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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reactive nitrogen in atmospheric emission inventories – a review" *by* S. Reis et al.

S. Reis et al.

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The authors would like to thank the reviewer for the comprehensive and constructive comments received. We have to our best knowledge replied to all issues raised in detail below, as well has having rewritten and revised – in parts substantially – those sections that have been identified to be lacking clarity or conclusiveness. We hope that in particular updating the datasets used to the year 2005 and using solely officially reported emissions in the EMEP inventory comparison are contributing to make our paper more useful for current scientific discussions.

1. In order to justify more clearly the choice of regions, please state how much of the global emissions per compound that are covered by the selected three regions according to the reference of your preference. A new table (Table 2) has been introduced

giving the total N contribution of the three regions selected for analysis in the year 2005, along with accompanying text to explain the rationale.

2. I would also recommend to spend one paragraph explaining the topic of lack of closure of the N budget to put this paper into perspective. Added a short section on current activities to close the N budget, with reference to the European Nitrogen Assessment Report.

3. I would recommend to include in the beginning of the paper a section on data sources to increase the transparency of the paper and in particular with respect to e.g. EDGAR (2008), EDGAR fast track, EDGAR (1990), EMEP model data vs EMEP officially reported data, data used for China etc. Accepted, a short section has been introduced in Section 2.2. to summarise the data sources used in the paper. A sentence was added to address the state of publication of the EDGAR v4 inventory data.

4. It would be helpful with a table with at least total emissions for the different pollutants, at least in the section concerning emission from China, as this section is now rather obscure. A global table (Table 2) has been introduced in the introduction to give an overview over all three regions; in addition, the China-section has been significantly revised, see below.

5. It would also increase the transparency if all emissions were referred to as e.g. Tg og Gg N (not NH3, NOx, NO2, N2O). This is also fits the spirit of this paper which is interested in telling us something about reactive nitrogen as such and not really in N2O, NO2 or NH3. We agree with the reviewer and have changed all figures and tables accordingly, displaying Gg/Tg N instead of the original amounts of NH3, NOx, N2O.

6. p. 12414, l.21: What is meant by: robustness (of emission estimates)? A less ambiguous term was used instead, replacing “robustness” by “level of uncertainty”.

7. p. 12415, l. 7: Is basic gas a well defined term? How is it defined? This is referring to the alkaline nature of ammonia in the atmosphere; “alkaline gas” is now used to

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avoid confusion.

8. P 12416 l. 18: I have a problem in seeing the contradiction put up between the bottom up inventories used for compliance monitoring (also scientists are working with those), and the bottom up inventories e.g. EDGAR. One main difference is that while many countries have access to country specific EFs, detailed and up to data activity data, good knowledge of penetration of measures and technologies, this is not always the case for "scientific" inventories. On the other hand, it can be argued that e.g. the EDGAR dataset is more comparable over countries and regions, since the same methodology are apparently applied. However, this might not be the case as availability of input data to the calculations differs for different countries, and the Guidelines/ guidebooks followed by many national emission experts to a large extent assure a common methodological framework in the national submissions under different international obligations. This is a valid point, as there is indeed not a contradiction or the question of which type of inventory is better/worse. The paragraph has been rephrased to – at this stage in the paper – merely point out the different inventories and leave the evaluation for later on.

9. p. 12417, l. 25: We therefore critically investigate the way nitrogen in its different forms is accounted for in these processes. [I read processes as the reporting obligations or the emission inventories resulting from them] I do not agree that the paper does investigate the difference between the UNECE and the UNFCCC reporting obligations, and how they might be defective in order to do proper nitrogen management. It is however a very interesting subject, so I encourage you to look further into the reporting guidelines in order to highlight differences of importance for the work on the nitrogen cycle. This is a valid point, this sentence was rephrased to: "In this paper, we compare how different approaches to inventory compilation may lead to similar or quite different results and – where possible – discuss likely reasons for differences observed."

10. p. 12419 l. 8: See my recommendation for a session on data sources See response to item 3.

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11. p. 12419 l. 26: The air pollutants data are not officially released Added a sentence to elaborate on this situation: “The EDGAR v4 inventory has only been partly published at this stage (greenhouse gases). However, the authors had access to the final version of the dataset for air pollutants, which will be published in the near future (http://edgar.jrc.ec.europa.eu/).”

