Reviewer 1:

This is a comprehensive analysis of emission trend and mitigation options. I focused on section 4.2 on the comparison of the emissions with the satellite observations, for which I have more expertise.

The comparison of satellite observations presented in sec 4.2 is qualitative, but seems reasonable for the scope of this study. The comparison of NO2 columns and NOx emissions is subject to time-dependent chemical feedbacks of NOx on its own lifetime. A more rigorous comparison would involve incorporating the emission inventory into a chemical transport model and comparing the simulated NO2 versus satellite NO2; however that may be beyond the scope of this manuscript.

Response: We agree with the reviewer that it is more rigorous to calculate NO_2 vertical column density with a chemical transport model and then compare with satellite observations. This manuscript focuses on the emission trends and mitigation options of air pollutants, the calculation of NO_2 column with chemical transport model is beyond the scope of this study. However, in our previous study (Zhao et al., 2013), we once compared the NO_2 column simulated by the Community Multi-scale Air Quality (CMAQ) model with the satellite observations in 2005 and 2010, and demonstrated good agreement with each other. In the revised manuscript, we have added the importance of comparing the simulated NO_2 column trends with satellite observations in the future. (Page 39 Line 13-16 in the revised manuscript)

Reference:

Zhao, B., Wang, S. X., Dong, X. Y., Wang, J. D., Duan, L., Fu, X., Hao, J. M., and Fu, J.: Environmental effects of the recent emission changes in China: implications for particulate matter pollution and soil acidification, Environ. Res. Lett., 8, doi:10.1088/1748-9326/8/2/024031, 2013.

The SO2 comparison is subject to uncertainty in the retrieval algorithms. The authors may be able to easily strengthen the confidence in Fig 5b by adding GOME-2 from Fioletov et al. (2013), but I suggest this only for consideration.

Response: We appreciate the reviewer's valuable comment. We have added the SO_2 column retrieved by Fioletov et al. (2013) from GOME-2 DLR and GOME-2 SAO products, as shown in Figure R1 below, or Figure 5(b) in the revised manuscript. It can be seen that the temporal trends of SO_2 vertical column density retrieved from all four data sources (OMI, SCIAMACHY, GOME-2 DLR, and GOME-2 SAO) agree fairly well with each other. The addition of GOME-2 strengthens the confidence but does not change our previous conclusions.

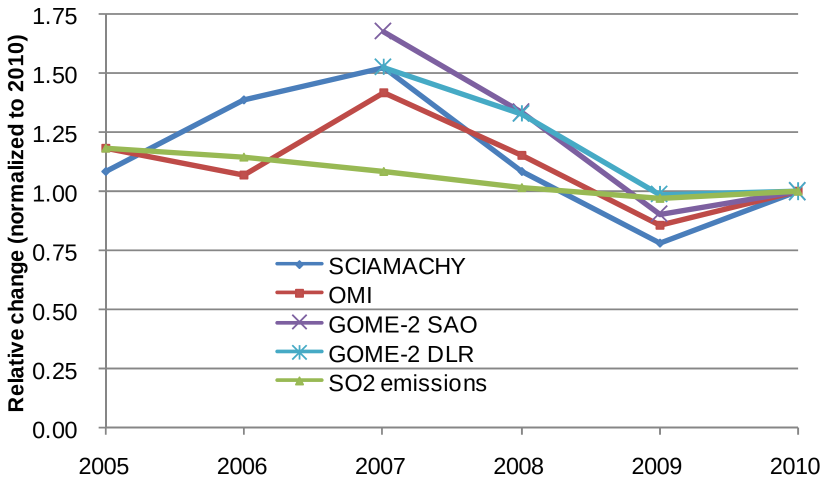


Figure R1 Inter-annual relative changes of SO_2 vertical column density and total SO_2 emissions over an area of Eastern China (34°N–38°N, 112°E–118°E). SO_2 vertical column density was derived by Fioletov et al. (2013), in which a filtering procedure was applied to remove local biases. All data are normalized to 2010. This figure is consistent with Figure 5(b) in the revised manuscript.

References:

Fioletov, V. E., McLinden, C. A., Krotkov, N., Yang, K., Loyola, D. G., Valks, P., Theys, N., Van Roozendael, M., Nowlan, C. R., Chance, K., Liu, X., Lee, C., and Martin, R. V.: Application of OMI, SCIAMACHY, and GOME-2 satellite SO2 retrievals for detection of large emission sources, J. Geophys. Res-Atmos., 118, 11399-11418, doi:10.1002/jgrd.50826, 2013.

Spelling and grammar do need some attention throughout the manuscript.

Response: We thank the reviewer for this comment. While revising the manuscript, we took special care to assure correct spelling and grammar. In addition, we have invited Dr. Michael B. McElroy and Dr. Chris P. Nielsen, co-authors of the manuscript, to help us edit the language of the whole manuscript.

Specific:

I could not find in Fioletov et al. (2013) where they attributed the pronounced between in

2009 and 2010 to transient volcanic signals. It may be more accurate to say that the difference arises from time-dependent bias in the retrieval algorithms.

Response: We appreciate the reviewer's valuable comment. We double checked the relative literature (Fioletov et al., 2013). The author did not explicitly attribute the pronounced increase between in 2009 and 2010 to transient volcanic signals. Instead, we concluded that the transient volcanic signals resulted in the pronounced increase by discussing with the author of Lu et al. (2011). Lu et al. applied a filtering procedure quite similar to Fioletov et al. (2013), except that they did not eliminate transient volcanic signals. Therefore, we believe the volcanic signals should be the major contributor to the pronounced increase. To be more accurate, we accepted the reviewer's suggestion and revised the original text as follows:

Lu et al. (2011) shows a significant increase in SO_2 vertical column density (VCD) between 2009 and 2010 (especially that retrieved from SCIAMACHY), while Fioletov et al. (2013) shows a slight increase. Fioletov et al. (2013) implies that the pronounced increase between 2009 and 2010 arises from time-dependent bias in the retrieval algorithms. When the filtering procedure developed in Fioletov et al. (2013) was applied, the pronounced increase turned into only a slight increase. Therefore, we exclude the SO_2 VCD in 2010 in Lu et al. (2011) in the following discussion. (Page 40, Line 1-7 in the revised manuscript)

References:

Fioletov, V. E., McLinden, C. A., Krotkov, N., Yang, K., Loyola, D. G., Valks, P., Theys, N., Van Roozendael, M., Nowlan, C. R., Chance, K., Liu, X., Lee, C., and Martin, R. V.: Application of OMI, SCIAMACHY, and GOME-2 satellite SO2 retrievals for detection of large emission sources, J. Geophys. Res-Atmos., 118, 11399-11418, doi:10.1002/jgrd.50826, 2013.

