

## **Author' Response to Referees' Comments**

### **Anonymous Referee #2**

Household air pollution from burning biomass and coal for cooking foods and heating rooms has long been a major environmental problem. Previous studies suggested that the uncontrolled and inefficient combustion of solid fuels for heating in winter also contributed substantially to outdoor PM<sub>2.5</sub>, BC, OC, SO<sub>2</sub> and NO<sub>x</sub> in many regions, such as in the North China Plain (Liu et al., 2016, PNAS). The field observations at the rural site of Beijing in this study further demonstrated that the combustion of solid fuels for heating in winter made remarkable contribution to ambient volatile organic compounds (VOCs). The authors also took advantage of the temporary intervention measures for emission control during the APEC to evaluate the actual effect of the control measures on the ambient VOCs levels through reduction of the source contributions. The comparison between the heating and non-heating periods offered robust results indicating the influential emission from winter heating. Overall, the data quality of this manuscript is quite good, and the interpretation of the results is appropriate and convincing. Therefore, I strongly recommend publication of this manuscript.

**Reply:** Thanks for the comments. We have revised our manuscript with your constructive comments and suggestions as below.

Majors:

[1] As stated above, an important finding of this study is that residential coal burning, especially during winter heating period, could be a major contributor to the ambient VOCs. Apart from the emission factors available for residential coal burning, is it possible for the authors to have the amounts of coals consumed in the residential sector especially during winter and give an in-depth explanation why this source could contribute substantially?

**Reply:** Thanks for the suggestions. The information about coal consumptions and an in-depth explanation to the substantial contribution from residential coal burning have been added into the revised manuscript (section 3.3.2, line 443-459):

“Coal is consumed in residential, industrial and power sectors in Beijing. As showed in Fig. S5a, while annual total coal consumptions dropped rapidly during 2006-2015, the annual residential coal

consumptions remained almost unchanged with their percentages in total coal consumptions rising from 8.7% in 2006 to 23.4% in 2015 (Beijing Municipal Bureau of Statistics, 2016; Yu et al., 2018). As a matter of fact, over 60% of the residential coal consumption occurred in rural areas of Beijing (Fig. S5b), and residential coal is mainly burned in the cool winter season for house heating (Xue et al., 2016). While emission factors of VOCs from residential coal burning have been found to be a factor of 20 greater than those from coal-fired power plants (Liu et al., 2017), the differences in coal quality between the urban and rural areas augment emissions in rural areas: coal used in urban area was entirely anthracite with comparatively much lower emissions of volatiles than other types of coal (Xu et al., 2017); instead only 5-15% of coal used in rural area was anthracite (Xue et al., 2016). Consequently, residential coal combustion could have been a major contributor to the ambient VOCs in rural areas of Beijing during winter.”

The coal consumptions in Beijing from 2006 to 2015 were also added to the supplement information as shown below (Fig. S5).

