Supplementary Material
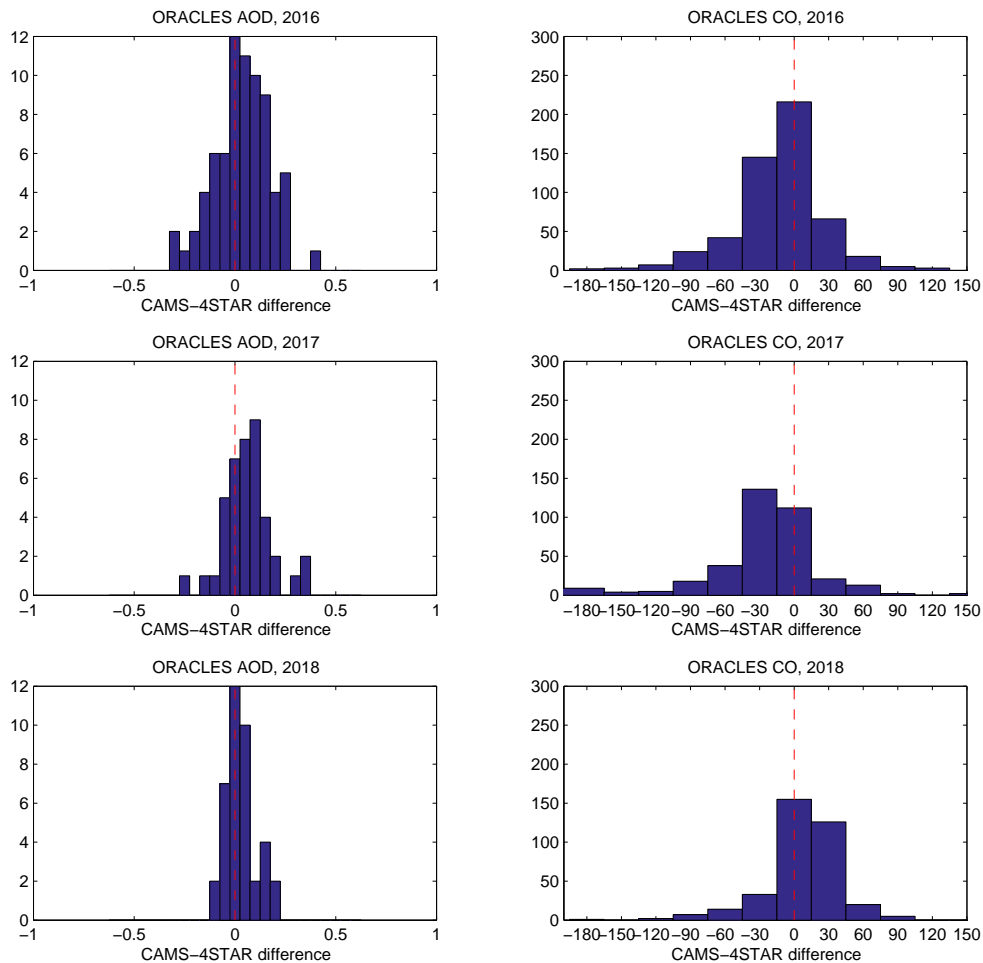
Figure S1. Difference between (left) CAMS BB AODs and ORACLES 4STAR-reported AODs and (right) CAMS CO and ORACLES COMA-measured CO for each deployment, taken at the subsets shown in Figure 6. The majority of the AODs are within ±0.2 of one another; CAMS tends to overestimate AOD relative to 4STAR. In contrast, CAMS tends to underestimate CO relative to the observations, except in October.
