Analysis on the Spatiotemporal Distribution of OCO-2 XCO\textsubscript{2} over South Korea

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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\textsubscript{2}) distributions. In this study, we analyzed the spatiotemporal distribution of OCO-2 column-averaged dry air mole fractions (XCO\textsubscript{2}) over South Korea (34°N-38°N, 124°E-130°E) from October 2014 to February 2017 to improve our understanding on CO\textsubscript{2} monitoring for the regional scale. Monthly mean Korea OCO-2 XCO\textsubscript{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\textsubscript{2} in Anmyeon-do (AMY FTS, 36.54°N, 126.33°E) corresponds to OCO-2 XCO\textsubscript{2} with average difference of 0.21% (R=0.89). Surface CO\textsubscript{2} in Tae-ahn peninsula (36.73°N, 126.13°E) shows similar annual behavior to OCO-2 XCO\textsubscript{2} (R=0.92) but larger amplitude and higher concentration (average difference of 1.84%) because surface CO\textsubscript{2} is affected by more factors than the column-averaged CO\textsubscript{2}. To find the spatial distribution of Korea OCO-2 XCO\textsubscript{2}, 0.1°X0.1° grid mean OCO-2 XCO\textsubscript{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\textsubscript{2} indicates that the enhancement of CO\textsubscript{2} due to the anthropogenic emitters is well reflected in OCO-2 XCO\textsubscript{2}. However, CO\textsubscript{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\textsubscript{2} and other satellite-observed anthropogenic gases over Korea is under investigating.

**Figure 1.** (a) Monthly mean concentration of OCO-2 XCO\textsubscript{2} (red), Anmyeon-do FTS XCO\textsubscript{2} (green) and Tae-ahn CO\textsubscript{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\textsubscript{2} anomalies during the whole research period over Korea domain.