Lu, Z., Zhang, Q., and Streets, D. G.: Sulfur dioxide and primary carbonaceous aerosol emissions in China and India, 1996-2010, Atmos. Chem. Phys., 11, 9839–9864, doi:10.5194/acp-11-9839-2011, 2011.

Reviewer 2

In this work, Wang et al. reviewed the current control measures of air pollutants in East Asia, estimated the emission trends of these pollutants for the period 2005-2010, and projected the emissions to 2030 on the basis of two/six emission scenarios/strategies.

The technical part is clearly described and of good quality and the manuscript is well organized. However, there are a number of format issues and numerous grammatical errors. The reviewer suggests a grammar-checking by native English speaker, and recommends the revised manuscript for publication in ACP.

Response: We thank the reviewer for supporting the publication of our manuscript. We also appreciate his or her comments which help us improve the quality of our manuscript. We address the reviewer's comments below. The original comments are in blue and our responses are in black. In response to the reviewer's comments about the grammatical errors, we took special care to assure correct spelling and grammar when revising the manuscript. In addition, we have invited Dr. Michael B. McElroy and Dr. Chris P. Nielsen, co-authors of the manuscript, to help us edit the language of the whole manuscript.

Specific comment:

The reviewer is wondering whether it is possible to add a section discussing the uncertainties of emission inventories complied in this study.

Response: We thank the reviewer for this comment. In the revised manuscript we have performed a Monte Carlo uncertainty analysis of the historical emission inventories, and added a section to discuss the results (Sect. 2.4 and Table S5 in the revised manuscript). The added text is shown as follows:

A Monte Carlo uncertainty analysis was performed on the emission inventories of East Asia during 2005-2010, following the methodology described in Bo et al. (2008) and Wei et al. (2008). Table R1 (Table S5 in the revised manuscript) shows the calculated uncertainties by sector.

During 2005-2010, the average 90% confidence interval of the total NO_X emissions is [-31%, 44%]. The coefficient of variation (CV) is ±25% on average. The uncertainties of emissions vary with emission sectors (see Table R1), attributable to the different magnitudes of uncertainties associated with activity levels and emission factors. Biomass open burning has the largest CV (±177%) because both the activity levels and the emission factors are quite uncertain. The transportation sector has the second highest uncertainty (CV=±66%), as its fuel consumption is calculated from vehicle population, annual average mileage travelled, and fuel economy, rather than the energy statistics.

The average 90% confidence interval and CV of the total SO_2 emissions are [-29%, 45%] and ±28%, respectively, during 2005-2010. Similar to that of NO_X emissions, the SO_2 emissions from biomass open burning have the highest uncertainty (CV=±179%). The uncertainties of the industrial, residential, and transportation sectors are quite close to each other, with CVs at a range of ±48%-±51%.

During 2005-2010, the average 90% confidence interval and CV of the total $PM_{2.5}$ emissions are [-39%, 49%] and ±39%, respectively. Biomass open burning is the sector subject to the highest uncertainty (CV=±216%). The residential sector has the second highest uncertainty due to the relatively fewer emission factor measurements for coal stoves and biomass stoves, the dominant $PM_{2.5}$ emission sources of this sector.

The average 90% confidence interval and CV of the total NMVOC emissions are [-42%, 67%] and ±42%, respectively. The “other sectors”, which include biomass open burning, waste treatment, cooking, and smoking, with biomass open burning contributing over 80% of NMVOC emissions, have the highest uncertainty (CV=±184%), followed by solvent use (CV=±78%), for which the activity levels are not directly available from statistics and the emission factor measurements are lacking. The CVs for the industrial, residential, and transportation sectors are all within the range of ±57%-±65%.

It can be seen that NMVOC is the pollutant subject to the highest uncertainty, followed by $PM_{2.5}$. The high uncertainty of NMVOC emissions is mainly attributable to the lack of local measurements for many industrial and solvent use sources. The higher uncertainties of $PM_{2.5}$ emissions compared with NO_X and SO_2 result from the larger uncertainties in the emission factors (e.g., uncertainties in the emission factors of industrial fugitive dust, uncertainties in removal efficiencies of dust collectors), and a relatively larger share of emissions from small-scale emission sources (e.g., coal stoves, biomass stoves).

References:

Bo, Y., Cai, H., and Xie, S. D.: Spatial and temporal variation of historical anthropogenic NMVOCs emission inventories in China, Atmos. Chem. Phys., 8, 7297–7316, 2008.

Wei, W., Wang, S. X., Chatani, S., Klimont, Z., Cofala, J., and Hao, J. M.: Emission and speciation of non-methane volatile organic compounds from anthropogenic sources in China, Atmos. Environ., 42, 4976–4988, 2008.

Table R1. Results of the uncertainty analysis of the emissions in East Asia during 2005-2010. The numbers in the table except the last line are the coefficients of variation (CVs). The last line shows the average 90% confidence intervals of the total emissions during 2005-2010. This table is consistent with Table S5 in the revised manuscript.

		NO_X	SO_2	$PM_{2.5}$	NMVOC
power plants	range of CVs during 2005-2010	±33%-±35%	±29%-±31%	±30%-±32%	--
	average CV	±34%	±30%	±31%	--
industrial sector	range of CVs during 2005-2010	±39%-±44%	±47%-±51%	±49%-±57%	±62%-±64%
	average CV	±41%	±49%	±53%	±63%
residential sector	range of CVs during 2005-2010	±55%-±56%	±49%-±53%	±67%-±69%	±61%-±69%
	average CV	±55%	±51%	±68%	±65%
transportation sector	range of CVs during 2005-2010	±63%-±70%	±47%-±49%	±52%-±53%	±53%-±60%
	average CV	±66%	±48%	±52%	±57%
solvent use sector	range of CVs during 2005-2010	--	--	--	±74%-±81%
	average CV	--	--	--	±78%
other sectors (mainly biomass open burning) [a]	range of CVs during 2005-2010	±172%-±183%	±163%-±196%	±212%-±220%	±183%-±186%
	average CV	±177%	±179%	±216%	±184%
total emissions	range of CVs during 2005-2010	±23%-±26%	±25%-±30%	±37%-±40%	±41%-±43%
	average CV	±25%	±28%	±39%	±42%
	average 90% confidence interval	[-31%, 44%]	[-29%, 45%]	[-39%, 49%]	[-42%, 67%]

[a] "Other sectors" represent biomass open burning for NO_X, SO_2, and $PM_{2.5}$; for NMVOC, they include biomass open burning, waste treatment, cooking, and smoking, with biomass open burning contributing over 80% of the total NMVOC emissions from these sources.

