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Comment on amt-2021-313

Sihe Chen (Referee)

Referee comment on "On the potential of a neural-network-based approach for estimating XCO_2 from OCO-2 measurements" by François-Marie Bréon et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-313-RC2, 2022

Overview

This paper corrects a problem in a previous work, David et al., (2021). In that work, the NN is overfitted to be able to predict the latitude of the sounding. In this work, the problem from the previous work is fixed, and the weak CO2 band is excluded from the analysis. Good results are obtained in comparison to different XCO2 sources.

Comments:

The article provides a very good general network trained for prediction of XCO2. I recommend that this article be added to the literature with several of the following minor issues addressed.

The authors have clearly shown a nice hypothesis of how D21 could have made a precise prediction on its location. From my perspective of view, this hypothesis is not hard to test. For example, the authors could try to train a NN with wCO2 as the input only and try to retrieve the time information, or they can show a figure just like Figure 1 for an NN with wCO2 removed.

Regarding the description of NN: can you provide the loss function that is used? Also, for the NN structure, I suggest that you show what specific hidden layer numbers are chosen in a table and how they are chosen. Doing something similar for the number of hidden layers could be good too, which should be better than simply stating the decision to be related to experiences. An example is Chen et al., 2022, fig. 8: https://www.sciencedirect.com/science/article/pii/S0022407321005409

Line 267: At first it was stated that sCO2 band was considered but later an O2 band albedo increase is specified. Also, it would be good if both bands' albedo could be compared to the standard deviation, so that we can see which factor plays a more important role.