Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
https://doi.org/10.5194/amt-2021-177-RC1, 2021

Comment on amt-2021-177

Anonymous Referee #2

Referee comment on "Automated detection of atmospheric NO_2 plumes from satellite data: a tool to help infer anthropogenic combustion emissions" by Douglas P. Finch et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-177-RC1, 2021

General comments

The manuscript entitled 'Automated detection of atmospheric NO_2 plumes from satellite data: a tool to help infer anthropogenic combustion emissions' by Finch et al. presents a convolutional neural network to identify plumes of NO_2 from TROPOMI. The authors claim that the algorithm can be used for detecting individual plumes (urban, oil and gas production, power plants) and the distribution of the detected plumes was compared with an anthropogenic CO_2 emission inventory. I found the approach is appealing, especially with regard to combining VIIRS data to sort out locations of open biomass burning. Furthermore, the attempt to correlate NO_2 plumes with anthropogenic CO_2 emission can be an interest of many readers in AMT. Notwithstanding the possible global application of such algorithms, I would suggest drawing conclusions more carefully by stating possible false detections of plumes caused by either the proposed model itself or the TROPOMI retrieval algorithm.

Specific comments

Line 89. I am not sure whether this 'active fire' (VNP14 data) can be identical to 'open biomass (or fossil fuel) burning. Maybe further explanations or rationales may be useful.

Line 114. Can you please elaborate regarding the random drop of 50% of the intermediate features (not the data)? As far as I understand, this random dropout is not learnable. This means that you could actually reduce the number of convolutional layers before dropping the features randomly.

Line 122. What does this mean 'individually normalized'? Does it mean it was normalised per image? If it is true, doesn't it increase the possibility for false detections? What happens if you normalise TROPOMI data globally? What is the benefit of normalizing per image?

Line 125-140. A machine learning algorithm is basically 'training data' itself. It seems that the training data were selected by 'crowd sourcing', and then by authors. Is it correct? If yes, why is that? Why not using actual distribution of plumes (or several known plumes)? Please discuss this point.

Line 232-234. '2019 ODIAC emissions were used for January-June 2020' – How about the effect of COVID lockdowns during 2020? Can you also mention about this?

Line 189-290, 287-290, and Figure 7. I would suggest to examine carefully these detected clusters with other data sources (even Google maps). Couldn't these be possible errors from TROPOMI retrieval algorithms? For instance, reflection from salt lakes, solar panels,,, etc.. ?

technical corrections

Line 83. 'the the Copernicus'

Line 85. the spatial resolution of TROPOMI has been changed since 6 August 2019 (https://sentinels.copernicus.eu/web/sentinel/data-products/-/asset_publisher/fp37fc19FN8F/content/sentinel-5-precursor-level-2-nitrogen-dioxide)

Line 106. Is '(progressively incomprehensible to human)' part necessary?

Line 186. 'overpass time of 1330' to 'overpass time of 13:30'

Line 301. 'and then and then displays'