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Interactive comment

Interactive comment on "Space-based NO_x emission estimates over remote regions improved in DECSO" *by* Jieying Ding et al.

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The manuscript "Space-based NOx emission estimates over remote regions improved in DECSO " by Ding et al. presents an improved version of the DESCO algorithm and its application to the Asian region and very interesting observations of ship tracks. The approach to derive emission inventories from satellite observations definitely address relevant scientific questions and is within the scope of AMT. The DESCO algorithm itself has been described in previous papers, but the improvement presented in this manuscript as well as the application to the Asian region is worth publishing as a separate paper. The study is generally suitable for publication in AMT, but needs some revisions as listed below.

Comments:

It is not clear to me how you can derive the uncertainty of 20% for the monthly grid cell emissions just by comparing 2 years. van der A et al. (2016) showed that the average NOx emission over Eastern China stays more or less constant in those two years, but also shows that the different provinces have their peak NOx emissions in different years, so the assumption of constant emissions might only hold on average but not for individual locations. What data are you comparing exactly, daily values or monthly? What starting conditions are you varying? Since with this approach you can only determine the precision but not the accuracy of your results, have you tried to determine systematic errors as well?

Would it be possible to use model data to test your algorithm? You could integrate the model output over height to simulate the satellite measurement, add some noise and then apply your retrieval technique. Of course you cannot determine how the model uncertainties affect your emission estimates, but at least you could compare improvement efforts to the algorithm.

You mention the precision of monthly emissions, but since you have the word 'daily' in your algorithm name, you might want to refer to the daily emission estimates.

In Sec. 2 you describe how you filter the observations, so it might be interesting to get to know how much data is left after that.

It might be helpful to better describe what the variables in Eq. 1 depend on. eˆf(t) e.g. looks like it only depends on the current day, but it depends mainly on the previous day, right? Unfortunately I couldn't find the time to read all the referenced papers with the more detailed algorithm description, so maybe more details are given there, but a more detailed in this paper might help. Does the observed NO2 column concentrations vector y only contains observations from the same day or also includes previous days?

The sentence starting in line 12 on page 5 is a little confusing. You might want to add 'forecasted' and 'measured' to the sentence "...the [] emissions of one day are equal to the [] emissions of the previous day" to be consistent with the equation. Please clarify if the equation and the sentence are only true on average.

In addition to the correlation coefficients provided in lines 18ff on page 7, you could also mention slope and offset of a linear fit between modeled and measured NO2 columns, because a consistent over- or underestimation is equally important and doesn't show in the correlation coefficient.

Adding the locations of the cities mentioned in the text to Fig. 7 would make it easier for those not familiar with this area of the world to follow the description in Sec. 4.2.

Can you provide a correlation coefficient of the emission data from Fig. 7 with the ship location density from Fig. 8? It seems to be quite good for the quadrangle marked in Fig. 7 but not so much in the Yellow Sea where you detect some emissions as well, any idea why that is?

You write that changing the threshold value of the sensitivity matrix H reduced the errors and I'm wondering how you determined the optimal threshold.

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