Format issues:

According to the style of the ACP, tables "should be numbered sequentially". However, in the main text, Table 2 occurs earlier than Table 1; Table 6 occurs earlier than Table 5; and Table 8 occurs earlier than Table 7.

Response: We appreciate the reviewer's careful check. We have revised either the sequence of the tables or the citations in the main text to assure that all the tables are numbered sequentially.

Page 2602, line 10. "FGD" should be defined at first occurrence.

Response: We have added the full name of "FGD" (flue gas desulfurization) at its first occurrence. (Page 1, Line 24 of the revised manuscript)

Page 2604, line 9. Page 2609, line 4. Page 2639, line 12. Page 2640, line 24. Zhao et al. (2013d) is not in the reference list or "d" is not added to the last literature of the References.

Response: We appreciate the reviewer's comment. We did include Zhao et al. (2013d) in the manuscript but it was dropped during the typesetting process. We apologize for this. We will make sure it is modified before the final revised paper is published.

Page 2609, line 27. Page 2610, line 22. UNEP (2010) is not listed in the References.

The reviewer did not see NDRC (2007) was cited in the main text.

Response: We have deleted NDRC (2007) and added UNEP (2010) in the reference list.

United Nations Environment Programme (UNEP): Overview of the Republic of Korea's National Strategy for Green Growth, United Nations Environment Programme, Geneva, Switzerland, 54 pp., 2010.

Caption of Fig. 1. Add "in China" after "standards".

Response: Revision has been made.

Page 2 of the SI. "(c) PM" should be "(3) PM".

Response: Revision has been made.

Some examples of grammatical errors in the first 27 pages:

Page 2602, line 21. Add commas before and after "respectively". Correct it throughout the manuscript.

Page 2603, line 5. Change “reports” to “reported”. Change “contribute” to “contributes”.

Page 2603, line 8. Change “calculation” to “calculations”.

Page 2603, line 10. Change “rate” to “rates”.

Page 2603, line 25. Add “the” before “Kyoto”

Page 2604, line 5. Change “estimation” to “estimations”.

Page 2604, line 24. Add a comma after “Hence”.

Page 2605, line 5. Change “incorporate” to “incorporated

Page 2605, line 6. Add “a” before “full”.

Page 2605, line 8. Add “the” before “annual”. Change “reduction” to “reductions”.

Page 2605, line 25. Add “the” before “model”.

Page 2606, line 13. Add “a” before “special”.

Page 2607, line 12. Add “the” before “rapid”.

Page 2607, line 13. Add “the” before “lower”.

Page 2607, line 18. Add “the” before “rapid”.

Page 2608, line 12. Add “of” before “coal-fired”.

Page 2608, line 18. Change “share” to “shares”.

Page 2609, line 9. Add commas before and after “respectively”.

Page 2609, line 14. Change “inspection” to “inspections”.

Page 2609, line 17. Add commas before and after “respectively”.

Page 2609, line 23. Add “the” before “energy”.

Page 2609, line 26. Add “the” after “through”.

Page 2610, line 5. Add “the” before “stable”.

Page 2611, line 27. Add commas before and after “respectively”.

Page 2612, line 18. Add “the” before “large”.

Page 2612, line 25. Add “the” before “commercial”.

Page 2613, line 25. Add “a” before “small”.

Page 2614, line 8. Change “requires” to “require”.

Page 2614, line 21. Change 3 “furnace” to “furnaces”.

Page 2615, line 9. Add commas before and after “respectively”.

Page 2615, line 20. Change “Previous” to “A previous”.

Page 2615, line 22. Change “accounted” to “accounting”.

Page 2616, line 4. Change “is” to “are”. Add “the” before “national”.

Page 2616, line 5. Add a comma before “respectively”. Correct it throughout the manuscript.
Page 2618, line 3. Add “the” before “agreement” and “development”.
Page 2618, line 16. Add “the” before “estimation” and “vehicle”.
Page 2618, line 17. Change “regulations” to “regulation”.
Page 2618, line 28. Add “in” after “installed”.
Page 2619, line 22. Change “standard” to “standards”.
Page 2620, line 3. Change “accounts” to “account”.
Page 2620, line 21. Change “/” to “and”.
Page 2621, line 2. Add “the” before “transportation”.
Page 2621, line 5. Add “the” before “industrial”.
Page 2621, line 8. Change “emission” to “emissions”.
Page 2621, line 12. Change “improving” to “improved”.
Page 2622, line 12. Add “the” before “slower”.
Page 2622, line 18. Add “the” before “transportation”.
Page 2623, line 20. Change “scenarios consistent” to “scenarios which are consistent with”.
Page 2623, line 27. Add “the” before “urbanization”.
Page 2624, line 1. Add “the” before “PC” and “BAU”. Correct it throughout the manuscript.
Page 2624, line 1. Change “scenarios” to “scenario than”.
Page 2624, line 3. Change the comma before “therefore” to a semicolon.
Page 2624, line 10. Add “the” before “residential”.
Page 2624, line 11. Add “the” before “urban” and “rural”.
Page 2624, line 13. Add “the” before “implementation”.
Page 2624, line 26. Change “larger” to “higher”.
Page 2625, line 19. Add “the” before “slow”.
Page 2625, line 23. Add “the” before “transportation”.
Page 2626, line 6. Add “the” before “maximum”.
Page 2626, line 12. Add “and” before “the progressive”.
Page 2626, line 23. Add “a” before “total”.
Page 2627, line 25. Add a comma after “i.e.”. Correct it throughout the manuscript.
Caption of Table 2. Add “the” before “power”.
There are more: : :

Response: We sincerely appreciate the reviewer’s detailed comments. We have revised all the grammatical errors listed above. For such errors like “Add commas before and after ‘respectively’”, we have corrected it throughout the manuscript. Besides, while revising the manuscript we took special care to assure correct spelling. Finally, we have invited Dr. Michael B. McElroy and Dr. Chris P. Nielsen, co-authors of the manuscript, to help us edit the language of the whole manuscript.

Reviewer 3

It is of great significance to know well about the recent trend and future direction of anthropogenic emissions for air pollutants in East Asia, which has recently become the world leader in air pollutant emissions. The study conducted by S.X. Wang and coauthors provides an annual trend for the period from 2005 to 2010 in NOx, SO2, PM10, PM2.5 and NMVOC emissions in East Asia based on the detail country-specific information about recent control measures (energy-saving measures and end-of pipe control measures) and also compare it with the previous studies and observation in China. In addition the authors projected future emissions up to 2030 for six emission scenarios, considering both energy-saving and end-of-pipe measures. The authors provide recent emission inventory and future emission projections which are more reliable than previous works in East Asia. And also the emission scenarios developed in this work will make a great contribution to the policy making for atmospheric environmental management in East Asia. Consequently, this reviewer believes that the paper is of the interest of ACP and recommends publishing this paper with minor revisions in response to the following questions, comments, and suggestions.

