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Comment on amt-2021-145

François-Marie Bréon (Referee)

Referee comment on "Assessing the feasibility of using a neural network to filter Orbiting Carbon Observatory 2 (OCO-2) retrievals at northern high latitudes" by Joseph Mendonca et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-145-RC2>, 2021

This paper develops and discusses a Neural Network method to select "good" XCO₂ retrievals from a number of input parameters with a focus of high latitudes. It shows that the NN approach, when compared to the standard quality filter, allows a higher throughput and a slightly better quality in most cases.

Neural Network approaches are gaining popularity for the processing of remote sensing data and this paper can be of interest to a growing community. The paper is well written, very clear, and the conclusion are clearly supported by the data analysis. It could be published with little modifications.

I nevertheless urge the authors to consider the following suggestions

My only significant criticism on the method is the use of 0/1 quality parameters. Indeed (line 173) the target for the neural network is 0 when the XCO₂ error is less than 2.5 ppm and 1 when it is larger than that. This means that a sounding with an error of 2.45 is considered as good as a sounding with an error of 0, while a sounding with 2.55 is as bad as that with an error of 7 ppm. I would have suggested to rather train the NN with a target that is a continuous function of the absolute error $|\text{TCCON-OCO}_2|$.

Similarly, I am surprised by the choice of the threshold at 0.1 (line 205) that is not justified. It would have been interesting to show the standard deviation of the error as a function of the NN output (before the 0/1 classification). This would have provided arguments for the selection of the selection threshold (currently set at 0.1)

- The abstract could mention the NN input features that seem to have the highest influence on the results
- Some of the technical description of the NN approach (lines 150-160, lines 186-196) may not be needed in the paper as they are described in other documents
- Line 219 : I do not think that "separated into two datasets" is appropriate as some elements of the original dataset are in none of the two while some others are in both
- The paper shows the pass fraction as a function of 3 of the NN input parameters (features) (Figure 4). I assume the same has been done for the others. If not mentioned, I assume it means there is so significant variation. Please confirm
- Figure 3a is impossible to read as they are two many datapoints. I strongly suggest to change the figure style, or to make a random sample of the datapoints before plotting
- Figure 5-7 are difficult to read. I believe it would be better by showing two bars side by side rather than the plain/dash drawing