Review of "NOx lifetimes and emissions of hotspots in polluted background estimated by satellite observations" by Liu et al.

The manuscript introduces a creative way of quantifying the NO_x emissions from the satellite NO_2 retrievals for both power plant and urban sources located in the polluted background. It is well written and includes the detailed discussion on uncertainties in the developed method. I recommend publication of this manuscript after revisions based on the comments below. Since the manuscript can mislead the readers and future studies, careful revisions and another review of the revised manuscript may be necessary.

The strength of this paper is the new method applicable to the sources in the polluted background. However, due to uncertainties in the estimated emissions from this method, the assessments of the bottom-up emission inventories with respect to the emissions in this study should be documented more carefully. For an example, the statement in the abstract, "Global inventory significantly underestimated NOx emissions in Chinese cities, most likely due to uncertainties associated with downscaling approaches" assumes that the emissions in this study are accurate. The emissions in this study from power plants are compared with the ones from CPED or eGRID, which is used as a strong support for excellent performances of the method. Looking at Figure 7, the agreement between the emissions in this study and the bottom-up inventories is not satisfactory, especially for the US, and numbers of power plants used are limited. Improved methodologies to derive the bottom-up emission inventory, MEIC are highlighted. But it does not guarantee accurate resulting emissions. In addition, errors in the ECMWF wind speed were not discussed in the manuscript. Table S3 in the supplementary material shows overestimated wind speed in ECMWF, which could underestimate NOx lifetime and increase the estimated emission rate. To evaluate the method thoroughly, extensive validations of the developed emission estimations (and bottom-up emission inventories) utilizing independent data set and/or regional chemical transport models will be required.

Regarding the method developed in this study, the background level of NO_2 ($\varepsilon_i + \beta_i x$) can have information on the emissions from the source of interest since the lifetime of NO_2 is much shorter than relatively passive scalars such as CO and CH_4. In addition, the chemical lifetime defined in this study is an e-folding time. Whether the lifetime can be directly used for derivation of emission rate without application of an empirical coefficient or a weighting factor is a question.