Abstract: J.Ryoo

Title: New approach to characterize CO2 and CH4 emissions over Sacramento, California using an airborne aircraft measurement

Emission fluxes of carbon dioxide (CO2) and methane (CH4) over Sacramento, California, USA, are estimated using an aircraft equipped with a cavity ring-down greenhouse gas sensor through the Alpha Jet Atmospheric eXperiment (AJAX). To better quantify the emission fluxes over the entire city and two small point sources within the area, we designed flights in a cylindrical pattern and computed the emission fluxes from 9 flights over all seasons using the Kriging method based on Gauss's divergence theorem. The concentrations at the downwind side of Sacramento show somewhat persistent patterns among the 9 flights, but the magnitudes and locations of the fluxes vary depending on the individual weather conditions and seasonality on a given flight day. The net emission fluxes tend to be smaller in summer (July) than winter (November). Both trace gas mixing ratios as well as the wind speed and direction show high spatial variability both horizontally and vertically.
The local maximum emission fluxes over a landfill and a rice field measured on July 29, 2015, were 2–3 times lower than the maximum measured over the entire city. These low emission fluxes suggest that not only the local source but also the transport of greenhouse gases due to diurnal and seasonal variation in winds have a strong effect on the CO2 and CH4 flux estimation of the both local emissions and city-size emissions. Our results highlight that the aircraft-based approach is effective and useful for capturing city-size emission fluxes and estimating the greenhouse gas emissions and its sources.