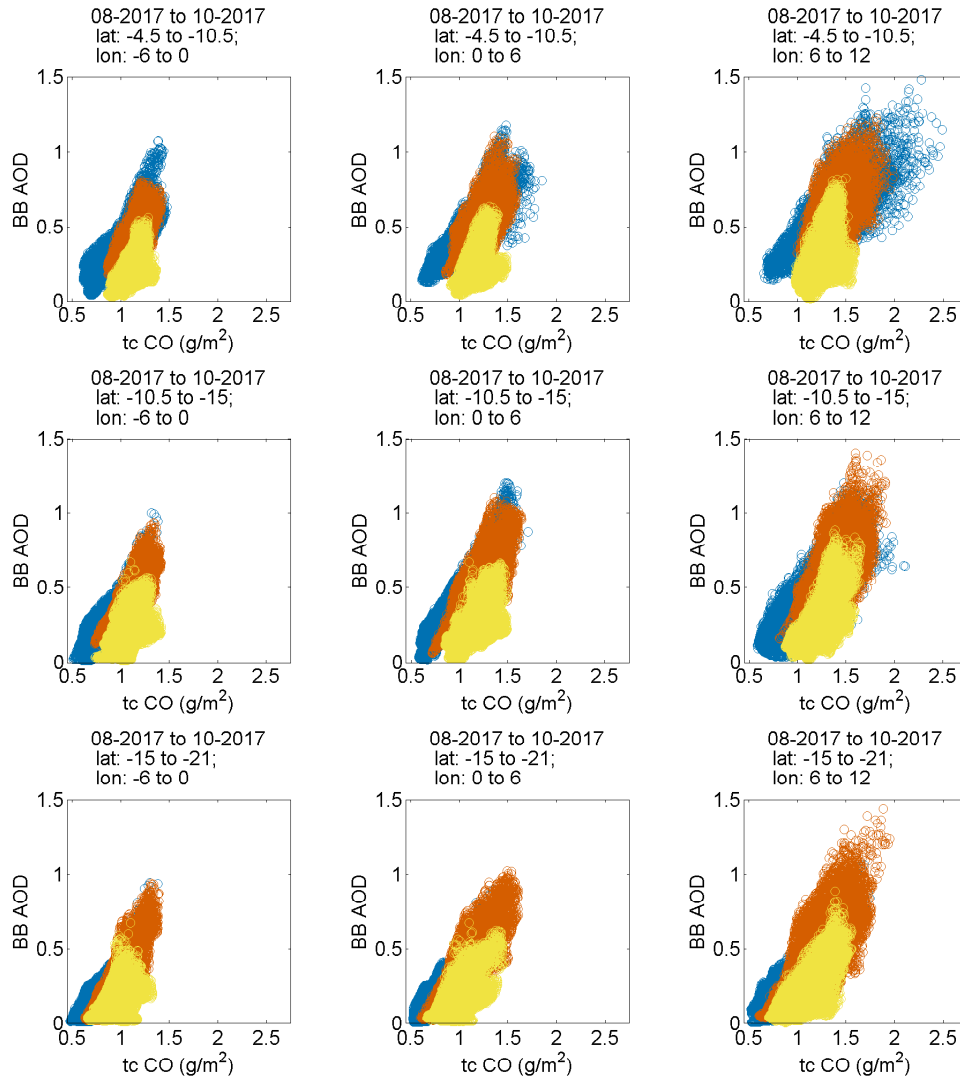
Figure S2. Gridded CAMS column total column carbon monoxide versus column biomass burning AOD (organics + BC) for 2017. August (blue) has a less steep slope than October (yellow) with September (orange) intermediate, showing the seasonal evolution of column values.
