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Detecting small scale CO_2 emission structures using OCO-2

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Localized carbon dioxide (CO_2) emission structures cover spatial domains of less than 50 km diameter and include cities and transportation networks, as well as fossil fuel production, upgrading and distribution infrastructure. Anthropogenic sources increasingly upset the natural balance between natural carbon sources and sinks. Mitigation of resulting climate change impacts requires management of emissions, and emissions management requires monitoring, reporting and verification. Space-borne measurements provide a unique opportunity to detect, quantify, and analyze small scale and point source emissions on a global scale.
NASA's first satellite dedicated to atmospheric CO_2 observation, the July 2014 launched Orbiting Carbon Observatory (OCO-2), now leads the afternoon constellation of satellites (A-Train). Its continuous swath of 2 to 10 km in width and eight footprints across can slice through coincident emission plumes and may provide momentary cross sections. First OCO-2 results demonstrate that we can detect localized source signals in the form of urban total column averaged CO_2 enhancements of $\sim$2 ppm against suburban and rural backgrounds. OCO-2's multi-sounding swath observing geometry reveals intra-urban spatial structures reflected in XCO_2 data, previously unobserved from space. The transition from single-shot GOSAT soundings detecting urban/rural differences (Kort et al., 2012) to hundreds of soundings per OCO-2 swath opens up the path to future capabilities enabling urban tomography of greenhouse gases.
For singular point sources like coal fired power plants, we have developed proxy detections of plumes using bands of imaging spectrometers with sensitivity to SO_2 in the thermal infrared (ASTER). This approach provides a means to automate plume detection with subsequent matching and mining of OCO-2 data for enhanced detection efficiency and validation.