

***Interactive comment on “Towards space based verification of CO<sub>2</sub> emissions from strong localized sources: fossil fuel power plant emissions as seen by a CarbonSat constellation” by V. A. Velazco et al.***

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Received and published: 5 November 2011

First of all, we thank the two anonymous referees for their comments, suggestions and ideas that serve to improve this manuscript. Advances in science depend not only in researchers but also on their peers willing to spend precious time in contributing to the review process. We have addressed all the referees' comments and outlined them below. For clarity, we designate referee comments as “RC” and author comments as “AC”.

C1987

RC: 1. Page 3, line 9: accross => across AC: Done, thanks

RC: 2. Page 3, line 35: “: : : in 2009, unfortunately, : : :” => “: : : in 2009, but unfortunately, AC: Done, thanks

RC: 3. Page 4, line 12: “: : :2018 earliest.” => “: : :2018 at the earliest.” AC: Done

RC: 4. Page 8, equation 4: the assumption of data independence for configuration 1 and 3 is reasonable given that any air parcels after a day would have moved on as it were. But what about configuration 2, with 5 measurements 2 hours apart? What effect might a 2 hour correlation length make in the first one or two off-diagonal elements?

AC: This is a good point and may be relevant especially at very low wind speeds. For a typical wind speed of about 3 m/s, an air parcel travels approximately 7 km within 2 hours, i.e., it is still “close” to the power plant when the next CarbonSat overpass is to be expected. Under these circumstances non-diagonal elements may be relevant indicating positive correlations. In this case the precision reduction upon averaging will be less compared to uncorrelated observations. This is basically another reason why configuration 003 is preferred over 002. We will mention this aspect in the revised version of the manuscript.

RC: 5. Page 9, line 13: This sentence might read a bit better thus; “The reason for this, in this example, is that the : : :”

AC: Thanks, we reworded this sentence to: “This is because, in this example, the emissions during day do not vary so much (therefore one sample per day is sufficient).“

RC: 6. Page 9, lines 22-27: the night – day bias is mentioned here, while the cloudy – clear bias is also quantified at 3%. Given the data, is the bias in the night – day data of about 0.8 Mt CO<sub>2</sub>/yr (by inspection of the reported numbers earlier on this page) at all consistent with what might be expected from sampling only during the day? Or maybe there is no independent way of doing this as presumably this is reflected directly from the emission data at hand. This former bias is around 3% as well so it is interesting

C1988

that this bias is consistent with quite different sampling intervals.

AC: The conclusion of the referee that the day-night bias is close to 0.8 Mt CO<sub>2</sub>/yr seems to stem from the difference of the true to the retrieved CO<sub>2</sub> emission values listed in the first paragraph of Section 3 (21.2 Mt CO<sub>2</sub>/yr – 20.4 Mt CO<sub>2</sub>/yr = 0.8 Mt CO<sub>2</sub>/yr, i.e., 4%). This value is however only true for the discussed Navajo Generating Station. In fact the day-night bias depends significantly on the time dependence of the emission, which significantly differs for each power plant as discussed in our manuscript. As shown in Fig. 2, the day-night bias is on average 8.7%, which is close to the systematic sampling related error of the annual emissions obtained from CarbonSat. These findings are therefore consistent.

RC: 7. Page 11, line 20: “ : : :coverage is important, such as for : : :” => “ : : :coverage is important for : : :”

AC: We changed this sentence to: “Configuration 002 might be advantageous for observing the daily cycle of CO<sub>2</sub>, but for other reasons, fast global coverage is important; for instance, in monitoring important events that only last a few days.”

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Interactive comment on Atmos. Meas. Tech. Discuss., 4, 5147, 2011.