Response: We thank the reviewer for supporting the publication of our manuscript. We also appreciate his or her comments which help us improve the quality of our manuscript. We address the reviewer's comments below. The original comments are in blue and our responses are in black.

1. Page 2617, Line 14: I suggest that 'Non-energy related sectors" should be changed to "Solvent use" or other appropriate title because solvent use emissions alone are discussed in this section. Section 3.2.5 is similar.

Response: we agree with the reviewer and have replaced the titles of Section 2.2.5 and Section 3.2.5 with "Solvent use", and "Solvent use and biomass open burning", respectively.

2. Page 2621, Lines 16-17: "Japan's NMVOC emissions decreased by 30% mainly because of the implementation of stringent vehicle emission standards." is correct? Fig. 3e shows that a decrease in solvent use and others is larger than a decrease of transportation.

Response: We appreciate the reviewer's valuable comment. We agree that the decrease in solvent use is even larger than that of transportation. Therefore, we revised the statement as follows in the revised manuscript:

Japan's NMVOC emissions decreased by 30%, mainly attributed to the government's efforts to reduce the emissions from solvent use and the implementation of stringent vehicle emission standards. (Page 18, Line 9-11 in the revised manuscript)

3. Chapter 3: The authors should add the explanation about activity data for industrial process, such as cement production and cokes production, and for evaporative NMVOC sources, such as solvent use and others.

Response: We thank the reviewer for this valuable comment. Below we describe the method for the projection of the activity data for industrial process, fossil fuel distribution, and solvent use. For industrial process, we just include a brief description in the revised manuscript and refer the readers to Zhao et al. (2013) for detailed information. As for fossil fuel distribution and solvent use, we have added the descriptions below accordingly in the revised manuscript. (from Page 22, Line 15 to Page 23, Line 2 in the revised manuscript)

1) Industrial process

We applied an elasticity coefficient method for the estimation of future production of industrial products, the governing equation of which is as follows:

$$Y_{t1} = Y_{t0}\left(\frac{dv_{t1}}{dv_{t0}}\right)^{\delta} \quad (1)$$

where, $t0$, $t1$ are time periods, e.g., $t0 = 2010$, and $t1 = 2030$; Y is the yield of a specific industrial product; dv is the driving force, namely sectoral value added or population; δ is the product specific elasticity coefficient. The values of δ are determined through (1) historical trend during 1995-2010; (2) experience of developed countries; (3) projections of industrial associations. Generally speaking, most energy-intensive products for infrastructure construction are expected to increase until 2020, and stabilize or even decline after 2020, whereas the products closely related to everyday life are expected to increase until 2030, though at a declining rate. Future yields in PC scenario are less than those in BAU scenario because of a more conservative life style.

2) Fossil fuel distribution

The increase of fossil fuels stored and distributed is expected to be consistent with the increase of total fuel consumption in the future. The gasoline or diesel sold at service stations is expected to have the same growth rate with fuel consumption of the transportation sector. Therefore, the future activity levels of this sector are derived from the projections of fuel consumption.

3) Solvent use

The activity data for the solvent use sector are the consumption of products containing solvents. The forecast approach, which is consistent with Wei et al. (2011), is illustrated as follows:

$$A_{t1} = \sum_j \left(A_{t0,j} \times \frac{Y_{t1,j}}{Y_{t0,j}} \right) \qquad (2)$$

where, $t0$, $t1$ are time periods, e.g., $t0 = 2010$, and $t1 = 2030$; j represents the industries using a specific solvent product; A_{t1} is the consumption of this solvent product in the year $t1$; $A_{t0,j}$ is the consumption of this solvent product in industry j in the year $t0$; $Y_{t0,j}$ and $Y_{t1,j}$ are the yields of the major products (e.g., crude steel for the iron and steel industry) for industry j in the year $t0$ and $t1$, respectively. The yields of industrial products were projected using the methodology illustrated by Eq. (1).

References:

Wei, W., Wang, S. X., Hao, J. M., and Cheng, S. Y.: Projection of anthropogenic volatile organic compounds (VOCs) emissions in China for the period 2010-2020, Atmos. Environ., 45, 6863-6871, doi: 10.1016/j.atmosenv.2011.01.013, 2011.

Zhao, B., Wang, S. X., Xu, J. Y., Fu, K., Klimont, Z., Hao, J. M., He, K. B., Cofala, J., and Amann, M.: NOx emissions in China: historical trends and future perspectives, Atmos. Chem. Phys., 13, 9869-9897, doi:10.5194/acp-13-9869-2013, 2013.

4. Page 2637, Line 8: "NOx" is "NMVOC"?

Response: We thank the reviewer for this comment. "NOx" has been replaced with "NMVOC" in the revised manuscript. (Page 34, Line 10 of the revised manuscript)

5. Page 2639, Line 12: "Zhao et al. (2013d)" is missing in references.

Response: We did include Zhao et al. (2013d) in the manuscript but it was dropped during the typesetting process. We apologize for this. We will make sure it is modified before the final revised paper is published.

6. Page 2644, Lines 6-7: The authors should explain the reason why the change from 2009 to 2010 in the SO2 emissions in this study and SO2 VCD from satellite observations are quite different.

Response: We thank the reviewer for this comment. Figure R1(a, b) (or Figure 5(a, b) in the revised manuscript) show the comparison of SO_2 vertical column density (VCD) from satellite observations with emission estimation. Lu et al. (2011) shows a significant increase in SO_2 VCD between 2009 and 2010 (especially that retrieved from SCIAMACHY), while Fioletov et al. (2013) shows a slight increase. Fioletov et al. (2013) implied that the pronounced increase between 2009 and 2010 arises from time-dependent bias in the retrieval algorithms. When the filtering procedure developed in Fioletov et al. (2013) was applied, the pronounced increase turned into only a slight increase. Therefore, we exclude the SO_2 VCD in 2010 in Lu et al. (2011) for the comparison with the temporal trend derived from emission estimation. Actually we have explained this briefly in the original manuscript. In the revised manuscript, we provided a more detailed explanation to this point. (Page 40, Line 1-7 in the revised manuscript)

(a)

(b)

