

Interactive comment on “Modelling NO₂ concentrations at the street level in the GAINS integrated assessment model: projections under current legislation” by G. Kieseewetter et al.

Anonymous Referee #1

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General comments

This paper develops a methodology to predict annual mean concentrations of NO₂ across Europe by combining used to predict background concentrations and empirically constrained methods to predict roadside concentrations. The paper is and well-written and covers a topic of interest to ACP. Each step in the analysis is clearly explained and the limitations of the methods used have been identified. The paper should be published in my opinion. I do have some comments the authors should consider below that could improve certain aspects of the paper.

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Specific comments

While there are many assumptions and approximations used in predicting urban/roadside NO_x/NO₂ concentrations, the authors have done well to set out the methods clearly as well as their limitations.

2.3.2 It is not clear to me how the primary NO₂ fraction is calculated (p in Eq. 9). It is stated it cannot be known at specific stations, but it is not clear how this variable is estimated. Given the importance of primary NO₂ close to roads more explicit information is needed in this section. Note also when historical trends are estimated (section 3), several countries are shown to have less of a decrease in observed NO₂ concentrations than is suggested by the model. The authors state that this could be due to the value of p . This is actually a critical issue for any model estimates made at roadside locations. There are also important implications of failing to capture the variation in time and space of p and the lack of reduction in observed (but not modelled) NO₂ at locations such as London. These locations will drive the exceedances of NO₂ in future in Europe and failing to capture the trends has important implications. I would like to see more discussion of this issue.

End of section 3/Figure 10b. There is quite a large variation in the NO₂/NO_x ratio across the EU, which will be governed by vehicle fleet differences. To what extent do those locations with high NO₂/NO_x emissions also correspond to locations with future NO₂ exceedances? Would reducing the fraction of NO₂ in exhaust but not reducing total NO_x remove most of the exceedances? I would like to see some discussion on how the predicted NO₂ is made up e.g. background, primary, secondary (NO + O₃).

One of the main conclusions of this work is the strong improvement in NO₂ air quality towards 2030. This conclusion is very dependent on the performance of Euro 6/VI. While the authors are aware of this I would like to have seen a sensitivity analysis looking at the implications of the new emission standards not delivering the expected reduction in NO_x emissions. One of the key reasons the paper is relevant is that histori-

C8196

cally emission standards for NO_x in Europe have **not** delivered the expected reductions in NO_x - particularly for light duty diesel vehicles. What if this were to happen again for Euro 6/VI - what are the implications for European NO₂ concentrations. I would not suggest lots of additional work but it would be a good opportunity to get a feel for the implications Europe-wide of a less than expected reduction in NO_x emissions. The same is also true of estimates of p . These can be very uncertain (particularly when projecting to future years), exceedances in future years may well be controlled mostly by p but it is difficult to gauge how sensitive the predictions are to this variable. Such information would be extremely helpful to policy makers rather than just presenting one view of the future.

There is a better reference for Carslaw and Rhys Tyler (2013):

Carslaw, D. C. and Rhys-Tyler, G. (2013). New insights from comprehensive on-road measurements of NO_x, NO₂ and NH₃ from vehicle emission remote sensing in London, UK. *Atmospheric Environment*, Vol. 81 339-347.

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