

Interactive comment on “Emissions of air pollutants and greenhouse gases over Asian regions during 2000–2008: Regional Emission inventory in ASia (REAS) version 2” by J. Kurokawa et al.

Anonymous Referee #3

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General comments:

In this work, Kurokawa et al. described the methodology, the results, and the improvement of the updated Regional Emissions inventory in ASia (REAS) version 2.1. The work is very important to the Asian emission inventory community and will be of great value to the modeling activities associated with the Asian atmospheric environmental problems. Generally, the manuscript is well organized and well-written. However, some discussion is unclear and not enough to the reviewer. The reviewer would recommend

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the manuscript for publication in ACP after comments below are carefully addressed.

Specific comments

The reviewer strongly suggests the authors adding tables summarizing the yearly activity rates and emission factors for the REAS 2.1 inventory (similar to Table 2 and Table 3 in the REAS 1.1 paper, Ohara et al., 2007). This information is essential and important for an inventory, and it could help the other researchers compare with their own works.

A power plant emission database was developed in the REAS 2.1 inventory for the Asian region based on the CARMA Database and UDI World Electric Power Plants Database. First, the authors used the old version of the CARMA (i.e., 2000, 2007), which, to the reviewer's knowledge, contains incomplete and inaccurate information, especially for China. Second, even for the new version of CARMA (i.e., 2004, 2009), the information is not completed. For example, there are more than 2200 Chinese power plants in the CARMA for year 2009; however, more than 500 plants (accounting for ~20% of the total electricity generation) do not have location information (latitude/longitude). The reviewer did not see any discussion in the manuscript about this issue. Distributing the total power sector emissions only to location-known plants will overestimate emissions in these plants (e.g., overestimate by 25%+). The reviewer is wondering why the REAS 2.1 does not incorporate more reliable unit-based inventories developed specifically for China's power plants by Zhao et al. (2008), Zhang et al. (2009), or Wang et al. (2012).

To the reviewer's knowledge, there have been several published papers using the REAS 2.1 inventory in model simulations, such as Irie et al. (2013), Itahashi et al. (2013a), Itahashi et al. (2013b), etc. The reviewer suggests the authors adding a section in the manuscript summarizing the current applications of the updated inventory. The use of the inventory and the new knowledge gained from the modeling activities will support that the REAS 2.1 is a valuable and reliable product for the Asian modeling community.

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Page 10059, lines 4-16. The authors said that “in REAS 2.1, emissions from agricultural activities during 2001 and 2008 were extrapolated from the gridded emission data of REAS 1.1 for 2000”. The resolution of the old REAS 1.1 inventory is 0.5 degree by 0.5 degree, but the new REAS 2.1 inventory has a resolution of 0.25 degree by 0.25 degree. The reviewer is wondering how the agricultural emissions were distributed to a finer grid. Were any surrogates used? Or the REAS 2.1 just retains the coarse resolution for this sector?

Page 10066, lines 25-26 and Table 4. The reviewer is wondering why the authors gave an additional separate table for Southeast Asian countries, not other regions. Are there any specific reasons?

Section 3.3. Only monthly emissions for SO₂, NO_x, and BC are shown and discussed. How about the other 9 species?

Section 3.5. First, only the comparisons of 9 species (i.e., SO₂, NO_x, CO, NMVOC, BC, OC, NH₃, CH₄, and N₂O) with previous works are presented. How about the other 3 species? Second, from the reviewer’s point of view, the authors missed some important previous works, such as GAINS (Klimont et al., 2009) for all species in all countries and regions, IPCC RCP inventories for all species in all countries and regions, Smith et al. (2011) for SO₂ in all countries and regions, Zhao et al (2011) for all species in China, etc.

Technical corrections:

Page 10053, line 15. Change “discussions’ to “discussion”.

Page 10079, lines 17-19. “Fig. 1S” should be “Fig. S1”. And these figures should be in the main text instead of in the Supplement.

Page 10079, line 21. “in January and July”. Figure 8 shows monthly emissions in July and December.

Fig. 12. “NMV” in figures should be “NMVOC”.

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References

Irie, H., Yamaji, K., Ikeda, K., Uno, I., Itahashi, S., Ohara, T., and Kurokawa, J.: An evaluation of the CMAQ reproducibility of satellite tropospheric NO₂ column observations at different local times over East Asia, *Atmos. Chem. Phys. Discuss.*, 13, 14037-14067, 2013.

Itahashi, S., Uno, I., Irie, H., Kurokawa, J., and Ohara, T.: Trend analysis of tropospheric NO₂ column density over East Asia during 2000–2010: multi-satellite observations and model simulations with the updated REAS emission inventory, *Atmos. Chem. Phys. Discuss.*, 13, 11247-11268, 2013a

Itahashi, S., Uno, I., and Kim, S. Seasonal source contributions of tropospheric ozone over East Asia based on CMAQ-HDDM, *Atmos. Environ.*, 70, 204-217, 2013b.

Klimont, Z., Cofala, J., Xing, J., Wei, W., Zhang, C., Wang, S., Kejun, J., Bhandari, P., Mathur, R., Purohit, P., Rafaj, P., Chambers, A., and Amann, M.: Projections of SO₂, NO_x and carbonaceous aerosols emissions in Asia, *Tellus B*, 61, 602–617, 2009.

Ohara, T., Akimoto, H., Kurokawa, J., Horii, N., Yamaji, K., Yan, X., and Hayasaka, T.: An Asian emission inventory of anthropogenic emission sources for the period 1980–2020, *Atmos. Chem. Phys.*, 7, 4419–4444, 2007

Smith, S. J., Van Aardenne, J., Klimont, Z., Andres, R. J., Volke, A., and Delgado Arias, S.: Anthropogenic sulfur dioxide emissions: 1850–2005, *Atmos. Chem. Phys.*, 11, 1101–1116, 2011.

Wang, S. W., Zhang, Q., Streets, D. G., He, K. B., Martin, R. V., Lamsal, L. N., Chen, D., Lei, Y., and Lu, Z.: Growth in NO_x emissions from power plants in China: bottom-up estimates and satellite observations, *Atmos. Chem. Phys.*, 12, 4429–4447, 2012.

Zhang, Q., Streets, D. G., Carmichael, G. R., He, K. B., Huo, H., Kannari, A., Klimont, Z., Park, I. S., Reddy, S., Fu, J. S., Chen, D., Duan, L., Lei, Y., Wang, I. T., and Yao, Z. L.: Asian emissions in 2006 for the NASA INTEX-B mission, *Atmos. Chem. Phys.*, 9,

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5131–5153, 2009.

Zhao, Y., Wang, S. X., Duan, L., Lei, Y., Cao, P. F., and Hao, J. M.: Primary air pollutant emissions of coal-fired power plants in China: Current status and future prediction, *Atmos. Environ.*, 42, 8442–8452, 2008.

Zhao, Y., Nielsen, C. P., Lei, Y., McElroy, M. B., and Hao, J.: Quantifying the uncertainties of a bottom-up emission inventory of anthropogenic atmospheric pollutants in China, *Atmos. Chem. Phys.*, 11, 2295–2308, 2011.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 13, 10049, 2013.