12. p 12429, l. 2: What is improved in the spatial distribution in EDGAR v4? Does this inventory have the sufficient spatial resolutions for all studies relevant to your paper? What is the resolution of the other inventories applied in this paper? Is there a difference in the spatial allocation of sources between the inventories included in your paper? The spatio-temporal resolution had initially been a topic we wanted to investigate, but the size of the paper as is and the level of detail that needed investigation relating to the level of emissions and sectoral structure has made it necessary to exclude this analysis. We have added a sentence clarifying this accordingly.

13. p. 12420, l. 25: The reason for this small difference in emissions that have the same underlying data sources is most likely revised animal numbers and more accurate emission calculations that have been available to the experts during the consultations, but have not yet been used to submit recalculated inventory figures to EMEP. I disagree. You have used outdated year 2000 EMEP emissions prepared for modelling in 2006. If you check the web site for officially reported data: http://www.ceip.at/emission-data-webdab/emission-as-reported-by-parties/, you will see that countries have reported recalculated emissions for year 2000, which are not reflected in the data you have used. For the countries which displays largest difference with IIASA data: Diff reported data – model data France Germany Romania 7.8 -18.8 -46: Sector: N08 4 D 1 a: Synthetic N-ferilizers Pollutant: NH3 Austria Belgium France Germany Spain United Kingdom 2000 3.76870571 10.0269415 156.718325 80.9306908 261.564873 35.0905059 Thus my conclusion is that the EMEP trends should be updated with the most recent submission form countries. Duly noted and accepted, all European emissions have been updated to 2005, including the latest (2009, where available, 2008

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else) official country submissions have been used from EMEP CEIP for all countries. In the case of Greece, no data for NH3 had been submitted to EMEP in the 2008/2009 reporting rounds, hence 2007 data was used for the year 2005. One reason to move to 2005 data was that officially reported data for 2000 were in most cases available only in NFR01/02 or SNAP structure, while the new NFR 08 structure allows for a better comparison with other inventories.

14. p. 12421, l. 6: I disagree that this assumption cannot be checked. In the officially reported data you can compare the emissions from agricultural soils. I do not have the EDGAR data, but the data officially reported to EMEP is: p. 12421, l. 9-14: What is your conclusion? You have stated that EDGAR emissions are much higher than EMEP for EU27 countries. For Europe (seems to be defined as EU27, TK, MK, HR, NO, CH in the case of EMEP inventory), they are comparable. The whole section has been revised and the discussion of 2005 figures leads to partly different results, which have been duly acknowledged.

15. Which countries do the EDGAR emissions of 4.02 Tg NH3 include? The analysis always covers the same set of European countries, this has been clarified in the text.

16. p. 12421, l. 28: Overall lack of country specific emission factors measurement programs? This has been clarified in the text.

17. p. 124322, l. 4: ALSO in the future? Changed.

18. p. 12422, l. 8-10. Something is wrong with Fig 3, otherwise swap higher with lower. Also insert a reference to the figure in the text. This has been changed and rewritten due to updating emissions with 2005 data.

19. p. 12422, l. 15 Turkey (not show in Figure 3) The non-EU member tables have been taken out of the section entirely and will be replaced by a global table with all emissions in the ANNEX of the paper.

20. p. 12422, l. 16: It is fully possible to compare the emissions of N2O from agri-

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cultural soils in the UNFCCC database with those of EDGAR. I would recommend that you do so, for all countries and regions that have reported to UNFCCC in order to strengthen you argumentation. This has been done and Fig. 4 has been updated accordingly with figures for 2005, comparing agricultural N2O emissions for both inventories and elaborating on differences observed.

21. p. 12424, l. 12, It might be worth including a note that US is moving from Mobile 6 to MOVES, and possible consequences of that : http://www.epa.gov/otaq/models/moves/: EPA has performed a preliminary comparison of Draft MOVES2009 to MOBILE6.2 using local data for several different urban counties, vary-ing the local data used by fleet age distribution, fraction of light- and heavy-duty VMT, local fuel specifications, meteorology, and other input factors. The results described here are based on the most recent data available and will vary depending on actual local inputs. Because only preliminary studies are available for MOVES, we have restricted our analysis to the emissions currently distributed in the National Emission Inventory. To reflect the reviewer's suggestions, we have added these sentences to improve the completeness of the manuscript: "A more advanced mobile source emissions model, MOVES (http://www.epa.gov/otaq/models/moves/), is currently under development and a draft version is available for public use. Important improvements include more detailed inspection and maintenance data and better representation of extended idling emissions."

