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Interactive comment on "Air quality simulations for London using a coupled regional-to-localmodelling system" by Christina Hood et al.

Anonymous Referee #2

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Review of Hood et al. "Air quality simulations for London using a coupled regional-to-local modelling system"

The manuscript deals with modelling of air quality in London. The authors present an evaluation of simulations with two different set-ups of a local, "quasi-Gaussian", model and compare the results with a relatively high-resolution Eulerian regional model covering the whole UK. The manuscript also describes a significant but realistic update of the available emissions inventories for London, and use the modelling together with observational data to show that the updated traffic emissions are likely more accurate than the original data.

C1

This is an excellently written paper. The presentation is very clear and pedagogic; the text is supported by a good balance of illustrative and well-drawn figures and a number of information-packed tables. I did not spot a single typo or erroneous formulation. The modelling tools used are clearly state-of-the-art, which yields impressing results.

The manuscript could be published in its current form, or with very minor revision –if the editors deem the scope relevant for ACP. The paper undoubtedly fit in ACP but, in my opinion, would GMD be the optimal choice for this, rather technical, presentation.

General remark: As far as I can see is there no information on the vertical distribution of the emissions. This, I think, is an oversight in an otherwise detailed and complete description of the modelling set-ups. Similarly is there no discussion on what levels the monitoring sites are measuring at. Can there, for example, be systematic differences in the height of the intake between "urban background" (roof-top?) and "kerbside" locations? The possibility that model results and observations are valid at different heights can also be remarked when discussing the models' abilities to reproduce observed concentrations.

Minor issues:

Page 2, Line 14: "... up to 4.5." It would be interesting to learn how much of this major discrepancy is due to real-world journeys vs. test cycles in labs, and how much that could be attributed to the so called Volkswagen "diesel-gate" scandal.

Section 2.2: At times it is not clear whether the given information relates to EMEP4UK or the pan-European EMEP MSC-W model. For example:

a) "v4.5" (p4,l1) what model does this refer to?

b) "...boundary conditions..." (p4,l10-12). This must be the pan-European model. EMEP4UK has the pan-European model on its boundaries, right?

c) "...output from ... WRF...". This is EMEP4UK? The pan-European version uses ECMWF? In the description of the one-way nesting of the EMEP models (p4,l1-4) I

take it that the nesting goes directly from a domain with 50 km x 50 km grid-cells to an inner domain with 5 km x 5 km grid-cells. Some scholars would argue that this leap in resolutions is too big. Maybe you should justify or comment this feature of EMEP4UK.

Section 2.3 (p5,l8): Why do you mention that ADMS-Urban has "…two street canyon formulations"? It is not clear from the presentation if one or both are used in the present simulations.

(p5, line 25): Maybe you could indicate the location of "Heathrow" in Fig. 3 or Fig 1. Would be helpful for readers not familiar with the London geography.

Section 2.4 (p6,l4-…): The paragraph on how to avoid counting the emissions twice is difficult to follow. Maybe this paragraph can be re-formulated?

Section 2.5: A description of the vertical release height is missing. It is also stated that the horizontal re-gridding reduces the total emissions by ca. 5%. It is not clear whether it is left this way or if this missing 5% is "put back" to the regridded emissions to not loose such a significant amount of the emissions.

Section 3.1 (p9,l20-21): Consider defining, mathematically, fractional bias (Fb), normalised mean square error (NMSE) and correlation coefficient (R).

Section 3.2: a)The coloured points in Figs 5-7 (and Fig. A1) are sometimes difficult to discern, maybe consider adding a black or white frame.

b) The legend of Figs. 5-7 (and Fig. A1) should probably read "Modelled … annual average…".

Section 3.3 (p.11,l8-9): Consider defining, mathematically, the MQI.

(p11,l13-14): Eq. (1) is not complete and should start with: $RHC=X(n)+$ …

(p12,l19): "…Fb$\sim$0." should probably read "…Fb is close to 0…" or similar. Harmonize spelling of "…standalone…" (p12, l19), "…stand-alone…" (p12,l21).

Section 3.4: (p13,l6) "…normalised bias…" is that the same as "fractional bias" which is used elsewhere in the presentation?

(p13, l6-7)? What is "centred root mean square error (CRMSE)"? Consider write out the mathematical definition.

(p13,l10) Unclear to me how "…the correlation here is calculated with a consideration of measurement uncertainty…"; I assume it is described in the DELTA tool mentioned earlier in the paragraph.

Section 3.5 (p13, l17-20): I note that you only devote four lines of text to 2 comprehensive and illustrative figures. If the editor deems your presentation to long you may omit this paragraph along with Figs. 10 and 11.

Section 4: (p14, l8). Why did you choose to model the year 2012 (London Olympics?), I understand the underlying LAEI emissions inventory is valid for 2010. It may have been more interesting with a more recent year (or two contrasting years!).