Fine-scale CO_2 variations over the Tokyo megacity observed by CONTRAIL

*Taku Umezawa[1], Hidekazu Matsueda[2], Toshinobu Machida[1], Yousuke Sawa[2], Yosuke Niwa[2]

1.National Institute for Environmental Studies, 2.Meteorological Research Institute

Urban areas are considered to account for ~70% of the global anthropogenic carbon emissions. Many cities now take actions to reduce their carbon emissions. However, atmospheric CO_2 measurement networks capable of verifying carbon emissions from large cities are still far from sufficient. CONTRAIL, an ongoing project to measure trace gases with instruments onboard aircraft of Japan Airlines, has obtained millions of CO_2 data over worldwide large cities since 2005. In general, we have observed increases of CO_2 concentration approaching down to the airports, indicating presence of CO_2 plume over metropolitan areas. We found vertical gradient of CO_2 concentration (i.e. difference between the free troposphere and the lowermost layer) larger for large megacities, suggesting that CO_2 plume correlates with size of the city. This infers that the CONTRAIL measurements may have potential to assess city's carbon emission trends. In this study, we focus on detailed analysis of CO_2 distributions over Tokyo, currently the world largest megacity. Analyzing thousands of vertical profiles of CO_2 over the Narita and Haneda airports over the last 10 years, we found CO_2 levels significantly different between areas over Haneda and north and south of Narita. This likely reflects different catchments of CO_2 plumes over the respective areas.

Keywords: Megacity, CO2, Aircraft measurements

