

The line numbers below are based on the change-marked version of the revised manuscript.

L97: Please give the full name of PM.

L180-181: Please rewrite this sentence. It should be “transport of pollutants are driven....., and changes of .... provide feedback to ....”.

L183: “chemistry”.

L204-206: Is it aerosol liquid water content (ALWC)?

L225-228: Are these radius values for dry or wet aerosols?

L279: Remove the word “following” since land surface module and boundary layer module are not described in the following paragraph.

L280: change “account for” to “calculate”

L286-287: It is difficult to understand how the coupling works in the model from this sentence. What was the integration time step of the base model (RIEMS)? At every 2.5 minutes or 30 minutes were the physical variables, e.g., T and J-values, updated for chemical calculations? Was the feedback allowed to occur at every 30 minutes?

L292: “has” ?

L299: The species concentrations are affected by emissions, dynamic transport, and physical and chemical process.

L310: Cloud chemistry should be included in the chemical processes although it is generally taken into account in the cloud module.

What the physical and chemical processes refer to should be clearly clarified from the beginning and used correctly throughout the entire manuscript. It may not be appropriate to consider advection and diffusion as physical processes, which are different from real physical processes affecting aerosols such as condensation and coagulation.

L357-359: The definition of the NoAer simulation is not well described, which was also mentioned by Referee#1. It is stated in Line 208-209 that RIEMS-Chem treats 9 aerosol types including sulfate, nitrate, ammonium, black carbon (BC), primary organic aerosol (POA), secondary organic aerosol (SOA), anthropogenic primary PMs

(PM<sub>2.5</sub> and PM<sub>10</sub>), dust and sea salt. What did you do with these types of aerosols to remove anthropogenic ones considering that some type of aerosols can originate from both natural and anthropogenic sources? It might be more appropriate to use NoAerfeedback or NoFB for this simulation.

L596: Is this section title appropriate considering that Sect. 5 also presents model results?

L805: Again, It might not be suitable to consider emissions as physical process.

L855, L903 and L908: How or what can gas-phase chemistry lead to formation of PM<sub>2.5</sub>? The reaction of SO<sub>2</sub> with OH in the gas phase produces H<sub>2</sub>SO<sub>4</sub>, which is acid gas not sulfate, and need to undergo nucleation or condensation to form sulfate aerosols. Are the formation rates of aerosols (including those in the clean stage stated in Line 843) comparable to the results from previous studies?

L1224-1225: Please rewrite or delete this sentence.

L1226: Specify what “aerosol effects” refer to or remove “with and without aerosol effects”

L1325-1327: It is the size distribution pattern, more specifically the distribution shape parameters, was used. See my comments on L225-228 and L1224-1225. Some descriptions in the first paragraph of the conclusions are repeated here. The conclusions can be more concise.