Reviewer comments are copied below. Our responses are written below each comment in blue font.

REVIEWER 1

General comments: Curry et al. present updated values for reactive uptake of glyoxal and methylgloxal for use in models. These are based on RH parameterizations of maritime and remote aerosols and clouds that are comprised of sodium chloride or mixtures of ammonium nitrate and ammonium sulfate. These parameterizations are based on recent (bulk and aerosol) laboratory data that have probed gas-particle partitioning as a function of pH and aerosol or bulk solution chemical composition. This work will result in a more accurate reflection of SOA formed from the water-soluble aldehydes glyoxal and methylglyoxal. I have a few comments, but recommend publication in ACP after minor changes.

We thank the reviewer for the overall positive comments.

Specific comments:

1. Methods and Data: Statistical analysis and parameter estimation: It should be clarified in this section (rather than 3.2) that the authors also tested pH and aerosol chemical composition and the results of those are in the SI.

Thanks for this suggestion. The title of the subsection "Particle types" has been modified to "Particle types and composition" and we have inserted the sentence "Calculated results for γ_{GLY} and γ_{MGLY} as a function of S:A and S:N are available in the Supporting Information" after the sentence describing the particle types and composition and RH ranges considered. As discussed below, the results as a function of pH are now discussed separately in section 3.

2. Methods and Data: Calculating the Henry's constant: clarify that the KH,w values are the effective Henry's law constants that incorporate hydration.

The sentence "Note that the K_H values are effective Henry's constants which account for hydration of the carbonyl species upon uptake." has been added after the introduction of K_H in equation (3).

3. Section 3.2: It looks as though there is a strong correlation of γGLY with pH in Fig. S1 so it is not clear how the authors determined that pH is not necessary.

The reviewer is correct, there is a correlation of γGLYX with pH in figure S1. In this study, variation in aerosol pH was not controlled independently, but rather it developed from the variation in S:N and S:A. Since the correlation with S:N and S:A was not strong, and aerosol pH is not a variable in GEOS-Chem, we chose not to address this dependence in the original manuscript. Since we see the value of providing this information despite its lack of direct applicability to GEOS-Chem simulations, we now discuss this data in more detail and include parameterizations for γGLYX and γMGLY as functions of pH.

4. Figure 1 and Figure 2: The "average γGLYX" and "average γMGLY" values are recommended due to large scatter and lack of correlation with RH. What "average" are the authors referring to? The black line does not appear to be the mean of the γGLYX or γMGLY values.

The statistical analysis and parameter estimation is described in section 2. The averages were obtained via weighted linear least squares regression, so points with lower uncertainty were given more weight in

the average, and the average does not lie in the middle of all of the points. We have added a parenthetical note to make this more clear: "The scatter in the calculated γ_{GLYX} led to a low-confidence result from the weighted least squares regression. For this reason, we recommend use of the average γ_{GLYX} value (obtained via weighted linear least squares regression, with slope = 0) in lieu of a parameterization (Table 4)."

Minor comments:

5. Introduction: Work by David De Haan's group should also be cited for brown carbon formation, e.g.: Powelson et al. (2014) ES&T "Brown carbon formation by aqueous-phase aldehyde reactions with amines and ammonium sulfate"

This reference, as well as a reference to De Haan et al. ES&T 52 (7) 4061-4071 (2018) have been added.

6. Atmospheric Implications: Consider citing Sareen et al. (2017) ES&T, "Potential of Aerosol Liquid Water to Facilitate Organic Aerosol Formation: Assessing Knowledge Gaps about Precursors and Partitioning" as salting constants were included in this work and they do find that methylglyoxal is a minor contributor as Curry et al. predict.

We now mention and cite this study: "The reduced contribution of MGLY to aqueous SOA formation due to salting out is consistent with the calculations of Sareen et al. (2017)."

7. Figure S1: consider changing y-axis to γGLYX for consistency with the main text.

The change has been made.

8. References: check for formatting issues (e.g. "Henry ' s Law" in Aster et al., "ChemPhysChem" in Herrmann et al., "(NH4(+))" in Nozière et al., etc.)

We have checked the reference list and made corrections where necessary. ChemPhysChem is the correct name of the journal in the Herrmann et al. (2010) reference.