Atmos. Chem. Phys. Discuss., 11, C3417–C3419, 2011
www.atmos-chem-phys-discuss.net/11/C3417/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of China's vehicle emissions on regional air quality in 2000 and 2020: a scenario analysis" *by* E. Saikawa et al.

Anonymous Referee #1

Received and published: 16 May 2011

This paper assesses the impact of vehicle emissions in China on ozone and PM2.5 air quality in China and the surrounding region. The study examines the projected growth in vehicle emissions from 2000 to 2020 under a business as usual scenario, and the impacts of imposing Euro 3 vehicle emission standards by 2020 on emissions and air quality. The paper finds significant benefits of adopting the tighter standards for both ozone and PM2.5. Due to atmospheric transport, these benefits extend beyond China to the East Asia region. Although these findings are somewhat expected, this paper provides a more detailed and comprehensive assessment of the impact of Chinese vehicle emissions and the benefits of their mitigation than the previous literature. In addition, this paper contributes new estimates of Chinese vehicle emissions under different emission standards, updating the REAS emission inventory using new estimates for vehicle numbers, miles traveled, and emission factors. The manuscript is very thor-

ough, clearly written, and well organized and is suitable for publication in ACP with only a few minor changes.

Specific comments:

It is very difficult to read the text on many of the figures, especially when printed but even when viewing on a computer screen. The text in Fig. 4 is virtually unreadable and perhaps could be more legible if laid out more horizontally rather than vertically. Please enlarge the font size for all figures.

There is a heavy reliance on Borken et al. (2008) for the development of the emissions projection, including growth rates for vehicle numbers, miles traveled, and emission factors. The authors should ensure that all the pertinent information from that paper (including the methods and numbers used) is restated here since readers may not have access to that paper.

Under 2.2.2 Emission Factors, the second sentence of the third paragraph ("Because there is no regulation adopted for motorcycles. . .") seems like it is misplaced, and perhaps should be moved to the second paragraph.

Is there seasonality to vehicle emissions in China? Does this differ by gasoline vs. diesel? Even if seasonality is not accounted for in the emissions, the authors should comment on whether that is an accurate assumption or misses an important feature of realistic vehicle emissions. This information should come before the discussion of Figure 3 in section 2.3.

Section 2.3, paragraph 4, the sentence beginning "For example, while vehicle emissions share. . ." is unclear and should be edited (e.g. "For example, while the contribution of vehicles emissions is 46%...").

Section 4.2.2: Would it be possible to evaluate each PM2.5 component separately to corroborate the explanations given for underestimation of total PM2.5? In addition, please clarify the explanation given in the 5th paragraph of this section. Does SO4

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really only contribute 2-3% of total PM2.5 at both Rishira and Oki? If so, does the small contribution of SO4 to total PM2.5 reflect the lack of aqueous phase SO4 production in WRF/Chem, as noted in the preceding sentence? Is this really “of less importance” as stated by the authors or actually a major source of underestimation? Finally, can any model performance conclusions realistically be made by comparing simulated concentrations to only two observation sites, one of which (Rishiri) is at the very edge of the model domain?

Would "frequency distribution" be a more accurate term than "probability distribution" since no uncertainties in the simulated concentrations are being accounted for and thus the graphs are essentially counts of gridcells with concentrations of a certain value? It would be useful to note whether the gridcells where concentrations are highest are also the most populated or whether they are occurring outside of the most populated areas (though it may be argued that population exposure is outside the scope of this paper).

Section 5.3, paragraph 3, the sentence beginning “Maximum O3 reductions from BAU to Euro 3. . .” is unclear and should be clarified.

Section 6, paragraph 4, the sentence beginning “We find that as the result. . .” should be “We find that as a result. . .”

The authors cite Shindell et al. (2011) in the last paragraph of the paper in reference to additional impacts of vehicle emissions on health, agriculture, and climate. Although a full assessment of these impacts is outside the scope of this paper (as the authors state) the authors should consider whether comparisons of results (e.g. emissions impacts) of the present analysis and Shindell et al. (2011) are possible.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 13141, 2011.