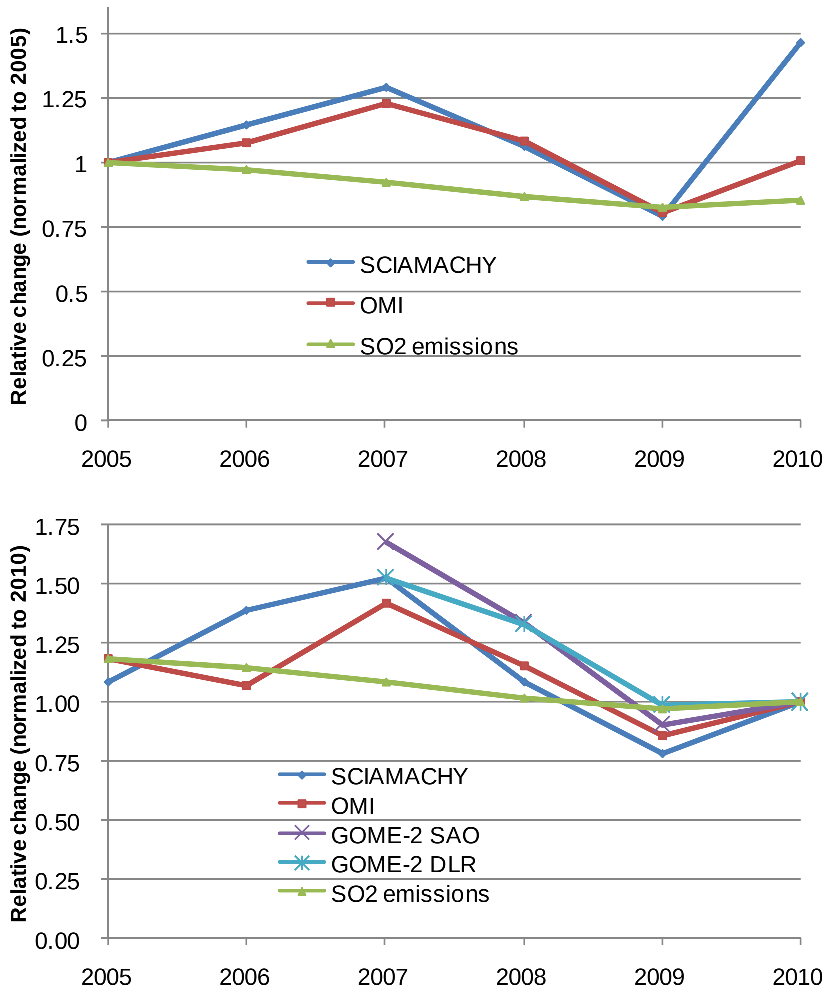


Figure R1 Inter-annual relative changes of SO_2 VCD from satellite observations and emission estimation in this study. (a) Average SO_2 VCD and total SO_2 emissions in Eastern Central

China (latitude <45ºN, longitude >100ºE). SO_2 VCD was derived by Lu et al. (2011). All data are normalized to 2005. (b) Average SO_2 VCD and total SO_2 emissions over an area of Eastern China (34°N–38°N, 112°E–118°E). SO_2 VCD was derived by Fioletov et al. (2013), in which a filtering procedure was applied to remove local biases, in particular volcanic signals. All data are normalized to 2010 because the data of GOME-2 are only available since 2007. This figure is consistent with Figure 5 (a, b) in the revised manuscript.

References:

Fioletov, V. E., McLinden, C. A., Krotkov, N., Yang, K., Loyola, D. G., Valks, P., Theys, N., Van Roozendael, M., Nowlan, C. R., Chance, K., Liu, X., Lee, C., and Martin, R. V.: Application of OMI, SCIAMACHY, and GOME-2 satellite SO2 retrievals for detection of large emission sources, J. Geophys. Res-Atmos., 118, 11399-11418, doi:10.1002/jgrd.50826, 2013.

Lu, Z., Zhang, Q., and Streets, D. G.: Sulfur dioxide and primary carbonaceous aerosol emissions in China and India, 1996-2010, Atmos. Chem. Phys., 11, 9839–9864, doi:10.5194/acp-11-9839-2011, 2011.

7. Page 2645, Line 14: What is the evidence about "PM2.5 concentration still increased in a large part of China"?

Response: We appreciate the reviewer's comment. In fact, this conclusion is mainly based on the simulation results in our previous paper (Zhao et al., 2013). The observations of $PM_{2.5}$ concentrations were quite rare in China during 2005-2010, and there were few continuous monitoring data for the whole period. Aerosol Optical Depth (AOD) from satellite increased in a large part of China during this period, with especially pronounced increase in the Sichuan Basin and the southern part of the North China Plain. This serves as a circumstantial evidence rather than a direct proof for the increase of $PM_{2.5}$ concentrations in some parts of China. To be more accurate, we emphasize that this conclusion is based on the modeling results in the revised manuscript. (Page 41, Line 13-25 of the revised manuscript)

References:

Zhao, B., Wang, S. X., Dong, X. Y., Wang, J. D., Duan, L., Fu, X., Hao, J. M., and Fu, J.: Environmental effects of the recent emission changes in China: implications for particulate matter pollution and soil acidification, Environ. Res. Lett., 8, 024031, doi:10.1088/1748-9326/8/2/024031, 2013a.

8. Table 1: For the definition of BAU [1], the authors should specify that the assumption for end-of-pipe control strategy is for only China.

Response: We thank the reviewer for this comment. In the revised manuscript, we have modified the definition of the BAU[1] scenario as follows:

The BAU[1] scenario assumes the energy-saving policies of the BAU scenario. For an end-of-pipe control strategy in China, it assumes that new pollution control policies will be released and implemented, representing a progressive approach towards future environmental protection. For the other countries in East Asia, the assumptions of the BAU[1] scenario are exactly the same as the BAU[0] scenario. (Page 20, Line 19-22; Page 24, Line 13-19; and Table 1 of the revised manuscript)

9. Table 6b: For LDB-B and CAR, the vehicle emission standards are incorrect in the sequence and in the number of penetration (%).

Response: We appreciate the reviewer's carefulness. The table in our manuscript was correct but there seems to be a problem with the typesetting process again. We are sorry for this. We will make sure it is modified before the final revised paper is published. The correct table is shown as follows. Note that Table 6 in the original manuscript corresponds to Table 5 in the revised manuscript.

Table 5. Penetrations of vehicle emission standards in China, Japan, and South Korea (%).