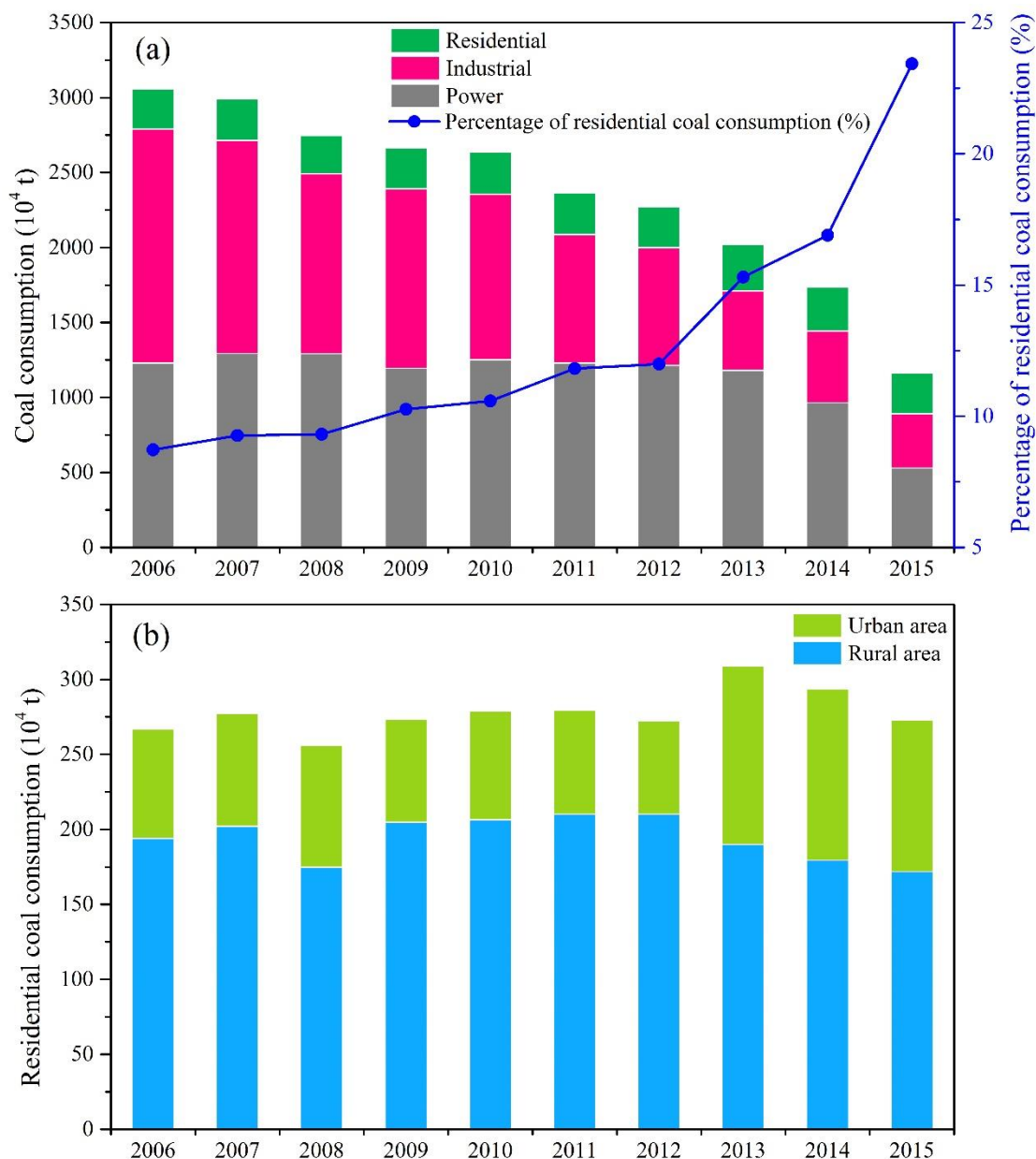


Figure S5. (a) The total coal consumption in residential, industrial and power generation sectors and the percentage of residential coal consumption in total coal consumption in Beijing during 2006-2015; (b) Residential coal consumption in urban and rural areas of Beijing during 2006-2015.

[2] The study suggests clean energy use in residential sector is vital for reducing VOCs in the heavily polluted winter. This aspect should be incorporated into the discussion or the conclusion part of the manuscript.

**Reply:** Thanks. In the revised manuscript we have re-write the introduction part to stress that residential burning of solid fuels for cooking and heating is not only a problem of indoor air

pollution, but also an important source of outdoor air pollutants. In the conclusion part, based on the results that residential burning of solid fuels contributed nearly halves of VOCs in ambient air during wintertime heating, we added:

“However, as observed in this study, even in megacities like Beijing, burning raw coal or biomass for household heating in winter could contribute near half of VOCs in ambient air. If the emission control over residential burning of solid fuels is underappreciated, the intervention measures targeted on traffic and industry sectors would be not so effective in the wintertime heating period as did in non-heating periods either to lower PM<sub>2.5</sub> as indicated by Liu et al. (2016) or to lower VOCs in ambient air as indicted by this study. If fact, a study by Yu et al. (2018) during the same field campaign of this study demonstrated that, without emission control over residential burning of solid fuels, ambient PM<sub>2.5</sub>-bound toxic polycyclic aromatic hydrocarbons in rural Beijing during the 2014 APEC summit remained unchanged despite of the temporary intervention control measures, and they were largely aggravated after the start of wintertime heating. Therefore, cleaner energy use instead of poor-technology burning of solid fuels household heating would have tremendous health benefits in lowering both indoor and outdoor air pollution particularly in heavily polluted winter. It worth noting that this study was conducted in a rural area of the megacity Beijing. Emission from residential burning of solid fuels would be a source of greater importance and thus deserves more concern in less developed regions.”

Minors:

Although I am not a native English speaker, I would say that there is still room for improving English writing of the manuscript. The authors better find a native English speaker to check the English.

**Reply:** Thanks for your careful check and your great patience in listing the errors/mistakes. For the revised manuscript, we have also asked a native English speaker to re-check the English writing.

