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ΔXCO/ΔXCO2 characteristics over coal-fire areas in Xinjiang, China using a portable EM27/SUN FTIR spectrometer

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Long-term coal spontaneous combustion (CSC) represents a severe and persistent threat, resulting in substantial waste of energy resources, significant environmental degradation, and serious risks to human health and safety. To better understand the emission characteristics of CSC, we conducted ground-based measurements of XCO□, XCH□, XCO and aerosol optical depth (AOD) using a Fourier-transform infrared spectrometer (EM27/SUN) within the COCCON network, in the Wugonggou coal-fire region near Fukang, Xinjiang.

Our results indicate that TROPOMI satellite data systematically underestimated XCO, with a mean bias of 4.53 ± 5.53□ppb (4.54%). For distinct enhancement events observed by COCCON, ΔXCO□ and ΔXCO exhibit a strong correlation (R^2□=□0.6082), with a slope of 9.782□ppb/ppm (9.782□×□10^{-3}□ppm/ppm). This value is lower than the CAMS inventory ratio of 13.52□×□10^{-3}. This discrepancy arises primarily from their distinct spatial representativeness. The COCCON instrument, located within the coal fire region, captures intense local combustion emission. In contrast, the CAMS product represents a daily average over a much larger model grid cell, which dilutes strong local point sources like coal fires within a broader regional background. Additionally, correlation analysis shows that ΔXCO is more closely linked to AOD (R^2□=□0.2283) than either ΔXCO□ or ΔXCH□, underscoring the distinct behavior of CO in coal-fire plumes.