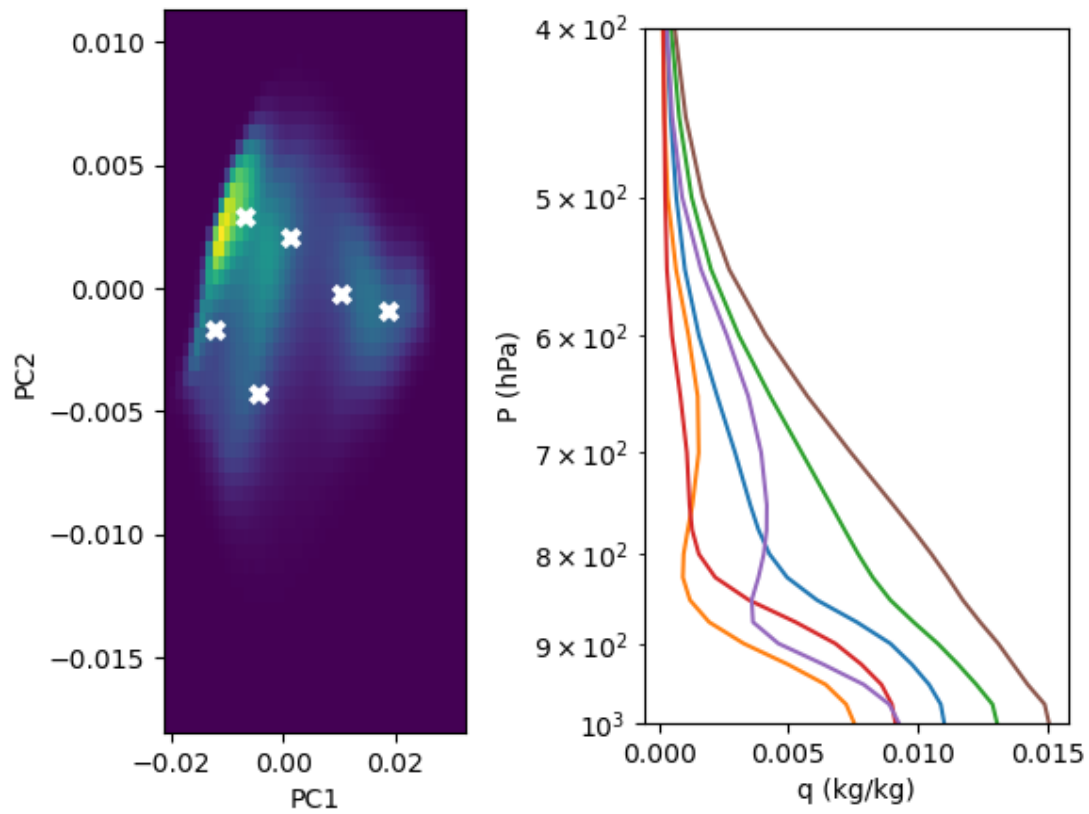
Figure S3. k-means clustering used to identify the canonical water vapor profiles of Figure 7.
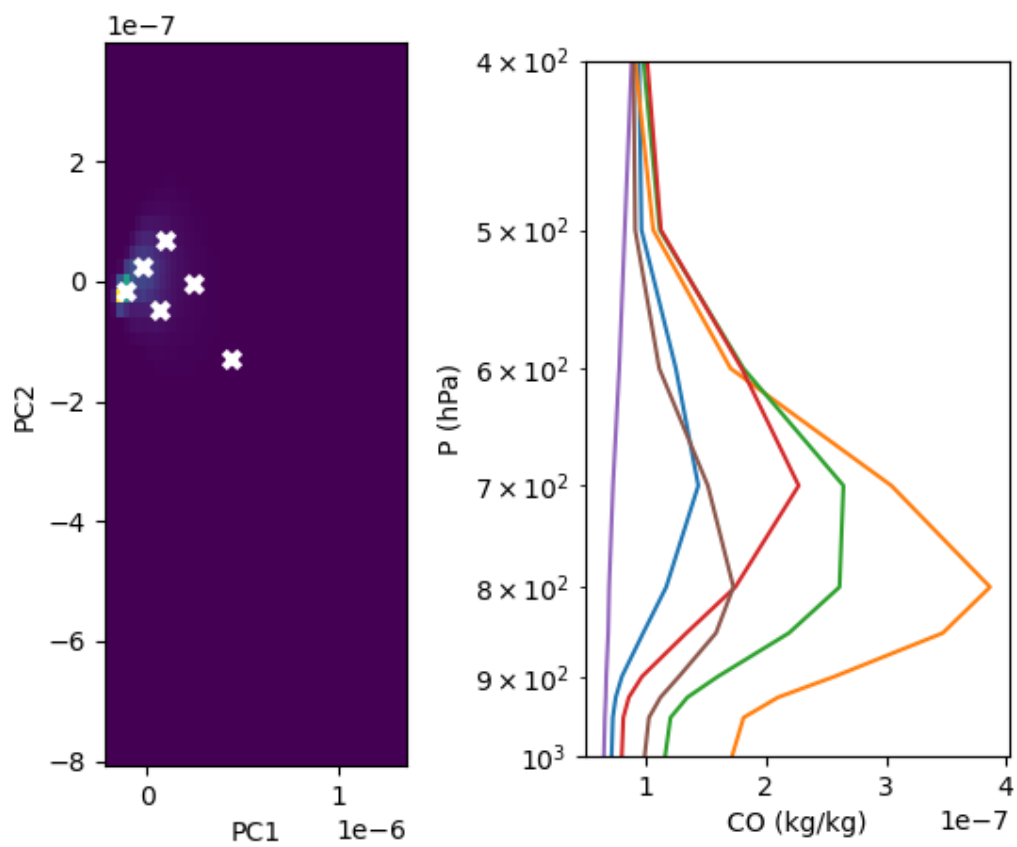
Figure S4. k-means clustering used to identify the canonical carbon monoxide profiles of Figure 8.
