Overall comments:

This work performed direct measurements of N_2O_5 heterogeneous uptake coefficients on atmospheric aerosols in southwestern China and further compared the measured results with those predicted based on different parameterization scenarios. Considering that most of previous studies focusing on gas uptake kinetics are conducted under laboratory conditions, the obtained uptake coefficients may be deviate from the real case in the ambient air. The authors in this work made a step forward and quantified the uptake coefficients of N_2O_5 on real ambient aerosols. The results will help to constrain the uptake coefficients of N_2O_5 to a more realistic basis and further improve our understanding of the heterogeneous reaction kinetics under ambient conditions and their potential impacts on aerosol formation at least locally. Generally, this work could be a meaningful addition into the literature. However, there are several major issues (as pointed out below) need to be addressed at the present stage.

Major issues:

Regarding the methods, the related descriptions on the experiment using the aerosol flow tube system are missing key messages. Please give a more detailed description about the air sampling system. Did ambient air directly enter into the flow tube? The measurement system can generate N_2O_5 by itself, but how did you deal with the N_2O_5 in the ambient air? This would also influence the obtained uptake coefficient. For uptake coefficient calculation, the authors took the flow tube wall effect into account, how did the authors consider the effect caused by aerosol wall losses? Did the wall loss also apply for the gas and particles? What uncertainties would the authors expect for the obtained uptake coefficients?

Even though for some cases the parameterized gamma agreed well with the measured gamma (median values), the correlations between them were very bad for all the parameterization scenarios. It would be more helpful to have additional discussions regarding this. Is this more likely caused by parameterization methods or the measurement method? More suggestions on how to choose the different parameterization scenarios under various conditions would be more meaningful from the modelers' point of view.

The presentation quality of manuscript seems to be poor. The use of the language appears to be a big problem. Some mistakes should have been avoided if the authors carefully inspect the text before the submission. As shown below, additional edits need to be done regarding the "low level" grammar mistakes. Please note that these grammar issues are not limited to the following list. The authors should therefore check through the whole manuscript very carefully for the revised version.

Minor suggestions/edits:

Line 41-42: What does “response coefficients” mean?

Line 91-95: “However, the comparisons of ….” Please rephrase this sentence, as it reads unclearly and awkwardly.

Line 96: “can leads to” should be “can lead to”.

Line 105: “European” should be “Europe”.

Line 113-114: “We further notice …” the whole sentence reads awkwardly. Please rephrase it.

Line 126: What does CNST mean?

Line 129: “Google Maps images” should it be “Google Map images” ?

Line 138: “and” should be “which”.

Line 147: “A total of 117 kinds of VOCs …” could be like “A total of 117 VOCs species …”.

Line 155: “included” should be “including”.

Line 158: For the header of Table 1, “Detection of limit” should be “Detection limits”, “Method” should be “Methods”, “Accuracy” should be “Accuracies”.

Line 160: “The” is not needed in front of “measurement”, for this case. The same applies to the title of the other sections.

Line 165: “(excess)” should be “(in excess)”.

Line 166: “consist of” should be “consists of”.

Line 170: “concentration” should be “concentrations”.

Line 169-176: These three sentences read awkwardly and apparently have several grammatical mistakes. Please rewrite them.

Line 192: “the reaction rate of constant of…” should be “the reaction rate constant of …”.

Line 209: “The mean diurnal of measured…” should be “The mean diurnal variation of the measured …”. The authors seem to have a big problem on how to correctly use “the”.

Line 216: “(PNO3)” should be “P(NO3)”.

Line 218: “observation campaign” is not the common way. Either “observation period” or just “campaign”.

Line 252: “Functional dependence” reads very awkwardly. Please change it.

Line 254: What is “organic wet mass faction”? How did you measure it?

Line 260-262: As the authors stated, “the negative correlation of particulate organic and $\gamma(N_2O_5)$ was usually weak derived from field measurements”. In the present work, however, the authors found a significant negative correlation between the organic wet mass fraction and the gamma. Could the authors discuss why this study shows such a difference?

Line 275: “showed” should be “shows”.

Line 290: In the caption of Fig. 3, the authors state that “The points represent the median in each bin,…”. How do the authors select the different bins? Should be the symbols or the points represent the median values?

Line 338: “(aka. low …)”, for me it is the first time to see the use of “aka.”. Probably it is not the official way to use it in a scientific research paper?

Line 339-340: The authors use “response coefficients” several times throughout the manuscript. At least it is not a scientifically meaningful definition, as far as I know. What is the exact meaning of this? Any references?

Line 358-361: Please rephrase the whole sentence to make it more scientifically readable.

Line 377-379: Same as above.