22. EPA's findings are described below, by criteria pollutant.For oxides of nitrogen (NOx), EPA has found that emissions from both light- and heavy-duty trucks are higher than previously estimated. In Draft MOVES2009, emissions estimates are based on EPA's analysis of I/M testing data, which incorporates in-use emissions data on a very large number of vehicles with model years from the mid-1990s to 2004. For heavy-duty trucks, Draft MOVES2009 incorporates newer "real world" data from on-road testing. In Draft MOVES2009, uncontrolled extended idle emissions from heavy-duty vehicles are projected to become a significant share of the mobile source NOx inventory in

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the future, assuming no change in extended idle activity as a fraction of total activity. Because only preliminary studies are available for MOVES, we have restricted our analysis to the emissions currently distributed in the National Emission Inventory. To reflect the reviewer's suggestions, we have added these sentences to improve the completeness of the manuscript: "A more advanced mobile source emissions model, MOVES (http://www.epa.gov/otaq/models/moves/), is currently under development and a draft version is available for public use. Important improvements include more detailed inspection and maintenance data and better representation of extended idling emissions."

23. p. 12425, l. 2: Does your argument about difference in allocation between EDGAR and USEPA in your opinion explain the fact that EDGAR emissions for the sum of PP and IND are substantially higher that the sum in USEPA? We have updated to 2005 emission data, and the split between power plants and industrial emissions do not seem to be a source of major difference. We have changed this sentence to "The NEI power generation emission rates are measured at the electricity generating units as part of the Continuous Emission Monitoring System and are likely more accurate."

24. p. 12425, l. 4: I find it strange that the USEPA includes international shipping in their inventory. This can be checked however. According to the CEIP online database, the US reports 3780 Gg NOx in the off-road sector to EMEP for the year 2003. These data should be without international shipping. This sentence "This could be caused by including all/part of international shipping emissions, which have been omitted from the EDGAR inventory and are estimated in EDGAR v4 at about 1.930 Gg in the year 2000" is ambiguous. In response to the reviewer's comments, we have changed it to "The NEI partially includes international shipping emissions near the US coast, which have been omitted from the EDGAR inventory and are estimated in EDGAR FT32 at about 1.930 Gg for the US in the year 2000."

25. p. 12425, l. 27: However, the models and data sources used in the US to quantify emissions of the air pollutants are not the same as those used to quantify the

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N2O emissions. Please reference or explain the difference. We have updated the text to point out one example, but there are too many examples to enumerate in this document. The reader is directed to the documentation of the data sources. We have added this sentence “However, the GHG emission inventory and the NEI do not use the same models and data sources. For example, direct fertilized crop emissions of N2O are estimated using the DAYCENT model (Del Grosso et al., 2001), while NH3 emissions are estimated using an emission factor approach (Goebes et al., 2003), and NO emissions are calculated using the BEIS model (http://www.epa.gov/asmdnerl/biogen.html).”

26. p. 12426, l. 5: According to what you write: Klimont estimated 5 Tg (N?) for N-fertilizer application in 1990, while Li Yu estimated 1.65 Tg N. Yan estimated 5.8 Tg N and Klimont 9.7 for the total ammonia emissions. What is your analysis of the difference between different ammonia inventories in China? This section has been expanded a bit and includes now a comparison with EDGAR v4 NH3 data, as well as expressing all values as Tg N in addition. Additional data sources hve been investigated, but most papers and the GAINS China model do not provide NH3 data at this stage.

27. p. 12427, l. 1: for this section I recommend a table, to keep track of all the different emission numbers and references, and to possibly draw some conclusions. What is the total Bai emissions? Reference the recent findings line 9 (to Titan et al., 2001?) Reference the 9.5 and 12 Tg N numbers This section has been revised and partly rewritten and should be more clear now.

