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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of a future H_2-based road transportation sector on the composition and chemistry of the atmosphere – Part 1: Tropospheric composition and air quality" *by* D. Wang et al.

Anonymous Referee #2

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1 General comments

The 2 papers by Wang et al try to assess the environmental impact of a replacement of fossil fuel by hydrogen for road transportation using 2 state of the art global models and a regional model. The simulations were done for 2 IPCC scenarios. It would be better to merge the papers and shorten some parts (esp. the part on stratospheric ozone). The main focus is on maps with percentage differences of annual average of different species. Some more information on seasonal effects and correlations would be useful.

It is assumed that hydrogen is available without any emissions from its production and distribution which appears to be very unlikely. Here some realistic estimate or at least more discussion would be useful to include.

2 Specific comments

At several places in the introduction and sections 3 and 4 the soil sink for hydrogen is mentioned but it is not described how it is implemented. Is it a uniform deposition velocity over land surfaces or is it dependent on vegetation type? This should be critical for the regional model. Are the emissions available for the fine grid of the regional model? Even if more information is in the (difficult to get) reference a little bit more should be said in the text.

Page 19376: I suppose the annual tropospheric average of OH concentration is meant without any weighting for reaction constants with CH_4 or CO as sometimes in the literature.

Page 19379: The hydrogen demand is assumed to be the same for FC and ICE. I would expect that the efficiency of both techniques is different. Is the percentage of leakage larger in densely populated regions? Please clarify.

Page 19385: What is average tropospheric ozone? Ozone in the boundary layer or in the whole troposphere including stratospheric influences? Please expand, the given number alone is not useful. The word 'summertime' is misleading here and in the figure caption since for the southern hemisphere winter is shown.

Page 19387, last paragraph: I'm surprised not to see the reference to the Spivakovsky climatology here.

Page 19390: What is average NOx? Mention also peak values and their changes and/or probability density functions. 80% of what?

Page 19393, third para.: mention nitrate explicitely, I suppose this is meant here.

Page 19396: I don't understand the different results in section 4.6.2 for the northern midlatitudes. Please explain better.

Page 19397: Please expand the explanation of nitrate changes slightly.

3 Technical corrections

Page 19388, line 19: 'which would reduce'.

Page 19401, line 17: typo.

Page 19404 and 19405: Don't use 'burden' (usually an integral) for mean mixing ratios and concentrations.

Figures 2, 3, 4, 8, 10, 12, 14, 15, 16: The different blue colors are difficult to distinguish. Please modify the color palette.

Figure 3 and 4: Replace in caption 'summertime' by 'NH summer'.

Figure 5, 9, 11, 13: The color scheme for the changes is confusing because in most publications the strongest decrease is blue or violet. It is also inconsistent to the results of the global model.

Figure 12, caption: Without dust and sea salt? Be consistent with text.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 19371, 2012.