Line 33-34: Change “during wintertime severe haze events” to “during severe wintertime haze events”;

**Reply:** Revised as suggested.

Line 35: Change “comparatively much less” to “not well”;

**Reply:** Revised as suggested.

Line 37: Change “inside” to “on”;

**Reply:** Revised as suggested.

Line 37: add “the” before “University”;

**Reply:** Revised as suggested.

Line 38: Change “northeast” to “northeastern”;

**Reply:** Revised as suggested.

Line 39: Remove “that”;

**Reply:** Revised as suggested.

Line 39: Change “during” to “on”;

**Reply:** Revised as suggested.

Line 40: Add “the” before “air quality”;

**Reply:** Revised as suggested.

Line 41: Change “in” to “on”;

**Reply:** Revised as suggested.

Line 41: Remove “that”;

**Reply:** Revised as suggested.

Line 41: Change “since” to “on”;

**Reply:** Revised as suggested.

Line 42: Change “it is” to “this sample collection period provided”;

**Reply:** Revised as suggested.

Line 43: Remove “the” before “temporary” and before “wintertime”;

**Reply:** Revised as suggested.

Line 44, 45: Add “the” before “temporary”;

**Reply:** Revised as suggested.

Line 46: Change “about” to “approximately”;

**Reply:** Revised as suggested.

Line 47: Change “that” to “the values”;

**Reply:** Revised as suggested.

Line 46-48: Change “that of 23.41 ppb before the APEC (25 October-2 November; Period I) or

21.71 ppb after the APEC (13 November-31 December; Period III)” to “the values of 23.41 ppb in Period I (25 October-2 November) before the APEC and 21.71 ppb in period III (13 November-31 December) after the APEC”;

**Reply:** Revised as suggested.

Line 48: Change “Their” to “The”;

**Reply:** Revised as suggested.

Line 49: Change “drop” to “decrease”;

**Reply:** Revised as suggested.

Line 50: Change “of” to “over”;

**Reply:** Revised as suggested.

Line 51: Remove “the” before “southerly”;

**Reply:** Revised as suggested.

Line 52: Change “that in the northerly ones during period I, II and III” to “those in northerly air masses during periods I, II and III”;

**Reply:** Revised as suggested.

Line 53: Remove “and”;

**Reply:** Revised as suggested.

Line 54: Change “south” to “southern”;

**Reply:** Revised as suggested.

Line 56: Change “changed” to “the altered”;

**Reply:** Revised as suggested.

Line 57, 58: Remove “the” before “Period”;

**Reply:** Revised as suggested.

Line 58: Change “emission” to “emissions”;

**Reply:** Revised as suggested.

Line 59: Add “the” before “ambient”;

**Reply:** Revised as suggested.

Line 60: Change “emission” to “emissions”;

**Reply:** Revised as suggested.

Line 60: Remove “they”;

**Reply:** Revised as suggested.

Line 61-62: Change “VOCs during the period I, II and III” to “the VOCs during periods I, II and III”;

**Reply:** Revised as suggested.

Line 62-63: Change “became the dominant source which accounted for 45.1% of the VOCs” to “became the largest source, accounting for 45.1% of the VOCs”;

**Reply:** Revised as suggested.

Line 64-65: Change “with a remarkably lower average contribution percentage (38.2%) in the southerly air masses than that of 48.8% in the northerly air masses” to “with a specifically lower average contribution percentage in southerly air masses (38.2%) than in northerly air masses (48.8%)”;

**Reply:** Revised as suggested.

Line 72: Change “emission” to “emissions”;

**Reply:** Revised as suggested.

Line 73: Change “benefit improving” to “improve the”;

**Reply:** Revised as suggested.

Line 74: Change “an extensive concern” to “a widespread concern”;

**Reply:** Revised as suggested.

Line 75, 79: Change “summertime” to “summer”;

**Reply:** Revised as suggested.

Line 75: Change “wintertime” to “winter”;

**Reply:** Revised as suggested.

Line 80: Remove “as well”;

**Reply:** Revised as suggested.

Line 82: Change “comparatively the role of VOCs in the wintertime with PM<sub>2.5</sub>” to “comparatively, the effect of VOCs on wintertime PM<sub>2.5</sub>”;

**Reply:** Revised as suggested.

Line 88: Change “in the control of air pollution by PM<sub>2.5</sub> in wintertime” to “in the control of PM<sub>2.5</sub> air pollution in winter”;

**Reply:** Revised as suggested.

Line 90: Change “under” to “on”;

**Reply:** Revised as suggested.

Line 92: Change “vehicle exhausts are” to “vehicle exhaust is an”;

**Reply:** Revised as suggested.

Line 96: Change “particularly in north China in wintertime” to “particularly in northern China in winter”;

