Atmospheric observations of CO2, 14CO2 and O2 concentrations to capture fossil fuel CO2 emissions from the Greater Tokyo Area

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The Greater Tokyo Area is the most populated (38 million) metropolitan area in the world. To capture fossil fuel carbon dioxide (CO2) emissions from the Greater Tokyo Area, we performed ground-based atmospheric observations for measuring concentrations of CO2, radiocarbon in CO2 (14CO2), oxygen (O2) and carbon monoxide (CO) at Tokyo Skytree (TST, with high altitude (250m) inlet) and Yoyogi (YYG, turbulent CO2 flux measurement site located in resident area) in Tokyo and at National Institute for Environmental Studies (NIES, suburb/rural area) in Ibaraki, Japan. The 14CO2 measurement was used for separating the fossil fuel CO2 emissions from the biotic emissions. Results from 14CO2 measurements showed that a ratio of fossil fuel-derived CO2 to the variation of CO2 concentrations was 71% in average for winter both at TST and YYG but varied from 44% to 92%, indicating significant contribution of biotic CO2 in Tokyo. The O2:CO2 exchange ratio (oxidation ratio, OR) was used for the partitioning of CO2 into emissions from gas fuels and gasoline. We observed larger OR in winter than in summer (due to both wintertime increases of fossil fuel combustion and summertime terrestrial biospheric activities) at TST and YYG and larger OR in the morning and late evening in winter due to increase of gas fuel combustion at YYG. We showed that the O2 concentrations might be also used as a proxy for continuous monitoring of fossil fuel CO2 content by assuming typical ratio of gas fuels and gasoline combustions. The presenter will introduce the related projects including development of building/road-scale dynamic CO2 mapping and grid-based CO2 emission inventory with high special resolution in Tokyo.