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Long open-path measurements of CO₂ and CH₄ with an 125HR FTS in an urban environment.

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Quantifying sources and sinks, as well as chemical activity of trace gases in the lower troposphere, requires accurate measurements of the concentrations of the species of interest. While there exist in-situ measurement techniques, which are highly accurate, point-like measurements are only sufficiently representative in the spatial domain for a small area. This holds true in particular in high-gradient environments, e.g., urban settings. Hence, measuring those concentrations averaged on the length scale of a few kilometers is desirable. Furthermore, quantifying emissions requires combining concentration measurements with regional transport models, which cover a comparable spatial resolution.

We present a long open-path setup that measures average concentrations on the kilometer-scale in the urban boundary layer. Our setup, which is operational since March 2022, is based on a Bruker IFS 125 HR Fourier transform spectrometer, a commercially available spectrometer, which offers high resolution and throughput. The instrument choice provides flexible and explorative experimental setups such as variable and high spectral resolution and the extension of spectral coverage from the shortwave-infrared to the near ultra-violet spectral range. Here, we present the results on CO₂ and CH₄ from our 2022 measurement campaign as well as analysis of the diurnal variability in comparison to the prediction of local and regional transport models.