**Reply:** Revised as suggested.

Line 99: Add “the” before “VOCs”;

**Reply:** Revised as suggested.

Line 100: Change “is widely occurring in the rural areas” to “widely occur in rural areas”;

**Reply:** Revised as suggested.

Line 101-102: Change “how the enhanced emission” to “how enhanced emissions”;

**Reply:** Revised as suggested.

Line 109: Change “north” to “northern”;

**Reply:** Revised as suggested.

Line 110: Add “the” before “air quality”;

**Reply:** Revised as suggested.

Line 111: Remove “so”;

**Reply:** Revised as suggested.

Line 111: Remove “when”;

**Reply:** Revised as suggested.

Line 112: Change “especially in wintertime with” to “especially in winter, with”;

**Reply:** Revised as suggested.

Line 116: Change “kind” to “type”;

**Reply:** Revised as suggested.

Line 118: Change “As for” to “For”;

**Reply:** Revised as suggested.

Line 121: Change “drops of” to “decreases in”;

**Reply:** Revised as suggested.

Line 123: Change “inside” to “on”;



**Reply:** Revised as suggested.

Line 124: Add “the” before “total”;

**Reply:** Revised as suggested.

Line 124: Add “were” before “reduced”;

**Reply:** Revised as suggested.

Line 125: Add “those in” before “the period”;

**Reply:** Revised as suggested.

Line 126: Change “about” to “of”;

**Reply:** Revised as suggested.

Line 127, 134: Remove “the” before “urban”;

**Reply:** Revised as suggested.

Line 127: Remove “entirely”;

**Reply:** Revised as suggested.

Line 128: Add “on” before “a regional scale”;

**Reply:** Revised as suggested.

Line 132-133: Change “The objectives of present study are” to “The objectives of the present study are as follows”;

**Reply:** Revised as suggested.

Line 135, 136: change “crucial” to “the major”;

**Reply:** Revised as suggested.

Line 136: Change “wintertime” to “winter”;

**Reply:** Revised as suggested.

Line 137: Add “the” before “APEC”;

**Reply:** Revised as suggested.

Line 141: Change “\_” to “\_”;

**Reply:** Revised as suggested.

Line 142: Change “inside the campus of” to “on the campus of the”;

**Reply:** Revised as suggested.

Line 142: Add “the” before “Huairou”;

**Reply:** Revised as suggested.

Line 143-144: Change “The UCAS is located about 60 km northeast of central Beijing and about 150 km northwest of the Tianjin city” to “UCAS is located approximately 60 km northeast of the center of Beijing and approximately 150 km northwest of the city of Tianjin”;

**Reply:** Revised as suggested.

Line 145-147: Change “16 meters above ground on the top of a four-story building, about 100 m west of a national road and only 1.5 km far away from the APEC main conference hall” to “16 meters above the ground on the top of a four-story building, approximately 100 m west of a national road and only 1.5 km away from the main APEC conference hall”;

**Reply:** Revised as suggested.

Line 152: Remove “of”;

**Reply:** Revised as suggested.

Line 153: Add “and” before “one”;

**Reply:** Revised as suggested.

Line 154: Add “was” before “less than”;

**Reply:** Revised as suggested.

Line 154: Add “a” before “relative”;

**Reply:** Revised as suggested.

Line 154: Add “of” before “less”;

**Reply:** Revised as suggested.

Line 158: Remove “the time span”;

**Reply:** Revised as suggested.

Line 163-164: Change “and average temperature was 11.4, 7.0, and 0.6°C during periods I, II and III” to “and the average temperature was 11.4, 7.0 and 0.6°C during periods I, II and III”;

**Reply:** Revised as suggested.

Line 224: Remove “the” before “period”;

**Reply:** Revised as suggested.

Line 226: Change “Total” to “The total”;

**Reply:** Revised as suggested.

Line 226: Change “inside” to “at”;

**Reply:** Revised as suggested.

Line 227: Change “in” to “on”;

**Reply:** Revised as suggested.

Line 229: Change “halves of 57.45, 36.17, and 56.56 ppb” to “half the values (57.45, 36.17, and 56.56 ppb)”;

**Reply:** Revised as suggested.

Line 231: Remove “both”;

**Reply:** Revised as suggested.

Line 234: Add “a” before “more than”;

**Reply:** Revised as suggested.

Line 234: Remove “the”;

**Reply:** Revised as suggested.

Line 234: Change “about” to “an approximately”;

**Reply:** Revised as suggested.

Line 237: Change “or” to “and the”;

**Reply:** Revised as suggested.

Line 238: Change “densities” to “density”;

