Interactive comment on “Modelling NO$_2$ concentrations at the street level in the GAINS integrated assessment model: projections under current legislation” by G. Kiesewetter et al.

Anonymous Referee #1
Received and published: 18 October 2013

General comments
This paper develops a methodology to predict annual mean concentrations of NO$_2$ 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.

Specific comments
While there are many assumptions and approximations used in predicting urban/roadside NOx/NO$_2$ 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 NO$_2$ fraction is calculated (p in Eq. 9). It is stated it cannot be be known at specific stations, but it is not clear how this variable is estimated. Given the importance of primary NO$_2$ 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 NO$_2$ 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) NO$_2$ at locations such as London. These locations will drive the exceedances of NO$_2$ 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 NO$_2$/NOx ratio across the EU, which will be governed by vehicle fleet differences. To what extent do those locations with high NO$_2$/NOx emissions also correspond to locations with future NO$_2$ exceedances? Would reducing the fraction of NO$_2$ in exhaust but not reducing total NOx remove most of the exceedances? I would like to see some discussion on how the predicted NO$_2$ is made up e.g. background, primary, secondary (NO + O$_3$).

One of the main conclusions of this work is the strong improvement in NO$_2$ 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 NOx emissions. One of the key reasons the paper is relevant is that histori-
cally emission standards for NOx in Europe have not delivered the expected reductions in NOx - 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 NOx 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):


Interactive comment on Atmos. Chem. Phys. Discuss., 13, 22687, 2013.