Interactive comment on "The new implementation of a computationally efficient modeling tool (STOPS v1.5) into CMAQ v5.0.2 and its application for a more accurate prediction of Asian dust" *by* Wonbae Jeon et al.

Anonymous Referee #2

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P3, line 24-35, grammatical errors. For describing what was done in this paper, the past tense would be used. Not just in this paragraph, many grammatical errors are in the text. Sentences are not conveying arguments smoothly that I need to read them a few times to understand authors' intention (such as P3, line 30-33). Sometimes, the wordings are redundant in carrying out the arguments (like p7, p9 line 5-10, p9, line 13-24). With the help of professional English editing and proof reading, the manuscript will be more concise and readable. P3, line 11, give citation (Byun and Schere, 2006) when the model is 1st mentioned in the paper. P3, line 27, "We utilized STOPS..." P3, line 29, "input data inside the modeling domain." P4, line 5, re-phase the sentence to

"A small sub-domain of STOPS was configured inside the CMAQ domain and it moves along with the mean wind from CMAQ." P4, line 9, the sentence is confusing, please re-write it. P4, line 10-11, "...is determined by the layer-averaged wind from the 1st model up to the top of planetary boundary layer (PBL), weighted by the layer thickness." P4, line 27, "but in this study, STOPS has been updated to v1.5 and implemented in CMAQ v5.0.2." P4, line 31-33, No need to give citation again for the CMAQ. "In this study, we configured the CMAQ model with a domain in a grid resolution of 27 km covering the northeastern part of Asia..." P4, line 29, the list and description of all the simulations – standard CMAQ, CMAQ with windblow dust, CMAQ with adjusted emission and four STOPS with adjusted emission are expected in the section titled as experimental design. It can be in its own section if appropriate. P5, line 1-2, "Gobi Desert which is a major source of Asian dust." P5, line 2, spell out full name of "CB05" and "AERO6" and provide citations. P5, line 5-22, missing CMAQ and WRF's model configuration. Please list physics options used in WRF and the schemes (such as advection, deposition, etc...) used in CMAQ. Also, the model configuration for STOPS should be described in this section. P5, line 24, please provide overview of the synoptic weather pattern during the dust event that will help readers to interpret the model result. P5, line 23-25, the paragraph should be re-written to give clear information about the simulation period and when the dust event happened. "The WRF-CMAQ simulations were conducted for the period of January 21st – February 28th, 2015 which included the first ten days for spin-up. Evaluations applied to the month of February, 2015 and the three-day Asian dust event occurred during February 22nd – 24th. The PM surface observations measured at the surface stations in Korea are listed in Table 1. P5, line 29, "This study used surface observational data..." P6, line 3, what does it mean for constraining of PM concentration? Is it through data assimilation? If so, it should be described in methodology section like 2.2. P6, line 30-35, what does the windblown dust module do in CMAQ? Any references for other studies using it? Figure 2 comparison shows almost no difference in PM predictions from simulations of standard CMAQ and CMAQ with dust module, even during the period of the dust event. If you lower the

threshold in the dust module, will the CMAQ be able to simulate the dust event? P7, line 4-20, I think it will be more appropriate to have these paragraphs in section 2.3 to describe how the satellite AOD used for CMAQ evaluations. Then, section 3.2 can focus on presenting the comparison and discussing the underestimation during the dust period. P8, section 4.1, it is out of place but better to be moved to section 2.2. P8, line 32, why the STOPS domain does not cover the whole Korean Peninsula? In this case, is the AQMS station at the east coast not included in the domain? P9, section 4.2, I cannot get the point of the section. Using half of the page, it repeats findings (CMAQ failed to simulation the dust event and STOPS could produce CMAQ's result with mush less computational time) that have already shown in the previous sections. This section should be re-written to be more concise and informative. P9, line 34, I cannot understand how can you add extra amount of PM directly to CMAQ without some kind of data assimilation technique? P10, Rather than improving the dust module in CMAQ, using satellite AOD to take into account the extra emission due to the dust event is one reasonable way to improve PM10 prediction for this study. But why the STOPS model is a tool for "a more accurate prediction" (as highlighted in the title)? STOPS is more efficient computationally than running the full CMAQ model? The improvement shown in STOPS results is due to the use of adjusted emission estimated according to the satellite data. By using the same adjust emission, can the CMAQ also produce better PM10 prediction compared to the standard CMAQ? P10, line 32, what is PMT? P11, line 8-16, the text talks about the CMAQ .vs. STOPS simulations but the figure is in CMAQ domains. And the caption indicates both are CMAQ simulations. Please clarify and use consistent names. P11, line 8, re-phase it to "Figure 7 shows the comparison of the PM10 concentration from CMAQ simulations using standard and adjusted emission". P11, line 33-37, I do not know what the "updated" is referring to. Use just "STOPS simulation" instead of "updated STOPS simulation" P12, line 6-7, re-phase to "the impact of the alternative emissions on the PM10 prediction highly depends on the durations of emission release and the impact was gone after the release ended." P12, line 17, '. . .AOD data contained missing data due to the cloud cover over the

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study area . . ." P13, line 28-29, re-phase to "With reasonable meteorological input, the under-prediction of PM10 concentration was mainly due to the inaccurate estimation of dust emission during this period used in CMAQ." Figure 2, the CMAQ_dust simulation should be explained in the text and please briefly describe what is the dust module in CMAQ. Figure 7, caption: ". . .alternative emission estimated according to the GOCI-derived AOD."

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