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Interactive comment on "Russia's black carbon emissions: focus on diesel sources" *by* N. Kholod et al.

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Russia's black carbon emissions: focus on diesel sources" by N. Kholod et al. Minor revisions

1. The health information on p. 1 should be updated to reflect the most recently available health impact information (GBD 2013 was published in early 2016). Thank you for the suggestion. We updated the text as follows (Lines 36-37 of the updated text): "According to the Global Burden of Disease study, ambient PM pollution caused over 100,000 premature deaths in Russia in 2013 (GBD, 2016)." GBD: The global burden of disease study 2013, Institute for Health Metrics and Evaluation, Seattle, WA.

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Available at http://ghdx.healthdata.org/gbd-data-tool (Last access: 12 July), 2016.

2. On p. 4, the authors discuss the movement to low sulfur fuel, but omit an important piece of information – low sulfur fuel is necessary for operation of the most effective emission control devices on diesel vehicles. This would be additional context that would be helpful to add. Thank you. We updated the text as follows (L 118-122): “Sulfur content of diesel fuel is an important factor in emission reductions. Diesel with high sulfur content (measured in parts per million or ppm) can destroy emission control devices, such as particulate filters. Availability of low sulfur diesel is an important prerequisite for the introduction of more stringent vehicle emission standards.”

3. If the information is available, it would be informative to include the share of industry that is made up of small businesses rather than the number of people employed to give a better indication of the impact of the lack of reporting. (p. 5, lines 140-150). Thank you for pointing this out. Small businesses are not required to submit this information, yet they employ 11 million people (Fedstat, 2015f, a, b, e) and produced more than 20% of goods and services (GKS, 2015a). GKS: Russian Statistical Yearbook 2015. Federal Statistics Service of the Russian Federation. Available at http://www.gks.ru/free_doc/doc_2015/year/year15.rar (last access: 26 February 2016), 2015a.

4. Authors should consider defining "fuel balance approach" at first mention rather than later in discussion in case readers are not familiar with this methodology. (p. 5, line 155) We added to the text (Lines: 160-161): However, their assessments both have their limitations because they do not use a fuel balance approach; in other words they do not match diesel consumption by on-road vehicles and off-road engines with the production of diesel fuel in the country.

5. It is not clear why there is discussion of gasoline vehicles in the section of distribution by emission standards. The authors note that they produce almost no BC, so could easily be left out or addressed with a sentence explaining that they produce almost

no BC. If there is a reason the comparison of emission standards is important to the discussion, this should be clarified. (p. 6, lines 198-208) Thank you for this suggestion. We deleted the discussion about gasoline vehicles. The updated text (L 216-219): "Splitting the on-road fleet by fuel is important because gasoline vehicles emit almost no BC. Hence, we do not analyze gasoline vehicles in this study. Figure 2 shows the distribution of diesel vehicles by emission standard."

6. For logical flow, authors should consider moving the active vehicles section (p. 7, lines 210-221) to immediately following the registered fleet section. Thank you, we moved the Active Vehicle section after the Registered Fleet section. (For easy reading, the changes were not tracked).

7. The assumptions for speed and type of road traveled would benefit from further explanation (i.e., are these based on standard speeds/distribution of roads in Russia?) (p. 9, line 285) The assumption on the speed in cities is based on actual speed in Moscow and other large cities. The assumptions on the average speed on rural roads and highways are based on maximum allowable (standard) speed on these types of roads in Russia. The updated text (L 291-294): "The assumption on the speed in cities is based on actual speed in Moscow and other large cities. The assumptions on the average speed on rural roads and highways are based on maximum allowable (standard) speed on these types of roads in Russia. The share of vehicle-kilometers traveled on urban roads is taken from ICCT Roadmap model."

8. The assumptions for controls on agricultural vehicles would benefit from further explanation (i.e., who no Stage 1?) (p. 11, line 351) We assume that 95% of agricultural fleet has no emission controls and 5% meets Stage 2 standards. Only imported used tractors may have emission controls. In the European Union, Stage 1 emission standard was implemented in 1999 and Stage 2 implemented from 2001 to 2004. Stage 1 tractors might be too old for importing them to Russia so we assume that all imported tractors with emission controls meet Stage 2 standard. Stage 3 standards were phased in from 2006 to 2013, and these tractors are too new to be sold as used in 2014. We

updated the text as follow (L 356-357): “We assume that used tractors imported from Western countries have emission controls; however, their share in the total agricultural fleet is very small (no more than 5%).

9. For logical flow, recommend moving the paragraph on uncertainty regarding BC/PM ratios after the paragraph on activity data (p. 14). It appears that the BC/PM ratios are NOT a major source of uncertainty, so it would make more sense for the reader if this is discussed after the two major sources of uncertainty that are identified. Thank you for the suggestion. We moved the paragraph (L 485-487).

Thank you for the useful comments and suggestions!

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