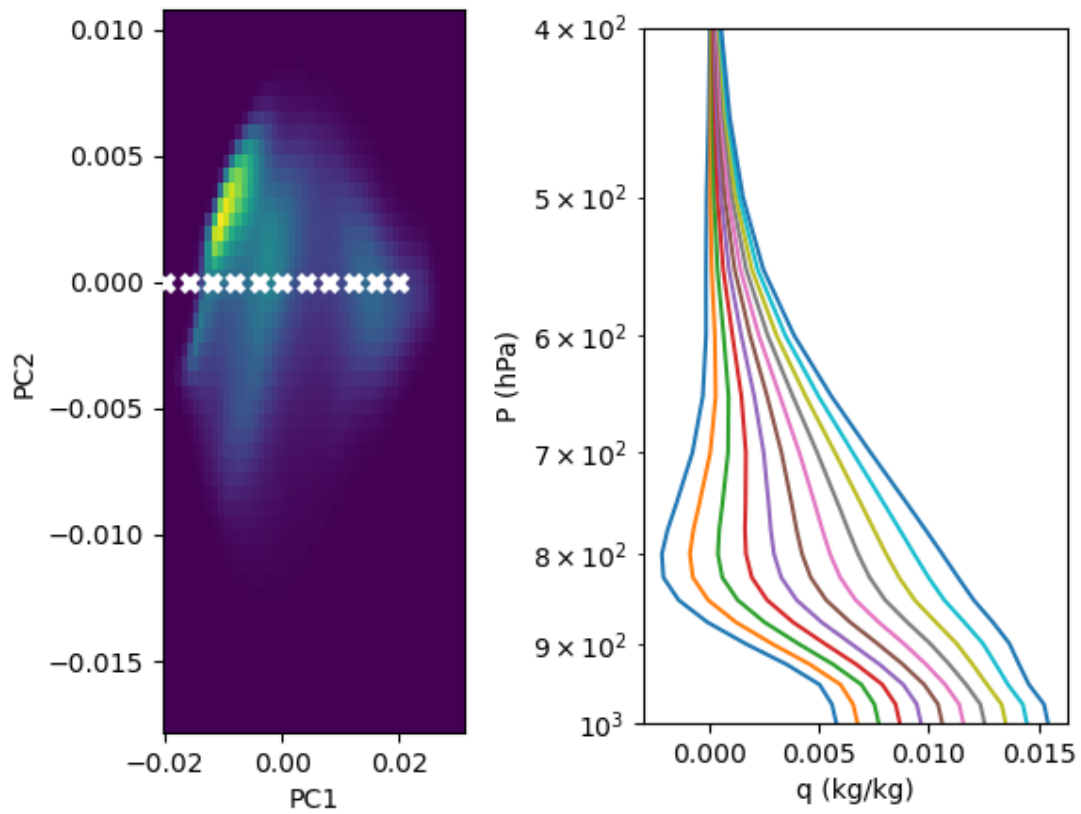
Figure S5. Example cross-section of water vapor profiles across PC1, showing the variation in total magnitude.