28. You might also like to include more information from space observation e.g. Satellite derived trends in NO2 over the major global hotspot regions during the past decade and their inter-comparison Author(s): Ghude SD, Van der A RJ, Beig G, et al. Source: ENVIRONMENTAL POLLUTION Volume: 157 Issue: 6 Pages: 1873-1878 Published: JUN 2009 Adjoint inverse modeling of NOx emissions over eastern China using satellite observations of NO2 vertical column densities Author(s): Kurokawa J, Yumimoto K, Uno I, et al. Source: ATMOSPHERIC ENVIRONMENT Volume: 43 Issue: 11 Pages: 1878-1887 Published: APR 2009 Global distribution pattern of anthropogenic nitrogen

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oxide emissions: Correlation analysis of satellite measurements and model calculations Author(s): Toenges-Schuller N, Stein O, Rohrer F, et al. Source: JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES Volume: 111 Issue: D5 Article Number: D05312 Published: MAR 11 2006 Evaluation of long-term tropospheric NO2 data obtained by GOME over East Asia in 1996-2002 Author(s): Irie H, Sudo K, Akimoto H, et al. Source: GEOPHYSICAL RESEARCH LETTERS Volume: 32 Issue: 11 Article Number: L11810 Published: JUN 14 2005 We have pondered the extension of the paper to include remote sensing data, both for trend analysis and verification purposes. However, we feel that this would require a significant expansion of an already long paper (as the wealth of references already hints at) and would rather do this in an individual exercise as this very relevant aspect would merit a paper of its own.

29. p. 12429, l. 17: Reference to Xing is not in ref list. The references have been corrected to reflect the correct referencing (Xing, 1998)

30. p. 12430, l. 13: Replace in country by centralized This has been changed accordingly.

31. p. 12431, l. 9: Depending on what ”robust” means. I tend to disagree. According to Rypdal et al the uncertainty in total NOx emissions are 4 times higher than in CO2. Uncertainty in sector data could certainly be higher. p. 12431, l. 17: Repetition of what is said before. I disagree. See my comments above on this issue. This was clarified and elaborated upon, the statement was to express that NOx – in spite of being dependent on EFs varying with processes, temperature, airflow etc. – are comparatively less uncertain as sources have been measured and are in most cases well understood, which is not the case for some sources of NH3 and N2O.

32. p. 12431, l. 23: What is meant by system boundaries? Difference in allocation of emissions in different sectors? This has been changed to “sectoral allocations”.

33. p. 12432, l. 9 and Fig 6: The “hypothesis” that the reason why N2O emissions from road transport is larger in the US than in Europe, should be

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rather easy to check in e.g. one of the SYNTHESIS AND ASSESSMENT REPORT ON THE GREENHOUSE GAS INVENTORIES reports available from e.g. http://unfccc.int/resource/webdocs/sai/2008.pdf reports or national communications http://unfccc.int/national_reports/annex_i_natcom/submitted_natcom/items/3625.php In this way the arguments can be strengthened. Very good suggestion, even though the reports do not provide sufficient detail information on the EFs used. A query at the IPCC Emission Factor database revealed quite different N2O EFs for passenger cars, which has been included in the text as a comparison hinting at different assumpitions.

34. p. 12433, l. 1-4: The CEIP database also contain activity data reported by countries. This section has been rewritten and should be more clear now.

35. p. 12433, l. 11: delete power plants. Deleted.

36. p. 12433, l. 16: I recommend to insert information from the NAEI about the uncertainty in the UK NOx inventory. The total uncertainty is something like 8% which is much lower than the difference in inventories that you show. p. 12433, l. 24: This may hint at a difference in allocation between these sub-sectors. I recommend to check if this is truly the case. Information about the uncertainties for each substance assumed by the UK NAEI have been added and the detailed comparison improved with further text to account for the valid question raised in this comment.

37. p. 12434, l. 1: In summary, the difference between country total emissions between both inventories is within the uncertainty margins expected, albeit somewhat large for NOx emissions (EDGAR v4 20.9% below NAEI). Based on what information in this paper is the expectation about what the differences in inventories should be? I do not find that Table 5 is of much help. It shows that uncertainty in total N2O is large, and larger than CO2 and CH4. Please summarize your findings to show the reader how you arrive at your conclusion. A sentence has been added to relate the content of the table to the discussions in this paper and should clarify its relevance better.

38. p. 12434, l. 10: Is the EDGAR v4 more detailed than the UK NAEI? I cannot believe

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that. I also think than the more than 100 sectors reported to the LRTAP convention, plus activity data, plus the reports about the inventory you mentioned is more information than what is included in EDGAR. Also all inventories are accessible online from the CEIP web site. Also, does this sentence imply that you can recommend the EGDAR v4 for nitrogen management purposes above the other inventories? The whole section has been revised and rewritten, in addition reflecting the new NFR 08 structure of EMEP which has improved the sectoral allocation esp. for non-combustion sources again.

