

Geosci. Model Dev. Discuss., referee comment RC2  
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## Comment on gmd-2021-80

Anonymous Referee #2

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Referee comment on "Exploring deep learning for air pollutant emission estimation" by Lin Huang et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-80-RC2>, 2021

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The study presented in this paper is very interesting and the topic is within the scope of GMD. The authors proposed a novel network-based method to model the dual relationship between emission inventory and pollution concentration, so as to improve the performance of chemical transport models by updating the emission inventory. Considering the complexity and inaccuracy in preparing anthropogenic emission inventory, this research is of great significance. Overall, the acceptance of this paper is greatly encouraged, but some revision is recommended to address the specific comments below.

### Major Comments:

- Concentrations at a point can be affected by emissions from local as well as can be transported through long range transport. How do the authors make sure that while updating the emissions using the difference in gradients between the predicted and observed concentration, not only the local emissions but emissions from other regions having possibility of transport of concentrations to the said point are also updated?
- The simulated concentrations will have some positive or negative bias based on a range of factors ranging from under/over prediction of meteorology, chemical mechanism as well as emissions. The authors seem to add/subtract all this bias in predicted concentration to update the emission inventory. How correct is to then update the emission inventory based on biases in predicted concentration?

- Compared with the observed value, there are still errors in the simulation results using the new inventory, which is inevitable. Can the authors explain more about the constraints when inserting machine learning method into the emission update? In other words, to what extent can we consider the improvement of model performance to be reasonable and acceptable.

#### Minor Comments:

- Page 5, Line 117. Change 'step' to 'steps'.
- Page 5, Line 127. Change 'the same to' to 'the same as'.
- Page 6, Line 140. Change 'sequence' to 'sequences'.
- Page 6, Line 142. Remove 'a' in 'a supplementary ...'.
- Page 8, Line 171. Should use 'based on the error ...'.
- Page 9, Line 199. Change 'has' to 'have'.
- Page 9, Line 225. Notice the singular and plural forms.
- Page 11, Line 249. Change 'regions' to 'region'.
- Page 17, Line 341. Change 'achieve' to 'achieves'.