



## **Direct space-based observations of anthropogenic CO<sub>2</sub> emission areas from OCO-2**

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Anthropogenic CO<sub>2</sub> emissions from fossil fuel combustion have large impacts on climate. In order to monitor the increasing CO<sub>2</sub> concentrations in the atmosphere, accurate spaceborne observations—as available from the Orbiting Carbon Observatory-2 (OCO-2)—are needed. This work provides the first direct observation of anthropogenic CO<sub>2</sub> from OCO-2 over the main pollution regions: eastern USA, central Europe, and East Asia. This is achieved by deseasonalizing and detrending OCO-2 CO<sub>2</sub> observations to derive CO<sub>2</sub> anomalies. Several small isolated emission areas (such as large cities) are detectable from the anomaly maps. The spatial distribution of the CO<sub>2</sub> anomaly matches the features observed in the maps of the Ozone Monitoring Instrument NO<sub>2</sub> tropospheric columns, used as an indicator of atmospheric pollution. The results of a cluster analysis confirm the spatial correlation between CO<sub>2</sub> and NO<sub>2</sub> data over areas with different amounts of pollution. We found positive correlation between CO<sub>2</sub> anomalies and emission inventories. The results demonstrate the power of spaceborne data for monitoring anthropogenic CO<sub>2</sub> emissions.