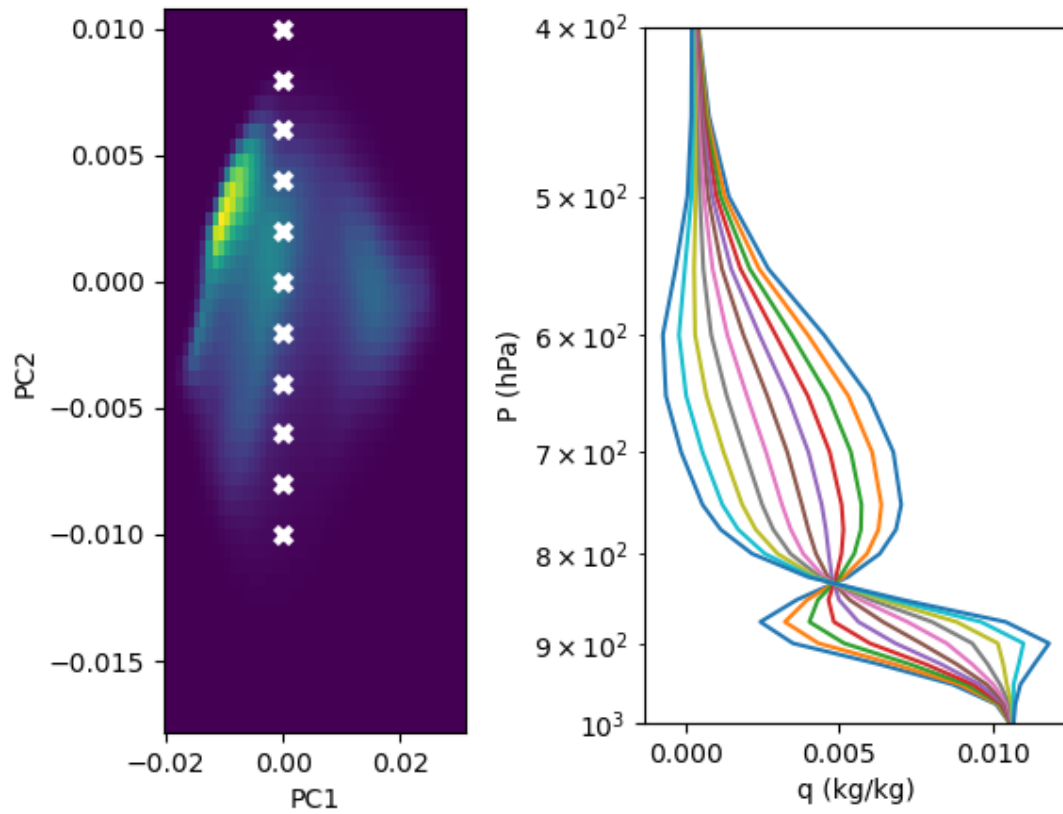
Figure S6. Example cross-section of water vapor profiles across PC2, showing how the upper-level to lower-level q varies along this component.
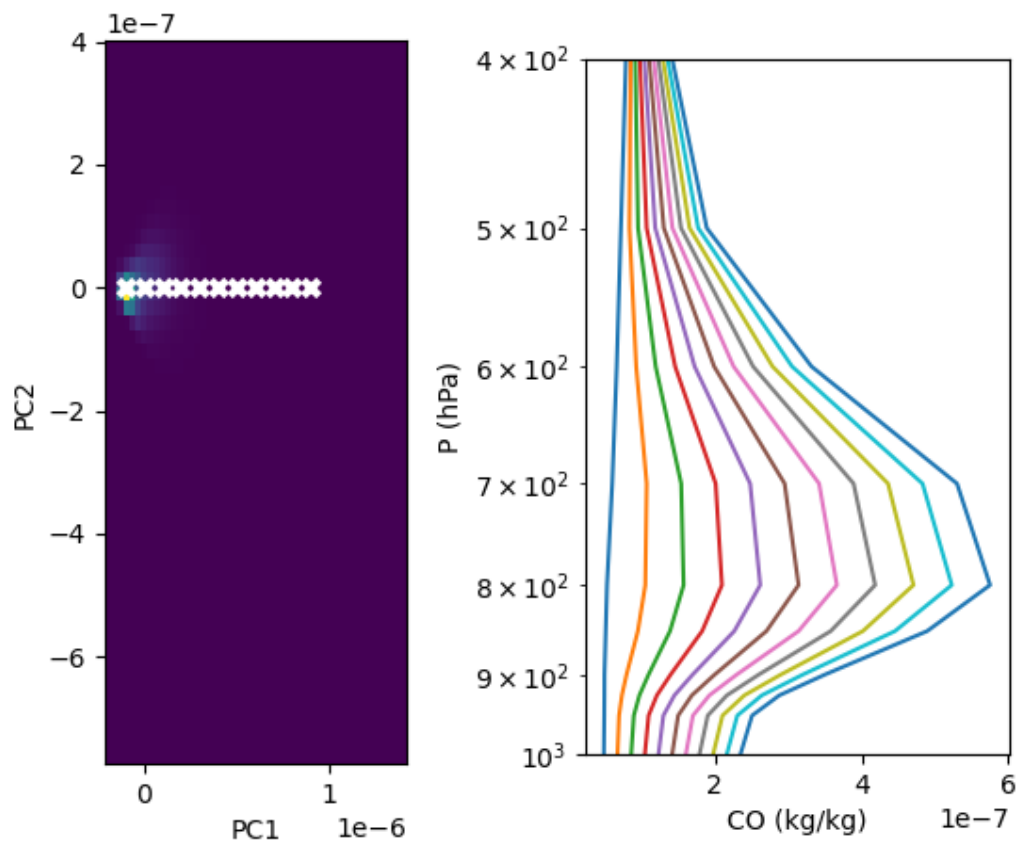
Figure S7. Example cross-section of carbon monoxide profiles across PC1, showing the variation in total magnitude.
