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Toward CO_2 and CH_4 measurements by ground-based observations of surface-scattered sunlight

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Precise knowledge of sources and sinks in the carbon cycle is desired to understand its sensitivity to climate change and to account and verify man-made emissions. In this context, extended sources like urban areas play an important role. While in-situ measurements of carbon dioxide (CO_2) and methane (CH_4) are highly accurate but localized, satellites measure column-integrated concentrations over an extended footprint. The CLARS-FTS [1, 2] stationed at the Mt. Wilson observatory looking downward into the Los Angeles basin has pioneered an innovative measurement technique that fills the sensitivity gap between in-situ and satellite measurements. The technique enables mapping the urban greenhouse gas concentration fields by collecting spectra of ground scattered sunlight and scanning through the region.

Here, we report on progress developing a portable setup for a CLARS-FTS-like measurement geometry. The instrument is based on the EM27/SUN FTS with a modified pointing technique and a more sensitive detector. The retrieval algorithm is based on the RemoTeC software, previously employed for solar backscatter satellite measurements. We discuss first steps in terms of instrument performance and retrieval exercises. For the latter, we have carried out simulations on how the neglect of scattering by the retrieval affects the retrieved boundary layer concentrations of CO_2 and CH_4 for an ensemble of hypothetical scenes with variable complexity in aeorsol loadings and viewing geometry. We also report on a test to apply RemoTeC to a small set of CLARS-FTS spectra collected throughout the Los Angeles basin.

References

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