(b) Japan

Vehicle	Standard	Base year		BAU[0]/ BAU[1]/ PC[0]/ PC[1]		BAU[2]/ PC[2]	Vehicle	Standard	Base year		BAU[0]/ BAU[1]/ PC[0]/ PC[1]		BAU[2]/ PC[2]
		2005	2010	2020	2030	2030			2005	2010	2020	2030	2030
HDT-D	BST	41%	25%	0%	0%	0%	LDT-G	BST	38%	16%	1%	0%	0%
	ST	27%	19%	1%	0%	0%		ST	4%	2%	0%	0%	0%
	LT	26%	25%	22%	0%	0%		LT	10%	6%	0%	0%	0%
	NST	7%	11%	10%	0%	0%		1998R	14%	10%	6%	0%	0%
	NLT	0%	20%	22%	7%	0%		NST	34%	31%	19%	0%	0%
	PNLT	0%	0%	44%	93%	100%		NLT	0%	34%	24%	8%	0%
HDB-D	BST	52%	32%	0%	0%	0%		PNLT	0%	0%	49%	92%	100%
	ST	19%	15%	2%	0%	0%	LDB-B	BST	12%	4%	0%	0%	0%
	LT	25%	24%	23%	0%	0%		ST	4%	1%	0%	0%	0%
	NST	5%	8%	8%	0%	0%		LT	4%	1%	0%	0%	0%
	NLT	0%	20%	22%	8%	0%		1998R	16%	6%	3%	0%	0%
	PNLT	0%	0%	45%	92%	100%		NST	63%	35%	17%	0%	0%
LDT-D	BST	41%	27%	0%	0%	0%		NLT	0%	52%	27%	10%	0%

	ST	27%	20%	0%	0%	0%		PNLT	0%	0%	53%	90%	100%
	LT	27%	23%	22%	0%	0%	CAR	1983R	72%	32%	8%	0%	0%
	NST	5%	11%	10%	0%	0%		NST	28%	37%	24%	0%	0%
	NLT	0%	20%	23%	7%	0%		NLT	0%	31%	23%	9%	0%
	PNLT	0%	0%	46%	93%	100%		PNLT	0%	0%	46%	91%	100%

Notes: BST, before short term target; ST, short term target; LT, long term target; NST, new-short term target; NLT, new-long term target; PNLT, post new-long term target; 1998R, 1998 regulation; 1983R, 1983 regulation.

10. Figs. 2-4: These figures are too small to be visible and should be improved.

Response: We thank the reviewer for the comment. We have improved the quality of these figures and show the revised figures below. We will also assure that the figures are clear enough when the final revised paper is published.

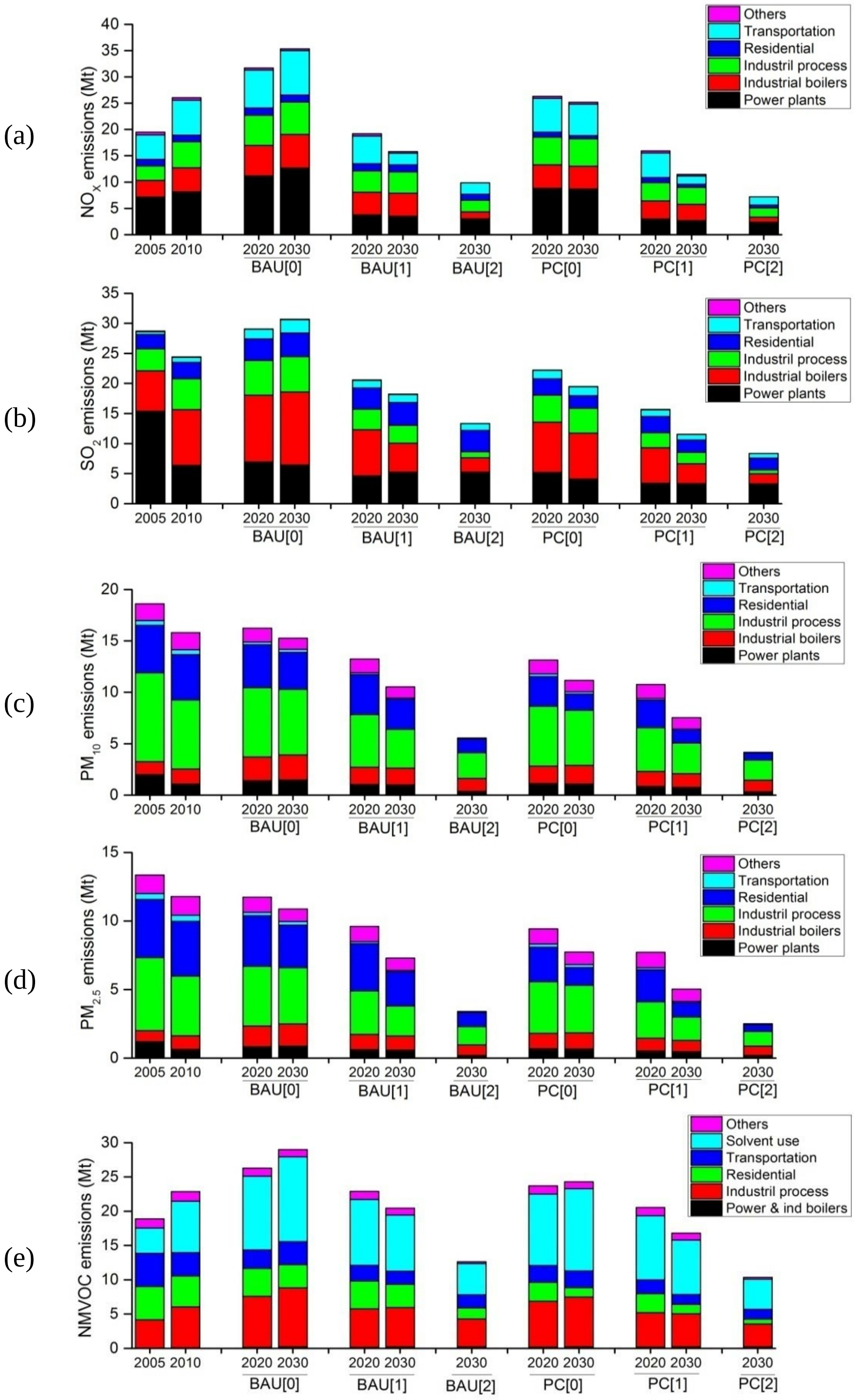


Figure 2. Emissions of major air pollutants in China and their sectoral distribution during 2005-2030: (a) NO_X; (b) SO_2; (c) PM_{10}; (d) $PM_{2.5}$; (e) NMVOC. The sector of “Others” represents biomass open burning for NO_X, SO_2, PM_{10}, and $PM_{2.5}$; for NMVOC, it includes biomass open burning, waste treatment, cooking, and smoking, with biomass open burning contributing over 80% of the total NMVOC emissions of this sector.

