# Analysis on the Spatiotemporal Distribution of OCO-2 XCO$_2$ over South Korea

G. Kim, Y. Oh, S.T. Kenea, J. Rhee, T. Goo and Y. Byun

National Institute of Meteorological Sciences, Seogwipo-si, Jeju-do, South Korea; +82-6-4780-6743, E-mail: kimgawon@korea.kr

Recently, satellite observations with wide coverage and high spatial resolution such as Orbiting Carbon Observatory-2 (OCO-2) have made it possible to study regional carbon dioxide (CO$_2$) distributions. In this study, we analyzed the spatiotemporal distribution of OCO-2 column-averaged dry air mole fractions (XCO$_2$) over South Korea (34°N-38°N, 124°E-130°E) from October 2014 to February 2017 to improve our understanding on CO$_2$ monitoring for the regional scale. Monthly mean Korea OCO-2 XCO$_2$s follow the annual cycle which can be characterized by low concentrations in summer and increases in winter [Figure 1(a)]. Fourier Transform Spectroscopy (FTS) XCO$_2$ in Anmyeon-do (AMY FTS, 36.54°N, 126.33°E) corresponds to OCO-2 XCO$_2$ with average difference of 0.21% (R=0.89). Surface CO$_2$ in Tae-ahn peninsula (36.73°N, 126.13°E) shows similar annual behavior to OCO-2 XCO$_2$ (R=0.92) but larger amplitude and higher concentration (average difference of 1.84%) because surface CO$_2$ is affected by more factors than the column-averaged CO$_2$. To find the spatial distribution of Korea OCO-2 XCO$_2$, 0.1°X0.1° grid mean OCO-2 XCO$_2$ anomalies during the whole research period were computed [Figure 1(b)]. Most of positive anomalies tend to be located near the big cities and the industrial regions. The regional differences presented in OCO-2 XCO$_2$ indicates that the enhancement of CO$_2$ due to the anthropogenic emitters is well reflected in OCO-2 XCO$_2$. However, CO$_2$ concentration varies not only by the human activity but also by the natural causes. Hence, to identify local anthropogenic sources in detail, comparison between the spatial distributions of OCO-2 XCO$_2$ and other satellite-observed anthropogenic gases over Korea is under investigating.
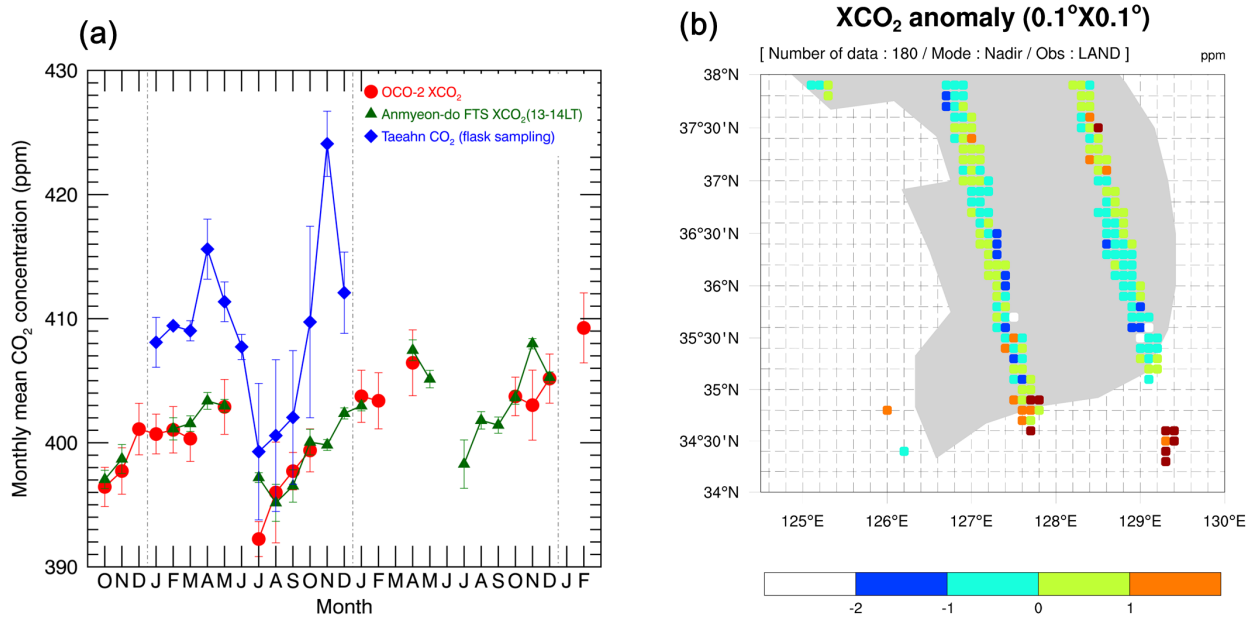
Figure 1. (a) Monthly mean concentration of OCO-2 XCO$_2$ (red), Anmyeon-do FTS XCO$_2$ (green) and Tae-ahn CO$_2$ (blue) for the period of October 2014-February 2017. Error bars indicate 1 standard deviation. (b) 0.1°X0.1° grid mean OCO-2 XCO$_2$ anomalies during the whole research period over Korea domain.