**Reply:** Revised as suggested.

Line 240: Change “shared by” to “of”;

**Reply:** Revised as suggested.

Line 240: Remove “quite”;

**Reply:** Revised as suggested.

Line 243-244: Change “percentages shared by aromatics became lower during period II (12%) when compared to that in period I (21%) or period III (15%)” to “the percentage of aromatics was lower during period II (12%) than during period I (21%) and period III (15%)”;

**Reply:** Revised as suggested.

Line 246-247: Change “decreased by 49.0, 32.5, 72.8, and 48.1%, respectively, when compared to those during period I” to “were 49.0, 32.5, 72.8 and 48.1% lower than those during period I, respectively”;

**Reply:** Revised as suggested.

Line 247-248: Change “Aromatics evidently had a more substantial drop” to “Aromatics evidently

underwent a larger decrease”;

**Reply:** Revised as suggested.

Line 249: Remove “as”;

**Reply:** Revised as suggested.

Line 252: Change “ozone formation potentials (OFPs)” to “ozone formation potential (OFP)”;

**Reply:** Revised as suggested.

Line 253: Change “in average during periods I, II and III were” to “on average during periods I, II and III was”;

**Reply:** Revised as suggested.

Line 255: Change “Their” to “The”;

**Reply:** Revised as suggested.

Line 255: Change “potentials (SOAFPs)” to “potential (SOAFP)”;

**Reply:** Revised as suggested.

Line 257, 259: Add “the” to “total”;

**Reply:** Revised as suggested.

Line 261: Change “VOCs” to “VOC”;

**Reply:** Revised as suggested.

Line 262: Change “drop” to “decreases”;

**Reply:** Revised as suggested.

Line 264: Change “changed contribution by aromatic” to “the altered contribution of aromatics”;

**Reply:** Revised as suggested.

Line 266: Change “condition” to “conditions and from”;

**Reply:** Revised as suggested.

Line 267: Change “condition” to “conditions”;

**Reply:** Revised as suggested.

Line 270: Change “showed” to “shown”;

**Reply:** Revised as suggested.

Line 271: Change “with the increase in” to “with an increase in the”;

**Reply:** Revised as suggested.

Line 272: Change “like that” to “as those”;

**Reply:** Revised as suggested.

Line 276: Add “the” before “wind”;

**Reply:** Revised as suggested.

Line 280: Change “showed” to “shows”;

**Reply:** Revised as suggested.

Line 281: Change “the” to “a”;

**Reply:** Revised as suggested.

Lines 282-285: “It clearly demonstrated that the mixing ratios of VOCs increased rapidly, and the back trajectories indicated that air masses changed from northerly to southerly and then declined sharply while the air masses changed back from southerly to northerly”, rewrite the sentences.

**Reply:** Revised as suggested.

Lines 285-286: Change “The southern areas of UCAS are the central Beijing with stronger emissions” to “The southern areas of UCAS are in central Beijing where emissions are stronger”;

Line 286: Add “that”;

**Reply:** Revised as suggested.

Line 287: Change “increase of” to “increase in the”;

**Reply:** Revised as suggested.

Line 288: Change “of source regions” to “in the source region”;

**Reply:** Revised as suggested.

Line 289: Change “showed” to “shown”;

**Reply:** Revised as suggested.

Line 291: Change “changed” to “altered”;

**Reply:** Revised as suggested.

Line 295: Add “and” before “2)”;

**Reply:** Revised as suggested.

Line 296: should be “: : Mongolia and quickly: : .”;

**Reply:** Revised as suggested.

Line 297: Change “emission” to “emissions”;

**Reply:** Revised as suggested.

Line 302: Change “period” to “periods”;

**Reply:** Revised as suggested.

Line 303: Change “that” to “those”;

**Reply:** Revised as suggested.

Line 304: Change “OFPs in the southerly air masses were” to “the OFP in southerly air masses was”;

**Reply:** Revised as suggested.

Line 305: Change “and SOAFPs in the” to “and the SOAFP in”;

**Reply:** Revised as suggested.

Line 305: Change “were” to “was”;

**Reply:** Revised as suggested.

Line 308: Change “This indicates that the north and south” to “These results indicate that the northern and southern”;

**Reply:** Revised as suggested.

Line 313-314: Change “OFPs and SOAFPs” to “OFP and SOAFP”;

**Reply:** Revised as suggested.

Line 314: Add “that” before “the changes”;

**Reply:** Revised as suggested.

Line 315: Remove “to”;

**Reply:** Revised as suggested.

Line 316: Change “when compared to that during period I average” to “compared to that during period I, the average”;