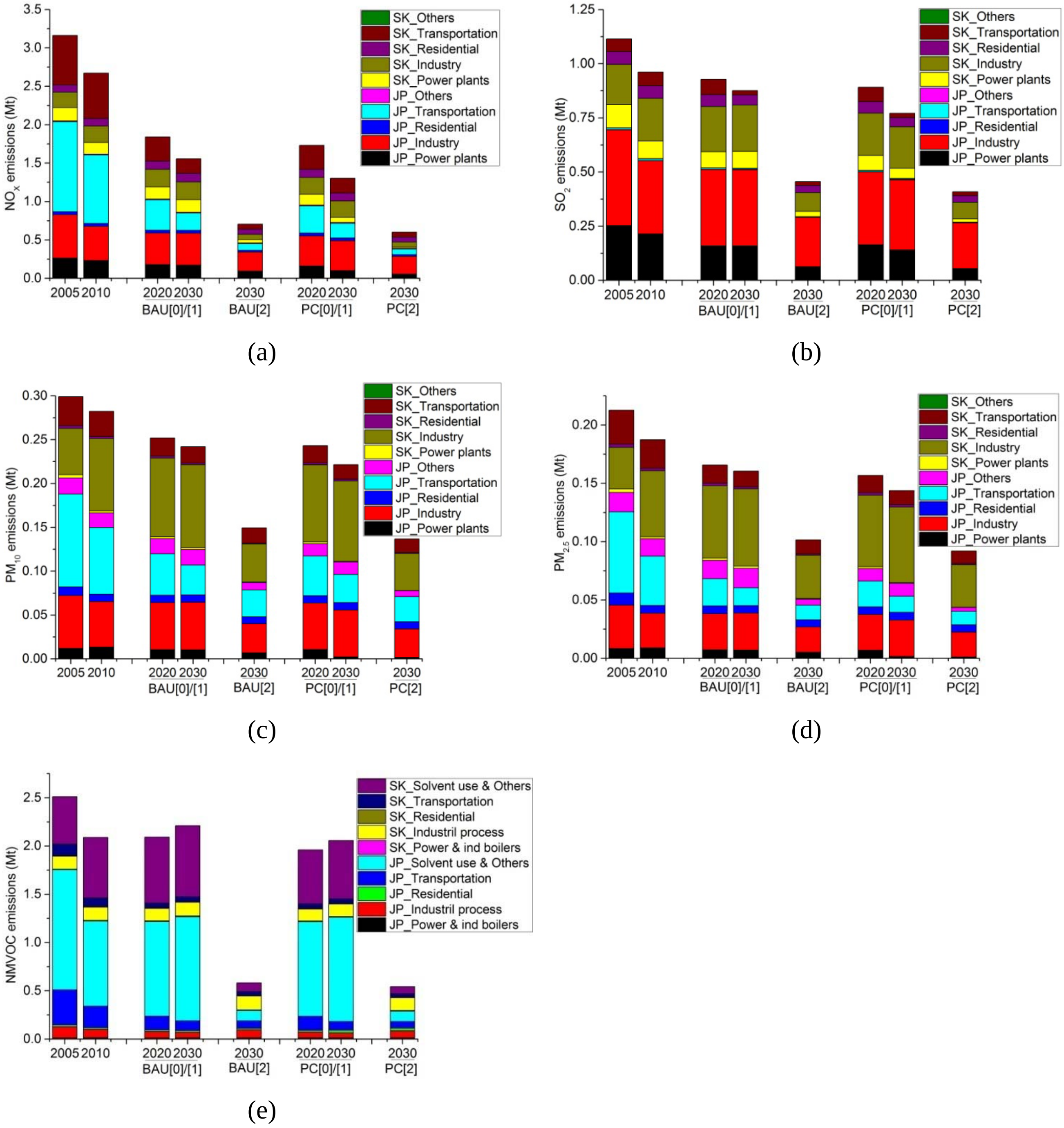
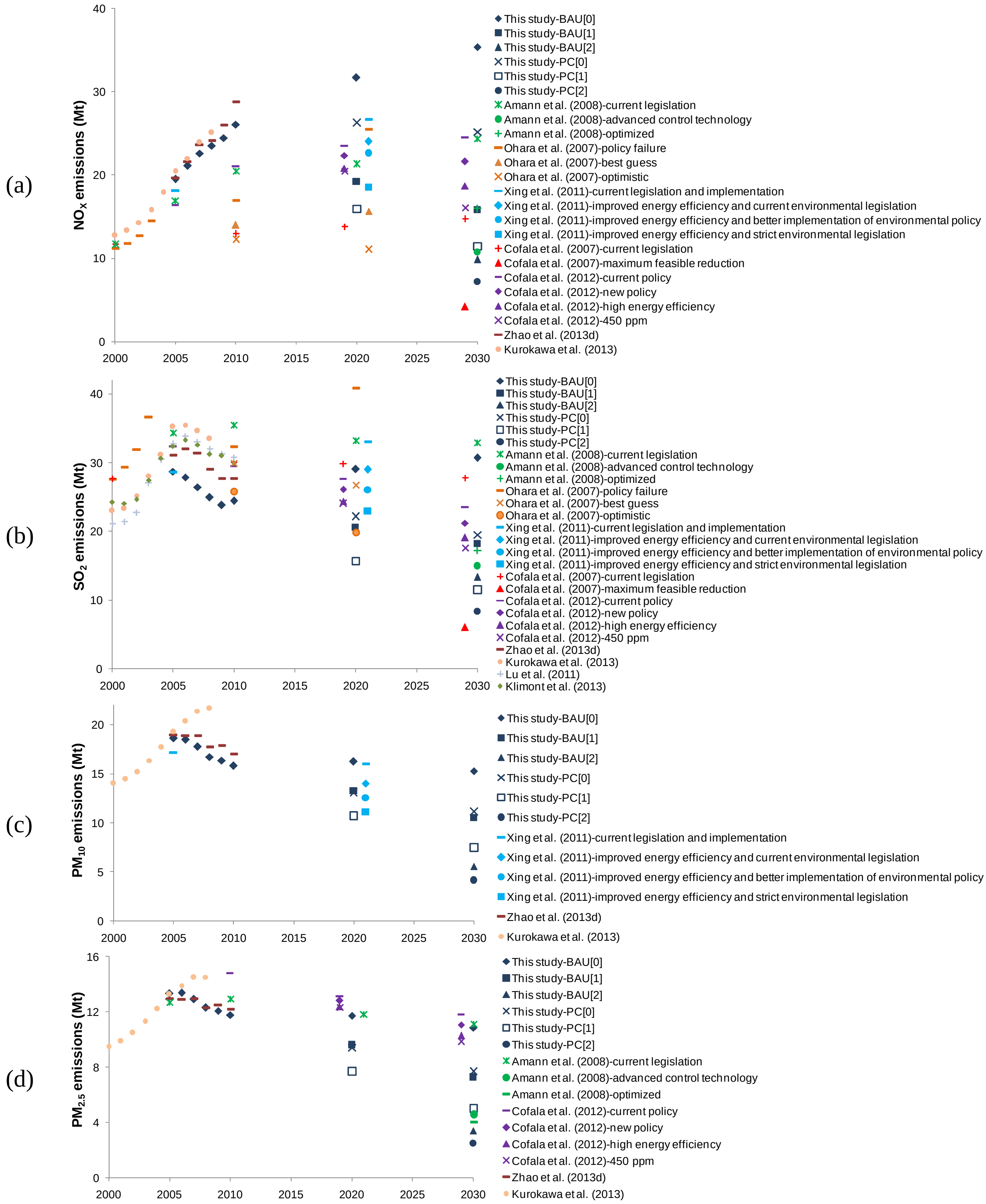


