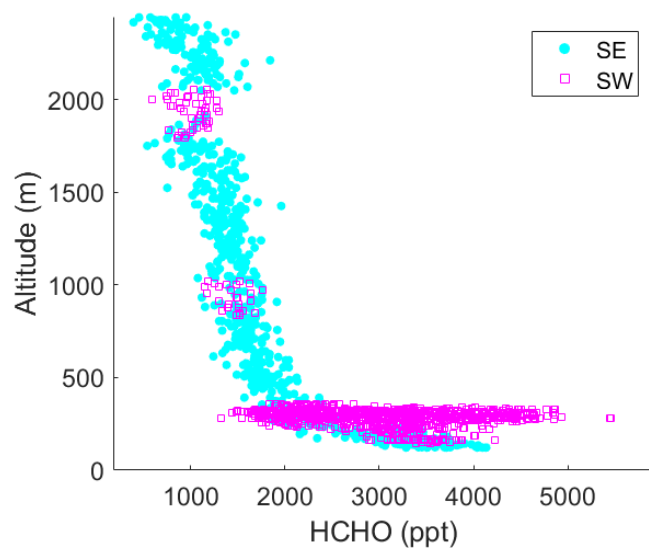


Figure S2. HCHO concentrations (pptv) measured by CAFE between 9:45 and 10:30 AM local time on 06/24/2024 near the RRC Pandora site. Data points are color coded by their relative location (southeast vs. southwest) relative to the Pandora.

Figures S3 through S7 show profile comparisons for each site during the two campaign years.

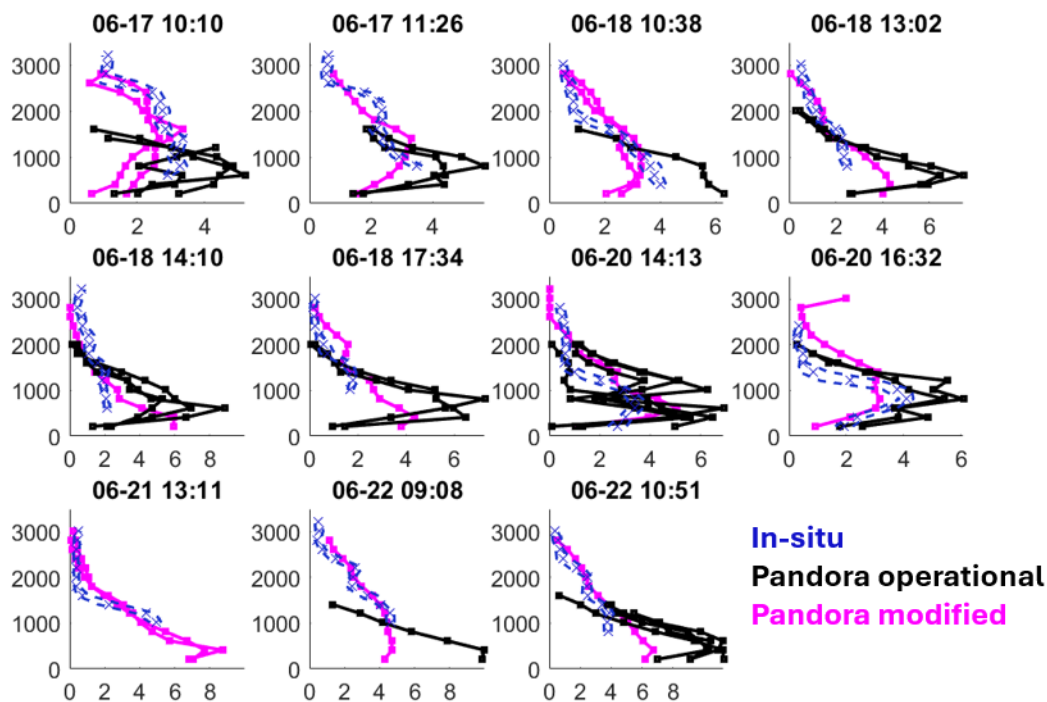


Figure S3. HCHO vertical profiles at Essex, MD (Pandora #75) during the SARP-East 2024 and ALEGROS campaigns. Each panel pair shows the aircraft in-situ profile alongside Pandora retrievals using the operational (black) and revised height-mapping (magenta) approaches. Aircraft profiles (blue crosses and dashed lines) show means and 2 standard deviations for observations smoothed in 200 m bins.

