We thank anonymous referee #1 for evaluating our manuscript and for the very useful comments, which we treat in the following item-by-item. In this author comments all the points one-by-one raised by the reviewer are replicated in blue text, along with the corresponding reply from the authors in black text.

L42: a reference would be good.

You are right, this would be appropriate. We have added the following references:

Hoegh-Guldberg, O., D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K.L. Ebi, F. Engelbrecht, J. Guiot, Y. Hijioka, S. Mehrotra, A. Payne, S.I. Seneviratne, A. Thomas, R. Warren, and G. Zhou, 2018: Impacts of 1.5ºC Global Warming on Natural and Human Systems. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

L50: the reference is only 7 years after 2005, which is in conflict to the statement.

Correct, sorry for the incorrect statement. We have changed the sentence to:

Unfortunately, after several years the global anthropogenic emissions of GHGs continued increasing (Harris et al., 2012).

L59: 'long lived' should be specified.

We added the following information and reference:

[CO_2 …] is long lived because it has an atmospheric lifetime which spans from centuries to millennia (IPCC, 2018)

IPCC (2018). Summary for Policymakers. in Global Warming of 1.5 C: An IPCC special report on the impacts of global warming of 1.5 C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, [Masson-Delmotte, V., et al. (eds.)] 32 pp, World Meteorological Organization, Geneva, Switzerland.

L61: 'more crucial than ever' should be rewritten.

Thanks, we rephrased the sentence as follows:

Both applications require measuring relatively small changes over a large background concentration, which requires high-accuracy instrumentation and calls for continuous efforts on improving the instrumental and data processing state-of-the-art (Frey et al., 2019, Alberti et al., 2021).

L66: I know there is no freely available data from Tansat so far, but shouldn't it still be mentioned ?

Agreed, we have added this information and reference:

…, and the Chinese Carbon Dioxide Observation Satellite (TanSat) (Liu et al., 2018).

Liu, Y., Wang, J., Yao, L., Chen, X., Cai, Z., Yang, D., Yin, Z., Gu, S., Tian, L., Lu, N., and Lyu, D.: The TanSat mission:434 preliminary global observations, Sci. Bull., 63, 1200–1207, https://doi.org/10.1016/j.scib.2018.08.004, 2018.

L105: this region has 'high uncertainties' because of the high emissions and high fluxes. This then raises the question if the scaled COCCON product can contribute to lower these high uncertainties also on the global scale?

This is a very interesting question! As COCCON is on its way of becoming a quasi-global network, we expect that COCCON will be able to contribute to lower the uncertainties on global scale as well. This could be achieved by either generating "nudged" CAMS fields (which is what we did for a target region in the framework of our study) or by more advanced procedures of data assimilation. The usefulness of TCCON for this purpose has been demonstrated by Chevallier et al., 2011.

Chevallier, F., et al. (2011), Global CO2 fluxes inferred from surface air-sample measurements and from TCCON retrievals of the CO2 total column, Geophys. Res. Lett., 38, L24810, doi:10.1029/2011GL049899.

L315: There are very few (or no?) overpasses within 50km for Yekaterinburg. Do the points with a higher difference in Fig. 10 (d and e) correspond to the overpasses with a higher distance? Maybe a plot delta xGas vs. distance would clearify this (in the appendix).

This is a valid point. We have added the following paragraph in the paper and added the following Table 1 and the Figure 1 to the paper appendix.

The Table A-2 lists the number of coincidences (pixel-wise) for 50 and 100 km radius, and the number of coincident satellite pixels is reduced by a factor of 3 to 5 for the narrower radius. From the Figure A-5, we do see a tendency of slightly reduced differences with closer colocation within the 100 km limit in case of CH_4, but no clear tendency for the other species. Due to the low number of coincident measurements when using 50 km, we decided to accept the 100 km distance criterion for the Yekaterinburg observations.

Table 1. Number of TROPOMI measurements within 50 km and within 100km, respectively.

	R = 50 km	R = 100 km
XCH_4	101	345
XCO	265	1111
XH_2O	19	136

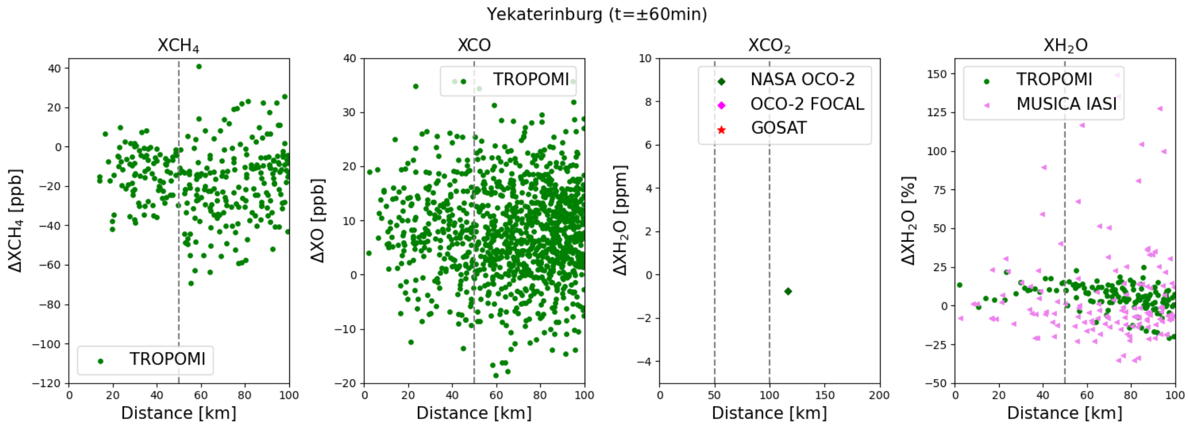

Figure 1. Difference between a single TROPOMI measurement with the averaged COCCON measurement (±1 h of satellite overpass) with respect to their distance.