**Reply:** Revised as suggested.

Line 319: Change “OFPs decreased by 48.1% and SOAFPs” to “the OFP decreased by 48.1% and the SOAFP”;

**Reply:** Revised as suggested.

Line 320: Change “when compared to that” to “compared to those”;

**Reply:** Revised as suggested.

Line 321: Add “the” before “average”;

**Reply:** Revised as suggested.

Line 323: Remove “when”;

**Reply:** Revised as suggested.

Line 323-324: Change “OFPs decreased by 48.9% and SOAFPs decreased by over 70% during period II relative to period I” to “the OFP decreased by 48.9%, and the SOAFP decreased by over 70% during period II relative to those in period I”;

**Reply:** Revised as suggested.

Line 325: Add “a” before “more”;

**Reply:** Revised as suggested.

Line 326: Change “emission control in” to “control over emissions from”;

**Reply:** Revised as suggested.

Line 327: Change “less changes in mixing ratios” to “decreased changes in the mixing ratios”;

**Reply:** Revised as suggested.

Line 328: Change “of” to “over”;

**Reply:** Revised as suggested.

Line 331: Change “that” to “those”;

**Reply:** Revised as suggested.

Line 331: Change “This difference in the increase rates” to “These different increases”;

**Reply:** Revised as suggested.

Line 332: Change “are” to “were”;

**Reply:** Revised as suggested.

Line 333: Change “heating supply was only available since” to “heat sources were only available after”;

**Reply:** Revised as suggested.

Line 334: Change “already” to “have”;

**Reply:** Revised as suggested.

Line 336: Change “apportioning” to “apportionment”;

**Reply:** Revised as suggested.

Line 338: Add “the” before “campaign”;

**Reply:** Revised as suggested.

Lines 338-339: Change “might be resulted from changed contribution by emission sources, such like” to “might have resulted from the altered contributions from emission sources, such as”;

**Reply:** Revised as suggested.

Line 341: add “the” before “characteristic”;

**Reply:** Revised as suggested.

Line 344: Change “in average during period” to “on average during periods”;

**Reply:** Revised as suggested.

Line 345: Change “were approaching” to “approached”;

**Reply:** Revised as suggested.

Line 347, 351: Remove “the” before “period”;

**Reply:** Revised as suggested.

Line 348: Remove “, which is characteristic of vehicular exhaust”;

**Reply:** Revised as suggested.

Line 349: Add “the” before “incomplete”;

**Reply:** Revised as suggested.

Line 354: Change “in” to “on”;

**Reply:** Revised as suggested.

Line 355: Change “that coal burning contributed more” to “an increased contribution of coal burning”;

**Reply:** Revised as suggested.

Line 357: Change “emission” to “emissions”;

**Reply:** Revised as suggested.

Line 359: Change “are mainly from” to “mainly originate from”;

**Reply:** Revised as suggested.

Line 361: Change “were” to “are”;

**Reply:** Revised as suggested.

Line 364: Change “when compared to that of” to “than the values of”;

**Reply:** Revised as suggested.

Line 365: Change “or” to “and of”;

**Reply:** Revised as suggested.

Line 366: Change “This drop in aromatics/CO ratios” to “This decrease in the ratios of aromatics to CO”;

**Reply:** Revised as suggested.



Line 367: Change “of” to “over”;

**Reply:** Revised as suggested.

Line 370, 371: Add “those in” before “period I”;

**Reply:** Revised as suggested.

Line 371-372: Change “Apparently larger decrease in TEX/CO ratios in the northerly air masses reflected” to “A larger decrease in the TEX/CO ratios in northerly air masses reflects the fact that”;

**Reply:** Revised as suggested.

Line 374: Change “3.3.2 Source Apportioning by PMF” to “3.3.2 Source Apportionment by PMF”;

**Reply:** Revised as suggested.

Line 375: Change “Thirty-five” to “The 35”;

**Reply:** Revised as suggested.

Line 375: Add “and” before “ethyne”;

**Reply:** Revised as suggested.

Line 376: Change “sources” to “source”;

**Reply:** Revised as suggested.

Line 377: Add “use with” before “the PMF”;

**Reply:** Revised as suggested.

Line 385: Change “the gasoline vehicle emission” to “gasoline vehicle emissions”;

**Reply:** Revised as suggested.

Line 386: should be “trichloroethylene and tetrachloroethylene”;

**Reply:** Revised as suggested.

Line 387: Change “of” to “by”;

**Reply:** Revised as suggested.

Line 388: Change “manufacturing industrials” to “industrial manufacturing”;