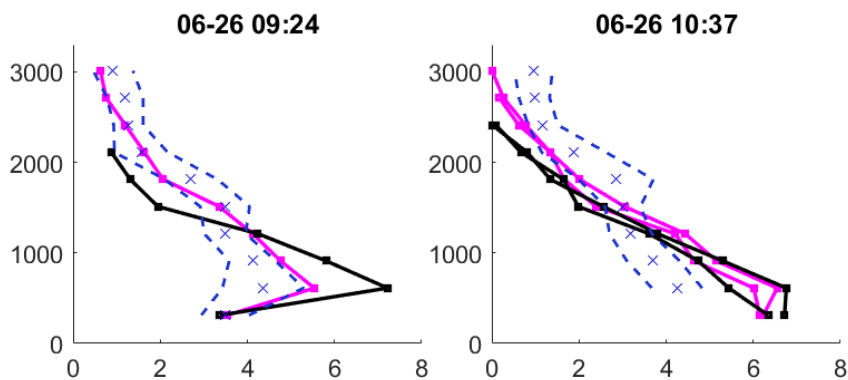


Figure S4. HCHO vertical profiles at the Chesapeake Bay Bridge-Tunnel (CBBT), Virginia Beach, VA (Pandora #255) during the SARP-East 2024 campaign. Format as in Figure S2.

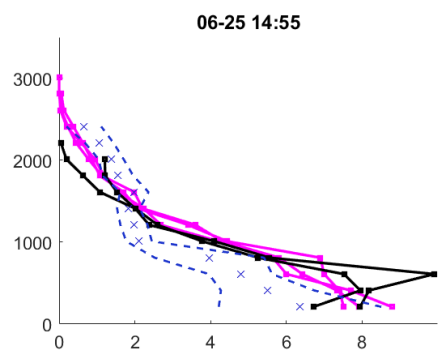


Figure S5. HCHO vertical profiles at the Chesapeake Bay Bridge-Tunnel (CBBT), Virginia Beach, VA (Pandora #255) during the SARP-East 2025 campaign. Format as in Figure S2.

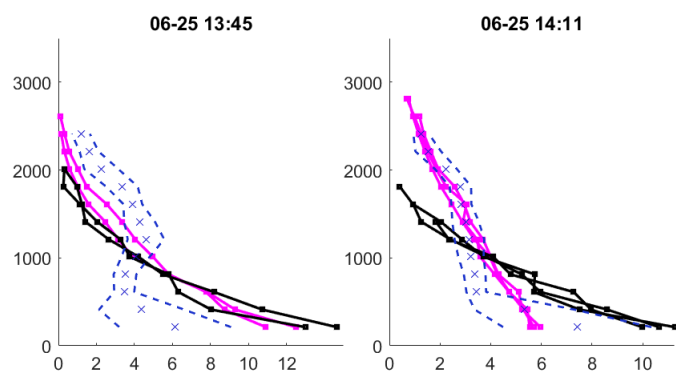


Figure S6. HCHO vertical profiles at Rice River Center (RRC), Charles City, VA (Pandora #31) during the SARP-East 2025 campaign. Format as in Figure S1.

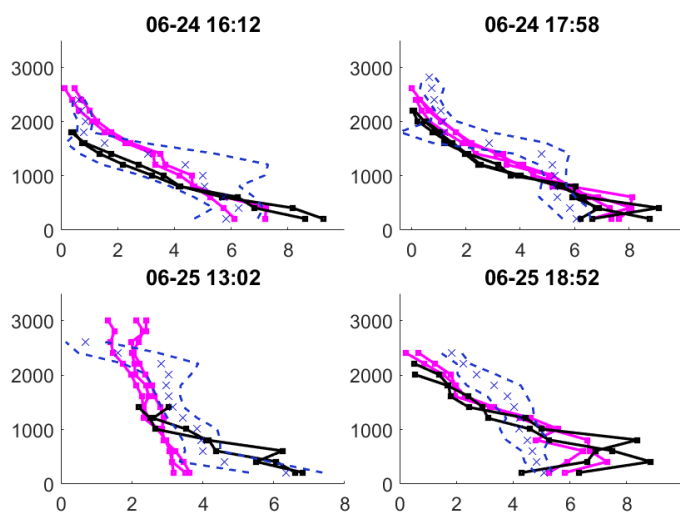


Figure S7. HCHO vertical profiles at Wallops Island, VA (Pandora #40) during the SARP-East 2025 campaign. Format as in Figure S1.