Comments from the three reviewers are in blue, and our replies are in black. Changes to the manuscript are highlighted in red.

In this manuscript, the authors developed a database of diffusion coefficients for atmospheric trace gases. The goal is to use these diffusion coefficients to calculate the rate of gas uptake onto particles. The authors compiled an extensive list of coefficients and made recommendations, and also cited Fuller's method to estimate diffusivities. These diffusion coefficients are then applied to calculate Knudsen numbers and condensation into particles. The paper is clearly written, and the topic is relevant to the scope of Atmospheric Chemistry and Physics. This manuscript should be published after considering these comments:

Reply: We would like to thank ref. 1 for recommending our manuscript for final publication. We have revised the manuscript according to his/her very helpful comments.

- In general, the range in diffusion coefficients is small. It ranges from 30 to around 100 torr cm2 s-1, within 1 order of magnitude of each other. It seems to be that the difference between MVK and $C_{20}H_{32}O_{12}$ is a result of its volatility, not diffusion coefficient. Why is it then an important task to compile gas-phase diffusion coefficients to correctly model condensation flux? It would seem to be that understanding volatility (which has an error of ~2 orders of magnitude) is more important, and we can assume an average gas phase diffusivity of ~0.1 cm2 s-1. Perhaps the authors can choose a better example?

Reply: We agree with the Ref. 1 that understanding the volatility is more important for predicting the formation of SOA. However, it does not mean that taking into account the effect of gas phase diffusion accurately is not important, especially considering that diffusion coefficients were arbitrarily used in some previous studies. Our work can definitely contribute to reduce the error in this aspect. In the revised manuscript (P5, L16-18), we have added one sentence to further explain the role of gas phase diffusion in heterogeneous reactions: "The effect of gas phase diffusion largely depends on the particle size and the uptake coefficient, as discussed in our previous work (Tang et al., 2014a)".

We have chosen MVK and C20H32O12 in our simulations because their uptake coefficients differ a lot due to their very different volatilities. As a result, the role of gas phase diffusion varies significantly for the two compounds, illustrating very well when gas phase diffusion can be important. In the revised manuscript, we have added one paragraph at the end of Section 6 (P15, L15-24) to explain/interpret our simulation results, and to discuss the role of gas phase diffusion on unreactive/reactive uptake and the formation of SOA.

- If gas phase diffusion becomes the limiting step for these ELVOCs to condense, can the authors comment on the relative importance of heterogeneous reactions of smaller molecules that lead to SOA formation (e.g. glyoxal dissolution and subsequent reactions) and larger molecules such as ELVOCs condensing onto particles? It would seem to me that heterogeneous reactions of smaller, more diffusive compounds can potentially be very important.

Reply: It is a very good point. We have added one paragraph (P15, L15-24) to discuss the heterogeneous uptake of smaller molecules due to reactions in the particle phase.

- In general, it would be nice to perform some sensitivity analysis. For example, the uncertainty in measurements could be used to investigate errors in the condensational flux. Also, the uncertainty in using Fuller's estimation (<10%) can also be investigated. My guess is that these uncertainties are quite small and have little overall effect on estimated condensational flux.

Reply: The simulations we did is to illustrate the role of gas phase diffusion in SOA formation. It has not been designed to simulate the formation of SOA in a realistic manner. However, we agree with Ref. 1 that it is helpful to investigate the error of uptake coefficients caused by uncertainties of estimated diffusivities using Fuller's method. We discussed the uncertainties of the derived uptake coefficients at the end of Section 5 (P13, L26-30). Indeed as Ref. 1 pointed out, the overall effect is quite small.

- Tables 1 and 2 list diffusivities of common gases. It would be useful to tabulate estimated diffusivities of common oxidation products, such as glyoxal, pinonic acid, IEPOX, which would be helpful for the SOA community. Fig. 2 lists some common oxidation products, but it would be nice to see the diffusion coefficients that went into the calculations listed in a table.

Reply: In the revised version (P11, L22-27) we have listed the diffusivities of common oxidation products which are important intermediates in SOA formation.

The purpose of Figure 2 is to show that Knudsen numbers are similar for inorganic and organic compounds which have very different diffusivities. We only include a few compounds in Figure 2 to ensure its readability.

Minor comments: - I suggest rearranging Tables 1 and 2 so that the compounds are listed in increasing molecular weights or carbon numbers from top to bottom, not left to right.

Reply: We respect Ref. 1's comments. However, we feel the way we arrange these tables assures better readability.

Pg. 5475 Equation (12): Particle diameter is usually in nm or um, so it may be more convenient to adjust the units in Dnorm (e.g. 150 torr um)

Reply: We agree with referee 1. In the revised manuscript, we have replaced D_{norm} with a new parameter, λ_{P}, which is equal to 100 nm atm^{-1}. It means that the mean free path of all gas molecules in 1 atm air is around 100 nm. Please see the revised manuscript for further details (P13, L17-L30).

- Pg. 5464 line 24: “condendation” should be “condensation”
- Pg. 5467 line 13: insert “in” into “: : :used our previous work: : :”
- Pg. 5469 line 9: “differenciate” should be “differentiate”
- Pg. 5472 line 8: “multifuntional" should be “multifunctional”
- Pg. 5472 line 12: “tropshere” should be “troposphere”
- Pg. 5473 line 13: “tempereatures” should be “temperatures”
- Pg. 5474 line 11: “sqaure" should be “square”
- Pg. 5476 line 4: “assumed to consists” should be “assumed to consist”
- Pg. 5477 line 5: “alcoholes” should be “alcohols”
- Pg. 5486 Table 2 caption: “multifuntional" should be “multifunctional”
- Pg. 5488 Table A1 caption: “fours” should be “four”
- Pg. 5492 Figure 3: The units on the y-axis label are not shown correctly. I am guessing that they should be in ug m-3.

Reply: Thanks. All typos have been corrected.