**Reply:** Revised as suggested.

Line 389-390: Change “by industries for make” to “in industry to prepare”;

**Reply:** Revised as suggested.

Line 390: Add “during the” before “production”;

**Reply:** Revised as suggested.

Line 392: Change “emission” to “emissions”;

**Reply:** Revised as suggested.

Line 393: Change “a larger percentage of the” to “larger percentages of”;

**Reply:** Revised as suggested.

Line 394: Change “It is known that TEX are” to “TEX is known to be”;

**Reply:** Revised as suggested.

Line 396: Change “They are also” to “These compounds are also the”;

**Reply:** Revised as suggested.

Line 396-397: Change “auto factory painting and building coating” to “automobile factories, paint and building coatings”;

**Reply:** Revised as suggested.

Line 398: Change “as” to “to be”;

**Reply:** Revised as suggested.

Line 403-404: Change “top 3 species of” to “the top 3 species emitted during”;

**Reply:** Revised as suggested.

Line 405: Change “were” to “are”;

**Reply:** Revised as suggested.

Line 405-406: Change “and aromatics like benzene” to “as well as aromatics such as benzene”;

**Reply:** Revised as suggested.

Line 406-407: Change “So factor 5 is related to the coal/biomass burning” to “Thus, factor 5 is related to coal/biomass burning”;

**Reply:** Revised as suggested.

Line 408: Change “period” to “periods”;

**Reply:** Revised as suggested.

Line 409: Add “the” before “VOCs”;

**Reply:** Revised as suggested.

Line 411: Add the “the” before “temporary” and remove “the” before “period”;

**Reply:** Revised as suggested.

Line 412: Change “by” to “of”;

**Reply:** Revised as suggested.

Line 413: Change “drop” to “decrease”;

**Reply:** Revised as suggested.

Line 414: Change “by” to “from”;

**Reply:** Revised as suggested.

Line 415: Change “Quite similar” to “Similar”;

**Reply:** Revised as suggested.

Line 417: Remove “the”;

**Reply:** Revised as suggested.

Line 418: Change “from” to “on”;

**Reply:** Revised as suggested.

Line 419: Change “emission” to “emissions”;

**Reply:** Revised as suggested.

Line 420: Add “the” before “VOCs”;

**Reply:** Revised as suggested.

Line 421: Change “were showed” to “are shown”;

**Reply:** Revised as suggested.

Line 422: Change “by” to “of”;

**Reply:** Revised as suggested.

Line 422: Change “with the” to “with the increase in”;

**Reply:** Revised as suggested.

Line 423: Remove “instead”;

**Reply:** Revised as suggested.

Line 427: Change “consumptions” to “consumption”;

**Reply:** Revised as suggested.

Line 429: Change “The residential coal combustion is prevailing” to “Residential coal combustion is primarily carried out”;

**Reply:** Revised as suggested.

Line 429: Change “by using” to “with”;

**Reply:** Revised as suggested.

Line 430: Add “the” before “rural”;

**Reply:** Revised as suggested.

Line 431: Change “wintertime” to “winter”;

**Reply:** Revised as suggested.

Line 431: Remove “the”;

**Reply:** Revised as suggested.

Line 431: Change “accounts” to “accounted”;

**Reply:** Revised as suggested.

Line 433: Change “contribute predominately to” to “have been the predominant contributor to the”;

**Reply:** Revised as suggested.

Line 437, 438, 444, 446, 449: Remove “the” before “period”;

**Reply:** Revised as suggested.

Line 437, 440, 441: Change “by” to “from”;

**Reply:** Revised as suggested.

Line 441: Change “reduced” to “decreased”;

**Reply:** Revised as suggested.

Line 443: Change “showed” to “made”;

**Reply:** Revised as suggested.

Line 443: Change “period” to “periods”;

Line 447: Change “account” to “accounted”;

**Reply:** Revised as suggested.

Line 451: Change “period” to “periods”;

**Reply:** Revised as suggested.

Line 451: Remove “respectively”;

**Reply:** Revised as suggested.

Line 452: Change “emission (gasoline and diesel vehicles) was” to “emissions (gasoline + diesel) were”;

**Reply:** Revised as suggested.

Line 453: Change “VOCs during the period” to “the VOCs during periods”;

**Reply:** Revised as suggested.

Line 454: Remove “instead”;

**Reply:** Revised as suggested.

Line 456: Change “period” to “periods”;

**Reply:** Revised as suggested.

Line 459: Change “Contributions” to “The contributions”;

**Reply:** Revised as suggested.

Line 460: Change “were” to “are”;