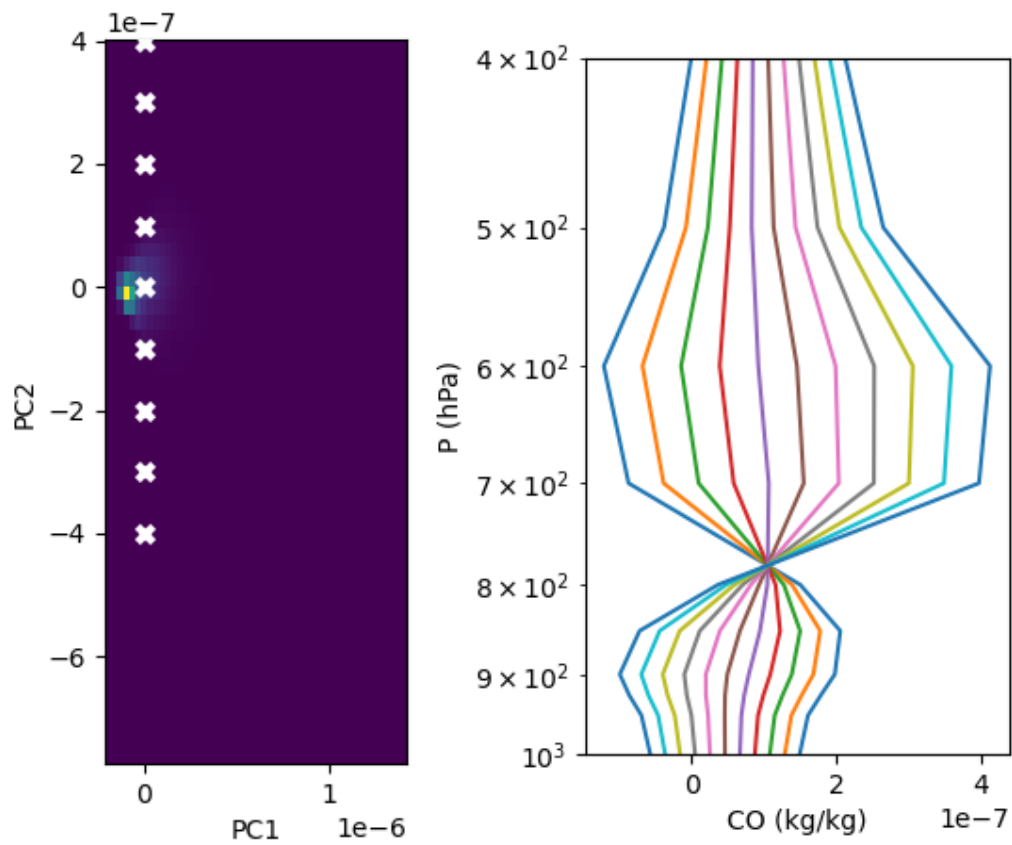
Figure S8. Example cross-section of carbon monoxide profiles across PC2, showing how the upper-level to lower-level CO varies along this component.