

Interactive comment on “Study the impact of three Asian industrial regions on PM_{2.5} in Taiwan and the process analysis during transport” by Ming-Tung Chuang et al.

Anonymous Referee #1

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General Comment

The manuscript focuses on the impact of three industrial regions in China on the PM_{2.5} pollution in Taiwan for the winter and summer in 2017 by using the WRF/CMAQ modeling system. The authors demonstrated the net impact of each industrial region as well as the different roles of different physical and chemical processes in detail. Some evaluation of model output through comparison with observations were also provided. The topic of the manuscript is suitable for ACP, it presents original data, and might give a useful information for East Asian Haze studies in Taiwan. However, it requires some major revisions (see my major concerns below) to be accepted. The authors

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should also address some other specific remarks (listed below). Moreover, several grammatical issues can be found, so English proofreading is strongly recommended before revised submission.

Major Concerns:

1) The manuscript shows the analysis both for January and July. However, the impacts of three industrial regions on Taiwan in summer (July) is quite small, almost negligible even in the last few days when the impacts were relatively large. I don't think it is worthwhile spending much space for the July analysis, rather focusing on winter case would make the paper more concise and scientifically focused.

2) The results of process analysis was described and discussed in 3.2, 3.4, 3.5, and 3.6, which formed a main part of this paper. However, the descriptions in these sections were not firmly reasoned. In these sections, the author argued “dominant” contribution of three industrial regions at some locations. For example, in 3.2, the author pointed out that PM_{2.5} was influenced “mainly” by BRIR and YRDIR at the place #19. However, these arguments were not convincing. For the abovementioned example, Fig5 (c-2) and (c-3) which was regarded as representing the contributions by process of BRIR and PRDIR, respectively, showed similar variations to those of total contributions shown as Fig5 (c-1). However, the range of values largely differed each other, so I cannot understand why the author can conclude that the BRIR and YRDIR were “main” contributors to the variation of PM_{2.5} at #19. Similar arguments to this case can be found in these sections, and they considerably deteriorate the persuasiveness of the manuscript. I strongly recommend the author to revise such arguments in these sections and provide how to read and understand the main figures (Fig 5, 8, 11, and 14).

Specific Comments:

- L37: Seasonality of EAH is not “due to” rapid economic grows in Asian countries.

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- L43-45: Why did you specify these data and models for trajectory analysis?
- L50-51: Could you state more clearly why TS method would contain substantial uncertainty?
- L54: The difference between those two runs does not directly mean the contribution of specific source but impact of the reduction of that specific source. To distinguish these two concepts is quite important.
- L56-58: What do you mean "under-represented chemical reaction" here? Could you explain more specific?
- L67: CTM? This should be AM method?
- L87: These abbreviations (LRT, LP) have already been defined.
- L90: Meaning of these terms (LRT-Event and so on) should be explained.
- L98-99: Are power and industrial sectors the largest for entire Asia or any specific region in Asia?
- L103-104: This should be "the impact of reduction in source emission in each industrial region", because BFM can estimate "impact" not "contribution". Or you can define the wording that you will use the word "contribution" for the difference between control runs and sensitivity run.
- L123-127: For Figure1, the formal, not abbreviated, names for each monitoring station should be appeared here.
- L130-131: Why you don't show the model domains in Figure 1 but just describe horizontal resolution?
- L146: "MB" has already been defined in the previous sentences.
- For the evaluation of WRF and CMAQ shown in Table 1 and 2, the results from which domain were used? And in addition to the summary of statistical indices in Table 1,

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figures of comparisons of temperature and wind between observation and simulation are quite informative. Could you put them together at least as supplement?

- You should explain how you draw Fig3. Are the values in Fig3 difference between Base case and sensibility case? If so, it's better to note it in the manuscript or in figure caption. Fig3 is a bit busy, so it seems better to select fewer locations out of seven to avoid redundancy.
- L176: Remove unnecessary "the".
- Could you check the wording "China East Sea"? "East China Sea" has been also used for the same area in many literatures.
- For Figure5, you should explain how to deduce the values shown in the figure, in particular the values in Fig5(*-2,3,4). Are they the difference between Base case and sensitivity case? If so, you should instruct briefly how to interpret these Figures. Is the title of y-axis correct? This should be " Δ concentration" or "daily concentration change"?
- L204: Fig5(a-1) and (a-2) do not seem quite similar to each other. Could you specify more about which features of both figures look similar?
- L204: You concluded that main contributor to #17 PM2.5 is BRIR, but I cannot understand why you can conclude like this. The values in Fig5(a-1) and (a-2) are quite different. You should give an instruction how to read and understand the Fig5.
- L205: Can HADV process "produce" PM2.5? The term "production" here is not appropriate.
- L211: What process considered in AERO can reduce PM2.5?
- L213: If the intrusion of PM2.5 from PRDIR is like that depicted in Fig4, why the contribution of ZADV is not so large in Fig5(c-4)? Since #19 is located between PRDIR and Taiwan island and the transport of PM2.5 between them occurs about 1-2 km high

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above the surface as in Fig4, any kind of vertical (downward) motion should transport PM2.5 from that layer to the location of #19 which must be at the surface.

- L227: What does "minor PM2.5" means here?
- L228: Why can you describe "The PM2.5 at BQ then transport up- and then southwards"? Which figure show this transport of PM2.5?
- L228-229: Fig.(f-1) -> Fig5 (f-1)
- L234-235: If this is true, why ZADV in Fig5 (f-4) is largely negative from Jan 8 to 10?
- L256: Why did you exclude Fig.8(a)?
- L267: Could you put the prevailing wind vector in Figures 2 and 6, otherwise I can not verify what you described here and similar descriptions in the manuscript explaining the impact of wind patterns.
- L280: Layer4? Is this Layer14?
- L281: It is apparent that only vertical motion can not transport PM2.5 from BRIR to #17. What do you mean here?
- L282-283: Why does ascent (descent) motion enhance (decrease) aerosol formation? What processes are involved ?
- L291: Fig. (e-2)-(e-4) -> Fig11. (e-2)-(e-4).
- L293: mixed -> mixture
- L340: higher -> lower?
- L341: underestimated -> overestimated?
- L353: There is not Fig.S2.6 in the supplement.
- L380: There is no comparison for July 30th (no Fig. S2.6).

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