Combined balloon, aircraft, and surface greenhouse gas measurements at Traînou supersite, France

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The Traînou supersite, located approximately 100 km south of Paris, is the only site in Europe where both ICOS and TCCON networks are operated: this supersite benefits from a tall tower setup for in-situ greenhouse gas (GHG) measurements at 5, 50, 100 and 180 m height, and is equipped with a ground-based FTIR (TCCON-Orléans) for total column measurements. In addition, an aircraft measurement program allows monthly flights to measure GHGs between 100 and 3000 m above the tall tower.

Recent developments of AirCores carried by weather balloons make now possible to derive GHG vertical profiles up to 30 km above the mean sea level (amsl) for moderate costs and logistics. These innovative systems are based on passive sampling of ambient air in a long tube while descending from high altitude. Analysis of trace gas mixing ratios in the sampled air core provides information on the vertical distribution of these trace gases from 30 km down the surface. Initially invented at NOAA, different versions have been developed with success in several research institutes.

Since October 2016, LSCE and LMD have developed their own AirCore system and initiated several intensive field campaigns at Traînou supersite. The aim of these campaigns is to demonstrate the scientific interest for combining surface, airborne, balloon-based and remote sensing measurements of CO_2 and CH_4 mole fractions. During the campaigns, several lightweight AirCores specifically designed for weather balloons were flown and successfully analyzed for GHGs retrieval. In parallel, aircraft measurements were performed. Moreover both a LIDAR and a second compact FTIR (EM27) were implemented during the last campaign (April 2017) at the bottom of the tall tower. In addition to the Traînou tower, we have benefited from the measurements of both the Saclay ICOS station (~80 km north of Traînou) and the Qualair plateform (in Paris downtown) where a second ground-based FTIR (TCCON-Paris) sampled the urban atmospheric column. The instrumental synergy used during the campaigns leads us to be in a unique and innovative position for analyzing spatiotemporal coherence between various measurement technics dedicated to the GHG survey.

Our poster describes in details the AirCore measurement technique developed at LSCE and LMD. We also present the dataset acquired from the different campaigns that merge observations from surface, aircraft, and AirCore measurements at the Traînou supersite, at the Saclay station and at the Qualair platform.