AGU FALL MEETING
Online Everywhere | 1–17 December 2020

A241 - Remote Sensing of CH_4 and CO_2 from Space: The Expanding Observing System I

Can a COVID-19 related regional-scale CO_2 emission reduction be detected from space using satellite XCO_2 retrievals?: A case study for East China

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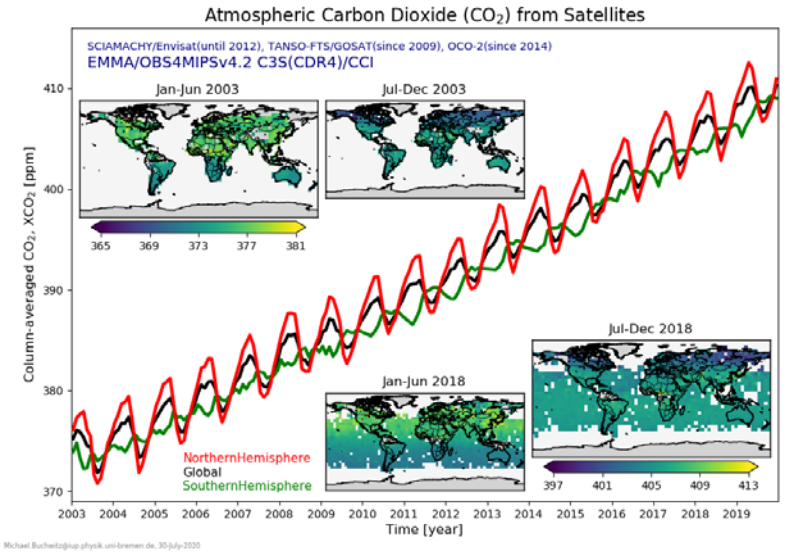
Motivation

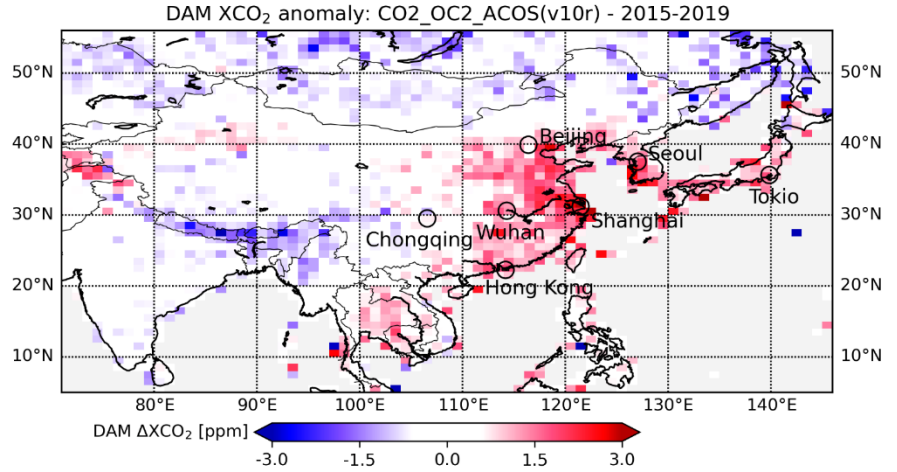
Research question:

- Can a COVID-19 related regional-scale CO_2 emission reduction be detected from space using satellite XCO_2 retrievals? A case study for East China



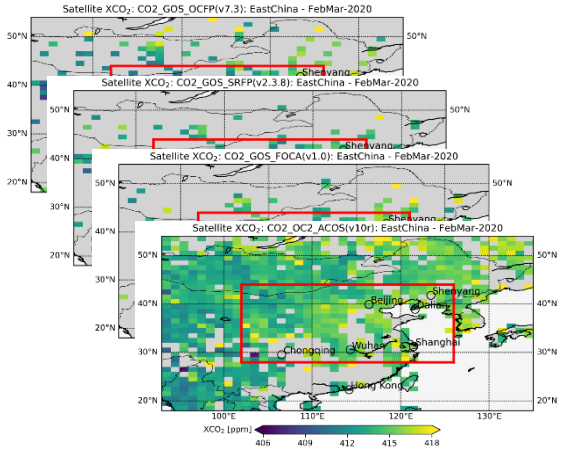
Relevance:

- CO_2 is an important greenhouse gas and tracking emissions is important (e.g., Paris Agreement)
- Future satellite missions (e.g., CO2M) will be optimized to get information on anthropogenic emissions and existing satellites are important to help preparing for this

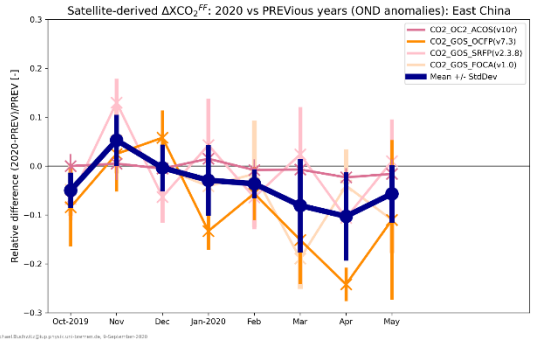


Results

Input: 4 XCO_2 data sets
(x1 OCO-2, x3 GOSAT)



Output: Estimated East China FF CO_2 emission changes 2020 compared to pre-COVID-19 and previous years:



Details?
Please see:

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Atmospheric Measurement Techniques Discussions

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Can a regional-scale reduction of atmospheric CO_2 during the COVID-19 pandemic be detected from space? A case study for East China using satellite XCO_2 retrievals

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Method:

- Simple & data-driven: XCO_2 -> XCO_2 anomalies, ΔXCO_2 -> emission estimates, ΔXCO_2^{FF}

Findings w.r.t. East China CO_2 emissions:

- Large month-to-month variability
- Large uncertainty and significant differences between ensemble members, e.g.:
  - Ensemble mean suggests an emission reduction of ~9% ± 10% (1-sigma) in March/April 2020
  - OCO-2 suggests much smaller emission reduction (1-2% ± 2%)

Main conclusions:

- Study highlights the challenge to reliably detect and to accurately quantify regional-scale reduction of FF emissions
  - Small signal (sub ppm), sparseness of satellite data (current satellites are not optimized for this application), clouds, remaining potential biases, impact of biosphere and transport, …
  - Application likely requires, if at all possible, detailed inverse modelling
  - Local emission hot spots (power plants, cities) may be less challenging
- Findings not unexpected as regional-scale XCO_2 enhancements due to FF emissions are only ~1 ppm above background and therefore even a 20% emission reduction would only result in a regional-scale XCO_2 reduction of ~0.2 ppm

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