Developing a lower-cost medium precision urban GHG monitoring system using commercial NDIR sensors

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Abstract:
Atmospheric pollution due to anthropogenic activities from cities is a major issue for air quality and for climate change by causing an increase in the atmospheric concentrations of GHG. It is also clear that accurate estimates of the magnitude of anthropogenic emissions are needed to assess their influence on the regional and global carbon balance.
A reliable dense ground-based GHG monitoring in cities (here Paris) combined with an atmospheric inversion framework would have the potential allow retrieving sector specific GHG emission estimates (Wu et al. 2016). One major barrier for denser observation networks can be the high cost of high precision instruments or high calibration cost of cheaper and unstable instruments. Within a climate KIC project, LSCE and SenseAir AB have worked on novel inexpensive NDIR sensors for CO_2 measurements (so-called HPP platform). The aim of the project is to obtain a prototype which delivers measurements that are accurate within 1 ppm for hourly means but only requiring monthly calibration. We conducted extensive laboratory tests (short and long-term repeatability, cross-sensitivities, etc.) on a series of prototypes and the final versions were also tested in a climatic chamber. On four final HPP prototypes the sensitivity to pressure and temperature were precisely quantified and correction&calibration strategies developed. Furthermore, we fully integrated these HPP sensors in a Raspberry PI platform containing the CO_2 sensor and additional sensors (pressure, temperature and humidity sensors), gas supply pump and a fully automated data acquisition unit. This platform was deployed in parallel to Picarro G2401 instruments in the peri-urban site Saclay, near Paris, France. These measurements were conducted over several months in order to characterize the long-term drift of our HPP instruments and the ability of the correction and calibration scheme to provide bias free observations.
From the lessons learned in the laboratory tests and field measurements, we developed a specific correction and calibration strategy for our NDIR sensors. Latest results and calibration strategies will be shown.

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Wu, L., Broquet, G., Ciais, P., Bellassen, V., Vogel, F., Chevallier, F., Xueref-Remy, I. and Wang, Y., 2015. Atmospheric inversion for cost effective quantification of city CO 2 emissions. Atmospheric Chemistry and Physics Discussions, 15(21), pp.30693-30756, accepted for publication in AMT.