Figure 3. Emissions of major air pollutants in Japan and South Korea and their sectoral distributions during 2005-2030: (a) NO_X; (b) SO_2; (c) PM_{10}; (d) $PM_{2.5}$; (e) NMVOC. JP and SK in the legend represent Japan and South Korea, respectively. The sector of “Others” is mainly biomass open burning.


(a)
NO_X emissions (Mt)
0
10
20
30
40
2000
2005
2010
2015
2020
2025
2030
This study-BAU[0]
This study-BAU[1]
This study-BAU[2]
This study-PC[0]
This study-PC[1]
This study-PC[2]
Amann et al. (2008)-current legislation
Amann et al. (2008)-advanced control technology
Amann et al. (2008)-optimized
Ohara et al. (2007)-policy failure
Ohara et al. (2007)-best guess
Ohara et al. (2007)-optimistic
Xing et al. (2011)-current legislation and implementation
Xing et al. (2011)-improved energy efficiency and current environmental legislation
Xing et al. (2011)-improved energy efficiency and better implementation of environmental policy
Xing et al. (2011)-improved energy efficiency and strict environmental legislation
Cofala et al. (2007)-current legislation
Cofala et al. (2007)-maximum feasible reduction
Cofala et al. (2012)-current policy
Cofala et al. (2012)-new policy
Cofala et al. (2012)-high energy efficiency
Cofala et al. (2012)-450 ppm
Zhao et al. (2013d)
Kurokawa et al. (2013)
(b)
SO_2 emissions (Mt)
0
10
20
30
40
2000
2005
2010
2015
2020
2025
2030
This study-BAU[0]
This study-BAU[1]
This study-BAU[2]
This study-PC[0]
This study-PC[1]
This study-PC[2]
Amann et al. (2008)-current legislation
Amann et al. (2008)-advanced control technology
Amann et al. (2008)-optimized
Ohara et al. (2007)-policy failure
Ohara et al. (2007)-best guess
Ohara et al. (2007)-optimistic
Xing et al. (2011)-current legislation and implementation
Xing et al. (2011)-improved energy efficiency and current environmental legislation
Xing et al. (2011)-improved energy efficiency and better implementation of environmental policy
Xing et al. (2011)-improved energy efficiency and strict environmental legislation
Cofala et al. (2007)-current legislation
Cofala et al. (2007)-maximum feasible reduction
Cofala et al. (2012)-current policy
Cofala et al. (2012)-new policy
Cofala et al. (2012)-high energy efficiency
Cofala et al. (2012)-450 ppm
Zhao et al. (2013d)
Kurokawa et al. (2013)
Lu et al. (2011)
Klimont et al. (2013)
(c)
PM_{10} emissions (Mt)
0
5
10
15
20
2000
2005
2010
2015
2020
2025
2030
This study-BAU[0]
This study-BAU[1]
This study-BAU[2]
This study-PC[0]
This study-PC[1]
This study-PC[2]
Xing et al. (2011)-current legislation and implementation
Xing et al. (2011)-improved energy efficiency and current environmental legislation
Xing et al. (2011)-improved energy efficiency and better implementation of environmental policy
Xing et al. (2011)-improved energy efficiency and strict environmental legislation
Zhao et al. (2013d)
Kurokawa et al. (2013)
(d)
$PM_{2.5}$ emissions (Mt)
0
4
8
12
16
2000
2005
2010
2015
2020
2025
2030
This study-BAU[0]
This study-BAU[1]
This study-BAU[2]
This study-PC[0]
This study-PC[1]
This study-PC[2]
Amann et al. (2008)-current legislation
Amann et al. (2008)-advanced control technology
Amann et al. (2008)-optimized
Cofala et al. (2012)-current policy
Cofala et al. (2012)-new policy
Cofala et al. (2012)-high energy efficiency
Cofala et al. (2012)-450 ppm
Zhao et al. (2013d)
Kurokawa et al. (2013)

(e)

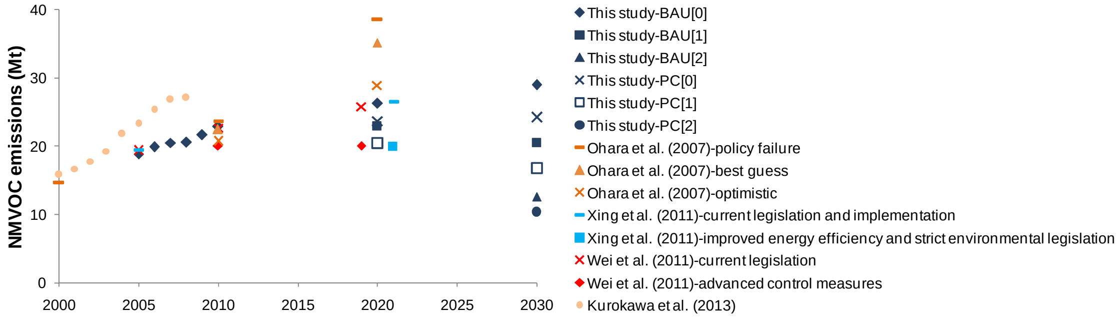


Figure 4. Comparison of emission estimation in this study with other studies: (a) NO_X; (b) SO_2; (c) PM_{10}; (d) $PM_{2.5}$; (e) NMVOC. The scenarios from the same study are shown with symbols of the same colour, and only the historical emissions for the first scenario are shown. Some points for the years 2020 and 2030 are shifted a little left or right, in order to avoid overlapping. Note that the current legislation scenario in Amann et al. (2008) is consistent with the baseline scenario in Klimont et al. (2009), and the historical emission trends of Zhao et al. (2013a) is consistent with this study. Therefore, Klimont et al. (2009) and Zhao et al. (2013a) are not shown in the figures.