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Atmospheric Measurement Techniques Discussions

Interactive comment on "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" *by* Michael Buchwitz et al.

Anonymous Referee #1

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General comments The authors prepared an analysis of available satellite CO2 observations to quantify impact of CO2 emission reduction in early 2020 on the amplitude of the regional XCO2 anomaly observed over East China. The analysis is made without detailed transport modeling and thus has to rely on the magnitude of the regional mean CO2 concentration enhancements. Positive outcome of the analysis is that the change in the regional CO2 difference relative to the background was possible to detect, and the negative one was that the uncertainty appears to be of the same order as signal. Authors cite weak signal, large variability in observation/cloud coverage and

impact from biospheric fluxes on XCO2 as complicating factors. The elaborate analysis is a valuable addition to a body of evidence on capability of global carbon observing system to detect the short and long-term changes in CO2 emissions and sinks. The paper is well written and can be published after applying minor revisions and technical corrections.

Detailed comments

Introduction. Authors can use opportunity to mention more recent publications on the topic, complimentary to this study (Chevallier et al. 2020; Tohjima et al. 2020; Zeng et al. 2020)

L205-210 Not clear if the CarbonTracker-derived scaling of XCO2 to FF emissions helps correcting for year to year variability in wind speed, or it is a climatology. Need to clarify. It can be mentioned Zheng et al, 2020b used transport model for a similar purpose.

L336 The DAM method is not supposed to extract exclusively anthropogenic emission contributions to XCO2, it is better to revise the sentence accordingly.

L355-362 The discussion gives impression that the satellite observation/retrieval errors are most important, while the contribution of the short and long-range transport including both biogenic and fossil signals is not explicitly mentioned, while it is likely to contribute to differences between different time periods, especially across GOSAT products

L365 If errors do not scale with the inverse of the square root of number of observations, then those may be not random enough.

Technical corrections

L92 Suggest checking reference format: Sussmann and Rettinger, 2020, or (2020) L770 Zheng et al. paper status changed to published.

References

Chevallier, F., Zheng, B., Broquet, G., Ciais, P., Liu, Z., Davis, S. J., et al. Local anomalies in the columnâĂŘaveraged dry air mole fractions of carbon dioxide across the globe during the first months of the coronavirus recession. Geophysical Research Letters, 47, e2020GL090244, https://doi.org/10.1029/2020GL090244, 2020.

Tohjima, Y., Patra, P.K., Niwa, Y. et al. Detection of fossil-fuel CO2 plummet in China due to COVID-19 by observation at Hateruma. Sci Rep 10, 18688. https://doi.org/10.1038/s41598-020-75763-6, 2020.

Zeng N., Han P., Liu D., Liu Z., Oda T., Martin C., Liu Z., Yao B., Sun W., Wang P., Cai Q., Dickerson R., Maksyutov S. Global to local impacts on atmospheric CO2 caused by COVID-19 lockdown. https://arxiv.org/abs/2010.13025, 2020

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