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Comment on acp-2021-940

Anonymous Referee #2

Referee comment on "Observations and modelling of glyoxal in the tropical Atlantic marine boundary layer" by Hannah Walker et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-940-RC2, 2021

Walker et al. made several months of in situ measurements of glyoxal at a remote site in the Cape Verde islands. While glyoxal concentrations measured in this study were lower than those reported from other remote marine locations, a detailed model using the Master Chemical Mechanism significantly underpredicted the amount of glyoxal at the site. The authors explored the sensitivity of glyoxal to several different processes in the model, pointing to future directions of research.

This is an excellent, well written paper, and I recommend that it be published in Atmospheric Chemistry and Physics once the following few points are addressed.

Page 1, lines 13-14: The modeled glyoxal seems rather insensitive to aerosol effects, especially compared to the effects of acetaldehyde or sesquiterpenes. Later in the paper the authors say this (page 21, line33-34): "…the sensitivity of the modelled glyoxal to changes in the rate of aerosol uptake is not sufficient to reconcile the model with the observations." I would suggest changing the language in the abstract to be more consistent with the later text.

Page 3 line 18-19: It would be good to also cite Lerot et al. 2021, who report glyoxal retrievals from TROPOMI, which like the other satellites also sees enhanced glyoxal over remote tropical oceans. The authors discuss several reasons why this might be the case.

Page 3, line 34-35: While 1.5e14 is the number from Lawson et al. (2015), it is a little confusing to compare a column measurement with an in situ measurement without also discussing the assumptions used to convert the in situ mixing ratio into a VCD. Stating that the satellite columns indicated higher levels of glyoxal than the in situ measurements would be fine.

Page 14, line 8: Are there any measurement of aerosol composition, either at Cape Verde Atmospheric Observatory or from the ATom campaign, that could be used to better inform the model? Several of the references for the glyoxal uptake value (e.g. Volkamer 2007) are from studies in urban areas, where I would expect the aerosol to be mostly organic. I'm not sure what effect the different ions in sea spray aerosol would have (e.g. Waxman et al. 2015), and a "real" number is better than a made up on, but it should be noted that an uptake coefficient for urban aerosol may not be representative of marine aerosol.

The yellow font, and to a lesser extent the yellow traces, used in Figures 10, 12, and S10 is rather hard to read. A darker shade of yellow for at least the legend would help.

I'm not sure what the ACP style guide says, but in Tables 1 and 2 I would use a lowercase "i" and "n" to abbreviate iso-butane and n-butane (and the other VOCs where this applies), to avoid confusion with nitrogen and iodine.

Figures 5, 7, S1, and S2: Figure 5 uses day of month, while the other figures use Julian Day. It would be easier for the reader if a consistent date format, preferably that which was used in Figure 5, was used for all these figures. Alternatively, dashed vertical lines on the Julian Day plots to indicate the first day of each month would work.

References:

Lerot et al. Glyoxal tropospheric column retrievals from TROPOMI- multi-satellite intercomparison and ground-based validation, Atmos. Meas. Tech., 14, 7775–7807, https://doi.org/10.5194/amt-14-7775-2021, 2021.

Waxman et al., Glyoxal and Methylglyoxal Setschenow Salting Constants in Sulfate, Nitrate, and Chloride Solutions: Measurements and Gibbs Energies, Environ. Sci. Technol., 49, 19, 11500–11508, https://doi.org/10.1021/acs.est.5b02782, 2015.