

***Interactive comment on* “Towards constraints on fossil fuel emissions from total column carbon dioxide” by G. Keppel-Aleks et al.**

Anonymous Referee #2

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The manuscript “Towards constraints on fossil fuel emissions from total column carbon dioxide” from Keppel-Aleks et al. submitted for publication in ACP covers an interesting topic relevant for ACP, is well written and contains new material not published before. I therefore recommend publication after the items listed below have been carefully considered by the authors.

The authors missed to cite other relevant publications discussing total column carbon dioxide observations to derive information on anthropogenic/fossil CO₂ emissions. This is a serious shortcoming of the manuscript. Among these publications are at least the following (see References): Schneising et al., 2008, discussed the use of real SCIAMACHY satellite data to obtain information on anthropogenic CO₂ emissions for central Europe. The potential of future satellites (focusing on finer scales than in

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this manuscript, primarily power plants) is discussed in Bovensmann et al., 2010, and Velazco et al., 2011. These and possibly other related publications need to be cited. This is a major comment. Please make sure that all relevant publications are cited. It is also recommended for the revised version to cite publications which appeared after submission of this manuscript, e.g., Schneising et al., 2012.

Page 29892, line 9 following: The approach of selecting the north-south boundaries based on potential temperature is explained, but no assessment is presented on the impact of this approach on the quality of the results. Please provide an assessment of the impact of the assumptions made on the derived XCO₂ contrast presented later.

Page 29893, line 7-9: Is “prediction” the right term or is “method” more appropriate?

Page 29893, line 15 following: Is the same filtering as applied to GOSAT data also applied to the AM2 model data?

Page 29894, line 9 following: Discussion of Table 2 and content of table caption: Please add a more detailed explanation on Table 2. Is my understanding correct that the table shows, for example, the contrast between a European source region and an upwind region in India? If yes, does this really make sense? But maybe I misunderstood the table.

Page 29898, line 28: The statement on geostationary observations seems to be quite optimistic and not justified by a reference. GEO observations of XCO₂ and XCH₄ at high spatial resolution in combination with high SNR will be much more challenging and there are clear limitations: likely compromises on the spatial resolution have to be made, the large amounts of “slant observation conditions” from GEO will likely yield larger systematic errors for XCO₂ and it will not be possible to get globally comparable data from one GEO satellite only. If the better temporal sampling will outperform the above deficiencies needs to be shown. Either remove or at least tone down the statement on GEO or include a reference where the advantages of GEO for the envisaged application are justified.

Page 29899, line 6 and following: Concerning future missions: The published Carbon-Sat (Bovensmann et al. 2010) and CarbonSat constellations concepts (Velazco et al., 2011) also aim at contributing to quantify fossil fuel contributions to the overall carbon budget, with similar spatial resolution as OCO-2, but much improved spatial coverage (one order of magnitude better than OCO-2). This also needs to be mentioned and cited adequately in the conclusions section.

References:

Bovensmann, H., Buchwitz, M., Burrows, J. P., Reuter, M., Krings, T., Gerilowski, K., Schneising, O., Heymann, J., Tretner, A., and Erzinger, J.: A remote sensing technique for global monitoring of power plant CO₂ emissions from space and related applications, *Atmos. Meas. Tech.*, 3, 781-811, 2010.

Schneising, O., Buchwitz, M., Burrows, J. P., Bovensmann, H., Reuter, M., Notholt, J., Macatangay, R., and Warneke, T., Three years of greenhouse gas column-averaged dry air mole fractions retrieved from satellite - Part 1: Carbon dioxide, *Atmos. Chem. Phys.*, 8, 3827-3853, 2008.

Schneising, O., J. Heymann, M. Buchwitz, M. Reuter, H. Bovensmann, and J. P. Burrows, Anthropogenic carbon dioxide source areas observed from space: assessment of regional enhancements and trends, *Atmos. Chem. Phys. Discuss.*, 12, 31507-31530, 2012.

Velazco, V. A., Buchwitz, M., Bovensmann, H., Reuter, M., Schneising, O., Heymann, J., Krings, T., Gerilowski, K., and Burrows, J. P.: Towards space based verification of CO₂ emissions from strong localized sources: fossil fuel power plant emissions as seen by a CarbonSat constellation, *Atmos. Meas. Tech.*, 4, 2809-2822, doi:10.5194/amt-4-2809-2011, 2011.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 12, 29887, 2012.

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