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Methane source mapping in Paris urban area from mobile measurement of mole fraction and isotopic composition

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On a global scale, CH4 emissions are relatively well estimated. However, characterization of local scale CH4 sources is still not clear and require further analysis (Dlugokencky et al., 2011). Urban and sub-urban areas contribute from 30% to 40% anthropogenic greenhouse gas emission and concentrate more than 50% of the global population. However, those areas cover 2% of the Earth's surface. Moreover, an urban ecosystem is a complex case, where many different sources coexist: oil and natural gas networks, heating/cooling system, landfills and waste treatment, wastewater and road transport (Gioli et al., 2012; Townsend-Small et al., 2012; Zazzeri et al., 2017).

One of the significant urban CH4 sources can be the Ile-de-France (IDF) region (number of inhabitants:12,14 million, Paris contributing to 18% population). Due to this, methane emissions in IDF region need independent estimations, from atmospheric measurements. The main approach of this project is focused on field mobile campaigns using cavity ring-down spectrometer (CRDS analyzer).

Measurements of mole fraction focused on Paris city and suburbs allow to better understand urban fugitive emissions in a metropolitan area. Moreover, during campaigns, the isotopic composition of methane is also measured, which can extend knowledge about CH4 isotopic composition of European anthropogenic sources (Townsend-Small et al., 2012; Zazzeri et al., 2015; Zazzeri et al., 2017).

Here we present results from campaigns focused on measurement of mole fraction and isotopic composition performed in 2018 and 2019 in Paris. We show that in Paris there are districts where CH4 concentration is on background level but also there exist regions with concentration higher than 2.5 ppm or even 4 ppm. Additionally, we observe significant variations in measured isotopic composition.