**Reply:** Revised as suggested.

Line 460-461: Change “was mainly coming” to “mainly originated”;

**Reply:** Revised as suggested.

Line 467, 468, 470: Change “of” to “in”;

**Reply:** Revised as suggested.

Line 472: Change “emission” to “emissions”;

**Reply:** Revised as suggested.

Line 474: Change “3.3.3 Source contributions to SOAFPs” to “3.3.3 Source contributions to the SOAFP”;

**Reply:** Revised as suggested.

Line 475: Change “apportioning” to “apportionment”;

**Reply:** Revised as suggested.

Line 475: Change “SOAFPs by” to “the SOAFP of”;

**Reply:** Revised as suggested.

Line 476: Change “showed” to “shown”;

**Reply:** Revised as suggested.

Line 477: Change “condition” to “conditions”;

**Reply:** Revised as suggested.

Line 477: Change “SOAFPs by solvent use were much higher than that by” to “SOAFP of solvent use was much higher than that of”;

**Reply:** Revised as suggested.

Line 478: Change “were” to “was”;

**Reply:** Revised as suggested.

Line 479, 481: Change “period” to “periods”;

**Reply:** Revised as suggested.

Line 482: Change “of SOAFPs” to “in SOAFP”;

**Reply:** Revised as suggested.

Line 483: Change “by” to “from”;

**Reply:** Revised as suggested.

Line 485: Change “condition,” to “conditions, the”;

**Reply:** Revised as suggested.

Line 485: Change “of” to “in”;

**Reply:** Revised as suggested.

Line 486: Change “by” to “from”;

**Reply:** Revised as suggested.

Line 490: Change “or” to “and”;

**Reply:** Revised as suggested.

Line 490: Change “from” to “during”;

**Reply:** Revised as suggested.

Line 494: Change “SOAFPs” to “the SOAFP”;

**Reply:** Revised as suggested.

Line 494: Remove “only”;

**Reply:** Revised as suggested.

Line 496: Change “is a large of” to “are large”;

**Reply:** Revised as suggested.

Line 500-501: Change “SOA often shared higher factions in” to “SOAs often composed higher fractions of”;

**Reply:** Revised as suggested.

Line 502: Change “are much less” to “not well”;

**Reply:** Revised as suggested.

Line 504: Change “inside” to “on”;

**Reply:** Revised as suggested.

Line 505: Change “during” to “on”;

**Reply:** Revised as suggested.

Line 505, 506: Remove “and, in fact”;

**Reply:** Revised as suggested.

Line 507: Change “could take” to “took”;

**Reply:** Revised as suggested.

Line 509: Change “with” to “from”;

**Reply:** Revised as suggested.

Line 510: Change “could also compare” to “also compared”;

**Reply:** Revised as suggested.

Line 511: Add “use”;

**Reply:** Revised as suggested.

Line 512: Change “investigate” to “investigated”;

**Reply:** Revised as suggested.

Line 513: Change “the” to “a”;

**Reply:** Revised as suggested.

Line 514-515: Change “period II (3-12 November)” to “period (period II; 3-12 November), the”;

**Reply:** Revised as suggested.

Line 515: Change “when compared to that” to “compared to those”;

**Reply:** Revised as suggested.

Line 516: Change “And their” to “In addition, the”;

**Reply:** Revised as suggested.

Line 516: Change “potentials” to “potential”;

**Reply:** Revised as suggested.

Line 518: Change “drop” to “decrease”;

**Reply:** Revised as suggested.

Line 519: Change “of” to “over”;

**Reply:** Revised as suggested.

Line 520: Change “apportioning” to “apportionment”;

**Reply:** Revised as suggested.

Line 523: Change “about” to “of”;

**Reply:** Revised as suggested.

Line 524: Change “With” to “Through”;

**Reply:** Revised as suggested.

Line 525: Change “of wind directions” to “in wind direction”;

**Reply:** Revised as suggested.

Line 526: Change “Total” to “The total”;

**Reply:** Revised as suggested.

Line 527: Change “that” to “those”;

**Reply:** Revised as suggested.

Line 531: Change “were” to “was”;

**Reply:** Revised as suggested.

Line 533: Change “by” to “of”;

**Reply:** Revised as suggested.

Line 534: Change “in average due to drops in the percentages by” to “on average due to decreases in the percentages of”;

**Reply:** Revised as suggested.

Line 535-536: Change “that accounted” to “accounting”;

**Reply:** Revised as suggested.

Line 537: Change “south” to “southern”;

**Reply:** Revised as suggested.

Line 538: Change “north” to “northern”.

**Reply:** Revised as suggested.

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