39. p. 12435, l. 20: Please see my comment about a section on data sources. The references used in Fig 8 of which many of them are incomplete and not in the reference list, needs to be better explained and that is also the case in the text here. e.g. F.J. Dentener and et al., Emissions of primary aerosol and precursor gases in the years 2000 and 1750 prescribed data-sets for AeroCom, Atmos. Chem. Phys. 6(2006), pp. 4321-4344 could be included for NH3 emissions year 2000 here. The EDGAR 2000 fast track data are just scaled by activity level. This should be mentioned, as it explains the trend. Valid points on EDGAR 2000 FT and the missing/incomplete references, these have been taken up and updated; regarding Dentener et al. 2006, this paper has been assessed before and contains a lot of valuable information, albeit on BC, POM, and SO2 and is not immediately useful for our paper; Dentener et al. by the way base emissions on EDGAR Hyde, which has been used as well for this paper, but for N-containing species and is hence covered. In addition, a figure on N2O trends has now been included, drawing from and the discussion of trends in general has been revised.

40. p. 12435, l. 21: What does “adjusted to Olivier and Berdowski” means? This was a note to be checked in relation to the original reference and should have been removed, this has been done now.

41. p. 12436., l25: officially reported data are available for the actual year minus 2. I do not cal that a significant time lag compared to “scientific” inventories, as you point out yourself with respect to ammonia for instance. Also, the officially reported data are

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reviewed, both under the UNFCCC and under the UNECE. There is to my knowledge no such procedural review of (unpublished) scientific inventories where they are often used a long time before some modeller applying these emissions starts to wonder about his results, and find that the emission data is not of sufficient quality, e.g. cross pollutant ratios do not make sense or emission are not correctly allocated in space. This point is in theory valid for officially reported inventories, albeit reporting compliance – both regarding the availability of a full inventory dataset for all detailed sectors as well as the completeness of datasets available for all countries in a region that is to be modelled – is often hampering modelling efforts in particular for recent years. There is a clear trade-off with using a mixture of official reports and gap-filling (with different/unknown methods used for the two data sources) and using a comprehensive, complete, but unvalidated inventory, without doubt. This should be reflected and has been added.

42. p. 12437, l. 2, instead of statistics I propose country specific EFs, penetration of measures and technology Taken on board and text changed accordingly.

43. p. 12437, l. 5 Please add reference for identification of missing sources. Also I recommend that you make it clear that the inventories reported to different international bodies and even national inventories exclude natural emissions because it is out of the scope for policy making. In my opinion, natural emission inventories should be funded over different budgets than the national inventories. It is somewhat unclear to me if you regard the natural emissions as so important for the closure of the N gap, that it should be a (first) priority. In that case I would recommend that you add to your conclusion a call upon funding for such inventory development from relevant funding organizations. A reference and sentence has been added at the end of this paragraph to the IPCC, 2000 Good Practice Guidance document.Furthermore, a sentence on the reporting of anthropogenic emissions mainly for regulatory purposes has been inserted.

44. p. 12437, l. 22: Are you saying that you could not identify systematic error and gas due to too low level of detail in the inventories assessed. I do not disagree that

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this is the case, however, I recommend that you more strongly spell out the “sufficient evidences” you talk about as I read as flagging of sectors and pollutants for which such investigations are needed in order to improve the level of confidence in the emission data. Good point, the sentence has been rephrased accordingly.

45. p. 12437, l. 27, Please also check out Dentener et al (2006) Done, see response to item 37.

46. P. 12438, l. 7: Here it might be relevant to mention also the work undertaken by EMEP (e.g EMEP report 1/2008, http://www.emep.int/publ/reports/2008/status_report_1_2008.pdf) on the issue of spatial resolution. This has been added, in particular with regard to the testing of 25x25 and 10x10 km modelling for the EMEP domain.

47. p. 12439, l. 22: Trends in N2O are not shown in Figure 8 or elsewhere. Please consider a figure or a table to show the trend. While not many consistent datasets are available for NO2, we added a graph to the figure displaying the trend for NO2 as far as possible for consistency sake..

48. p. 12441, l. 6: I am not so sure natural emissions should be a part of the obligations under eg UNECE and UNFCCC, but these bodies could (continue to) develop methodology also for natural emissions. As stated before, I think that given that these sources are important, and might become even more important in the future, more resources should be spent on research projects concerning such emissions. This is a valid point and accepted, but for this paper, we decided to focus on anthropogenic sources only. However, a sentence has been added to reflect this and acknowledge the relevance of biogenic and natural emissions. As it was, the message was indeed not clear and should now be better phrased.

Figures and tables: 1. Tables 1-4 are not addressed and referenced in the text. If Tabs 1-4 are commented in the text that would probably clarify my question to p. 12421, l. 9-14 Tables 2-4 have been removed and will be included in an overview table for Europe

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giving emissions for all countries as taken into account in this analysis for reference.

2. Table 1. replace consumption by combustion. Add X for NOx emissions from Agricultural mineral N fertilisation Both taken up and Table 1 revised accordingly.

3. Table 5. If NH3 and NOx is not included I find this table obsolete. This analysis has only been done with this level of detail for GHGs, and the usefulness to illustrate the different levels of uncertainties for different sources is valuable, even if it is beyond the scope of our paper to fully extend this analysis for all sources and substances.

4. Table 6: Please make the sub total more visible in this table Subtotals have been typset in bold and with increased fonts to improve visibility.

5. Fig 1. Cyprus is shown. I disagree to conclusion mention in caption as stated above. Also see the difference in the EMEp data you have used for ammonia 2000 and the reported data. Figs 1 and 2 have been completely redrawn based on officially reported data and updated to 2005; the analysis of the figures has been rewritten as well.

6. Fig 2. Cyprus is included. I disagree to conclusion mention in caption as stated above. DIFF officially reported-EMEP model data NO2 Germany is -62.93582021 Gg NO2. My conclusion is stated above. Figs 1 and 2 have been completely redrawn based on officially reported data and updated to 2005; the analysis of the figures has been rewritten as well.

7. Fig 3 is probably wrong, and not referenced in the text. Fig has been completely redone and reference in text added.

8. Figure 7 is not referenced in the text. EDGAR is wrongly spelt. Spelling corrected and reference added to text.

9. Figure 8: Please add N2O if possible. Check fig carefully. Reference properly the data sources. NOx as NO2? EMEP (2006) or (2008)? Fig. checked and corrections made as indicated. Trend for N2O has been added and Fig 8 expanded to three individual figures for ease of discussion.

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Technical/editorial corrections:

1. P 12415, l. 13: role Corrected

2. P 12415, l.27 consider: The alteration in agricultural practice and increase in fossil fuel combustion have impacts human health, ... Text changed accordingly.

3. P 12416, l. 3: What is meant by alteration of the GHG balance? Replaced by “global radiative balance”

4. P 12416, l. 17: insert in (LRTAP) after Pollution, delete IPCC and spell out United Nation Framework Convention (UNFCCC) Text changed accordingly

5. P 12416 l. 27: implications for – conclusions on Corrected.

6. p. 12417, l. 17: Explain and reference GAINS (and MITERRA) Both done.

7. p. 12418, l. 24: Does the document read prevent formation of NOx, or rather minimize??? It does indeed read “prevent the formation”, which hints are non-fossil/non-combustion energy sources rather than improved combustion processes.

8. p. 12420, l. 3: Fulfil Corrected. p. 12419, l. 11 and so forth: Parties not signatories. Corrected.

9. p. 12421, l. 8: as EDGAR Text has been changed.

10. p. 12421, l. 27: than delete for Text has been changed.

11. p. 12429, l. 5: The direct N2O emission intensities significantly depend upon the economic situation of the region, implying potentially higher emission in the future. P. 12433, l. 1: driven by fossil fuel combustion sources, REF. Do you intend to insert a reference? This paragraph has been rewritten and revised.

12. p. 12434, l. 19. from the literature Corrected.

13. p. 12434, l. 24. PR of China spell out People’s Republic. No comprehensive or official?? Revised, changed into official.

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14. p. 12435, l. 3 fig 8 Corrected.

15. p. 12435, l. 11: Provide a reference to the increase of 22%. This is a direct calculation using US NEI values for 1990 and 2005, this has been clarified now in the text.

16. p. 12439, l. 5: estimated in Text has changed.

17. p. 12439, l. 24: However, the trends depicted by data from the EDGAR Hyde 1.4 project and THOSE reported to UNFCCC. Also see my comment about the EDGAR fast track above. Corrected.

18. p. 12440, l. 8: Vestereng et al. (2009) is probably not the correct reference here, but rather a reference for the EMEP NOx emissions. Corrected, the Vestreng ref. had been intended for the paragraph above.

19. p. 12440, l. 13: IPPC not IPCC. Corrected.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 12413, 2009.